Sustainable Power for Maharashtra

Electricity Markets and Reforms Blueprint

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Is Electricity a Public or a Private Good?

What qualifies for public vs. a private good?

In any economy, there are certain commodities and services that the government pledges to provide to the people because they are considered essential for social and economic welfare. These are made available at a cost or free, depending upon the nature of the good in question. Vis-à-vis this, there are goods that are not essential for welfare. When such goods have to be purchased, it depends on the individual's willingness and ability to buy such items.

Whether the government provides a good or not, all commodities and services have to be bought and sold in markets. When we talk of markets in economics, we essentially are interested in how a commodity is being traded or is being made available to the consumer. This is largely determined by the nature of the good in question – whether, public or private.

The following discussion and argument is to determine whether electricity is a public or private good. Paul A. Samuelson is usually credited as the first economist to develop the theory of public goods. In his classic 1954 paper *The Pure Theory of Public Expenditure*, he defined a public good, or as he called it in the paper a "collective consumption good", as follows: … [goods] which all enjoy in common in the sense that each individual's consumption of such a good leads to no subtractions from any other individual's consumption of that good...This is the property that has become known as **Non-rivalry**. In addition a **pure public good** exhibits a second property called **Non-excludability**: that is, it is impossible to exclude any individuals from consuming the good.

A **public good** is a good that is non-rivalrous and non-excludable. In plain terms,

- Exclusive means it is reasonably possible to prevent a class of consumers (e.g. those who have not paid for it) from consuming the good.
- Rivalrous means consumptions by one consumer prevent simultaneous consumption by other consumers.

Private goods satisfy an individual want while public good satisfies a collective want of the society[1]. This means that for a commodity to be called a "public good", the consumption of the good by one individual does not reduce availability of the good for consumption by others; and that no one can be effectively excluded from using the good. In the real world, there may be no such thing as an absolutely non-rivaled and non-excludable good;

[1] Hal R. Varian, *Microeconomic Analysis* ISBN 0-393-95735-7; Mas-Colell, Whinston & Green, *Microeconomic Theory* ISBN 0-19-507340-1; or Gravelle & Rees, *Microeconomics* ISBN 0-582-40487-8.

but economists think that some goods approximate the concept closely enough for the analysis to be economically useful. For example, if one individual visits a doctor there is one less doctor's visit for everyone else, and it is possible to exclude others from visiting the doctor; it is a rivaled and excludable private good. Conversely, breathing air neither significantly reduces the amount of air available to others, nor can people be effectively excluded from using the air. This makes it a public good, but one that is economically trivial, as air is a free good. A less straight-forward example is the exchange of MP3 music files on the internet: the use of these files by any one person does not restrict the use by anyone else and there is little effective control over the exchange of these music files.[2]

The opposite of a public good is a **private good,** which does not possess these properties. It is safe to assume that a private good, on the other hand, is clearly excludable and rivalrous and are almost exclusively made for profit. A loaf of bread, for example, is a private good: its owner can exclude others from using it, and once it has been consumed, it cannot be used again.

Non-rivalness and non-excludability may cause problems for the production of such goods. Specifically, some economists have argued that they may lead to instances of market failure, where uncoordinated markets driven by parties working in their own self interest are unable to provide these goods in desired quantities. These issues are known as **public goods problems**, and there is a good deal of debate and literature on how to measure their significance to an economy, and to identify the best remedies. These debates can become important to political arguments about the role of markets in the economy. More technically, public goods problems are related to the broader issue of externalities.[3]

A good which is rivalrous but non-excludable is sometimes called a **common pool resource**. Such goods raise similar issues to public goods: the mirror to the "public goods problem" for this case is sometimes called the **tragedy of the commons**. For example, it is so difficult to enforce restrictions on deep sea fishing that the world's fish stocks can be seen as a non-excludable resource, but one which is finite and diminishing.

As per the definition of non-excludability, we know that it is impossible to exclude individuals from consumption. Though, technology now allows radio or TV broadcasts to be encrypted such that persons without a special decoder are excluded from the broadcast; however, an unencrypted broadcast is still non-excludable.

Many forms of creative works have characteristics of public goods. For example, a poem can be read by many people without reducing the consumption of that good by others; in this sense, it is non-rivalrous. Similarly, the information in most patents can be used by any party without reducing consumption of that good by others. Creative works may be excludable in some circumstances, however: the individual who wrote the poem may

[2], Paul A. Samuelson (1954). "The Pure Theory of Public Expenditure". *Review of Economics and Statistics* 36 (4): 387–389. doi:10.2307/1925895, Joseph E. Stiglitz, Knowledge as a Global Public Good in *Global Public Goods*, ISBN 978-0-19-513052-2

[3] Lecture notes on public goods from University of California, Berkeley

decline to share it with others by not publishing it. Copyrights and patents both encourage and inhibit the creation of such non-rival goods by providing temporary monopolies, or, in the terminology of public goods, providing a legal mechanism to enforce excludability for a limited period of time. For public goods, the "lost revenue" of the producer of the good is not part of the definition: a public good is a good whose consumption does not reduce any other's consumption of that good[4].

The economic concept of public goods should not be confused with the expression "the public good", which is usually an application of a collective ethical notion of "the good" in political decision-making. Another common confusion is that public goods are goods provided by the public sector. Although it is often the case that Government is involved in producing public goods, this is not necessarily the case. Public goods may be *naturally* available. They may be produced by private individuals and firms, by non-state collective action, or they may not be produced at all.

The theoretical concept of public goods does not distinguish with regard to the geographical region in which a good may be produced or consumed. However, some theorists (such as Inge Kaul) use the term **global public good** to mean a public good which is non-rival and non-excludable throughout the whole world, as opposed to a public good which exists in just one national area. Knowledge has been held to be an example of a global public good[5].

Terminology and types of public goods[6]

	Excludable	**Non-excludable**
Rivalrous	**Private goods** food, clothing, toys, furniture, cars	**Common goods** (**Common-pool resources**) fish, hunting game, water
Non-rivalrous	**Club goods** satellite television	**Public goods** national defence, free-to-air television, air

Are all public goods meant for social welfare?

The concept of public goods is essentially meant for social welfare that is to be accomplished by the government. Depending on the social welfare argument, some governments choose to allocate and distribute certain goods and services which are usually or can be easily made available through free markets. In free markets, goods and

[4] www.economics.harvard.edu/files/.../40_Government_Purchases.pdf, www.nytimes.com/2009/06/28/business/economy/28view.html,Principles of Economics By N. Gregory Mankiw, 5E, CENGAGE Learning, South-Western
[5] Joseph E. Stiglitz, Knowledge as a Global Public Good in *Global Public Goods*, ISBN 978-0-19-513052-2
[6] Principles of Economics By N. Gregory Mankiw, 5E,CENGAGE Learning, South-Western

services are obtainable to consumers by their willingness and ability to pay. This means that not everyone may be willing or able to pay for the good or service in question. Yet, the government feels that all and sundry in the economy should consume the good because of its ability to enhance "joint benefits and happiness in society". Public goods such as these are called collective goods.

Collective goods (or social goods) are defined as public goods that could be delivered as private goods, but are usually delivered by the government for various reasons, including social policy, and finances from public funds like taxes.

Some economists have used the term **public good** to refer only to non-excludable **pure public goods**. They may then call excludable public goods **club goods**. [7]

Common examples of public goods include: defence and law enforcement (including the system of property rights), public fireworks, lighthouses, clean air and other environmental goods, and information goods, such as software development, authorship, and invention. Some goods (such as orphan drugs) require special governmental incentives to be produced, but can't be classified as public goods since they don't fulfill the above requirements (Non-excludable and non-rivalrous.)

The provision of a lighthouse has often been used as the standard example of a public good, since it is difficult to exclude ships from using its services. No ship's use detracts from that of others, but since most of the benefit of a lighthouse accrues to ships using particular ports, lighthouse maintenance fees can often profitably be bundled with port fees (Ronald Coase, *The Lighthouse in Economics* 1974). This has been sufficient to fund actual lighthouses.

Technological progress can create new public goods. The simplest examples are street lights, which are relatively recent inventions (by historical standards). One person's enjoyment of them does not detract from other persons' enjoyment, and it currently would be prohibitively expensive to charge individuals separately for the amount of light they presumably use. On the other hand, a public good's status may change over time. Technological progress can significantly impact excludability of traditional public goods: encryption allows broadcasters to sell individual access to their programming. The costs for electronic road pricing have fallen dramatically, paving the way for detailed billing based on actual use.[8]

Can social welfare always be achieved successfully with collective goods?

As we argued sometime ago, all public goods should ideally bring about social welfare and a fine and responsible government's aim is to achieve hundred percent of it. However, depending on the kind of externalities (see below, next paragraph) those public goods necessitate, the aspect of "social wefareness" may get completely unfocused and

[7] James M. Buchanan (February 1965). "An Economic Theory of Clubs". *Economica* 32: 1–14. doi:10.2307/2552442

[8] Varian, H 1987 *Intermediate Microeconomics*

diverted. Very often the government cannot uphold its promise to achieve absolute welfare in the economy. At least, definitely not without making something or someone else worse off in the nation. It is so, since social goods need to be provided to all; this usually cannot be achieved without the burden of ample negative externalities in the bargain. Often, this may lead to market failure (refer to Appendix 1 for further details). Public goods provide a very important example of market failure, in which market-like behavior of individual gain-seeking does not produce efficient results.

The production of public goods may result in positive externalities as well but these are not remunerated. Hence, the public motivation may be absent to patronize such goods such that the government has to solely decide its allocation, distribution and consumption.

In economics, an **externality** or **spillover** of an economic transaction is an impact on a party that is not directly involved in the transaction. In such a case, prices do not reflect the full costs or benefits in production or consumption of a product or service. An advantageous impact is called an **external benefit** or **positive externality**, while a detrimental impact is called an **external cost** or **negative externality**. Producers and consumers in a market may either not bear all of the costs or not reap all of the benefits of the economic activity. For example, manufacturing that cause air pollution (negative) imposes costs on the whole society, while fire-proofing a home improves the fire safety of neighbors (positive).[9]

In a competitive market, the existence of externalities would cause either too much or too little of the good to be produced or consumed in terms of overall costs and benefits to society. If there exists, external costs such as pollution, the good will be overproduced by a competitive market, as the producer does not take into account the external costs when producing the good. If there are external benefits, such as in areas of education or public safety, too little of the good would be produced by private markets as producers and buyers do not take into account the external benefits to others. Here, overall cost and benefit to society is defined as the sum of the economic benefits and costs for all parties involved.

If private organizations do not reap all the benefits of a public good which they have produced, their incentives to produce it voluntarily might be insufficient. Consumers can take advantage of public goods without contributing sufficiently to their creation. This is called the free rider problem, or occasionally, the "easy rider problem" (because consumer's contributions will be small but non-zero).

The free rider problem depends on a conception of the human being as *homo economicus*: purely rational and also purely selfish—extremely individualistic, considering only those benefits and costs that directly affect him or her. Public goods give such a person an incentive to be a free rider. For example, consider national defence, a standard example of a pure public good. Suppose *homo economicus* thinks about exerting some extra effort to defend the nation. The benefits to the individual of this effort would be

[9] Principles of Economics By N. Gregory Mankiw, 5E, CENGAGE Learning, South-Western

very low, since the benefits would be distributed among all of the millions of other people in the country. There is also a very high possibility that he or she could get injured or killed during the course of his or her military service.

On the other hand, the free rider knows that he or she cannot be excluded from the benefits of national defence, regardless of whether he or she contributes to it. There is also no way that these benefits can be split up and distributed as individual parcels to people. The free rider would not voluntarily exert any extra effort, unless there is some inherent pleasure or material reward for doing so (for example, money paid by the government, as with an all-volunteer army or mercenaries). In the case of information goods, an inventor of a new product may benefit all of society, but hardly anyone is willing to pay for the invention if they can benefit from it for free.

Note:

1. ***We shall discuss free riders and externalities arising in the electricity markets, at length, in subsequent discussions.***
2. ***Solutions to problems arising from externalities are listed in Appendix 2. They are discussed at length as and when we encounter them in our discussion of electricity markets.***

Is there an efficiency yardstick for the production of public goods?

A public good is provided efficiently at the level where the combined marginal rate of substitution of all individuals is equal to the marginal rate of transformation. (The marginal rate of substitution is the rate at which an individual is willing to exchange a private good for a public good, the marginal rate of transformation is the quantity of a private good which the society has to give up in producing one unit of a public good).

When should a public good be provided? To illustrate the basic principle, consider a community composed of just two consumers, A and B. The government is considering whether or not to provide a park. A is prepared to pay up to Rs. 2000 for use of the park, while B is willing to pay up to Rs. 1000. The total value to the two individuals of having the park is Rs. 3000. If it can be produced for Rs. 2250, there is a Rs. 750 gain on its production since it provides services that the community values at Rs. 3000 at a cost of only Rs. 2250.

Regardless of the method of providing public goods, the efficient level of such provisions is still being subjected to economic analysis. For instance, the Samuelson condition calculates the efficient level of public goods production to be where the ratio of the marginal social cost of public and private goods production equals the ratio of the marginal social benefit of public and private goods production.” If the amount of a public good can be varied continuously, the optimal quantity to produce is that quantity for which the marginal cost of the last unit is just equal to the sum of the prices that all consumers would be willing to pay for that unit." This equilibrium guarantees that the last unit of the public good costs as much to produce as the value that it gives to all of its consumers.

Note: We need to find out what is the efficient level of production for electricity. Given, its perishable nature, a so called efficient level may be an over production in terms of units required or underproduction in terms of capacity of the power plants in question. Again, this point has to be considered in light of what is efficient for Maharashtra state, given the current situation. This can be determined and dealt with, when we are broaching upon that aspect of the problem.

Can the government provide electricity free of cost?

Having said all this, then how do we categorise power as an economic good? Power definitely has social and economic qualities as an indispensable commodity. Social, because every person has the right to the basic infrastructural amenity; Economic, since one cannot deny its role in growth and development and as a basic necessity. In such a situation, the government then should ensure that energy/electricity/ power should be made available to each and every citizen and sectors of the economy.

Assume for a moment that power is a free good. That means it is available in abundance any time of the day and in any quantities to all and sundry in the economy. This makes it a completely non-excludable and non-rivalrous good. This also means that the government will take care of all that is required to make this possible: obtaining raw material, setting up infrastructure for the manufacturing of power and its distribution right up to the end user, ensuring excellence in resource management, technology implementation and the protection of the environment and society, etc. In our argument here, if power is treated as a pure public good, then this entire industry should not have any profit motive; neither can it generate any revenue to finance its own operations. This money will then have to be sourced from surpluses in government revenue (which in turn will come from taxes) or the income generated from some other profitable public sectors, if any, will have to mobilize funds to make the power sector operable and functioning. The burden of taxes falls on the consumers, even though indirectly, in this case. This means that the access to energy as a free public good is negated because we are paying for it in some way or the other. Also, for a pure public good, as more and more households and firms become a part of the economy, the government has to provide electricity to more and more people. This will eventually reduce the marginal social benefits and increase the social costs. Not only have that, the good will now become congestible.

It is also impossible to imagine how a government can reduce externalities that will arise from a market like this. Externalities will arise in the form of the following:

- Pollution, climate change
- Pattern of land holding and usage
- Ability to forecast a day-to-day need for power and then be able to produce, distribute and/or even store it, if at all

- No incentive for production because there is no profit motive
- Also, the industry being solely owned and controlled by the government, it will eventually become a monopoly – this means that it will finally be detrimental to the implementation of new technology and productivity and fairer markets
- Politically, if the government is out to grab power and make money for its self then, of course, no public sector will be efficient in the least.

There are many, many more reasons to site here. In short, competition, price, information, transaction, distribution, firm motivation, risks, turnovers, usage of government expenditure – all will be distorted. All this is evidently going to end up being a market failure. The intention and objective of making power an abundant good with stable market behaviour, is completely beaten. Also, there will be no scope of Pareto optimality*, even remotely.

(*Pareto optimality is a situation which exists when economic resources and output have been allocated in such a way that no-one can be made better off without sacrificing the well-being of at least one person.)

The promise made by the government that all individuals shall be entitled to basic amenities (in our case, power/energy) may be sorted out by looking at it from a marketable point of view.

Which brings us to what is marketable? **–** It is measure of the ability of a commodity to be bought and sold. If there is an active marketplace for a commodity, it has good marketability. Marketability is similar to liquidity, except that liquidity implies that the value of the good is preserved, whereas marketability simply indicates that the good can be bought and sold easily.

A marketable public good is not free but is probably subsidized as a government policy. This ensures that more and more people can consume the good and pay as per their respective consumption patterns. This also means that to bring about more efficiency and competition in the market, the government may indulge in public-private-partnerships. This brings down the burden off the government and cuts down the market distortions, externalities and market failure. So then, can we conclude that power should be treated as a “marketable public good”?

Note: James Buchanan and a few other eminent modern day economists have argued beyond a public good being just non-rivaled or non excludable. They have insisted on the “publicness” of a good as a social construct - the public or private nature of a good is not a given (as was believed earlier) but a matter of policy choice. For a detailed discussion refer to Appendix 3.

Why should electricity be treated as a merit good?

Electricity as a commodity cannot be stored and it is a very capital intensive industry. This point is reiterated in the National Electricity Policy of India, as well. Another important point to be noted from the Electricity Policy is that power should be provided as a "minimum lifeline consumption of 1 unit/household/day as a **merit good** by year 2012." - (See Appendix 4)

Let us take a moment and see what a merit good is. More formally, a merit good can be defined as a good which would be under-consumed (and under-produced) in the free market economy. This is due to two main reasons:[10]

1. When consumed, a merit good creates positive externalities (an externality being a third party/spill-over effect which arises from the consumption or production of the good/service). This means that there is a divergence between private benefit and public benefit when a merit good is consumed (i.e., the public benefit is greater than the private benefit). However, as consumers only take into account private benefits when consuming merit goods, it means that they are under-consumed (and so under-produced).

2. Individuals are myopic, they are short-term utility maximisers and so do not take into account the long term benefits of consuming a merit good and so they are under-consumed.

In short, a good (or service) which some "outside analyst" considers to be intrinsically desirable, uplifting or socially valuable for other people to consume, independently of the actual desires or preferences of the consumer himself, is called a merit good. In the case of such goods, it is sometimes held that free consumer choice is inappropriate, and therefore that if many consumers left to themselves are unwilling to purchase "appropriate" quantities of such goods, they should be encouraged or even compelled to consume them anyway. Such arguments are often employed in an effort to justify government intervention in the market place to provide such alleged merit goods to the citizenry, either through direct government provision of the good at no cost to the consumer or through payment of tax-financed government subsidies that enable private providers to sell the good far below its true costs of production (1).

Merit goods are provided in a free market system, but would almost certainly be under-provided. Take the case of education. If there were no state education provided at all, there would still be private schools for those who could afford them, and indeed many new private schools might open. However, there would not be nearly enough education

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[10] Richard A. Musgrave (1957). "A Multiple Theory of Budget Determination," *FinanzArchiv*, New Series 25(1), pp. 33-43.
_____ (1959). *The Theory of Public Finance*, pp. 13-15.
_____ (1987). "merit goods," ," *The New Palgrave: A Dictionary of Economics*, v. 3, pp. 452-53.
Richard A. Musgrave and Peggy B. Musgrave (1973). *Public Finance in Theory and Practice*, pp. 80-81.
Amartya K. Sen ([1977] 1982). "Rational Fools: A Critique of the Behavioral Foundations of Economic Theory," in *Choice, Welfare and Measurement*, pp. 84-106. (1977 JSTOR version)

provided for everyone to benefit. This happens because the market only takes account of the *private costs and benefits*. It does not take account of the *external benefits* that may arise to society from everyone being educated. For this reason, merit goods will be under-provided by the market. If the private sector will not provide these goods in sufficient quantity, then the only way more will be provided is either if the government encourages firms to produce more (perhaps by subsidising the good or service) or if the government provides them itself. A significant proportion of government expenditure arises from the government providing merit goods. The main examples are: education, health, fire service, sanitation, work training programmes, public libraries, museums, inoculations for children and students, etc.

Electricity can be treated as a merit good in India because

1. People in the country do not understand the importance of electricity and hence do not consume as much as is required for a bare minimum. But then, this is not true. The Indian demand for electricity is hardly being met. Consumers want electricity but are not being provided the asking quantum.

2. A merit good is, publicly or privately, always under-produced because consumers are unaware of the long term social benefit and do not consider it to be a part of conscious public choice. Again, this is not true in case of India. Leave alone positive externality, as a basic amenity, electricity supply has fallen short.

3. Sentence (1) in the aforementioned paragraph says that a government may justify regulation of free markets, raise more taxes and finance subsidies through that. This ends up in rent seeking behaviour which is what happens when both a market economy and government are present; government agents are a source of numerous special market privileges. Both the government agents and self-interested market participants seek these privileges in order to partake in the monopoly rent that they provide. When such privileges are granted, they reduce the efficiency of the economic system. In addition, the rent-seekers use resources that could otherwise be used to produce goods that are valued by consumers. Rent-seeking is broader than Public Choice in that it applies to autocracies as well as democracies and, therefore, is not directly concerned with collective decision-making. However, the obvious pressures it exerts on legislators, executives, bureaucrats, and even judges are factors that Public Choicers[11]must account for in their effort to understand and assess collective decision-making rules and institutions. Moreover, the members of a collective who are planning a government would be wise to take prospective rent-seeking into

[11] Buchanan, (2003)

account. This means that the Indian government is looking at electricity as a commodity that will not be consumed as per willingness and the ability to pay but as per the minimum requirement of the household. This will ensure positive social benefits in the long run though in the short run the market benefits and marketable profits may get thwarted.

Out of the above three options, the third seems to be the most viable argument for the provision of power to all.

1. Since the government pledges power for all by 2012, it must be treated as a basic amenity: non-rivaled and non-excludable – a typical economic public good. But this may end up being congestible.

2. It should be provided to all at minimum costs (through subsidies and market allocation efficiency) for short and long term positive social benefits and externalities – a merit good.

3. The government cannot possibly provide the entire nation electricity by its self. It will have to involve private players and look at the market mechanism for allocation, efficiency and optimization of resources – a marketable good.

4. Having a little of all three characteristics, public, merit and market, electricity may then be called a public merit good which is marketable.

5. However, as has been discussed before, the entire premise does not rule out negative externalities, government monopolies, cross subsidies and inefficient markets that may result because of this – there will always be a threat of overproduction (due to subsidies), rent-seeking and price distortions (due to public and private monopoly pockets).

There seems to be no clear winner in terms of a right answer here. So can we then say that, the government will have to bring in private players in the power/energy market, as well as, play a crucial role in implementing and executing policies for it? What is vital is the recognition of the fine line between what turns fair markets into rent-seeking monopolies suddenly. Also, one has to ensure that the positive externalities far outreach the negative ones. This truly is a very tricky task at the public welfare strategies' level. To answers these questions, we need to examine the functioning of electricity markets.

**** Production is minimum cost, and revenues exactly cover (opportunity) costs.***

***** Profits in excess of the opportunity cost of provision.***

****** Supernormal profit also referred to as abnormal profit, pure profit, excess profit or economic rent is an economic term of profit exceeding the normal profit. Normal profit equals the opportunity cost of labour and capital, while supernormal profit exceeds the normal return from these input factors in production.***

Appendix 1

Market failure is a concept within economic theory wherein the allocation of goods and services by a free market is not efficient. That is, there exists another outcome where market participants' overall gains from the new outcome outweigh their losses (even if some participants lose under the new arrangement). Market failures can be viewed as scenarios where individuals' pursuit of pure self-interest leads to results that are not efficient – that can be improved upon from the societal point-of-view. The first known use of the term by economists was in 1958, but the concept has been traced back to the Victorian philosopher Henry Sidgwick.

Market failures are often associated with information, non-competitive markets, externalities or public goods. The existence of a market failure is often used as a justification for government intervention in a particular market. Economists, especially micro economists, are often concerned with the causes of market failure, and possible means to correct such a failure when it occurs. Such analysis plays an important role in many types of public decisions and studies. However, some types of government policy interventions, such as taxes, subsidies, bailouts, wage and price controls, and regulations, including attempts to correct market failure, may also lead to an inefficient allocation of resources, (sometimes called government failures). Thus, there is sometimes a choice between imperfect outcomes, i.e. imperfect market outcomes with or without government interventions. But either way, if a market failure exists then the outcome is not Pareto efficient. Mainstream neoclassical and Keynesian economists believe that it may be possible for a government to improve the inefficient market outcome, while several heterodox schools of thought disagree with this.

Appendix 2:

Solutions to the free rider problems

There are many options that society/governments can undertake to mitigate the problem, if not completely weed it out. Economists have suggested the following to address the situation:

1. Assurance contracts
2. Coasian solution
3. Government provision
4. Subsidies and joint products
5. Privileged group
6. Merging free riders
7. Introducing an exclusion mechanism (club goods)
8. Social norms

Appendix 3:

An overview of recent developments in public goods theory – congestible goods

As long ago as 1965, James Buchanan argued that treating goods as either rival or non-rival is not satisfactory and is contrary to everyday experience. He contended that a large number of goods are neither purely rival nor purely non-rival. A swimming pool, for example, can be shared, so it isn't truly rivalrous. But the pool cannot be shared infinitely, so it isn't non-rival either. The same can be said for things as diverse as roads, movie theaters, parks, recreational facilities, televisions, stereos, and dormitory bathrooms. All of these things can be shared, but not endlessly. They are, in a word, **congestible.**[1]

Congestible goods are conceptually different from non-rival goods. The optimal size of the sharing group for a non-rival good is infinitely large. That is because adding people to the group will reduce the per person expense but will not detract from the enjoyment of the good for people already in the group. Determining the optimal size of the sharing group for a congestible good presents a classic economic problem. For a given amount of the good (say, a swimming pool of a given size), increasing the size of the group reduces per-person expense, but it also reduces the enjoyment of people already consuming the good. At first the effect may be small, but as the size of the sharing group rises, so does the negative impact of the marginal user's contribution to congestion? Individuals may weigh the costs and benefits of sharing a congestible good differently. Some may prefer to pay more to avoid much congestion. They will pay to keep the sharing group small. Others may be willing to accept quite a bit of congestion if it means reducing the amount they have to pay. There can be many different sizes of sharing groups that make sense to different users.

Whether congestible goods are provided privately or publicly depend on both the degree to which exclusion is technologically feasible and on the law. It is possible to exclude people from tennis courts. It is therefore possible to privately provide them, and private racquet clubs exist. Yet it is sometimes the case that a city chooses to provide tennis courts that are open to the public. In that case, the law says that individuals cannot be excluded. The choice of where to play tennis generally depends on one's evaluation of the trade-off between fees and congestion.

Roads provide another example. It is feasible to exclude people from highways, and toll roads exist. Some are public and some are private. But in most cases, the law prevents exclusion, which necessarily means that highways must be publicly provided. Or consider fire-suppression services. In most cities, the law says that no one can be excluded, so the government provides fire suppression services. But it is possible to provide such services privately. If someone does not pay his fire protection bill, he is excluded from the service. Note that such exclusion is technologically feasible for single-family dwellings, but not for single apartments. If a freestanding house catches fire, fire crews can pour water on nearby houses to prevent the fire from spreading to people who have paid their bills. If an apartment catches fire, it would be impossible to protect the apartments of people who pay for the service without fighting the fire in the non-payer's apartment.

In the time since Buchanan published his seminal article, a large literature on his theory of clubs has emerged. More than a quarter of a century ago there was already enough work in the area for the *Journal of Economic Literature* to publish a survey article [Sandler and Tschirhart, 1980]. An important implication of Buchanan's theory is that purely private goods and purely public goods can be thought of as endpoints on a continuum. Some goods really are both rival and excludable, and are best provided by private markets. A few goods are both non-rival and non-excludable, and are best provided by the government. But there is a large gap between the two, and who should provide these goods depends on public policy and on technology. Examples of congestible are abundant, and should no longer be ignored.

The basic premises of traditional public goods theory have recently been severely questioned for their lack of relevance and practicality in today's globalized world by several researchers in the international development scene (Kaul et al (1999), Kaul and Ryu (2001), Kaul (2001a, b), Stalgren (2000), Ferroni (2000).) These recent critiques can be summarized as follows: [1]

- The lines between "public" and "private" are blurred and constantly changing. "Public" and "private" are not anymore fixed but time-variable properties of goods. Although some researchers suggest to abandon the public-private distinction altogether, others argue forcefully that a good's properties should be made explicit- even though they may be of a temporary nature – because they determine the provision strategy for the good and affect actors' decisions to reveal their preference and level of demand. They assert that the good's "publicness" is a social construct. And that the public or private nature of a good is not a given but a matter of policy choice.

- The role of non-state actors in the provision of public goods is increasing, locally and globally. The state is not the only policy response to public goods provision. Civil society and private business can be active promoters and shapers of public goods. However it is recognized that although civil society and business can press for change in norms and adopt voluntary standards, only national governments can translate these demands into binding law and make agreements stick.

- Publicness in consumption does not mean positive utility for all. People enter market arrangements voluntarily. But in the case of a public good they may not have an avenue for criticism or an exit opportunity. They may be compelled to consume the public good (or bad). Therefore, it is important to ascertain whether a good's publicness in form goes hand in hand with publicness in substance.

Kaul (2001a) proposes therefore an expanded definition[1] for public goods that characterizes them in terms of their:

- Publicness in consumption or inclusiveness[2]: Inclusiveness has three origins: (i) deliberate public policy to place or to keep the good's benefits in the public domain, (ii) non-excludability of the goods benefits due to economic and technical reasons, and (iii) inadvertent existence of the good (or bad) in the public domain.

- Publicness in provision: based on a fully participatory decision making and design. All key actors should have a fair opportunity to help shape the good in question, monitor its production, assess its impact and recommend, if necessary adjustments in its design.

- Publicness in the distribution of benefits

Appendix 4:

The **National Electricity Policy** (EXTRAORDINARY**/**PART I - Section 1**,** PUBLISHED BY AUTHORITY**/**No…., New Delhi, Dated ….Ministry of Power/New Delhi, Dated the 12th, February, 2005, RESOLUTION **No.** 23/40/2004-R&R (Vol. II)) aims at achieving the following objectives:

- Access to Electricity - ***Available for all households in next five years***

- Availability of Power - Demand to be fully met by 2012. Energy and peaking shortages to be overcome and adequate spinning reserve* to be available.

- Supply of Reliable and Quality Power of specified standards in an efficient manner and at reasonable rates.

- ***Per capita availability of electricity to be increased to over 1000 units by 2012.***

- ***Minimum lifeline consumption of 1 unit/household/day as a merit good by year 2012.***

- Financial Turnaround and Commercial Viability of Electricity Sector.

- Protection of consumers' interests.

And in clause 1.5: "***Electricity industry is capital-intensive having long gestation period.*** Resources of power generation are unevenly dispersed across the country. ***Electricity is a commodity that cannot be stored in the grid where demand and supply have to be continuously balanced.*** The widely distributed and rapidly increasing demand requirements of the country need to be met in an optimum manner."

****Spinning reserve is any back-up energy production capacity which can be made available to a transmission system with ten minutes' notice and can operate continuously for at least two hours once it is brought online. Spinning is derived from hydroelectric and combustion turbine terminology. Reserve generator turbines can literally be kept spinning without producing any energy as a way to reduce the length of time required to bring them online when needed. Non-spinning reserve is generating capacity which is capable of being brought online within 10 minutes if it is offline, or interrupted within 10 minutes if it is online, and which is capable of either being operated or interrupted for at least two hours.***

A Brief Overview of What Electricity Markets Are

In the previous chapter we have made long drawn arguments about electricity being a public or private good. We concluded that electricity is a marketable public and merit good. Now when we say marketable, it means that there is an "economic market place" where one can buy and sell electricity.

Electricity markets are those commodities markets that deal specifically with the trading and supply of electricity.

What Are The Characteristics / Nature of The Electricity Market?

Electricity is by its nature difficult to store and has to be available on demand. Consequently, unlike other products, it is not possible, under normal operating conditions, to keep it in stock, ration it or have customers queue for it. Furthermore, demand and supply vary continuously.

The measures within an electricity market generally consist of two types: generation – the metered net electrical output of a generator or production plant at any given time and is measured in Megawatts (MW) and transmission - electricity that flows through a metered point for a given time and is measured in Megawatt Hours (MWh).

There is always a physical requirement for a controlling agency, the transmission system operator, to coordinate the dispatch of generating units to meet the expected demand of the system across the transmission grid. If there is a mismatch between supply and demand, the generators speed up or slow down causing the system frequency (either 50 or 60 hertz) to increase or decrease. If the frequency falls outside a predetermined range the system operator will act to add or remove either generation or load.

In addition, the laws of physics determine how electricity flows through an electricity network. Hence the extent of electricity lost in transmission and the level of congestion on any particular branch of the network will influence the economic dispatch of the generation units.

The scope of each electricity market consists of the transmission grid or network that is available to the wholesalers, retailers and the ultimate consumers in any geographic area. Markets may extend beyond national boundaries.

Buying and Selling Electricity in Electricity Markets

In economic terms, electricity is a commodity like any other that is capable of being bought, sold and traded. An electricity market is a system for effecting purchases, through bids to buy; sales, through offers to sell; and short-term trades, generally in the form of financial or obligation swaps. Bids and offers use supply and demand principles to set the price. Long-term trades are contracts similar to power purchase agreements and generally considered private bi-lateral transactions between counterparties. Wholesale transactions (bids and offers) in electricity are typically cleared and settled by the market operator or a special-purpose independent entity charged exclusively with that function. Market operators do not clear trades but often require knowledge of the trade in order to maintain generation and load balance.

What Are Wholesale Electricity Markets?

A wholesale electricity market exists when competing generators offer their electricity output to retailers. The retailers then re-price the electricity and take it to market, in a classic example of the middle man scenario. While wholesale pricing used to be the exclusive domain of the large retail suppliers, more and more markets like New England are beginning to open up to the end users. Large end users seeking to cut out unnecessary overhead in their energy costs are beginning to recognize the advantages inherent in such a purchasing move. Buying direct is certainly not a novel concept in economics; however it is relatively novel in the electricity context.

Buying wholesale electricity is not without its drawbacks (market uncertainty, membership costs, set up fees, collateral investment), however, the larger the end user's electrical load, the greater the benefit and incentive to make the switch.

For economically efficient electricity wholesale market to flourish it is essential that a number of criteria are met. Professor William Hogan of Harvard University has identified these criteria. Central to his criteria is a coordinated pricing mechanism such as spot market transactions that has "bid-based, security-constrained, economic dispatch with nodal prices". Other academics such as Professors Shmuel Oren and Pablo Spiller of the University of California, Berkeley have proposed other criteria. Variants of Professor Hogan's model have largely been adopted in the US, Australia and New Zealand.

Understanding pricing mechanisms for wholesale markets –

Bid-based, security-constrained, economic dispatch with nodal prices:

The theoretical price of electricity at each node on the network is a calculated "shadow price", in which it is assumed that one additional kilowatt-hour is demanded at the node in question, and the hypothetical incremental cost to the system that would result from the optimized re-dispatch of available units establishes the hypothetical production cost of the hypothetical kilowatt-hour. This is known as locational marginal pricing (LMP) or nodal pricing and is used in some deregulated markets, most notably in the PJM Interconnection, New York, and New England markets in the USA and in New Zealand. However, many established markets do not employ nodal pricing, examples being the UK, Powernext and Nord Pool (Scandinavia and Finland). While in theory the LMP concepts are useful and not evidently subject to manipulation, in practice system operators have substantial discretion over LMP results through the ability to classify units as running in "out-of-merit dispatch", which are thereby excluded from the LMP calculation. In most systems, units that are dispatched to provide reactive power to support transmission grids are declared to be "out-of-merit" (even though these are typically the same units that are located in constrained areas and would otherwise result in scarcity signals). System operators also normally bring units online to hold as "spinning-reserve" to protect against sudden outages or unexpectedly rapid ramps in demand, and declare them "out-of-merit". The result is often a substantial reduction in clearing price at a time when increasing demand would otherwise result in escalating prices. Hogan and others have noted that a variety of factors, including energy price caps set well below the putative scarcity value of energy, the impact of "out-of-merit" dispatch, the use of techniques such as voltage reductions during scarcity periods with no corresponding scarcity price signal, etc., results in a "missing money" problem. The consequence is that prices paid to suppliers in the "market" are substantially below the levels required to stimulate new entry. The markets have therefore been useful in bringing efficiencies to short-term system operations and dispatch, but have been a failure in what was advertised as a principal benefit: stimulating suitable new investment where it is needed, when it is needed.

Since the introduction of the market, New Zealand has experienced shortages in 2001 and 2003, high prices all through 2005 and even higher prices and the risk of a severe shortage in 2006 (as of April 2006). These problems arose because NZ is at risk from drought due to its high proportion of electricity generated from hydro. Similar shortages arose during the 1970s before the electricity market was introduced. The absence of shortages during the 1980s appears to be due to the large increase in capacity as a result of the "Think Big" projects started during the 1970s. The difference the market has made is that now cuts in electricity demand are made voluntarily while in the 1970s cuts were imposed. If the users of electricity know more about what they prefer to cut than the government, this has led to an increase in efficiency

In LMP markets, where constraints exist on a transmission network, there is a need for more expensive generation to be dispatched on the downstream side of the constraint. Prices on either side of the constraint separate giving rise to congestion pricing and constraint rentals.

A constraint can be caused when a particular branch of a network reaches its thermal limit or when a potential overload will occur due to a contingent event (e.g., failure of a generator or transformer or a line outage) on another part of the network. The latter is referred to as a security constraint. Transmission systems are operated to allow for continuity of supply even if a contingent event, like the loss of a line, were to occur. This is known as a security constrained system.

The system price in the day-ahead market is, in principle, determined by matching offers from generators to bids from consumers at each node to develop a classic supply and demand equilibrium price, usually on an hourly interval, and is calculated separately for sub-regions in which the system operator's load flow model indicates that constraints will bind transmission imports. In practice, the LMP algorithm described above is run, incorporating a security-constrained, least-cost dispatch calculation (see below) with supply based on the generators that submitted offers in the day-ahead market, and demand based on bids from load-serving entities draining supplies at the nodes in question. In most systems the algorithm used is a "DC" model rather than an "AC" model, so constraints and re-dispatch resulting from thermal limits are identified/predicted, but constraints and re-dispatch resulting from reactive power deficiencies are not. Some systems take marginal losses into account. The prices in the real-time market are determined by the LMP algorithm described above, balancing supply from available units. This process is carried out for each 5-minute, half-hour or hour (depending on the market) interval at each node on the transmission grid. The hypothetical redispatch calculation that determines the LMP must respect security constraints and the redispatch calculation must leave sufficient margin to maintain system stability in the event of an unplanned outage anywhere on the system. This results in a spot market with "bid-based, security-constrained, economic dispatch with nodal prices".

Managing the Transactional Risks Involved In Electricity Markets

Financial risk management is often a high priority for participants in deregulated electricity markets due to the substantial price and volume risks that the markets can exhibit. A consequence of the complexity of a wholesale electricity market can be extremely high price volatility at times of peak demand and supply shortages. The particular characteristics of this price risk are highly dependent on the physical fundamentals of the market such as the mix of types of generation plant and relationship between demand and weather patterns. Price risk can be manifest by price "spikes" which are hard to predict and price "steps" when the underlying fuel or plant position changes for long periods.

"Volume risk" is often used to denote the phenomenon whereby electricity market participants have uncertain volumes or quantities of consumption or production. For example, a retailer is unable to accurately predict consumer demand for any particular hour more than a few days into the future and a producer is unable to predict the precise time that they will have plant outage or shortages of fuel. A compounding factor is also the common correlation between extreme price and volume events. For example, price spikes frequently occur when some producers have plant outages or when some consumers are in a period of peak consumption. The introduction of substantial amounts of intermittent power sources such as wind energy may have an impact on market prices.

Electricity retailers, who in aggregate buy from the wholesale market, and generators who in aggregate sell to the wholesale market, are exposed to these price and volume effects and to protect themselves from volatility, they will enter into "hedge contracts" with each other. The structure of these contracts varies by regional market due to different conventions and market structures. However, the two simplest and most common forms are simple fixed price forward contracts for physical delivery and contracts for differences where the parties agree a strike price for defined time periods. In the case of a contract for difference, if a resulting wholesale price index (as referenced in the contract) in any time period is higher than the "strike" price, the generator will refund the difference between the "strike" price and the actual price for that period. Similarly a retailer will refund the difference to the generator when the actual price is less than the "strike price". The actual price index is sometimes referred to as the "spot" or "pool" price, depending on the market.

Many other hedging arrangements, such as swing contracts, Virtual Bidding, Financial Transmission Rights, call options and put options are traded in sophisticated electricity markets. In general they are designed to transfer financial risks between participants.

Virtual Bidding

Virtual bidding is a strategy implemented in various Independent System Operator (ISO) electricity markets of trading Day-Ahead prices against Real-Time (or Hour-Ahead) prices. The term "bid" can be used loosely in electricity markets to refer to an offer to buy or to sell. And the term "virtual" is used to refer to the fact that, while these trades occur in a physical market, virtual trades never entail taking a physical position--because every sell (or buy) Day Ahead will be closed by a buy (or sell) in Real Time. The ISO maintains a trade execution system that ensures all virtual positions will be closed before delivery time. A virtual bidding platform gives financial entities a way to participate in these physical markets, with no physical assets or presence on the grid. They can attempt to capitalize on regular divergences between these markets of different time period for the same underlying (perhaps using time, absolute price levels, or other external variables as conditioning factors). If this strategy of trading one time period against another without the intent (or perhaps even the ability) to deliver or receive physical power is implemented outside of a transaction system that identifies virtual bids and ensures they will be closed, it may be referred to as "implicit" virtual bidding. Virtual positions are included in the same simultaneous feasibility tests and price determination processes as real positions. Thus they can serve to reduce inefficiencies in the market.

Virtual bidding is a form of speculation not dissimilar to futures trading in the other commodity markets. Virtual bidding is the buying and selling of electricity without ever physically producing or consuming it. Instead all trades are offset in a subsequent market thus preventing physical delivery. There are a number of differences between virtual bidding and traditional commodity markets. Prominent amongst these are that virtual bidding occurs in electricity markets that are discrete, whereas most commodity markets allow for continuous trading. In addition virtual bidding usually occurs for very short time horizons, usually between the day-ahead market and the real-time market. That being said, there is no reason why it should not occur in different electricity markets. For example, buying and selling monthly contracts for a common delivery point without ever taking physical delivery is extremely similar to virtual trading, although in this latter case the product is not explicitly identified as a virtual product. Identifying virtual trades explicitly occurs in all the organized Independent System Operator-type markets and confers the benefit of not co-mingling truly physical bids with financial bids. This clear delineation prevents the financial act of speculation from unduly affecting the reliability of the electric system.

Virtual bidding is implemented for a number of reasons, not the least of which is the fact that in its absence there is a tendency for implicit virtual bidding to occur and the presence of this practice tends to create difficulties for grid operators. There are many benefits of virtual bidding besides the fact that its presence creates an appropriate avenue for arbitrage and in essence assists reliability. The most commonly identified benefits are as follows:

Market Power Mitigation - Often generators reside in load pockets where physical competitiion is constrained due to insufficient transmission. Virtual bidding allows virtual traders to compete to supply power within the constrained area. For this benefit to exist the type of virtual bidding must allow bid submission at the nodal level or at the constrained area level.

Mitigation of the Monopsony Power of Load - Load is often large enough to influence the market outcome by varying the quantity they bid into the DA market. Virtual bidding mitigates this power by allowing other market participants to simply bid in the load that was under-scheduled.

Mitigation of Supplier Market Power - The mitigation of supplier (generators) market power is commonly accepted but less well documented. For suppliers to exercise market power they would need to withhold generation in the Day-Ahead market (DAM). This is more difficult in the presence of virtual bidding as virtual traders can submit virtual supply to compete away this withholding practice.

Market Efficiency Improvements - The improvements to market efficiency emerge as the prices in the DA (day-ahead) and RT (real-time) markets tend to converge. This makes pricing less volatile and this decrease, albeit small, is the benefit. Prices will not converge completely as there will still be stochastic differences that were not foreseen between DA and RT, but the narrowing of the price spread leads to greater predictability.

Risks of Virtual Bidding

The purported benefits of virtual bidding have resulted in it spreading to new ISOs over time. There remain some risks though. The principal risk is that virtual trades will be used to leverage positions in other markets, such as the Financial Transmission Rights market. To prevent this some markets have implemented specific rules to prevent this sort of gaming.

Mechanics of Virtual Bidding

The ability to insert virtual bids is usually controlled by the host market, and requires specific registration due to the differing characteristics between virtual bids and physical bids. The submission method is generally similar across Independent System Operators.

What is electricity retailing?

Electricity retailing is the final process in the delivery of electricity from generation to the consumer. The other main processes are transmission and distribution.

Electricity retailing began at the end of the 19th century when the bodies which generated electricity for their own use made supply available to third parties. In the beginning, electricity was primarily used for street lighting and trams. The public could buy once large scale electric companies had been started.

The provision of these services was generally the responsibility of electric companies or municipal authorities who either set up their own departments or contracted the services from private entrepreneurs. Residential, commercial and industrial use of electricity was confined, initially, to lighting but this changed dramatically with the development of electric motors, heaters and communication devices.

The basic principle of supply has not changed much over time. The amount of energy used by the domestic consumer, and thus the amount charged for, is measured through an electricity meter that is usually placed near the input of a home to provide easy access to the meter reader.

Customers are usually charged a monthly service fee and additional charges based on the electrical energy (in kWh) consumed by the household or business during the month. Commercial and industrial consumers normally have more complex pricing schemes. These require meters that measure the energy usage in time intervals (such as a half hour) to impose charges based on both the amount of energy consumed and the maximum rate of consumption, i.e. the maximum demand, which is measured in kVA.

The initial monopoly supply phase

The rapid growth in electric appliance usage in the early part of the 20th century contributed to an explosive growth in electrification around the world. The supply of electricity to homes, offices, shops, factories, farms, and mines became the responsibility of public utilities, which were either private organizations subject to monopoly regulation or public authorities owned by local, state or national bodies. In some countries a statutory or government-granted monopoly was created, which was controlled by legislation (for example Eskom in South Africa).

Electricity retailing in the period from approximately 1890 to 1990 consisted of managing the connection, disconnection and billing of electricity consumers by the local monopoly supplier. In many utilities there was a marketing function which encouraged electricity usage when there was excess capacity to supply and encouraged conservation when supply was tight.

Creating a market

In 1990 there was a significant development in the way electricity was bought and sold. In many countries, the electricity market was deregulated to open up the supply of electricity to competition. In the United Kingdom the Electricity Supply Industry was radically reformed to establish competition, including a market in advising users about switching supplier. This trend continued in other countries (New Zealand Electricity Market) and the role of electricity retailing changed from what was essentially an administrative function within an integrated utility to become a risk management function within a competitive electricity market.

Electricity retailers now provide fixed prices for electricity to their customers and manage the risk involved in purchasing electricity from spot markets or electricity pools. This development has not been without casualties. The most notable example of poor risk management (coupled with poor market regulation) was the 2001 California electricity crisis, when Pacific Gas and Electric and Southern California Edison were driven into bankruptcy by having to purchase electricity at high spot prices and sell at low fixed rates.

Customers may choose from a number of competing suppliers. They may also opt to pay more for "green" power, i.e. electricity sourced from renewable energy generation such as wind power or solar power.

How are electricity retail prices set?

Retailers buy electricity in large volumes from the wholesale markets, and then sell the electricity in smaller packages to their customers. The prices residential, farm and small business/commercial customers pay are known as retail prices.

Electricity prices are set when companies that make electricity (generators) offer to sell their electricity to buyers (energy retailers). Energy retailers buy enough electricity to meet their customer supply requirements. Retail rates reflect the prices in the wholesale markets, together with some margin and profit for the energy retailer.

What affects electricity retail prices?

Wholesale prices are affected by many factors that relate to the supply and demand for electricity. These factors include:

- generation outages
- maintenance down times
- weather/temperature
- provincial growth
- new generation coming on stream
- water levels in dams
- wind
- price of fuel (coal and natural gas) used as generation inputs
- time of day, and time of the year electricity is to be used.

What are the methods used to retail electricity?

Energy providers purchase electricity through a combination of long-term contracts with the generation companies and short-term purchases. Energy providers then sell the electricity to consumers, either at the regulated rate or under contracted terms. Below are some of the methods energy providers use to purchase energy:

Energy Exchange Auctions

- *Whole Sale Markets: this is where all wholesale electricity is dispatched and the current wholesale price is provided*

- *Bilateral agreements are agreements made between a generator and a retailer*

- *Power purchase arrangements are arrangements where the energy that was purchased for terms up to the year 2020 for the generating station's output*

- *Forward month index is an index that shows the upcoming month's prices*

- *Request for offers Is a request for proposal or offers by a company that wants to buy electricity. The company seeks offers from generators to supply the retailer. For regulated companies, the request for offers is done through the energy exchange board*

- *Contracts or other methods to ensure customers always have electricity available is a contract is an agreement between two parties (buyer and seller) on how they will exchange and pay for the energy delivered*

Understanding the Structure of Electricity Trading In India

Power trading essentially means a transaction where the price of power is flexible for negotiation and options exist about whom to trade with and in what quantities. In India, power trading is in an evolving stage and the volumes of exchange are not huge. All ultimate consumers of electricity are largely served by their respective State Electricity Boards or their successor entities, Electricity and Power Departments, private licencees, etc. and their relationship is primarily that of captive customers versus monopoly suppliers. In India, the generators of electricity like Central Generating Stations (CGSs), Independent Power Producers (IPPs) and State Electricity Boards (SEBs) have all their capacities tied up. Each SEB has an allocated share in central sector/ jointly owned projects and is expected to draw its share without much say about the price. In other words, the suppliers of electricity have little choice about whom to sell the power and the buyers have no choice about whom to purchase their power from.

The pricing has primarily been fixed/controlled by the Central and State Governments. However, this is now being done by the Regulatory Commissions at the Centre and also in the States wherever they are already functional. Power generation/transmission is highly capital intensive and the fixed charge component makes up a major part of the tariff. India being a predominantly agrarian economy, power demand is seasonal, weather sensitive and there exists substantial difference in demand of power during different hours of the day with variations during peak hours and off peak hours. Further, the geographical spread of India is very large and different parts of the country face different types of climate and different types of loads.

Power demand during the rainy seasons is low in the States of Karnataka and Andhra Pradesh and high in Delhi and Punjab. Whereas many of the States face high demand during evening peak hours, cities like Mumbai face high demand during office hours. The Eastern Region has a significant surplus round the clock, and even normally power deficit states with very low agricultural loads like Delhi have surpluses at night. This situation indicates enough opportunities for trading of power. This would improve utilization of existing capacities and reduce the average cost of power to power utilities and consumers.

In view of high fixed charges, average tariff becomes sensitive to PLF*(plant load factor). Trading of power from surplus State Utilities to deficit ones, through marginal investment in removing grid constraints, could help in deferring or reducing investment for additional generation capacity, in increasing PLF and reducing average cost of energy. Over and above this, the Scheduled exchange of power will increase and un-scheduled exchange will reduce bringing in grid discipline, a familiar problem.

** A plant load factor is a measure of average capacity utilization. If the PLF is affected by non-availability of fuel, maintenance shut-down, unplanned break down and no off-take (as consumption pattern fluctuates lower in nights); the generation has to be adjusted. Power (electricity) storage is not feasible. A generation of power is controlled to match the off-take. For any duration, a power plant generates below its full capacity. To that extent it is a capacity loss.*

Plant Load factor = Actual Energy (Electrical) Output for a period / What it could have produced in the period (i.e. rated capacity output)

= Actual Output in time period T / (Rated capacity x T)

So, Actual Output = Rated capacity x T x PLF

In fact it is other way round; PLF is calculated based on the above (e.g. annual PLF, Monthly PLF etc)

Of course, along with this, one has to consider availability factors, etc.

Open Access and Trading

The Electricity Act, 2003 which has come into force from 10th June, 2003 repeals the Indian Electricity Act, 1910; Electricity (Supply) Act, 1948; and Electricity Regulatory Commissions Act, 1998. In view of a variety of factors, financial performance of the state Electricity Boards has deteriorated. The cross subsidies have reached unsustainable levels. A few States in the country have gone in for reforms which involve unbundling into separate Generation, Transmission and Distribution Companies. To address the ills of the sector, the new Act provides for, amongst others, newer concepts like Power Trading and Open Access.

Open Access on Transmission and Distribution on payment of charges to the Utility will enable number of players utilizing these capacities and transmit power from generation to the load centre. This will enable utilization of existing infrastructure and easing of power shortage. Trading, now a licensed and regulated activity is expected to help in innovative pricing which will lead to competition resulting in lowering of tariffs. However, what the innovative pricing should be or what should be regulated and by how much and why, are all at the imprecise stage, as of now.

Definition of "Open Access" In the Electricity Act, 2003:

"The non-discriminatory provision for the use of transmission lines or distribution system or associated facilities with such lines or system by any licensee or consumer or a person engaged in generation in accordance with the regulations specified by the Appropriate Commission"

A More General Definition of "Open Access":

"Enabling of non-discriminatory sale/purchase of electric power/energy between two parties utilizing the system of an in-between (third party), and not blocking it on unreasonable grounds".

Issues
a) Freedom to buy/sell, and access to market.
b) Adequacy of intervening transmission.
c) Transmission/wheeling charges.
d) Treatment of transmission losses.
e) Energy accounting, scheduling, metering and UI Settlement.

The present level of inter-regional electricity exchange is still quite limited and the constraints for enhancing the same are the relative lack of commercial awareness with SEBs, lack of proper market mechanism (absence of tariff structure to promote merit-order operation and encourage trading of power), inadequate transmission capacity, lack of statutory provisions for direct sale by IPPs/CPPs/ Licensees outside the State, grid indiscipline and financial viability of State Utilities, among others.

Suppose a company from Maharashtra wants to sell 100 MW to a Discom-A in Andhra Pradesh, the following steps need to be taken:
a) The company and Discom-A to agree on terms and conditions of sale
b) The company to get the consent of MSEB and "no-objection" of MSERC
c) Discom-A to get the consent of APTransco and "no-objection" of APSERC.
d) MSLDC (Maharashtra State Load Dispatch Centre) and APSLDC (Andhra Pradesh State Load Dispatch Centre) to ascertain transmission adequacy, and agree to arrange necessary metering, scheduling, energy accounting and UI settlement.
e) WRLDC (Western Region State Load Dispatch Centre) and SRLDC (Southern Region State Load Dispatch Centre) to ascertain transmission adequacy in their regional transmission systems.
f) All concerned to have a common understanding about treatment/sharing of transmission losses and levy of transmission/ wheeling charges for the use of intra-State and inter-State systems

Impact of "Open Access System" On "Discom"

Electricity Act 2003 has authorized that with immediate effect open access should be implemented. While everyone accepts that it may serve the consumer interests, there are two contradicting views regarding the implications of the open access system on the electricity entities especially the DISCOMs. The first view is that competitive power generation will bring down the ultimate costs to the consumers. Cost reduction is possible only by reducing the T&D

losses (transmission and distribution), keeping under control the operating costs and keeping the additional power purchase costs low. Given the facts that power purchase costs keep increasing and the HT (high tension electricity supply) tariff has been mandated to be brought down closer to the average costs (thereby reducing the cross-subsidy) according to a fixed time schedule to be set by the regulator, the first group argues that taking up additional liability by way of HT consumers at such high marginal costs of power purchase would be financially imprudent for the electricity entities.

The other view is that electricity entities have heavy responsibility to meet the needs of agricultural consumers and small domestic consumers at a lower rate than the average cost. Consumers who are currently the HT consumers and commercial consumers paying a higher tariff are providing the means to do this. If such consumers walk away from Grid supply subsidy from Government will have to increase. The correct position would depend on the state-wise situation regarding relative tariff of the different consumers, the possible rates of growth of category wise consumption and the potential for purchasing additional power at low rates in the future.

Market Development

In the legal framework before enactment of the new Act, the development of market in power was highly constrained as the industry structure was horizontally and vertically integrated. The electricity supply to a customer is through a chain of monopolies earlier regulated by the Government and now by the Regulatory commission.

With the new Act, a liberalized market structure is sought to be provided. A customer has a number of choices to get his power. The generators can also compete among themselves for distribution companies/individual customers. There is a provision for surcharge to meet current level of cross subsidy, if a consumer opts to get electricity directly from generator or any source other than his own distribution licensee and has been allowed open access by the Regulator. However, there is no surcharge when a distribution company buys power from a generator directly. There is also a provision for bilateral contract for supply of power through a competitive process between a generator and distributor. With the provision of non-discriminatory open access to transmission, the competition for bulk supply to distribution companies could become a reality in the near future. The market structure will, perhaps, require being transformed. The commission is committed to the development of a fully competitive power sector. However, given the current realities of the sector (shortages, cross subsidies, long term PPAs, capacity allocation from CGS (Central Sector Generation) to state etc), the market development has to go through a number of intermediate phases. It may be noted that the retail competition has yielded perceptible benefits to consumers in the countries having surplus generation. There are a number of complex issues such as transition risks, settlement of imbalances in power injected and withdrawals, effective metering, efficient pricing of transmission, management of congestion, etc. on which the Electricity Commission has not come to definite conclusions.

As per an estimate, Captive Power capacity in the country is about 20,000 MW of which about 14,000 MW is grid connected. Surplus is available with many Captive Power plants and also with IPPs and Licensees of some of the States. They need permission from the State Govt. as well as consent for usage of SEB's transmission network, which besides being difficult to come by, is also usually irrationally priced. Many Captive plants are keen to trade their power at a remunerative tariff, but there is no statutory provision presently for direct sale of surplus power by them to outside States. A provision for this however, exists in the Electricity Bill.

Power Market

The Wholesale transactions for electric power globally are through spot contracts, forward and future contracts and long term bilateral contracts. The primary driver for change in the power market in India today, at least from the consumers' point of view, is the desire to see lower prices in the wholesale electricity market. For this objective to bear fruit, attention has to be paid to the ideal power exchange for India backed with adequate regulations, as poor exchange design may lead to market failures. The envisaged power market will rely on competition, instead of regulation, to minimize generation costs and additionally will obtain long-term financing for power systems / generating companies.

Transmission and Wheeling

With the introduction of mandatory open access, there will be demand by third parties for wheeling of power through the existing transmission networks in addition to wheeling being undertaken at present for various beneficiaries importing power from outside the region. In this context, CERC has jurisdiction for regulation of transmission and wheeling charges for all inter-state and inter-regional power flows. As per the existing notification, the wheeling charges are payable at the same rate as the transmission charges for a particular region.

Methodology for Sharing Of Transmission Charges

Although the principle for sharing of transmission charges/wheeling charges have been enumerated in detail in the present notification, there appears to be needed to bring further clarity in the matter. The following methodology for sharing of transmission and wheeling/congestion charges is proposed for discussion:

a) Transmission charges for the inter-regional lines may be shared by the two contiguous regions on 50:50 basis and further shared among the beneficiaries within the respective region.
b) b) Transmission charges for the inter-regional lines may not be pooled with those for the other transmission assets in the respective regions.
c) Transmission charges (after deducting the wheeling/congestion charges realized from others) for the regional assets (other than the inter-regional assets) may be shared by the "regional beneficiaries" (Regional beneficiaries means beneficiaries located in the region concerned)
d) If an inter-regional asset is used for wheeling by a third party, the balance transmission charges after accounting for the payable wheeling/congestion charges, may be shared by the beneficiaries of the contiguous region on 50:50 basis.

Possible Learnings

The best system would be one in which the consumer has a choice that comes out of competition. Establishment of markets with rules for their operation and a regulator to see that they are followed will give acceptable results for consumers and investors both. Competition and markets do not have to wait for shortages in supplies to be overcome. Trading is a bridge even in shortage situations and regulators can rightly be expected to look after the interests of the less powerful.

However, the lessons from around the world indicate that adequate availability of power, its unrestricted flow across geographical boundaries, strong commercial mechanisms that determine market operations and the paying ability of consumers are vital necessities that would need to be in place for competition at all levels to be truly sustainable. Rules and regulations are to be formulated for interstate, inter-regional and international transactions which have built-in relaxation that encourages trading and makes transfer of power easier. Streamlining levy of reasonable transmission charges, wheeling charges and losses on power to be traded are important, otherwise trading will not remain competitive with incidental use of transmission system to be priced on incremental cost basis. Transmission losses should also be charged on actuals, rather than on a normative basis.

There is an immediate need for strengthening the upstream and downstream transmission networks to better utilize the existing Inter-regional transmission capacity. Also better reactive power management would lead to significant additions to existing transmission capacity utilization. Bottled-up capacities of the IPPs and Captive Generators as well as underutilized capacities of Utilities need to be tapped urgently through a more commercial approach. Trading of such capacities would mean availability of extra energy at only the variable cost, thus bringing down the average cost of power not only to bulk consumers but also reducing the burden of rate increases on ordinary consumers too.

India is already on its way to establishing a power market. This requires considerable and continuous effort starting from continued strengthening of inter-regional power transmission links, open access to transmission and later to distribution links, releasing the underutilized captive capacities, to the designing of an effective market mechanism suited to India's needs. The institutional set-up of the Market could make a significant difference to the final market price. In the short term, market rules should promote economic efficiency, so that customer loads are served and reliability is maintained at the lowest possible cost. In the long term, the market should produce prices that stimulate appropriate levels of investments in new generation and transmission capacity.

In addition, the market rules should be such as to encourage broad participation and ensure fairness. Such a process will reduce the need for government oversight because it will be to a large extent self-policing and it will be difficult for individual participants to manipulate results in their favor. Of the two market mechanisms evaluated, Pool day-ahead market, with Pay SMP settlement, may produce lower prices than the bilateral model. However, in the case of a power exchange with a small number of buyers and sellers, often there may be not enough bids to provide an assurance that the price is competitive, thus creating the need for more market participants.

To ensure that sufficient generating capacity is available to prevent capacity shortages and wholesale price spikes an installed-capacity requirement may be made mandatory as proposed in California. This standard would require all retail providers to acquire, either through contracts or physical assets, sufficient capacity to meet peak demand plus a certain reserve margin. Combining the above mentioned reforms with a more transparent bidding and price setting mechanism, could also lead to more demand-side participation, and hence greater price elasticity.

We will take up each of these points mentioned above and check their feasibility in terms of implementation, execution, efficiency, etc. in the latter discussions regarding reforms and governance.

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Appendix A

A Short Note on How Electricity Markets Operate Internationally

Although mentioned in the section "Electricity Markets' Jargon" – we may find it worthwhile to go through the terms 'derivatives' and 'hedging' once more, to understand the dynamics of how Electricity markets operate world-wide.

What is a derivative?

A derivative is the collective name used for a broad class of financial instruments that *derive* their value from other financial instruments (known as the underlying), events or conditions.

Derivatives are usually broadly categorised by the:

- relationship between the underlying and the derivative (e.g. forward, option, swap)
- type of underlying (e.g. equity derivatives, foreign exchange derivatives, interest rate derivatives or credit derivatives)
- market in which they trade (e.g., exchange traded or over-the-counter)
- pay-off profile (Some derivatives have non-linear payoff diagrams due to embedded optionality)

Derivatives are used by investors to

- provide leverage or gearing, such that a small movement in the underlying value can cause a large difference in the value of the derivative
- speculate and to make a profit if the value of the underlying asset moves the way they expect (e.g. moves in a given direction, stays in or out of a specified range, reaches a certain level)
- hedge or mitigate risk in the underlying, by entering into a derivative contract whose value moves in the opposite direction to their underlying position and cancels part or all of it out
- obtain exposure to underlying where it is not possible to trade in the underlying (e.g. weather derivatives)
- create optionality where the value of the derivative is linked to a specific condition or event (e.g. the underlying reaching a specific price level)

What Is Hedging?

Hedging is a technique that attempts to reduce risk. In this respect, derivatives can be considered a form of insurance.

In financial economics, a hedge is a position established in one market in an attempt to offset exposure to price fluctuations in some opposite position in another market with the goal of minimizing one's exposure to unwanted risk. There are many specific financial vehicles to accomplish this, including insurance policies, forward contracts, swaps, options, many types of over-the-counter and derivative products, and perhaps most popularly, futures contracts. Internationally, Public Futures Markets were established in the 1800s to allow transparent, standardized, and efficient hedging of agricultural commodity prices; they have since expanded to include futures contracts for hedging the values of energy, precious metals, foreign currency, and interest rate fluctuations.

The International Scenario

Internationally increased competition in bulk power and retail electricity markets is likely to lower electricity prices worldwide. This will also result in greater price volatility as the industry moves away from administratively determined, cost-based rates and towards market-driven prices. Price volatility introduces new risks for generators, consumers, and marketers. In a competitive environment, some generators will sell their power in potentially volatile spot markets and will be at risk if spot prices are insufficient to cover generation costs. Consumers will face greater seasonal, daily, and hourly price variability and, for commercial businesses, this uncertainty could make it more difficult to assess their long-term financial position. Finally, power marketers sell electricity to both wholesale and retail consumers, often at fixed prices.

Marketers who buy on the spot market face the risk that the spot market price could substantially exceed fixed prices specified in contracts.

Electricity futures and other electric rate derivatives help electricity generators, consumers, and marketers manage, or hedge, price risks in a competitive electricity market. Futures contracts are legally binding and negotiable contracts that call for the future delivery of a commodity. In most cases, physical delivery does not take place, and the futures contract is closed by buying or selling a futures contract on or near the delivery date. Other electric rate derivatives include options, price swaps, basis swaps, and forward contracts. Futures and options are traded on an exchange where participants are required to post margins to cover potential losses. Other hedging instruments are traded bilaterally in the “over-the-counter” (OTC) market.

Why Should Governments Care?

Although derivatives offer the potential for managing commodity price risk in a competitive electricity market, their use will introduce new risks.

When retail competition develops, state regulators may have an interest in protecting customers from the indirect consequences of potentially speculative derivative activities undertaken by marketers, generators, and other retail service providers. To the extent regulated distribution utilities enter the derivatives market, state regulators will want to ensure that these transactions are in the best interest of retail customers. Yet futures and derivatives should not be regulated simply because they can produce losses. Not using futures in volatile commodity markets can also produce losses. Instead, policies should be motivated by the effect the use of futures will have on the objectives of utility regulation. The traditional goal of utility regulation has been to ensure that consumers have a reliable supply of electricity that can be purchased at a fair price. This raises the issue of whether large futures losses by firms that play a vital role in maintaining the reliability of the electricity grid could increase the likelihood of a costly electrical outage.

In some situations, state regulators may need to monitor or set limits on derivatives transactions undertaken by utilities because of market power concerns during the transition to competitive electricity markets. Some economists and policy makers have argued that, in states such as California where large distribution utilities are required to sell into a power pool or exchange (PX), they may have incentives to manipulate PX prices in order to reap returns on positions taken in futures and other derivatives contracts. A related concern is that, where futures contracts are settled through delivery—a rare event, as we discuss, but one that nonetheless can and does occur—the distribution utility may be required to buy or sell electricity outside the PX, a sale that would violate their requirement to sell only to the PX. As far as India is concerned, the derivatives markets are at a fledgling stage - especially so, for electricity transactions. However, as this section of the market gradually develops, we will have to keep in mind that there needs to be clear norms for transactions in such situations, since ours is a developing nation. This is discussed in detail in latter sections.

Price Volatility and Risk in Competitive Electricity Markets

As the most nations move towards competitive electricity markets, the expectation is that electricity prices will be lower overall but price volatility will increase.

What Are The Determinants Of Price Volatility?

Electricity is also characterized by seasonal demand and its price can be quite volatile. A traditional and explicit goal of utility regulation has been to stabilize retail prices, even though the underlying costs of producing electricity are quite volatile. Bonbright (1961), in his classic text on rate design, gives two reasons for stable rates. First, regulatory proceedings are “notoriously expensive and cumbersome,” making it impractical to frequently change rates. Second, Bonbright argues that consumers need to see prices that reflect long run costs so that they can make intelligent purchasing decisions for items that use energy. Yet while price stability may promote rational consumer decisions regarding energy using equipment and has a small benefit in reducing consumer risk, it also causes a significant inefficiency in the electricity market by making it impossible for customers to respond to the true cost of electricity. Schnitzer (USA, 1995) estimates that peak power costs may approach 50¢/kWh, but because of utility rate designs, consumers treat power even at these times as if it cost only 10¢/kWh. Consequently, customers significantly over-consume during peak hours. However, consumers do pay for these costs during off-peak hours when power is overpriced, in many places by a factor of two or three. At these times, the distortion is towards under-consumption.

As the electricity market becomes more competitive, cost and demand fluctuations will increasingly be translated into price fluctuations. This should make both generation and consumption more efficient. Customers will gain access to cheaper off-peak power, and will receive more accurate price signals during expensive, on-peak power periods. This should result in a flattening of the load-duration curve and an increase in load factors, which will, in turn, reduce reserve margins and the average cost of power. Price fluctuations occur as companies attempt to maximize profits. For competitive firms, profit is maximized by setting price equal to marginal cost, and for firms with market power, profit is maximized by marking up marginal costs. Either way, the price fluctuations are simply the result of marginal cost fluctuations.

There are four major factors that cause marginal costs to fluctuate. On the shortest time scale are demand fluctuations, which affect marginal cost by moving production quantity along an upward sloping marginal supply curve. Most of the amplitude of these fluctuations is experienced on a daily basis, but the height of the peak also varies with the season. As discussed in the next section, derivatives are not typically used to hedge risks associated with daily price fluctuations, but they are used to hedge risks associated with seasonal price fluctuations.

A closely related source of marginal cost fluctuation is shifting of the marginal cost curve as various sources of supply become temporarily unavailable. For example, availability of inexpensive hydroelectric power can shift the short run marginal cost curve. In years with plentiful rainfall, hydroelectric generation typically increases, and the short run marginal cost curve shifts down. Unit outages will also influence which generating unit operates on the margin. If a large base load plant is being serviced, fossil plants with higher marginal costs will be forced to operate. Derivatives can play a useful role in hedging some of these fluctuations.

Probably the most important source of price volatility from the point of view of understanding futures is volatility in the cost of fuel. This will have a strong seasonal component, but can also be affected by geo-political events and changes in global market conditions. The final source of marginal cost fluctuations is changes in the production technology itself.

Technical progress reduces the cost of production; production costs can also be affected by environmental and labor costs. These cost fluctuations can be very important over the life of a twenty year contract, but are generally beyond the time scope of hedging strategies based on futures and other derivatives.

What Are The Risks Of Risks Of Price Volatility?

In a competitive electricity market, daily fluctuations in electricity commodity prices will be the most dramatic manifestation of price volatility. Those customers on real-time rates will face prices that may increase and decrease by more than 100% over several hours. These fluctuations will not, however, constitute a serious risk because it is easy for customers to time average on a daily basis, and because the amount of money spent on energy in one day is relatively small. For these reasons, electric rate derivatives are not typically designed to mitigate the risks associated with daily price fluctuations.

Price volatility alone does not create serious risk, but when a volatile input price is coupled with a fixed output price; a firm can face significant risks in its financial operations. Consider a marketer that buys power from generators in a spot market and sells power through fixed price contracts. The marketer's markup is likely to be small (e.g., less than 10% above the spot price), and most of the markup goes towards covering marketing overhead, leaving only a small profit. If the spot price jumps 25% in a given year due to a supply shortage, the marketer could lose several years worth of profits. This is an unacceptable risk, and the marketer would be interested in hedging it.

Utilities may find themselves in a similar position if they purchase power in the spot market and are under comprehensive price-cap regulation or otherwise unable to pass costs on to customers. Generators can be placed in a similar bind if they sell in a market that is competitive and dominated by generation from another fuel. If their fuel costs increase more than the fuel costs of other types of generation, then it is likely that spot power prices will not completely cover their increased fuel prices and their profits will suffer.

Risks Faced by Industry Participants

How will risk be managed in the emerging competitive electricity market? It is useful to compare how traditional regulation managed risk and to specify what risks industry participants will face in the future. Cost of service regulation relies largely on the "prudency" standard. If a utility's investments and expenditures were deemed prudent, regulators would allow the firm to include these investments and expenditures in rates. Some risks (e.g., interest rates, fuel prices, and purchased power prices) were considered beyond the control of utilities and were passed on to customers through automatic adjustment clauses and balancing accounts. Ultimately, the customer received one bundled price for the myriad services provided by the utility.

In a competitive market these different services will be unbundled and priced separately. In many states, regulators are considering or have already required a functional or physical separation of generation, transmission, and distribution assets. It is easier to understand the risks of a competitive market by taking a functional view of the industry. Participants in the electricity market may perform one or more of the following functions: (1) generate power, (2) transmit/distribute power, (3) market power, and (4) consume power. The positions and risks faced by generators, marketers, and end users are described below and summarized in the table below.

Generators

In a restructured electricity industry, generators will include utilities, federal power authorities, qualifying facilities, merchant power plants, and on-site industrial plants. An entity that owns a power plant has a “long” electricity position. That is, the entity’s wealth increases and decreases with the price of power. When power prices increase, the value of the plant increases, and when power prices decrease, the value of the plant decreases.

Marketers

A marketer buys and resells power. A marketer can have either a “long” or “short” position.

A marketer who buys fixed-price power before finding a market for that power has a “long” position. A marketer who has sold fixed-price power before securing supply has a “short” position. San Diego Gas and Electric and Portland General Electric are examples of utilities who currently serve as marketers for significant portions of their native load. Each of these utilities has greater load than generating resources. Accordingly, they buy power in the wholesale market and resell it at the retail level. Their obligation to serve these retail loads gives them a “short” position, since they must buy power in the wholesale markets in order to meet their obligations to customers.

End Users

Competition will change the choices that customers have for suppliers. An electricity consumer is naturally “short.” As is typical with a short position, consumers benefit when prices go down and are hurt when prices increase.

One firm may perform several of the functions described above, making it difficult to categorize risks as those faced by “utilities” or “marketers” or “end users.” A co-generator may decide to become a power marketer. An investor-owned utility may be long power in its own service territory but may market significant amounts of power in other parts of the country. Firms such as Chevron and Dupont perform all of these functions as they have large electricity loads, own generation on-site, and have established power marketing subsidiaries. As the industry develops, it will be necessary to piece together the different functions that a given firm performs in order to understand the risks that it faces

<u>Industry Participants and Risks</u>

Functions	Example	Natural Positions
Generators	Utilities, Independent Power Producers, Qualifying Facilities	Long
Marketers	Utilities, Power Marketers	Long or Short
End users	Industrial, Commercial, Residential Customers	Short

Potential Dangers of Derivatives

If the experience in natural gas markets is replicated in electricity, the use of derivatives could increase rapidly and quickly become a significant market. Although derivatives offer the potential of managing price risk, their use will introduce new risks. Losses have been incurred by both speculators and hedgers, and by both sophisticated and naive investors.

Description of Electricity Futures Contracts

Commodity futures contracts are legally binding and negotiable contracts that call for the delivery of agricultural, industrial or financial commodities in the future. While agricultural futures have traded since the 1860s (Brown and Errera 1987), energy futures were not introduced until the 1970s. NYMEX initiated trading in heating oil futures in 1978, liquefied propane gas futures in 1987, crude oil futures in 1983, unleaded gasoline in 1984, natural gas in 1990, and electricity futures in 1996.

Futures contracts are traded on a commodity exchange where the delivery date, location, quality, and quantity have been standardized. A future is a standardized contract where all terms associated with the transaction have been defined in advance, leaving price as the only remaining point of negotiation. Standardization helps make the price transparent because no correction for quality is needed to compare different contracts. When the real nature of prices is coupled with the reporting of all transaction prices by the exchange, we have a situation of complete price transparency.

Most energy futures in the United States are traded on the NYMEX (the exception is the Kansas City Board of Trade's western natural gas contract). Each commodity has its own trading area, known as a "pit," where contracts are traded by brokers using the open outcry method. Under this method, brokers yell the prices at which they are willing to buy (the bid price) or sell (the offer price) of a particular month's contract. When a trade takes place, the price is submitted to a recorder who posts the price. Brokers can either trade for their own account or execute orders for customers. Some brokers, known as "locals," trades exclusively for their own account, others only execute customers' orders, while others trade both for themselves and customers.

A futures contract is created when a buyer and seller agree on a price. Because futures contracts are created instruments, and are not limited in quantity the way stocks are, the number of contracts that have been created is a measure of the interest and importance of any particular type of futures contract. This number is termed the "open interest" in the contract.

"Open" positions can be closed in two ways. By far, the most common form of liquidation occurs when a party with a long position (someone who previously bought a futures contract) decides to sell, and a party with a short position (someone who previously sold a futures contract) decides to buy a futures contract. More than 98% of all futures positions are closed prior to delivery. The alternative to this financial closing of positions is to hold the contract to maturity and actually take or make physical delivery. The holder of a short position must deliver the commodity while the holder of a long position must receive the quantity.

The Purpose of Hedging

Most derivatives function like a side bet on commodity prices. They are a zero sum game where there is a loser for every winner. The seller of a future or an option loses one dollar for every dollar that the purchaser earns. But this does not mean that risk is a zero sum game.

All parties in a futures market could be hedgers, and all could be successfully using the market to reduce their risk (Stoll and Whaley 1993).

A "short hedger" sells futures to hedge a long position in the underlying commodity (electricity), while a "long hedger" buys futures to hedge a short position in the underlying commodity. A generator is long in electric power and will use a short hedge. A marketer who has sold power to a utility is short that power because he cannot produce it. A marketer will buy futures to hedge its short position in the power market. If these were the only participants in the futures market, then all parties would be hedgers and all would simultaneously reduce their risk.

There is, however, no reason that the amount of short hedging will necessarily equal the amount of long hedging. For this reason, speculators are useful. Hedgers are often willing to pay to reduce their risk. This is analogous to being willing to pay for insurance. If there is an imbalance of hedgers, then speculators can make money by shouldering the risk of hedgers. For example, if the market consisted only of marketers who wished to buy futures, then speculators could sell them futures at a high price. This would, on average, produce a profit for the speculators and it would provide the marketers with insurance at the price of the speculators' profit. Because speculators hold no position in the underlying commodity, their risk is increased by being long or short futures, but this risk is compensated for by the fact that hedgers are willing to pay for the insurance that the speculators provide.

The speculators just described are professionals who would not stay in the market if they did not make a profit. But amateur speculators (including would-be professionals) are also thought to play an important role. A rather dry graduate finance text puts it like this:

"Amateur speculators consist of two categories—gamblers and fools. Gamblers...know the risks and the fact that there is a house take, but they enjoy the game. Fools...think they know how to make money in futures, but they do not... The supply of fools is replenished by Barnum's Law. (There's a sucker born every minute.)" (Stoll and Whaley 1993)

Because speculators are not tied to any specific underlying commodity, they can and do diversify their portfolios. Modern finance theory tells us that the proper measure of risk is the amount of risk that cannot be diversified away. The risk to a speculator from holding a specific future is given by the variability of that future times its correlation with the speculator's portfolio. This is typically far smaller than the risk that the hedger is laying off. To sum up, there are three reasons that a futures market can be an inexpensive way for hedgers to reduce their risk. First, short hedgers can trade with long hedgers. Second, professional speculators can diversify away most of the risk inherent in any particular future.

And third, amateur speculators bear risk essentially for free.

The Pricing of Futures

To understand hedging, one must analyze the behavior of the price of futures relative to the price of the commodity being hedged. The most basic point is that the futures price converges at the time of maturity to the spot price of the underlying commodity. This leaves the questions of whether this convergence takes place from above or below, and how the price of the underlying commodity relates to the price of the commodity being hedged.

A futures contract can be settled either by delivery of the physical commodity or by a cash settlement. In either case, the settlement price should be identical to the spot market price for the same product at the same place. This "convergence to spot prices" is a fundamental feature of futures markets (see Williams 1986).

It requires either a mechanism for determining the appropriate spot price in the case of a cash settlement process, or the location of the delivery point at an active spot market. Coordinating delivery and receipt of a non-storable commodity, such as electricity, requires careful consideration of the rights and obligations of the delivering and receiving parties. In natural gas, a set of procedures have been worked out to deal with these issues (NYMEX 1992). The exchange takes an active role in matching buyers with sellers for the delivery process (in the terminology of contracts, "longs" with "shorts"). Once a pair is matched they are free to work out mutually acceptable alternative arrangements. In defining these procedures, careful attention must be paid to defining *force majeure* situations so that one party cannot take advantage of another.

One of the paradoxes of futures markets is that the delivery mechanism must be highly reliable and certain, and if this is the case, then no one will use it. The reason for this paradox is that only with a high degree of confidence in the integrity of delivery will market participants accept that the futures price converges to the spot price. Once this confidence is established, it will typically be more convenient for participants to close out positions financially rather than through the delivery mechanism. In typical futures markets, only about 2% of all contracts settle through delivery.

To understand and evaluate hedging strategies, one must have a basic understanding of the determinants of futures prices. This fact is underscored by Metallgesellschaft's $1.3 billion in losses in the oil futures market in 1993. MG, an oil and gas marketer developed a hedging strategy based on historic spot-futures price relationships. When these price relationships did not occur in 1993, the oil marketer experienced huge margin calls. Ultimately, MG was forced to close these positions and realize the losses.

The price of a futures contract is a function of the underlying asset's spot price, interest rates, storage costs, and expectations of future supply and demand conditions. The price of a futures contract is related most importantly to the current price of the underlying cash commodity.

Even though actual delivery is quite rare, the possibility of delivery provides the critical link between spot and futures markets, enabling arbitragers to profit when prices get too far out of line.

The determinants of futures prices are most easily understood using a tangible example, in this case one where storage costs are pertinent. Suppose a firm expects to need 1,000 barrels of oil in six months. The firm can both buy the commodity today and store it for six months (the "buy and store" approach) or purchase a futures contract for delivery in six months. The firm will compare the price of the two alternatives and select the cheaper one. Futures prices are reported in the newspaper each day, and for purposes of this example we will assume that the futures price for delivery in six months is $18 per barrel.

To calculate the costs of the "buy and store" approach, the firm must know the current spot price, interest rates, and storage costs. Assume that the spot price of oil is $16 per barrel, that annual interest rates are 10%, and that storage costs for six months total $1 per barrel. Accordingly, the total cost of the "buy and store" approach are:

$16.00 Spot Price

$ 0.80 Opportunity cost of money spent on oil ($16.00 × 10% × ½ year)

$ 1.00 Storage costs

$17.80

Since the futures price equals $18.00 and the "buy and store" approach costs only $17.80, the firm will choose the "buy and store" approach. In fact, these price relationships provide an opportunity to secure a riskless profit today. The firm could sell futures contracts for $18.00 per barrel, buy and store the oil for $17.80 and lock in a profit of $0.20 per barrel by delivering under the terms of the futures contract. This is called riskless arbitrage. As more people take advantage of this riskless profit, the futures price will decline, because people are selling futures, and the spot price will go up, because people are buying on the spot market.

In equilibrium, the futures price and the "buy and store" price will be equal.8 Thus, market forces will tend to make the futures price higher than the spot price by the amount of carrying costs (the time value of money) and storage costs.

An examination of actual futures prices indicates that the futures-spot price relationship posited above does not always hold true. For consumption commodities, the futures price does not always exceed the spot price by carrying and storage costs. In fact, the futures price is sometimes less than the spot price. This indicates that a large number of market participants choose not to take advantage of arbitrage opportunities. When this is the case, "users of the commodity must feel that there are benefits of ownership of the physical commodity that are not obtained by the holder of a futures contract. These benefits may include the ability to profit from temporary local shortages or the ability to keep a production process running. The benefits are sometimes referred to as the *convenience yield* provided by the product" (Hull 1993). We would expect convenience yields to be high when the physical commodity is in short supply and low when the physical commodity is abundant. The following equation summarizes the futures-spot price relationship:

Futures Price = Spot Price + Carrying Costs + Storage Costs - Convenience Yield

This equation illustrates another important characteristic of the spot-futures price relationship.

As the delivery month for a futures contract approaches, the futures price converges with the spot price of the underlying asset. This is an intuitive result, since carrying costs and storage costs will decrease with time. The convenience yield will also diminish with the time to delivery, since the benefits of holding the commodity rather than a futures contract will be less. The possibility of delivery will ensure that the futures price and spot price are the same on the delivery date. Otherwise, it would be possible to arbitrage prices in the spot and futures markets to secure a riskless profit.

How Generators, End Users, and Marketers Hedge Futures contracts can be used to hedge or to speculate:

An entity with a long (short) position in the electricity market can hedge by selling (buying) a future. A speculator, in contrast, takes an outright long or short position in expectation of a price move. Someone with a long futures position (i.e., has purchased futures) profits when prices increase and loses when prices decline. Someone with a short futures position (i.e., has sold futures) profits when prices decline and loses when prices increase. The following table shows that hedgers mitigate risk by taking opposite positions in the physical and futures markets. The fact that the hedging arrows oppose the cash-position arrows shows that hedgers are insulated from price changes because gains in the physical position are offset by losses in the futures position, and vice versa. With a perfect hedge, the magnitude of the corresponding gains and losses in the physical and futures positions will be exactly the same.

	End User	Generator
Cash Position	**Short** the physical commodity (electricity) at a future date.	**Long** the physical commodity (electricity) at a future date.
Risk from Cash (Physical) Position		
• Spot Price Increase • Spot Price Decrease	Profits decrease ↘ Profits increase ↗	Profits increase ↗ Profits decrease ↘
Hedge (Futures Position)	**Long** Electricity Futures. (bought futures)	**Short** Electricity Futures. (sold futures)
Risk from Futures Position		
• Spot Price Increase • Spot Price Decrease	Profits increase ↗ Profits decrease ↘	Profits decrease ↘ Profits increase ↗

Appendix B

What Is "Nodal Pricing" (also referred to as "Locational Marginal Pricing")?

Nodal Pricing is also referred to as "Locational Marginal Pricing" (“LMP”) - which is a market-pricing approach used to manage the efficient use of the transmission system when congestion occurs on the bulk power grid. The Federal Energy Regulatory Commission (FERC) has proposed Locational Marginal Price as a way to achieve short- and long-term efficiency in wholesale electricity markets.

Marginal pricing is the idea that the market price of any commodity should be the cost of bringing the last unit of that commodity - the one that balances supply and demand - to market• In electricity, Nodal Pricing (Locational Marginal Pricing) recognizes that this marginal price may vary at different times and locations based on transmission congestion. With Locational Marginal Price, market participants will know the price of hundreds of locations on the system

Electric grid congestion develops when one or more restrictions on the transmission system prevent the economic, or least expensive, supply of energy from serving the demand. For example, transmission lines may not have enough capacity to carry all the electricity demand required to meet the demand at a specific location. This is called a “transmission constraint.” Locational Marginal Price includes the cost of supplying the more expensive electricity in those locations, thus providing a precise, market-based method for pricing energy that includes the “cost of congestion.”

LMP provides market participants a clear and accurate signal of the price of electricity at every location on the grid. These prices, in turn, reveal the value of locating new generation, upgrading transmission, or reducing electricity consumption—elements needed in a well-functioning market to alleviate constraints, increase competition and improve the systems’ ability to meet power demand.

Calculating LMP (Example)

Unlike the original market in New England, in which there is the only one energy clearing price, under SMD, prices are calculated at three types of locations: the node, the load zone and the hub. Offers and bids are submitted, markets settle, and LMPs are calculated at these locations. NodeUnder SMD , prices are first calculated at more than 900 locations, called nodes, throughout New England . Nodes represent places on the system where generators inject power into the system or where demand, or load, withdraws from the system. Each pricing node is related to one or more electrical buses on the power grid. A bus is a specific component of the power system at which generators, loads or the transmission system are connected. These location-specific prices are made up of three components: energy, congestion and losses. The energy component (or marginal cost) is defined as the cost to serve the next increment of demand at the specific location, or node that can be produced from the least expensive generating unit in the system that still has available capacity. However, if the transmission network is congested, the next increment of energy cannot be delivered from the least expensive unit on the system because it would cause overloading on the transmission system or violate transmission operating criteria, such as voltage requirements. The congestion component, or transmission congestion cost, is calculated at a node as the difference between the energy component of the price and the cost of providing the additional, more expensive, energy that can be delivered at that location. The congestion component can also be negative in export-constrained areas where there is more generation than demand.

All transmission systems experience electrical losses, which occur as electricity is sent over transmission lines and accounts for a small percentage of electricity from generators. Nodal prices are adjusted to account for the marginal cost of losses. If the system was entirely unconstrained and there were no losses, all of the LMPs would be equal and would reflect only the energy price. The lowest possible cost generation could flow to all nodes over the transmission system. Generators are paid nodal LMPs. SMD market rules assure that generators recover their as-offered or bid-in costs, including start-up and no load costs for all energy generated. If a generator operates "in-merit," most of its compensation will be from the energy market, unless the energy revenues are insufficient to cover its costs. If higher priced generation is dispatched to relieve congestion, the higher cost for this generation is borne by the location in which it occurs through higher LMPs that those locations must pay. In the original market, these costs are absorbed by all load, or demand, across the ISO's zone regardless of their areas' contribution to the transmission constraint.

Load Zone

Under SMD, demand, or load, will pay the price calculated for eight load zones, or aggregations of nodes. New England will be divided into the following zones: Maine , New Hampshire , Vermont , Rhode Island , Connecticut , Western/Central Massachusetts , Northeastern Massachusetts (which includes Boston) and Southeastern Massachusetts . The eight load zones under SMD coincide with the eight reliability regions in New England .Reliability regions reflect the operating characteristics of and the major transmission constraints on the transmission system.

The prices calculated for load zones are a load-weighted average of the nodal prices located within each zone. They still reflect the cost of congestion and represent a true cost for delivering power by location. But because they are an aggregation of nodes, zonal prices are less volatile than nodal prices. The New England market is likely to move to a nodal pricing system for load and generation. Load zones are being implemented as a temporary means to help market participants transition from the old market design to SMD . To move to a nodal system, more detailed metering of the 900-plus nodes is needed. Hub In addition to the nodes and zones, a hub has been defined as a single trading location in which the average price is not affected significantly by congestion. It provides a stable pricing location for energy transactions within New England , which serves to enhance transparency and liquidity in the marketplace. The hub is calculated as an average of the prices at all of the nodes defined of the hub. These nodes are electrically connected and are located in an area that has little congestion within it and therefore has a price that reflects the overall energy price.

Short-term, long-term and real-time benefits of Locational Marginal Price

Locational Marginal Price is a market-based means of pricing the efficient use of the transmission system when constraints prevent economically priced power from flowing to where it is needed. In the short-term, LMP improves the efficiency of the wholesale electricity market by ensuring that the cost of congestion is reflected in electricity prices and ensures that the least-cost supply of electricity is delivered while respecting the physical limitation of the transmission network. In the long-term, LMP helps relieve congestion by promoting efficient investment decisions. Because LMP creates price signals that reflect the locational value of electricity, participants can readily determine areas of congestion and will see the value of investing in generation, transmission and demand response programs. Appropriately located generation additions, transmission and demand response will increase the competitiveness of the New England market. Greater access to a larger number of competing suppliers helps to enforce market discipline without resorting to administratively applied market power remedies. Increased access to energy from lower-cost generators or imported power will ensure robust, competitive prices. And increased competition from strategically located lower-cost units and demand response will benefit much of New England, as the transmission grid is utilized more efficiently. Ultimately, increased competition should result in a more efficient wholesale energy market with lower costs.

How is Locational Marginal Price Used?

Transmission, or the electricity superhighway, can get very crowded, very fast. When congestion occurs, available low-cost electricity cannot be delivered. This challenge requires an efficient, fair solution. Generators and loads can choose to:

- Engage in the bilateral contracts– Sell to or purchase from the spot market (at LMP prices)
- Marginal generation and load:– Set the clearing prices of the markets– Prices are calculated for all nodes, zones, and hubs within the footprint based on the dispatched units and power flows

Benefits of Locational Marginal Price in the Market

Locational Marginal Price has been proven to lessen the impact of power flows jamming up the grid, and to improve reliability for all

Market participants gain:

- The opportunity to hedge congestion costs
- Assurances that power/MWs are available at a given time/location
- Greater knowledge of the cost of moving power when traffic on the grid is full

- Confidence in their decision-making

LMP increases the efficiency of a competitive wholesale energy market

Benefits include:

- Reliability of the electric grid - More options for purchasing energy cost-effectively
- More options for energy producers to find markets for their electricity
- Greater transparency for regulators seeking to ensure reliability and affordability of energy

Appendix C

Electricity Markets' Trading Jargon

Across electricity markets, worldwide, various electricity financial/physical instruments traded on the exchanges and over the counters. Most of the electricity futures and options on futures are traded on the commodities exchange or power/electricity exchange boards or even stock exchanges. The plainest forms of electricity trading are in the form of derivatives such as forwards, futures and swaps. Being traded either on the exchanges or over the counters *(OTC - A decentralized market of securities not listed on an exchange where market participants trade over the telephone, facsimile or electronic network instead of a physical trading floor. There is no central exchange or meeting place for this market.),* these power contracts play the primary roles in offering future price discovery and price certainty to generators and LSEs *(A load-serving entity (LSE) secures energy and transmission service (and related interconnected operations services) to serve the electrical demand and energy requirements of its end-use customers.).* It has been observed that a large variety of electricity derivatives are traded among market participants in the OTC markets. The trading volume of electricity futures is less than electricity forwards traded in such markets.

Some of the important and commonly used transaction jargons are clarified below:

A ***hedge*** is a position established in one market in an attempt to offset exposure to price fluctuations in some opposite position in another market with the goal of minimizing one's exposure to unwanted risk. There are many specific financial vehicles to accomplish this, including insurance policies, forward contracts, swaps, options, many types of over-the-counter and derivative products, and perhaps most popularly, futures contracts.

A ***derivative*** is a financial instrument (contract) between two parties with opposite views on the market, who are willing to exchange certain risks. Many derivative instruments are used in electricity trading, but the most common ones applied to energy risk management strategies are future, forward and option contracts. In some instances, these financial contracts can be used to accomplish what might be termed as virtual divesture.

Future Contracts

Future contracts include an obligation to buy or sell a specified quantity of an asset at a certain future time for a certain price. The futures are standardized contracts which are traded on and cleared by an exchange and the exchange could guarantee that the contract would be honored. However, that the only point of negotiation is the price. All other terms and conditions are pre-specified, thereby making it a standardized contract. The main justification of futures contract is that it permits specialization between two elements of the economic process: the function of holding commodities and the function of bearing the risk of price changes. The seller of futures contracts on a commodity does not normally intend to deliver the actual commodity nor does the buyer intend to accept delivery; each will, at some time prior to delivery specified in the contract, cancel out obligation by an offsetting purchase or sell. In fact, historically, less than one or two percent of futures contract have been fulfilled by actual delivery.

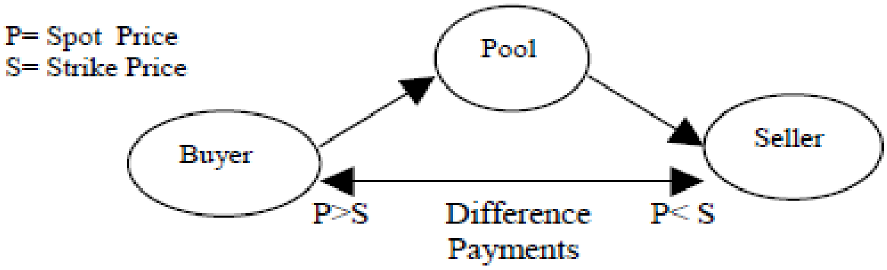
Forward Contracts

Forward contract are in some aspects similar to future contracts. They include an obligation to buy or sell a specified quantity of an asset at a certain future time for a certain price.

Forward contracts are traded bilaterally or over the counter between two financial institutions or between a financial institution and one of its corporate clients and the contracted parties usually customize the contract in order to make it fit their needs. Usually, in future contracts, there is a range of possible delivery date. Whereas forward contracts have a specific expiration at which the asset is delivered and payment is made. The buyer of contract is called long whose purchase obligates him to accept delivery unless he liquidates his contract with an offsetting sale. The seller of the contract is called short.

Contract for Differences (CfDs)

CfDs, which are mechanisms to stabilize the power costs to consumers and revenues to generators, is one form of forward contract. These contracts are suggested due to the fact that the spot price set by Poolco***** fluctuates over a wide range and difficult to forecast over a long periods. A CfD can be either one way or two-way. A two-way CfD is similar to financial future contract and is defined in terms of a strike price ($/MWh), and a quantity (MWh). As shown in the figure below, when spot price is above the strike price, the seller pays buyer an amount equal to difference between the spot price and strike price and when the spot price is below the strike price, buyer pays the seller an amount equal to the difference between strike price and spot price. Thus both parties have hedged their exposure to spot price. A one way CfD is similar to financial option contract and also include an option fee in addition to strike price and contract quantity. Under one way contract, difference payments are made only if spot price rises above the strike price.



* THE POOLCO

The Poolco model for dispatching and selling electricity is simple and well documented (Garber et al. 1994; Budhraja and Woolf, 1994). The important points to note about Poolcos are the bid-based dispatch of generating units, and the payment rule whereby all units dispatched in each time interval receive the market clearing price, which is set by the bid price of the marginal unit required to meet demand in each time interval. Thus, regardless of their production costs, or even their bid prices, infra-marginal units dispatched in each time interval all receive the market clearing price. Some Poolco proponents believe that competition in the generation industry will force firms to base their bids on the variable production costs of their generating units. In fact, if all units bid their variable production costs, the resulting market clearing price of electricity assumes its "perfectly competitive" value, given by the short-run marginal cost of electricity generation. This bidding practice is also referred to as production cost bidding. However, if the downward competitive pressure on price in a Poolco is insufficient to bring about production cost bidding, generating firms can employ opportunistic bidding strategies that result in stable market clearing prices significantly above the short-run marginal cost of generation.

Option Contracts

An option contract includes a right (not obligation) to buy or sell a specified quantity of an asset at a certain future time for a certain price. In case of futures/forwards, contract is either held for delivery or liquidity, but option contracts may be held for liquidity, delivery or they expire worthlessly. To enter an option contract, the buyer pays a premium to the seller of options, while in futures and forwards, the buyer does not have to pay any charges. A call option gives the holder the right to purchase the underlying asset at some future date, and a put option gives the holder the right to sell the underlying asset at some future date.

Let utility-A purchase call options from utility-B with a strike price of \$8/MWh at a premium of \$2/MWh. For utility-A, any future price of \$8/MWh or less would result in loss equal to premium, which is \$2/MWh. At a future price of \$10/MWh, utility-A’s profit (loss) is zero (it is called break even transaction) and at any price greater than \$10/MWh, utility-A would gain up to an unlimited value. In another case let utility-A purchase put options from utility-B with a strike price of \$20/MWh at a premium of \$2/MWh. For utility-A, any future price at \$20/MWh or more would result in a loss equal to the premium, which is \$2/MWh. At a futures price of \$18/MWh, utility-A’s profit (loss) is zero (it is called break even transaction) and at any price less than $18/MWh, utility-A would obtain a gain. Since option contracts are tradable, the holders have the flexibility to sell the contract in secondary market. However, option contracts are financial instruments and are not directly related to physical delivery of electricity. The holder does not have to exercise this right. This fact distinguishes options from future contracts. A new electricity forward contract bundled with bilateral financial options or optional forward contract is introduced in, which gives option holder a right but not an obligation to purchase or sell the contract energy at a delivery time for a given price. This allows both seller and buyer to take advantage of flexibility in generation and consumption to obtain monetary benefits while simultaneously removing the risk of market price fluctuations.

Vesting Contract

The key policy objective of the vesting contract regime is to curb market power in order to promote efficiency and competition in the electricity market for the benefit of consumers. The vesting contracts are bilateral electricity contracts between generation companies and agents of market support services*****. Under the vesting contracts, the generation companies are committed to sell a specified amount of electricity (viz. the vesting contract level) at a specified price (viz. the vesting contract price). This removes the incentives for generation companies to exercise their market power by withholding their generation capacity to push up spot prices in the wholesale electricity market.

Energy Market Authorities/ Regulatory Bodies review both the vesting contract level and the parameters used to set the vesting price. The vesting price is set based on the long run marginal cost ("LRMC") of the most efficient generation technology that accounts for more than 25% of the total electricity demand and taking into consideration the key policy objective. The vesting contract level is set to effectively curb the exercise of market power based on projected electricity supply and demand.

***** Services such as the buying of electricity indirectly from the wholesale electricity market for contestable (The right to choose between electricity retailers for electricity purchase.) consumers at spot prices, reading meters, managing meter data, administering transfer processes, and providing electricity to non-contestable consumers at regulated tariffs.

Examples

Valuable lessons can be learned from California, where there were no vesting contracts, and from other countries like Australia, where vesting contracts were used extensively.
Vesting contracts are a powerful tool to allow the existing electricity industry transition to open and functional markets. The electricity market in Australian State of Victoria was deregulated in the mid-1990s. When market opened, there was a potential for exacerbated oversupply, when new owners of the privatized power plants improved capacity factor and availability. The resulting spot market prices hovered at or just above the marginal fuel cost for much of 1996 and 1997. Hedging contracts acted to shield the newly privatized generators from several financial losses.

In contrast to Victoria, the Australian State of South Australia entered the Australian National Electricity Market in late 1998 with a potential shortage of generating capacity and a high reliance on imported power from other states similar to the case of California. Spot prices were very high. Vesting contracts in South Australia insulated end-use customers from price shock as well as controlled the potential market power held by newly privatized generating stations. One of the major causes behind crisis in California electricity market during summer 2000 was weakness and flaws in the design of electricity market including limitations on forward contracting. Taking a lesson from this, New Electricity Trading Arrangements (NETA) for England and Wales has encouraged forward and future contracts.

Transmission Rights

In order to hedge the congestion prices and facilitate trading in power market few transmission rights are introduced. These include financial transmission right and physical transmission right.

Financial Transmission Right (FTR)

The classic financial transmission rights are called transmission congestion contract (TCC). FTR is a purchased right and can hedge congestion charges on constrained transmission paths. It provides FTR owners with the right to transfer an amount of power over a constrained transmission path for a fixed price. FTRs are advantageous when designated paths are in same direction as congested flow, which also indicates that point of extraction locational marginal price (LMP) is greater than point of injection LMP. It may happen that FTR holder pays for having the FTR when the point of extraction LMP is less than point of injection LMP. In this case the monetary share is equal to MWh value of the FTR multiplied by difference in LMPs from the point of receipt to point of delivery. The disadvantage of not holding FTR is that participants do not have a mechanism to offset the extra cost due to congestion charges. On the other hand, the holders of FTR will receive a credit that counteracts the congestion charge for specified path. Each FTR holder receives a congestion credit in each congestion hour proportional to the value of FTR. This credit allocation is calculated based on preferred schedule while congestion charges are based on actual deliveries. Alomoush et al, suggested a combined zonal and FTR schemes to manage congestion problem. The problem of FTRs that it is requested for any two points in the system is solved using zonal scheme. A static simulation model is proposed by R. Mendez et al, for congestion management. This incorporates FTR for nodal pricing under a centralized electricity market and flow gate rights (FGR) for zonal pricing under decentralized market.

Physical Transmission Right (PTR)

PTRs are tradable rights referred to as the right to use transmission capacity and represent a claim on physical usage of the transmission system. Unlike financial rights, they do not provide payment, and they are only useful to those actually trading power. These rights are used to guarantee an efficient use of transmission system capacity and to allocate transmission capacity to users who value it the most. Usually a trade will require several rights on a number of lines. On a power line, with a capacity limit of P MW, at most P MW of physical rights can be issued in each direction. The feasible set of physical rights cannot account for counter flows.

Electricity Tariffs: The Underlying Principles and Practice

In this note, we are going to try and find out what exactly is an Electricity Tariff, how can it be structured so as to reduce cross subsidies and then try and recommend solutions for Maharashtra's increasing tariff structure and cross-subsidies. The full and final recommendations on the latter, however, is discussed later in the "reforms and governance" sections.

What is an Electricity Tariff?

Electricity Tariff is price that the end user has to pay in order to consume electricity. Each consumer in the economy has a different requirement and level of usage and hence, the tariff varies accordingly. Tariffs also vary widely from country to country. There are many reasons that account for this difference in price. The cost of power generation depends largely on the type of fuel used, government subsidies and even the weather patterns.

Basis of electricity rates

Electricity "tariffs" (a term that implies a certain market structure, generally that of a regulated monopoly) vary all over the map, even within a single region or power-district of a single country. In standard regulated monopoly markets, they typically vary for residential, business and industrial customers, and for any single class, might vary by time-of-day or by the capacity or nature of the supply circuit (e.g., 5 kW, 12kW, 18 kW, 24 kW are typical in some of the large developed countries); for industrial customers, single-phase vs. 3-phase, etc. If a specific market allows real-time dynamic pricing, a more recent option in few markets to date, prices can vary by a factor of ten or so.

Price Comparison

As of June 2009, Denmark has the most expensive electricity tariff in the world with tax included, followed by Italy. Ireland has the highest pre-tax tariff. France has the lowest pre-tax price for electricity in Europe, at 4.75 Eurocents/kWh, and second-lowest price with tax of European countries. A comparative list of June 2009 prices for Europe may be found in the European Household Electricity Price Index.

The following is a rough comparison of electricity tariffs of industrialised countries and territories around the world.

Global Electricity Tariffs Comparison

Country/Territory	US cents/1kWh	As of	Sources
Australia	7.11	2006-2007	PEI[2]
Belgium	11.43	2006-2007	PEI[2]
Canada	6.18	2006-2007	PEI[2]
Croatia	17.55	2008-07-01	HEP
Denmark	42.89	2006-2007	PEI[2]
Finland	6.95	2006-2007	PEI[2]
France	19.25	2009	EEP[3]
Germany	30.66	2009	EEP[3]
Hong Kong (Kowloon/ NT)	10.90	2008-05-07	CLP[4]
Hong Kong (HK Is.)	12.30	2008-05-07	HEC[5]
Iceland	11.61	2008-07-07	OR[6]
India			
Ireland	23.89	2006-2007	ESB[7]
Italy	37.23	2009	EEP[3]
Malaysia	7.42	Dec 2007	ST[8]
Netherlands	34.70	2009	EEP[3]
Perú	10.44	2006-2007	PTL[9]
Portugal	16.39	2009	EDP[9]
Singapore	15.31	2009-2009	PEI[2]
Spain	19.50	2009	EEP[3]
South Africa	10.15	2008-2009	Eskom[10]
Sweden	27.34	2009	EEP[3]
UK	18.59	2009	EEP[3]
USA	9.28	2006-2007	PEI[2]

In 2009, the price per unit of electricity in India was about Rs. 4 (8 US cents) for domestic consumers, and Rs. 9 for the commercial supply.

Power price forecasting (also referred to as **Electricity price forecasting**) is simply the process of using mathematical models to predict what electricity prices will be in the future

Driving factors

Weather-driven demand - Studies show that generally demand for electricity is driven largely by temperature. Heating demand in the winter and cooling demand (air conditioners) in the summer are what primarily drive the seasonal peaks around the year in most regions. Heating degree days and cooling degree days help measure energy consumption by referencing the outdoor temperature above and below 65 degrees Fahrenheit, a commonly accepted baseline.

Hydropower availability - Snowpack, stream flows, seasonality, etc all affect the amount of water that can flow through a dam at any given time. Forecasting these variables allows one to predict the available potential energy for a dam for a given period. Some regions such as the Pacific Northwest get a large percentage of their generation from hydro-electric dams.

Power plant and transmission outages - Whether planned or unplanned, outages affect the total amount of power that is available to the grid.

Fuel prices - The Fuel used to generate electricity at a Power Plant is the primary cost incurred by Electricity Generation Companies. Particularly, Coal, as a fuel for base-load plants and more importantly, to a degree, Natural Gas for peaking plants affect power prices.

Economic health - During times of economic hardship, many factories will cut back their production due to a reduction of consumer demand and therefore reduce production-related electrical demand.

Price Schemes With Cross Subsidies

A cross-subsidy is said to exist if a group of consumers would be better off seeking alternative provision.

The notion of cross subsidies has been developed for dealing with the relation between service payments from a group of consumers and the costs associated with providing a service or related services to them. Are proposals made by the regulator, the manager and the consultant free of cross subsidies? The answer depends on how a price scheme that is free of cross subsidies is defined. Several definitions have been used for price schemes free of cross subsidies. The following are the different ways cross subsidies can be considered:

Definition 1: Marginal Cost Criterion

Under this criterion, a price scheme is said to have cross subsidies, if some consumer prices are lower than the marginal cost. Otherwise, if all consumer prices are equal or above marginal costs, then the price scheme is subsidy free. Notice that according to this criterion, a price scheme in which all consumer prices just equal marginal cost is cross subsidy free. However, such a scheme may not raise enough revenues to cover the total cost of the service.

Definition 2: Average Cost Criterion

Under this criterion, a price scheme is said to have cross subsidies if some consumer prices are below average costs and others are above. This criterion may be difficult to apply to multiproduct firms because their average cost schedules may not be well defined. In particular, when some costs are shared among different products, the average cost schedule cannot be precisely defined. For example, a firm providing electricity and water or more pertinently in our case, a firm involved in generation and distribution or distribution or transmission or any two combinations (generation, distribution, transmission) out of the three that can be had, thereof.

Definition 3: Incremental Cost Criterion

Under this criterion, a price scheme is said to have cross subsidies if revenues from a consumer or a group of consumers are less than the incremental cost of providing services to that consumer or group of consumers.

Definition 4: Stand-Alone Criterion

Under this criterion, a price scheme is said to have subsidies if the revenues from a consumer or group of consumers are larger than the cost of providing service alone to this consumer or group of consumers.

This leads to the following observations:

1. ***First, definitions 1 and 2 compare prices with the actual costs of providing services, whereas definitions 3 and 4 compare prices to the costs of other alternatives for providing the service. This means that, for assessing price schedules according to criteria 1 and 2, only the knowledge of the regulated firm cost schedule service is required, while for assessing price schedules according to 3 and 4, criteria information about other technologies is needed.***

2. ***Second, it is necessary to examine all groups of consumers in order to establish that a price scheme is subsidy free under definitions 3 and 4. In other words, it is not enough to test some individuals or some groups. Thus, definition 3 requires that all consumers and consumer groups pay the incremental costs that correspond with the actual technology used by the regulated firm and any other available technologies. Definition 4 requires that all consumers and all consumer groups prefer the service of the regulated firm to all other alternatives.***

3. ***Third, with increasing returns, a price scheme that is free of cross subsidies according to the average cost criterion will be also subsidy free according to the marginal cost criterion since marginal costs will be below average costs when average costs are decreasing. Increasing return technologies have decreasing average costs.***

4. ***Fourth, if the profit of the firm is zero, then a price scheme is subsidy free according to definition 3 if, and only if, the price scheme is subsidy free according to definition 4.***

Cross Subsidies and Market Efficiency

If a regulated company is supported by well-known theoretical results which state that any uniform price schedule different from marginal cost can be welfare dominated by a non-uniform price schedule, it means that then consumers have different price elasticities.

These findings are relevant for setting discriminatory prices in infrastructure services because marginal cost pricing does not cover total cost in the presence of increasing returns, a common feature of infrastructure. Therefore, if revenues from infrastructure services cover total costs, then prices must diverge from marginal cost. In other words, from a welfare standpoint, price discrimination schedules may be better than a uniform price when the uniform prices do not equal marginal cost and price elasticities differ among consumers.

However, price discrimination may or may not imply cross subsidies. If regulators set prices so that they just cover costs without yielding extraordinary profits, then any price discrimination scheme has implicit cross subsidies according to the average cost criterion. The reason is that consumers who pay higher prices are paying more than average costs, while consumers who pay lower prices are paying less than average costs. In these cases, the allocations resulting from pricing with cross subsidies according to the average cost criterion may dominate, from an efficiency standpoint, allocations resulting from uniform prices. It may occur that a price scheme that increases welfare with respect to uniform prices has cross subsidies according to the average cost criterion and does not have them according to the stand-alone or the incremental criterion.

However, it may also be the case that a price scheme appropriate for welfare purposes has cross subsidies according to the average cost, the stand alone, and incremental cost definitions. Nevertheless, prices must be free of cross subsidy according to the marginal cost criterion for welfare goals.

Although a formal proof of the above is not intended, the following arguments may be useful in understanding them. Notice that if the price is above marginal cost and if consumers have different price elasticities then welfare may be increased by reducing prices to consumers with a high price elasticity of demand and increasing prices to consumers with a low price elasticity of demand. This is so because the increase in consumption and consumer surplus of the former group would compensate for the decrease in consumption and consumer surplus of the latter group.

Note: the price elasticity of demand is the response of the consumer to a change in price. It is the ratio of the percentage change in price by the percentage change in quantity demanded.

Appendix 1

Cost causation and price signals – options for regulators

When considering efficient pricing and investment, if economists agree on one point, it is the following: rate design matters. A strong case can be made for regulators to allow some discretion in rate design, since firms have far greater information on cost structures and demand patterns than is available to the regulatory. When cost allocation manuals substitute for estimates of forward-looking incremental costs, inefficiencies arise. In recognition of the important role of price signals, a wide range of rate designs has been analysed. The following represents a partial listing of the methods addressed on optimum pricing and capacity:

Marginal cost pricing - The allocative efficiency consequences of such pricing are well known. For example, the financial viability of the firm may require a subsidy, or more complicated rate designs (such as multipart pricing). Furthermore, short run and long run marginal costs will differ — so while the former serve as the standard for pricing decisions, the latter are relevant for comparing alternative investment patterns — as when alternative providers have different production technologies.

Cross subsidisation and regulation as taxation - Cross subsidisation can be deliberate regulatory objectives as some customers cover the incremental costs of serving favoured customers. Alternatively, it can stem from inappropriate allocations of fixed or variable costs. A related concern is transfer pricing which increases the reported costs of the regulated firm. This device might be used to shift profits from the regulated firm to an unregulated subsidiary. Such shifting raises a dilemma, because when regulators mandate complete separation among business units in response to this problem, the firms can lose economies of scope. The result is higher costs.

Discriminatory pricing and demand separation - The ability to separate markets and prevent resale is facilitated by customers being hooked up to utility distribution systems. Since consumers with inelastic demanders are often the ones regulators are trying to protect from monopoly power, commissions often will overlay cost allocation regulation upon rate level regulation — preventing 'undue' discrimination.

Ramsey pricing - If the firm can identify different customer groups and charge different prices to the various customer classes, Ramsey pricing can be utilised to minimize economic misallocations. However, such a pricing policy (charging more to those with relatively inelastic demands) might still be viewed as unduly discriminatory, even though the firm does not realise excess profit. Citizens might prefer other price configurations for the multi-product natural monopolist. Furthermore, there is no guarantee that Ramsey prices are sustainable in the long run: some coalition of customers could end up paying more than the stand-alone costs of serving them — leading to self production and the loss of their business.

Predatory pricing and market dominance - If high cost suppliers are driven from the market due to entry by a multiproduct natural monopoly, resource allocation is improved. However, these suppliers may claim predatory pricing if the output is produced by an unregulated subsidiary or by the regulated firm. Producers of substitute products could argue that revenues from the utilitys captive consumer groups (or regulated products) cover costs associated with products subject to competition. However, one ought not accept fully -distributed costs as indicators of subsidisation.

Furthermore, when a group of firms is under industry-wide regulation and when price is based on industry average costs, the presence of high cost firms could increase the profits of efficient suppliers (Daughety, 1984). The removal of such cost -based pricing would reduce prices and lead to bankruptcy or consolidation of inefficient firms. Such a development would again bring forth charges of predation, but these charges would be groundless.

Cost allocation regulation - A multiproduct firm is charged with allocating its total costs, including common costs, over its various products in an effort to ensure that revenue from the sale of each product covers its allocated cost (Braeutigam, 1980). This area may be one of the more under-analysed in the field of regulatory economics. Regulators have often viewed fully -distributed cost allocations as techniques for ensuring that customer groups are not unfairly burdened with shared costs. Besides leading to potentially undesirable prices and cross subsidies, there is the danger that separations procedures and cost allocation manuals may foster an unwarranted feeling of accomplishment among regulators. Sweeney, 1982, finds that output-based allocation schemes can yield perverse results: we end up with prices such that one or more of them can be lowered — improving welfare without decreasing the monopolist's profit. In addition, we can have relatively high prices in unregulated markets. Finally, Cabe, 1988, illustrates that any output vector can be achieved by some fully-distributed cost method.

Peak load pricing and intertemporal patterns of demand - This literature has a rich history. The early contributions by Boiteux, 1960 and Steiner, 1957, stimulated analyses of intertemporal demand patterns. The production technology (involving fixed or variable coefficients and with and without scale economies) drew upon actual engineering studies of cost structures. Diverse technologies, interdependent demands, selection of rating periods and other issues were addressed, as economists began to characterise realistic demand and cost conditions. Rate design in such situations must take these factors into account. Sweeney explains these results by noting that because regulated products are permitted to obtain a 'fair return' on shared input, output reductions in unregulated markets allow more of the common cost to be shifted to regulated markets. As a result, greater profits are earned in these regulated markets. In one sense, these results may appeal to regulators. The prices are high in the unregulated markets, thereby quelling fears of cross subsidies from the regulated markets. Also, competitors in the unregulated markets would be pleased, since the monopolist is apparently not relying on profits from the regulated markets to predatory price in their markets. In the long run, the monopolist's prices could be undercut in at least some of the unregulated markets, perhaps even driving the monopolist out entirely. The advantages of natural monopoly production for multiple markets are then lost, and the regulator's optimism regarding FDC procedures proves short-lived.

Pricing with random demand and supply - The intertemporal issues noted above have also been addressed in the context of uncertainty. Consumers value reliability of service, which will be affected by the interaction of price (announced in advance) and uncertain demands (driven by weather, seasonal conditions, and hourly factors) and production capabilities (related to unplanned outages).

Nonlinear pricing and interpersonal patterns of demand - Whether one is considering pricing entry and rides in an amusement park or access to and usage of a telephone system, multipart pricing offers a viable option for enhancing revenues. Much of the literature on multipart pricing and nonlinear outlay schedules is surveyed by Brown and Sibley, 1986. The pattern of individual demands proves to be important for the development of first and second best rate designs involving fees and usage charges.

Sustainable pricing - Faulhaber, 1975, showed that a natural monopolist was not necessarily immune to entry under certain cost structures. This insight raises a dilemma for regulators and implies significant information requirements for optimal pricing decisions. A related issue is the role of the incumbent firm as the supplier of last resort (Weisman, 1988).

Quality of service - Service quality also raises a number of important issues for analysts. The quality level provided under competition, monopoly, or regulation has received substantial attention. In practice, regulators tend to utilise pass/fail standards. While such standards are clear and precise, problems arise in using them to monitor and reward quality. For example, by evaluating performance relative to a pass/fail cut-off, distinctions among various levels of sub-standard and super-standard performance are ignored: utilities have little incentive to exceed targets. In addition, the targets themselves are often somewhat arbitrary, having arisen from a chaotic process reflecting historical engineering capabilities, political pressures, and administrative happenstance. Consumer valuations of different quality dimensions and firm knowledge of emerging technological opportunities are not likely to be reflected in current pass-fail standards.

Recovery of joint costs in a competitive environment

The brief overview of rate design concepts provides a foundation for addressing the recovery of joint costs in a competitive environment. Electric utility managers understand that the industry has rapidly moved from local monopolies to one that is customer-driven. Co-generation and competition via open transmission policies have disrupted traditional pricing arrangements. Cost allocation manuals are becoming increasingly irrelevant as the electricity industry becomes more competitive. This section outlines two approaches that enable the recovery of joint costs in a competitive environment. One approach involves utilising Two-Part Pricing schemes, so the customers' share of joint costs is less dependent on total consumption. Such rate designs better reflect cost causation on the margin, while permitting recovery of some fixed costs. Another approach involves lower prices to those demanders with alternative sources of supply.

Although higher prices to inelastic demanders — those without options — raises some tough political issues, those customers would be even worse off if business and other large customers abandoned their traditional suppliers. Thus, Ramsey pricing involves price discrimination (or price differentiation, if the former term seems too value -loaded). Electric utilities are going to have to generate value for customers by devising new rate designs which create win-win opportunities. Both Two-part pricing (using Historical Customer Baselines) and Ramsey pricing represent innovative ways to recover joint costs. First, some background material needs to be reviewed.

Multipart pricing and the promotion of efficiency

In the short run, with capacity costs fixed, changes in the wholesale pricing structure can involve particular customers or customer classes benefiting at the expense of others. Whether the process is a zero-sum game depends on the nature of rate restructuring. If the savings obtained by winners is roughly equal to the additional outlays required of losers, then the objective of net revenue neutrality sow s the seeds of conflict. For example, lowering the price to one group and raising it for another can have this characteristic. However, multipart pricing enables the supplier to create win-win options — bringing the marginal price down to incremental cost, while recovering current capacity costs via fixed monthly fees.

It should be noted that cost allocations which are currently used may seem reasonable and consistent with industry practice. Nevertheless, these allocations often are quite arbitrary — reflecting some view of fairness rather than cost causation. Evidence from other industries suggests that competition will force marginal price towards incremental cost.

A diagrammatic representation may help explain the win-win aspects of multipart pricing. Figure 1 depicts a demand curve. At lower prices, the customer is willing to buy more electricity. At very high prices, customers will only apply electricity to very high valued uses. If price is quite low, then thermostats may be adjusted to give greater comfort, more electricity-intensive machinery might be utilised, and energy conservation activity is less cost-effective from the standpoint of the buyer. In the short run, customers are not likely to be able to make substantial behavioural or operating adjustments, but the change in consumption will be greater as customers have more time to adapt to a permanent price change. Greater long-run responsiveness means that the efficiency gains from improved price signals are greater when consumers have time to make adjustments.

Utilities are used to thinking in terms of a customer’s load shape and how this influences the system load. However, the load shape is a function of the price structure. Time-of-use pricing will alter the hourly pattern of electricity consumption — with that pattern changing more dramatically as customers have more time to adjust to the new price structure. Responsiveness of customers is characterised by economists in terms of demand curves. Greater long run responsiveness means that the consumers have time to make adjustments.

The Law of a Downward Sloping Demand has theoretical and empirical support. Utilities recognise that price influences consumption in the way described above. The Law's Corollary of Greater Responsiveness with Longer Adjustment Time has also been verified. The position of the demand curve is affected by other factors outside the utilities control. If the price of substitutes decreases, demand for electricity shifts in. If the prices of appliances that use electricity (complements) fall, then the demand for electricity shifts out. Weather conditions also affect the hourly load and monthly consumption. In the Figure, if price is $.08/kwh, then the customer depicted here consumes 1000 kWh. This could be broken down to hourly consumption, but this simple example illustrates the impact of a price reduction. If price falls to $.05/kwh, more than 1000 kWh would be demanded with a lower price. Note that if incomes rise, or average family size increases, or square feet per house increases, or temperatures are less moderate, the demand schedule will shift out. The hypothetical demand curve depicted in Figure 1 holds all these other factors constant, so that monthly consumption depends on price.

In this example, if price per kWh is $.08, then 1000 kWh are purchased, for a total consumer outlay of $80. If price were $.05, then 1300 kWh would be purchased, for a total outlay of $65. If demand had been more responsive to the price reduction (so that consumption rose to, say 2000 kWh, then total expenditures by this customer would have risen to $100. Thus, an increase in outlays does not necessarily imply a reduction in customer satisfaction. In this case, the price reduction induced additional consumption, and kWh were applied to valued uses by the customer!

In the case of the demand curve depicted in Figure 1, the price reduction from $.08 to $.05 yielded an improvement for the consumer. Analytically, this gain could be broken into two parts. The first part reflects the $.03 is saved on each of the 1000 units that used to be purchased at the higher price (area A = $30). Furthermore, 300 additional units are purchased when the price is only $.05. Economists identify area B as reflecting the benefits (above the outlays) associated with this additional consumption. Area B is $4.50 (the area of this triangle is half the base times the height). Thus, the price reduction benefits the customer by $34.50. The $15 reduction in outlays (from $80 to $65) is not a good indicator of the consumer benefits associated with the price reduction. This point is very important, because rate design that focuses on outlays rather than customer satisfaction is likely to miss some win –win opportunities. In a competitive environment, suppliers cannot afford to ignore opportunities.

So far, we have not considered the firm. If its incremental costs were $.08, then a price reduction to $.05 is a losing proposition. The cost of serving the customer is $104 ($.08/kwh times 1300 kWh), but the revenue from the customer is only $65 ($.05/kwh times 1300 kWh). Under pricing electricity relative to its cost hurts the supplier more than it benefits the customer! From the diagram, the customer gains A+B, while the firm loses A+B+E. If, during peak periods, the price is below incremental costs, the utility ought to revise its prices (if the metering costs are not small relative to the savings). In the case of the price reduction, what if the incremental cost were $.05? The $.08 price was hig h relative to the cost of additional kWh. Now the customer gains (A+B), which is more than the supplier loses (-B) from the price reduction! This observation suggests that a win-win option is possible. The utility could offer the customer a multipart price instead of the uniform price of $.08/kwh. The rate structure could be a $30 monthly fee (regardless of units consumed) and a per unit price of $.05. Since area A is $30, it is clear that the customer is better off by area B ($4.50) under this alternative rate design. And the firm is no worse off. So long as the monthly fee is less than $34.50 (and per unit price is $.05), the customer is better off under the multipart scheme than paying a uniform per unit price of $.08.

Return to the $30 fee case, where total customer outlays now equal $95 and incremental cost is $.05. If the total bill is divided by the 1300 kWh, the average price is about $.073. Why not just set a price of $.073 and avoid the slightly more complicated pricing scheme? After all, customers look at their total bills. The response to this question is that the combined gains to the customer and the supplier would be less if price were only lowered from $.08 to $.073 than if the $30.00 monthly fee were imposed in conjunction with $.05/kwh. By himself, the customer is better off by more than $7.00 with the $.007/kwh price reduction. That per unit saving times 1000 kWh happens to be greater than area B. But all of that gain is essentially balanced by a net revenue loss experienced by the supplier! That price reduction is not a win –win outcome. The multipart scheme keeps the supplier whole, while making the customer

$4.50 better off than before. Furthermore, the price of $.073/kwh is inefficient. It discourages consumption that is worth more than the resources that would have gone into the production of additional kWh (i.e. the price of $.073 is greater than incremental cost, $.05).

We saw that setting the marginal price equal to incremental cost increased consumption to 1300 kWh. The customer valued that additional consumption more than society valued the resources that went into creating the additional kWh. Thus, incremental cost pricing promotes the efficient use of society's resources. If price is above incremental cost (as is the case with much off-peak consumption), we are under-consuming electricity. If price is below incremental cost (as can be the case with on-peak consumption), we over-consume electricity. Multi-part pricing combined with peak load pricing can make both the firm and the customer better off. Peak load pricing by itself may benefit customers and/or the supplier.

The firm lacks information on the full nature of customer willingness to pay. Billing records can provide clues regarding potential consumption patterns, but optimal rate designs can facilitate both cost-recovery and efficiency. Figure 2 illustrates the benefits from utilising self-selecting two part tariffs. Two demands are depicted in the Figure; the supplier does not know which customer has which demand. As shown in the example, Option 1 has a $10 monthly fee, but a marginal price of $.05 per unit. The larger demander will select this option, since Option 2 (no fee, but a per unit price of $.06) yield less consumer surplus. The smaller demander selects the second option.

Such price options enable the supplier to extract more consumer surplus than under uniform pricing — which enhances the financial viability of a firm under competitive pressure. Such rate designs are especially important if there are substantial fixed costs.

Note, these observations regarding multipart pricing are strengthened when longer run adjustments are taken into account. Demand is more elastic (or responsive to price changes) when customers have more time to adjust their energy-using equipment. If price increases, the firm may have few alternatives in the short run. But soon, energy conserving investments can be implemented, and consumption drops more dramatically than in the initial months. The time for adjustment depends on the nature of the industrial, residential, or commercial demand. Utility managers who understand the role of price signals can promote the efficient conservation of energy.

The precise amount to be included in the fixed fee is not a simple calculation. Were recent years 'normal'? What if the level of this historical contribution is no longer sustainable in a competitive market? The answers to these questions require substantial analysis. Suffice it to note that such monthly fees can be calculated that would leave the firm better off than before. Bringing the incremental price in line with incremental cost is a potential win-win move. Rate designers ought to consider this addition to their price portfolios in a competitive era.

Ramsey pricing

As noted earlier, Ramsey pricing corresponds to price discrimination such that total revenues equal total costs. The ability to separate markets and prevent resale is facilitated by customers being hooked up to utility distribution systems. Faulhaber and Baumol (1988, p. 594) cite Ramsey pricing as '... a clear example of a principle that derives from the [economic] literature and has (recently) achieved a good deal of attention among government agencies.' They note that it has been discussed in many courts, state commissions, the Federal Communications Commission (FCC), the Federal Energy Regulatory Commission (FERC) and the Interstate Commerce Commission (ICC), as well as in other countries. Faulhaber and Baumol also highlighted the stand-alone cost test as an example of a contribution of economic theory to regulatory pricing practices. The test places a ceiling on rates. No consumer or group of consumers ought pay more for service than the cost of serving them apart from all other consumers. Although this approach can be traced to pr icing practices established for the Tennessee Valley Authority under the name 'separable costs and remaining benefits' (EPA, 1975, Straffin and Heaney, 1981), only in the last two decades has it become prominent in the literature where it has been related to the core concept in game theory (Faulhaber, 1975; Sorenson, et al., 1976, Sharkey, 1982). The theory also provides regulators with a rigorous definition of cross subsidisation that eschews the arbitrary definitions associated with fully distributed cost pricing practices. Faulhaber and Baumol indicate that both the FCC and ICC have considered using stand alone cost tests in rate making. Since consumers with inelastic demands are often those regulators or municipally-owned utilities are trying to protect, firms often overlay cost allocation procedures onto price level decisions — limiting 'undue discrimination'.

Ramsey Pricing is related to marginal-cost pricing in that prices are a percentage deviation from marginal costs, where the percentage is inversely proportional to demand elasticities: more elastic (responsive) demands have lower price-cost margins.

In Figure 4, two demands are illustrated. If price is \$.04 in each market, then the total contribution towards fixed costs is E+F (\$20 in market 1) and T+V (\$20 in market 2). So the base case involves 1000 kWh monthly consumption in each market, with \$40 in revenue above incremental cost going towards fixed costs. If price is increased to \$.06 in the relatively inelastic market 1, the firm gains A (\$18) and loses F (\$2), for a supplier gain of \$16 in this market. Although the firm no longer receives revenues of F + G (\$4) due to the 100 kWh reduction in quantity consumed, the supplier also avoided the cost (G) of producing that output. Thus, the loss of F is recorded. The customer is worse off: given by -(A+B), or \$19. The numbers indicate that societal welfare has declined by \$3, as price has been increased far above incremental cost (\$.02). However, if the price is reduced to \$.025 in market 2, then this customer gains more than the utility loses, and the potential for an overall welfare improvement exists.

On net, the reconfiguration of prices can improve societal welfare as long as gains (and losses) experienced by either customer are valued equally. To see this, consider Market 2 in greater detail, where price is reduced from \$.04 to \$.025, and consumption increases from 1000 kWh to 1600 kWh. The supplier loses T (\$15) but gains W (\$3) when it reduces price to \$.025. There is a supplier loss of \$12 in market 2. However, customer 2 gains T and U, where U is \$4.50. Clearly, the customer gains (T+U equals \$19.50) are more than the supplier's losses. The common sense explanation is that bringing price closer to incremental cost increases economic efficiency in this market (here, by \$7.50). When the two markets are taken into account together, the supplier is actually better off (+ \$18 – \$12) while customer welfare (weighted equally for winners and losers) has also increased (down \$19 in market 1 and up \$19.50 in market 2).

This example is meant to illustrate the benefits of pricing closer to incremental cost in elastic markets — balancing off the inefficiencies of raising price further above incremental cost in another market. The formula for calculating optimal markups in the two markets involves markups that are inversely proportional to the respective demand elasticities.

Electric utilities have charged different prices to different customers for decades. Ramsey Pricing involves charging more to those with relatively inelastic demands. Commercial customers often do not have co-generation opportunities and are often the ones hit with the highest prices relative to incremental cost of service. Residential customers have political clout, so that despite relatively inelastic demands, their price cost margins are often smaller than for other customer groups. Industrial customers, on the other hand, may be footloose in the long run: firms can move production capacity to other locations. Alternatively, industrial customers may have self-production as an option. In either case, these customers have relatively more elastic demands. Electric utilities have responded to such situations by offering lower prices (via 'cooked' cost allocations) or interruptible rates at discounts that might be greater than the savings warranted by the extent of actual interruptions. Competition is likely to attack those customer classes with greatest price -cost margins. Thus, commercial accounts would appear to be vulnerable to entrants who have access to transmission and distribution facilities. All utilities will have to respond to such threats by re-structuring their rate designs. The presence of alternatives makes customer demands more elastic. So utilities will act in such a way as to reduce the prices quoted to such customers. From the standpoint of social efficiency, this restructuring is appropriate if the market demand of such customers is relatively elastic.

If the customers market demand for electricity is actually relatively inelastic — but it becomes elastic with the availability of competitive options, then the reduction of such prices may not promote social efficiency. However, from the standpoint of public policy, this possibility is probably swamped by the view that competitive pressures will be more effective in promoting cost containment than regulation. In terms of economic theory, the social efficiency losses (and gains) associated with welfare triangles are dominated by the large rectangles reflecting cost savings associated with improved incentives for cost containment. Public policy has supported increased competition in generation not just because of the associated rate restructuring (such that prices track costs), but also because costs are likely to be lower with competitive pressures.

Concluding observations

What are the implications of competitive trends for utility pricing?

Utilities that understand their cost structure and are successful at cost containment will be in a better position to develop prices that enable them to survive in a competitive world.

Utilities that understand their customers' actual (and potential) consumption patterns (and valuations) have an advantage over potential rivals. Market intelligence will become a major factor in decision-making. Major customers will be lost and gained on the basis of the types of contracts that are developed. New skills will be required of utilities. During the transition to competition, utilities must restructure themselves to provide the information and internal incentives required to compete effectively with their rivals.

These points need to be underscored. If the supplier does not know its own incremental cost, it cannot be sure whether additional sales are financially desirable. One implication of this point is that an obligation to serve high cost customers with low prices will need to be replaced by other funding mechanisms, if 'universal service' is to remain a public policy objective. Similarly, if the supplier does not know how the customer is likely to respond to new prices, financial planning and capacity decisions become problematic. Potential load shapes become relevant for decision-makers, since new rate designs will induce changes in consumption patterns. If simplicity is one casualty of competitive pressures, utility account managers will have to explain the benefits of more complicated rate structures to their customers. Competition will make life harder for infrastructure executives. The possibility of competition also complicates rulings on the price and quality of interconnection or an entrant's access to information possessed by an incumbent.

Monopoly suppliers are able to dictate price. An unregulated monopolist has an incentive to know its cost structure and demand patterns. However, a regulated monopolist (or a government enterprise) whose prices are partly the result of political compromises, has weakened incentives for cost containment and an inadequate understanding of cost-drivers. So long as total revenues cover total costs, there may not be pressure for a nonprofit oriented firm to identify incremental costs. Some customers may be paying far more than cost of service while others could be paying less that incremental cost. However, the prices, based on (politically acceptable) cost allocations are not necessarily sustainable under competition — where price tends to track the incremental cost of electricity. Cost allocations which were unrelated to cost causation were possible in the absence of customer choice. But the world of electric utility and telecommunications monopolies is rapidly disappearing.

New price structures can offer win-win opportunities, such that both the supplier and customers can be better off than before. Of course, if competition drives the average price too low relative to the utility's average cost, most of the benefits from rate redesign will be captured by customers — if the utility tries to successfully retain its customers. The principles of rate design identified here are crucial to the recovery of joint costs in a competitive environment. Both managers and regulators need to understand the efficiency implications of alternative rate structures.

Figure 1: Benefits from a price change

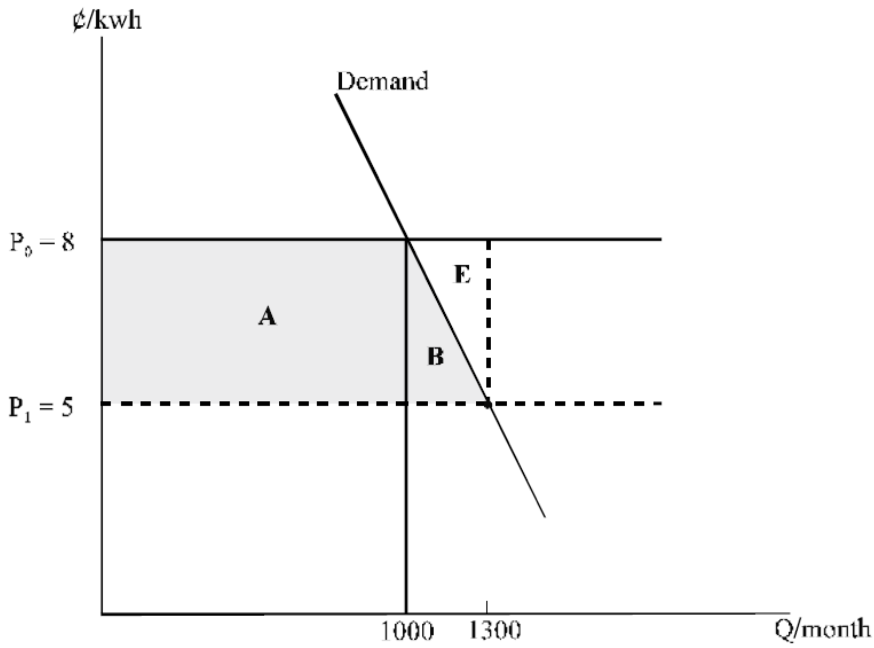
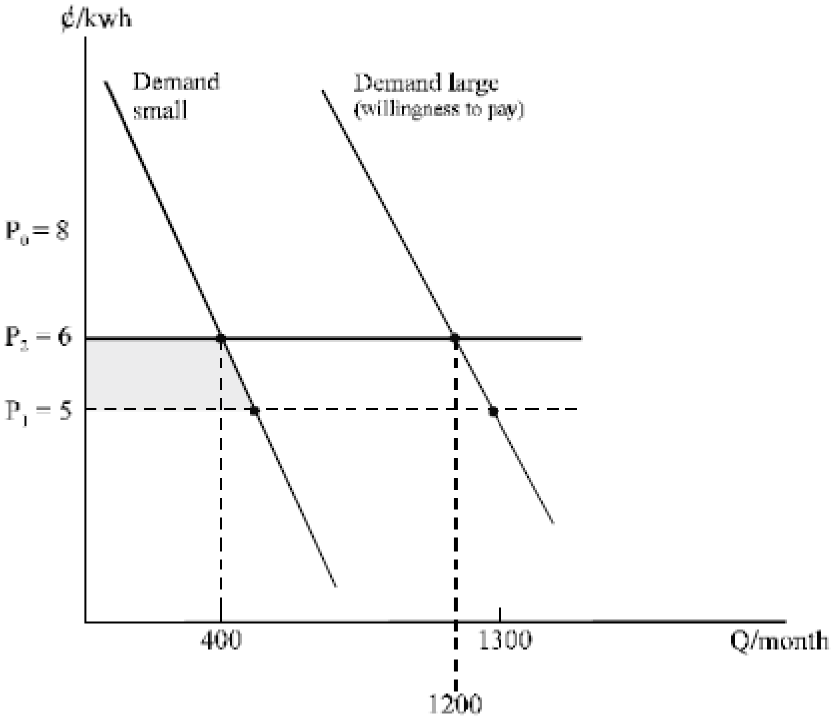


Figure 2: Self-selecting two part tariffs



Option 1

$F_1 = \$10$
$P_1 = 5¢$

Option 2

$F_2 = 0$
$P_2 = 6¢$

D_{large}: if select option 2, lose more than \$12 of surplus (vs F_1 is only \$10)

D_{small}: if select option 1, gain less than \$10 of consumer surplus (vs F_1 = \$10)

Figure 3: Pricing below incremental cost

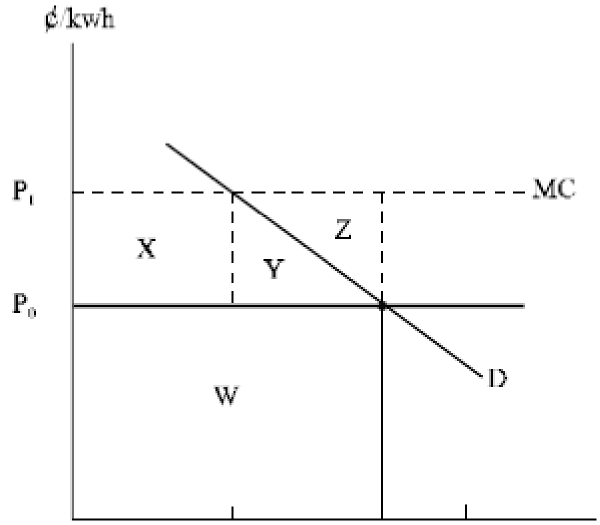
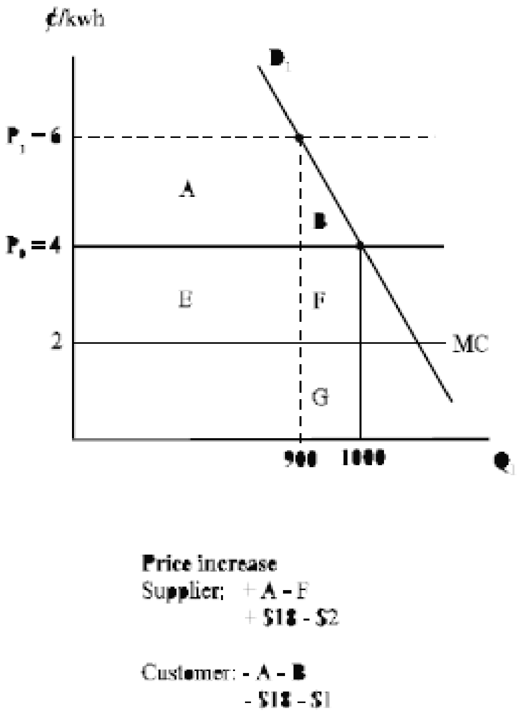


Figure 3 illustrates the problem of pricing below incremental cost. Each unit sold is priced at less than the cost of production. The supplier would be better off making a deal in which he gave the demander a lump sum credit to his bill of X+Y, while raising the price to P1. The customer is no worse off than initially (less electricity is consumed, but the customer is indifferent to P0 for each kWh versus a rebate of X+Y per month and a higher price of P1).

Case of demand elasticities in Ramsey Pricing:



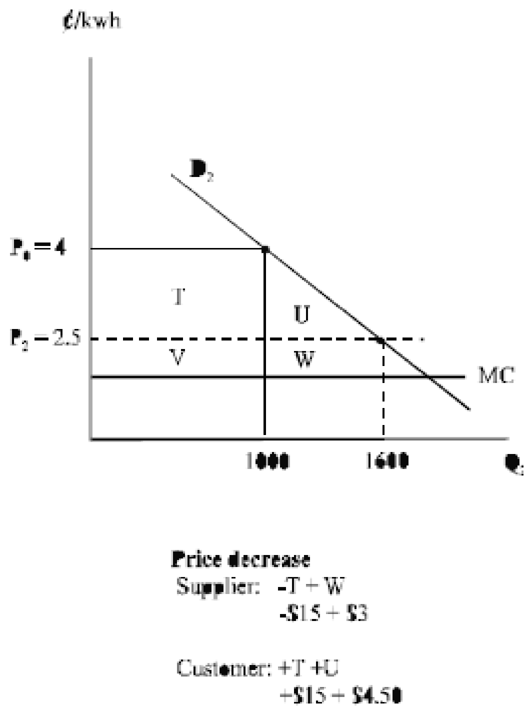


Fig 1 **Fig 2**

Appendix 2

Tariff averaging and cross-subsidization

Tariff averaging

Tariff averaging is a mechanism used virtually everywhere to reduce cost-related tariff variations to a relatively small number of tariff bands. Averaging is applied to what are generally regarded as the three elements of cost (and hence of tariffs):

- Connection charges, which are (notionally, at least) related to the cost of connection;
- Periodic rental fees, which are related in principle to the cost of upkeep and maintenance of the service; and
- Usage tariff bands

Averaging is strongly associated with cross-subsidization (and hence with noncompetitive tariffs), but in its narrowest definition, it need not be. In fact, tariff averaging is applied to rental and call fees in the most competitive of markets.

Effects on universal service

Averaging, simply means, concentrating tariffs at fixed points. If these points are broadly strung along a spectrum of the cost of providing the service, the effect is that the tariff charged to any individual is rounded up or down to the nearest fixed point. Obviously, individuals whose tariffs are rounded down the most benefit the most, and those whose tariffs are rounded up the most lose the most. The more tariff bands there are; the less extreme the rounding needed.

On its own, averaging effectively offers similar terms of access to differentiated groups of users. It tends to favour rural rather than urban areas, especially for connection fees. Rapidly falling maintenance and operation (usage) costs overall mean that the marginal cost for all users is both, falling and converging, affecting the cost basis of rentals and usage. In theory, this should reduce the benefits and losses of averaging to any particular group, but the existing small number of rental and usage tariff bands means that low-volume users currently tend to benefit the most.

As a mechanism for universal service, averaging per se, is relatively indiscriminate between different groups of users, with a general bias toward high-cost users, such as rural and low-usage groups. Even in the most liberalized environments, such as in the United Kingdom and in all the European Union countries (as a result of recent regulations), some degree of tariff averaging is retained in the explicit interest of universal service; that is, averaging is used as a means to deliberately cross-subsidize. In fact, tariff averaging may in its basic form have only a very weak cross-subsidization effect, and this can ultimately be justified by the cost to the provider of not averaging costs.

Averaging is applied partly to simplify the service supplier's accounting and billing procedures, and it puts the supplier in a position to offer a much more transparent and understandable, hence attractive, service to customers. Tariff averaging will thus always be present. However, there is a tendency for operators to introduce more differentiated tariff bands for various user groups and areas as they try to reduce the benefit of averaging to certain outlying high-cost users and implement profit-maximization strategies that differentiate between user groups based on what they can pay. (Strictly speaking this is a form of cross-subsidization because tariff variations are not based on cost, as is also the case when an operator's averaged tariffs are deliberately different from those of its competitors. These cross-subsidies do not distort competitive processes but rather are a part of them.) However, unless averaging is used as a means to cross-subsidize, the impact of this specific, narrow form of de-averaging is likely to affect only the most expensive rural users.

Cross-subsidization

There are three main types of tariff cross-subsidization: within tariff elements; between tariff elements; and between basic and advanced services.

Cross-subsidization within tariff elements

In a purely commercial and competitive context, tariff averaging may be considered as a form of cross-subsidization within a specific band, such as a local tariff rate, justified by all service providers on purely commercial grounds. However, tariff averaging is most often discussed as a specific instrument of cross-subsidization, going beyond what would be justified in a competitive context. By manipulating the number of averaged tariff bands and their size in monetary terms (tariff setting), very considerable cross-subsidization can be implemented.

In general, the following points apply to the three tariff elements (connection charges, rental fees, and usage tariffs):

- Connection charges are held to a single or a few levels, irrespective of the cost of deploying the network connection, so those expensive to connect are subsidized by others.
- Only one or a few levels of rental charges are applied (often differentiating between business and domestic users), irrespective of the volume of use or the cost of maintaining the line, so low-volume, high-maintenance customers are subsidized.
- There are usually only a small number of usage tariff rates, rising with usage and related to costs in relative, but not absolute, terms. In general, it is accepted that local tariffs should currently be subsidized by heavy commercial users

Effects on universal service

Cross-subsidization within tariff elements is, traditionally, one of the main instruments of universal service for rendering services affordable to users, but rapid changes in technology and in the costs of different elements have complicated and somewhat blurred the picture. Virtually all countries with a liberalized environment have retained tariff averaging as a means of cross-subsidy. The main effects on universal service are as follows:

- Uniform connection fees imply a sometimes significant cross-subsidy for rural users, thus making it much easier for them to connect to the network.
- To the extent that rural lines need more maintenance, uniform rental tariffs also subsidize rural users and help them stay connected.
- Higher rental fees for business users than for domestic users subsidize the latter, making it easier for them to stay on the electricity network, although networks are "dimensioned" to deal with business peak traffic, justifying a higher rental for business use. In India, however, this kind of technology is not completely in place.
- The fact that the overall level of usage of a line is not taken into account in the rental fee (and only partially in the usage tariffs) discriminates in favour of low-volume users.
- Relatively low usage tariffs discriminate in favour of domestic users and small local businesses and against larger businesses, especially international corporations. This allows domestic users and small local businesses to make more use electricity. Within these parameters, the effects do not discriminate between users who can afford the services and those who cannot, so some of the subsidy ends up with those who do not need it. However, the subsidies also favour the egalitarian principle of universality.

Comments

1. Competition (or the anticipation of it) constrains the extent to which cross-subsidy by tariff averaging within tariff elements can be used as a means to implement universal service, because competition forces tariffs toward their costs. However, license conditions and regulations are usually used to ensure that operators pursue universal-service aims.
2. The extent of cross-subsidy between, for instance, local and international services is extremely difficult to determine and has led to much debate. The issue, however, is unavoidable in competitive contexts because regulators have had to set tariffs both to prevent predatory pricing by incumbent operators and to simulate the effects of competition where they are only weakly present. Tariff-setting formulae must thus be devised that are not directly based on competitive pressures. Furthermore, the cost of universal-service provision (that is, of

extending the network beyond profitable users to currently loss-making users) must also be calculated so that it can be divided in some way between the different operators. Such a calculation must also deduct the economic benefits of universal service to the operator, such as the increased utility of the network derived from more users and economies of scale and scope. All of this increases the complexity of determining real cost.

3. Monopoly regimes can significantly endanger and reduce the extent of cross-subsidy between international-usage and local-usage tariffs because such services can exploit the difference between the cost of phoning from country A to country B and the cost of phoning from country B to country A, although many such services manage to avoid paying the full cost of their own operations.

Cross-subsidization between tariff elements

Cross-subsidy can also occur between the three tariff elements: connection charges, rental fees, and usage tariffs. In general, some patterns in cross-subsidy have emerged. Although tariff setting was often originally cost based, the failure of tariffs to keep pace with changing costs has resulted in the following in developed countries:

- Connections are generally provided well below cost, overall.
- Rental charges do not cover the costs of network maintenance, overall.
- Usage charges generally yield far more than the marginal cost of service usage.

Thus, usage charges cross-subsidize rental and connection charges.

Effects on universal service

Cross-subsidy between tariff elements has the following main effects on universal service:

- It favours expansion of the network over more intensive use of the network, thus leading to a general increase in the level of universal service.
- It favours the retention of low-usage users, which also helps to maintain universal service.

This form of subsidization does, in a general way, benefit low-income groups that cannot afford to spend more on electricity bills.

Comments

1. Because the service provider in monopolies usually maintains the network and provides the services, the allocation of costs between these elements has been largely determined on a non-cost basis. However, liberalization of networks and services changes this, so service providers tend to reduce this cross-subsidy by increasing connection charges and rental fees. However, it remains extremely

difficult to accurately cost different services in a network environment with many large, indivisible elements when rapid technological change is introducing premature technical equipment redundancy and writing down payback periods and organizational restructuring is affecting the cost basis.

2. By favouring network expansion, this cross-subsidy has clear medium- and long-term economic benefits to the network operators, especially in less-developed networks with major growth potential. It is thus the subject of regulation even in liberalized regimes. Liberalized regimes have therefore had to develop mechanisms for this cross-subsidization to take effect, to control its rate, and to allocate its cost among operators. Such regulation has in turn caused controversy over the means of valuing existing networks and over interconnection charges when the service provider is different from the network provider.

Cross-subsidization between basic and advanced services

Tariffs on advanced services, such as leased lines, dedicated non-stop power supply, and other value-added services, can also be used to subsidize basic services. A case in point is leased lines: very high tariffs relative to costs have been levied in many European countries. However, the reverse seems to be the trend: advanced services are priced at marginal costs and fail to contribute to the basic existing network over which they are carried. This is probably because advanced services are more recent and have therefore tended to be introduced in a more liberalized environment. Where monopolies have been maintained on basic services (and even in cases of competition), basic services can be used to cross-subsidize more advanced services to make the latter more competitive in the lucrative and growing advanced-services market.

Effects on universal service

Advanced services are used almost exclusively by business, especially larger and multisite firms. Subsidization can operate in contradictory directions, depending on the cost of specific services and the tariffs charged. In some situations, the tariffs provide a general subsidy to smaller and domestic users of basic services. However, the trend seems to be in the opposite direction: users of basic services provide a general subsidy to business users. In either case, it is highly indiscriminate because the destination of the subsidy is undetermined.

Comments

1. Because many advanced services have been introduced in the context of at least partial liberalization, this form of tariff cross-subsidization has limited and diminishing relevance.

2. Where advanced services are provided in a competitive context and basic services are not, there is a real danger that monopoly-service customers (for instance, domestic and rural users) will be used to subsidize the competitive-service customers (mainly larger firms).

Recommended Principles to Be Used In Determining an Alternative Electricity Tariff Structure

Objectives

The objectives of the current electricity tariff structure determination are:

(1) to have a tariff that genuinely reflects the economic costs and to promote efficient use of electricity, in particular to encourage less consumption during the peak period of the power system, which will help reduce generation and distribution costs in the long run;

(2) to secure the financial status of the three power utilities, which will enable future expansion of their operations;

(3) to provide fairness for all power consumer categories by reducing cross subsidization from one category to another; and

(4) to achieve a mechanism of the electricity tariff adjustment that is flexible and automatic, corresponding with changing fuel prices in the competitive market.

Criteria for Determining the Electricity Tariff Structure

In determining the electricity tariff structure, the following criteria have been taken into consideration:

Marginal Costs

1. Marginal costs mean "the incremental costs resulting from the most appropriate adjustment of the power generation and distribution systems to meet the continuously increasing demand per unit." The electricity tariff calculation that is based on the marginal costs will reflect the actual costs of power generation and distribution. Such marginal cost based tariffs will give a correct signal to power consumers and will enhance most effective management of resources.
2. Marginal costs in the power sector can be divided into four levels, i.e. generation, transmission, distribution and retailing.
3. Marginal costs that reflect the actual costs of power generation and distribution will vary in each period or every hour. However, to determine the tariffs in such a manner will entail a considerable expenditure on meter installation. Therefore, various designs of tariff determination have been initiated to best reflect the marginal costs, for example, the two-part tariff comprising the demand charge and energy charge. The demand charge reflects the power utilities' investment in constructing power plants, transmission and distribution systems so as to maintain the availability

capacity once demand arises; the energy charge reflects the cost of fuel used in power generation when actual consumption takes place. The demand charge and energy charge may vary according to the Time of Day (TOD) or the Time of Use (TOU), which will be in line with the load curve of the system.

Load Pattern

1. Power consumption in Mahrashtra can be divided into three periods in a day, i.e. the peak period (from 18.30 hrs. to 21.30 hrs.), the partial peak period (from 08.00 hrs. to 18.30 hrs.), and the off-peak period (from 21.30 hrs. to 08.00 hrs.) During the peak period, the MAHAGENCO would have to operate at full scheme of its generating capacity to the point of the minimum reserve margin, while the MAHATRANSCO would have to use full dispatch capacity during the same period. As for the MAHATRANSCOM, the full dispatch capacity would typically take place in the afternoon when the consumption at the state level was moderate. Consequently, if the demand had increased during the peak period, the power sector would have been required to increase investment in power generation and distribution.

Load Pattern of the System

Load Pattern	Time
Peak	18.30 – 21.30 hrs.
Partial Peak	08.30 – 18.30 hrs.
Off-Peak	21.30 – 08.30 hrs.

2. Power consumers whose consumption was high during the twilight, which was under the peak period of the system, should, therefore, pay for electricity at a higher rate than that imposed on small consumers during the off-peak period of the system. One approach to create fairness in determining the electricity tariffs was to establish different tariff rates at different intervals of the day (Time of Day rate).
3. If TOD is introduced, then the consumption pattern may change to the following:

Load Pattern of the System

Peak	09.00 – 22.00 hrs. Monday - Saturday
Off-Peak	22.00 – 09.00 hrs. Monday – Saturday and the whole Sunday

4. Due to the changing load pattern, the TOU rate was offered as an alternative rate for the existing TOD customers and as a compulsory rate for new power consumers. Under the TOU rate, the tariffs would be expensive during the peak

period and would be cheaper during the off-peak. In addition, the whole Sunday was considered to be the off-peak period. The purpose of such determination was to have the actual costs reflected in the electricity tariff structure and to send a correct signal to power consumers.

5. However, due to the problem of the meter installation expense, the tariff structures that can reflect the marginal costs, such as the TOD or TOU rates, could not be applied to all consumers. As a result, power consumers had to be classified according to their load patterns; those with a similar load pattern would be placed under the same category. Each consumer category will pay for electricity at a rate considered to best reflect the generation and distribution costs incurred for that particular group. The current consumer categories are as follows:

Consumer Category	Load Pattern
Residential	Peak Load In The Evening
Large Industries	Rather Consistent Load
Large General Services, Medium Industries and Small Industries	Peak Load In The Afternoon And Low Demand In The Evening
Small General Services	Peak Load In The Evening
Specific Business Services (Hotel)	Peak Load In The Evening

6. The current load pattern has altered again from what it used to be, i.e. the load curve during Saturday, Sunday and official holidays shows lower demand than that during Monday – Friday. That is, the peak period of the system is during 09.00 – 22.00 hrs from Monday to Friday and the off-peak is during 22.00 – 09.00 hrs from Monday to Friday and the whole day on Saturday, Sunday and public holidays.

<u>Possible Current Load Pattern of the System</u>

Peak	09.00 – 22.00 hrs.	Monday – Friday
Off-peak	22.00 – 09.00 hrs.	Monday – Friday and the whole day on Saturday, Sunday and public holidays

Revenue Requirement of the Power Utilities and Financial Criteria

(1) Revenue Requirement

a. In determining electricity tariffs, apart from the marginal costs that must be taken into consideration, as detailed before, the revenue requirement of the power utilities is another factor that must be considered. This means that the electricity tariff structure to be applied must ensure stability of the financial status and capability to expand operations of the power utilities.

b. The three power utilities will undertake an estimate of their financial status and make an estimate of the average electricity tariff that would yield the financial status pursuant to the established criteria. The revenue in each year will be called the "revenue requirement." In order to estimate the financial status, explicit assumptions are essential, particularly assumptions on fuel prices, inflation rates or consumer price index (CPI), efficiency improvement of the transmission system, distribution system and retail business.
c. The data on load forecast will be required for the estimation of the utilities' revenue requirements. The three power utilities will use the outcome of load forecast in developing their respective investment plans. ***For MSEB, a Power Development Plan (PDP) will be developed so that adequate and proper sources of power supply could be identified; priority will be given to the power plants based on their economic merit costs. Moreover, MSEB will have to develop the transmission system expansion plan to ensure that power supply would adequately meet the increasing demand in the future. For the distribution utilities, the MAHATRANSCO and MAHADISCOM will use the outcome of load forecast in developing their distribution system investment plans.***
d. Once the investment plans of the power utilities are developed, an appropriate level of revenue requirement of each utility can be determined. In this regard, the financial criteria will also be taken into account.

(2) Financial Criteria

Emphasis is placed on "cash-based" requirements in order to generate sufficient revenue that enables the utilities to make investments and to pay back loans together with interests. This will provide greater incentives for the power utilities to improve their investment efficiency. Besides, the current financial criteria are in line with the conditions for loan guarantee of the World Bank. The criteria are the following:

- Minimum self-financing ratio: the ratio of fund generated from internal sources over the average three-year capital expenditure
- Minimum debt service coverage ratio: the ratio of net cash income before interest over debt service requirement for the year
- Maximum debt/equity ratio: the ratio of long-term debt over total equity
- Maximum ratio of short and medium-term debt ratio: the ratio of all debt to total long-term debt maturing less than five years from the date on which it was issued over total long-term debt

Current Financial Criteria (What should be according to the World Bank's/PWC's/Mercados' standard recommendations)

	MAHAGENCO	MAHATRANSCO	MAHADISCOM
Self-Financing Ratio (SFR) (%)	> 25	> 25	> 25
Debt Service Coverage Ratio (DSCR)	> 1.3	> 1.5	> 1.5
Debt/Equity Ratio	> 1.5	> 1.5	> 1.5
Short and Medium Term Debt to Total Long-Term Debt (%)	> 15	> 15	> 15

Social Criteria for the Electricity Tariff Determination

The key political and social requirements are as follows:

1. Uniform tariffs should be applied nationwide for each individual customer category;
2. Subsidization for residential consumers should remain, particularly for small residential consumers whose consumption is low; and
3. The structure of electricity tariffs for other consumer categories should be designed to best reflect the marginal costs.

Retail Tariff Structure

The electricity tariff structure of each consumer category can be summarized as follows:

Residential

- The tariff is in the form of progressive rates.
- Small residential consumers receive subsidization, i.e. the tariff level is at 28% of the marginal costs.
- The tariff for large residential consumers almost reflects the actual generation and distribution costs, being partly subsidized, i.e. the tariff level is at 80% of the marginal costs.

Small General Services

- The tariff structure is similar to that of large residential consumers due to similar load patterns.

Medium and Large General Services and Specific Business Services (all figures are assumed to build a framework)

- The tariffs vary according to the voltage levels (69 kV, 11-33 kV, < 11 kV).
- For Medium General Services whose consumption does not exceed 355,000 kWh/month, the two-part tariff is applied, i.e. the tariff will be divided into the

demand charge and the energy charge. If the consumption is over 250,000 kWh/month, the TOU rate can be an alternative.

- For Large General Services, i.e. those whose consumption is over 2 MW or over 355,000 kWh/month, either the Time of Day rate or the Time of Use rate is applied.
- For Specific Business Services (hotels to accommodate tourism), the two-part tariff is applied; the TOU rate will be an alternative if the consumption is over 250,000 kWh/month.

Government Institutions and Non-Profit Organizations

- The tariff comprises only the minimum demand charge and the energy charge according to the voltage levels. If the consumption is over 250,000 kWh/month (for example), the TOU rate will be applied.

Agricultural Pumping Service

- A flat rate tariff is applied with no variation according to the voltage levels.

Electricity Tariffs according to the Current Automatic Adjustment Mechanism

The development of the power tariff structures as detailed in above will be based, to a certain extent, on the assumptions pertaining to fuel prices, inflation rates or consumer price index (CPI), exchange rates, and efficiency improvement of transmission, distribution and retail businesses. Therefore, in order to have the actual costs reflected by power tariffs and to reduce impact of the fuel price volatility on the power utilities' financial status, the Automatic Adjustment Mechanism (or F_t) has been introduced. In this regard, the monthly tariff collected from consumers will comprise two parts, i.e. the base tariff (cannot work this out as an alternative over and above the already existing structure) and the tariff derived from the F_t formula.

Automatic Adjustment Mechanism (F_t)

The key elements for the current determination of F_t are the following:

1. The change of fuel prices which is beyond control of MSEB (i.e. natural gas, fuel oil, diesel, and imported coal) and power purchasing prices that MSEB has contracted with private power producers;
2. The change of revenue from the actual total sale of electricity and the actual retail prices which differ from those forecasted and used as the base for determining the electric power tariff structure;
3. The change of the investment capital for the operation of the transmission and distribution systems and the customer service business due to inflation rates and the total sale which differ from the assumptions used in estimating the power utilities' financial status;
4. The change of foreign exchange rates, which affects the power utilities' liability burden;

5. Expenditures on the Demand Side Management (DSM).

Current Tariff Adjustment Mechanism

Disclaimer: the following is a very preliminary and crude attempt and should not be taken as a flawless mechanism

Description of Ft

The automatic adjustment mechanism that is applied to retail tariffs - **retail F_t** - is defined by an algebraic formula which is set out below. Retail F_t is an amount in Rs. per kWh which is applied to the energy charge for all customer classes (but not to any demand charges). It is calculated for every month, but is used to establish actual tariff levels for a future four month period, in order to provide reasonable tariff stability for consumers. Retail F_t accounts for about 20% of the average retail tariff, although, since it is a flat rate addition to energy charges, the proportion varies by customer category and by load factor.

The formula for retail F_t is as follows:

$F_t = FAC_{t-1} + MAC_t + AF_{t-1} + DC – MR_{t-1} + DT_t + DD_t + DR_t$

Where:

1. FAC_{t-1} is the Fuel Adjustment Charge in respect of month t-1. The effect of the Fuel Adjustment charge is to allow fuel cost pass-through. The formula is set out below;

2. MAC_t is the monthly adjustment charge for uncontrollable costs. It contains provision for the pass-through of:

   i. Land and Property Taxes - *Do the Maharashtra Power Utilities pay such taxes at this moment?*

   ii. MSEB's Demand Side Management costs;

   iii. Exchange rate losses on foreign debt

   iv. VAT, another uncontrollable cost - separately itemised on customer bills?

3. AF_{t-1} is the Accumulated Energy Adjustment Charge in month t-1. The purpose of the Accumulated Energy Adjustment Charge is to correct for the fact that retail tariffs are fixed for four months whereas F_t varies monthly;

4. DC is the Discrepancy Charge. This corrects for the lag in the application of the adjustment factors, which means that the volumes to which the adjustment factors

FAC, MAC, AF and MR apply are different from the volumes on which they were incurred;

5. MR_{t-1} is a factor to correct for differences between actual average unit revenue and planned average unit revenue: this would normally occur if there is a mis-estimation in customer mix. The specific formula for MR_{t-1} is set out below; and

6. DT_t, DD_t and DR_t are factors to correct for variances of actual inflation from the forecast figures used to set the planned purchase price, and are applied to the original estimates of transmission, distribution and supply operating costs respectively

7. FAC_{t-1}, the Fuel Adjustment Charge, is calculated according to the formula:

$FAC_{t-1} = AFC_{t-1} – BFC_{t-1}$

Where:

i. AFC_{t-1} is the Actual Fuel Cost incurred per unit of kWh of energy sold to final customers, calculated according to the formula:

$AFC_{t-1}= (\Sigma_i (P_{it-1} \times Q_{it-1}))/S_{At-1}$

where:

ii. P_{it-1} is the actual price of resource i in Month t-1. There are the following different resources: heavy fuel oil; diesel oil; natural gas; and energy purchased from IPPs, SPPs, and other nations, if at all.

iii. Q_{it-1} is the actual quantity of resource i consumed in Month t-1;

iv. S_{At-1} is the actual end-use energy sold in month t-1

8. BFT_{t-1} is the Base Fuel cost per unit of energy forecast to be sold. Standard monthly load profiles are then applied to the forecast annual demand to create a demand forecast for the month in question.

9. MR_{t-1}, the correction factor for the variance between the actual average price and the planned average price (usually due to any mis-forecast of customer mix), is calculated using the formula:

$MR_{t-1}= \Sigma_k [(P_{Akt-1} – P_{pk}) \times S_{Akt-1}]/S_{At-1}$

Where:

i. P_{Akt-1} is the actual average unit revenue of utility k in month t-1;

ii. P_{pk} is the planned average unit revenue for utility k for the year.

iii. S_{Akt-1} is the actual energy sold of utility k in month t-1; and

iv. S_{At-1} is the actual end-use energy sold in month t-1.

There is no algebraic expression for the automatic adjustment mechanism that is applied to the base BST - wholesale $\mathbf{F_t}$ - in the same way as there is for the retail F_t. Instead, it is derived by allocating to MSEB its “share” of retail F_t as follows:

- the Fuel Adjustment charge;
- the share relating to MSEB’s uncontrollable costs;
- the inflation adjustment to transmission operating costs; and
- the amounts due to MSEB in respect of the application of the correction factors.

Lessons for Maharashtra from the Reforms in Electricity Markets by World Economies

Document Summary

The following is an attempt to trace the vast electricity market reforms that have been undertaken by the world economies to help us build a road map for Maharashtra's Electricity Markets reforms and competencies, eventually. This has been done through a five part document that covers the context and background of power market reforms in developing countries. It then covers the strategic components of reform to power markets, starting with enterprise restructuring and corporate governance, including the respective roles of state-owned enterprises and private enterprises in the provision of electricity services. It next deals with market structure and restructuring power systems, the experience with independent power producers (IPPs), and competition in the power market. It then looks at regulation of power markets and—subsequently—at the social issues associated with power market reform for access and affordability to electricity services for the poor. Finally, the document examines issues for implementing a reform program, including government's roles and responsibilities, sequencing of reform steps, and transition issues for reform programs.

As mentioned before, this document is just a precursor to understanding, analyzing and implementing reforms for Maharashtra. In many sections there will come obvious questions which may not have been addressed immediately in this particular section. However, in subsequent documents, these concerns have been dealt with in detail.

While working on this document, I came across literature pertaining to many nations, big and small, developed and underdeveloped – to my amazement, every one of them have had teething trouble and hiccups to the road to reform. This mapping out of different reform formats has actually been very educational. Every single country has had an ignition point beyond which they have whole-heartedly accepted that they need to change the way their electricity markets work. What is interesting to note is that each economy has tried something unique pertaining to its specific problems, experimented with different options to reform, resorted to various means to implement the reforms and have sometimes even blindly adopted what other successful nations were doing in this arena, with or without accomplishing the objective, of course. Whatever the case is, there are some driving factors, lessons learnt and desirable outcomes pertaining to reforms, which are common to all electricity markets.

The following are the key points of this piece of work:

- All electricity market reforms are driven by quality, efficiency, sustainability, growth and welfare

- The essentials of such reforms are restructuring, regulating and in most cases privatizing
- Different nations have different starting conditions. Depending on this, the key aspects of reform characteristics change
- Reform is an even, not a process
- There is no prescriptive path to reform
- Socio-economic-political-legislative structures – all affect the way reforms can be devised and implemented
- The various outcomes of electricity markets in developing nations is a good way to map what Maharashtra needs to do and mark what it has already achieved.

Introduction

About 70 of the 150 developing countries and transition economies have embarked on reforming their Electricity markets since the early 1990s. One of the key drivers of this reform movement is being disenchanted with the poor performance of state-owned Electricity utilities, the need for new investments and modernization to meet the rapid growth in demand, and fiscal pressure, along with the desire to protect and help the economically backward to have access to Electricity. The reforms have generally been tentative and incomplete; particularly in relation to market structure, degree of private participation, and development of the regulatory framework. The countries that have embarked on Electricity market reform cover a broad range in physical, economic, and institutional terms. The most advanced countries in reform are located in Latin America and in Eastern Europe, where they also have relatively larger Electricity systems and higher levels of per capita national income compared to other developing countries and transition economies ("developing countries").

This document compiles the lessons and experiences from the reforming Electricity markets of developing countries and transition economies. It focuses on reforms that address the generally poor performance of Electricity markets in developing countries vis-à-vis reforms in those developing countries where Electricity markets are performing reasonably well. These lessons are taken from the rapidly growing instances while reforming such **Market Reform** markets in these countries.

Strategic Elements of Electricity

Electricity market reforms in developing countries are driven by three main concerns. They are a) better service quality for Electricity consumers to support economic growth and welfare, b) improvement in government's fiscal position, c) and more affordable access to Electricity for the poor.

The main elements of reform are — restructuring Electricity utilities and markets, regulation, competition, and the roles of public and private participants. These become the means for countering the concerns.

The most important lesson from reforming Electricity markets in developing countries is that "cookbook" solutions for reforming their Electricity markets are ruled out by the extensive range of economic and institutional endowments of these countries. This lesson emphasizes the importance of country and Electricity market starting conditions for reform, since these conditions determine the initial—and often subsequent—scope and composition of reform. Countries with better endowments should be able to achieve more ambitious outcomes from Electricity market reform than countries with lesser endowments.

Reforms based on substantial market restructuring for large middle-income countries, for example, would be infeasible for small low-income countries. Conversely, modest reforms designed for the limited economic and institutional capacities of small low-income countries would have unacceptably low outcomes in large middle income countries. Electricity market reform can be designed to suit the specific conditions of these two groups of countries.

The experience gained from implementing Electricity market reform is as important as the considerable experience gained about designing Electricity market reform.

Many dimensions of Electricity market reforms are important in developing countries. Under mounting experience, Electricity market reform in developing countries has increasingly emphasized the social, legal, and political dimensions of reform in defining the techno-economic dimension. This reflects the reality that reform has to confront underdevelopment of energy and financial markets, weakness in legal and governance systems, bouts of macroeconomic instability, and major concerns about access and affordability of electricity services at the prevailing low income levels. Few developing countries can contemplate the technically sophisticated Electricity market reforms, such as radical market restructuring and private risk investment with competition in both the wholesale and the retail markets for Electricity, that are feasible under the much higher economic and institutional endowments of Organisation for Economic Co-operation and Development (OECD) countries. (Differences in physical endowments are not a factor, since many developing countries have much greater primary energy resources than most OECD countries.)

Summary and recommendations:

1. ***Since early 1990s, Electricity market reforms have been a serious issue with most developing nations***
2. ***The key drivers are a) better service quality for Electricity consumers to support economic growth and welfare, b) improvement in government's fiscal position, c) and more affordable access to Electricity for the poor.***
3. ***The way to achieve the above is through restructuring Electricity utilities and markets, regulation, competition, and the roles of public and private participants.***
4. ***There is no prescriptive path to designing and implementing Electricity market reforms***
5. ***Different experiments and experiences by various nations, however, give us a fair idea of the general dos and don'ts***

Electricity Market Reform Has Many Dimensions

Change to commercially oriented governance is fundamental to achieving sustainable reform of Electricity markets. Electricity market reform in a broad sense can be viewed as a means to improve governance of the Electricity market and its participants. The traditional model of governance under state ownership is not sustainable in most developing countries. Commercially oriented governance irreversibly removes the management and development of Electricity supply from political and bureaucratic control to achieve commercial standards in management practices, financial performance, and the pricing of products and services. Changing these deeply ingrained attitudes is a major challenge for Electricity market reform in developing countries. Social and political factors are important for all Electricity market reform programs. Government must generate public acceptance and stakeholder consensus for these programs. Electricity market reform based on market restructuring and private sector participation involves complex social and political issues for market investors, utility employees, and Electricity consumers. Even the basic initial reform step of separating the generation, transmission, and distribution businesses of an Electricity utility can provoke huge social and political problems with utility employees and their political supporters.

The complexity of these issues can sometimes match the complexity of the technical issues involved in reforming Electricity markets. Distributional issues are often at the heart of designing Electricity reform programs. Reforms must not only offer benefits that substantially outweigh the costs of reform, but also provide the means for compensating losers or mitigating the impact of reform on them. Not everybody in the nation can gain in equal amounts through a reform mechanism; however, it is important to ensure the most gain out of it.

Although reforms to Electricity markets have delivered substantial benefits to society overall through efficiency gains, most of these benefits have been shared by Electricity producers, service providers, higher-income consumers, and commercial businesses, but have not reached other segments of society, including the poor. The impact of Electricity market reform on the poor is a critical distributional issue. The poor have obtained a low share of the benefits of Electricity market reform in developing countries, and some have even suffered welfare losses. Some of the poor have gained from reform by receiving otherwise unavailable connections to Electricity supply. Some of the poor who have lost from reform were obtaining some Electricity service before reform—albeit illegally and of poor quality— but were disconnected or now have to pay for their consumption. Other groups of the poor continued to receive legal service, but at higher tariffs as subsidies and cross-subsidies were removed under the commercial pressure on service providers introduced by reform.

Governments must sustain their political commitment in the face of considerable political risks for reforming their Electricity markets. Maintaining momentum for reform involves political costs and thus requires political commitment through successive phases of the reform process over one or more electoral cycles. Reform yields uncertain benefits in the long term because unanticipated events can derail reform programs, yet reform can also incur substantial unavoidable costs in the short term.

Governments often have to deal with opposition from the losers under reform (subsidized consumers, utility employees, or the beneficiaries of corrupt procurement) and by society at large to privatizing this essential public service, especially when the new service providers are foreign parties. Increases in Electricity prices that are perceived as entirely a consequence of reform are vulnerable to a public backlash. Yet reform proponents have often underestimated the importance of these risks when considering techno-economic issues.

Electricity Market Reform Must Be Adapted to Starting Conditions

Starting conditions in the Electricity market are important for designing Electricity reform programs. These conditions include the size of the country and its Electricity system and market, the country's location relative to other Electricity markets, its income level and macroeconomic condition, its political situation, and the capacity of its domestic financial markets and institutions. They reflect the many dimensions of Electricity market reform and critically influence the feasibility of reform programs and hence the outcomes that can be achieved from them in the short to medium term. The variety of starting conditions among developing countries partly explains the diversity of their Electricity market reform programs and the development of innovative Electricity market and industry structures and regulatory arrangements. The variety of market structures is one indicator of the range of reforms to Electricity markets. From the pre-reform structure of a monopoly, market structures can be categorized according to the increasing degree of competition, starting from a purchasing agency—also known as a single buyer—through whom passes all or most trade in wholesale and who therefore manages competition for market share among generators and independent Electricity producers. In developing countries the competitive structures are based on trading arrangements in the wholesale

Electricity market that allow distribution companies and large users of Electricity to purchase Electricity directly from generators either in a Electricity exchange or bilaterally. The economic case for breaking up a vertically integrated Electricity utility rests on various factors. The gains from breaking up (or "unbundling") the utility by separating the generation component from the distribution component are worthwhile when they exceed the costs of transactions among the separated segments introduced by unbundling.

The relevant factors are Electricity system size and country institutional capacity to manage complex trading mechanisms. The case for unbundling is strongest in large Electricity systems in countries well endowed institutionally. The case for unbundling is weakest in small systems in countries with undeveloped institutional capacity and weak economic conditions. The numerous countries whose Electricity systems are too small for a competitive Electricity market have intermediate reform options. Unbundling the generation and distribution segments of the Electricity supply chain into tiny entities would not make sense in these systems, because economies of scale and scope would be lost without gaining the benefits of competition. Forming Electricity trade areas with neighbouring countries can be facilitated by separating the generation, transmission, and distribution components of supply chains even in relatively small systems. This trend is noticeable in some regions of the developing world. Even in small Electricity systems, however, separation of these components helps regulation of Electricity service providers by revealing information about their costs, increasing the transparency of price setting, and helping benchmark costs and service standards.

These systems can adopt a purchasing agency or single buyer until they can reap the benefits from greater separation of the supply chain.

The variety of ways for the private sector to participate in the supply and delivery of Electricity services is another indicator of the range of reforms. The role of private participants should match their capacity to take on investment risks under specific country conditions.

Their roles can range from virtually no at-risk investment under management contracts through some investment risk under long-term concessions to accepting all investment risks under divestiture of ownership to the private sector. Problems—even failures—as well successes, have been associated with these forms of private participation in Electricity markets. As more risk and responsibility are passed to the private participants, the incentives become more powerful for these participants to improve services, which would lead to greater benefits for the country and its Electricity consumers in the absence of severe economic disruptions.

The case for bringing the private sector into Electricity supply functions rests on how well this would achieve the desired reform outcomes under the prevailing operating conditions.

Latin American experience shows that privatization of Electricity market assets can improve services at reduced costs and with fiscal benefits, provided that stable macroeconomic conditions prevail. However, many developing countries do not offer the necessary conditions for attracting substantial amounts of private investment in this way to their Electricity markets. Many of them have attracted substantial investments by independent Electricity producers, but only by giving contractual protection against most noncommercial risks to these producers.

Public-private partnerships have brought private management and technical expertise into countries with poor investment climates.

The public sector will remain an important source, and often for the medium term the main source, of investment for a Electricity market where country and market risks deter private investors. The public sector will also remain the main source of investment for network segments of the Electricity system and certain types of generation assets—such as hydroelectricity—that are kept under public ownership as a matter of policy. In many countries, some public investment will be needed to rehabilitate nonviable generation and distribution businesses as a prerequisite for attracting private investment in them or during the early years of concessions for distribution businesses. The public sector can play a financing or risk-bearing role by means of investment financing and the provision of subsidies and guarantees under public-private partnerships through management contracts, leases, and concessions. Finally, public financing will also be required to restructure Electricity sector debt arrears before privatizing many Electricity supply entities.

The range of approaches to establishing the credibility of Electricity market regulation is a third indicator of the range of reforms to Electricity markets. Credibility of regulation is needed to attract long-term private at-risk investment in Electricity services. It covers autonomy to carry out duties, transparency in procedures and processes, and accountability to government and consumers.

The principal means for developing credibility is a designated regulatory agency that discharges its duties in a neutral and depoliticized manner. A regulatory agency needs the legal status that gives it substantial autonomy from political and market influences, the authority to set parameters for contracts and monitor their implementation, and the discretion to respond to rapidly changing market conditions, but with restraint on arbitrary actions.

Specific contractual arrangements may be needed to provide stability and credibility for private investors under a new regulatory regime. Private investors place importance on the stability and enforceability of laws and contracts, and they contend that a credible regulatory system requires more than a newly formed regulatory entity. This is because many regulatory agencies begin performing their functions with the disadvantage of limited autonomy and capacity. In many Latin American countries, the means by which regulatory discretion is limited yet regulatory commitment is provided is by embedding specific rules and procedures in concession agreements and licenses provided to operators or in legislation (“regulation by contract”).

Empirical analysis presented here indicates that a clear threshold exists among developing countries in relation to size and income for the composition of power market reform. This threshold is formed by a combination of system size larger than 1,000 MW and national per capita income above US$900. A large middle-income group of countries is formed by a combination of size and income above these threshold values, and a small low-income group is formed by a combination of size and income below these threshold values. About two-thirds of developing countries fall into these two groups. Although these two variables influence all components of Electricity market reform, they have relatively stronger influences on different components. Country income level has a relatively stronger influence than Electricity system size on the roles of the public and private sectors and on access and affordability to Electricity services. It also has a stronger influence on the regulation of Electricity markets on the basis that institutional capacity increases with income level. Electricity system size has a relatively stronger influence on market structure. Table 1 (Source: World Bank) shows how this feature of developing countries influences the design of coherent Electricity reform programs for country and Electricity market conditions typically found in these two groups.

TABLE 1. Types of Power Market Reforms with Different Starting Conditions

	DEVELOPING COUNTRY GROUP	
	SMALL LOW-INCOME COUNTRIES	LARGE MIDDLE-INCOME COUNTRIES
COUNTRY STARTING CONDITIONS		
Power system size Access to electricity Investment climate Institutional capacity Governance rating	Very small Low Too poor to rate Very weak Poor	Small to large High Low to medium Low to good Poor to good
INITIAL REFORM CHARACTERISTICS		
Market structure	Limited vertical unbundling. Single buyer with some simple bilateral trading for wholesale power.	Substantial vertical and horizontal unbundling. Bilateral trading or a central exchange for wholesale power.
Regulation	Semi-autonomous regulatory agency mainly responsible for oversight of concessions.	Autonomous regulatory agency with power to issue licenses and approve retail tariffs and trading arrangements.
Role of private sector	Mainly independent power producers (IPPs); concessions in distribution under public-private partnerships.	Privatized generators and IPPs. Privately owned and financed distributors under long-term licenses.
Role of public sector	Continued ownership of most power supply facilities. Primary responsibility for financing sector development.	State ownership in sensitive generation sectors (hydro, nuclear), transmission, and nonviable distribution service areas.
Role of competition	Limited to bidding for long term agreements by IPPs and by private operators for distribution concessions.	Competitive bidding for wholesale power contracts under bilateral trading or bidding into a power exchange.

Summary and recommendations:

1. ***Electricity market reforms have many important aspects: social, political, financial, technological, macroeconomic, and most importantly legislative and governance-driven.***
2. ***Unbundling, market structures, vertical and horizontal integrations, contractual agreements, public-private partnerships also play different roles in each individual situation***
3. ***Different or even the same starting conditions in small, low-income and large, middle-income developing nations have varied impacts on the reforms required***
4. ***Staring conditions are: power system size, access to Electricity, investment climate, institutional capacity, governance rating***
5. ***Initial reforms need to be implemented in market structure, regulation, public and private participation, and competition structure***

Electricity Market Reform Is a Process—Not an Event

Pressures for rapid results should not obscure the point that reforming Electricity markets is a long-term process that requires patience to achieve the desired outcomes. This is because such outcomes as improving service quality for Electricity consumers, strengthening the government's fiscal position, and providing affordable access to Electricity for the poor take time to accomplish. This situation applies especially to countries starting with weak governance structures for power utilities and poor investment climates.

Electricity market reforms in developing countries are generally tentative and incomplete, and are still works in progress. To date, most reform programs have reached interim positions—such as the single buyer model of Electricity trade—and still need to find ways to attract private investment in a sustainable manner and develop their regulatory capacity. These achievements are unlikely to be sustainable over the long term without deeper reforms because the interim positions do not change the traditional model of governance under state ownership.

The initial transition stage is critical to the success of Electricity market reform and the most vulnerable period for derailment of the reform process by many developing countries. For market structure, transition concerns the separation of the industry structure into its main components and the adoption of a single buyer trader for wholesale Electricity. For private sector participation, transition focuses on private sector roles that fall short of full risk taking, such as management contracts and other forms of private participation, with temporary risk mitigation mechanisms, such as by setting limits on the amount of financial risk initially faced by private operators of Electricity distribution and generation facilities. Transition arrangements to provide stability and credibility for a new regulatory regime revolve around regulation by contract under which regulatory rules and procedures are incorporated into concession agreements. Sequencing of Electricity market reform should follow a sound strategy:

- The legal and regulatory framework necessary for creating the new market structure and trading arrangements is put in place before privatizing Electricity supply entities and setting up new market trading arrangements.

- Restructuring of Electricity markets progresses from an integrated structure to partially unbundled structures and eventually for some countries to a fully unbundled structure.

- Restructuring of wholesale Electricity trading arrangements progresses from only internal transactions within an integrated Electricity utility to the entry of IPPs selling their output to a single buyer, then to opening access to Electricity networks by large users of Electricity, and eventually to bilateral trading between generators and distributors or to a central Electricity pool under competitive trading. Major organizational and financial restructuring precede the creation of private ownership rights to avoid problems with stranded costs.

Some countries have skipped the early stages of these sequences, and others may do so in the future. A sequenced process, however, is less risky and more sustainable than a single-staged (“big bang”) process for reforming power markets in the conditions of developing countries. Reform sequencing should not, however, follow an overly cautious approach that runs the risk of delaying reform benefits and losing political momentum for reform.

Sequencing of Electricity market reform also raises tactical issues. A general approach would not be applicable in the case of tactical sequencing issues, given the wide variety in starting conditions for Electricity market reform found among developing countries. Tactics should be specifically designed for each set of local conditions to address problematical issues, such as the following.

- Whether to increase tariffs before or after investments to improve the quality of service to Electricity users.

- Whether to try improving the commercial performance of loss-making utilities and distribution entities before bringing in private participation or with private participation.

- How to base the reform of distribution entities on a feasible allocation of viable urban and nonviable rural areas among the entities, as well as the sequencing of privatization in one or more rounds of transactions.

- Whether to start the privatization sequence for poorly performing Electricity markets with distribution entities before privatizing generation entities.

- Whether to give investments Electricity shortages. In new generating capacity lower priority than investments in distribution, especially in a situation of bulk

Reform benefits take longer than expected. Consumers usually expect better services from private companies than from state-owned enterprises. Consumers understandably lose patience and blame the regulators if tariffs go up immediately but service improvements lag behind. Therefore, it is not surprising that most regulators, when faced with this situation, will try to find ways not to raise tariffs. The preservation of protective features, such as “life-line” rates, may be necessary, even if they mean continuing subsidies within income classes, as well as from industry to residential consumers.

Electricity Market Reform Is an Opportunity towards Development

Developing countries face major challenges to improve access and affordability to Electricity services for poor households. These countries have responded to the challenges differently according to their income levels. Some developing countries have met these challenges with some success since the 1990s partly by attracting some private investment. These countries have an extensive energy infrastructure and basic coverage service of Electricity services. The least-developed countries, such as those in Sub-Saharan Africa, have yet to meet challenges that are particularly daunting where typically less than 10 percent of their population is connected to Electricity networks. Extending access to affordable modern energy services—including Electricity services—for poor households is one of the most practicable ways of improving their welfare. This is because expanding access to these services from the low levels found in numerous developing countries helps to increase household incomes and meet basic needs, such as improved health and primary education, as well as support social empowerment and environmental sustainability. The cost of these services to users is often considerably lower than the corresponding traditional energy alternatives used by poor households without access to these services.

The causes of poor Electricity access and service for low-income households originate in policy and regulatory constraints. Policies that grant a legal monopoly to a Electricity utility in low-income service areas may impede the flow of private finance to the Electricity sector and discourage innovation in service delivery methods.

Regulatory frameworks often raise the biggest barriers to decentralized options for Electricity supply, including barriers to alternative Electricity technologies for locations not served by Electricity and fuel distribution networks. Poorly formulated taxes and subsidies often undermine Electricity service markets by favouring one fuel over another, giving consumers distorted price signals and creating disincentives for entrepreneurial solutions to Electricity supply. Finally, Electricity market reforms designed and implemented by technical groups at the national level that allow users little say in the design and delivery of Electricity services can end up hurting—rather than benefiting—the poor.

Reform provides an opportunity to rectify the policy and regulatory constraints on Electricity access and service for low-income households. Reform can overcome entrenched attitudes to providing Electricity services and introduce different kinds of Electricity services better suited to the poor. Opening up the main Electricity market to new entrants can stimulate incentives specifically designed to attract new entrants into markets serving poor areas. The establishment of a new regulatory system for the main Electricity market provides an opportunity to introduce regulations that help the poor. Reforms that place the Electricity market on a sound commercial footing, however, will not automatically improve access and affordability of Electricity services to low-income households. They may make little difference to this situation, or even worsen it. It is important to ensure that reform does not adversely impact access and affordability.

Access and affordable consumption of Electricity by poor households can be promoted by various policy instruments. Instruments that promote access require service providers to extend access, reduce connection costs, and increase supply options. Extending Electricity service to urban low-income households requires improvement to the existing Electricity system. Extending access to Electricity for rural households often involves creating the entire energy infrastructure network and developing viable new Electricity service providers.

Instruments that promote affordability protect low-income households from general increases in tariffs and costs of service and facilitate payment of bills. They stimulate services through non-standard service delivery mechanisms, service types, and tariff and payment mechanisms appropriate to low-income households. Even under successful Electricity market reform, poor households need help with financing the costs of connecting their premises to the network and installing meters at the points of consumption. Well-designed subsidies provide good incentives to service providers—both specifically for serving low-income areas, as well as generally—to attract private sector participation through concessions and asset sales. The substantial empirical evidence, however, questions the effectiveness of many existing subsidy schemes as a means of helping low-income Electricity consumers. A number of approaches have been developed to improve the targeting and cost-effectiveness of subsidy delivery for extending access to Electricity services by low-income households. They include output-based aid (OBA) – approaches and other competitive approaches, as well as more traditional input-based approaches.

Competitive approaches offer the advantage of allowing private innovation for finding solutions to extending Electricity services.

Note: OBA has been discussed at length in later sections. As of now, Output-based aid (OBA) is a form of output-based mechanism for supporting the delivery of basic services that warrant some degree of subsidy to address affordability or to obtain social benefits when these services have the characteristics of a merit good.

The Techno-Economic Basis for Electricity Market Reform in Developing Countries

Reform of the Electricity markets in developing countries generally starts from a market structure that is dominated by state-owned national Electricity utility or utilities. This structure is typically backed by a legally endowed or de facto monopoly and a vertically integrated supply chain in which all the main supply functions—Electricity generation, transmission, distribution, and customer services—are the responsibility of a Electricity utility, especially in Africa, Asia, and the Middle East. The pre-reform industry structure in some countries, notably in South America, placed distribution and customer services with local companies, separate from national companies that provided Electricity generation and transmission. This structure emerged during the 1940s and 1950s from a global wave of consolidation and nationalization of previously fragmented Electricity markets composed of privately and municipally owned local Electricity monopolies.

Summary and recommendations:

1. ***Reforms is a continuous process***
2. ***It is important that all Electricity market reforms need to be sequenced. However, it has also been seen that the some nations have managed with a big bang approach, as well.***
3. ***The sequence is not completely water-tight and sacrosanct but most developing nations have similar concerns sooner or later. Hence, the sequencing maybe often generalised. (see above)***
4. ***A clear tactical path needs to be decided for every nation. The considerations are mentioned above***
5. ***The reform process is a very sound opportunity towards further development - especially in developing and poor nations. It provides access to Electricity to the economically backward, helps design better subsidies, tariffs, market structures, distribution networks and improves technology eventually. The latter-most happens only if all the rest have been a success. This is because the industry is very capital intensive and has no shelf-life as a commodity.***

The General Argument for Reforms in the Electricity Markets

The justification for adopting a status quo or a "pre-reform" industry and market structures rested on four grounds:

1. First, this structure minimized the costs of coordination between the functions in the supply chain and the costs of financing the development of Electricity systems.
2. Second, state financing was favoured by the large-scale investments in production and network assets with high fixed costs that were needed to capture economies of scale, but which had little market value in alternative uses to mitigate investment

risks.

3. Third, state financing was also favoured by the view that the substantial degree of natural monopoly in the market should be kept under state stewardship to enhance consumer welfare from these services.

4. Finally, governments also considered the Electricity market to be critical to national economic security, as well as a means for pursuing economic and social distributional objectives.

Under the pre-reformed market structures, however, Electricity supply has deteriorated to critically low levels and has been failing to meet national needs in most developing countries. Notwithstanding the alleged advantages of the pre-reform structures, from the early 1990s these countries have been experiencing Electricity shortages and frequent interruptions. Their Electricity generating plants emit toxic pollutants, their Electricity utilities are bankrupt, their Electricity tariffs do not cover costs (particularly for residential users), Electricity is widely stolen by customers (frequently with the active support of existing employees), many citizens—especially those in rural areas—lack access to Electricity supply, and the Electricity sector drains the government's fiscal resources.

Worldwide, government policy, public attitude, and the intellectual environment have changed substantially for Electricity markets since the 1980s. Both OECD and developing countries became aware during the 1980s that a lengthy period of state ownership without the forces of competition or the incentives of the profit motive to improve performance is liable to result in the excessive costs, low service quality, poor investment decisions, and lack of innovation in supplying customers in these markets. The little synergy that Electricity generation has with transmission and distribution weakened the case for vertical integration. (The two business activities differ fundamentally. Electricity generation produces a tradable commodity—where cost discipline and risk management are essential for competitive success, whereas the transmission and distribution of Electricity is a regulated service business based on network management.)

The current movement toward breaking up these monopolies and reintroducing the private sector goes back partly to pre-consolidation and pre-nationalization structures, but with the important difference that it also now encompasses arm's length regulation and competition.

In principle, three separate sources of improvement in economic performance are postulated from Electricity market reform:

1. First, with regard to overall allocation of resources, making consumers pay at the margin what it costs to produce and supply them is expected to achieve a better economy-wide use of resources. Issues of income distribution and support for the poor are increasingly regarded as being supportable by targeted subsidies to needy groups, rather than by across-the-board subsidies that have the effect of generally distorting patterns of the consumption of energy. The extraordinary levels of subsidies seen in some countries (IEA 1999) have produced major welfare losses in relation to overall economic welfare.

2. Second, the profit motive gives a stronger incentive for efficient use of inputs—both lower-cost combinations of inputs and reductions in inputs—required to produce a given output, than any incentives offered by an enterprise controlled and managed by a bureaucracy (World Bank 1995).

3. Third, competition, where it is possible, provides the most likely means to reduce supply costs and pass benefits on to consumers. If the Electricity sector can be made to cover its costs and be profitable, firms will have an incentive to invest, and they will also have an incentive to seek out new markets that can be profitable. New entrants, also attracted by profit opportunities, can seek out specialty market niches—particularly in rural areas—that may not appeal to firms supplying mainstream market segments. The conventional wisdom of Electricity restructuring usually envisions six main elements of reform (given below).

Reform starts with moving the state-owned enterprise from the day-to-day control of the politicians and bureaucrats in government, and transforming it into independent legal business units (corporatization and commercialization) under a transparent system of economic regulation, often leading to the sale of assets to private investors (privatization). The subsequent elements consist of creating a market in which to trade Electricity by requiring these newly independent units to compete and by allowing new firms to enter the market. These elements are designed to create accountability and efficiency through competition for capital and customers. Such reforms depend on complementary reforms that liberalize access to capital markets and create institutions, particularly an independent regulator that can regulate prices and access to transmission and distribution networks, since the services provided by these facilities are natural monopolies.

The Argument for Electricity Market Reforms in Developing Countries

The following forces have stimulated reform of the Electricity markets of developing countries:

a. The poor performance of state-run Electricity sectors that has resulted in high costs, much of the population remaining unconnected to the public Electricity system, and those who are connected often receiving unreliable service.

b. The inability of state sectors to finance needed expenditures on new investment and maintenance. Many Electricity utilities are financially distressed because of their poor governance environment comprising endemic corruption, rampant theft of Electricity, political interference, and an inability by stakeholders to work toward long-term solutions. In the middle-income developing countries, Electricity supply has been scaled up to the extent that the financing and management needs of the sector have generally outgrown the capacity of state institutions.

c. The need to remove or reduce the fiscal stress from state involvement in Electricity supply in order to release state financial resources for other pressing public needs. Electricity tariffs often do not come close to covering the current costs of service provision, but low tariffs do not benefit most of the poor, who largely lack access to Electricity. By the end of the 1990s in

Eastern Europe, for example, the combination of high technical losses, non-payment of bills to the Electricity utilities, and Electricity tariff levels well below cost recovery levels imposed a fiscal cost that averaged 7.5 percent of gross domestic product (GDP) (Estache and Gassner 2004b). Severe fiscal problems from Electricity sector deficits have also existed in India (given below).

d. The desire to raise immediate revenue for governments through the sale of Electricity sector assets. In some cases, this driver was the need to reduce the high debt load of the sector under state ownership, which drove the design of the privatization process in some Latin American countries, notably in Argentina and Brazil.

e. Eastern European countries have the additional incentive of complying with the requirements of the European Union's Electricity Directive of 1996 in preparation for accession to the European Union (European Union 2003). The EU Directive focuses on breaking up vertically integrated supply chains to allow competition in the Electricity market, regulated or free third party access to the grid, coexistence of regulated and competitive markets side by side, and freedom for large ("eligible") consumers to choose their suppliers.

Pressure for Electricity market reform has often arisen in the context of a major economic crisis for the country. These crises have driven changes in public policy toward Electricity markets within a broader drive for economic reform, which have made restructuring and private sector participation politically feasible. This was particularly the case in Latin America during the 1990s, where the opening up of Electricity markets to competition reflected the replacement of the import substitution model led by public investment to a market-oriented model of economic development.

Electricity market reform has faced substantial difficulties and departed from the conventional economic model for reform, especially in developing countries. This is because fundamental reform of an Electricity sector is an extraordinarily complex undertaking, even for reforms that fall short of attempting to introduce a fully unbundled, competitive market. Yet many governments have been attracted by complex, "state-of-the-art" market models and regulatory regimes that were designed and, to some degree, implemented in countries much better situated for this approach. In most cases, the funding agency staffs, politicians, regulators, and the host government had a poor conception of the difficulties involved—the scale and scope of needed changes and the realities of the physical, social, legal, commercial, and political constraints. In other words, the selected reforms were too ambitious for the country conditions (Rosenzweig, Voll, and Pabon-Agudelo 2004).

The objectives for reforming Electricity markets differ significantly between OECD and developing countries. In general, reform in OECD countries is discussed in the context of raising the level of existing commercial standards of performance by means of competition. In developing countries, however, reform is generally concerned with investing in sufficient Electricity supply capacity to meet growth in demand for Electricity, expanding access to public Electricity supply by the population, and relieving fiscal pressure from supporting the Electricity sector.

Although the techniques and instruments of Electricity reform are generic, conclusions reached from empirical analysis about reform outcomes in OECD countries should be applied with caution to developing countries. This need for caution arises from the key differences in the main reform objectives between OECD and developing countries, as well as the huge differences in their starting conditions in relation to economic development (the appendix). Hence, reform in many developing countries may have the opposite outcome to reform in OECD countries. For example, the general direction of retail prices as efficiency improves following market reform is downward in OECD countries because prices already generally cover supply costs, whereas retail prices usually move upward in developing countries that are under pressure to remove subsidies and cross subsidies. In addition, developing countries do not have the substantial amounts of economic and institutional resources available to OECD countries that are needed to support complex reforms to their Electricity markets.

Elements of Full-Scale Electricity Market Reform

Following are the elements of full-scale market reform:

1. *Obliging Electricity enterprises to operate according to commercial principles*. These principles require that enterprises pay taxes and market-based interest rates, earn commercially competitive returns on equity capital, and have the autonomy to manage their own budgets, borrowing, procurement, and labor employment.

2. *Restructuring of the Electricity supply chain to enable the introduction of competition.*

This involves breaking up ("unbundling") the incumbent Electricity utility into multiple generators and distributors of Electricity that trade with each other in a competitive wholesale Electricity market.

3. *Development of economic regulation of the Electricity market that is applied transparently by an agency that operates autonomously.* In the wholesale market, the focus of regulation is to prevent anticompetitive abuses of market Electricity and to ensure appropriate investment in new supply capacity. In the retail market, the focus of regulation should be on balancing the interests of suppliers with the interests of their captive customers.

4. *Privatization of the unbundled Electricity generators and distributors under dispersed ownership,* generally in developing countries to bring in financial resources and technical and managerial expertise that will rectify the prevailing low standard of Electricity supply by state-owned Electricity utilities. Privatization is also necessary in those countries that intend to develop competitive Electricity markets, because competition is unlikely to develop properly between entities that are under common ownership—whether state or private.

5. *Development of competition in the generation and supply segments by development of Electricity exchanges.* Competition in the network segments (transmission, distribution, and system control) is not feasible because these functions are natural monopolies. Change the sentence

6. *Focusing government's role on policy formation and execution.* This role is performed with least conflict of interest when government also ceases to be the major owner, investor and controller of the entities that constitute the Electricity supply chain, particularly in wholesale generation and retail supply of Electricity.

Although much attention has been given to the construction of a standard model based on these elements, such a model has rarely been applied fully in practice. The divergence between theory and practice stems from three factors.

1. First, the special technical aspects of Electricity markets—in particular, the need for real time balancing of supply and demand because of the high cost of Electricity storage—have complicated market design in ways not fully anticipated.

2. Second, the proper operation of Electricity markets requires many complementary institutions—such as independent regulators—that have proved difficult for many countries to satisfy, especially where the "rule of law" is largely absent.

3. Third, many of the prescriptions for the standard model for reform, such as leaving Electricity tariffs to market forces, are particularly difficult for democratic societies to implement. (Heller,Tjong, and Victor 2003).

Reforming the Electricity sector involves far more than changing technical and institutional models. Electricity market reform is taking place in the context of larger processes of globalization—notably the opening up of markets, the growing role of private capital, and efforts to weave national Electricity markets into the fabric of international economic integration (World Resources Institute 2002). These views stemmed from two important advances in economics that took place in the 1980s: namely, research on the impact of the structure of property rights on the decisions and behaviour of firms, and the theory of incentive-based mechanism design. Ideally, privatization would bring an end to political control over firms, yielding reductions in costs and efficient prices.

The reforms are influenced by an emergent global ideology that the state should refrain from controlling resources that markets could allocate more efficiently, and instead focus its resources on a limited category of social spending—mainly health and education, and that this retreat by the state is a precondition for investor confidence (World Bank 1995).

Summary and recommendations:

1. *There are clear merits and demerits of the pre and post reformed electricity markets*
2. *Not only that, it has been clearly observed that most countries eventually choose some form and path towards reforms to get more efficient markets*
3. *Especially, the developing nations are a glaring set of examples for the benefits that come about with electricity market reforms.*
4. *One particular recommendation - The EU Directive focuses on breaking up vertically integrated supply chains to allow competition in the Electricity market, regulated or free third party access to the grid, coexistence of regulated and competitive markets side by side, and freedom for large ("eligible") consumers to choose their suppliers – we need to assess if this can be done for Maharashtra.*
5. *There is a generally accepted protocol for reforms of this nature however, the difference in theory and practice is large - technical aspects, the need for real time balancing of supply and demand because of the high cost of Electricity storage, laws for complementary institutions such as independent regulators, absolute laissez-faire, etc. are very poignantly balanced.*

Case Study - Fiscal Burden of the Indian Electricity Sector

In India, the combined dues of all the Indian State Electricity Utilities to central electricity suppliers and fuel suppliers amounted to about US$5.5-billion (Rs. 258.5 billion - Rs. 47 to a dollar in the year 2001) equivalent in 2001. (Figures relating to financial losses and so forth are drawn from Government of India Planning Commission 2001 and Ahluwalia 2001.) To put this magnitude into perspective, this amount was about half of what all the state governments in India combined were spending on all levels of education every year. It was double what they were all spending on health, and three times what they were spending on water supply. If Electricity sector financial losses were reduced by only one-third, the savings from a single year would have been sufficient to fill every teacher vacancy in the country and provide every school with running water and toilet facilities.

Note: Rs. 4 cr is used to generate 1 MW of electricity, approximately

State governments face huge accrued liabilities for guarantees for bonds issued by the state Electricity boards (SEBs) to central Electricity and fuel suppliers, for the pension funds of SEBs, and for contingent liabilities under their guarantees to independent Electricity producers that sell output to SEBs (whether, all of them or some, could not be determined). Moreover, the Indian financial sector faces huge risk exposure to the

Electricity sector. The subventions provided by Indian state governments to their SEBs undermine state budgets, even though these subventions are rarely paid in cash, but usually take the form of offsets against payables from government agencies to the SEBs and debt-servicing payments on behalf of the SEBs. State governments help the SEBs meet their debt serving obligations to avoid defaults that would provoke calls on the guarantees provided by state governments for these debts. Otherwise, a call on these guarantees would threaten the credit ratings on state governments' own borrowings. Central Electricity and fuel suppliers, equipment suppliers to the Electricity industry, and financial institutions have borrowed heavily via bonds from Indian financial institutions to finance their operations because of their high receivables from SEBs. SEBs have securitized large amounts of their dues to central Electricity and fuel suppliers through bonds issued in favour of the respective suppliers.

The Mula Pravara Electric Co-operative gets government support and pledges to provide free electricity to all farmers in the region. Given the despicable financial conditions that these entities have, is this arrangement really sustainable?

Also, BHEL being the single largest manufacturer of Electricity supply chain suffers from excessive financial backlogs. It may be a worthwhile exercise to investigate the cash flow of these utilities and find out why most of them are in such financial doldrums and if this situation can be corrected and how.

The Importance of Political Factors for Electricity Market Reform

Electricity market reform based on private sector participation and competitive markets involves complex issues for stakeholders—and in particular for governments, investors, employees, and consumers. Yet reform proponents have underestimated the importance of managing this process relative to techno-economic design and implementation issues. If reform were only a matter of economics, Electricity systems would not have been experiencing the problems experienced in so many countries. Political factors cover both the importance of politics and many vested interests, and they include the willingness or opposition of politicians to support a political consensus in favour of Electricity market reform.

This consensus is needed because reform entails a redistribution of property rights (to remove politics from the management of public service providers) and formulation of new ground rules (introduction of competition and market-oriented incentives) through changes in laws and regulations. Governments must generate public acceptance and stakeholder consensus for these programs.

For example, in Maharashtra, and also the rest of India, the reforms or changes in such markets are more populist in nature to gain vote banks. The reforms are not truly reforms as such and are mere tactics to keep the consumers happy. These are tentative changes that lack foresight or the inclination to even bring about positive change. When the political party no longer holds office, the so called reforms maybe changed to suit the new lobby. This cannot be a sustained process towards re-hauling and revamping markets where the only intention ought to be socio-economic development and market efficiency. The objectives are completely beaten with such political motivations and perpetual disinclination towards long term efficiency changes.

The Political Nature of Electricity Market Reform

Electricity market reform is an inherently political process. The political actors that support or oppose it—in government, industry, finance, labour unions, and civil society—are motivated to do so for reasons that may be irrelevant to economic theory, but are often quite relevant to the shaping of the actual policies created. Policies are implemented within institutional contexts—utilities, markets, courts, and regulatory bodies—that are profoundly influenced by political concerns. Finally, the impacts of reform are not confined to improvements in economic efficiency within the Electricity sector itself. Rather, they can affect matters of broad public concern, such as employment, dependence on foreign energy supplies, and environmental pollution.

The important role of Electricity in the national ideology of many developing countries forms part of the political dimension of Electricity market reform. This is because Electricity is a symbol of the social compact between state and citizen, as well as being a practical necessity of industrialization. For newly independent developing countries, as well as the former Soviet Union (FSU), Electricity represented the good life—well-illuminated homes and workplaces, modern factories and transportation, escape from the drudgery of manual labor—that had been denied most people. In propaganda and popular consciousness alike, images of a society with universal and affordable Electricity became an important expression of state-led development. (The case of China exemplifies this point (Zhang 2003; Yeh and Lewis 2004).)

The promise of an electrified future served governments as a justification for present sacrifices. For some countries, electrification projects involving massive public investment and labor mobilization (such as the construction of large dams) became nation-building exercises and, upon completion, symbols of fulfilled development promises.

Far from a dry techno-economic calculation, Electricity reform is often an arena of conflict between competing interests that are of fundamental importance to society.

A broader context is needed to examine and design sustainable reforms to Electricity markets in developing countries. The implicit social compact mentioned above was double-edged, because the definition of Electricity as a public good represented a long-term claim by citizens on the state for provision of Electricity, which would be a potential source of discontent if this aspiration should go unrealized. This ideological discourse left out economic concerns, such as competition and profitability; environmental and social constraints; and governance issues, such as transparency, accountability, and public participation. (This paragraph and the two before it are largely taken from Williams and Dubash 2004.)

Experience with reforming Electricity market suggests that political forces are difficult to align for reform. This is shown by the tendency for reforms—especially in developing countries—to start with independent Electricity producers and marginal reforms in the generation sector, and to defer the task of reforming tariffs and the retail end of the market generally. Reforms that fail to address social and political concerns—for example, by attempting to raise tariffs on the poor without a compensating plan for protecting access to vital electric services—create their own political opposition and usually fail. In developing countries especially, the preservation of the "social contract" has occurred in large part through the deferral of difficult decisions, such as restructuring of tariffs, even where such decisions are essential because low tariffs create perpetually loss-making enterprises (Heller, Tjong, and Victor 2003).

The gap between the apparent appreciation of the need for reform and actual implementation of reform measures is an important feature of Electricity sector reform to date. These measures apply particularly to privatization, antitheft measures, and tariff rationalization. With few exceptions, mainly in Latin America, such as in Argentina and Chile, the currently reformed Electricity systems among developing countries only partly resemble the theoretical market-oriented model, since market forces operate only at the margins of these Electricity systems that remain dominated by the state. The explanation for this difference is often attributed to the influence of politics, poor rule of law, and generally weak institutions that obstruct the operation of markets, and hence the ability of the governments to implement reform plans (Heller and Victor 2004). Governments with weak institutions have performed poorly even when they had ambitious reform plans. Conversely, governments with strong institutions and sustained commitment to reform have fared much better, even when pursuing modest reforms (Tongia 2003). Evidence for this latter point is provided by the experience of the Indian state of Andhra Pradesh in the period around 2000.

Consolidation of Electricity market reforms is not automatic, since it depends on management of the links between reform performance and the political process for the simultaneous creation of traditions of respect for the rights of investors and consumers. Consolidation hinges less on formal changes than on the existence of an effective system of social checks and balances and on mobilizing those interests that favor reform. The interests of investors and consumers are balanced by good regulation in the short term, and in theory they should converge in the long term. The timing of reform relative to the electoral cycle can be critical for the privatization of Electricity entities and for unpopular increases in Electricity tariffs. The success of a privatization program often depends on divesting most of the state's ownership before the government faces the next election, which can force a compromise with long-term efficiency objectives for the sector (as happened in England and Wales). A crucial window of opportunity may be created by a change of government because the incoming group may have the mandate, strength, and time to carry out the program. In many countries, although the problem and possible solutions became evident early in the 1990s, action was not possible for several years because of the political priorities facing the incumbent governments around that time.

The scheduling of some Electricity market reforms to fit perceived political windows of opportunity has often not been sustainable. These opportunities are usually linked to a compliant or interested incumbent politician who faced an impending re-election against politicians that opposed Electricity market reform. This threat of a cut-off in government support led to short deadlines for reform tasks that were totally unrelated to the scale, scope, and difficulty of the tasks involved. This rush to introduce an "irreversible" step that would lock in future governments has proved to be counterproductive. In practice, no step is so irreversible that it forces a reluctant government to continue the reform. Some Latin American countries, for example, are under pressure to reverse their Electricity market reforms because of the lack of public support for privatization and the succession of recent crises and events, such as macroeconomic crises and droughts in Electricity systems dependent on hydroelectricity. Carrying out structural reform and attracting and sustaining private investors are extremely difficult during conditions of economic and associated political turmoil. This lesson is shown by the experience in Latin America, Eastern Europe, and the FSU (given below). Electricity market reform involving restructuring and privatization of the unbundled entities was most difficult in countries that experienced prolonged turmoil (Georgia, Moldova, the Russian Federation, and Ukraine). Reform was less difficult in countries that achieved economic stabilization more quickly (Hungary, Lithuania, and Poland). Although private operators of distributors improved cash collections during such turmoil, they could not reach the levels needed for viability.

In developing countries, contrary to OECD countries, environmental issues (including renewables and energy efficiency) generally have not figured prominently in the process of reforming Electricity markets. This difference may reflect different political priorities. It may indicate that developing countries will face a growing problem if such environmental concerns are not addressed at the time that private firms are encouraged to invest in long-lived capital stock that "locks in" particular environmental regimes.

Case Study - The Impact of Economic Turmoil on FSU Electricity Sectors during the 1990s

One of the priorities for governments during periods of intense economic turmoil is to combat severe nonpayment of Electricity bills induced by macroeconomic factors, according to the experience of countries in Eastern Europe and the FSU. The required measures are macroeconomic stabilization, removal of constraints—legal, political, and attitudinal— denial of service to defaulters, promotion of budget discipline to eliminate payment defaults by government agencies, and improvement of procedures for the recovery of arrears and debts by utilities (Krishnaswamy and Stuggins 2003). During the 1990s these countries experienced a collapse of industrial production, continuous GDP contraction, hyperinflation, massive devaluation of their local currencies, severe fiscal and current account deficits, high levels of unemployment, and hence low and falling household incomes. Consequently, Electricity demand dropped, and the ability of people and industries to pay for their consumption of energy was seriously eroded. Under-pricing of energy—including Electricity—and nonpayment to energy suppliers were a major source of fiscal subsidies in many of these countries (Freinkman, Gyulumyan, and Kyurumyan 2003). Tight monetary policies under the need to contain fiscal deficits to bring down the massive inflation left government agencies and state-owned enterprises with no funds to pay their utility bills.

Both during periods of economic turmoil and some years thereafter, the utility sectors in many of these countries faced acute non-payments. In the worst cases, collections from Electricity users dropped to 60–70 percent of billings, and cash collections fell to only 20–30 percent of the billings until late in the 1990s under the rapid increases in Electricity and gas prices as the costs of imported fuels rose toward international levels. Thus, industrial and residential consumers and government agencies defaulted on payments to utilities, which in turn defaulted in its payments to domestic and foreign fuel and energy suppliers, payment of wages to staff, and payment of taxes to the government (Krishnaswamy 1999). Ukraine's economy, for example, was barter-based at the time that it attempted major restructuring of its Electricity market. Salaries and pensions were in arrears, and consumers could not be made to pay for Electricity with cash because the government condoned the culture of nonpayment. In such an environment, the introduction of an advanced model of a competitive Electricity market was bound to fail. Market reform objectives should have been more modest and targeted to improving technical, institutional, and financial problems.

Source: World Bank 2003b.

The Political Incentives to Reform

Politicians may be willing to give up the benefits from existing arrangements for Electricity supply by supporting reform only if they have an incentive to do so. These benefits often include patronage opportunities through commissions on contracts for construction, plant and equipment for Electricity supply capacity. It also includes indirect fiscal support to governments through non-payment for Electricity by government agencies. Even if the Electricity sector is not commercially viable, it can be a source of jobs and other favors.

To provide this incentive, the reform must fulfill at least one of the following conditions for politicians: it must (a) enhance their political support; (b) not meet with overwhelming opposition; and (c) provide benefits and avoid heavy losses for their supporters (Tongia 2003). Reform will happen only if a dedicated cadre of bureaucrats and politicians can withstand opposition from groups that stand to lose from reform, since the likely losers are typically better organized than the eventual winners are. New conceptual frameworks from economic theory have been developed for explaining this type of behavior (see Appendix A).

Experience with Electricity reform in many countries supports the view that "interest groups" constitute a major impediment to reform. These groups include rent-seeking interests, such as protected domestic industries, unionized labor forces, politicians with short time horizons, and Electricity consumers that benefit from subsidies.

Those aspects of the reform that are being blocked by vested interests or simple inertia can be distinguished from those that are publicly resisted because of legitimate concerns or different viewpoints. The latter arise when most Electricity consumers are unconvinced that Electricity market reform is designed to help them, and when few among them believe the promises that reform will eventually improve Electricity supply and services.

This indicates that reform is less likely in areas where its costs are concentrated on a small number of powerful actors while the benefits are dispersed among a wide number of prospective beneficiaries (who may not even be aware of their beneficiary status). A stakeholder analysis is needed to identify the range of interests for and against reform. Examples of comprehensive stakeholder analysis can be found for Guatemala (Fundación Solar 2002), Colombia (Ayala and Millán 2002), and Honduras (Walker and Benavides 2002).

In many countries, politicians have not had an ideological bias for or against reform, but have approached the issue pragmatically. They have neither opposed it wholeheartedly nor advocated it coherently. In Electricity markets where politicians have had incentives to pursue reform, they have done so; otherwise, they have not. Pragmatism can be their guiding principle when, for example, fiscal distress compels a country to give priority to Electricity reform because this sector is a serious drain on the state's financial resources. However, the risk with this approach is that reform is publicly perceived as just a bankruptcy workout without social objectives for the Electricity sector, under which Electricity consumers bear the cost of this reform with little noticeable benefit in improved service. In this situation, reform does not receive the required public support and hence only lukewarm political commitment. This section draws on an unpublished paper by Sumir Lal entitled "Political Factors Affecting Electricity Sector Reform in India."

Political Issues for Reforming Electricity Markets

The fundamental issue for public acceptance of a Electricity reform plan is credibility. In many countries, the Electricity utilities are publicly viewed as corrupt, mismanaged, and in a financial plight of their own making. In some countries, public perception of corruption and mismanagement has extended to contracts by Electricity utilities with independent Electricity producers, especially those concluded without public scrutiny.

The ingredients of credibility include full government ownership of the reform, managing expectations, building in compensatory mechanisms with believable assurances of carrying them through, and committing to stability of the new policy. These, in turn, depend on the government's reputation with its constituents, the prevalence of political checks and balances, and binding the new policy to wide ownership and statutory commitments. Without this credibility, the public may sense that a reform plan is being forced on them "from above," and that they are expected to pay for the utilities' inefficiencies and corruption. If politicians fail to recognize and address this perception, they will struggle to make Electricity consumers believe that the reform effort is intended to benefit the wider public, and they will be unable to create pro-reform constituencies.

Certain aspects of reform are endorsed when the need for reform is widely accepted in principle, but other aspects often remain unaccepted. The publicly acceptable aspects usually include making state-owned Electricity utilities autonomous of government, corporatizing these utilities, establishing an autonomous regulator, and introducing transparent accounting mechanisms for Electricity suppliers.

By contrast, key areas of public concern are usually the removal of subsidies and cross-subsidies, unbundling of a vertically integrated Electricity utility, and privatization of components of Electricity supply. The first set that is little disputed deals with institutional issues related to governance of the Electricity market, whereas the second describes a particular reform model that is questioned as an ideological choice. A public consensus generally emerges that the market must be better governed and made more efficient, but it often fails to cover what would be the appropriate way of doing so.

Competition and private ownership in the Electricity market is vulnerable to a public backlash if consumers perceive that increases in Electricity prices are a consequence of this reform. Generally, private management and ownership has brought about significant improvements in performance at the enterprise level, but much of this improvement has not been translated into corresponding improvements at the economic and social levels. Electricity prices did not fall in all countries that liberalized their Electricity markets.

In El Salvador, Electricity prices to final consumers increased slightly after reforms were implemented, creating a public backlash against the reform. In Bolivia, Electricity prices rose as a result of an increase in the price of natural gas used for generating Electricity (World Energy Council 2001). The elimination of cross-subsidies between consumer categories led to tariff increases for consumers from whom the subsidies were removed.

Private investments in generation are vulnerable to financial problems in the distribution end of the industry and to local vested interests that are defending the status quo. The sustainability of private investment in generation depends crucially on collecting payments in full from Electricity consumers. Introducing competition among generators without reforming distribution and retail consumer services to achieve commercial standards can impair the effectiveness of the overall reform program. Yet Electricity utilities in most developing countries—generally in South Asia and Sub-Saharan Africa, but also in many countries elsewhere—are financially insolvent.

Political will to support necessary increases of prices for Electricity is usually one of the most critical factors in a viable reform process. Any reform of Electricity markets is seriously handicapped without such commitment. The design of these reforms in the past, however, has generally taken for granted the existence of the necessary political support to convince customers and voters to accept higher Electricity prices and to curtail inconsistent or corrupt behaviour by customers and employees (Rosenzweig, Voll, and Pabon-Agudelo 2004).

The treatment of utility employees affected by privatization raises important issues. Sorting out employment issues before privatization through formal agreements with labour unions helps attract investors to Electricity sectors.

Electricity market reform usually leads to lower employment levels under commercialization of supply functions, and reforms that result in heavy job losses elicit tremendous political resistance. This was the case in Hungary where some of the privatization receipts were used to secure employee cooperation. These receipts can also be used to fund severance compensation. The possibility of allocating to staff some shares in privatized entities was an important element in some of the private participation deals in Latin America, including the Chilean practice of vesting shares into pension funds on behalf of the employees. Elsewhere, as in Ukraine, employees merely sold their shares quickly to investors to supplement their low wages.

Electricity consumers need to understand and accept the proposed reforms. Since reforming Electricity tariffs in developing countries is complicated by the legacy of highly subsidized prices for the population, reformers should explain the rationale for tariff increases and demonstrate that in return, consumers will experience tangible benefits, such as improved service. Tariff increases for low-income households should be tempered to keep Electricity affordable for them. Public expectations about Electricity tariffs inherited from the pre-reform era can be a major obstacle to reform. Reforming Electricity tariffs in the FSU countries, for example, has been complicated by the legacy of highly subsidized prices for the entire population, the public sense of entitlement for such continued service, and the vital importance of reliable energy services during the long and cold winters.

Electricity tariffs rose during the 1990s in local currency terms by about 200 percent to cover costs, and they became a significant component of household expenditure (Krishnaswamy and Stuggins 2003). Foreign ownership of Electricity supply entities is often an issue for the political feasibility of Electricity market reform.

In countries that have a relatively small, internal, formal financial structure (compared with the size of the sector) and possibly no stock market, privatization inevitably means foreign ownership in part or in total. Control of such a key domestic sector by foreign companies must be clearly linked to the underperformance of the Electricity sector, and the government must have the support for implementing this policy of those groups that are likely to determine its future. This issue has arisen in countries, such as El Salvador and Bolivia.

Summary and recommendations:

1. ***Political motives affect the way reforms pan out***
2. ***Reforms need vision, acceptance and change at all levels of society including governance, regulation, legislation, infrastructure, economic policies, etc.***
3. ***Especially in unbundled, privatized and public private partnership oriented reforms, transparency, lucrative investment climate and water-tight competition rules are very important***
4. ***Most political parties in power tend to take populist measures in order to keep all stakeholders happy. These policies/reforms are rarely successful and tend to actually distort efficiencies***
5. ***Most importantly, when a political party in no longer in power, the new reigning party may change the regulations completely. Frequent policy changes affect markets, consumers, investors negatively.***
6. ***Last, but not the least, short lived and politically motivated reforms rarely help in the long run since it only attempts to increase vote banks and not tackle the real root of the problem.***

Current Extent and Outcomes of Electricity Market Reform in Developing Countries

The Extent of Electricity Market Reform

About 70 of the 150 developing countries have embarked on reforming their Electricity markets since the early 1990s in response to poor technical and financial performance and lack of public financing needed to expand Electricity supply. Reforms of these markets, however, are generally tentative and incomplete, and are still works in progress (Bacon and Besant-Jones 2002).

The remaining countries have retained the traditional structure of a vertically integrated monopoly, in some cases because they felt it impossible or undesirable to embark on any reform strategy that entails opening Electricity production or sales to private participants.

The countries that have embarked on reform have progressed to date to various stages, which can be categorized in ascending extent of reform as follows:

A vertically integrated monopolist with independent Electricity producers (IPPs) that sell Electricity to it.

A national generation, transmission or distribution entity, a combined national generation and transmission entity or a combined transmission and distribution entity acting as the only wholesale Electricity trader (single buyer) with IPPs that sell Electricity to it and regional distribution entities unbundled from the monopolist that buy Electricity from it.

Many distribution entities and generation entities and a transmission entity formed from unbundling the monopolist, in which the transmission entity acts as a single buyer of Electricity from the generators and IPPs and sells Electricity to the distribution entities and large users of Electricity

An organized market of generation entities, distribution entities and large users in which Electricity is traded competitively, supported by a transmission entity, a Electricity system operator and a Electricity market administrator.

The stages outlined above can be viewed as progressive stages through which countries pass on a graduated reform path. Electricity market reform programs in developing countries currently exhibit this variety of progress, particularly in market structure, degree of private participation, and development of the regulatory framework. This variety is shown by the lists of countries in (given below) that have reached each reform stage.

Developing Country Groups by Current Electricity Supply Structure

Developing countries fall into the following groups according to their current structure of Electricity supply:

Vertically integrated monopolist (79 countries)

Angola, Antigua and Barbuda, Azerbaijan, Barbados, Belarus, Benin, Bhutan, Botswana, Burundi, Cape Verde, Central

African Republic, Chad, Comoros, the Democratic Republic of Congo, the Republic of Congo, Djibouti, Dominica,

Equatorial Guinea, Eritrea, Ethiopia, Fiji, Gabon, the Gambia, Grenada, Guinea, Guinea-Bissau, Guyana, Haiti, Islamic

Republic of Iran, Iraq, Kiribati, Democratic People's Republic of Korea, the Kyrgyz Republic, Lebanon, Lesotho, Liberia,

Libya, Madagascar, Malawi, Maldives, Mali, Marshall Islands, Mauritania, Micronesia Fed. Sts., Mongolia, Mozambique,

Myanmar, Namibia, Nicaragua, Niger, Paraguay, Rwanda, Samoa, São Tomé and Principe, Saudi Arabia, Seychelles,

Sierra Leone, Solomon Islands, Somalia, South Africa, St. Kitts and Nevis, St. Lucia, St. Vincent and Grenada, Sudan, Suriname, Swaziland, Syrian Arab Republic, Tajikistan, Timor-Leste, Togo, Tonga, Turkmenistan, Uruguay, Uzbekistan,

Vanuatu, Venezuela, the Republic of Yemen, Zambia, Zimbabwe

Vertically integrated monopolist + IPPs (36 countries)

Bangladesh, Belize, Burkina Faso, Cambodia, Cameroon, China (most provinces), Costa Rica, Côte d'Ivoire, Croatia,

Cuba, the Czech Republic, the Dominican Republic, the Arab Republic of Egypt, Ghana, Honduras, India (most states),

Indonesia, Jamaica, Lao People's Democratic Republic, Malaysia, Mauritius, Mexico, Morocco, Nepal, Nigeria, Oman,

Pakistan, Papua New Guinea, Senegal, Sri Lanka, Tanzania, Thailand, Trinidad and Tobago, Tunisia, Vietnam, West

Bank and Gaza

Single buyer as a national genco, transco or disco, or a combined national genco–transco or transco–disco+ IPPs (16 countries)

Albania, Algeria, Armenia, Bosnia and Herzegovina, Estonia, Georgia, India (Andhra Pradesh, Karnataka, New Delhi,

Orissa, Rajasthan, Uttar Pradesh), Jordan, Kenya, Latvia, Lithuania, the former Yugoslav Republic of Macedonia, the

Philippines, Serbia and Montenegro, the Slovak Republic, Uganda

Many discos and gencos, including IPPs, transco as single buyer with third party access (6 countries)

Bulgaria, Ecuador, Hungary, Moldova, Poland, Russian Federation

Electricity market of gencos, discos and large users, transco and ISO (13 countries)

Argentina, Bolivia, Brazil, Chile, Colombia, El Salvador, Guatemala, Kazakhstan, Panama, Peru, Romania, Turkey, Ukraine

The countries that have embarked on Electricity market reform cover a broad range in physical, economic and institutional terms. Reform is unevenly spread among regions (given below, 2A). Countries in Latin America and the Caribbean and in Europe and Central Asia account for all the countries that have progressed to the two most advanced stages described above. In Africa, Asia and the Middle East, progress to date is generally limited to the first two stages with long-term contracts by IPPs to supply incumbent utilities (ESMAP 1999). Some countries in East Asia, for example, have made tentative steps to further their reforms, as in the cases of China (Yoeh and Rajaraman 2004; Zhang and Heller 2004) and the Philippines (Sharma, Madamba, and Chanc 2004). Many of these countries have announced plans to take their reforms to more advanced stages, and many others have announced plans or intentions to start the reform process.

Some Latin American countries have advanced Electricity market reform with private participation and competition in the Electricity market. Their experience provides invaluable lessons for later reformers (Covarrubias and Maia 1994; Fisher and Serra 2000; Inter-American Development Bank 1999; Millán and von der Fehr 2003; Moscote, Maia, and Vietti 1995; Mota 2003; Rudnick and Zolezzi 2001; World Energy Council 2001). These countries learned from the experience of earlier reforming countries, and in particular from the Chilean experience during the 1980s. The evolution of reforms under this process has led to less regulation of segments that are or can be made competitive (generation and energy supply services), and regulation of the noncompetitive markets (transmission and distribution network services) combined with the unbundling of competitive and noncompetitive segments of the industry. Even in these countries, however, reform is still incomplete and in some cases may not be sustainable, especially since a backlash against these reforms that has emerged in some of these countries (Lora and Panizza 2002; Millán, Lora, and Micco 2001).

TABLE 2. Distributions of Power Supply Structures in Developing Countries

TABLE 2A. Distribution of Power Supply Structures in Developing Countries by Region

REGION AND TOTAL NUMBER OF COUNTRIES IN REGION		POWER SUPPLY STRUCTURE GROUP				
		VERTICALLY INTEGRATED MONOPOLIST	VERTICALLY INTEGRATED MONOPOLIST +IPPS	REGIONAL DISCOS, IPPS, A GENCO-TRANSCO AS SINGLE BUYER	MANY DISCOS, GENCOS, IPPS, TRANSCO AS SINGLE BUYER	POWER MARKET GENCOS, DISCOS AND LARGE USERS, TRANSCO-SO
Africa	49	39	8	2	0	0
EAP	17	10	6	1	0	0
ECA	28	7	2	10	5	4
LAC	32	14	8	0	1	9
MENA	13	6	5	2	0	0
SAR	11	3	7	1	0	0
Total	150	79	36	16	6	13

TABLE 2B. Distribution of Power Supply Structures in Developing Countries by Installed Power Supply Capacity

INSTALLED POWER CAPACITY GROUP (MW)	POWER SUPPLY STRUCTURE GROUP				
	VERTICALLY INTEGRATED MONOPOLIST	VERTICALLY INTEGRATED MONOPOLIST +IPPS	REGIONAL DISCOS, IPPS, A GENCO-TRANSCO AS SINGLE BUYER	MANY DISCOS, GENCOS, IPPS, TRANSCO AS SINGLE BUYER	POWER MARKET GENCOS, DISCOS AND LARGE USERS, TRANSCO-SO
<300	44	5	0	0	0
301–1,000	13	8	1	0	0
1,001–5,000	11	13	10	2	3
>5,000	12	11	5	4	8

Reform has progressed mostly among developing countries with relatively larger Electricity systems.

Restructuring of Electricity supply arrangements through unbundling of an integrated structure is a sure indicator of whether a country has started to reform its Electricity market radically. Unbundling is a feature of the larger Electricity systems to date, however, and has not occurred in the smaller Electricity systems (given above, 2B). Thirteen of the 71 countries with Electricity systems smaller than 1,000 MW have opted so far to contract for Electricity supplies from IPPs without any unbundling. On the other hand, 15 of the 39 countries with Electricity systems that lie between 1,000 MW and 5,000 MW have been unbundled, and 28 of these systems have IPPs. Moreover, Electricity supply has been extensively unbundled in 17 of the 40 countries with more than 5,000 MW of Electricity supply. Most countries that have unbundled their Electricity supply chain (generation from distribution, in particular, with transmission in a separate entity or combined with one of the others—"vertical unbundling") have further unbundled their generation and distribution sectors into numerous entities ("horizontal" unbundling).

Reform has also progressed among developing countries with relatively higher levels of per capita national income. This feature is shown in the relationship between the stage of Electricity reform in a country and the national income classification used by the World Bank (given below, 2C). Developing countries are classified by the following per capita income groups: low—US$765 or less; lower-middle-income—US$766 to US$3,035; and upper-middle-income—US$3,036 to US$9,385. Per capita incomes are computed according to the World Bank Atlas method (http://www.worldbank.org/data/aboutdata/workingmeth.html#World_Bank_Atlas_method).

Only four of the 62 countries in the low-income group of countries have undertaken any unbundling of their Electricity supply chain, whereas 20 of the 55 lower-middle income countries and 9 of the 33 upper-middle income countries have undertaken some or extensive unbundling. (The correlation between Electricity system size and national per capita income in developing countries is not sufficiently strong to allow only one or the other to be used. On the other hand, national income should not be used instead of per capita income because it is strongly correlated with Electricity system size.)

The total installed generating capacity in the country is over 148,700MW and the total number of consumers is over 144 million. Apart from an extensive transmission system network at 500kV HVDC, 400kV, 220kV, 132kV and 66kV which has developed to transmit the power from generating station to the grid substations, a vast network of sub transmission in distribution system has also come up for utilisation of the power by the ultimate consumers.

This means that despite other developing nations who have initiated reforms earlier than us, India, as a nation has come a reasonably long way and faster than its counterparts in this aspect.

TABLE 2C. Distribution of Power Supply Structures in Developing Countries by National Income					
	POWER SUPPLY STRUCTURE GROUP				
INCOME GROUP (PER CAPITA IN 2003)	VERTICALLY INTEGRATED MONOPOLIST	VERTICALLY INTEGRATED MONOPOLIST +IPPS	REGIONAL DISCOS, IPPS, A GENCO-TRANSCO AS SINGLE BUYER	MANY DISCOS, GENCOS, IPPS, TRANSCO AS SINGLE BUYER	POWER MARKET GENCOS, DISCOS AND LARGE USERS, TRANSCO-SO
Low	43	15	3	1	0
Lower middle	22	13	9	3	8
Upper middle	15	9	4	2	3

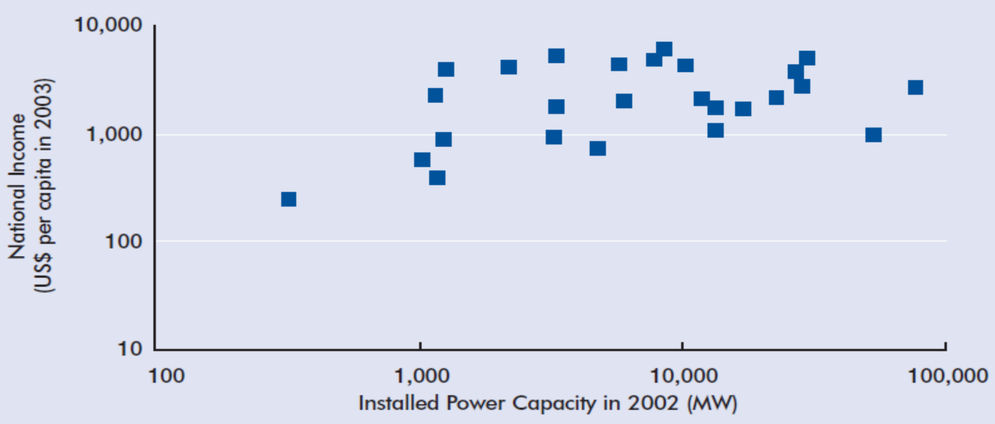
Note: EAP—East Asia and the Pacific; ECA—Europe and Central Asia; LAC—Latin America and the Caribbean; MENA—Middle East and North Africa; SAR—South Asia.
Sources: World Bank 2005 for country income levels; Energy Information Administration 2002 for country installed power capacities; various documents for country power supply structures.

The tendency for countries of similar economic, legal and political backgrounds to adopt similar Electricity market reforms indicates the importance of these basic characteristics for designing market reforms. It shows clear regional groupings, with Latin America the most advanced in restructuring, Asia (APEC 2000; Fairhead and others 2002) and Africa (Estache and Gassner 2004a) the least restructured, and the level of restructuring in Eastern Europe falling in between (Bacon and Besant-Jones 2002; EBRD 2001). Many Latin American countries have adopted competition in the wholesale Electricity market (Appendix B). They adopted a mixture of two variants of this structure (the Electricity pool design of the Chilean model, the independent transmission and system operator of the England and Wales model) and divested most of their state-owned assets in combination with structural reform and Greenfield investment by the private sector (Argentina, Bolivia, Brazil, Chile, Colombia, and Peru). “Greenfield investment” refers to investment in new facilities on undeveloped sites—typically for Electricity generation. A related concept is “Brownfield investment” which refers to investment in existing facilities. Greenfield investment has been the dominant mode for IPPs in Asia, Brownfield investment has been the dominant mode for IPPs in Eastern Europe, and both forms are widely used in Latin America and the Caribbean. This model led to increased sector investment and improved sector performance in these countries. This model also spread the impact of shocks throughout sector stakeholders, thereby improving its robustness (but even this model could not withstand the huge macroeconomic shocks of 2001 in Argentina). Eastern European and Central Asia countries have also implemented variations on this model, particularly for the use of bilateral contracts between Electricity generators and distributors (Appendix C). Many countries in East Asia and South Asia opted for attracting private investment in generating capacity with Greenfield Electricity plants developed and operated by IPPs. These countries include Bangladesh, China, India, Indonesia, Malaysia, Nepal, Pakistan, the Philippines, Thailand, and Vietnam. Most countries proceeded without structural reform, although some plan to move to some market restructuring (China in some provinces, India in some states, the Philippines). This model also increased sector investment, but it did not improve overall sector performance. It also concentrated the impact of macroeconomic shocks from the 1997 Asian financial crisis on the single buyer.

Classification of Developing Countries by Electricity Market Reform

Most developing countries can be broadly classified into two groups in assessing their experience with Electricity market reform. One of these groups ("the large middle-income group") is formed by a combination of system size larger than 1,000 MW and national per capita income above US$900, and the other group ("the small low-income group") is formed by a combination of size and income below these threshold values. This approach is indicated by the figure (System Size and National Income of Unbundled Electricity Systems) given below for the developing countries that have unbundled their Electricity supply arrangements to date. (Uganda is an exception among the countries in this group to this finding, since it has an installed capacity of much less than 1,000 MW and a per capita income of well below US$900.) It accommodates the huge range of country and sector characteristics found among developing countries. The existence of empirical threshold values between these groups shows the influence of scale economies on market reform. These two variables have relatively stronger influences on different components of Electricity market reform. Country income level has a relatively stronger influence on the roles of the public and private sectors and on access and affordability to Electricity services. It can also have a stronger influence on the regulation of Electricity markets on the basis that institutional capacity increases with income level. Electricity system size has a relatively stronger influence on market structure. The threshold values of 1,000 MW and US$900 are indicative because the two groups defined by them do not hold all developing countries. Some countries have lower Electricity capacities but higher income levels than the threshold values. Other countries have higher Electricity capacities but lower income levels than the threshold values.

System Size and National Income of Unbundled Electricity Systems



Sources: Based on income data from World Bank 2005 and on capacity data from Energy Information Administration 2002.

Developing countries fall into the following groups according to their per capita income and size of the power system (Appendix D). The above scatter diagram can be supported on the foundation of this.

The basis for this classification is strengthened by the observed divergence in social and institutional characteristics that corroborate the divergence in physical and economic characteristics of these groups, for example:

The proportion of the population without access to Electricity indicates a social dimension of the Electricity sector that is particularly relevant to the priorities for Electricity market reform. Statistically, this proportion is extremely high—averaging 83 percent—for countries that fall below both threshold values, whereas it is very low — averaging 9 percent — for countries that fall above threshold values. The average proportions for the other two groups lie between these values at around 50 percent. These are highly significant differences for specifying the conditions for reforming a country's Electricity sector.

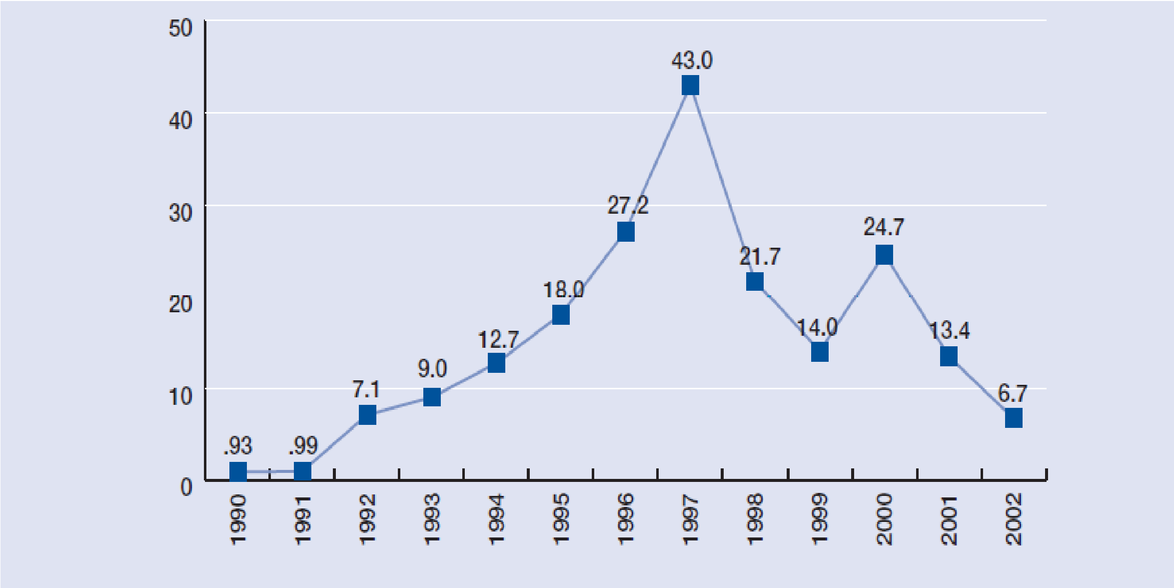
A country's rating for corruption—as measured by Transparency International Corruption Perceptions Index—shows an institutional dimension that is relevant to attracting investment and improving governance of the Electricity sector. The national per capita income is the critical factor for distinguishing country groups by this rating, since countries in the lower income groups have markedly lower (worse) ratings than countries in higher income groups. The difference in rating based on size of Electricity system is not significant. This analysis provides insights into Electricity market reform in developing countries. For example, in nine countries with competitive Electricity trading arrangements, three have non-access rates of 20 percent or more and eight have corruption ratings of below five. Such conditions indicate difficulties for sustaining these arrangements.

The Importance of Private Investment in the Electricity Markets

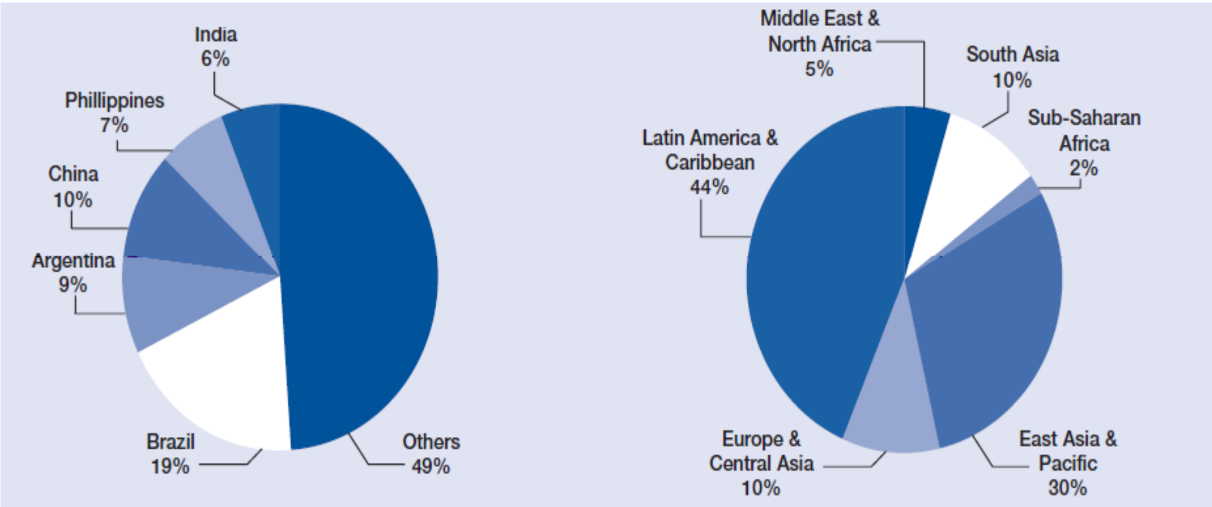
A direct result of the global movement to reform Electricity was the rapid growth from the early 1990s in private investment in the Electricity sectors of developing countries.

The rate of this investment peaked at US$43 million in 1997, but it dropped sharply after the Asian financial crisis of 1997 to around a quarter of that level from 2001 onwards (Izaguirre 2004; World Bank 2003a). This surge in foreign investment was stimulated by low interest rates and high supplies of private funds in international capital markets, allied to growing global interest in market oriented reforms to infrastructure sectors. (See also Izaguirre 2000 for information about private participation in energy.) Public investment declined, including donor financing for such investments, in the expectation that private investment would be an adequate replacement. For example, annual financing for Electricity sector investments from multilateral organizations fell from around US$8 billion during 1980s to around US$3 billion from 1998 and thereafter (World Bank 2004a). Most private investment went to a relatively few countries. Two regions—East Asia and Latin America and the Caribbean—received 75 percent of this investment, while about 50 percent went to only five countries — Argentina, Brazil, China, India, and the Philippines. About 70 percent went to the Electricity generation segment, and the rest was mainly in the distribution segment; little went into transmission.

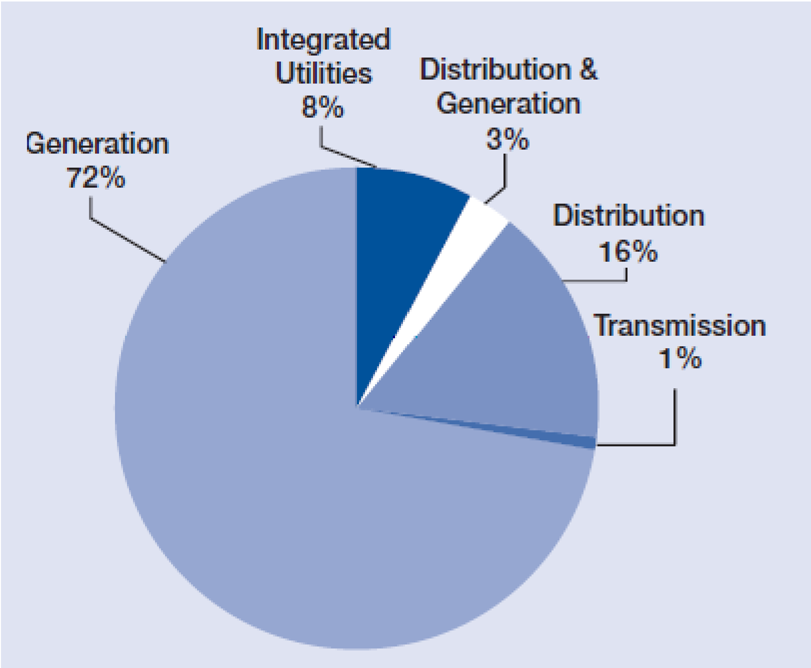
Private Investments in Electricity in Developing Countries, 1990-2002 (billions of U.S. dollars)



Geographic Imbalance in Private Investment in Electricity, 1990-2002



Distribution of Private Investment by Electricity Market Segment, 1990–2002



Sources: The World Bank PPI (Private Participation in infra) database, which is the source for this data, tracks total financial flows to projects in emerging markets that have a private component, including both investment in Electricity generation capacity that supplies the public Electricity system, and investments in capacity by industrial and commercial users to provide Electricity for their own needs.

Foreign private investment in the Electricity markets of developing countries has been vulnerable to economic conditions in these countries. This is shown by the decline in private investment in developing countries after the East Asian and Russian financial crises in 1997 and 1998, respectively. These crises dealt a double blow to the prospects for attracting private investment to developing countries in general and to countries in Eastern Europe and the FSU in particular just as they were embarking on reforms to their Electricity markets (Besant-Jones 1999). This decline is mainly attributable to three factors: investors' bad experiences in some countries, the unattractive investment climates of many countries, and the difficulty for many countries in sustaining the reforms to Electricity market and corporate governance needed to place the Electricity market on a commercial footing. This surge in foreign investment was stimulated by low interest rates and high supplies of private funds in international capital markets, allied to growing global interest in market oriented reforms to infrastructure sectors. (See also Izaguirre 2000 for information about private participation in energy – link given in the reference section). A classification based on these two factors allocates many more countries into the two target groups (one higher than both threshold values, the other lower than both threshold values) than a classification based on one or other factors alone, as shown in Table 3A. A single factor classification allocates countries in nearly equal numbers above and below each threshold value (73 and 78 below and above 1,000 MW, respectively; and 66 and 85 below and above US$900 per capita income, respectively), which shows little discrimination. Uganda is an exception among the countries in this group to this finding, since it has an installed capacity of much less than 1,000 MW and a per capita income of well below US$900. (For a detailed case study of Uganda, refer to attachment - UGANDA'S EXPERIENCE IN THE IMPLEMENTATION OF POWER SECTOR REFORMS (POWER SECTOR REFORM AND THE KEY PILLARS TO THE REFORM)

Investors' bad experiences in some developing country Electricity markets, which outweigh some good experiences - this situation arises from a general reduction in interest of international Electricity investors in developing countries. For example, about a dozen foreign Electricity producers have withdrawn from Indian Electricity projects over pricing issues. Many foreign investors are carrying losses from their investments in Argentina and Brazil because of large currency devaluations, and some have sold their holdings at substantial losses.

The unattractive investment climates of many countries - investors are being deterred by a combination of continued regulatory uncertainty and general concerns about risk and reward tradeoffs in countries where it is politically difficult to raise Electricity tariffs, competition and financial difficulties in home markets for leading firms in the Electricity business, turmoil in some markets, such as in Argentina, and lack of access to debt financing for investment in developing countries.

The difficulty for many developing countries in sustaining reforms to Electricity market and corporate governance needed to place the Electricity sector on a commercial footing. Several developing countries are pulling back from private sector participation in Electricity supply.

For example, the economic crisis in Latin America led to the postponement of privatizations of Electricity entities in Peru, Ecuador and Brazil. This pullback stemmed from many sources, including unmet expectations and popular criticism of poorly designed concessions, greater sensitivity about increases in Electricity prices, and concerns over contingent public liabilities under private provision of Electricity services.

A recovery in the interest of foreign investors in developing country electric Electricity sectors is uncertain both in timing and extent. Yet more than 40 developing countries have announced their intention to privatize some or most of their electric Electricity assets, which indicates a high demand for private investment in these markets. As a result of these developments, overall investment in developing country electric Electricity sectors has generally not kept pace with the estimated needs during the1990s. The current level is a fraction of total investment requirements of over US$100 billion annually in developing country electric Electricity sectors (IEA 2003).Many developing countries face a huge backlog of maintenance and capacity expansion in their electric Electricity sectors, and have experienced a marked deterioration in service quality and an increase in unserved Electricity demand. Industrial and commercial enterprises in many countries have resorted to installing their own generator sets to serve their Electricity needs, but at substantial cost that is undermining their businesses in competitive markets.

Outcomes of Electricity Market Reform

Electricity market reform in developing countries should be assessed against three outcomes that reflect their drivers for reform. These outcomes are better service quality for Electricity consumers, improvement in government's fiscal position, and more affordable access to Electricity for the poor. Outcomes are distinguished from outputs or elements of reform and are — or at least should be — closely related to the drivers of reform. The main elements of reform — restructuring Electricity supply chains and markets, regulation, competition and the roles of public and private participants — are considered as the means for achieving these outcomes. Empirical analysis to date about reform outcomes has been carried out largely for OECD countries, Latin America and Eastern Europe where outcomes have been systematically monitored.

Overall, implementation of reforms has been constrained by lack of country commitment, macroeconomic and political crises, and lack of experience among reform practitioners, particularly with political economy factors (World Bank 2003b). These reforms have not been in place for sufficient time to take full effect. Electricity market reforms that restructured and privatized Electricity entities and liberalized Electricity markets beyond just bringing in IPPs started only in the mid-1990s and most countries that embarked on this course are still at the early stages of reform. The empirical evidence for reform is thus limited and not in a form suitable for econometric analysis.

Country case studies are therefore the most important means for examining reform outcomes. The sustainability of reform is threatened in some cases by various political, economic and technical factors. Political manipulation of tariffs is a major threat. Problems arising from market design or regulation create technical and economic problems. Some Latin

American countries, such as Colombia, have yet to resolve the particular problems of managing a wholesale competitive Electricity market in a system dominated by hydroelectricity under variable hydrology (Ayala and Millán 2002; Larsen and others 2004).

The public image of Electricity market reform has been damaged by some notorious cases in OECD countries, such as in California (Besant-Jones and Tenenbaum 2001; Wolak 2003), as well as highly publicized controversies with IPPs in some Asian countries and politically inspired public opposition to the removal of general subsidies in Electricity tariffs. (Even serious Electricity shortages in recent years caused by abnormally low rainfall in countries dependent on hydroelectricity (Brazil, Colombia, Ghana, New Zealand, Norway, and Tanzania) have been spuriously linked to actual or nascent Electricity sector reform in these countries.). The main policy conclusions from one econometric assessment (Zhang, Parker, and Kirkpatrick 2002) are that (a) neither privatization on its own nor regulation on its own leads to obvious gains in economic performance, since the effect of privatization and having an autonomous regulator separately is statistically insignificant; (b) the coexistence of privatization and an autonomous regulator reforms together is correlated with greater Electricity availability, more generation capacity, and higher labour productivity; (c) hence, an effective regulatory framework should be emphasized when privatizing Electricity supply under monopolistic conditions; and (d) introducing competition is effective in improving performance, irrespective of changes in ownership or regulation, since competition appears to bring about favourable results for service penetration, capacity expansion, labour efficiency, and prices to industrial users. (This assessment of the effects of privatization, competition and regulation on the performance of the Electricity generating industry uses panel data for 51 developing countries. It identifies the impact of these reforms on generating capacity, Electricity generated, labour productivity in the generating sector, capacity utilization, and industrial and residential user prices. The conclusions are subject to tradeoffs between methodology and data availability (Jamasb and others 2004).

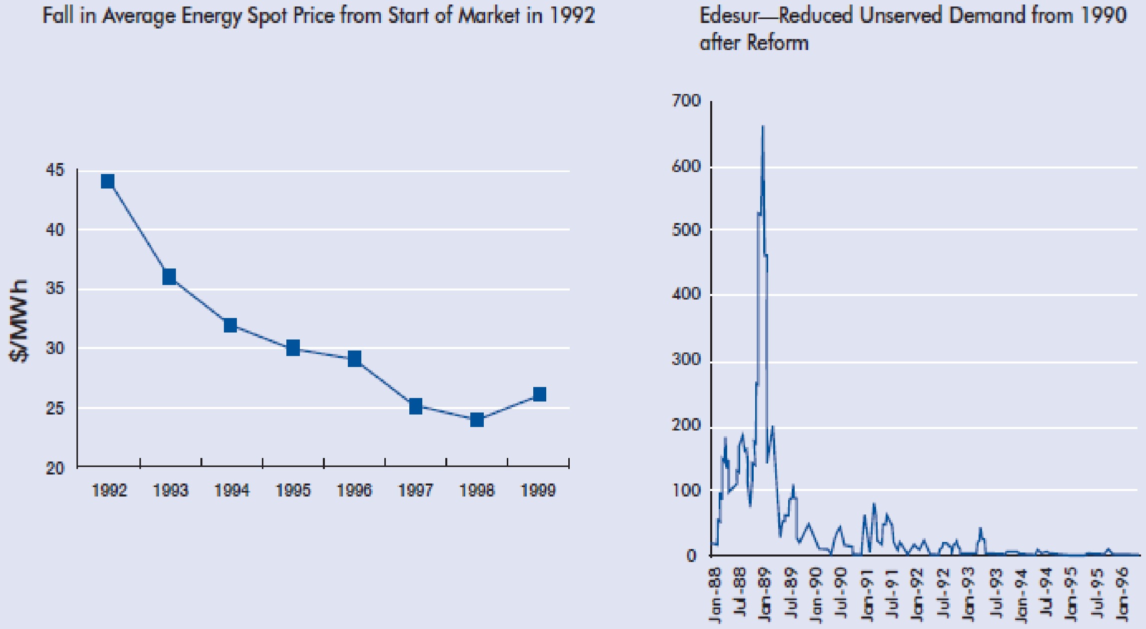
Successful Outcomes of Electricity Sector Privatization in Chile and Argentina

BOX 9. Successful Outcomes of Power Sector Privatization in Chile and Argentina

In Chile, power suppliers increased their capacity substantially by more than doubling annual generation from 1990 to 1998. Privatization also increased the productivity of utilities by cutting energy losses by more than half to 8.3 percent in 1997, by doubling labor productivity in distribution, and by tripling energy generation by worker in the largest generating company. Although privatized companies became substantially more efficient, however, these gains were only transferred to customers in areas under competition. In the main market, the regulated wholesale price of electrical energy fell by 37 percent, and technological change rendered uneconomical a large fraction of existing thermoelectric plants. In contrast, the final price to customers did not fall to reflect the huge productivity gains that were achieved after privatization, since between 1987 and 1998 the regulated price to consumers fell by only 17 percent. This situation led to spectacular increases in the profit rates of distribution companies: the rate of return of the largest distributor rose from 10.4 percent to 35 percent in this period, which is striking considering the low market risks carried by distribution monopolies (Fischer and Serra 2000).

In the case of Argentina, wholesale power prices and unserved demand dropped substantially following market reform, as shown in the figure below. (This figure shows only the years immediately following privatization to illustrate the gains that were actually realized then. Recent events in the country have undermined the sustainability of this reform.) The average energy spot price dropped steadily from around US$45 per MWh in 1992—the first year of operation—to US$25 per MWh by 1998 under intense competition among the privatized generators. Retail power prices did not decline as much, however, because of contracts between distributors and generators concluded before the parties were privatized. Electricity prices for industrial users declined more than prices for residential users. Similar price trends occurred in other South American countries (Bolivia, Colombia, Peru) that followed the same reform model as Argentina, with wholesale prices dropping by more than retail prices.

Benefits from the New Wholesale Electricity Market in Argentina



Source: Adapted from Deloitte Touche Tohmatsu 2004; World Bank 2003c.

A Short Summary of the Socio-Economic Changes in the Argentinean Electricity Markets, Post Reform

Tariffs

- The post-reform electricity markets clearly benefited large consumers through significant reductions in electricity input costs relative to the pre-reform period.
- Until 1999, retail rates did not show a consistent decline in parallel to declines observed in the wholesale market.
- A comparison of present retail rates across jurisdictions indicates that tariff differences are not significant and do not reflect differences in the characteristics of markets, or the public or private nature of the distribution companies. This seems to indicate that the alleged higher efficiency of the private distributors has not translated into lower rates for consumers.
- A declining price structure based on consumption levels prevails for residential tariffs, particularly those that were previously under federal jurisdiction and in provinces that adopted similar rate structures. These rate structures lack a clear theoretical-technical justification, reduce incentives for energy conservation and efficiency measures, and are socially regressive.
- Distribution companies are reaping benefits from tariffs that include a component for "distribution value added" that was negotiated when these services were privatized. As a result, current distribution tariffs do not reflect real costs. It is possible this component will be reduced or eliminated in the pending renegotiation or revision of concession tariffs.
- Restructuring and privatization led to the elimination of all social pricing over a two-year period.
- These social tariffs benefited low-income populations, in particular pensioners and retirees receiving minimum social security benefits. Private and local government initiatives have preserved some aspects of social tariffs in individual jurisdictions.

Access and Quality of Service

- The degree and number of consumer complaints with regard to service quality in the GBA area was not recognized until the EDESUR incident that brought these problems to public attention.
- Public hearings on the incident led to an increase in complaints regarding privatized services generally, and generated pressure on ENRE to change its position with regard to the indemnities to be paid by the distributor.

- The number of households that have gained access or electricity in the post-reform period has been limited. Distributors have generally concentrated their investments in already electrified urban and suburban areas.

- The PAEPRA and the PERMER programs have not been implemented and face important stumbling blocks in the post-reform system.

Employment Effects

- Actions taken to reduce personnel while the companies were still in State hands were linked to schemes for voluntary advantageous retirement.

- This process had consequences for those made redundant and for the State. In the first case, incomes diminished, their welfare decreased and the solution chosen had a regressive redistributive impact. In the case of the State, the process was financed by taking on additional external debt that impacted on the level of external indebtedness.

(Note: Appendix E has more details on this issue and the current scenario)

The case of Argentina's success is very noteworthy amongst other developing nations. In fact, it is a great lesson to be drawn for Maharashtra as to how reforms can be made quickly, efficiently and made sustainable. It is only recently that with recession, that the electricity markets in Argentina have had a major financial setback.

Better Service Quality for Electricity Consumers

Better supply quality at reduced cost should be the main outcome of investments in supply capacity. Among developing countries, these outcomes have been achieved successfully so far in a few South American countries, such as Chile (Pollitt 2004a) and Argentina (Bastos and Abdala 1996; Pollitt 2004b) where privatized Electricity entities increased their efficiency and coverage substantially. Additions to generation capacity through IPPs from the mid-1990s onwards helped many developing countries that were experiencing severe supply shortages in the midst of global financial crises, although temporary surpluses occurred under constrained demand. Efficiency gains have not been shared equitably between Electricity suppliers and consumers, or among consumers. Generators initially kept a high proportion of their productivity gains, and were obliged to pass some of these gains to purchasers of their output only in competitive wholesale Electricity markets. Distributors were obliged to pass some of these gains to consumers only under regulatory price reviews, for example in the case of

Brazil (Mota 2003). Likewise, real prices have generally decreased for industrial and commercial consumers, but not for residential consumers. (A comparison of Electricity prices in the Electricity market after reform with those before reform should be interpreted cautiously, however, because this type of comparison can be distorted by specific regulatory actions over prices, as when Electricity prices for residential users start well below cost at the start of reform. The comparison becomes more reliable when post-reform prices are largely determined under market forces, as in the case of some Latin

American countries.) The main policy lesson from this experience with privatized Electricity sectors is that countries should aim to establish conditions that lead to the broadest possible scope for competition.

Improvement in Government's Fiscal Position

Government's fiscal position can improve in three ways from reforms to the Electricity sector. First, by removing or reducing support for Electricity suppliers' debts. Second, by removing or reducing direct subsidies for specific groups of Electricity consumers. Third, by receipts of proceeds from divestiture of some or all of the state's shareholdings in Electricity suppliers. The first two benefits recur continually over time, whereas the third constitutes a single boost to the public exchequer. Investments by IPPs under long-term contracts with state-owned off-takers, however, do not relieve the fiscal burden entirely because they substitute government backing for borrowing by government backing for off-take commitments by state-owned entities, especially if the latter involves payment guarantees that rank as contingent liabilities.

Latin American experience shows that privatization of Electricity sector assets can yield substantial fiscal benefits under stable macroeconomic conditions. The high costs of restructuring the sector reduced the immediate benefits for government budgets. Divestitures of public Electricity assets yielded around US$60 billion between 1990 and 2002 for the most successful nine countries in the region during a period when such infusions of funds were needed for economic stability and social programs in Chile in the 1980s, Argentina and Bolivia under the Brady Plan, and then Brazil, Colombia, and Peru in the mid-1990s. In comparison, divestitures of public Electricity assets yielded around US$10 billion between 1990 and 2002 for the most successful eight countries in Asia. Substantial additional fiscal benefits flowed from payment of income and other taxes and dividends to governments for their remaining shareholdings in divested entities, as well as reductions in subsidies to the Electricity sector, as shown by the following cases from Latin America (World Bank 2003b). This assessment of the effects of privatization, competition and regulation on the performance of the Electricity generating industry uses panel data for 51 developing countries. It identifies the impact of these reforms on generating capacity, Electricity generated, labour productivity in the generating sector, capacity utilization, and industrial and residential user prices. The conclusions are subject to tradeoffs between methodology and data availability (Jamasb and others 2004).

A comparison of Electricity prices in the Electricity market after reform with those before reform should be interpreted cautiously, however, because this type of comparison can be distorted by specific regulatory actions over prices, as when Electricity prices for residential users start well below cost at the start of reform. The comparison becomes more reliable when post-reform prices are largely determined under market forces, as in the case of some Latin American countries.

Bolivia: Fiscal revenues from the Electricity sector (sales and profit taxes) increased by 247 percent in three years (from US$17 million in 1994 to approximately US$42 million in 1997). In addition, debt service of approximately US$61 million for the main Electricity entity pre-privatization, which was guaranteed by the government, was transferred to the private companies.

El Salvador: The sale of 75 percent shareholdings in the distribution companies totaling US$575 million had a substantial financial impact equivalent to 5.5 percent of the 1996 national GDP.

Panama: In FY 2000, the privatized Electricity sector companies contributed US$70.8 million to the treasury, of which US$34.5 million was in income taxes and US$36.3 million in dividends for the shares still in government hands.

Peru: The sector shifted from draining the public treasury of US$300 million in 1990 to being a source of fiscal income from US$300 million in profits in 1998.

Private Electricity operators saved governments from providing heavy operating subsidies. Where private operators took over retail supply, they also drastically reduced payment delays, theft, and unpaid bills (from 30 percent to 12 percent in Buenos Aires, and about the same in Côte d'Ivoire, where assets were not sold but just leased). A lot of the gains that eliminated or reduced the need for subsidies stemmed from better asset management.

Typically in the reformed Latin American Electricity sectors, over a five-year period plant availability increased by 10 percent to 40 percent, the number of customers per employee also increased by 50 percent, and Electricity outage indicators decreased by more than half.

Latin American distribution companies substantially improved their performance following privatization through long-term concessions. These improvements show the benefit of focusing private management on commercial performance, which has been a major weakness of state-owned utilities. The improvement in efficiency after privatization of four South American distribution companies is summarized in table below.

These improvements are measured in the change in performance between the date of privatization and 1998.

Improvement of Privatized South American Distribution Companies

TABLE 4. Improvement of Privatized South American Distribution Companies

ITEM	PERU LUZ DEL SUR	ARGENTINA EDESUR	ARGENTINA EDENOR	CHILE CHILECTRA
Year privatized	1994	1992	1992	1987
Change in energy sales (%)	+19	+79	+82	+26
Change in energy losses (%)	-50	-68	-63	-70
Change in number of employees (%)	-43	-60	-63	-9
Change in customers per employee (%)	+135	+180	+215	+37
Change in net receivables (days)	-27	-38	—	-68
Change in provisions for bad debts (percent of sales)	-65	-35	—	-88

— Not available.
Note: Performance improvement is measured from the date of privatization until 1998 in relation to performance relative to the year of privatization.
Source: Bacon and Besant-Jones 2002.

Affordable Access to Electricity for the Poor

The poor have obtained a low share of the benefits of Electricity market reform in developing countries, and some have even suffered welfare losses. Although reforms to Electricity markets have delivered substantial benefits to society overall through efficiency gains, most of these benefits have been shared between Electricity suppliers, non-poor Electricity consumers and governments (through fiscal gains). Most of the poorest people, especially those in rural areas, lie outside the ambit of Electricity market reform. In many developing countries, improving Electricity access for the poor was overshadowed in the 1990s by the pressing need to add generation capacity. Lagging reforms in transmission and distribution constrained Electricity delivery and expansion of access for the poor.

Some of the poor have gained from Electricity market reform, and some of the poor have lost from Electricity market reform.

The poor who gained received otherwise unavailable connections to Electricity supply. The poor who lost were obtaining some Electricity service before reform—albeit illegally and of poor quality—but have been disconnected or now have to pay for their consumption. Other groups of the poor continued to receive legal service but at higher tariffs as subsidies and cross-subsidies were removed under the commercial pressure on service providers introduced by reform. Some of the poor may have benefited indirectly through economic growth and job creation. The poor are often the last to benefit from increased access because of reform (Chisari, Estache, and Waddams Price 2001).

Reforms have led to improved access to Electricity supply by low-income households in some countries, with substantial benefits for these households. Even where Electricity tariffs were raised under reforms toward cost-recovery levels, the energy services met by household electrification still cost the households less than beforehand. For example, new connections and the percentage of households having Electricity access grew in Chile from 64 percent to 95 percent in 1990–94, in Bolivia from 56 percent before the reform to 70 percent in 1997, and in Peru from 53 percent in 1993 to 70 percent in 1998. South Africa substantially extended access to Electricity during the last 10 or so years, however, using innovative measures, such as prepaid metering to control customer service costs (Tewari and Shah 2003).

Where reforms involved adjusting tariffs to cover costs, poor households supplied from the public Electricity system were adversely affected, at least in the short term. In Poland, energy subsidies have tended to help the rich more than the poor (Freund and Wallich 1995). In Hungary, energy price reforms did not have a regressive impact, suggesting that subsidies prior to reforms were not effectively targeted at the poor (Newbery 1995). In Guatemala, the social tariff introduced following privatization of the Electricity distribution companies largely fails to reach poor households, and access to modern utility services remains highly inequitable (the richest 20 percent are twice as likely to have Electricity connections as the poorest 20 percent). Electricity coverage is close to universal in urban areas, but reaches little more than half of rural households (Foster and Araujo 2004). Existing customers, including low-income consumers and industries that provide employment to the poor, clearly benefited from the relatively quick elimination or reduction of supply shortages. Based on research findings that growth is good for the poor (Dollar and Kraay 2001), reducing generation supply constraints should have benefited the poor through growth in GDP. While this may be demonstrable in a macroeconomic context of trade liberalization and transition into market economies, the argument is less tenable in the sectoral context of private capital flows into developing country electric Electricity sectors suffering from transmission and distribution constraints on reaching the poor.

Reforms to urban Electricity markets can spur support for improving access and affordability to the poorest urban areas. This is shown by experience in Tbilisi in Georgia and in Buenos Aires in Argentina after Electricity distribution was privatized through long term concessions. Under the inefficient state-run Electricity systems, theft of Electricity was widespread as consumers tapped into Electricity networks without facing pressure to pay or be disconnected.

The solution in Georgia for the general population was a combination of activities aimed at increasing revenue collections.

The solution adopted in Buenos Aires was the Acuerdo Marco, which was a four-year framework agreement between public authorities and new distribution concessionaires to subsidize the cost of network extension and regularize Electricity services to the inhabitants of the city’s shantytowns. The national government waived taxes to cover unpaid bills from users in these areas, and local authorities waived taxes to contribute funding to capital works on the Electricity system in these areas. The local authorities also provided support to the distributors in many other essential ways. The agreement has yielded substantial benefits for these local communities (Chisari and Estache 1999; Haselip, Dyner, and Cherni 2005).

The impact of electricity market reform on the poor forms part of the broader consequences of this reform for public benefits — both social and environmental. Public benefits have tended to be overshadowed in many country reform programs, however, by the pressing need for new investment in supply capacity. Yet new investment by itself has been insufficient to sustain reform in many countries, especially when it has resulted in negative social outcomes, such as large increases in Electricity tariffs and pressure on government budgets. Experience shows that social and environmental policies are seldom incorporated into reform processes for Electricity markets. Experience also shows that public benefits are seldom given due consideration once the urgent financial problems are fixed, partly because the technical and institutional solutions adopted for the financial situation constrain the options available for addressing public benefits. Consequently, a political commitment to promote public benefits is needed as part of the reform process (World Resources Institute 2002).

Impact of Electricity Market Reform on Georgia's Urban Households

At the end of 1998, Government of Georgia sold the electricity distribution company serving Tbilisi to AES Telasi, a subsidiary of AES Corporation. AES Telasi greatly improved revenues and cash flow from the beginning of 2000, accompanied by substantial improvements in the quality of power supply and customer service. Revenue from the residential sector increased 91 percent from 2000 to 2001 and another 41 percent from 2001 to 2002. While tariff increases of 8 percent in 2000 accounted for some of the increase, better collections from customers—as well as increases in the amount of targeted and nontargeted subsidies—was the main source. AES Telasi was particularly successful at reducing household payment arrears. They steadily improved collection rates, rising from 44 percent in 2000 to 86 percent in 2002.

The consequence of this reform on the welfare of Tbilisi's households was found to be mixed. A major concern was how reform to access and prices for energy services would lead to changes in energy consumption and expenditure patterns. Government provided energy subsidies for households through various schemes, such as subsidizing the extension of natural gas supply for heating and cooking, which helped households with affordability for other goods and services including electricity.

A major finding was that an aggressive approach to reducing nonpayment did not have a disproportionate adverse impact on low-income households—particularly when suitable subsidy and transfer mechanisms were in place. Under the increased price for electricity and policy of reducing nonpayments, households in Tbilisi paid a larger share of their electricity bills. The mean household consumption of electricity remained constant at around 125 kWh per month, which is sufficient for lighting and some small appliances but not for heating or air conditioning. Demand for electricity in Tbilisi remained constant despite the increase in electricity prices. This finding indicates that demand at this level of consumption was quite inelastic, and that the increase in price for serving this demand therefore caused welfare losses for these households. These losses appeared to more than offset, however, by welfare gains from access to natural gas supply.

Analysis of changes to household electricity consumption patterns indicates that enforcement explains much of the improvement in collections. Metering and subsidies had a much larger impact on collection rates and revenue increases than service quality and retail prices. Collection rates were systematically higher for remetered households. The threat of disconnection seemed almost as effective in reducing nonpayment as an actual cutoff. Remetering was found to be as important a determinant of utility receipts as prices, followed by service quality and subsidies. Remetering in conjunction with tariff increases should therefore be given high priority, particularly at the early stages of reform. Improving collections did not have a disproportionate impact on low-income households, since collection rates increased uniformly across the top and bottom quintiles of household incomes. This challenges the conventional wisdom that nonpayment is closely related to affordability, since collections would be lower for the bottom quintile if affordability were important.

Source: Lampietti and others 2004.

Summary and recommendations:

1. ***There are different unbundling models. Depending on the countries' requirements, these should be adopted.***
2. ***Nations can be classified as per income group, and electricity utility structure, market competition structures, government systems and private participation. It helps to predict what kind of reforms may be required over a period of time and how they may be implemented***
3. ***These reforms have a direct effect on FDIs, government fiscal positions and economic development paths.***
4. ***the welfare option of "electricity as a public good" can only be achieved through appropriate reforms***

Appendix A

Political and Institutional Concepts Applied to Reform of Electricity Markets

The institutional issues for reforming Electricity markets can be analyzed in relation to three approaches developed for microeconomic reforms: the transaction-cost politics approach, the new institutional economics, and the new political economy.

The transaction-cost politics approach: This approach proposes that an instantaneous switch to a first-best world is a fantasy. Tradeoffs between the political feasibility of the reform and the elimination of economic rents are likely to exist. Multiple interests will put the new order under conflicting pressures, thus reducing the scope of the original goals or altering their intended direction. The changes that are feasible may therefore be modest. Regulation of public services takes place under asymmetric information and limited possibilities of commitment, because the rules of the game can be skewed, skipped, or modified. Under the informational limitations of policy designers, regulation is posed as the solution to a problem of incentives between agents (the firms regulated) and a principal (the regulator). This approach contrasts with the normative approach that predominated up until the 1980s, and which contended that markets and government were equally efficient, the role of government was to remedy market failures (in regulatory terms, this meant preventing the exercise of monopoly market Electricity), to produce public goods, and to redistribute income. The implicit assumption was that the government in question was perfect and would maximize welfare.

The new institutional economics: This approach characterizes institutions as crystallized beliefs. It stresses the support of customers and the role of complementary institutions (such as the judiciary and the antitrust bodies) as the two ultimate pillars of reform sustainability. In the case of regulation, the population should perceive that the increased cost of a service is offset by tangible benefits (for example, freeing up fiscal resources and using them to provide social services). It should be anticipated that changing beliefs about the benefits of a regulatory reform could operate under loss aversion conditions documented in experimental studies on decision making under uncertainty (the population may be risk-loving over regulatory losses and risk-averse over regulatory gains at the same time). This would explain, in part, the unfavorable perceptions of reform documented in opinion surveys like those of Latinobarómetro, even in situations where there are positive gains.

The new political economy: This approach stresses the need of permanently assessing the net balance of political support at each instant of time so as to calibrate the depth of reform changes and its sequence. It can be used in examining the issue of the order and speed of the measures that are introduced under a reform. The two extremes are shock therapy ("big bang"), which involves all the required changes taking place at the same time, and a gradual approach, which involves the measures being taken separately and over time ("gradualism"). Gradual progress would be preferable where there is uncertainty about the results of reform, about the higher costs of getting it wrong under the big bang approach, and where the suggested measures reinforce each other at each step.

Source: Benavides 2003.

Appendix B

Evolution of Electricity Market Reform in Latin America

Electricity market reform in Latin America proceeded in three distinct rounds. The first round started in Chile in the late 1970s with the development of new legislation that was introduced in 1982, and ended with the privatization of the major Electricity firms between 1986 and 1989. Chile's neighbors carried out the second round of reforms in the first half of the 1990s, an example of the demonstration effect of reform. The third round took place during the second half of the 1990s, and it included most of the remaining Latin American countries. Reform designers attempted to extend the scope and depth of competition in each round. Moreover, reforms were accomplished faster. The changes made in Argentina from 1990 to 1992 took a whole decade to achieve in Chile.

The Chilean reform contained three major innovations. First, competition was introduced to the wholesale market, in which Electricity generation companies and large customers and distribution companies established long-term supply contracts, and transmission services were provided by a separate entity to introduce open access to the transmission network. Second, investment in generation capacity was left to market forces, specifically the profitability of developing new capacity as rising demand leads to higher wholesale Electricity prices. Third, incentive regulation was used to compute the value added of network services provided by the distributor.

Reform introduced more pro-competition regulation and restructuring of the market. Vertical integration of generation and distribution was either prohibited outright or limited. Horizontal unbundling of the generation segment helped promote competition in wholesale Electricity pools. Restructuring of the wholesale energy market allows generators to submit price and quantity bids into a Electricity pool, which the pool operator uses to build a system wide supply curve for energy.* This curve is used to determine the order of dispatch of generating plants, replacing the merit-order system based on operating costs used by earlier reform countries.

Transmission fees, as well as the charge for local distribution services provided to large customers, were set by either the regulator or the Electricity market operator. The minimum demand threshold for eligibility by large customers to buy Electricity from the wholesale market was reduced. Governance of the Electricity market was strengthened by allowing distributors, some eligible customers and the transmission company to join generators as members of the wholesale market operator. Moreover, instead of regulating the price at which distributors purchased Electricity, some countries obliged distributors to tender their energy requirements among all generators. Some countries employed yardstick competition to regulate their unbundled distribution segment.

Regulations became more flexible, bestowing more discretion on regulators. Regulations also began to incorporate quality issues and increase fines for bad service. The process of setting regulated prices became more transparent. In Chile regulators were not allowed to publish the information used in rate-setting, except to the regulated firms, which prevents the demand side of the market from counteracting the lobbying pressure of regulated distributors. In Argentina, in contrast, public hearings became an important tool of the regulatory process. These changes made the Electricity market in Argentina considerably more competitive than the one in Chile.

* The supply curve is based on prices at nodal points in the Electricity system. These prices reflect the anticipated weighted average values of marginal costs across the system load duration curve of meeting the projected demand on the Electricity system over the next 48 months under an operating program for the generation capacity on the Electricity system that minimizes these costs. The values of marginal costs take account of technical losses in the Electricity network. The prices are adjusted monthly by indexation formulae.

Source: Fischer and Serra 2000.

Appendix C

Reforms Undertaken in Eastern Europe and Central Asia

Countries in Eastern Europe and Central Asia have followed a variety of reform paths for their Electricity markets:

Kazakhstan privatized quickly most of its generation and some of its distribution at “throwaway” prices, and now it operates a bilateral contract driven wholesale market. Some of the investors have disinvested and walked out.

Tajikistan and the Kyrgyz Republic have either unbundled or are considering unbundling their sector and have not undertaken any privatization yet. The concession for Pamir

Electricity Company to operate as a vertically integrated utility in Tajikistan is the first case of private investment.

Turkey and Lithuania have substantially commercialized and unbundled the sector and are poised to introduce competitive wholesale markets.

Poland and Hungary have unbundled the sector, introduced a single buyer model wholesale market and have substantially privatized generation and distribution. Poland and Hungary have completed privatization substantially.

Ukraine has unbundled and adopted a sophisticated competitive pool (which could not work as envisaged because of extensive nonpayment problem) and has privatized more than 50 percent of its distribution. It is still searching for a workable model.

Georgia has unbundled and privatized distribution in its capital region and some generation. It has given management contracts to manage non-privatized generation, transmission, and the Wholesale Market Operation and operates a single buyer model pool.

Moldova, the smallest among the countries reviewed, has unbundled its sector, has privatized three of its five distribution companies, and operates a wholesale market based on bilateral contracts between distributors and domestic and foreign generators.

Hungary, Poland and Turkey started with BOT(build, operate, transfer)-BOO(build, own, operate)-TOOR(transfer of operating rights) type of private sector involvement and are devising methods to accommodate them in a competitive structure and to manage the resulting stranded costs and contracts.

Romania and Bulgaria have unbundled their sectors and have privatized some distribution entities.

Source: Krishnaswamy and Stuggins 2003; World Bank 1999.

Appendix D

Developing countries fall into the following groups according to their per capita income and size of power system:

Countries with per capita income of less than US$900 and a power system smaller than 1,000 MW (44): Angola, Benin, Bhutan, Burkina Faso, Burundi, Cambodia, Cameroon, Central African Republic, Chad, Comoros, the Democratic Republic of Congo, Côte d'Ivoire, Equatorial Guinea, Eritrea, Ethiopia, the Gambia, Guinea, Guinea-Bissau, Haiti, Kiribati, Lao PDR, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mongolia, Nepal, Nicaragua, Niger, Papua New Guinea, Rwanda, São Tomé and Principe, Senegal, Sierra Leone, Solomon Islands, Somalia, Sudan, Tanzania, Timor-Leste, Togo, Uganda, the Republic of Yemen

Countries with per capita income of more than US$900 and a power system smaller than 1,000 MW (27): Antigua and Barbuda, Barbados, Belize, Botswana, Cape Verde, Djibouti, Dominica, Fiji, Gabon, Grenada, Guyana, Honduras, Maldives, Marshall Islands, Mauritius, Micronesia, Fed. Sts., Namibia, Samoa, Seychelles, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Swaziland, Tonga, Vanuatu, West Bank and Gaza

Countries with per capita income of less than US$900 and a power system larger than 1,000 MW (20): Azerbaijan, Bangladesh, the Republic of Congo, Georgia, Ghana, India, Indonesia, Kenya, Democratic People's Republic of Korea, the Kyrgyz Republic, Moldova, Mozambique, Myanmar, Nigeria, Pakistan, Tajikistan, Uzbekistan, Vietnam, Zambia, Zimbabwe

Countries with per capita income of more than US$900 and a power system larger than 1,000 MW (59): Albania, Algeria, Argentina, Armenia, Belarus, Bolivia, Bosnia and Herzegovina, Brazil, Bulgaria, Chile, China, Colombia, Costa Rica, Croatia, Cuba, the Czech Republic, the Dominican Republic, Ecuador, Egypt Arab Rep., El Salvador, Estonia, Guatemala, Hungary, Islamic Republic of Iran, Iraq, Jamaica, Jordan, Kazakhstan, Latvia, Lebanon, Libya, Lithuania, FYR Macedonia, Malaysia, Mexico, Morocco, Oman, Panama, Paraguay, Peru, the Philippines, Poland, Romania, Russian Federation, Saudi Arabia, Serbia and Montenegro, Slovak Republic, South Africa, Sri Lanka, Syrian Arab Republic, Thailand, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Ukraine, Uruguay, Venezuela

Appendix E

The reforms of 1991/92 in Argentina

Prior to 1991, the electricity sector in Argentina was vertically integrated. The sector experienced a serious crisis in the summers of 1988/1989, primarily due to the lack of maintenance of the country's thermal power plants (50% were unavailable).Shortly after the crisis, the government of Carlos Menem introduced a new legal framework for the electricity sector through Law 24,065, which included the following elements: vertical and horizontal unbundling of generation, transmission and distribution; opening up of all segments to the private sector; and separation of the regulatory function from policy setting. As a result of the new law, there was substantial private investment which, together with the public power plants that started production in the 1990s, transformed a situation of power shortage and low quality into one of abundance and reliability at lower prices.

ENRE (Electricity National Regulatory Entity) was created in 1992. The Wholesale Electricity Market (MEM), which covers up to 93% of total demand corresponding to the Argentine Interconnected System (SADI), was also created in 1992. The remaining 7% share of the demand corresponds to Patagonia, which had its own interconnected market, the Patagonian Wholesale Electricity Market MEMSP), now interconnected with the MEM. CAMMESA (Wholesale Electricity Market Administration Company) was also created that year and assigned the responsibilities of coordinating dispatch operations, setting wholesale prices and administrating economic transactions performed through the Argentine Interconnected System.

The reforms implemented in the 1990s led to high investment, which allowed for a 75% increase in generation capacity, resulting in the decrease of prices in the wholesale market from US$40/MW·h in 1992 to US$23/MW·h in 2001. However, the reforms failed to deliver the necessary increase in transmission capacity. Only one relevant project, the addition of the 1,300 km high voltage line between Comahue and Buenos Aires, was built in the 1990s. Distribution networks were also renovated and expanded, which resulted in efficiency and quality improvements.

Tariff freeze

As a response to the 2001 economic crisis, electricity tariffs were converted to the Argentine peso and frozen in January 2002 through the Public Emergency and Exchange Regime Law. Together with high inflation (see Economy of Argentina) and the devaluation of the peso, many companies in the sector had to deal with high levels of debt in foreign currency under a scenario in which their revenues remained stable while their costs increased. This situation has led to severe underinvestment and unavailability to keep up with an increasing demand, factors that contributed to the 2003-2004 energy crises. Since 2003, the government has been in the process of introducing modifications that allow for tariff increases. Industrial and commercial consumers' tariffs have already been raised (near 100% in nominal terms and 50% in real terms), but residential tariffs still remain the same.

Creation of Enarsa

In 2004, President Néstor Kirchner created Energía Argentina Sociedad Anónima (Enarsa), a company managed by the national state of Argentina for the exploitation and commercialization of petroleum and natural gas, but also the generation, transmission and trade of electricity. Through the creation of Enarsa, the state will regain a relevant place in the energy market that was largely privatized during the 1990s.

The National Program for the Rational and Efficient Use of Energy (PRONUREE)

In December 2007, the government launched the National Program for the Rational and Efficient Use of Energy (PRONUREE, Decree 140/2007). This decree declared the rational and efficient use of energy to be in the national interest and is also part of the energy sector strategy to counter supply/demand imbalance. The PRONUREE, under the responsibility of the Secretariat of Energy, aims to be a vehicle for improving energy efficiency in the energy-consuming sectors and acknowledges that energy efficiency needs to be promoted with a long-term commitment and vision. It also acknowledges the connection between energy efficiency and sustainable development, including the reduction of greenhouse gas emissions. The program also recognizes the need for individual behavioral changes to be promoted with an educational strategy, with the public sector setting the example by assuming a leadership role in the implementation of energy conservation measures in its facilities.

The PRONUREE includes short- and long-term measures aimed at improving the energy efficiency in the industrial, commercial, transport, residential and service sectors and public buildings. It also supports educational programs on energy efficiency, enhanced regulations to expand cogeneration activities; labeling of equipment and appliances that use energy; improvements to the energy efficiency regulations; and broader utilization of the Clean Development Mechanism (CDM) to support the development of energy efficiency projects. The objective of the program is to reduce electricity consumption by 6%.

One of the first activities defined under PRONUREE is the national program to phase out incandescent bulbs by 2011 in Argentina. The program, financed by the government, aims to replace incandescent bulbs with energy efficient compact fluorescent lamps (CFLs) in all households connected to the electricity grid and selected public buildings. The program, which has initially undergone a pilot phase and expects to replace 5 million incandescent lamps in the next six months, foresees the distribution of 25 million lamps overall. Staff from the distribution companies will visit each household to replace the incandescent lamps and to inform residential users on the advantages of replacing the bulbs and of the efficient use of energy in general.

Recent tariff increases, 2008

In Argentina, retail tariffs for the distribution utilities in the Metropolitan Area of Buenos Aires and La Plata city (i.e. Edenor, Edesur and Edelap) are regulated by the national regulatory agency (ENRE) while provincial utilities are regulated by local regulators. While the utilities under ENRE's jurisdiction had not been allowed to raise residential tariffs since they were frozen in 2002 as a result of the Emergency and Exchange Regime Law, some provincial regulators had recently approved additional charges to residential tariffs. In particular, the Public Service Regulatory Agency in the Province of Córdoba (ERSeP) agreed in February 2008 to a 17.4% additional charge to residential customers. Likewise, Santa Fé approved increases between 10% and 20%; Mendoza between 0 and 5% below 300 kWh and between 10% and 27% above 300 kWh; Jujuy between 22% and 29% and Tucumán between 10% and 24%. Other provinces (i.e. San Juan, Chaco, Formosa, Corrientes, La Pampa, Neuqen, Río Negro and Entre Ríos) are expected to raise tariffs in the near future.

Recently, in August 2008, after a 7-year tariff freeze, residential electricity tariffs in the Buenos Aires metropolitan area (served by the Edenor, Edesur and Edelap utilities) have been increased by 10-30% for households that consume more that 650 kWh every two months. For consumption between 651 kWh and 800 kWh, the increase will be 10%; on the other end, for users over 1,201 kWh, the increase amounts to 30%. The increase impacts around 24% of all Edenor, Edesur and Edelap customers (1,600,000 households). For commercial and industrial users the increase will be 10%.

At the end of August 2008, ENRE also approved increases in transmission tariffs in the 17%-47% range. The increase granted by ENRE was below the increase determined by the Energy Secretariat for some transmission companies (e.g. Transener, Transba, Distrocuyo and Transnoa. Some of them (i.e. Transener, Transba), will most likely challenge ENRE's decision. An overall tariff revision is still pending and has been put off until February 2009.

Tariffs, cost recovery and subsidies

Tariffs

Electricity tariffs in Argentina are well below the LAC average. In 2004, the average residential tariff was US$0.0380 per kWh, very similar to the average industrial tariff, which was US$0.0386 per kWh in 2003. Weighted averages for LAC were US$0.115 per kWh for residential consumers and US$0.107 per kWh for industrial customers.

Subsidies

Investment and financing

In 1991, the Government of Argentina created the National Fund for Electric Power (FNEE, Fondo Nacional de la Energía Eléctrica), to be funded by a share of the petrol tax and a surcharge on sales from the wholesale market. This Fund, which is administered by CFEE (Electric Power Federal Council), provides funding to the following other funds at the shares indicated:

- 47.4%: Subsidiary Fund for Regional Tariff Compensation to Final Users (FCT), for homogenization of tariffs across the country (this created a de facto subsidy for those consumers in the areas with higher electricity costs)

- 31.6%: Fund for the Electric Development of the Interior (FEDEI), for generation, transmission and rural and urban distribution works. Most funds have been directed to rural electrification

- 19.75%: Fiduciary Fund for Federal Electricity Transmission (FFTEF) (created in 2000), for co-financing or projects in electricity transmission.

- 1.26%: Wind Energy Fund (created in 2002), for the development of wind energy,

In addition, CAMMESA, the administrator of the wholesale electricity market, had projected that by 2007 the country's energy demand would require an additional capacity of 1,600 MW. Faced with the need for specific investments but also with a lack of private investment, the Energy Secretariat (SENER) enacted Resolutions 712 and 826 in 2004, which created FONINVEMEM, the Fund for the Investment Needed to Increase the Supply of Electricity in the Wholesale Market. The Fund, which sought to encourage participation from creditors of the wholesale market, invited those creditors, mainly generation companies, to participate with their credit in the creation of the Fund itself.

Summary of private participation in the electricity sector

Prior to 1991, the electricity sector in Argentina was vertically integrated. The new legal framework for the electricity sector included: vertical and horizontal unbundling of generation, transmission and distribution; opening up of all segments to the private sector; and separation of the regulatory function from policy setting.

Currently, private and state-owned companies carry out generation in a completive, mostly liberalized electricity market, with 75% of total installed capacity in private hands. The publicly-owned share corresponds to nuclear generation and to the two bi-national hydropower plants: Yacyretá (Argentina-Paraguay) and Salto Grande (Argentina-Uruguay). On the other hand, the transmission and distribution sectors are highly regulated and less competitive than generation. In transmission, the Compañía Nacional de Transporte Energético en Alta Tension (Transener) operates the national electricity transmission grid, while in the distribution sector, three private companies, Edenor (Empresa Distribuidora y Comercializadora Norte), Edesur (Electricidad Distribuidora Sur) and Edelap (Empresa de Electricidad de la Plata), dominate a market with 75% control by private firms.

Activity	Private participation (%)
Generation	75% of installed capacity
Transmission	0%
Distribution	75% of clients

Governance – 1

Market Structure and Governance

Summary:

The extent of restructuring power markets should be assessed on a case by case basis. Full unbundling is generally preferred in medium to large power markets to facilitate the introduction of competition at least in the market for wholesale trade in power. For small markets with little or no opportunity for cross-border trading, regulation of a vertically integrated monopoly may be the most cost-effective choice until the power market has grown substantially. However, both market growth and regional power markets can be facilitated by the unbundling of even relatively small systems. Unbundling of accounts, staff and management should be the first step in this to increase the transparency of price setting and facilitate benchmarking of costs and service standards, but full unbundling will be required to make these changes effective. The potential benefits of moving to more competitive trading arrangements are well known and, in addition to governance and regulatory motivations, usually underpin the extensive vertical and horizontal unbundling of monopolistic service providers. The difficulties in implementing competition in power markets are also by now well known.

Full competition should be approached cautiously in developing countries because many existing markets are too small, there are significant risks of market power abuse, distributors may not be sufficiently creditworthy for trading on commercial terms, and policy makers have limited tolerance for the substantial price volatility that occurs with competition in the market.

Governments should consider for the near- to medium-term, gradual market opening and limited competition for the market. This can be facilitated by allowing open access to networks by third parties besides the main generators and distributors, and trading on a bilateral basis between generators and distributors and other suppliers. This document shows how market structure and the form of trading within the power market are linked to market size and income level. This relationship is clearly evident in the extent to which a power supply chain should be unbundled into separate entities. Unbundling of generation from distribution can be worthwhile even in small power systems, but forming numerous generation entities or distribution entities is only suited to introducing competition in large power markets that are at least in the middle-income level. Competition for the right to supply an incumbent supplier under long-term agreements by independent power producers, by contrast, can work in power markets of any size and at any income level, whatever unbundling is undertaken. These producers, however, are expected to carry more investment risk in the large middle-income countries than in the small low-income countries.

Importance of the Market Structure for Market Governance

The importance of market governance has emerged in a situation of large needs for investment in the power sectors of developing countries, yet low private sector willingness to invest in them. The experience of private investors has been particularly bad in countries where market governance was especially weak, for example, in some of the transition economies of Eastern Europe. The structure of the power market strongly influences the governance of the power market, regardless of whether electricity service providers are publicly or privately owned.

Governments can create the environment for attracting investors and operators only by reforming market governance. In this environment, investors face reasonable commercial risks without fear of expropriation and corruption, while consumers, regulators, and other stakeholders honor the contractual rights of utilities to recover their revenues. Robust reform strategies, regardless of the roles of the public and private sectors, must confront serious issues about market governance, often in a situation where prices are well below full-cost recovery (World Bank 1994b). Reform strategies are unlikely to succeed in improving sector performance and contributing to economic growth and poverty reduction without credible steps to improve suppliers' commercial and operational performance, and to align revenues with costs (World Bank 2004b).

Restructuring Power Supply

Integrated power suppliers are restructured to obtain benefits from competitive trading arrangements, as well as to strengthen governance and regulation of the markets in which they operate. The main issue concerns the extent of vertical and horizontal unbundling of the generation, transmission, and distribution-supply segments of the market, taking into account the size of the power system (The significance of power system size for restructuring to date is illustrated before).

The variety of market structures emerging from reforms to power sectors can be categorized according to increasing degree of competition, as follows (Hunt and Shuttleworth 1996).

• ***Monopoly***—involves no restructuring and no competition at all, since it consists of a vertically integrated monopoly at all levels of the supply chain within a country (typically) or a region in parallel to other vertically integrated regional monopolies (as in Japan and in parts of Canada and the United States).

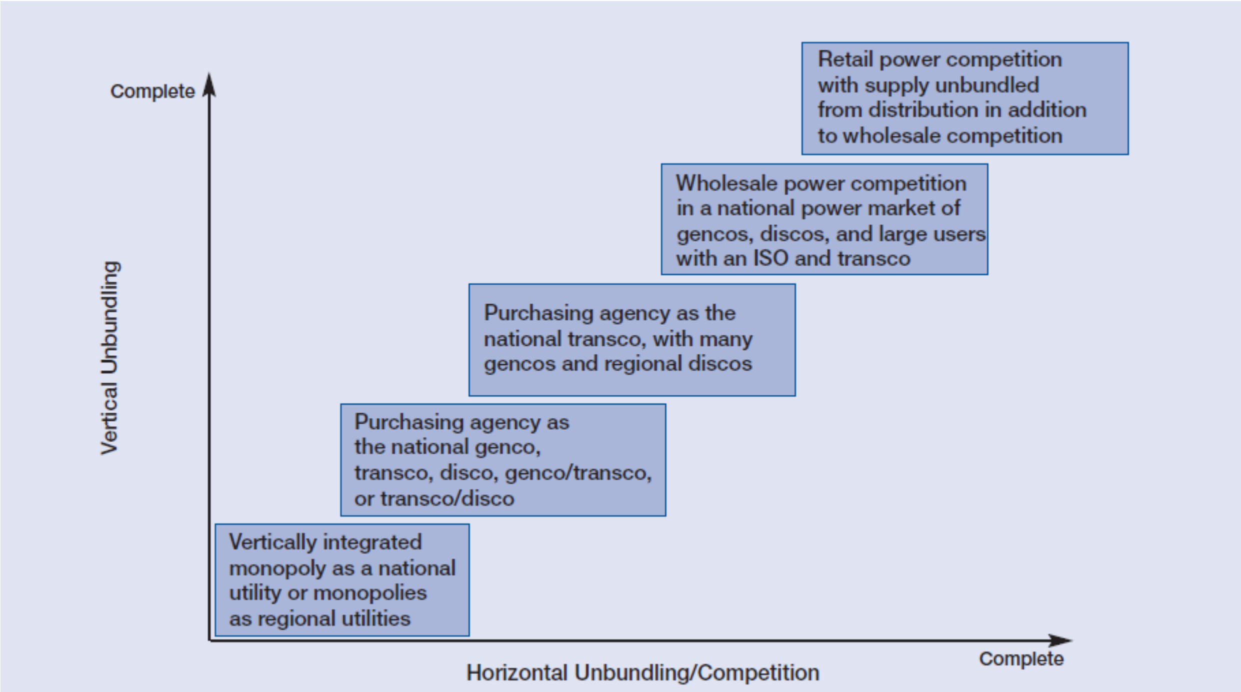
• ***Purchasing agency, also known as a single buyer*** — manages competition for long-term market share among generators and IPPs. It generally has a monopoly for supplying distribution companies that serve customers under regulated terms and also, in some cases, large power users under regulated terms.

The functions of this agency are carried out by many types of entities in different countries, including a national vertically integrated utility, a national generation entity, a national transmission entity, a national distribution entity, a combined national generation and transmission entity, and a combined national transmission and distribution entity.

• ***Competition in the wholesale power market ("wholesale competition")*** — allows distributors and large users of electricity to purchase electricity directly from generators they choose either in a power exchange or bilaterally (mentioned later), and to transmit this electricity under open access arrangements over the power networks to the points of electricity consumption. Independent power suppliers (firms that specialize in energy trading, but do not own or operate distribution networks) are allowed to compete with distributors for the custom of large users (This could be delayed in those countries where distribution and supply systems are so dilapidated that they need a period of assured revenues to remedy the worst deficiencies before having to compete for the business of their largest customers.).

• ***Competition for retail customers ("retail competition")*** — allows end users of electricity to choose their power supplier, with open access for suppliers to the transmission and distribution systems to procure their supplies competitively at the wholesale level from generators and suppliers. The correlation between power supply structures analyzed before with these market structures given in the figure below.

Correlation of Power Supply Structures with Power Market Structures



Within these market structures, competition for a long-term right to a share of the power market supplied by a purchasing agency or single buyer is clearly less radical than competition in the power market for a share of that market.

Competition for a share of the market is a single event that relies on the effectiveness of the procurement arrangements for its benefits. Competition in the market is much more dynamic and therefore potentially beneficial, since it involves repeated rounds of bidding in a market. It does, however, require much greater institutional capacity and market development to work properly, otherwise the results could be costly.

As discussed later in this document, competition for the market can be viewed as an interim arrangement in a long-term reform process, and competition in the market should be considered only when the main necessary conditions are in place.

Reform programs can progress through these structures. This progression starts from a vertically integrated monopoly or monopolies and progresses to a purchasing agency or wholesale competition, and possibly proceeds eventually to retail competition. It reflects the basic sequence of a reform program, whereby restructuring the supply industry and power market, as well as setting up the legal and regulatory framework, precedes the transfer of ownership of power generation and distribution from the state to the private sector (Sequencing of reform stages is discussed later). A vertically integrated monopoly is almost universally under state ownership in developing countries (as discussed in the reforms section).

The economic case for unbundling a vertically integrated power utility rests on whether the gains from unbundling exceed the costs of arm's length transactions among the separated segments.

This matter depends on such factors as power system size and country institutional capacity to manage complex trading mechanisms. In the weakest countries with little prospect of cross border power trading, a key issue is whether arm's length transactions among sector participants can be sustained. The case for unbundling is strongest in large power systems in countries well endowed institutionally. The case for unbundling gets weaker the smaller the system, the more undeveloped the institutional capacity, and/or the weaker the general country conditions.

The vertical unbundling of a state-owned power utility is seldom straightforward.

This is because many of these utilities supply a wide array of social services that blend goals like employment of idle workers, protection of the environment, and provision of energy services to poor areas into their daily production decisions. The deep links between one of these utilities and the state hinder the unbundling of a large state-dominated power utility and reassembling it in a different, more market-based form. Recasting the utility's methods of financing or labor-hiring decisions, for example, is difficult without broader reforms in capital and labor markets. The basic organization of a power utility can be durable and resistant to change, even once the utility has been unbundled in name. In the contest for control, the losers from unbundling—mainly the beneficiaries of the social services provided by the utility—are already organized within the utility and the state and have direct access to decision makers (Heller and Victor 2004).

In a wholesale power market where power is traded under competitive arrangements, the transmission and system control functions should be kept under separate ownership from distribution and generation.

Restrictions are necessary on ownership or on control (through governance arrangements) of the licensees for these functions by generators and distributors, in order to prevent the acquisition of anticompetitive amounts of market power by any generators or distributors. This separation of ownership and control also ensures that private operators and developers are not deterred from trading in this market by concerns about discriminatory control of these monopoly services by their competitors.

Private sector participation in the transmission system should be handled carefully to avoid subsequent abuse of market power by the new owners.

The primary concern for the transmission operator is that payment will be made by the users of the system, namely, the generation and distribution entities. As a result, effective private sector participation in the main transmission system will depend on clear improvements in the financial viability of these entities. If transmission capacity bottlenecks impede private sector participation in generation, early private sector participation may be in order. These bottlenecks may be best addressed by alternative forms of private sector participation to divestiture of shares in the transmission entity, such as transmission lines constructed and operated under build-operate-transfer (BOT) arrangements (BOT arrangements work for a natural monopoly, such as transmission services, because competitive supply of these services is not economically efficient.).

Sector unbundling should be undertaken under conditions that preserve the integrity of power system operation and power market trading.

It should be deferred, however, if it would worsen an ongoing crisis of serious and prolonged nonpayment that reduces the cash flow up the supply chain to generation and transmission entities. This happens when the unbundled distribution entities act in their own interests by holding on to most of the cash collected from customers. Under such severe financial indiscipline, competitive pools or even other modified forms of the wholesale market for electricity could not work as intended, as happened in Georgia, Kazakhstan, and Ukraine (given below in box 16).

The key decision for many developing countries is whether to choose a purchasing agency–single buyer or competition in the wholesale power market for bringing private investment to the power sector. This choice depends largely on whether the power system meets the necessary conditions for one of the forms of competition in the wholesale power market. If not, a purchasing agency–single buyer can be adopted because this option does not require unbundling of the existing integrated supply structure. These two structures are thus examined further in this piece.

BOX 16. Cash Flow Problems in Ukraine's Wholesale Electricity Market

In Ukraine during the late 1990s, the collapse of funds administration in the wholesale electricity market was the main indicator of distress in the market. These funds were supposed to be allocated to generators and service providers in proportion to their revenues due from the selling price and volume of units of electricity sold. In practice, these providers were not paid in full—and in fact they often received a very low proportion of their due amounts, because the revenues collected from users fell far short of their bills.

An algorithm was therefore developed for allocating the available cash in proportion to relative sales by providers. In practice, however, the Ministry of Fuel and Energy (Minenergo) intervened by directing scarce funds to particular providers according to short-term expediency in substantially different ways than the algorithm. It claimed a number of technical reasons for its actions, such as emergencies and the need to pay coal miners, which led to numerous changes to the algorithm. The operating companies could rely on receiving funds predictably under this transit account system.

According to the market rules, distributors that have not fully paid for the electricity purchased from the wholesale market should have been cut off from future electricity deliveries. But Minenergo insisted that delinquent distributors continue to receive wholesale power, and it tried to address the problem by reaching agreements with central and local governments on customers that could be disconnected without political repercussions. Consequently, some of the distributors took advantage of the nonenforcement of payment obligations and withheld from the market the cash collected from their customers.

The proliferation of barter and other noncash payment modes (mutual cancellation of payment obligations, promissory notes, and tax write-offs) further compromised the application of the market rules. Noncash transactions offered significant tax advantages because cash received in an enterprise's bank account was often confiscated by the tax service. Because noncash payments had limited fungibility, the market operator could only allocate cash payments.

Total collections soon fell to below 80 percent, of which the share of noncash transactions in the power industry surpassed 80 percent (the economywide average was about 40 percent) and cash payments dropped to below 10 percent (nonpayments accounted for the balance). In essence, only the general population paid cash for electricity. Generators and their fuel suppliers received little cash, and even the cash allocated to the distributors under the algorithm and Minenergo's interventions did not cover the costs of their distribution networks and customer services.

Summary and recommendations:

1. *The importance of market governance has emerged in a situation of large needs for investment in the power sectors of developing countries, yet low private sector willingness to invest in them.*
2. *Integrated power suppliers are restructured to obtain benefits from competitive trading arrangements, as well as to strengthen governance and regulation of the markets in which they operate*
3. *The variety of market structures emerging from reforms to power sectors can be categorized according to increasing degree of competition.*
4. *Within these market structures, competition for a long-term right to a share of the power market supplied by a purchasing agency or single buyer is clearly less radical than competition in the power market for a share of that market.*
5. *Reform programs can progress through these structures*
6. *The economic case for unbundling a vertically integrated power utility rests on whether the gains from unbundling exceed the costs of arm's length transactions among the separated segments.*
7. *The vertical unbundling of a state-owned power utility is seldom straightforward.*
8. *In a wholesale power market where power is traded under competitive arrangements, the transmission and system control functions should be kept under separate ownership from distribution and generation.*
9. *Private sector participation in the transmission system should be handled carefully to avoid subsequent abuse of market power by the new owners.*
10. *Sector unbundling should be undertaken under conditions that preserve the integrity of power system operation and power market trading.*
11. *The key decision for many developing countries is whether to choose a purchasing agency–single buyer or competition in the wholesale power market for bringing private investment to the power sector.*

Purchasing Agency–Single Buyer

The pure single buyer model is one among many forms of centralized purchasing arrangements.

There are several ways to implement what is broadly referred to as a single buyer model. All ways have a central entity aggregating the load, playing some role in the procuring of energy to serve that load, and allocating this energy among different consumers or distribution companies. Given those characteristics, the expression "centralized purchasing arrangement" more properly captures the multitude of commercial arrangements that can be in place (Arizu, Gencer, and Maurer 2006).

Although a purchasing agency–single buyer structure is easier to implement than other market structures, it carries substantial risks for reform outcomes.

Government can still impose noncommercial practices on the market by manipulating the single buyer's terms of trade. It can use single buyer to commission excess generating capacity to actual demand and to choose costly generation technologies. Its commitment to full reform may weaken to avoid the politically controversial consequences of introducing more private sector participation and competition (Lovei 2000). This structure is open to excessive risk exposure under long-term power purchase commitments with IPPs (discussed later - Experience with Independent Power Producers). It is also vulnerable to a government's reluctance to support increases of retail tariffs needed for the financial viability of the single buyer when generators receive guaranteed contract prices and distributors receive guaranteed margins. Hungary represents a prominent example of this situation (see below - The Roles of the Single Buyer Model in Eastern European Power Markets).

A purchasing agency–single buyer can be used as an interim stage for moving toward a competitive market model for wholesale power trade.

Under this strategy, this model is designed to provide the time required for the generation and distribution sectors to develop sufficiently for the operation of a competitive wholesale electricity market. It requires that stranded costs are manageable when the market moves to a competitive model from the rigidities associated with long-term PPAs with guaranteed "take or pay" provisions. These costs pose a substantial challenge to regulators (Arizu, Maurer, and Tenenbaum 2004), and they are unpalatable to consumers when they are recovered from them as a surcharge to the regular tariff.

A purchasing agency–single buyer should not be given a legal monopoly on trade in wholesale power.

This is to avoid obstacles to introducing different trading arrangements — bilateral or a central power exchange — when government decides to introduce stronger competitive pressures in the power market. The main obstacle is usually the difficulty in rescinding the legislation that grants this monopoly. A purchasing agency does not need to have a legislated monopoly to transact a large proportion of energy in a power system when generation and distribution companies find this arrangement the least risky under the poor business conditions found in many developing countries. The proportion of energy transacted by this agency should be allowed to decline if some of the generators and distributors in the market prefer to start trading bilaterally, which would signal that these market participants are ready to move away from the single buyer arrangement.

The Roles of the Single Buyer Model in Eastern European Power Markets

A market structure based on a single buyer model had been adopted in Hungary, Poland, and other countries as an interim measure before moving to a fully competitive pool. Under this model, the state-owned transmission and dispatch company buys power from generating companies on the basis of PPAs negotiated with each producer, and sells electricity at a single pooled average wholesale price to all distribution utilities and the large consumers eligible to buy directly from the wholesale market. The retail price for end consumers is regulated by adding a distribution charge to the wholesale price. Long term PPAs (generally 10 years or more) and short term PPAs (one year or less) are covered by "take or pay" provisions guaranteed by the state. The market risk is thus fully transferred from the generators to the single buyer, who is obliged to pay generators for the power not purchased if the demand declines, as well as for increased fuel prices, exchange rate variations, and so forth, for which the prices in PPAs are usually indexed. The single buyer carries the risk of not being compensated for the resulting increase in the average wholesale price per kilowatt-hour when government does not allow the necessary increase in retail tariffs. The Hungarian government, for example, did not allow retail prices to rise to the full extent, but instead compelled the single buyer to reduce wholesale prices and compensated the single buyer through direct budget subsidies. Russia and Ukraine have operated their wholesale electricity markets on a modified single buyer basis. Under this basis, no direct contractual link exists between the generators and distributors. Generators sell electricity at regulated prices, and the wholesale market entity supplies distribution utilities at the pooled average wholesale market prices. This kind of arrangement lends itself to abuses. When supply is less than demand in the market, the wholesale market entity can be pressured by government to allocate power to favored large users and distributors, instead of following the agreed algorithm. Likewise, when the demand is below available supply, the wholesale market entity can be pressured to allocate demand to favored generators, such as the coal-fired plants (to appease the strong mining lobby). It can also be pressured to allocate demand among all generators to ensure that every plant is kept working and employment in the plants is sustained, so that uncompetitive plants are not faced with bankruptcy. These practices distort least-cost dispatch by partial loading of the thermal plants that reduces efficiency and increases fuel consumption. Further, in an environment of extensive nonpayment, where the wholesale market is unable to collect dues from the distribution utilities and settle the dues of the generating companies, it has linked distributors to generators arbitrarily for purposes of payment. Such arbitrariness can lead to corrupt practices. Instead, direct bilateral contracting and settlement should be allowed between the distribution utilities and the generators.

Source: Krishnaswamy and Stuggins 2003.

Restructuring Small Power Systems

Small countries face similar problems to larger countries in reforming their power markets, but with greater intensity.

For example, all wholesale electricity markets must grapple with issues of market power, although such problems are likely to be more severe in the markets of small countries because collusion is easier among few suppliers. These countries therefore need stronger regulatory capacity to monitor and control their power markets and thus sustain competition in these markets.

Although regulatory capture and incompetence can afflict a power market of any size, small countries will more likely have ineffective regulation because of their smaller human resources and generally lower income levels.

Small countries are also sensitive to the impact of large — mostly foreign — investors and developers in power generation and distribution.

These investors can easily stifle competition and overwhelm regulators in small countries, because they have access to much greater resources — financial, technical, and legal — than the public sectors of these countries. Their proposed investments may represent a large proportion of total investment in the country and total power system capacity. Foreign developers bring expertise from their projects in other countries. They can mobilize the support of their embassy, and they can play small countries off against other countries. In contrast, many small countries seek private funds in situations of looming or actual electricity shortages. They have few experienced negotiators and experts in these types of transactions, and they have high country risks that deter foreign investors because of weak economies and unstable policies (Not all small countries are weak, for example Costa Rica and Singapore.) Altogether these factors can give foreign developers a strong bargaining position. As a result, many PPAs with these developers have entailed high prices and shifted many project-related risks to the power purchaser. This creates a perception of unfairness in the host country that politically undermines the sustainability of the PPAs and more general reforms over the long term (Rufin 2002).

The numerous countries whose power systems are too small for a competitive power market have intermediate reform options (Bacon 1994).

Horizontal unbundling into tiny entities would generally not make sense, because this would causes losses in economies of scale and scope without gaining the benefits of competition. However, both market growth and regional power markets can be facilitated by some unbundling of even relatively small systems under one of the following options:

• Privatizing the vertically integrated utility as a whole and regulating it until the market has grown substantially. This course, of action, runs the risk of having a private monopoly with weak regulation.

• Splitting the vertically integrated utility into two or three vertically integrated regional utilities, privatizing, and subjecting them to regulation.

• Unbundling the existing utility into one generating entity, one distribution entity, and one transmission and dispatch entity; privatizing generation and distribution; and retaining transmission and dispatch in the public sector, as in Uganda. All three entities would be subject to regulation. The smallest countries that presently have sophisticated competitive trading arrangements in their wholesale power markets are El Salvador, Guatemala and Panama. All three countries, however, have a per capita income level and power system size above the threshold levels that define small power systems in this context (US$900 per capita and 1,000 MW — mentioned in the "reforms" document).

Example of a Small Competitive Wholesale Power Market in Guatemala

The Guatemalan wholesale electricity market is formed by a spot market and a contract market in which energy and capacity are traded as distinct products in both markets. In the spot market, hourly energy prices are determined by the least-cost ranking of available resources, as established from incremental cost information submitted by thermal plant operators, from the value of water bids submitted by hydro plant operators, and from demand-side schedules allowing disconnection of load at certain spot market prices. Spot capacity prices are likewise determined by matching supply side offers and demand requirements. There are more than 100 participants in the wholesale market, which has exhibited considerable dynamism since its inception. Total installed generating capacity in the market totaled 1,875 MW in 2002. Although the market is concentrated in absolute terms, barriers to entry of new operators do not appear to be high with the possible—and important—exception of hydro producers. All distribution companies must supply their regulated customers through long-term contracts with generators. Rates are regulated under a price cap system, whereby the noncompetitive cost elements, such as the use of wires and transmission equipment, are set every five years in accordance with efficiency standards and adjusted periodically for inflation and other factors. Energy and capacity prices are passed through to the final consumers and adjusted every three months in accordance with the terms of the contracts. Unregulated large consumers are not required to have a capacity contract, and can contract directly from generators or marketers or buy from the spot market. The contract market offers a variety of standard contract types that accommodate bundling of energy and capacity, price certainty, and other characteristics. Four types of supply contracts are offered: (a) differences in load curve contracts, (b) capacity contracts without associated energy, (c) capacity contracts with associated energy, and (d) demand shortfall difference contracts. Capacity reserve contracts between generators are also possible. Take-or-pay contracts are not permitted. In the spot market, each buyer can buy from the pool of sellers with surpluses of their term contracts or from merchant plants. The spot price is fixed every hour and is the maximum variable cost of the generating units that generate at that corresponding hour, taking into account the power system loss factor. For each spot price there is a price for each node in the transmission grid. Each generator sells its energy to the market operator at the node in which it is connected to the grid and at the price corresponding to that node. Consumers pay the spot price for all the energy they consume in excess of their term contracts, including related losses. The difference between the spot market price for energy and the actual variable operating cost for each generating unit provides a premium for all units that are dispatched except for the marginal units. This premium contributes to meeting the fixed costs of these units, and is higher for units with relatively low variable costs. This payment system thus provides an incentive for investment in technologies with low variable costs and correspondingly high fixed costs, which favors units designed for base load operation. A capacity adjustment market supports the other markets by enabling buyers and sellers to trade surpluses and shortfalls in their contractual commitments in a pool. Prices for ancillary services are also determined by market rules.

Source: Fundación Solar 2002.

In small power systems, some degree of vertical unbundling is likely to improve services and lower costs.

This is because vertical unbundling helps the regulation of power service providers and even the introduction of competitive pressures in the generation and supply markets (see below: Types of Vertical Unbundling). Unbundling of accounts, staff, and management among the main functions in the supply chain should be the first step in this case, because it would provide better information about costs, increase the transparency of price setting, and help benchmark costs and service standards.

Forming power trade areas with neighboring countries and unbundling to the extent that makes sense in the larger regional power market is an option for small power systems.

This trend is noticeable around the world with the Southern Africa Power Pool (O'Leary, Charpentier, and Minogue 1998) and in Central America (Tomiak and Millán 2002), and the nascent regional power markets being developed in southeastern Europe (Kennedy and Besant-Jones 2004), East Africa, West Africa, and the Mekong region (Yu 2003). Similar groupings are emerging among Indian states and Chinese provinces (Berrah, Lamech, and Zhao 2001). Regional trade can only develop successfully under liberalized arrangements when the domestic power sectors of the trading partners are subject to sound governance.

Types of Vertical Unbundling

TYPE OF SEPARATION	DESCRIPTION	EFFECT ON INCENTIVES TO DISCRIMINATE	EFFECT ON ABILITY TO DISCRIMINATE
Accounting	The preparation of separate accounts on a defined basis for specific functions or services.	None	Very little without effective regulatory oversight
Functional	Separation of different services into different divisions of the same firm, possibly with different management and information systems, and with prohibitions on the flow of business-sensitive information between them.	None	Very little without effective regulatory oversight
Corporate	The separation of different services into different corporations, although owned by the same company.	None	Very little without effective regulatory oversight
Joint ownership	Each competitive firm owns a share in the noncompetitive agency.	None for newcomers; eliminates for incumbents	Some, but requires regulatory oversight
Operational	Putting the operation—but not the ownership—of the noncompetitive component under the control of an independent entity.	None	Some, but requires regulatory oversight
Ownership	Separate owners of the competitive and noncompetitive components.	Eliminates	Some

Source: Van Sicklen 2000.

Experience with Independent Power Producers

Independent power producers (IPPs) can help launch the reform process by showing the benefits of private investment and management. They are often the first private investors in a power market dominated by state-owned power utilities, and they can enter the wholesale power market under any of the market structures discussed above.

In many developing countries IPPs have generally sold their output to the state-owned utility acting as a purchasing agency–single buyer on the basis of a long-term PPA with a state-backed guarantee for the off-taking utility's performance. IPPs have spread across the developing world (World Bank 2003a) and are operating in more than 60 countries. Reviews of experience with IPPs have been published for many of these countries (Reviews of experience with IPPs have been published for the following countries: Argentina (Núñez-Luna and Woodhouse 2005), China (Woo 2005a), Egypt (Eberhard and Gratwick 2005a), India (Lamb 2005), Kenya (Eberhard and Gratwick 2005b), Malaysia (Rector 2005), Mexico (Núñez-Luna 2005), Pakistan (Fraser 2005), the Philippines (Woodhouse 2005b), Poland (House 2004), Thailand (Woo 2005b), and Turkey (Cakarel and House 2004).) These reviews complement general reviews of experience with IPPs in developing countries (International Finance Corporation 1999; Lefevre and Todoc 2000; Woodhouse 2005a).

Impact of Independent Power Producers

IPPs have provided timely and cost-effective solutions to chronic supply shortages in some countries under appropriately structured contracts.

They have mobilized financing and added supply capacity where governments had little alternative. Where IPPs signed long-term PPAs, they generally accepted construction and operating risks. In many cases, they shared fuel availability risk with fuel suppliers, either by signing an agreement with a fuel supplier who acts as a third party to the project, or by transferring equity in the project company to the fuel supplier. IPPs are generally insulated under the terms of their PPAs against demand risk through take-or-pay provisions, dispatch risk, price risk, and exchange rate risk (Roseman and Malhotra 1996).

The cost of power produced by IPPs can be competitive with the cost of power from new plants constructed and operated by state-owned power utilities.

This finding applies to IPPs that have freedom over plant specification, procurement, construction, and operation under competitive bidding. The comparison allows for differences in generating technologies used by IPPs and incumbent power utilities (IPPs have generally built gas-fired combined cycle gas turbines under commercial incentives to manage their investment risks, whereas power utilities have adhered to older but familiar generation technologies, such as coal-fired steam turbines or hydropower. Combined cycle plants have lower capital costs, shorter construction periods and generally higher fuel costs than the older generation technologies.) It also allows for differences in cost of capital, with IPPs at a disadvantage to state-owned utilities backed by their governments in this respect.

IPPs expect to offset their higher cost of capital by better control of construction and operating costs.

Their cost of capital is heavily influenced by country and technical risks faced by their investments under the project financing arrangements used by IPPs to develop their projects. International rating agencies have developed comprehensive methodologies for assessing these risks as guidance to the financiers of the high proportion of debt capital that is usually used in these projects (Rigby 1999).

Prices for power from the first IPPs in countries have tended to be higher than from subsequent IPPs.

High prices from the first IPPs reflected the high risk associated with pioneering investments in sectors new to private capital where the business climate and regulatory environments were highly uncertain. Subsequently, prices fell as developers and equipment suppliers competed for business following the initial success of the early entrants.

Successful investments for IPPs cannot ensure, and may even impede, attempts to produce good sector-level outcomes. In some countries (Pakistan and the Philippines, for example) the success of IPPs in reducing power shortages also relieved pressure on leadership and policy makers for needed reforms. Some countries that opened their power sector to IPPs in response to capacity shortages were slow or weak in reforming the transmission and distribution subsectors, resulting in downstream bottlenecks to fully utilizing the new generation capacity. In Pakistan, the failure to address downstream reform and capacity provision, coupled with weak system planning, resulted in under-utilization of the IPP capacity even as demand remained unmet (World Bank 2003b).

High PPA prices (in local currency terms) under IPP contracts with "take or pay" provisions impede moves toward competitive power markets. Many of the early PPAs in developing countries were structured as full "take-or-pay" agreements under which the purchaser is obliged to pay for a contracted minimum output even if the amount that is actually used is less than this minimum level. The prices that emerge from a liberalized wholesale power market are likely to undercut these PPA prices, and the difference between these prices become stranded costs that are have to be absorbed under the restructuring of a power utility (Woolf and Halpern 2001). One way to avoid stranded costs would be to renegotiate more flexible off-take terms to PPAs, such as providing in the PPA for the possibility of revising the power purchase terms once the project debt is paid off. If stranded costs are unavoidable, a state-backed special purpose financial entity could take over the off-take commitments with IPPs and then recover at least a part of the stranded costs through a retail tariff surcharge. Policy makers and regulators should anticipate this eventuality by insisting that PPAs contain provisions for assignment of obligations.

The cumulative obligations to purchase power from IPPs exposed power utilities in many countries to serious financial risks.

These obligations strained the already precarious financial condition of some Asian power utilities as a result of the 1997 Asian financial crisis, as happened in Indonesia, Pakistan, and Philippines. The utilities were obliged to continue payments to IPPs under the PPAs for energy that they did not need when retail sales fell below forecast levels, and their governments prevented them from raising their retail power tariffs to cover increases in power purchase costs in local currency terms under PPAs following currency devaluations (Gray and Schuster 1998). When some Asian and Latin American countries experienced substantial currency devaluations, the cost of power from IPPs in local currency terms rose to unaffordable levels under PPA prices denominated largely in U.S. dollar terms, as occurred in Argentina and Brazil (Gray and Irwin 2003).

The risk exposure of utilities that are off-takers for many contracts with IPPs depends on how these risks are structured. In some cases, the utilities have taken on substantial risks, whereas in other cases, the utilities are much less exposed to risks beyond their control. This difference is illustrated below in table 8 for four Asian countries (Indonesia, Malaysia, the Philippines, and Thailand) that have followed the IPP route to reform. The results show a wide difference in risk exposure just among these four countries. The Philippines has the greatest overall exposure, with a high rating for all five exposure indicators, which is creating enormous problems. Indonesia also has a high overall exposure, with a high rating for four indicators, whereas Thailand has a moderately low overall exposure, with a high rating for two indicators, and Malaysia has a low overall exposure, with a high rating for only one indicator.

TABLE 8. Risk Exposure to the Impact of IPP Costs in Four Southeast Asian Countries

SOURCE OF RISK EXPOSURE	INDONESIA	MALAYSIA	PHILIPPINES	THAILAND
IPP capacity in operation in mid-2000 (MW) (high if the fuel is imported)	2,329	7,121	3,676	2,419
Exchange rate exposure through origin of fuel supply (high if the currency is denominated in U.S. dollars or another hard currency)	Low	Low	High	High
Exposure to exchange rate through currency of wholesale tariff (high if the currency is denominated in U.S. dollars or other hard currency)	High	Low	High	Low
Exposure to exchange rate through foreign debt for project financing (high if the foreign debt made up more than 50% of project financing)	High	Low	High	Low
Exposure to market risk through proportion of domestic power needs supplied by IPPs (high if this proportion is over 50%)	High	High	High	Low
Exposure to off-taker payment problems through margin of retail tariffs over wholesale prices (high if this margin is less than US$0.03 per kWh for covering the costs of transmission, distribution, customer services, and system losses)	High	Low	High	Low

Source: Bacon and Besant-Jones 2002, adapted from Gray and Schuster 1998.

Institutions are important for supporting the credibility of government commitments to investment in power generation and infrastructure.

Differences in the level of policy credibility affect investors' choices of strategic safeguards. The level of policy credibility affects the efficacy of safeguards in the presence of a shock that strengthens political officials' incentives to behave opportunistically. This perspective complements the perspectives of power utilities and governments concerning the risk exposure that is faced by IPPs. The importance of political and regulatory institutions in shaping privatization outcomes is shown from empirical analysis of the experience with private power provision during the 1990s in Indonesia, Malaysia, the Philippines, and Thailand. These countries provide the conditions for this assessment, since all four countries followed the IPP route at roughly the same time and for roughly the same reason (see below: The Importance of Political Institutions: The Southeast Asian Experience).

Sophisticated political and regulatory risk mitigation strategies are important for investors.

Investors should choose the types of strategies that they think would be most effective in aligning governance with the institutional environment, given the extent to which the relevant institutions support credible commitments to private property rights. Regardless of the strategies chosen, investors in the two countries—the Philippines and Thailand—with the stronger institutions of these countries, received considerably better treatment following the crisis than did investors in Malaysia and Indonesia, despite the fact that the governments of all four countries faced strong incentives to engage in opportunistic behavior toward investors (Henisz and Zelner 2001).

Summary and recommendations:

1. *The pure single buyer model is one among many forms of centralized purchasing arrangements. Although a purchasing agency–single buyer structure is easier to implement than other market structures, it carries substantial risks for reform outcomes.*
2. *A purchasing agency–single buyer can be used as an interim stage for moving toward a competitive market model for wholesale power trade.*
3. *A purchasing agency–single buyer should not be given a legal monopoly on trade in wholesale power.*
4. *Small countries face similar problems to larger countries in reforming their power markets, but with greater intensity.*
5. *Small countries are also sensitive to the impact of large — mostly foreign — investors and developers in power generation and distribution.*
6. *The numerous countries whose power systems are too small for a competitive power market have intermediate reform options*
7. *In small power systems, some degree of vertical unbundling is likely to improve services and lower costs.*
8. *Forming power trade areas with neighboring countries and unbundling to the extent that makes sense in the larger regional power market is an option for small power systems.*
9. *Types of vertical unbundling affect incentives and ability to discriminate*
10. *Independent power producers (IPPs) can help launch the reform process by showing the benefits of private investment and management*
11. *IPPs have provided timely and cost-effective solutions to chronic supply shortages in some countries under appropriately structured contracts.*
12. *The cost of power produced by IPPs can be competitive with the cost of power from new plants constructed and operated by state-owned power utilities.*
13. *IPPs expect to offset their higher cost of capital by better control of construction and operating costs.*
14. *Prices for power from the first IPPs in countries have tended to be higher than from subsequent IPPs.*
15. *Successful investments for IPPs cannot ensure, and may even impede, attempts to produce good sector-level outcomes.*
16. *High PPA prices (in local currency terms) under IPP contracts with "take or pay" provisions impede moves toward competitive power markets.*
17. *The cumulative obligations to purchase power from IPPs exposed power utilities in many countries to serious financial risks.*
18. *The risk exposure of utilities that are off-takers for many contracts with IPPs depends on how these risks are structured*
19. *Institutions are important for supporting the credibility of government commitments to investment in power generation and infrastructure.*
20. *Sophisticated political and regulatory risk mitigation strategies are important for investors.*

The Importance of Political Institutions: The Southeast Asian Experience

The importance of political and regulatory institutions in shaping privatization outcomes is shown from empirical analysis of the experience of with private power provision during the 1990s in four countries in Southeast Asia.

These countries—Indonesia, Malaysia, the Philippines, and Thailand—provide a natural experiment for this assessment, since all four countries undertook electricity privatization at roughly the same time and for roughly the same reason. Additionally, although the details of individual country reform programs differed, all shared the common feature of using long-term PPAs with guaranteed off-take provisions to induce entry by private investors. Subsequently, the four countries experienced the same macroeconomic shock in the form of the 1997 East Asian financial crisis.

Foreign investors in the Philippines and Thailand chose to rely on contractual safeguards whose efficacy depended more heavily on credible ex post enforcement of private property rights by the government.

Since 1996, *Thailand* has operated under a new constitution that separates the branches of government and supports relatively rigorous democratic debate among multiple parties. At the time of the financial crisis, the dispersion of party affiliations in the lower house of the legislature meant that any new policy proposal or change in the status quo policy required the approval of multiple parties with their own competing interests. Further, Thailand had begun to develop an independent judiciary over the past decade, providing an additional institutional safeguard against abrogation or unilateral renegotiation of the contracts. In *the Philippines,* the government faced a razor-thin majority that relied upon the support of independents and other allies in both legislative chambers. The judiciary had also begun to play a more independent role.

Investors in Malaysia and Indonesia chose to rely more heavily on non-contractual safeguards whose efficacy was less dependent on the institutional environment.

This was because the level of institutional support for private property rights provided lower levels of credibility and safeguards for investors were considerably weaker in Indonesia and Malaysia than in the Philippines and Thailand. In *Malaysia,* despite the multiplicity of parties in parliament and the *de jure* independence of the courts, the ruling party controlled both the legislature and the judiciary. In *Indonesia,* the president controlled the legislature, and the judiciary was unable to exert any checks on the executive and legislative branches of government. Investors in these countries thus relied more heavily on local partnering and external enforcement by international financiers and multilateral agencies. Source: Henisz and Zelner 2001.

Sustainable Conditions for Independent Power Producers

The process for selecting IPPs is critical to obtaining benefits from them.

In many countries, the initial contracts with IPPs were concluded under nontransparent processes that attracted allegations of corruption and exposed these contracts to pressure for renegotiation that substantially reduced the investment returns for IPPs. A loss-sharing solution of lowering PPA rates in exchange for an extension of the PPA term has been the most common approach and successfully used in Guatemala, Pakistan, and Thailand. In a few cases, PPAs were cancelled or remained in dispute for years (India, Indonesia, and Tanzania), particularly where the off-take prices were extremely high by international standards for generation costs in U.S. dollar terms.

Much of this risk of renegotiation can be avoided by obliging IPPs to earn the right to enter into PPAs under a competitive bidding process.

The use of internationally acceptable bidding documents provides transparency to the process and thus sustainability to the agreement (K & M Engineering and Consulting Corporation 1994). Countries that engaged in transparent and competitive bidding processes for contracting with IPPs on the whole have got lower prices, especially in countries able to provide low-cost natural gas to IPPs (Bangladesh and Egypt), and more sustainable contracts than countries that adopted noncompetitive processes.

The failure of off-takers to honor their payments commitments to IPPs is an endemic risk in countries with generally poor governance and contract protection under the law. This usually arises when off-takers do not have sufficient revenues to meet these commitments because their retail tariffs are kept below supply costs by political pressure and a large proportion of their bills are not paid by consumers (the Dominican Republic), or because of a macroeconomic shock that resulted in a major devaluation of the local currency.

The incorporation of IPPs into a power market introduces some specific issues for system planning and operation. These issues include (a) how to ensure that power utilities and private producers have the incentive to trade power economically; (b) how to price a utility's bulk power purchases from private producers efficiently and in a way that gives these producers an incentive to develop capacity that can supply power at a lower resource cost than the utility's own cost of meeting the demand on its system; and (c) how to manage an orderly process for developing system capacity (APEC Secretariat 1997; Roxas 2001).

Long-term PPAs should be structured in a manner that is bankable by the IPPs, yet allows efficient use of plant output by the power system operator. This is a key issue for ensuring economic power trade with IPPs and enabling IPPs to finance the investment with large proportions of debt financing. A two-part price structure meets these criteria, under which one part is a periodic availability charge that covers all the costs covered by the PPA, except for fuel and variable O&M costs, which provides bankability. The second part covers fuel and variable O&M costs based on a rate that is applied to the actual amount of energy that is provided under the PPA, which provides the system operator with the correct price signals for dispatching IPP plants efficiently (The economically efficient amount of output taken from an IPP's plant is that which enables the demand on the power system to be met at least cost from all the power plants on the power system. A take-or-pay structure distorts this incentive by effectively imposing zero short-term marginal cost on the system for the amount of power covered by the take-or-pay provision, even if the variable cost of this power is higher than that of other plants on the system).

Access to the transmission network on transparent and equitable terms is a prerequisite for the sustainability of investments by IPPs and the efficient use of their generation capacity. This can be achieved credibly by forming an independent transmission entity that is regulated in accordance with these terms and is legally barred from cross-ownership with generators. Chile did this over concerns about abuse of market power after initially keeping transmission bundled with generation.

Power utilities should not risk overextending their financial capacity through long-term commitments under PPAs.

To avoid creating stranded costs for these utilities if the power market is subsequently opened to competition, these utilities should sign only a few PPAs before they are restructured. Hungary and Poland faced stranded cost issues with their single-buyer approach to contracting with IPPs, and so do such countries as India, Pakistan, and the Philippines. In Poland, the transmission company took on long-term PPAs with all the generating companies formed from restructuring the sector, but at prices that were later undercut by prices realized in the new competitive wholesale power market. In the other countries, the problem stemmed from arrears in payments by the stateowned utility to the IPPs caused by low retail tariffs and low collection of payments from power users.

A short- to medium-term PPA with an IPP to supply power from barge-mounted or skid-mounted (diesel engine power plant designs) generating units is an option to avert a costly shortage of power supply capacity. This capacity can be installed in fewer than six months from financial closure, and it requires far less investment than needed for a plant installed under long-term PPAs (Bacon 1995). The price of power under this alternative tends to be higher, however, than under a long-term PPA, because the generating units consume more fuel and the capital expenditures on these units have to be recovered over the short terms of their PPAs. The benefit of quick additions to supply, however, can be an advantageous tradeoff for the host country. This approach has been taken in Bangladesh, the Dominican Republic, Guatemala, Jamaica, Nigeria, and the Philippines.

Summary and recommendations:

1. *The process for selecting IPPs is critical to obtaining benefits from them.*
2. *Much of this risk of renegotiation can be avoided by obliging IPPs to earn the right to enter into PPAs under a competitive bidding process.*
3. *The failure of off-takers to honor their payments commitments to IPPs is an endemic risk in countries with generally poor governance and contract protection under the law.*
4. *The incorporation of IPPs into a power market introduces some specific issues for system planning and operation.*
5. *Long-term PPAs should be structured in a manner that is bankable by the IPPs, yet allows efficient use of plant output by the power system operator.*
6. *Access to the transmission network on transparent and equitable terms is a prerequisite for the sustainability of investments by IPPs and the efficient use of their generation capacity.*
7. *Power utilities should not risk overextending their financial capacity through long-term commitments under PPAs.*
8. *A short- to medium-term PPA with an IPP to supply power from barge-mounted or skid-mounted (diesel engine power plant designs) generating units is an option to avert a costly shortage of power supply*

The Role of Competition in Power Markets

Competition is introduced to power markets to achieve price reductions and improvements in electricity services.

Competitive power markets provide the dynamic pressure on service providers and power suppliers that is essential to achieving these benefits for power consumers and the country's economy. This dynamism is founded on the ease of entry to the power market by sufficient generators and independent power suppliers to control abuse of market power and to discourage collusion by incumbents.

Experience indicates that competitive arrangements can work in the mature power markets of OECD countries (Appendix 1). Competition in the power market and the reforms needed to introduce it, such as unbundling an integrated supply chain, private ownership, and mechanisms for power exchange, are not ends in themselves, but rather ways to achieve the broad reform goals.

The lessons of experience from countries that have successfully introduced competition to their power markets can be relevant to some developing countries in two respects (Besant-Jones 1996; Millán 1999; Wolfram 1999). First, competition offers a vision of a successful ultimate outcome, even when the conditions for attaining this state cannot be met from immediate reform efforts. Second, these lessons serve as warnings against attempting overly ambitious reforms in the unsuitable conditions for them found in most developing countries. Both viewpoints are examined in this section.

Characteristics of Competition in the Power Market

The concept of managed, or regulated, competition applies to the power market, rather than the economic ideal of atomistic competition without regulation. Competition can be developed in the power generation and supply service segments, but generally it is not feasible in the network segments (transmission, distribution, and system control) that are natural monopolies. Competition is more difficult to introduce in network industries than in other industries, and more difficult in electricity than in other networks.

As competition develops, the focus of regulation evolves from controlling prices and ensuring efficient provision of services to monitoring for abuse of market power and ensuring free and fair access to the transmission system.

Achieving this type of access regime requires regulatory intervention, as well as market structure interventions that maintain a strict separation between transmission, generation, and distribution activities. The quality of services provided by retail power suppliers (such as prices, service standards, and access) are regulated to help consumers benefit from competition among suppliers.

Power supply to large electricity users is an intrinsically competitive segment because the cost of competing for their business is small compared with the potential profits. Power supply to all but large electricity users is less likely to attract competition because the profits per customer are too small, unless the market has been become highly contestable and suppliers have to defend market shares (Consumers should be able to switch between suppliers at low cost, otherwise their original suppliers retain market power, even when these suppliers have only modest market shares.). This element of supply service has generally been carried out by the entity that distributes electricity to these users because both these functions serve the same market segments. Separate licenses are issued for the distribution ("wires") business—which has natural monopoly features—and power supply to facilitate regulation of the former and competition in the latter (The threshold level of customer demand at which the supply to meet it becomes competitive has been coming down, however, and full competition in the retail market has been introduced in England and Wales, the Nordic countries, and some parts of the United States (Texas/Pennsylvania/New Jersey/Maryland).). Hence the term supplier usually applies to a distributor that has a supply license, unless it applies to an independent power supplier.

The contestable form of competition is seldom sufficiently strong to force dominant wholesale power suppliers to pass on their efficiency gains by reducing their prices to consumers. Under weak competitive pressure, regulators are responsible for pressuring suppliers to do so (Newbery 2004). Contestability in this type of market is limited by the substantial sunk costs in generating plant involved in entering the market, and by the absence of second-hand markets for generating plant for exiting the market. The incumbent must be broken up to enable real competition in the market.

The social costs of private ownership could exceed the benefits under weak competitive conditions.

This situation could happen, for example, if competition were too weak to force producers to pass on cost reductions to consumers, as could happen under rapidly rising demand for power. This could also happen if consumer inertia blunts competitive forces by allowing producers and suppliers to earn excessively high profit margins that are paid in dividends, or dissipate efficiency gains in higher marketing costs, wages, and directors' remuneration (Newbery 2004).

State-owned enterprises will weaken competition in a power market by forcing out more efficient private competitors where both are present. This is because state-owned enterprises can borrow at the much lower rates than private investors can—and even as low as risk-free government bond rates (This position also reflects the philosophy underpinning centrally planned economies that the interests of state-owned enterprises are identical to the public interest, and so competition among them is wasteful.). Protection from the threat of takeover or bankruptcy bestowed by state ownership, however, reduces their incentives for efficiency and so may dissipate their lower apparent capital costs. In this situation, competition among state-owned service providers becomes weak or nonexistent (Newbery 2004). China's experiment with competition in the wholesale power market illustrates this tendency (see below: China's Experiment with Competition in the Wholesale Power Market)

Private ownership works best when subject to competitive pressures (Zhang, Parker, and Kirkpatrick 2002). Private ownership provides the diversity of ownership needed for real competition—including investment in new capacity— because private owners respond better than public sector managers to the commercial incentives that drive competitive behavior. Privatization and competition are therefore related elements of power market reform. One of these elements is usually given priority over the other for the reform strategy because there is a tradeoff between ease of privatization and of introducing competition.

If competition is the priority, privatization can become more difficult. Constant post-privatization vigilance is needed to prevent the privatized entities from anticompetitive behavior through acquisition of holdings and mergers. Cross-ownership between generating and distributing companies (especially when the wires business and supply business are bundled together) must be severely limited from the beginning and guarded against after privatization, so that these generators cannot prevent other generators from accessing power users through the distribution networks. When distribution is unbundled into supply and wires business, some cross-ownership between generation and the supply business may be tolerable. In a competitive model of this kind, the generating plants have to take full market risk, and distributing utilities have to face uncertainty over the terms of power supply. Under such conditions, the investors have more difficulty accessing long-term debt at reasonable costs, which causes privatization to become somewhat more difficult.

Since ease of privatization is the priority in many developing countries, restructuring of the power supply should focus on managing investment risks for private investors. Competition in the power market is not consumer inertia blunts competitive forces by allowing producers and suppliers to earn excessively high profit margins that are paid in dividends, or dissipate efficiency gains in higher marketing costs, wages, and directors' remuneration (Newbery 2004).

State-owned enterprises will weaken competition in a power market by forcing out more efficient private competitors where both are present. This is because state-owned enterprises can borrow at the much lower rates than private investors can—and even as low as risk-free government bond rates. Protection from the threat of takeover or bankruptcy bestowed by state ownership, however, reduces their incentives for efficiency and so may dissipate their lower apparent capital costs. In this situation, competition among state-owned service providers becomes weak or nonexistent (Newbery 2004). China's experiment with competition in the wholesale power market illustrates this tendency (see below: China's Experiment with Competition in the Wholesale Power Market).

Once most of the power supply industry has passed into private ownership and is exposed to competitive forces, oversight of the market becomes critical to the sustainability of the reform. However, when conditions that make competition possible, cease to exist, or prove to be inadequate, market interventions are clearly legitimate within the spirit of the new regulatory framework. This has been the rule, rather than the exception, in competitive power markets worldwide (Ayala and Millán 2002).

• Private participation will not automatically induce competitive behavior in a network industry, such as electricity supply that requires substantial coordination of producers, which inclines participants toward cooperation and collusion. Good regulation and antitrust enforcement are therefore required to support this form of competition.

• The private owners may carry out further restructuring to reduce market risks with moves to recombine some generation capacity with some distribution capacity, as in some OECD countries, or they may sell their stakes to other private parties under realignment of their investment strategies, as in Brazil. These tendencies require careful antimonopoly regulation to maintain competitive pressures on power producers and suppliers.

• When unexpectedly large profits by the new private producers and suppliers arouse public hostility to the reforms, they may provoke the regulator into making unscheduled price reviews or the government into considering a windfall tax on these profits (as happened in England and Wales).

• Strong pressure to increase retail tariffs caused by unanticipated large currency devaluations can lead to demands from the utility for reductions in the off-take prices under PPAs with IPPs, as in the case of some Asian countries following their financial crisis in 1998, and also in Argentina and Brazil.

China's Experiment with Competition in the Wholesale Power Market

Beginning with the economic reform which started in 1978, market and competition were slowly introduced into the national economy. The transition from a centrally planned economy to a market economy was a long process because China adopted a gradual approach to reforming. Competition in the electricity industry was particularly late because it was deemed a vital sector that needed to be controlled by the state. It was also because of prevalent capacity shortage to meet surging demand. Competition in the electricity industry first started in 1999 on a limited experimental basis. The direct cause was a sudden turnaround of the power market from chronic shortage to widespread surplus. Six Chinese provinces were chosen for this experiment. The experimental competitive market followed the old England and Wales power pool model. Each province selected its 12 largest independent power producers to compete for a part of the provincial demand. The bulk of the power demand continued to be met by allocated dispatch according to central plans. These producers were free to decide each day whether to compete or not. Simulation of the competition began in July 2000, with no actual financial settlement. The experiment was short-lived in all six provinces for two main reasons. The first reason was the absorption of surplus generating supply when power demand picked up in 2001 because of unanticipated economic growth. The second reason was the central government's influence on who could compete in favor of incumbent integrated power utilities. Source: Zhang 2003

Summary and recommendations:

1. *Competition is introduced to power markets to achieve price reductions and improvements in electricity services.*
2. *The lessons of experience from countries that have successfully introduced competition to their power markets can be relevant to some developing countries in two respects - competition offers a vision of a successful ultimate outcome, even when the conditions for attaining this state cannot be met from immediate reform efforts and these lessons serve as warnings against attempting overly ambitious reforms in the unsuitable conditions for them found in most developing countries.*
3. *The concept of managed, or regulated, competition applies to the power market, rather than the economic ideal of atomistic competition without regulation.*
4. *As competition develops, the focus of regulation evolves from controlling prices and ensuring efficient provision of services to monitoring for abuse of market power and ensuring free and fair access to the transmission system.*
5. *Power supply to large electricity users is an intrinsically competitive segment because the cost of competing for their business is small compared with the potential profits.*
6. *The contestable form of competition is seldom sufficiently strong to force dominant wholesale power suppliers to pass on their efficiency gains by reducing their prices to consumers.*
7. *The social costs of private ownership could exceed the benefits under weak competitive conditions.*
8. *State-owned enterprises will weaken competition in a power market by forcing out more efficient private competitors where both are present*
9. *Private ownership works best when subject to competitive pressures*
10. *If competition is the priority, privatization can become more difficult*
11. *Since ease of privatization is the priority in many developing countries, restructuring of the power supply should focus on managing investment risks for private investors*
12. *State-owned enterprises will weaken competition in a power market by forcing out more efficient private competitors where both are present*
13. *Once most of the power supply industry has passed into private ownership and is exposed to competitive forces, oversight of the market becomes critical to the sustainability of the reform.*

Wholesale Power Trade

Bilateral trading and organized power exchanges are the main market designs that have emerged for competitive trade in wholesale power. In a gross power pool, generators have to sell all their electrical energy into an organized exchange (Some national power markets (Belgium, France, Ireland) include trade in power capacity as well as energy, while regional trade in power is conducted via auctions for inter-connector capacity between power markets where demand for this capacity exceeds the available amount (increasingly in Europe, such as the undersea connector between England and France). In a net power pool most—typically over 90 percent—of the trade is conducted under bilateral arrangements, under which generators sell power to power retailers (including distribution companies) that sell power to end users, power marketers (traders that deal with other traders and retailers), and large end users of electricity.

A net power pool also has an organized power exchange to eliminate imbalances between supply and demand at the margin on the system. In a simpler form the system operator appoints a generator to increase or reduce its power production, as necessary, to keep supply in balance with demand on the system. Such a balancing arrangement is needed because a group of bilateral contracts will not match total supply precisely with the constantly changing total demand for electricity in the market, especially in the presence of transmission constraints on power flows from power generation plants to load centers.

Bilateral trading is the most common successor to a single buyer once the basic requirements for competition in the market are met. Electricity distributors, independent power suppliers, and large consumers buy from generators based on a set of market rules according to production costs, subject to the approval of contract terms by the market regulator. A form of this model is used in the current England and Wales power market, which uses a sophisticated arrangement for balancing supply with demand by which producers, suppliers and buyers trade at spot prices to balance their needs (see the glossary). It should start once merit-order dispatch of generators is established, metering to measure the energy traded under these contracts is in place, and settlement arrangements are in force, as well as any stranded cost issues associated with PPAs are resolved.

Traders are exposed to different risks under bilateral trading in net power pools from trading in gross power pools. Under bilateral trading, settlement for the contracted power is also carried out bilaterally, and each distributor is financially responsible for its own contracts. Only the value of the power sold for the balancing pool passes through wholesale market settlement procedures. This means that under bilateral contracts, generators are individually exposed to the risk of nonpayment by distributors, and so generators are concerned about the creditworthiness of the distributors that purchase their output. Gross power pools, on the other hand, relieve generators of this specific exposure by centralizing this risk, although this increases the incentive for payment delinquency by distributors (“free riding”).

A power pool based on price bidding with risk-hedging mechanisms in short- and long-term forward markets is the nearest design to pure competition in a power market. Most pools use an auction system to form prices based on bids from buyers and sellers in the market, and they work with the system operator to ensure the reliability of physical delivery of power. Power pools that offer a wider range of services, such as clearing services to provide financial security for transactions and ancillary services required to manage the power system, allow progressively more competition in the market (Barker, Tenenbaum, and Woolf 1997). Power pools based on price bidding are found in Australia, Scandinavia, Spain, and some states in the United States. The California experience with a price-bidding power pool offers many useful lessons for countries considering this type of power market (the appendix). The cost-based bidding approach used by South American countries allows competition for market share based on auditable costs of generators that give incentives to producers to reduce their costs.

A major concern about power pools is whether some form of regulatory intervention is needed in order to avoid serious shortages of power generation capacity. Underinvestment in generation capacity can arise under uncertainty about the future level of demand in a power pool, as well as investment risks arising from deficiencies in a country's investment climate (Finona, Johansen, and Midttun 2004). Capacity contracts can be used (as in Guatemala—see below: Example of a Small Competitive Wholesale Power Market in Guatemala), but this type of market should be designed carefully to be effective (von der Fehr 2002). Regulatory interventions include capacity payments and can be supported by structural measures that reduce investment risks, such as bilateral trading and forward hedging, as well as limited cross-ownership between the generation and distribution segments of the power market that can be monitored for abuse of market power. Regulators have to contend with the difficulty of setting a level for capacity payments that leads to economically efficient investment in generating capacity (Oren 2003; Turvey 2003). Energy rationing is the ultimate recourse in the case of a long-term shortage of capacity or energy (for more than one year, as can happen in hydropower systems through droughts). The Brazilian experience with energy rationing is interesting (Maurer, Pereira and Rosenblatt 2005).

The power supply industry is highly susceptible to the exercise of unilateral market power because it possesses product characteristics that enhance the ability of suppliers to exercise this power. This paragraph, and the following paragraphs on problems with market power and regulatory oversight of competitive markets, draws on Wolak, 2005. The main characteristic is the difficulty of balancing supply with demand for electricity at every instant in time and at every location of the network because of many factors. One of these factors is the inability to store electricity. Another is the technical constraints on generation capacity for temporarily increasing production. An additional technical constraint is imposed by congestion in the transmission network. A further factor is the inelasticity of power demand to wholesale electricity prices because of the way that power consumption is metered and charged. Moreover, power suppliers often possess local market power regardless of the congestion management protocols used in the power market as a whole when they are shielded by transmission constraints from sufficient competition to discipline their bidding behavior into the market. These constraints are common in newly established competitive power markets because transmission networks were configured for a different pattern of power flows under the former vertically integrated industry structure.

Competition or antitrust policy as it is applied to other industries may be insufficient to protect electricity consumers. The past two decades of international experience with wholesale electricity markets has shown the significant harm to power consumers that can result from firms simply engaging in unilateral profit maximizing behavior given the actions of their competitors. Unlike other product markets, coordinated actions among suppliers or the concentration of production capacity in the hands of small number of firms is unnecessary for electricity suppliers to raise prices substantially above competitive levels. Some wholesale electricity markets have had severe market power problems even though they had Herfindahl-Hirschman Index values that would not raise concerns about market power in other industries. Consequently, the relevant competition authorities have not been able to find conclusive evidence of coordinated actions among suppliers to raise prices in violation of the competition or antitrust law during these market power episodes.

In a competitive power market, a combination of regulatory oversight and competition law is needed to provide consumers with the protection from market power that conventional competition law provides in markets for other products. In the case of electricity, an industry specific regulator endowed with a pre-specified set of responsibilities is necessary to react to unanticipated events because unilateral market power problems can be extremely difficult to predict. Even small market design flaws that cause little harm during most system conditions can lead to substantial consumer harm when the load on the power system approaches the limit of the system's supply capacity. Clearly specified regulatory safeguards tailored to the electricity supply industry are needed to prevent the harmful exercise of unilateral market power before it can occur, and to rapidly implement remedies if it does occur.

Restructuring the generation sector for a competitive wholesale market should focus on control of market power while allowing investors to manage their risks efficiently, such as by forward hedging of contracts in the market. The selected structure created considerable market power even in some large industrial countries (such as Spain) where several approximately equal-sized private generators could have been created. Experience in the early years of the England and Wales competitive power market indicates that no entity should operate or control more than 20–25 percent of total generation capacity in this type of market. Thus the size of the power system should be able to accommodate at least four or five generation companies, as well as, have the appropriate economic characteristics. These characteristics are (a) the technological mix used in generation (competitive generation is more practicable without a large proportion of nuclear power or hydropower), and (b) the extent of power system interconnection, with competitive reform being more practicable where load centers are interconnected (including interconnection with power networks of neighboring countries).

Some Latin American countries have adopted measures to control market power in competitive power markets *(see below: table 9).* Argentina deliberately designed the reform so that no firm could have more than 15 percent of the market, and Brazil and Colombia also kept down concentration of ownership. Chile (where one firm has 60 percent of its market) has a very high ownership concentration. Bolivia and Peru are small countries with relatively few generating plants that managed to avoid creating high levels of market power (Bacon and Besant-Jones 2002).

TABLE 9. Market Concentration in Selected Latin American Power Markets, 1998

	NUMBER OF GENERATORS	LARGEST MARKET SHARE (%)	HERFINDAHL-HIRSCHMAN INDEX[a]	EQUIVALENT NO. EQUAL-SIZED FIRMS
Argentina	38	14	0.06	16.7
Bolivia	6	26	0.19	5.2
Brazil	14	25	0.15	6.7
Chile (main system)	4	60	0.43	2.3
Colombia	26	24	0.14	7.1
Peru (main system)	8	35	0.23	4.3

a. The Herfindahl-Hirschman Index is defined as $\sum(Si)^2$, where Si is the share in the market of the capacity of the *i*th firm. The index varies from unity for a monopoly toward zero for perfect competition (a very large number of equal-sized firms).

Source: Bacon and Besant-Jones 2002, based on data from Berrah, Lamech, and Zhao 2001.

The primary goal of the regulatory process in competitive power markets should be to prevent market participant behavior that significantly degrades system reliability and market efficiency. The regulatory process should ensure that the conditions necessary for vigorous competition exist and to limit the economic harm associated with the exercise of unilateral market power when they do not exist. Regulators cannot prevent firms from exercising unilateral market power. In fact, markets function most efficiently when suppliers have high-powered incentives to exercise all available unilateral market power provided that there are few barriers to entry to the market. Regulatory mechanisms that attempt to prevent all exercise of unilateral market power can introduce market inefficiencies that cause more economic harm than the market power they are attempting to prevent.

The regulator should have access to all information needed to analyze the behavior of market participants. The regulator should be able to replicate market clearing prices and quantities, given the bids submitted by market participants, total demand, and other information about system conditions. This is necessary for the regulator to verify that the market is operated in a manner consistent with the market rules. In addition, all data submitted to the real-time market and produced by the system operator should be immediately released to the public to help system reliability. In a bilateral trading system (net power pool), the real-time market should handle little energy trade because it is operated primarily for reliability reasons, and all market participants have a common interest in the reliability of the transmission network. The regulator's access to data submitted to the system operator by market participants or produced by the system operator should not be limited. The regulator should also have the ability to request information from market participants on a confidential basis to perform further analyses.

The institutional arrangements for market operation are important for developing a competitive wholesale power market. Appropriate regulatory tools—including grid codes, access rules, and commercial tools for the operation of the transmission system—should be established before competitive power trading arrangements are introduced (Arizu, Dunn, and Tenenbaum 2002). Responsibility for control of power system dispatch and administration of power trading arrangements should be placed in an entity beyond the control of competing sellers and purchasers of electricity. This responsibility could be given to the transmission company, especially when it is state-owned and so not under the control of private traders in the market. This arrangement provides a practical solution in the weak institutional and financial environments found in many developing countries. Separate licenses should be issued for transmission system operation and market operation to allow market operation to be spun off into a separate entity if, for example, government later decides to allow private shareholding in the transmission entity or the regulator becomes concerned about the manner in which the transmission system operator is managing market operation. A separate entity for market operation is found in some OECD countries. In the United States, many transmission networks are owned by investor owned utilities that also buy and sell power in the wholesale power market. In England and Wales the transmission entity is a separate privately owned corporation.

The governance of a separate power system operator should be kept independent of the market participants.

This lesson is reinforced by the Californian experience (Besant-Jones and Tenenbaum 2001). This independence can be achieved by prohibiting market participants from having any ownership in the system operator and requiring that the system operator's governing board is composed of non market participants. If governance boards are composed of market participants, however, they should not be too large or dominated by one or more classes of market participants. The system operator should monitor markets carefully and continuously for signs of trouble—such as unusual price movements that may indicate abuse of market power—and have the authority to penalize those who violate market rules.

Example of a Small Competitive Wholesale Power Market in Guatemala

The Guatemalan wholesale electricity market is formed by a spot market and a contract market in which energy and capacity are traded as distinct products in both markets. In the spot market, hourly energy prices are determined by the least-cost ranking of available resources, as established from incremental cost information submitted by thermal plant operators, from the value of water bids submitted by hydro plant operators, and from demand-side schedules allowing disconnection of load at certain spot market prices. Spot capacity prices are likewise determined by matching supply-side offers and demand requirements. There are more than 100 participants in the wholesale market, which has exhibited considerable dynamism since its inception. Total installed generating capacity in the market totaled 1,875 MW in 2002. Although the market is concentrated in absolute terms, barriers to entry of new operators do not appear to be high with the possible—and important—exception of hydro producers. All distribution companies must supply their regulated customers through long-term contracts with generators. Rates are regulated under a price cap system, whereby the noncompetitive cost elements, such as the use of wires and transmission equipment, are set every five years in accordance with efficiency standards and adjusted periodically for inflation and other factors. Energy and capacity prices are passed through to the final consumers and adjusted every three months in accordance with the terms of the contracts. Unregulated large consumers are not required to have a capacity contract, and can contract directly from generators or marketers or buy from the spot market. The contract market offers a variety of standard contract types that accommodate bundling of energy and capacity, price certainty, and other characteristics. Four types of supply contracts are offered: (a) differences in load curve contracts, (b) capacity contracts without associated energy, (c) capacity contracts with associated energy, and (d) demand shortfall difference contracts. Capacity reserve contracts between generators are also possible. Take-or-pay contracts are not permitted. In the spot market, each buyer can buy from the pool of sellers with surpluses of their term contracts or from merchant plants. The spot price is fixed every hour and is the maximum variable cost of the generating units that generate at that corresponding hour, taking into account the power system loss factor. For each spot price there is a price for each node in the transmission grid. Each generator sells its energy to the market operator at the node in which it is connected to the grid and at the price corresponding to that node. Consumers pay the spot price for all the energy they consume in excess of their term contracts, including related losses. The difference between the spot market price for energy and the actual variable operating cost for each generating unit provides a premium for all units that are dispatched except for the marginal units. This premium contributes to meeting the fixed costs of these units, and is higher for units with relatively low variable costs. This payment system thus provides an incentive for investment in technologies with low variable costs and correspondingly high fixed costs, which favors units designed for base load operation. A capacity adjustment market supports the other markets by enabling buyers and sellers to trade surpluses and shortfalls in their contractual commitments in a pool. Prices for ancillary services are also determined by market rules. Source: Fundación Solar 2002.

Summary and recommendations:

1. ***Bilateral trading and organized power exchanges are the main market designs that have emerged for competitive trade in wholesale power.***
2. ***Bilateral trading is the most common successor to a single buyer once the basic requirements for competition in the market are met.***
3. ***Traders are exposed to different risks under bilateral trading in net power pools from trading in gross power pools.***
4. ***A power pool based on price bidding with risk-hedging mechanisms in short- and long-term forward markets is the nearest design to pure competition in a power market.***
5. ***A major concern about power pools is whether some form of regulatory intervention is needed in order to avoid serious shortages of power generation capacity.***
6. ***The power supply industry is highly susceptible to the exercise of unilateral market power because it possesses product characteristics that enhance the ability of suppliers to exercise this power.***
7. ***Competition or antitrust policy as it is applied to other industries may be insufficient to protect electricity consumers***
8. ***In a competitive power market, a combination of regulatory oversight and competition law is needed to provide consumers with the protection from market power that conventional competition law provides in markets for other products***
9. ***Restructuring the generation sector for a competitive wholesale market should focus on control of market power while allowing investors to manage their risks efficiently, such as by forward hedging of contracts in the market.***
10. ***The primary goal of the regulatory process in competitive power markets should be to prevent market participant behavior that significantly degrades system reliability and market efficiency***
11. ***The regulator should have access to all information needed to analyze the behavior of market participants.***
12. ***The institutional arrangements for market operation are important for developing a competitive wholesale power market.***
13. ***The governance of a separate power system operator should be kept independent of the market participants.***

Competition in the Power Markets of Developing Countries

Competitive power markets have been developed successfully in some Latin American countries, but tried unsuccessfully in other countries. Some countries in the latter category have been reluctant to provide nondiscriminatory or even regulated third party access to their distribution services, even to large consumers.

In Poland such access is not available for the import of power from abroad. In Hungary such access is available only if the buyer buys at least 50 percent of annual needs from domestic generators. In Ukraine a competitive pool never functioned as intended because it was introduced prematurely in an environment of extensive non-payment and reluctance by government to let retail prices move up or down with wholesale market prices.

A shortage of real competitors is a major obstacle to developing competition in the power markets of most developing countries. This is because of the small sizes of these markets with limited scope for international trade. It is also because of the difficulty in attracting new entrants to an industry characterized by high sunk costs in investments with virtually no alternative economic uses and in countries with inefficient financial sectors, lack of credibility of institutions, and weak enforcement of laws. A key issue for competition policy is the rate of return that will attract the optimal level of investment. In most developing countries, however, this issue can be resolved more easily through concession contracts with regulated prices than with competition in power markets (Beato and Laffont 2002). Such concessions are in fact widely used in both power generations—with IPPs and distribution—as in Latin America.

Liberalization of fuel markets is an essential requirement for the development of competition among power generators. This requirement is often overlooked, even though fuel costs are a critical area for competition among generators, since these costs amount to at least 60 percent of the total costs of thermal power generation. Fuel costs and availability of fuel types (coal, natural gas, and liquid fuels) and specifications for each type (in regard to energy content and contaminants) not only affect operating costs directly, but also affect choices of plant types by investors. The greater the options for fuel choice, the greater are the potential for competition among investors in the power generation market. In many developing countries, fuel markets are tightly controlled under state-owned monopolies that usually produce a limited range of fuel products under rigidly controlled prices, and they struggle to meet even existing levels of domestic demand. They are likely to favor their contracts to supply state-owned power generators in this situation. IPPs often gain specific import rights for their fuel requirements in these circumstances. Governments have to choose between protecting these monopolists and allowing competition to flourish in their wholesale power markets. This was the case in Panama at the time of privatization of power generation and distribution assets, when the government allowed private generators to bypass the monopoly seller of oil products in the country to obtain fuels on a competitive basis (Rufin 2002).

In summary, only limited competition can work in the power markets of most developing countries for the following reasons:

• ***Insufficient power generating capacity to cover fast growing power demand***—including demand for access to electricity supply from currently unconnected households, because the development of competition requires adequate supply capacity to meet all segments (base, peak, and shoulder) of the load on the power system. This concern applies even to effective demand after allowing for the impact of below-cost tariffs and nonpayment of electricity bills by users.

• ***Many existing markets are too small*** to support the number of viable sellers and purchasers needed for full competition in the market.

• ***Lack of diversity in fuel supply markets*** needed for competition among power generators.

• ***Inadequate development of the power transmission system and power system control system*** necessary for managing the complex pattern of power flows in a competitive market.

• ***The insolvency of most power utilities*** that prevents them from paying their suppliers in full and which deters IPPs from developing large power projects.

• ***Domestic capital markets are too undeveloped*** to provide financing on the scale and terms needed for investment in supply capacity.

• ***Difficulty in controlling abuse of market power*** if generators and suppliers are allowed to charge market-based prices. Market power in a mixed hydropower and thermal power system is generally more difficult to control than in an all-thermal power system. García and Arbeláez 2002 discuss Colombia's example of pertaining to this problem. Panama and Chile have retained centralized models of their power systems to determine the optimal dispatch of their hydroelectric capacity (Walker and Benavides 2002).

• ***Policy makers have limited tolerance for the substantial price volatility*** that occurs with competition in the market.

• ***Lack of respect for property rights and obligations under contracts,*** notably keeping to merit order of dispatch of generating capacity and to agreements on tariff revisions.

• ***Also lacking is the availability of the legal infrastructure for dispute resolution*** in a rapid, fair, and competent manner, and mechanisms to enforce court decisions and property rights through courts and arbitration.

The general absence of the necessary conditions for open competition in power markets in developing countries indicates that competition should be introduced gradually to the wholesale power trade in these countries. This could be done by the following means: (a) generation capacity is distributed among many owners; (b) open access to transmission and distribution networks is provided to third parties; allowing multi-buyer trading on a bilateral basis between generators and distributors and other parties, instead of trading through a single buyer of wholesale power; (c) the system operator represents the interests of all wholesale market participants without being under undue influence of any group of participants when dispatching system supply capacity; and (d) distributors pay generators fully and promptly and, in turn, generators pay their fuel suppliers fully and promptly, preferably on liberalized fuel markets that enable generators to reduce their fuel costs.

Under weak regulatory capacity for monitoring and preventing abuse of market power, simple regulatory instruments are more prudent than theoretically more efficient, but complex rules. For example, simple limits on vertical integration or horizontal concentration avoid the need for collecting and processing the extensive amounts information necessary to identify behavioral changes in the market. They also help regulators avoid disputes in court when they oppose mergers and takeovers proposed by market participants. Complex rules tend to yield erratic results in courts that either do not share the regulatory philosophy or lack the capacity to grasp the highly technical issues involved in such cases (Benavides 2003).

Third-party access would allow entry by new types of suppliers, including industries that own power generators to meet their own power needs and that can sell excess power from these plants, developers of small power plants ("distributed generators") fueled by both conventional and unconventional renewable energy forms, IPPs able to conclude sales agreements directly with industrial and other large power consumers, and small service providers in rural areas that sell to local grid-connected power markets. Regulatory support in the form of reasonable wheeling and backup charges is essential to the success of open access for third parties to the power grid.

In summary, the following lessons from experience should guide developing countries in deciding how to introduce competition into their power markets.

• ***Price-based spot markets are generally too risky for small to medium-sized power systems,*** because these systems lack sufficient bidders to maintain effective competition.

• ***Cost-based spot markets, such as those developed in Latin America, offer a simpler and less risky alternative*** that can yield competitive benefits for medium-sized power systems.

• ***Most developing countries should start with limited forms of competition*** that can evolve to wholesale competition once the sector can manage competition without uncontrollable market power. The creation of bid-based spot markets should generally not be their top priority.

• ***Bilateral trading among multiple buyers and multiple sellers should be considered instead of gross power pools***, but only when distributors are creditworthy purchasers.

• ***A temporary single-buyer arrangement can be considered***—that is, one without a legal monopoly—in situations where bilateral trading or spot markets need substantial time to develop viable power purchasers and sellers.

• ***Full retail competition should be implemented last.*** Countries that have not achieved substantial household electrification should focus on encouraging competition to serve those who do not have access to electricity, instead of on retail competition for those who already have access.

Summary and recommendations:

1. ***Competitive power markets have been developed successfully in some Latin American countries, but tried unsuccessfully in other countries***
2. ***A shortage of real competitors is a major obstacle to developing competition in the power markets of most developing countries.***
3. ***Liberalization of fuel markets is an essential requirement for the development of competition among power generators.***
4. ***Only limited competition can work in the power markets of most developing countries. There are several reasons for this.***
5. ***The general absence of the necessary conditions for open competition in power markets in developing countries indicates that competition should be introduced gradually to the wholesale power trade in these countries***
6. ***Under weak regulatory capacity for monitoring and preventing abuse of market power, simple regulatory instruments are more prudent than theoretically more efficient, but complex rules.***
7. ***In summary, the following lessons from experience should guide developing countries in deciding how to introduce competition into their power markets.***
    - ***Price-based spot markets are generally too risky for small to medium-sized power systems***
    - ***Cost-based spot markets offer a simpler and less risky alternative***
    - ***Most developing countries should start with limited forms of competition that can evolve***
    - ***Bilateral trading among multiple buyers and multiple sellers should be considered instead of gross power pools, but only when distributors are creditworthy purchasers.***
    - ***A temporary single-buyer arrangement can be considered***
8. ***• Full retail competition should be implemented last.***

Appendix 1

This appendix briefly compares and contrasts the conditions for power market reform in OECD countries (see end of note) and developing countries.

Power market reform for OECD countries has conventionally been interpreted for radical market restructuring with the introduction of competition where feasible in both the wholesale and the retail markets for electricity. Economic regulation of the wholesale and retail power markets is used to promote competition and protect consumer interests. Regulation of electricity prices is essential since experience shows that competition is not sufficient to control pricing in the presence of the transmission and distribution natural monopolies. This movement has been led by Australia, England and Wales, the Scandinavian countries, and some regional groups in the United States. Chile was also a leader with these OECD countries. The extensive reach of this reform movement is shown by the existence of region wide monitoring reports for the United States (Center for the Advancement of Energy Markets 2003; Public Utility Commission of Texas 2005) and the European Community (Commission of the European Communities 2004).

The initial restructuring of the England and Wales power market showed that radical restructuring of an integrated power supply chain of functions is feasible, contrary to forebodings about disrupting technical coordination of a vertically integrated power supply. The generation, transmission, and distribution functions can be separated from one another and traded at arm's length in a wholesale power market. It was made possible by rapid changes in technology that occurred in both the generation of electricity and in the computing systems used to meter and dispatch power. There is now sufficient track record to provide assurance about the technical feasibility of coordinating these power supply functions and maintaining security of supply to power users. This experience countered widespread concern about the technical feasibility of decentralizing corporate control (but not control over power system operation) in power markets.

The experience of England and Wales also showed that the production and supply of electricity could be subject to competitive pressure, provided that transmission and distribution are regulated to support competition in production and supply. The new guiding principle was to introduce competition by restructuring the electricity supply industry where possible, and to simulate as far as possible the effect of competition on the natural monopoly network through price cap regulation. The passage of the 1989 Electricity Act and the restructuring of the Central Electricity Generating Board of England and Wales combined for the first time privatization with restructuring to introduce competition. The benefits of competition showed initially in rapid substantial reductions in wholesale electricity costs, followed later by a sharp decline in wholesale electricity prices under regulatory pressure and bargaining by the government or competition authority with the electricity supply industry to introduce further competition (Newbery 2004). The current competitive power trading arrangements in England and Wales are described below.

New Electricity Trading Arrangements for England and Wales

The system for trading electricity under the England and Wales power pool was changed on March 27, 2000, to the New Electricity Trading Arrangements (NETA). (NETA became BETTA—British Electricity Trading and Transmission Arrangements—in 2005 when the fully competitive wholesale power market was extended to Scotland.) Under NETA, market participants wishing to buy and sell electricity, including nonphysical traders, as well as generators and suppliers, are able to enter into any freely negotiated contracts to do so. There now exists a three-tier contract driven market:

- Forward and futures markets, including short-term power exchanges, which allow contracts for electricity over a time scale ranging from several years to day-ahead markets.
- A balancing mechanism in which the system operator accepts offers of, and bids for, electricity to balance generation and demand and resolve any constraints on the transmission system.
- A settlement process for charging participants whose contracted positions do not match their metered volumes of electricity, for the settlement of accepted balancing mechanism offers and bids, and for recovering the system operator's costs of balancing the system.

The system operator is responsible for ensuring balance one hour ahead of the beginning of the trading period. All trading except through the balancing mechanism, ceases at that time ("gate closure").

Bilateral contract markets for firm delivery of electricity operate from a year or more ahead of real time (the actual point at which electricity is generated or consumed), typically up to 24 hours ahead (the day-ahead market), and occasionally up to gate closure. These markets allow a buyer and seller to contract for delivery on specified date of a given quantity of electricity at an agreed price.

Currently three power exchanges operate over similar timescales, although trading tends to be concentrated in the last 24 hours. Offers and bids can be posted, modified, or withdrawn at any point until they are accepted in these exchanges. Once accepted, they represent firm financial commitments and are settled at prices specified in the offer or bid. For settlement purposes, generators and suppliers must notify the system operator about their overall contract volume of production and demand for the trading period by gate closure; thereafter, further trading for these periods is prohibited. Price discovery in these markets is provided through on-screen display of the last accepted trade, live offers, and bids, and by price reporting services.

The balancing mechanism operates from gate closure to the completion of each trading period. The system operator administers the balancing mechanism to balance generation and demand, taking into account and resolving any constraints on the transmission network. Every half hour generators, suppliers, and large customers are required to notify their intended physical positions for the periods ahead. Trades in the balancing mechanism are visible to all participants who can see competitors' bid or offer acceptances and choose to adjust their bids or offers accordingly.

Although participation in bilateral markets, power exchanges, and the balancing mechanism is optional for generators and suppliers, participation in the settlement process is mandatory. All generators and suppliers must comply with the Balancing and Settlement Code, which provides a framework within which participants comply with the balancing mechanism and settlement process. The code is administered by a nonprofit entity called Elexon.

After the trading period, Balancing and Settlement Code participants' metered output and off-take are compared with their contractual volumes (as notified at gate closure) and adjusted for balancing mechanism accepted offers and bids to determine the magnitude of imbalance. All generators and suppliers that are out of balance are subject to an energy imbalance charge. Energy imbalance (sometime called cash-out) prices are calculated for each half hour as the net volume-weighted average of all trades accepted by the system operator in the balancing market.

The drivers for reform have differed between OECD countries and developing countries, partly reflecting the differences in their starting conditions. Power market restructuring evolved in OECD countries to achieve further efficiency gains, even though the electricity supply industry in most of these countries worked well technically under vertically integrated, largely state-owned structures. OECD countries offered favorable conditions for restructuring because of their well developed power sectors, excess power supply capacity and moderate power demand growth that allowed time for introducing radical changes, and the availability of natural gas that allowed the entry of gas-fired generating plants into the power market at modest scale and relatively low cost. Within OECD countries, reform drivers have reflected particular pressures within countries and can generally be classified as follows:

- *In the United States, the passage of the Energy Policy Act of 1992 aimed at fostering competition to enhance efficiency, encourage technological innovation, and lower prices. Criticisms of the inefficiency of rate-of-return regulation for encouraging gold-plating and cost inefficiency (Averch and Johnson 1962) became decisive in the restructuring movement in the United States. Utilities were given incentives to invest as much as they could and only penalized for underinvestment. This led to waste in how they used resources. The attitude often was "better safe than sorry" and "we can pass it on to consumers." Significant amounts would be spent on efforts to woo the key politicians and regulators since they had more direct control over profits than did consumers.*

- *In Europe, the desire to bring about a single market in electricity—as well as other industries—has been a key driver of change. The countries of Eastern Europe have been motivated by the requirements of the European Union's Electricity Directive of 1996 for accession to European Union.*

- *In Britain, privatization was driven by more political motives, to "roll back the frontiers of the State" and because "the business of government is not the government of business." Economists argued that competitive pressures were more likely to deliver cost improvements and hence politically attractive price reductions.*

In contrast:

- *In much of the developing world, the driving forces have been fiscal pressure—in particular, disenchantment with the poor performance of publicly owned utilities, and the need for new investments and modernization to meet rapid growth in demand. Often these forces arose in the context of a major economic crisis for the country which made restructuring and privatization politically feasible. This was particularly the case in Latin America during the 1990s, where restructuring of power markets reflected the replacement of the import substitution model led by public investment by a market-oriented model of economic development.*

The restructuring of the electricity supply industry in England and Wales produced a number of key lessons (Newbery 2004):

- *Competitive pressure on generators is needed to reduce costs, which requires separating generation from transmission and distribution. All generating companies dramatically* *increased productivity and drove down costs immediately following restructuring. The original approach that was adopted to regulating the privatized utilities can be viewed as "competition where possible, regulation where not." Regulation was seen as a last resort, appropriate only where competition was unlikely to be applicable (Littlechild 2005).*

• Whether these benefits will be passed on to consumers through lower prices depends upon the intensity of competition—particularly the number of competitors and the existence of an open access wholesale market. These benefits were initially almost entirely captured as higher profits by generation companies, since wholesale prices did not fall in line with the fall in costs. Eventually wholesale prices fell under increased competition in the market following regulatory intervention that forced the companies to extensively divest substantial amounts of their generating capacity (Newbery and Pollitt 1997).

• Regulators have to work hard to translate efficiency gains into lower consumer prices. Securing efficiency improvements in transmission and distribution requires tough regulatory price controls. Britain sought to provide a new kind of regulation to improve the incentives to efficiency in the monopoly sectors and encourage innovation (Littlechild 2005). The performance of the British distribution companies has improved after privatization relative to the counterfactual of continuing under public ownership. Improvements in the first five years under the initial price controls were modest, with most of the price cuts, efficiency gains, and transfers to consumers confined to the second and subsequent regulatory reviews (Domah and Pollitt 2001).

• Well regulated network companies can deliver adequate infrastructure investment. Britain has invested £16 billion in transmission and distribution since privatization in 1990.

The economic lessons of restructuring are reinforced by evidence from the Nordic power market:

• Effective competition in generation under private ownership reduces costs and passes those cost reductions through to consumers in price reductions.

• Effective competition in generation requires regulated third party access to separately owned networks to lower the barriers to the power market.

• This in turn requires ex ante regulation by specialized utility regulators, since competition law alone is inadequate, given the special properties of electricity.

• Cost reductions will be passed through to price reductions under many competing generating companies and a well-designed market for the various ancillary and balancing services, as well as adequate supply capacity to meet demand reliably. The number of actively competing generators may be increased by improving transmission links, as among the countries of the Nordic market. Otherwise, enforcing or encouraging divestiture of plant by the incumbent may be necessary, as in England and Wales

.

The major concerns arising from restructuring of OECD power markets are that reforms have frequently failed to address issues of market power, and conversely that competition in the market may not be sustainable. Since generating companies benefit from a shortage of supply through higher prices for their output, they may delay investment and increase scarcity (Easy entry and a profitable market can also lead to excess entry. Competition in the English electricity wholesale market drove prices to cover only just variable costs, which are well below total costs) The complex reforms involved in market restructuring also run risks of incurring substantial economic costs if they are imperfectly designed, as shown by the California electricity crisis of 2001.

The California power crisis of 2001 gave reform an unjustified bad image. It showed that competition could lead to high prices and price volatility in the presence of serious faults in the design of a competitive market (see below). In the light of the experience in California, many governments are afraid of immediate and full restructuring of the market and total reliance on full market restructuring. Hence, a phased approach to market restructuring is advocated for developing countries, provided their governments don't use this approach to indefinitely postpone necessary reform steps (Besant-Jones and Tenenbaum 2001).

The different outcomes of power market reform in developing countries and OECD countries show the need for caution in applying OECD reform experience to developing countries:

• Efficiency improvements in OECD countries usually apply to power suppliers whose technical and financial performance satisfies prevailing commercial standards. Competition and regulatory incentives are required to raise these standards and thus apply pressure to improve performance. In most developing countries, however, the priority is to find ways to raise technical and financial performance standards up to commercial levels from much lower levels under much weaker regulatory capacity and less scope for introducing competition. Hence, positive reform outcomes can differ, as in the case of retail electricity prices. In OECD countries, reform is expected to lower prices by lowering costs, but in many developing countries reform requires substantial price increases to cover costs fully—at least for some consumer groups, such as households.

• The main fiscal impact of power market reform in OECD countries occurs through the receipt of privatization proceeds. Although this was also important for some

South American countries (Argentina, Brazil, Chile, and Colombia), such proceeds are seldom substantial elsewhere because of the poor investment climate, and sometimes these proceeds are used to recapitalize the sector, as in Bolivia (Moen 2000). The main fiscal impact in developing countries is through reduction in subsidies for below-cost tariffs to certain consumer groups and state guarantees to long-term debt financing and power purchase commitments by state owned power entities.

• The outcome of helping the poor has much greater relevance to developing countries than to OECD countries. The low affordability in relation to per capita incomes and the substantial proportions of households without access to electricity are serious concerns in developing countries, whereas affordability concerns are extremely limited, and the access rate is virtually 100 percent in OECD countries.

Confidence in the findings of the empirical analysis to date about the outcomes of power market reform is constrained by concerns about methodological rigor and inadequacy of the data (both cross-country and longitudinally over time) available for analysis (Jamasb and others 2004). Econometric studies can pick up the effects of reforms and restructuring on prices, investment, and productivity, although the length of time under most reforms is still rather short for the long-term effects to be clearly identified. Cost-benefit case studies can identify the net social gains from restructuring, but they are few and far between, and are also restricted to a relatively short period (Newbery 2004). However, it is certainly early enough to say that poor market design and poor regulation can make matters considerably worse, as the case of California demonstrates.

Different analyses can result in differing conclusions about similar issues. For example, two studies (Steiner 2001; Hattori and Tsutsui 2004) examine the impact of regulatory reform on power supply using panel data for 19 OECD countries. They reach different conclusions about the effect of creating a wholesale market on the industrial price of electricity, probably caused by slightly different definitions of regulatory reform indicators. However, both of them find that third party and retail access tend to lower industrial electricity prices and the ratio of industrial to domestic prices, which in many countries represents an improvement in allocative efficiency. One of them (Steiner 2001) finds that privatization improves operating efficiency and capacity utilization.

Lessons from California with Competition in the Power Market

The California power crisis produced the following useful lessons:

- A mandated, deregulated, wholesale bid-based spot market was shown to be highly complex to operate and difficult to monitor for abuse of market power. It should be pursued only if certain conditions are likely to be satisfied. Some of these prerequisites are also required for other, more limited forms of competition, but the consequences of not satisfying these conditions are most dramatic and harmful in a mandated and deregulated spot market.
- It is simpler and less risky to impose obligations on generators and distributors to provide ancillary grid support services as a condition for being connected to the grid, rather than trying to synchronize separate markets for ancillary services with an untested spot energy market.
- Vesting contracts should be allowed as a form of insurance for distributors purchasing from a new spot market. A vesting contract that fixes the sale price for trade between existing or new generators and distributors for five or more years should be established before the market goes into operation. They also provide at least initial protection against market power.
- Close attention is needed to the starting points for reform, the particular problems that need to be solved, and the appropriateness of the reform path selected for solving these problems.
- A poorly designed power market will not operate properly, and inadequate attempts or delays in correcting market distortions will spill over into a serious financial crisis.
- There is no way out of a crisis in a poorly designed power market that is quick, painless, or cheap. "Quick-fix" solutions to basic design flaws usually fail and may aggravate the problems. Any real solutions will impose heavy costs on stakeholders, such as suppliers, consumers, shareholders, and legislators.
- Retail tariffs should be aligned with the costs of wholesale power. Regulators should avoid rate freezes that expose distributors to the possibility of an unsustainable squeeze on their cash flow occurring when rising wholesale power costs approach or even exceed fixed retail rates.
- Regulators should encourage and even require suppliers to allow large users to adjust their demand for power in real time, through smart metering and other means, since competition works properly only when prices are seen by both the demand and supply sides of the market.
- Power suppliers should be given regulatory scope to absorb through risk management techniques the high price volatility that can occur in spot markets for power.
- One or more commercially viable entities must have a legal obligation to provide adequate supplies for small retail power users who prefer to deal with a default supplier rather than shop around in the market for a supplier and face volatile spot market prices.

Source: Besant-Jones and Tenenbaum 2001.

The Organisation for Economic Co-operation and Development (OECD)

The Organisation for Economic Co-operation and Development (OECD, in French: *Organisation de coopération et de développement économiques, OCDE*) is an international economic organisation of 32 countries. It defines itself as a forum of countries committed to democracy and the market economy, providing a setting to compare policy experiences, seeking answers to common problems, identifying good practices, and co-ordinating domestic and international policies of its members.

The OECD originated in 1948 as the Organisation for European Economic Co-operation (OEEC), led by Robert Marjolin of France, to help administer the Marshall Plan for the reconstruction of Europe after World War II. Later, its membership was extended to non-European states. In 1961, it was reformed into the Organisation for Economic Co-operation and Development by the Convention on the Organisation for

Economic Co-operation and Development. Most OECD members are high-income economies with a high Human Development Index (HDI) and are regarded as developed countries (Chile being the only OECD member who is also a member in the organisation of developing countries, the Group of 77).

The OECD's headquarters are at the *Château de la Muette* in Paris, France.

Governance – 2

Regulation of Electricity/Power Markets

Summary:

The development of capabilities and institutions to regulate power markets is an important part of sector reform. It is unrealistic, however, to expect that a new regulatory system will be fully functioning and credible soon after it is formally created.

Experience shows that developing robust regulatory frameworks and strong institutions to manage them can be hampered by underfunding and reluctance on the part of governments to transfer real independence in decision making to regulatory authorities even when required to do so by law.

Private sector investors contend that a credible regulatory system requires more than a formally independent regulatory entity, especially in the critical early years right after it is created. Since many regulators begin performing their functions with the disadvantage of limited independence and capacity, other transitional arrangements may need to be established to provide stability and predictability for a new regulatory regime. This could include limiting the amount of discretion that regulatory bodies have in setting prices and key parameters, particularly during the initial years of public private partnerships where the private sector is investing significant amounts of capital. This can be achieved by setting out details on key terms, such as initial price controls in the key regulatory instruments (licenses or contracts), or by having clear tariff-setting principles in the country's legislation.

The following covers regulation of power markets for all types of market structure. These structures range from a single integrated power supplier responsible for all publicly supplied electricity to a decentralized competitive wholesale power market with many participants. The structure of the regulatory system is linked to the market structure, since regulation is an important component of power market governance. In particular, the need for a separate, autonomous regulatory agency operating under transparent processes is much stronger with private sector participants in a power market than when all public power supply is under state ownership. Even in large middle-income countries, various forms of contractual arrangements and third party guarantees against regulatory risk are needed for attracting large amounts of private investment in the power systems with a new regulatory agency that has not had time to develop a track record for credibility. In small low-income countries, contracting out of regulatory functions is an option under their weak institutional capacity.

The Need for Public Regulation of Power Markets

Regulation of electricity service providers and consumers is the means of applying governance to the power market, complemented by competition where feasible.

Economic regulation of the power market is the formal arm of governance that balances the interests of market participants—power generators, suppliers, network and market service providers, and users. It should also consider the interests of those who aspire to participate in the market—new entrants that are either power suppliers that want to sell their product or power users that want access to the public power system. It is used to control prices and ensure efficient provision of services.

Regulation is applied both as a public good to protect the public interest through a public entity, or as a private good for market members through a private organization — as in a power market exchange.

Public regulation is the dominant form of arm's length regulation for power utilities. It forms part of a broader regulatory framework that encompasses public safety, employment conditions, and environmental safeguards, and more broadly the legal framework in which the power market operates. The following characteristics of the electricity supply industry make public regulation both necessary and difficult (Stern and Holder 1999).

• The assets are capital intensive and become sunk costs once invested, since they cannot be profitably redeployed, so investors need protection from expropriation.
• The electricity supply industry has considerable economies of scale and scope, especially in the network segments, which limits the number of firms that can support the power market viably. This means that governments cannot rely on the development of competition in the market to protect consumers from the abuse of market power by these firms.
• The price of electricity services is highly political because these services are important for the welfare of households.
• The quality of electricity services matters for economic growth because these services are important intermediate inputs for the industrial and service sectors.

Public regulation works better under a clear formal regulatory process, rather than by informal oversight and noncommercial objectives typically imposed on state-owned utilities.

Once a government decides to attract substantial private investment to the power sector, it is faced with the need to put regulation at arm's length from its executive agencies. The main governance elements of power market regulation consist of the following interrelated features: clear roles and objectives, regulatory independence and accountability, stakeholder participation, and transparency and predictability. These features promote legitimacy for market reform and the regulatory process, and enhance the credibility and reputation of the regulatory institution (Rodríguez and Jiménez 2005). If a government is unable or unwilling to create these arrangements, state ownership and financing of the electricity supply industry becomes the fall-back solution (Levy and Spiller 1993).

Price-setting arrangements under state ownership of power supply usually result in severe distortions to electricity prices, especially low prices for households and influential consumer groups (such as irrigation farmers in India—Monari 2002).

Under state ownership, regulation of the power market has traditionally been carried out implicitly by governments in combination with numerous other roles. Setting prices tends to be a process of negotiation between government ministries, the power utility and influential consumers in which political considerations are as influential as financial requirements. The regulatory function is usually carried out by the line ministry responsible for the power sector under a command-and-control approach. This tendency can be observed in many countries in Asia and Africa.

Environmental regulations are an important component of power market regulation.

Regulatory processes for environmental standards should guide, rather than hinder, the operation and development of power markets. They should address important aspects that include permissible levels of emissions—especially during times when the power system, as well as local environments, is particularly under stress—as occurred in California (Besant-Jones and Tenenbaum 2001). *They should provide the means for handling environmental concerns by community groups and nongovernmental organizations (NGOs) about the siting of power plants, the selection of fuels, and the development of hydropower resources for power generation (World Commission on Dams 2000). They should not be open to capture by vested interests to get round environmental regulations or at the other extreme to block the siting and operation of new power facilities.*

Institutional Approaches to Power Market Regulation

The development of capabilities and institutions to regulate power markets is an important part of power market reform. This development covers both regulatory governance (who does what under which laws, rules,and procedures) and regulatory substance (how tariff levels and structures are established and approved, and mechanisms for coordination of tariffs and subsidies and the establishment of quality of service standards).

Developing economies need to find appropriate ways to balance the costs and benefits of regulation in their circumstances. The design of new regulatory structures should take account of the political, legal, and constitutional arrangements under which they have to function. It should be consistent with country endowments (including constitutional checks and balances), technical expertise, auditing competence, and fiscal resources, as well as the economic characteristics of the power market (Kessides 2004).

The regulatory systems of developing economies tend to operate within legal frameworks modeled on one of the three frameworks used in OECD countries (Stern and Holder 1999):

• The U.S. model of regulation, which operates under a strong and well-established constitution, an administrative law code and a tradition of using the legal system to resolve issues.
• The U.K. model of regulation, which relies on achieving compromises between parties, rather than resorting to the courts, in the absence of a written constitution and a formal code of administrative law.
• In many European countries, whose regulatory systems operate within Napoleonic law codes with traditions of public service obligations. Thus, Latin America generally follows the European framework, Asia follows either the U.S. or U.K. framework, and Africa follows either the U.K. or European framework (In Latin America power supply entities were privatized under the "Washington consensus" that the quality of institutions have an important impact on economic growth. Attention was given to modernizing the regulatory frameworks of power markets for the newly privatized entities as part of the so-called second generation of reforms - Basañes and Willig 2002; Basañes, Saavedra, and Soto 1999). Although many developing countries follow the U.S. structure of independent regulatory commissions, they lack the legislative background and substantial resources needed to replicate the regulatory processes of U.S. style cost-of-service regulation developed for investor-owned vertically integrated utilities.

The core issue for designing a new regulatory structure is how to manage the tradeoff between flexibility and discretion.

The need for flexibility in applying regulations under changing market conditions must be balanced rules and procedures by limiting the regulator's discretion in applying them. Achieving a balance depends on which course risks more economic inefficiency under the prevailing institutional framework. Flexibility is more important under rapid technological change, such as with telecommunications, whereas commitment is more important under great social needs, such as with water supply. The power sector lies somewhere between. Flexibility and commitment can be in conflict (These approaches draw on agency theory that stresses the asymmetry of information between regulator and the firm (Lafont and Tirole 1993), under which the regulator proposes a contract in order to make the firm reveal its private information. Price cap regulation and cost plus regulation are forms of this contract). How a country resolves this conflict depends on the specific institutional environment of the country.

Countries can choose from two distinct institutional approaches to achieving regulatory flexibility and commitment.

The approach chosen should fit the particular country setting in the most credible and plausible way as a workable system. Some countries have the institutional background to get substantial efficiency and flexibility, while having the commitment that is needed for the system to be workable and for private investment to be forthcoming. Other countries may have to accept some compromise with the efficiency goal in order to establish the kind of commitment that induces the private sector to participate (Levy and Spiller 1993).

The approach that emphasizes regulatory flexibility focuses on creating autonomy in the regulatory agency in an environment that allows discretion, but restrains arbitrary, unexpected, and undesired actions by the agency.

Such actions include domination or excessive influence over the regulatory system by investors in their own interests, and expropriation of investors' assets by the government responsible for the regulatory system (This approach draws on transaction economics that emphasizes the need to minimize transaction costs over the long term. It views concessions as incomplete contracts, where the utility is guaranteed a fair rate of return and the regulator retains the residual rights of control.) This approach is generally suited to the conditions found in OECD countries. Many developing countries constrain regulatory discretion in various ways, both formally through incorporation of regulatory procedures and rules in concession contracts, and informally through covert pressure on regulators and regulated entities.

The approach that emphasizes regulatory commitment under limited discretion embeds highly specific substantive rules in licenses provided to operators or in legislation ("regulation by contract").

This contractual approach (see below: *Regulation by Contract to Support a New Regulatory Regime*), however, entails considerable loss of flexibility. The Chilean system provides a good example of this approach, since it consists of very precise benchmark regulations and leaves little room for discretionary action on the part of the regulator. Such a system relies on a set of institutions that can resolve conflicts, of which a judiciary is the most important, and an administrative apparatus. This regulatory model requires a strong institutional framework, since the parties involved must understand the basic logic of capital asset pricing models (for example, rate of return and marginal cost pricing), the need for technological change, and what efficient regulation looks like.

A well-designed regulatory system reduces the cost of private capital for the power sector.

Such a system ensures that regulatory responsibilities for financially important decisions for the investors—such as license awarding and tariffs setting—are based on technical, rather than political, factors. Otherwise, private capital would be attracted only on costly terms to the country. This would be apparent by either high rates of return sought by investors, or mitigation of risk exposure at more competitive returns by earning high returns to equity during the early years of operation, take-or-pay contracts as used in PPAs by IPPs for their first projects in many countries, and by sovereign guarantees or third party guarantees.

International guarantees against regulatory risk can support these approaches for those countries where the domestic institutions do not provide a basis for credible commitments to any set of rules.

This situation can exist if these institutions were created too recently to develop a good track record. Without adequate assurances of an effective regulatory framework (such as

BOX 21. Partial Risk Guarantees for Privatizing Distribution in Romania and Uganda

Romania: A Partial Risk Guarantee (PRG) from the World Bank for 60 million was used to support the privatization through majority asset sale of the Banat and Dobrogea distribution companies in April 2005. The investor—Enel SpA of Italy—acquired a 51 percent shareholding through equity injection, and the balance of the shareholding was retained by the state through its distribution holding company. The licensing framework consisted of a distribution license for 25 years and a supply license for 8 years (renewable) subject to European Union policy. Revenues are regulated by the National Energy Regulatory Authority (ANRE) on the basis of a price cap or price basket methodology introduced prior to the privatization.

The PRG backstops a Letter of Guarantee issued by Citibank Romania for a term of five years, which provides for payment to the distribution companies for loss of revenues resulting from a change or repeal by the government or ANRE or noncompliance by ANRE with the provisions of the preagreed regulatory framework comprising (a) the distribution formula; (b) the full pass-through of electricity costs; and (c) pass-through of PRG-related costs.

The PRG Guaranteed Events and the claims mechanism are outlined in a Government Support Agreement (GSA) concluded between the Government of Romania and the distribution companies. In the event of a claim under the Letter of Guarantee, the Government of Romania, through the Ministry of Public Finance, has the primary obligation to reimburse Citibank Romania, with the World Bank guaranteeing repayment to Citibank Romania under the PRG if the Government of Romania fails to meet its obligation.

In this way, the PRG-facilitated closing of the first electricity privatizations in Romania in the context of a new regulatory framework for the country and ANRE's limited track record. PRG's mitigation of regulatory risk during the transitional period resulted in an agreement by Enel to reduce its return of investment by two percentage points per year. The resulting reduction in the revenue requirements of the distribution companies will yield substantial savings for the country over the life of the distribution companies, even though the PRG is available only for five years. Moreover, the PRG has established a lower investment return benchmark for subsequent privatizations of Romanian distribution companies, thereby generating further significant savings for the country.

Uganda: An IDA PRG of US$5.5 million was issued in March 2005 in support of a 20-year concession of the Uganda Electricity Distribution Company for the benefit of UMEME Ltd. (a private consortium of Globeleq Ltd. of the United Kingdom and Eskom Enterprises of South Africa). Under the PRG structure, UMEME will have recourse to a Liquidity Facility in the form of a Standby Letter of Credit Facility issued by Citibank Uganda and backed by the PRG. The PRG is for a term of seven years and specifically provides protection for the following risks:

- Regulatory framework: Noncompliance by Uganda's Electricity Regulatory Authority (set up in 2000) with the preagreed framework relating to the distribution tariff; full pass-through of the bulk electricity supply from the domestic power transmission company acting as a single buyer; timely adjustments of tariffs.
- Government payment arrears: Nonpayment of electricity bills by government and its agencies.
- Termination payments: Buyout amount for underdepreciated investments resulting from early termination of the concession caused by breach of concession agreements by the government or any of its relevant entities.

The PRG helped to implement the first power distribution concession in Sub-Saharan Africa by catalyzing US$65 million of investment commitment from UMEME for the rehabilitation and expansion of the distribution network. This transaction is likely to have an important demonstration effect for similar privatizations in the region.

Source: World Bank staff.

an effective regulatory agency) and rules (for example, predictability about pricing and quality standards), private investors would be reluctant to commit their capital to the country's power sector. Export credit agencies provide guarantees against political risks for repatriation of profits and debt servicing (OECD 2003). Guarantees, such as the World Bank's Partial Risk Guarantee (PRG—World Bank 2002), have been specifically adapted to backstop a government's commitment to a predefined regulatory framework and a process of dispute resolution, thereby helping mitigate regulatory risk for private investors and facilitating a smooth transition to a credible regulatory framework. The PRG has recently been used successfully for this purpose in Romania and Uganda (box 21, given below). A PRG cannot, however, substitute for a basically poor regulatory framework (Gupta and others 2002).

Summary and recommendations:

1. ***The need for the need for public regulation of power markets***
2. ***Characteristics of the electricity supply industry make public regulation both necessary and difficult -***
3. ***The assets are capital intensive and become sunk costs once invested, since they cannot be profitably redeployed, so investors need protection from expropriation.***
4. ***The electricity supply industry has considerable economies of scale and scope, especially in the network segments, which limits the number of firms that can support the power market viably. This means that governments cannot rely on the development of competition in the market to protect consumers from the abuse of market power by these firms.***
5. ***The price of electricity services is highly political because these services are important for the welfare of households.***
6. ***The quality of electricity services matters for economic growth because these services are important intermediate inputs for the industrial and service sectors***
7. ***Public regulation works better under a clear formal regulatory process, rather than by informal oversight and noncommercial objectives typically imposed on state-owned utilities.***
8. ***Price-setting arrangements under state ownership of power supply usually result in severe distortions to electricity prices, especially low prices for households and influential consumer groups***
9. ***Environmental regulations are an important component of power market regulation.***
10. ***The development of capabilities and institutions to regulate power markets is an important part of power market reform.***
11. ***The regulatory systems of developing economies tend to operate within legal frameworks modeled on one of the three frameworks used in OECD countries – US ,UK, Europe***
12. ***The core issue for designing a new regulatory structure is how to manage the tradeoff between flexibility and discretion***
13. ***Countries can choose from two distinct institutional approaches to achieving regulatory flexibility and commitment.***
14. ***The approach that emphasizes regulatory flexibility focuses on creating***

autonomy in the regulatory agency in an environment that allows discretion, but restrains arbitrary, unexpected, and undesired actions by the agency.

15. ***A well-designed regulatory system reduces the cost of private capital for the power sector.***

16. ***International guarantees against regulatory risk can support these approaches for those countries where the domestic institutions do not provide a basis for credible commitments to any set of rules.***

Regulatory Credibility for Private Investment

The regulatory credibility necessary for attracting long-term private investment in electricity services covers autonomy, transparency, and accountability

The term “autonomy” is used in this context in preference to “independence” because a regulatory agency is an arm of government. Autonomy does not carry as much political controversy as independence when applied to sector regulators (for example, Rao 2004 discusses so-called independent regulation in India).The pressing need for this investment gives governments the incentive to improve the credibility of power market regulation.

The principal means for developing credibility is by establishing a designated regulatory agency that discharges its duties in a neutral and depoliticized manner.

This agency is an institutional solution to keeping entities responsible for formulating policy apart from entities responsible for providing services. From the early 1980s to the present, 134 countries around the world—both OECD and developing—have set up separate regulatory agencies for their infrastructure markets as a prelude to or in tandem with sector unbundling and private participation (Environmental Resources Management 2004), (This large number of countries relative to the lower number of countries that have undertaken some restructuring of their power systems indicates that establishment of many of these regulatory agencies was a first stage that has yet to be followed by structural reforms.) In the developing world, Latin America has advanced furthest, Central and Eastern Europe have advanced far, Asia is advancing, and Africa is starting to make progress (refer to Kirkpatrick and Parker 2004 for a review of experience with infrastructure regulation in low- and middle-income countries.)

A regulatory agency offers a number of institutional advantages.

It can attract and develop the highly specialized technical skills needed for a complex sector to relieve overstretched and under-resourced government departments of this burden. It can also use its powers of arbitration to relieve the judicial system of a heavy caseload arising from disputes and clarifications of electricity regulations, and thus provide a faster and more flexible service than available under the formal, lengthy, and costly procedures of the typically overburdened law courts in developing countries. Such an agency also avoids the problems associated with industry self regulation combined with anti-monopoly laws in the case of the power system, even when these laws are well developed and enforced. Experience with this approach in New Zealand showed up problems, such as the difficulty in finding a firm guilty of abuse of market power because of the technology-intensive nature of the industry (Patterson and Cornwall 2000).

In practice, regulatory agencies in many developing countries have not been allowed to discharge their functions properly.

Even in some countries where legislation explicitly provides the appropriate framework, government ministries and their power utilities have restricted the activities of the agencies. Regulators have been excluded, for example, from overseeing new private investment in the sector, such as by approving PPAs with IPPs. They have not been able to review tariffs without being subjected to political pressure—or they have been excluded from tariff decisions. They have lacked the powers to pressure managements to improve the performance of their utilities. And they have not been able to help expanding access to affordable electricity services. Examples of these cases can be found among Indian states (Prayas 2003), as well as in Africa (Eberhard 2005). These problems have stimulated interest in modifications to this regulatory model, particularly contracting out of regulatory functions (covered later in this subsection) and regulation by contract (covered below - *Regulation by Contract to Support a New Regulatory Regime*).

A regulatory agency should have the autonomy to carry out its duties.

Autonomy applies to the agency's organization, procedures, processes, and finances from arbitrary political and bureaucratic interference, and to undue influence from regulated companies and consumer interests. This autonomy is needed for providing the stability and enforceability of laws and contracts that are important to private investors (Lamech and Saeed 2003), (This finding is supported by an analysis of private investment in Latin American infrastructure (Pargal 2003). The analysis concluded that legislation that creates the legal basis for reform, rather than specific aspects of the institutional framework, is the most significant determinant of private investment volumes). Regulatory agencies need to show autonomy to establish a track record that builds up their credibility.

Autonomy for regulatory agencies from governments can never be total.

This is because ultimately governments are responsible for providing regulation, and therefore regulatory agencies must be accountable for their performance in conformity with government policies. Most laws that establish a regulatory framework allow governments to give policy directives to the regulatory agencies under their jurisdiction. A tariff policy directive from government, for example, should not reduce the regulatory commission to the status of a mere calculating machine. It should not take away discretion from regulators on rates of return, risk evaluation, rates of depreciation, incentives, and such elements of tariff regulation. It could, however, direct that subsidies to a particular class of consumers would continue for a given period at specified levels, propose a development charge for new investments, encourage hydro investments through preferential treatment, and ask for multiyear tariffs (Rao 2002).

A regulatory agency needs the legal status for autonomy from political and market influences, as well as for the authority to set parameters and monitor implementation of contracts.

This can be achieved with the following key measures:

• Making the regulator accountable to the legislators that provided its legal status, instead of to an executive ministry.
• Funding the agency independently of government budget allocations, such as through a small surcharge on consumer's bills or a levy on the utility's revenues in a process not open to diversion by the government (Kelley and Tenenbaum 2004).
• Appointing commissioners on fixed, staggered terms with limitations on government's powers to dismiss them.
• Limiting government's ability to delay or overrule commission decisions, by making these decisions subject only to appeal to the judiciary or some other impartial source (Tenenbaum 1996).

Many developing countries provide for operational autonomy in the enacting legislation, which is followed in practice to varying degrees among these countries, but few of them meet the requirements for financial autonomy.

The autonomy of regulatory agencies should be protected by appointing its staff on the basis of technical competence.

This principle has not been followed to date in many countries, including China and India. In India, the selection of regulatory commissioners has been biased toward retiring government servants, often from the sector they are to regulate. This policy perpetuates civil service mindsets and attitudes, and the resulting regulatory actions are unlikely to promote the commercial practices needed in the reformed power market (Rao 2002). Likewise in China, the national regulatory commission was set up with a small staff composed of engineers lacking economic training, which seriously affected the commission's ability to fulfill its mandate of regulating complex markets, preventing market power manipulation, and arbitrating industry disputes (Yeh and Lewis 2004). In both countries, the regulatory staff faced the difficulty of keeping at arm's length from the regulated entities because often these entities were managed by their former colleagues.

Transparency in a regulator's procedures and processes is critical for public credibility, especially for tariff setting, as well for attracting investors.

A transparent tariff revision process at least helps unearth data that was shielded from public scrutiny. It also helps develop public understanding of the issues involved, including their serious nature and the symptoms and sources of problems (Prayas 2003). Transparency supports the public interest in controlling the environmental and social impacts of power system development. It gives confidence in the fairness and predictability of the application of regulations to investors, as well as allowing them to see their regulatory risks clearly and make provisions to manage them. Transparency can be ensured through (a) regulations that prohibit off-the record communications between the parties involved in regulatory processes, (b) the obligation for the regulator to publish its reasoned decisions, and (c) the availability of all documentation presented and used in the processes to all participants and the public (except for commercially sensitive data).

The powers of the regulator should depend on how much autonomy it is likely to have.

Regulation of the power sector applied by a regulatory agency with substantial autonomy is appropriate for countries that intend to attract private investment, and whose political and judicial systems have the capacity to limit the risks of regulatory failure. Countries with weak political and judicial commitments to transparent and fair regulation, but which still intend to open their power sectors to private investment, should focus on contractual approaches to improving sector performance. In Africa and Asia, the new regulatory agencies have fewer decision-making powers and autonomy from government than those in Latin America and Central and Eastern Europe (Refer to Stern and Cubin 2003 for a review of regulatory governance arrangements – referenced in the citations section at the end of the document)

Where the regulator is likely to act autonomously, it can be given substantial decision-making powers without undue risk of regulatory capture by one of the regulated parties.

The reverse risk, that of a lack of checks and balances on the use of regulatory power, became an issue in Argentina and—according to some commentators—in the Indian state of Orissa. This risk can be managed within the broader legal framework. Where this risk is perceived to be serious, the regulator could be given a semi-autonomous status with mainly advisory roles, and other agencies would be vested with rulemaking and enforcement powers. This tradeoff is an option for countries with little separation of legal and executive powers (Brown and others 2006).

A new regulatory agency should not be allowed to become a roadblock in the view of investors, utilities, and customers.

In the Philippines, for example, an Energy Regulatory Board was created during the initial reform stage to make regulation of the power sector more efficient and transparent. However, utilities used the right to judicial review of the board's verdicts extensively, and the regulatory process became gridlocked. Instead of streamlining regulation, the new system made matters worse.

Contracting out of specific tasks can help regulators improve their competence, autonomy, and legitimacy and, hence, their credibility in the following ways:

- *Competence can be increased* by providing access to specialized skills and building core in-house skills through training.
- *Autonomy can be strengthened* by enabling the regulatory body to benefit from the reputation of an external agent, and giving the regulator a higher degree of control over who does the work, particularly in countries where there are constraining civil service rules.

• *Legitimacy can be established* in countries with weak or fledgling institutional capacity where external studies may be perceived to be more credible and can increase the transparency of the regulatory process.

***Contracting out is particularly helpful* for newly established regulators that need external support for their initial start-up phase. Suitable tasks for contracting out include gathering and analyzing information, monitoring compliance with existing rules, determining new rules, and enforcing rules.**

Contracting out of regulatory tasks is particularly widespread by water and telecommunications regulators in Africa and Latin America, but it is less prevalent among electricity and energy regulators in developing countries (Bertolini 2004; Environmental Resources Management 2004). The functions most contracted out include monitoring compliance with physical and quality targets, monitoring compliance with quality parameters, and legal opinions. Most regulators contract out functions that are advisory or nonbinding in nature, and few agencies use contracting out to produce binding inputs into the decision-making process because the agencies are accountable by law for their decisions.

An independent nongovernmental expert panel would be a novel way to conduct periodic price reviews to shield regulatory decisions from political influence.

This approach is an extension of the concept of contracting out regulatory functions to private entities.

It has been used for a few long-term concession agreements in the water and sanitation sector, but not so far in the power sector. It could be organized in one of three ways:

• The panel replaces the regulator for the periodic review of prices, and it is empowered to take binding decisions—subject, perhaps, to limited-scope appeal.
• The panel gives a recommendation, without binding force, before the case goes to the regulator.
• The panel serves as an appeals body for a decision made by the regulator.

The concession agreement or the enabling law and regulations should specify in detail the method of appointing the expert panel to ensure true independence and high competence, the requirements for information and reporting from the company, and the principles and rules governing the periodic review. The amount of discretion given to the expert panel should be limited to ensuring that tariffs are set at a level sufficient to enable the service provider to meet specified service standards. Setting these service standards, tariff structures, and the like should be the responsibility of the relevant public authority, not the expert panel (Shugart and Ballance 2005).

Summary and recommendations:

1. ***The regulatory credibility necessary for attracting long-term private investment in electricity services covers autonomy, transparency, and accountability***

2. ***The principal means for developing credibility is by establishing a designated regulatory agency that discharges its duties in a neutral and depoliticized manner.***

3. ***A regulatory agency offers a number of institutional advantages. It can attract and develop the highly specialized technical skills needed for a complex sector to relieve overstretched and under-resourced government departments of this burden. It can also use its powers of arbitration to relieve the judicial system of a heavy caseload arising from disputes and clarifications of electricity regulations, and thus provide a faster and more flexible service than available under the formal, lengthy, and costly procedures of the typically overburdened law courts in developing countries.***

4. ***In practice, regulatory agencies in many developing countries have not been allowed to discharge their functions properly***

5. ***A regulatory agency should have the autonomy to carry out its duties. Autonomy applies to the agency's organization, procedures, processes, and finances from arbitrary political and bureaucratic interference, and to undue influence from regulated companies and consumer interests.***

6. ***Autonomy for regulatory agencies from governments can never be total.***

7. ***This is because ultimately governments are responsible for providing regulation, and therefore regulatory agencies must be accountable for their performance in conformity with government policies.***

8. ***A regulatory agency needs the legal status for autonomy from political and market influences, as well as for the authority to set parameters and monitor implementation of contracts. This can be achieved with certain key measures:***

9. ***The autonomy of regulatory agencies should be protected by appointing its staff on the basis of technical competence***

10. ***Transparency in a regulator's procedures and processes is critical for public credibility, especially for tariff setting, as well for attracting investors.***

11. ***The powers of the regulator should depend on how much autonomy it is likely to have.***

12. ***Transparency in a regulator's procedures and processes is critical for public***

credibility, especially for tariff setting, as well for attracting investors.

13. *The powers of the regulator should depend on how much autonomy it is likely to have.*

14. *Where the regulator is likely to act autonomously, it can be given substantial decision-making powers without undue risk of regulatory capture by one of the regulated parties.*

15. *Contracting out of specific tasks can help regulators improve their competence, autonomy, and legitimacy and, hence, their credibility in the following ways:*

16. *An independent nongovernmental expert panel would be a novel way to conduct periodic price reviews to shield regulatory decisions from political influence.*

Regulation by Contract to Support a New Regulatory Regime

Specific contractual arrangements may be needed to sustain private investment under a new regulatory regime.

Private sector investors contend that a credible regulatory system requires more than a formally autonomous regulatory entity soon after it is created (Bakovic, Tenenbaum, and Woolf 2003). This is because many regulatory agencies begin performing their functions with the disadvantage of limited autonomy and capacity.

The development of robust regulatory frameworks and strong regulatory institutions can be hampered by a variety of constraints, in particular under funding and reluctance by governments to transfer real autonomy in decision making to regulatory agencies, even when required to do so by law (For example, it would be unreasonable to expect a new regulatory commission to close the gap between revenues and costs and rebalance tariffs across classes as merely technical adjustments when its government had previously failed to tackle these issues because of political opposition.)

The incorporation of regulatory procedures and rules in concession agreements can provide stability and credibility during the transition to regulatory autonomy.

This is achieved by setting out details on important terms, such as initial price controls, in the main regulatory instruments (licenses or contracts) or by having clear tariff-setting principles in the country's legislation.

This form of "regulation by contract" limits the amount of discretion that regulatory bodies have in setting prices and targets for key performance parameters in this situation. It is particularly suitable for the initial years—such as for the initial tariff-setting period of about five years—of public-private partnerships where the private sector is investing substantial capital. Since this form is expected to transit into "normal regulation," the contract should also specify the tariff principles that will be applied by the regulatory agency after the contract to reassure investors initially at the time of negotiating the agreement.

Governments may have a role in setting the initial terms and conditions of key regulatory instruments, since they are best established as an outcome of the transaction process with private investors (Bakovic, Tenenbaum, and Woolf 2003).

Under regulation by contract, the discretion of the regulator is limited in areas that are known to deter investment, while the autonomy of the regulator is used to avoid uncertainties for investors.

Such uncertainties arise from political micromanagement and changes of government or governmental policy. The objective is to define the tradeoffs between the regulatory objectives of protecting the interests of both consumers and investors.

Hence, regulation by contract specifies in one or more formal or explicit agreements the formulas and procedures that determine the prices that a distribution company will be allowed to charge for the electricity that it sells. These formulas can be based on either cost-of-service regulation or incentive regulation, or sometimes a combination of both. The key component of the contract is a performance-based, multiyear, tariff setting system.

The credibility of regulation by contract requires that the underlying principles and initial parameters of the contracts should be clearly specified in the country's primary or secondary electricity legislation (as in Argentina, Bolivia, Chile, and Peru).

Regulation by contract is less likely to survive if the concession agreement is poorly specified or exists only within a stand-alone concession or license agreement with little clear support in national laws (as in Brazil). Hence, the performance of regulation by contract has been variable in the power markets of developing countries. Regulation by contract has been combined with autonomous or partially autonomous regulatory commissions in many Latin American countries, and this combination has generally been successful in inducing and sustaining private sector investment in more than 60 privatizations of electricity distribution systems (See Guash 2004 for an extensive bibliography on experience with infrastructure concessions in Latin America – referenced below)

Concessions for power distribution under regulation by contract resemble PPAs with IPPs for investments in power generation.

This familiarity appeals to private investors. These concessions, however, are more difficult to negotiate and less able to be subjected to competitive bidding than PPAs, because of the large number of customers, the high visibility of retail power prices, and the need for ongoing investments, as well as their basic monopolistic features (See Littlechild 2002 for a review of issues and some experience with competitive bidding for long term distribution contracts – referenced below.) The experience in Argentina with regulation by contract was similar to the pressure on IPPs from governments to lower the sale price of power under their long-term PPAs in East Asian countries following the 1997 financial crisis. Unlike concession agreements under regulation by contract, however, PPAs and concession agreements do not require an autonomous regulator when these agreements specify the investments to be undertaken.

Risk allocation is a major design issue for regulation by contract, just as for PPAs and concessions.

This concerns which parties bear risks, especially risks from pass-through of power purchase costs, technical and non technical loss-reduction targets, foreign exchange fluctuations, and obligation to supply. Under regulation by contract, the parties to the concession act as agents for their principals, so it is the principals that bear these risks.

The regulator acts for the electricity users served under the contract, the government acts for the citizenry, and the management acts for the investors and shareholders in the company that wins the contract. In addition, the government sustains the credibility of the regulator's position (Stern and Holder 1999).

Regulation by contract is sustainable only if the underlying economics to the concessions are viable.

The concession agreement will not work if revenues are much less than costs. The gap must be closed by lowering costs or increasing revenues, or both. Investors must be protected, and the agreement might need to be combined with transition subsidies. Even in those countries where effective autonomous regulatory decision making has been achieved, regulators are not likely to follow policies that balance consumer and private investor interests where the financial, institutional, and technical performance are poor at the outset, and the transition to commercial standards takes longer than expected.

Concessions under regulation by contract cannot absorb major economic shocks to the regulatory system.

Long-term PPAs with IPPs and long-term contracts for distribution concessions in Latin America have been highly vulnerable to exchange rate shocks—but neither could any other regulatory system absorb such shocks.

Following the time that Argentina abandoned its Convertibility Law in December 2001, for example, which led to a major devaluation, government overruled the regulatory commitment under concession agreements to allow pass-through of increased supply costs to retail electricity tariffs. It was motivated by its desire to protect the economic welfare of power consumers, but at considerable cost to private investors in power distribution.

Robust and workable mechanisms for resolving disputes should be incorporated into concession agreements.

The possibility of contract reopening poses a major risk for investors in the highly politicized conditions found in most developing countries. These countries don't have a tradition of separation of legal and executive powers, nor do they have well-developed parliamentary and legal systems. This limitation applies particularly when such contracts involve many parties, investment in sunk assets, and politically accountable governments that cannot or are unwilling to legally bind their successors.

Contract features that appeared to increase the incidence of renegotiation of infrastructure concessions in Latin America are awards based on the lowest tariff bid, investment requirements specified in the contract, price cap regulation (mentioned next: *Incentive Regulation to Promote Efficiency*), absence of a regulatory body, and the regulatory framework embedded in the contract (Guash 2004). Alternative dispute resolution mechanisms to going through local courts are often preferable, including international arbitration.

The presence of a regulatory agency allows for simpler contracts that are easier to monitor, enforce, and revise.

In particular, the presence of a regulator operating under a defined regulatory process helps deal with substantial renegotiations (Stern and Holder 1999). From this perspective, regulation and contracts are complements for network industries, rather than substitutes (Stern 2003). Renegotiation occurs because it is not possible to write enforceable long term contracts that can cover all necessary contingencies in a power market.

Often events during the term of concessions lead to pressure to reopen them. Concession agreements may also set out the terms and conditions incompletely, which can lead to problems between the regulator and the investors early in the life of the concession, as has occurred in the case of the electricity distribution concessions in New Delhi (Agarwal, Alexander, and Tenenbaum 2003). Moreover, governments often delegate their monitoring responsibilities to their regulator in the case of distribution concessions (as in the Latin American cases) because of the heavy monitoring workload when they have concluded many concession agreements.

Ideally, of course, avoidance of renegotiation should be the aim of contract design and the behavior of the parties to the contract (Bell 2003).

Incentive Regulation to Promote Efficiency

Incentive regulation is designed to give suppliers incentives to behave as if they were subject to competition

Incentive regulation was first proposed during the 1980s for infrastructure sectors in the United Kingdom. In the United States, incentive regulations are often called performance based regulation — see NARUC 2000 for a full description of performance-based regulation for distribution utilities.

It promotes innovation, cost containment, and service tailored to the needs of power users, and it allows regulators to reward suppliers for good performance and penalize them for poor performance. Power suppliers are given explicit financial and other incentives to achieve certain performance goals, as well as significant discretion on how to achieve the goals. Performance goals are typically to improve investment and operating efficiency or connect a target number of new consumers (Alexander and Harris 2001). This discretion is the main distinction in principle between incentive regulation and old-style cost-of-service regulation (Cost-of-service regulation is sometimes called rate-of-return regulation). Another important distinction is that the link between suppliers' authorized prices and their realized operating costs are weaker and less explicit under incentive regulation than under cost-of-service regulation.

Incentive regulation is designed to offer the following advantages over cost-of-service regulation:

• A stronger incentive to reduce costs, because the supplier keeps more of its gains under the weaker link between rates and costs.
• Lower costs of administering regulation plans, because these plans avoid the micromanagement of the regulated entities and intensive data collection and authentication required under cost-of-service regulation.
• Helps power suppliers to adapt to competition, if and when some or all of their markets are liberalized, because it offers incentives similar to those that face firms in competitive markets. Incentive regulation that induces cost-minimizing behavior by power suppliers yields large gains to the most efficient suppliers, while cost-of-service regulation controls those gains, but creates weak incentives for minimizing costs. Incentive regulation is also appropriate for developing countries because of their generally weak capacity to audit the costs of power suppliers—which is critical to the effectiveness of cost-of-service regulation. These suppliers can exploit their advantage over regulators in information about their costs by padding their allowable rates.

Cost-of-service regulation (or rate-of-return regulation) can be considered for countries where rules can be enforced but complex regulatory arrangements cannot be managed.

Jamaica's environment suited this approach by using highly precise binding contracts as the basis for substantial private investment. However, the contract could not be written in the way that Chilean contracts are written (see below), because enforcing that type of contract would not be feasible in Jamaica's institutional environment. In this particular setting, cost-of-service regulation was the best that could be done for providing commitment, even though it is second best for efficiency when applied in a manner that increases risks to the profitability of investments (In India, for example, electricity regulatory statutes for many states require annual reviews of tariffs, which poses the risk that regulators will continually pass through to tariffs the benefits of investments that cut costs, and thus reduce the returns to these investments for the owners of distribution companies.)

Price cap regulation has emerged as the most popular form of incentive regulation

Even in the United States, where cost-of-service regulation for electricity suppliers has prevailed since the early twentieth century, 28 electric utilities (about 10 percent of the total number) were identified in a survey as being subject to incentive regulation - Sappington, Pfeifenberger, Hanser and Besheda 2001).

Incentive-based regulation typically puts limits on prices by one of the following means (A workable form of economically rigorous price regulation based on marginal costs has yet to be developed): indexation of tariffs to specific input costs (for example, fuel); price index less x on regulated services; price capping for markets that could become competitive in time; and yardstick competition for monopolistic functions—typically power distribution.

An incentive regulatory scheme typically specifies a commitment period (such as five years) during which the regulated company can adjust its rate as long as, on average, its rates rise no faster than inflation less a productivity offset (the x in the price formula), which allows consumers to share in the productivity gains.

A variant on this approach is to cap revenues, but this has the disadvantage for many developing countries of discouraging connections to new consumers because more profits can be earned by increasing sales to existing consumers under the allowable growth in sales revenue (There are other variants to incentive regulation which are much less common than price cap regulation (see Jamasb and Pollitt 2001).

In practice, the application of price cap regulation has tended to incorporate aspects of cost-of-service regulation, and vice versa.

This reflects differences in outcomes between price cap forms of incentive regulation and the cost-of-service form of regulation, because price cap regulation focuses more on short-term operational efficiency, whereas cost-of-service regulation focuses more on long-term investment efficiency. Power distributors in Latin America have performed at a better level under price cap regulation than under cost-of-service regulation. The performance of distributors under regulation that combines elements of price cap regulation with elements of cost-of-service regulation lies between these levels. Under cost-of service regulation, however, privately owned distributors are at most as efficient as publicly owned distributors (Estache and Rossi 2004).

The policy and regulatory framework based on incentives should cover not only the entities targeted for privatization, but also the entities that are likely to remain under state ownership in the medium term, especially the natural monopoly segments.

This principle applies even though incentive regulation is based on the fundamental assumption that the regulated entity responds to economic incentives, such as those that increase profits if efficiency targets are exceeded, yet publicly owned service providers generally do not respond strongly to economic incentives.

Regulation by contract and regulation by benchmarking are designed to overcome difficulties in applying incentive regulation (Benchmarking of power distribution and transmission utilities is reviewed in Council of European Energy Regulators 2005, Edvardsen and Førsund 2003, Jamasb and Pollitt 2001, and Shuttleworth 1999.)

They can help address the following three types of problems that have been encountered under severely inadequate information about service costs (found in many developing countries):

• If the regulator sets the productivity offset too low, the regulated firms can make super profits as they cut costs, but at the risk of arousing public ire and demands for price reductions, as occurred in England and Wales during the years following privatization of the electricity supply industry in the early 1990s.
• The rate freeze form of incentive regulation, under which a company cannot change its rates during the commitment period, is dangerous in the absence of provisions for pass-through of significant costs outside the control of the regulated firms, especially in the presence of other factors unrelated to the implementation of incentive regulation that provoke a crisis in the power market, as shown dramatically in California in 2001 (Besant-Jones and Tenenbaum 2001).
• In some cases of price cap regulation, regulators have reacted to politically controversial high returns to investment earned by suppliers under price caps, by such means as periodically reviewing the level of the cap (In the case of England and Wales, the incoming government in 1997 imposed windfall profits tax suppliers on the grounds that price caps had not fully reflected the scope for cost reduction.)This has the disadvantage of creating unpredictability about returns on investment, thus indirectly raising the cost of capital for investment.

Benchmarking involves comparison of a measure of actual performance against a reference benchmark performance.

The yardstick form of this approach can be used to promote indirect competition among regulated firms operating in geographically separate markets, under which the performance of a regulated firm is compared against that of a group of comparable firms. The National Energy Commission in Chile was the first to apply this approach to its electricity distribution firms. Benchmarking has been applied to many OECD countries for electricity distribution, and to Argentina, Brazil, Chile, Colombia, El Salvador, Guatemala, Panama, and Peru in Latin America, as well as to the Indian State of Orissa among developing countries.

Regulators have adopted a variety of benchmarking methods and techniques in incentive regulation.

These approaches can be classified by whether the benchmarks represent the best (“frontier”) practice or some measure of representative (“average”) performance (Jamasb and Pollitt 2001). The former focuses more strongly on performance variations between firms, and is suitable for the initial stages of regulatory reform when a priority calls for improving performance. Average benchmarking may be used to mimic competition among firms with relatively similar costs or when lack of sufficient, reliable data and comparators prevents application of frontier methods.

Benchmarking is particularly useful for regulating small off-grid power systems, particularly in its average form, because it costs relatively little to administer under the wide variety of production technologies and local market characteristics found in these systems.

Benchmarked cost levels will seldom be optimal, but this disadvantage is often outweighed by ease of application. The essence of off-grid regulation should be light-handed with a focus on lower but affordable service standards and fewer regulatory requirements than applied to the main power grid supply. Otherwise regulation becomes unworkable, such as when using individual cost-of-service calculations for the 119 electricity cooperatives in the Philippines (Reich, Tenenbaum, and Torres 2006).

The Government of India has adopted a variant of benchmarking to provide incentives for improving the performance of State Electricity Boards.

Performance is measured and ranked on a series of indicators related to improvements in transmission and distribution, installation of meters, and institutional reform, with less emphasis on financial results. Simple and transparent measures are intended to make it easier to allocate resources according to true performance—rather than to states that are politically better connected to the central government—thus creating competition between states and, it is hoped, incentives for innovation. Two ratings firms produced the first such ranking in 2003 (Tongia 2003), (http://powermin.nic.in/report/Rating%20of%20State%20Power%20Sector-January%202003.pdf)

Summary and recommendations:

1. *Specific contractual arrangements may be needed to sustain private investment under a new regulatory regime.*

2. *The incorporation of regulatory procedures and rules in concession agreements can provide stability and credibility during the transition to regulatory autonomy.*

3. *Under regulation by contract, the discretion of the regulator is limited in areas that are known to deter investment, while the autonomy of the regulator is used to avoid uncertainties for investors.*

4. *The credibility of regulation by contract requires that the underlying principles and initial parameters of the contracts should be clearly specified in the country's primary or secondary electricity legislation*

5. *Concessions for power distribution under regulation by contract resemble PPAs with IPPs for investments in power generation*

6. *Risk allocation is a major design issue for regulation by contract, just as for PPAs and concessions*

7. *Regulation by contract is sustainable only if the underlying economics to the concessions are viable*

8. *Concessions under regulation by contract cannot absorb major economic shocks to the regulatory system.*

9. *Robust and workable mechanisms for resolving disputes should be incorporated into concession agreements.*

10. *The presence of a regulatory agency allows for simpler contracts that are easier to monitor, enforce, and revise.*

11. *Incentive regulation is designed to offer the following advantages over cost-of-service regulation:*

    - *A stronger incentive to reduce costs, because the supplier keeps more of its gains under the weaker link between rates and costs.*

    - *Lower costs of administering regulation plans, because these plans avoid the micromanagement of the regulated entities and intensive data collection and authentication required under cost-of-service regulation.*

    - *Helps power suppliers to adapt to competition, if and when some or all of their markets are liberalized, because it offers incentives similar to those that face firms in competitive markets. Incentive regulation that induces* *cost-minimizing behavior by power suppliers yields large gains to the most efficient suppliers, while cost-of-service regulation controls those gains, but creates weak incentives for minimizing costs. Incentive regulation is also appropriate for developing countries because of their generally weak capacity to audit the costs of power suppliers—which is critical to the effectiveness of cost-of-service regulation. These suppliers can exploit their advantage over regulators in information about their costs by padding their allowable rates.*

12. *Cost-of-service regulation (or rate-of-return regulation) can be considered for countries where rules can be enforced but complex regulatory arrangements cannot be managed*

13. *Price cap regulation has emerged as the most popular form of incentive regulation*

14. *In practice, the application of price cap regulation has tended to incorporate aspects of cost-of-service regulation, and vice versa.*

15. *The policy and regulatory framework based on incentives should cover not only the entities targeted for privatization, but also the entities that are likely to remain under state ownership in the medium term, especially the natural monopoly segments.*

16. *Regulation by contract and regulation by benchmarking are designed to overcome difficulties in applying incentive regulation*

17. *Benchmarking involves comparison of a measure of actual performance against a reference benchmark performance*

18. *Regulators have adopted a variety of benchmarking methods and techniques in incentive regulation.*

19. *The Government of India has adopted a variant of benchmarking to provide incentives for improving the performance of State Electricity Boards*

Governance – 3

Access and Affordability to Electricity Services

Improvements in access to electricity services do not automatically follow comprehensive reforms that generate increased resources for investment in system expansion. The cause—lack of access to credit, high connection costs, and affordability constraints—should first be diagnosed, and the findings should guide policies to address access and equity issues in the sector.

Various regulatory and policy approaches have been tried to expand access and affordability. They include the use of connection or coverage targets in concession and license agreements, the obligation to offer service, liberalizing entry by other suppliers to unserved or underserved areas, allowing different levels of service for consumers, and the provision of subsidies for system expansion and consumption.

Governments should also recognize that electricity may be appropriately provided by cooperatives or other community organizations operating mini-grids or reselling power purchased from the grid or by private entrepreneurs offering solar home or battery recharging systems.

In general, targeting subsidies at connections would be preferable to subsidizing consumption. Governments should assess the extent to which proposed subsidy schemes would benefit the poor and whether there is sufficient fiscal space for these subsidies. Schemes that ensure competition for subsidies on the part of the service provider should reduce the fiscal burden. Cross-subsidies from other consumers can also be employed, but this approach should not unduly distort electricity prices or burden those consumers.

Governments may seek to introduce new, local service providers into the rural electrification business to meet demand in areas currently not served by the incumbent(s). They should consider how best to deliver this support, and in particular whether it should be provided through such existing facilities as small and medium enterprise (SME) development windows and NGO-supported microfinance and business development entities. They should factor in the state of private sector and financial sector development when assessing the possibilities for SMEs or community-driven models in the power sector.

Where subsidies are needed, they must be well targeted and based on a clear policy rationale, and include output based aid (OBA) approaches, as well as more traditional input-based approaches.

Power market reform entails a number of important social dimensions for the poor. These dimensions include the prices of electricity services, access to electricity services, and quality of electricity services. Without access to services, other social aspects of power supply are irrelevant. The higher power prices that have followed power market reform in many developing countries raise concerns about affordability for low-income households and the role of subsidies in the new power markets. Quality of electricity service is closely linked to investment in supply capacity needed to meet growing demand for power by all types of power users, including low-income users located on the margins of power grids and in areas not connected to these grids (See World Bank and ESMAP 2000 for a review of issues and options for providing energy services for the poor. Surveys of the social impact of power market reform in Brazil, Guatemala, Georgia, and India are reported in PA Government Services Inc. 2002)

Context and Background

Developing countries face major challenges to improve access and affordability to electricity services for households on low incomes.

These countries have responded to the challenges according to their income levels in the following two main ways:

- Some developing countries—generally in the middle-income group—have met these challenges with some success since the 1990s, partly by attracting private investment. These countries have an extensive energy infrastructure and basic coverage service of electricity services. This observation applies irrespective of the size of the power system.
- Small low-income countries, such as those in Sub-Saharan Africa, face low and stagnant growth in access to electricity. Their share of households with access has sometimes even declined as their population has grown faster than their power supply. Their challenges are particularly daunting because typically less than 10 percent of the population is electrified, mostly in urban areas.

Extending access to affordable modern energy services—including electricity services—for poor households is one of the most practicable ways of supporting their welfare (Access for a household to electricity services from a public supplier encompasses a connection from a local distribution network to the place of residence and a legally valid agreement between the supplier and the householder for the supply of electricity services.)

This is because expanding access—and therefore consumption—of these services from the low levels found in numerous developing countries helps to increase income and meet basic needs, such as improved health and primary education, as well as support social empowerment and environmental sustainability, and hence achieve the Millennium Development Goals (U.N.-Energy 2005), (low access rates). The cost of these services to users is often considerably lower than the corresponding traditional energy alternatives used by poor households without access to these services (Households in Guatemala without electricity, for example, pay implicit prices of more than US$11 per kWh (more than 80 times the price of electricity) for lighting with candles and wick lamps and to power appliances with dry cell batteries (Foster and Araujo 2004)).

Households that are not connected to electricity supply are generally urban poor.

The main reason is that the access charges levied by power utilities amount to the equivalent of many months of the low incomes of these households, especially for residential premises situated far from the electricity grid. In addition, the premises occupied by many poor households are precluded from connection to public electricity supply because they are too poorly constructed to be safe for electrical wiring. Households may also experience long waits to obtain new connections to electricity service from poorly performing utilities and face demands for informal payments from utility employees to get connections. Their multifamily dwellings create uncertainty about liability for payments that deters traditional utilities from serving them. Finally, householders without formal title to the land they occupy face legal obstacles to obtaining electricity service from utilities.

Low-income households that are connected to electricity supply also suffer from low-quality technical and customer service.

Low quality of power supply hits these households hardest, since they cannot afford to repair damage to their electrical appliances caused by high voltage fluctuations and power surges, nor purchase protection equipment. They experience long waits for utilities to restore service after local network failures and to rectify inaccuracies in billing. Consumers on unauthorized connections to the network are exploited by dishonest utility employees for informal payments.

Households that can only afford to meet their basic needs sometimes prefer to receive electricity service from informal vendors rather than from utilities.

In many cases, this happens because these consumers expend less on purchasing the small amounts of services that they can afford from vendors than they would by paying the relatively high fixed charges levied by utilities to cover the high up-front costs of their networks. Vendors also deliver services—such as recharging 12-volt batteries for lighting and radios—directly to households where the formal network does not extend to their communities.

Many governments actively discourage informal electricity distributors that serve many off-grid communities around the world.

These distributors may be illegal where the incumbent utility has an exclusive franchise. They lack access to subsidies and to the capital markets. They may be disadvantaged by regulatory provisions suited to formal network providers because they create public hazards, high unit costs, low service quality, and harmful fumes from generators. Small operators may also form cartels and charge exorbitant prices to consumers. Nevertheless, in many countries informal providers are needed because services from the network operators are too expensive for poor areas, or the operators take too long to expand service.

Most of the poor in developing countries—especially the rural poor—tend to be avoided by private operators and have benefited little from private capital flows into developing country electric power sectors.

One reason is because the poor do not have access to public electricity supply, and lack of access is far more prevalent in rural areas than in urban areas (Four out of five people without access to electricity live in rural areas of the developing world, mainly in South Asia and Sub-Saharan Africa. Globally about 1.6 billion people lack electric power (IEA 2002b). In Sub-Saharan Africa only 8 percent of the rural population has access to electricity, compared with 51 percent of the urban population. In South Asia only 30 percent of the rural population has access, compared with 68 percent of the urban population). Another reason is that private operators are reluctant to serve low-income clients because these markets are not financially viable on a freestanding basis (In Bolivia, for example, coverage of access to power supply did not change much in rural areas but grew in urban areas during the decade following power sector reform (Bojanic and Krakowski 2003)).Investment and operating costs of rural energy projects are high relative to revenue potential, making returns unattractive to private investors. Meanwhile, few private rural energy and renewable energy investments have been commercially viable or competitive with investment opportunities in the generation sub sector (World Bank 2003b).

Unless efforts are targeted at urban areas, as well as rural areas, much of the urban poor will not gain in access to electricity (Saghir 2005).

Poor areas—especially slums and shantytowns—in many large cities have been virtually abandoned by the traditional electricity service providers because their staffs are reluctant to enter these areas, particularly those areas that are known for their violent crime. Moreover, a large proportion of the growth in low-income households requiring access is expected to be in urban markets, since much of the population increase in developing countries will occur in urban areas, partly caused by migration from rural areas (World Urbanization Prospects: The 2001 Revision, United Nations Department of Economic and Social Affairs—Population Division.). Fast population growth, rapid urbanization, and rising demand for electricity are overloading supply capacity and creating strong demand for new investment.

Extending electricity service to the urban low-income households requires improvement to the existing power system.

Since power service providers in most urban areas are already serving better-off populations, they face modest demands for new capital investment—such as extending the grid to new peri-urban areas—relative to the cost of extending supply to rural areas. Even with lower connection costs and higher incomes relative to rural areas, though, many urban low-income households cannot afford the connection charges or monthly rates for electricity.

Policies for reforming urban power markets should consider the impacts on access and affordability in rural electricity markets.

Despite differences in economic characteristics, these two markets are usually linked—in some cases physically, as well as technically, institutionally, and economically. Many rural areas are supplied from the national power grid and are subsidized from urban power markets. In these cases, scalable models for improving rural service provision can work only by improving the overall governance and management of the national power sector.

Summary and recommendations:

1. *Developing countries face major challenges to improve access and affordability to electricity services for households on low incomes.*
2. *Extending access to affordable modern energy services—including electricity services—for poor households is one of the most practicable ways of supporting their welfare*
3. *Households that are not connected to electricity supply are generally urban poor.*
4. *Low-income households that are connected to electricity supply also suffer from low-quality technical and customer service.*
5. *Households that can only afford to meet their basic needs sometimes prefer to receive electricity service from informal vendors rather than from utilities.*
6. *Many governments actively discourage informal electricity distributors that serve many off-grid communities around the world.*
7. *Most of the poor in developing countries—especially the rural poor—tend to be avoided by private operators and have benefited little from private capital flows into developing country electric power sectors.*
8. *Unless efforts are targeted at urban areas, as well as rural areas, much of the urban poor will not gain in access to electricity*
9. *Extending electricity service to the urban low-income households requires improvement to the existing power system.*
10. *Policies for reforming urban power markets should consider the impacts on access and affordability in rural electricity markets.*

Reform Policies for Improving Access and Affordability

The impact of reform to power markets on the affordability of electricity for the poor has been a recurring issue.

This is because of concerns that reform will unwind subsidies in power tariffs for poor households under policies that enable electricity service providers to recover their costs through user fees or subsidies.This issue has been studied for many countries (For example, see Dodonov, Opitz, and Pfaffenberger 2004, Fankhauser and Tepic 2005, Freund and Wallich 1995, and IPA Energy Consulting 2003 for countries in Eastern Europe; McKenzie and Mukherjee 2003 for Latin America; and Monari 2002 for India.). Power market reforms designed and implemented by technical groups working at the national level, for example, allow users little say in the design and delivery of electricity services and can end up hurting—rather than benefiting— the poor.

Power market reform in developing countries is generally perceived as providing limited support to poverty alleviation (Estache, Gómez-Lobo, and Leipziger 2001; Wamukonya 2003).

The focus on commercial performance by power suppliers that comes with reform is also viewed as detrimental to the interests of the poor because this focus reduces the scope for addressing social objectives through cross-subsidies from better-off consumers to poor consumers. This view would not be valid, however, in a well-conceived reform program, because reform offers the opportunity to introduce new ways for expanding access to electricity supply by the poor, and it also helps target subsidies efficiently on the poor in place of current approaches that largely favor the better-off consumers. Indirectly, reform should also help the poor by allowing governments to redirect fiscal resources from supporting power utilities to expanding social programs that benefit the poor.

Reforms can produce services that are better matched to the needs and ability to pay of low-income households.

These services can emerge from making a power utility adopt commercial objectives or by allowing alternative suppliers to create new delivery mechanisms. The challenge is to discover an appropriate price-quality combination by offering service options to these consumers that lie between a high-quality service offered by a utility that is too expensive for low-income households or not available to them at all, and a low-cost service offered by informal suppliers but whose low quality imposes other costs or limits the benefits to these consumers. One option, for example, involves trading off fewer hours of electricity supply at a steady frequency for a lower price.

Power market reform provides an opportunity to rectify the policy and regulatory constraints on electricity access and service for low-income households by overcoming entrenched attitudes to providing electricity services and developing different kinds of service.

Opening up the main power market to new entrants can stimulate incentives specifically designed to attract new entrants into markets serving poor areas. The establishment of a new regulatory system for the main power market provides an opportunity to introduce regulations that specifically help the poor. Reforms that place the power sector on a sound commercial footing, however, will not automatically improve access and affordability of electricity services to low-income households. They may make little difference to this situation, or even worsen it. It is important to ensure that reforms do not adversely impact access and affordability. The ways in which market reforms can impact access and affordability to electricity services are given below:

Impacts on Access and Affordability of Different Types of Utility Reform

	PUBLIC MARKET REFORM	PRIVATE SECTOR PARTICIPATION	REGULATORY REFORM	MARKET RESTRUCTURING
Price of service	Prices ***may*** adjust toward efficient cost reflective levels.	Prices ***should*** adjust toward efficient cost reflective levels.	Prices ***should*** adjust toward efficient cost reflective levels.	Prices ***should*** fall because of competitive pressures.
Quality of service	Quality ***may*** improve because of better management.	Quality ***may*** improve because of better management.	Quality ***should*** improve because of increased oversight and accountability.	Quality ***should*** improve as a result of competition.
Access to service	Access ***may*** improve because of improved finances.	Access ***may*** improve because of improved finances.	Access ***should*** improve because of increased oversight and accountability.	Access ***should*** improve as new providers widen consumer choice.
Fiscal flows	Subsidies to the sector ***may*** be reduced.	Subsidies to the sector ***should*** be reduced, and tax revenues from the sector ***may*** increase.	Subsidies to the sector ***should*** be reduced as tariffs converge to cost reflective levels.	Entry fees ***may*** generate revenues, and tax revenues ***should*** increase.

Note: ***May*** indicates possible impact; ***should*** indicates probable impact.
Source: Adapted from Foster, Tiongson, and Laderchi 2005.

Removing Regulatory and Institutional Constraints on Electricity Services

The causes of poor electricity access and service for low-income households originate in regulatory and institutional constraints:

• Institutional arrangements may impede the flow of private finance to the power sector and discourage innovation in service delivery methods. In many countries, for example, it is illegal for local private or cooperative generation and distribution enterprises to enter the power market.
• Regulatory frameworks often raise the biggest barriers to decentralized options for electricity supply, including barriers to alternative power technologies for locations not served by electricity and fuel distribution networks.

Setting up efficient regulatory and institutional structures is an essential part of supporting electricity services for low-income households.

Regulation of Electricity Markets Serving Low-Income Users

Electricity regulators have an important role in protecting the interests of poor consumers.

They perform this role by promulgating service standards, guidelines, and codes of practice for electricity service. Many regulators of power markets have not issued these standards and codes, with such exceptions as the state energy regulator for Andhra Pradesh in India (The Andhra Pradesh Energy Regulatory Commission's order Regulation No. 6 Standards of Performance in Connection with Electricity Supply to Consumers, issued in the AP Gazette of September 4, 2000, covers: restoration of supply in the event of power outage, quality of power supply, period of scheduled outage, complaints about meters, applications for new connections or additional load, paying off accumulated dues by customers, disconnecting seriously delinquent payers, and complaints about consumer's bills.).They need to find the right balance between protecting the commercial interests of the electricity service providers and the social interests of consumers. In the case of protecting poor consumers, this may not be achievable without funding arranged by government. The license conditions for distributors in some South American countries also spell out these standards and codes in some detail.

The regulatory system for rural electrification should not simply mimic the regulatory system for existing urban distribution systems.

This is because of large differences in market characteristics, especially lower load densities and higher supply costs in rural areas. The following regulatory measures help create a business environment conducive to private sector participation and investment in rural electrification:

• Ensure that rural service providers face sensible incentives for supply under tariff reforms. Such incentives may include deregulation of retail prices to facilitate entry by suppliers to rural service areas in the absence of public funding.
• Focus regulation on the price at which bulk service or network access is provided to competing providers.

• Add an antitrust or competition law element to regulation, or issue nonexclusive licenses to prevent providers that have a dominant position in a market from using that position to prevent competition in that or related markets.
• Simplify legal mechanisms for extending electricity service to unserved or poorly served customers to reduce the legal barriers to entry to a rural electricity market.
• Set affordable service standards for rural customers—covering distribution codes and standards for service quality, customer metering, and enforcement of disconnections.
• Allow rival technologies to be selected on the basis of their economic merits without discrimination through barriers for entry to markets.
• Apply wheeling charges and fair terms for providing backup support from the grid that facilitate the creation of multi-village power systems as an alternative to power supply from the main grid operator. In case of Maharashtra, if hubs can be created from the main grid and distribution licenses can be given to private players, then this may be a good option to explore.
• Encourage participatory approaches to rural electrification to improve interaction between the electricity service providers and rural consumers.
• Lighten the information and reporting requirements imposed on service providers.

The traditional strategy of one national electricity regulator "doing it all" is often not sensible for enterprises that provide off-grid electrical services.

Successful electrification requires that the traditional regulatory functions and tasks are often best performed by entities other than the national electricity regulator. Nontraditional regulatory techniques need to be developed and implemented for different forms of electrification. Four basic regulatory principles are presented in below for designing and implementing regulatory systems that promote electrification in ways that maximize benefits and minimize costs (Reiche, Tenenbaum, and Torres 2006).

Policy Instruments for Promoting Access to Electricity Services

INSTRUMENT	ADVANTAGES	DISADVANTAGES
INSTRUMENTS THAT REQUIRE OPERATORS TO PROVIDE ACCESS		
Universal service obligation	Provides a legal obligation to serve all customers, including those that may not be commercially attractive.	The obligation is rather vague and may not be meaningful if poor customers cannot afford connection charges or if others live far from existing networks.
Connection targets	Forces a concrete definition of realistic coverage targets, ensuring that unprofitable customers are served. Can be monitored and enforced by use of financial penalties.	Requires users to accept an obligation to connect. Affordability of connection charges can be an issue.
INSTRUMENTS THAT INCREASE SUPPLY OPTIONS		
Broader service obligations	Ensures that an alternative is available for households that are not able to connect to the network.	Poor households prefer private connections. Communal supply points tend to be unprofitable.
Licensed entry of alternative providers	Provides choice to consumers. Increases competitive pressures on the dominant utility.	May make investment unattractive to utility. Difficult to regulate small suppliers for adequate quality of service.
Promotion of partnerships	Improves supply quality to communities lacking utility connections. Reduces utility commercial risk from serving marginal communities.	May be difficult to achieve collaboration between the formal and informal sectors.
INSTRUMENTS THAT REDUCE CONNECTION COSTS		
Labor contributions	Allows households to contribute their time rather than money. Reduces external financing requirement.	There may be significant costs in training and supervising community volunteer labor.
Credit lines	Addresses what is sometimes the real underlying problem—credit constraints—rather than absolute affordability of access.	Provided by private operator could lead to increased risk exposure. Requires collaboration of microcredit institutions.

Source: Derived from Estache, Foster, and Wodon 2003.

Summary and recommendations:

1. *The impact of reform to power markets on the affordability of electricity for the poor has been a recurring issue.*
2. *Power market reform in developing countries is generally perceived as providing limited support to poverty alleviation*
3. *Reforms can produce services that are better matched to the needs and ability to pay of low-income households.*
4. *Power market reform provides an opportunity to rectify the policy and regulatory constraints on electricity access and service for low-income households by overcoming entrenched attitudes to providing electricity services and developing different kinds of service.*
5. *Impacts on Access and Affordability of Different Types of Utility Reform*
6. *The causes of poor electricity access and service for low-income households originate in regulatory and institutional constraints:*
    - *Institutional arrangements may impede the flow of private finance to the power sector and discourage innovation in service delivery methods*
    - *Regulatory frameworks often raise the biggest barriers to decentralized options for electricity supply, including barriers to alternative power technologies for locations not served by electricity and fuel distribution networks.*
7. *Setting up efficient regulatory and institutional structures is an essential part of supporting electricity services for low-income households.*
8. *Electricity regulators have an important role in protecting the interests of poor consumers.*
9. *The regulatory system for rural electrification should not simply mimic the regulatory system for existing urban distribution systems.*
10. *The traditional strategy of one national electricity regulator "doing it all" is often not sensible for enterprises that provide off-grid electrical services.*

Institutional Reforms for Supporting Access and Affordability

Extending access to electricity for rural households often involves creating the entire energy infrastructure network and developing viable new electricity service providers.

Rural areas often lack any infrastructure for providing energy services—whether electricity or other modern forms of energy. The remote locations and low density of demand raise the costs of electrification to unaffordable levels for many rural users. This lack of affordability challenges business models for rural electricity supply that are economically sustainable and financially replicable. Policies are needed for reducing the capital and operating costs of supplying electricity services to affordable levels for rural households. Where this is not feasible, as is the case in many places, the policy choice is whether to subsidize capital costs for extending national power grids to rural areas or for developing off-grid solutions.

The interests of low-income consumers should be specifically represented on policy bodies for the power sector.

Otherwise these consumers tend to be outweighed by pressure from politically well organized and influential consumer groups who benefit from preferential services and low tariffs. NGOs that specialize in consumer protection have sprung up in various countries, such as India, and consumer watchdog organizations exist in many countries to monitor issues that affect consumer interests generally. Nevertheless, consumer representation is usually limited to the likes of regulatory advisory councils, where they exert little influence over major policy issues.

Meeting the major specific challenges of expanding electricity services—as part of wider energy services—to rural areas usually requires dedicated institutional arrangements.

A common problem for meeting this challenge is dispersion of responsibilities for rural electrification among numerous ministries and agencies, in which rural electrification needs receive little attention among the demands of mainstream energy sectors. Hence, an inter-ministerial or interdisciplinary mechanism supported by a dedicated agency is required that can tackle the essentially local nature of many challenges for delivering electricity services in rural areas. This institutional arrangement is important for formulating policies for rural electrification, such as for the roles of public and private sectors, incentives and subsidies, appropriate quality standards, and prioritizing the areas covered by these policies (Barnes 2005), (This referenced document—Barnes, Douglas F. (ed). 2005. Meeting the Challenge of Rural Electrification in Developing Nations: The Experience of Successful Programs—has case studies of rural electrification programs in the following developing countries: Bangladesh, Chile, China, Costa Rica, Mexico, the Philippines, Thailand, and Tunisia.).

New entrants can bring many advantages to serving the electricity needs of low-income households:

• They can increase the available range of service options.
• They may be able to provide a "basic needs" level of service more cheaply than formal network operators.
• They may offer cost-quality combinations better suited to poor people's willingness to pay.
• They may offer innovative tariff and payment systems that enable low-income households to access service.
• They are only likely to flourish if they provide a better service than the incumbent's service to electricity consumers, or if they serve areas that do not receive service from the incumbent utility.
• They are more likely to encourage more of the population to connect to their systems, involve local leaders in the collection of bills to lower costs, provide flat rates for minimum service, and develop lower-cost systems to provide service to consumers who have low demand for electricity.

In the Republic of Yemen, for example, electricity use in rural areas is high compared to other middle-income countries because small-scale electricity providers supply rural towns and villages not served by the public utility. These providers range from individual households that generate for their own use and to supply a few neighbors, to larger operators supplying up to 200 households using diesel generators (Ehrhardt 2000). This may be a very useful idea to implement amongst the urban poor and the rural population. However, the entire concept needs to be executed with the right technological support and environmental concerns.

Decentralized generation can be incorporated into the rural energy service company model

It can augment power supply, provide voltage support, and reduce energy losses in the transmission network. Decentralized generation by the private sector has expanded significantly in many countries, largely with financial assistance provided through local institutions. It has grown in the power deficit situations that many developing countries face, where expanding grid connections is of little value because the available bulk power supply cannot fully meet the demand on the power grid. The smaller niche market–based and community-based systems are applicable for remote areas where small village-level, mini-grid systems are powered by micro-hydro or diesel generation, or both, as in Nepal, Bhutan, Bangladesh, etc.

Private companies and suppliers would be best suited to provide individual solar photovoltaic (PV) systems, possibly with sales and maintenance support provided through a local NGO. This is a very successful method for rural electrification and self sufficiency. However, local policies, governance and infrastructure matter a lot. Most of these schemes are in partnership with the first world players. It may be very useful to evaluate and assess the pertinence of such arrangements for Maharashtra.

Opening the electricity markets to new service providers involves the development of private, community, or cooperative distribution companies that are responsive to consumers.

Some approaches to attracting new entrants have had some success, including the dealer model, the concession model, and the retailer model (see below: Three Models for

Attracting New Electricity Service Providers). Under these approaches, suppliers can provide a range of services besides power supply, including metering and billing, rehabilitation and maintenance, system improvement, quality improvement, and demand-side management. Approaches should be selected according to their potential for widespread adoption in the specific circumstances of a country, given the prevailing constraints from financing for subsidies, technical assistance inputs, and the pace of overall market reform.

Three Models for Attracting New Electricity Service Providers

The dealer model centers on developing dealers that can sell equipment (such as solar PV systems) to people living far from the grid. Many countries already have retailers that serve rural areas, but they are typically weak and undercapitalized, and they serve limited territories. Kenya has a robust solar PV market (EAA, RAEL, and ERG 1999). Programs based on this model have tried various ways to strengthen dealer networks, with mixed results. In Indonesia such a program failed in part because it was implemented just before the financial crisis, although it had become evident that participating retailers preferred to sell PV systems for cash rather than providing them on a lend-lease basis. In Sri Lanka a project started out successfully, but multinational companies soon took over the local retailers.

The concession model is aimed at minimizing subsidies and encouraging private sector participation. The model depends on regulation by contract of large-scale competitive licensees or sub-licensees more than by market forces, but it helps to ensure that projects achieve scale economies. In Argentina and Chile, for example, competitive bidding is used to award franchise rights for rural service territories to concessionaires providing service for the lowest subsidy. Concessionaires can choose from a range of off-grid technologies, although PV systems are expected to be the most cost-effective choice in many cases. Users pay a connection fee and monthly service tariff (set by the government), and the government pays the concessionaires a declining subsidy determined by their contract (Jadresic 2000).

The retailer model involves a decentralized approach to providing electricity to households without access to grid service. Variations include rural electric cooperatives and competitive licensees (rural energy service companies), models based on various small market service providers, and various community-based models. A community, organization, or entrepreneur develops a business plan for meeting local demand for electricity, and then submits the plan to a project committee. If the committee approves the plan, it grants a loan or subsidy for developing the business. The retailer uses a fee-for-service arrangement to recover costs, repay the loan, and earn a profit. This approach ensures significant local involvement and consumer choice.

Source: Saghir 2005

Financial Viability and Affordability

The financial viability of electricity service providers is essential for the sustainability of affordable services to low-income households.

Market segments serving low-income consumers raise important issues for viability that need to be considered under reforms to the power market as a whole. These issues cover delivery costs, service prices, and subsidies.

Unless electricity can be produced and delivered more cheaply than presently, it can be unaffordable without subsidies for many low-income households.

The costs that matter are not only the unit energy costs, but also the costs of extending the network into an urban slum, for example, or to a rural town. The low demand for services would raise tariffs—including access charges—to recover the costs of extending a power network to unaffordable levels for low-income households and small or isolated communities. As a result, these users benefit from power market reform that brings down the average cost of extending power networks in urban and periurban areas and spurs alternative solutions—including minigrid services—for rural areas (Powell and Starks 2000).

Reducing Service Costs

Low-cost services should be emphasized in policies for providing electricity services to low-income households.

These policies should support technologies for low-cost electricity generation and distribution. They should allow some flexibility in regulated service standards, since the levels of electricity service applied to the main power markets are generally unaffordable for low-income households. Special programs for service delivery can be developed to cater to their needs by adopting lower construction and supply reliability standards, so as to reduce the costs of extending access and delivering services without compromising safety and environmental standards.

Connection costs can be reduced by exploiting cost effective technical designs and the scope for reducing the construction costs of rural networks.

In many cases, as in South Africa, careful attention to system design reduces construction costs by up to 30 percent, contributing significantly to the pace and scope of rural electrification. Adopting urban system design standards for the electrification of rural areas has led to the poor service, high losses, and low collection efficiency facing the power sector. For example, low-hanging bare conductors on low-tension lines facilitate energy theft by unauthorized connections to the lines, old meters are easily tampered with, and low voltage levels over long lines create large line losses of energy.

The following policy instruments are available for promoting access to electricity services by low-income households:

• Instruments that require service providers to extend access—universal service obligation and connection or coverage targets in concession and license agreements—in order to overcome a reluctance to serve customers whose business is not commercially attractive to service providers.
• Instruments that increase supply options under restrictions on alternative ways to provide services under privatization when connection to the public network is mandatory—broader service obligations, licensed entry to unserved or underserved areas of alternative service providers, and promotion of partnerships between utilities and alternative service providers.
• Instruments that reduce connection costs using the private cost of capital for financing network expansion—lower-cost technologies, labor contributions in kind, credit lines, connection subsidies, and connection cross-subsidies.

These instruments have the advantages and disadvantages summarized below:

TABLE 11. Policy Instruments for Promoting Access to Electricity Services

INSTRUMENT	ADVANTAGES	DISADVANTAGES
INSTRUMENTS THAT REQUIRE OPERATORS TO PROVIDE ACCESS		
Universal service obligation	Provides a legal obligation to serve all customers, including those that may not be commercially attractive.	The obligation is rather vague and may not be meaningful if poor customers cannot afford connection charges or if others live far from existing networks.
Connection targets	Forces a concrete definition of realistic coverage targets, ensuring that unprofitable customers are served. Can be monitored and enforced by use of financial penalties.	Requires users to accept an obligation to connect. Affordability of connection charges can be an issue.
INSTRUMENTS THAT INCREASE SUPPLY OPTIONS		
Broader service obligations	Ensures that an alternative is available for households that are not able to connect to the network.	Poor households prefer private connections. Communal supply points tend to be unprofitable.
Licensed entry of alternative providers	Provides choice to consumers. Increases competitive pressures on the dominant utility.	May make investment unattractive to utility. Difficult to regulate small suppliers for adequate quality of service.
Promotion of partnerships	Improves supply quality to communities lacking utility connections. Reduces utility commercial risk from serving marginal communities.	May be difficult to achieve collaboration between the formal and informal sectors.
INSTRUMENTS THAT REDUCE CONNECTION COSTS		
Labor contributions	Allows households to contribute their time rather than money. Reduces external financing requirement.	There may be significant costs in training and supervising community volunteer labor.
Credit lines	Addresses what is sometimes the real underlying problem—credit constraints—rather than absolute affordability of access.	Provided by private operator could lead to increased risk exposure. Requires collaboration of microcredit institutions.

Source: Derived from Estache, Foster, and Wodon 2003.

Summary and recommendations:

1. ***Extending access to electricity for rural households often involves creating the entire energy infrastructure network and developing viable new electricity service providers.***
2. ***The interests of low-income consumers should be specifically represented on policy bodies for the power sector.***
3. ***Meeting the major specific challenges of expanding electricity services—as part of wider energy services—to rural areas usually requires dedicated institutional arrangements.***
4. ***New entrants can bring many advantages to serving the electricity needs of low-income households***
5. ***Decentralized generation can be incorporated into the rural energy service company model***
6. ***Opening the electricity markets to new service providers involves the development of private, community, or cooperative distribution companies that are responsive to consumers***
7. ***The financial viability of electricity service providers is essential for the sustainability of affordable services to low-income households.***
8. ***Unless electricity can be produced and delivered more cheaply than presently, it can be unaffordable without subsidies for many low-income households.***
9. ***Low-cost services should be emphasized in policies for providing electricity services to low-income households***
10. ***Connection costs can be reduced by exploiting cost effective technical designs and the scope for reducing the construction costs of rural networks.***
11. ***The following policy instruments are available for promoting access to electricity services by low-income households:***
    - ***Instruments that require service providers to extend access***
    - ***Instruments that increase supply options***
    - ***Instruments that reduce connection costs***

Designing Appropriate Tariffs

Well-designed tariffs can lower customers' bills while increasing the service provider's profits.

Such tariffs cover pricing for specific service quality standards and the payment arrangements for electricity. Where necessary, they also incorporate subsidies provided through service providers. Well-designed tariffs allow consumers to choose tariff options that best meet their specific demands. For example, a customer could choose to pay a lower monthly fee, but a higher per-unit charge, or to pay a higher monthly fixed fee and a lower per-unit charge. Monopoly providers seldom offer such services because they do not face market risk. This practice is common, however, in competitive markets for other goods and services, such as telecommunications.

New entrants may also offer innovative tariff and payment mechanisms more suited to the services demanded by low-income households.

These entrants are more likely than power utilities to charge flat rates for their services without imposing periodic fixed charges. This enables low-income households to match the amounts of electricity purchased according to changes in their actual cash incomes and other expenditures. Informal providers are also more likely to design payment mechanisms that can accommodate non-cash transactions for the poor who operate outside the traditional cash economy and engage in bartering activities to meet their needs.

Even incumbent power utilities can be pushed under regulatory pressure to implement flexible payment mechanisms suited to the poor.

These utilities are often unwilling to provide service to predominantly poor areas because of the risk of nonpayment. Their periodic bills for accumulated consumption tend to strain the cash resources of low-income households. Prepayment mechanisms increase payment security to the service provider and ease budgeting by low-income households. Prepayment meters and cards have been widely adopted, for example, in South Africa (Tewari and Shah 2003). Another example is the recharging for a fee at privately operated charging facilities of 12-volt batteries used for electricity supply in many African households. For customers with low and variable cash incomes, these advantages offset the disadvantages of higher unit costs and lower payment convenience relative to grid-based electricity supply.

Appropriate services to low-income households can be provided through nonstandard service delivery mechanisms, service types, and tariff and payment mechanisms.

This requirement arises from geographical features, economic capabilities, social patterns, and land tenure arrangements. Traditional power utilities, however, tend to have a one-size-fits-all approach to service standards and charging. Few utility managers have much contact with poor areas or a real understanding of the needs of potential customers there. Private sector participation in utility management can help, but it may not overcome the tendency to ignore poor and marginal areas. The following policy instruments are available for jointly promoting the financial viability of service providers and the affordability of electricity by low-income households:

• Instruments that facilitate payment of bills by low-income households arising from requirements to improve revenue collections—billing frequency and prepayment devices.

• Instruments that protect low-income households from increases in costs of service arising from more demanding quality-of-service standards—different levels of service for consumers and consumption limiting devices.

The advantages and disadvantages of these instruments are summarized below:

Policy Instruments for Promoting Affordability of Electricity Services

INSTRUMENT	ADVANTAGES	DISADVANTAGES
INSTRUMENTS THAT FACILITATE PAYMENT OF BILLS BY LOW-INCOME HOUSEHOLDS		
Billing frequency	Facilitates budgeting for low-income households.	Increases administrative costs of revenue collection, but may improve revenue collection rates.
Prepayment devices	Facilitates budgeting for low-income households.	May lead to "self-disconnection." May be costly and subject to fraud. Requires the creation of a network for selling "smart cards" if electronic technology is used.
INSTRUMENTS THAT PROTECT LOW-INCOME HOUSEHOLDS FROM INCREASES IN THE COSTS OF SERVICE		
Different levels of service	Allows consumers to choose their preferred balance between the cost and quality of service.	May not always be technologically possible to differentiate quality of service provided through a common network.
Consumption limiting devices	Prevents low-income households from consuming beyond their means.	May lead to hardship if basic needs exceed imposed consumption ceiling. Required metering technology may be too expensive. Runs against the private operator's commercial incentives.

Source: Derived from Estache, Foster, and Wodon 2003.

Subsidizing Electricity Services to Low-Income Households

Governments have traditionally subsidized electricity rates as a means of income support for the poor

The countries of the former Soviet Union subsidized electricity tariffs as rewards for acts of bravery, patriotism or other achievements. These subsidies were also given to victims of disasters (such as at Chernobyl nuclear power station), war veterans, old age pensioners and others. In some countries, such privileged tariffs applied to more than 50 percent of the population (Krishnaswamy and Stuggins 2003). They have usually chosen below-cost tariffs to make electricity usage more affordable, but they have often applied this policy indiscriminately by failing to ascertain whether electricity rates are really unaffordable to low-income households (Ascertaining the affordability of electricity rates for low-income households should usually be carried out at the local level, since the necessary understanding of the consumption characteristics of these households is seldom found in national institutions.)

They have also applied this policy regressively when the richest users received a large share of this subsidy because they consume the most electricity. Under some tariff structures, the average payment per kilowatt-hour of electricity by rich users is actually lower than the payment by poor users. Moreover, subsidies are generally ineffective in many developing countries where chronic power shortages reduce consumption by subsidized users to well below their needs. In these countries, power rationing tends to reflect the greater political influence of better-off consumers by favoring the areas that serve them at the expense of low-income areas. Generally, therefore, the substantial empirical evidence questions the effectiveness of many subsidy schemes as a means of helping low-income electricity consumers (Komives and others 2005).

Governments have also subsidized connection charges to help low-income households gain access to electricity services.

This is a better policy than subsidizing the operating costs of service providers, because the latter are poorly targeted at the intended beneficiaries. The initial connection charges demanded by power utilities are often a greater barrier to obtaining electricity service for households than monthly electricity bills. These charges can be reduced through subsidies, such as a preset payment per connection to a private investor, to meet annual targets of new connections to the power system under rural distribution concessions, as in Guatemala (Economic Consulting Associates and Mercados Energéticos 2002a; Foster and Araujo 2004), (See Economic Consulting Associates and Mercados Energéticos S.A. (2002b) for lessons from the private provision of rural electrification in Southeast Asia—Cambodia, Laos, and Vietnam.) These charges can also be spread over several years without subsidies as a surcharge on the recurrent costs of electricity, where the need is to correct for a weakness in financial markets rather than to overcome constraints on affordability. These practices allow larger numbers of low-income rural households to pay for the low levels of electricity consumption that they value highly.

Well-designed subsidies can be used to attract private sector participation through concessions and asset sales.

A "good" subsidy scheme is one that enhances access for low-income households while sustaining incentives for efficient delivery and consumption, as well as being practicable within the financial and administrative capacities of the subsidy provider—usually the government (Barnes and Halpern 2000). They meet the three criteria of efficiency, equity, and effectiveness. They are efficient because they maximize the social (or economic) benefits relative to the opportunity costs of the subsidies. They are equitable because they reach the poor people that do not have electricity service, rather than better-off people that can afford to pay the full cost of services. And they are effective because they deliver sustainable support to the intended population (Barnes 2005).

Electricity services for the poor generally meet the economic criteria of suitability for subsidies.

Subsidies for extending access meet these criteria better than subsidies for consumption. Even under successful reform, low-income households need help with financing the costs of connecting their premises to the network and installing meters at the points of consumption. Lifeline rates serve a social purpose by enabling these households to afford a limited amount of electricity consumption when electricity tariffs are increased toward cost-recovery levels under reform. Subsidizing the cost of bulk power to privately managed distributors in situations where revenues fall below the full cost of supply—including financing costs—can ameliorate tariff increases for low-income households, but only regressively since most of this subsidy goes to other electricity consumers. Governments should provide financial support for subsidies that it requires, as shown by experiences in two Indian states (The government of Andhra Pradesh provides a good example of implementing this policy, but the government of Orissa did not provide subventions to cover subsidies and also blocked tariff increases needed to cover deficits, thus undermining the willingness of the private owners to undertaken critical investments for improving services). The following instruments are available for implementing these subsidy policies. Their advantages and disadvantages are summarized below (Subsidy Instruments for Helping Low-Income Electricity Consumers).

• Instruments that help low-income households gain access to electricity services.
• Instruments that protect low-income households from general increases in tariffs arising from cost recovery requirements and removal of major cross-subsidies—lifeline tariffs, targeted tariff discounts, vouchers, and tariff rebalancing.

The design of subsidies to help low-income users may be enhanced by a number of considerations when implementing power market reform:

• Subsidies should not be incompatible with commercialization of power supply. They should therefore be transparent to show their full cost to the parties that benefit from them and to those that finance them.
• Subsidies should be well targeted so that users who really need them receive subsidies while improving the affordability of the total subsidy. There are practical issues for designing targeting mechanisms where affordability is a binding constraint on providing electricity services to low-income households (Komives and others 2005). For example, a "lifeline rate" should be available only to users of small amounts of electricity (since this class of users is a fairly reliable proxy for low-income households). General subsidies for electricity use could impose unsustainable burdens on financial resources.
• Subsidies and taxes should avoid undermining electricity service markets by favoring one fuel over another, giving consumers distorted price signals, or creating disincentives for entrepreneurial solutions to electricity supply.
• Subsidies should be targeted to make access more affordable in ways that bring down the one-off fixed costs associated with electricity consumption, rather than the recurring costs of electricity consumption.
• Some degree of cross-subsidy will always be possible, even with open access to the power market, because of the economies of scale in network services. The scope for large cross-subsidies could become unsustainable, though, if new entrants are able to take the most profitable consumers away from the customer base used for cross-subsidizing low-income households.

Approaches have been developed for delivering subsidies to extend access to electricity services by low-income households.

They include OBA (output based bid) approaches (Brook and Smith 2001—see below) and other competitive approaches (Wellenius, Foster, and Malmberg-Calvo 2004), as well as more traditional input-based approaches (World Bank 2004b). For example, a competitive auction for subsidies for rural electrification was developed in Chile in association with the reform of the power sector, with successful results (Jadresic 2000; Gómez-Lobo 2001). Competitive auctions for payments to cover the capital costs of new connections to rural households by private contractors and operators were successfully implemented in Gabon (Environmental Resources Management 2002), Guatemala (Harris 2002), and Mozambique (Sakairi 2000).

Competitive approaches offer the advantage of allowing private innovation for finding solutions to extending electricity services.

They allow governments and donor agencies to structure projects and provide a mechanism for donor contributions. They allow all types of projects (grid, off-grid, and solar) to be considered. They leverage private sector investment while keeping down public contributions to the cost of extending access. Finally, they help develop market testing of alternative approaches to see which ones work best in the specific circumstances of a country or region (Townsend 2002), (See Econ One Research, Inc. (2002) to see how a private distribution operator was able to improve service quickly in Namibia.).

The design of subsidy delivery mechanisms should be compatible with the design of a new power market structure.

This would improve the efficiency of subsidies and reduce the need for cross-subsidies (Ehrhardt 2000). The delivery mechanism should be selected according to the following sequence of decisions:

• If government can afford to allocate fiscal resources to subsidizing low-income users, providing subsidies for electricity access and consumption from direct taxation is economically the most efficient way.
• If the government is fiscally constrained, a Universal Service Fund should be considered that is designed to provide cross-subsidies without distorting competitive forces in the power market. All service providers must pay a levy into a fund, and providers supplying poor customers at below cost receive subsidies from the fund. This fund may be difficult to administer, however, particularly if it involves numerous small-scale providers.
• If a subsidy is required, but administrative capacity is too limited for a Universal Service Fund administered through several service providers, government needs to decide whether competition or cross-subsidies is more helpful to the poor. A cross-subsidy would require restrictions on free entry and unbundling. Alternatively, free entry and unbundling should be considered if entrants can serve the poor without a subsidy. This choice should be assessed on a case-by-case basis.

This process can be represented by the decision tree shown in the figure below (Decision Tree for Source of Subsidy Funding)

Subsidy Instruments for Helping Low-Income Electricity Consumers

INSTRUMENT	ADVANTAGES	DISADVANTAGES
INSTRUMENTS THAT HELP LOW-INCOME HOUSEHOLDS GAIN ACCESS TO ELECTRICITY SERVICES		
Connection subsidies	Targets subsidy funds to low-income individuals with low administrative costs. Costs of community-level subsidies can be kept down by competitive bidding.	Requires government finance and is relatively costly per household connected. User cofinancing should be required to ensure commitment.
Connection cross-subsidies	Does not require external source of funding and spreads cost over a large connected population (often with greater ability to pay than the unconnected population).	Requires the unconnected population to be small relative to the connected population. The connected population may be unwilling to shoulder the subsidy.
INSTRUMENTS THAT PROTECT LOW-INCOME HOUSEHOLDS FROM GENERAL TARIFF INCREASES		
Lifeline tariffs	Entails minimal administrative costs.	Based on the questionable assumption that poor customers are small consumers, because of large families, shared dwellings, and reliance on secondary retailing (sales between neighbors).
Targeted tariff discounts	May provide a more reliable way of identifying low-income households.	It is difficult to find good targeting variables, and administrative costs may be significant. May be difficult to raise subsidy or cross-subsidy funds.
Vouchers	May provide a reliable way of identifying low-income households. Adds flexibility for user to select service provider. Low-income customers can be commercially attractive.	May be administratively complex and open to abuse. Remains difficult to identify good targeting variables and raise fiscal funds.
Tariff rebalancing	Reduces burden of fixed costs on small consumers.	The overall impact on affordability may not be large Utilities may need to cover fixed costs of billing.
Source: Derived from Estache, Foster, and Wodon 2003.		

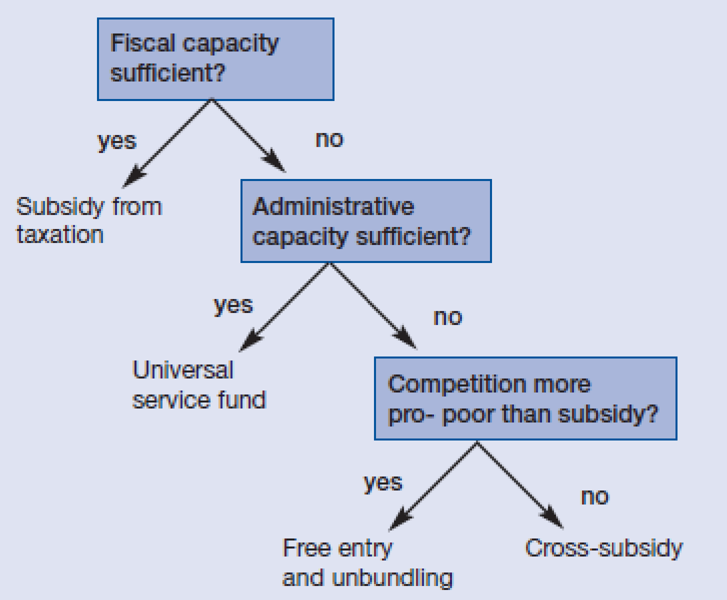
Output-Based Aid

Output-based aid (OBA) is a form of output-based mechanism for supporting the delivery of basic services that warrant some degree of subsidy to address affordability or to obtain social benefits when these services have the characteristics of a merit good. Traditional responses have focused on financing assets or other inputs used by public sector service providers, often with disappointing results. In contrast, OBA involves delegating service delivery to a third-party (typically private firms, but also NGOs) under contracts that tie payment of the subsidy to the particular outputs or results delivered. The public payments may complement or substitute for user fees, and may be funded from Bank loans, other sources of development assistance, or from a government's own resources. OBA approaches can also help to mobilize private financing in support of development outcomes.

OBA schemes take a variety of forms. Examples include the contracting out of services under performance-based contracts, the award of concessions or franchises for the delivery of services on the basis of least subsidy required, and voucher-type schemes, which give consumers a choice of supplier. The choice of approach, the specification of performance requirements and payment structures, and the design of detailed implementation arrangements need to take account of a variety of sector- and country-specific features. Although some of the design and implementation issues can be challenging, much can be learned from experience dealing with similar issues in private infrastructure arrangements, and many of the lessons can be transferred not only across countries, but also across sectors.

Source: Brook and Smith 2001.

Decision Tree for Source of Subsidy Funding



Source: Ehrhardt 2000.

Summary and recommendations:

1. ***Well-designed tariffs can lower customers' bills while increasing the service provider's profits.***
2. ***New entrants may also offer innovative tariff and payment mechanisms more suited to the services demanded by low-income households.***
3. ***Even incumbent power utilities can be pushed under regulatory pressure to implement flexible payment mechanisms suited to the poor.***
4. ***Appropriate services to low-income households can be provided through nonstandard service delivery mechanisms, service types, and tariff and payment mechanisms.***
5. ***Governments have traditionally subsidized electricity rates as a means of income support for the poor***
6. ***Governments have also subsidized connection charges to help low-income households gain access to electricity services***
7. ***Well-designed subsidies can be used to attract private sector participation through concessions and asset sales***
8. ***Electricity services for the poor generally meet the economic criteria of suitability for subsidies.***
9. ***The design of subsidies to help low-income users may be enhanced by a number of considerations when implementing power market reform:***
10. ***There are various approaches have been developed for delivering subsidies to extend access to electricity services by low-income households.***
11. ***The design of subsidy delivery mechanisms should be compatible with the design of a new power market structure.***

Governance – 4

Implementing Electricity/Power Market Reform

Summary:

The extensive range of economic and institutional endowments found across developing countries rules out “cookbook” solutions for reforming power sectors. This lesson applies regardless of the choices made for roles of public and private sectors for power supply.
Power sector reform strategies should be designed to fit an overall framework for delivery of modern energy services to promote poverty alleviation and economic growth. Meeting these two objectives requires the provision of reliable electric power services in sufficient quantity to meet affordable demand at the lowest cost reflecting the resources and impacts involved in their production and transportation.
Competition, unbundling, private participation, and other reform elements are not ends in themselves, but rather intended to contribute to the achievement of broad goals for poverty reduction, economic growth and environmental sustainability. In particular, these reforms should improve the economic efficiency of the sector and the commercial and operational performance of service providers.
Given the differing points at which they find themselves, countries must fashion power sector reform strategies that reflect the strategic priorities for the sector, and the immediate country conditions that influence the suitability of particular approaches.
Governments face critical decisions in reforming their power sectors.
The following valuable policy lessons have been learned from experience with implementing reforms to power sectors in developing countries (discussed before):

- *The role of the private sector in the power market should be suited to the prevailing country and sector conditions*
- *Competition in the power market is open to serious abuse of market power and is best started by limited forms under the conditions generally found in developing countries*
- *The form of the regulatory framework should be chosen to produce credibility and predictability for private investors and operators*
- *Power market reform should take account of the needs of the poor on the grounds of equity and political sustainability*

Additional policy lessons are argued in this document about the implementation of power market reform, including the need for careful consideration in the sequencing and pacing of power market reforms to manage risks for investors, consumers, and governments during the transition period to the reformed structure.

Challenges for Implementing Power Market Reform

Reform strategies must address a generic set of interrelated challenges.

The main challenges are the following: ensuring that consumers pay fairly and promptly for their electricity consumption; changing the manner in which new investments are financed; increasing the efficiency and development effectiveness of those investments; and increasing operational efficiency, while addressing equity concerns as the power market expands. However, the process of comprehensively reforming power markets through industry and market restructuring, private sector participation, arm's length regulation, and competition is technically complex, time-consuming, resource-intensive, and politically risky. It requires phasing and good sequencing to create the conditions for market transformation (World Bank 2003b).

Reform of power markets should cover the whole power market—not just discrete parts.

For example, rural power markets should be included in reforms carried out in urban markets because these markets are linked physically by grid interconnections and financially by cross-subsidies and joint costs. Regulatory reform should also apply to all suppliers—both state-owned and privately owned—to ensure economically efficient operation and development of the power market. Furthermore, reforms should be extended to energy markets rather than be concentrated on the power market, where reforms to these markets have many spillover effects. For example, fuel supply markets usually need to be liberalized to support restructuring of the power market.

Developing countries face many formidable priorities for reviving power investor interest in their power markets in a challenging global environment.

The priorities concern the following areas:
• Legal framework for private investors.
• Consumer payment discipline and enforcement.
• Regulatory predictability.
• Administrative efficiency for approvals and licenses.
• Credible arbitration available for investors.
• Investment grade (country) credit rating for foreign exchange debt.
• Positive view of private investment by civil society.
• Commitment to new sector structure by key stakeholders.
• Good country reputation for preventing corruption.

Arranging the large amounts of financing for covering the costs of power market reform can be a major challenge.

Some of the main cost items have been discussed earlier in the context of justifiable public investment. Major reform programs usually incur substantial costs for the following items:
• The cost of new metering for a competitive wholesale market, which can be enormous if a low threshold allows a large number of participants.
• Substantial investments that are usually needed to upgrade the power system control and communications system needed for a decentralized trading system.
• The substantial cost of establishing a new regulatory agency.
• Extensive consulting services to help draft legal and regulatory documentation and system technical documents, such as grid codes; plan and implement the restructuring of the incumbent power utility into new corporate entities; and draft the legal agreements

and design the market bidding, dispatch, and settlement systems for establishing new trading arrangements.

• Hiring transaction advisers for carrying out due diligence and preparing and marketing entities for privatization. These costs can amount in total to hundreds of millions of U.S. dollars, even excluding the cost of restructuring sector debts (The cumulative costs of advisers and consulting services needed for implementing a major power reform program alone can amount to tens of millions of U.S. dollars, based on the experience of reforms in Ukraine and Orissa (India), for example).

Reforming power sectors is a long-term process that carries many political risks for governments.

This situation applies especially to countries starting with weak governance structures for power suppliers and poor investment climates. Risks arise from the following features of reform:

• Unavoidable substantial costs in the short term.

• Uncertainty about when reforms will yield benefits in the long term because unanticipated events can derail reform programs.

• Opposition from politically influential interest groups that lose under reform (subsidized consumers, employees of the former state-owned enterprise who will be made redundant, bureaucrats and politicians who lose powers of patronage).

• Opposition by society at large to privatizing an essential public service, especially to foreign parties.

• Difficulty in improving service quality needed to gain public acceptance for tariff increases needed for reform, and vice versa. Opponents of reform have blamed private investors for tariff increases needed for financial viability, and have generated a backlash against private power supply in some countries that raises the prospect of re-nationalization.

• Mobilizing the financing for the heavy costs of reform (debt restructuring, investments essential for restructuring) under strained public budgets, as well as for expanding supply capacity to keep up with growing demand until the reformed sector can attract substantial risk capital.

Government Roles and Responsibilities

Governments have important roles and responsibilities in reforming their power markets.

They must decide on the relative roles of public and private sectors in providing power services, the governance and reform of public enterprises operating in the market, the new structure of power supply arrangements to introduce competition where feasible, including unbundling and the development of power markets; and reform of the governance and regulatory arrangements to improve oversight of the power market and introduce incentives for service providers to be efficient and responsive to consumer needs. They should also incorporate priorities for access, equity, and environment in the policy framework.

Governments should address the challenges for reforming power markets in ways that credibly show commitment to the reform strategy.

This emphasis on policies and commitment recognizes that policy constraints and lack of political commitment cannot be overcome and sustained by contracts and regulation alone. Governments create credibility by establishing a track record of keeping to its commitments under its laws and contracts (Bakovic, Tenenbaum, and Woolf 2003). Maintaining momentum for reform involves political costs and thus requires political commitment through successive phases of the reform process over one or more electoral cycles. Governments must be confident that the legislative changes required for reforms are politically feasible. Here, the strength of a government's parliamentary majority, the nearness of the next election, and the mandate of the previous election all impact on the willingness and ability of the government to institute the required changes.

A good indicator of a government's political commitment is its day-to-day support to distribution companies and regulators.

Government's support is needed for reducing theft of electricity and materials and nonpayment of bills by electricity users, providing subsidies for a transition period, and ensuring that its departments and agencies pay their electricity bills regularly. Payment arrears can often be settled through financial restructuring, but private operators are often helpless in enforcing policies for disconnecting power supply to consumers in payment arrears in the public sector, in particular for essential services, such as water supply, hospitals, army, and police. In some countries, government and its agencies account for more than 50 percent of a power utility's sales, so failure to pay their electricity bills becomes a real obstacle to reform. A government can publicly demonstrate its commitment by the passage and enforcement of antitheft legislation that allows for disconnection and prosecution of those who steal electricity, and by successfully prosecuting politically well-connected thieves (The case of Andhra Pradesh shows how this can be done – discussed before)

Government's implementation strategy should include the following elements:

- Ways to compensate or reassure losers in reforms to the power sector, with appropriate social safety nets.
- A build-up in trust between private entrepreneurs and the other parties, which can be achieved by seeking modest levels of private participation initially to overcome mutual suspicions.
- Mobilization of public support for the reform process by involving the main interest groups in the planning stage.
- Initial steps to establish government's commitment to reform to manage the political risks involved in restructuring the supply structure, establishing the new regulatory framework and introducing private participation.
- A transition process that takes into account the political realities facing reform.

Governments have to radically change their roles to support reform strategies based on private sector participation.

Their current roles are multiple, because they encompass policy maker; legislator; power producer and supplier as owner, system operator, and majority or only investor in the power sector; user of power services through its numerous agencies; and employer when power workers are subject to civil service employment conditions. The scope for conflict among these roles is usually too great to manage through tradeoffs. In a reformed power market, governments should adopt more selective roles, focusing mainly on being policy maker, legislator, creator of an enabling environment and risk-mitigator for private investors, and financier of subsidies for low-income consumers (Governments would, of course, retain their responsibility for representing national interests in energy—related international affairs, such as trans-boundary emissions, international rivers, energy producer associations, climate change initiatives and international energy trade.). Even governments' role as consumers would diminish under programs to privatize state-owned businesses.

One of government's key roles is to facilitate the development of power markets. This role carries the following responsibilities:

• Ensure that regulation of the power market achieves a fair balance between protecting the interests of electricity consumers and attracting the investment needed to meet demand for electricity.
• Mobilize financing of access costs to modern energy services for the poor where usage is socially worthwhile.
• Provide or arrange guarantees to mitigate political risks that are exceptional and deter private suppliers of electricity services.
• Provide limited performance undertakings on behalf of state-controlled enterprises to help privately financed investments and concessions in difficult business environments.
• Reduce barriers to market penetration for energy service providers and for promising new technologies (including some renewables).
• Build a good track record for paying subsidies to support its social development policies so as to help reduce risk for the viability of investments that depend on these payments.

Decisions about the level of government financial support should be consistent with decisions about power market development and electricity prices.

This requirement reflects the reality that electricity must be paid for either by consumers or by taxpayers (A major drawback with payment by taxpayers is the high economic cost to developing countries of public funds raised through general taxation.).Revenue shortfalls are costly since they lead to deterioration in the quality of supply and assets, as well as an inability to meet demand, as seen in many countries. Robust reform strategies, regardless of the choices made for the different roles of the public and private sectors, must confront these issues, often in a situation where prices are well below full-cost recovery (World Bank 1994b). Without credible steps to improve suppliers' commercial and operational performance and to align revenues with costs, reform strategies are unlikely to succeed in improving sector performance and contributing to economic growth and poverty reduction.

Government's responsibilities do not cease at privatization.

Instead, its oversight role often becomes more complex, partly because its support is needed to sustain private investment (as outlined before). Government has to maintain stable sector policies and keep to the letter and spirit of privatization agreements by avoiding actions that go against these agreements. It has to work jointly with investors to solve local problems as they arise and maintain fair and transparent mechanisms for dispute resolution. It has to quickly adapt to the concept of the autonomous functioning of the regulatory body. The types of post-privatization actions to be avoided include the action of Hungarian government in allowing retail tariffs to rise at a lower rate than wholesale tariffs, the actions of Ukrainian government in preventing and later staggering retail tariff adjustments called for in the tariff compacts of the privatization agreements, and government of Orissa's inability to resolve the heavy financial problems in the power sector after privatization.

Sequencing of Power Market Reforms

Sequencing of power market reform raises both strategic and tactical issues.

Strategic issues concern the design of the new structure of the power market and wholesale power trading arrangements with the attendant reforms to market regulation and the roles of public and private participants. The logical sequences for addressing strategic issues are as follows:

- The legal and regulatory framework for creating the new market structure and trading arrangements is put in place before restructuring the power supply arrangements, privatizing power suppliers, and setting up new market trading arrangements (again, discussed earlier).
- Restructuring of power markets progresses from an integrated structure—under which the power utility may not even be corporatized—to partially unbundled structures of corporate entities, and eventually for some countries to a fully unbundled structure, as discussed before.
- Restructuring of wholesale power trading arrangements progresses from internal transactions within an integrated power utility to the entry of IPPs selling their output to a single buyer, then to opening access to power networks by large users of power, and eventually to bilateral trading between generators and distributors or to a central power pool under competitive trading.
- Major organizational and financial restructuring precedes the creation of private ownership rights to avoid problems with stranded costs.

Power market reforms in most of the developing countries that have progressed substantially have broadly followed the logical sequence.

The sequences followed by 20 of these countries are summarized below. All of these countries passed primary legislation for power market reform, established sector regulation, transacted with IPPs, and privatized some of the power supply industry. Fourteen these countries implemented corporatization or passage of primary legislation for reform as their first step. Conversely, none of them started with restructuring, privatization, or the introduction of wholesale competition to the power market. IPPs entered the power supply chain at various steps in the reform sequence, which shows the adaptability of this form of transaction. The nine countries that introduced wholesale competition undertook the necessary main reform steps beforehand.

Sequence of Power Market Reform Measures in 20 Developing Countries

	NUMBER OF COUNTRIES AT EACH REFORM STEP					
REFORM MEASURE	FIRST STEP	SECOND STEP	THIRD STEP	FOURTH STEP	SUBSEQUENT STEPS	TOTAL COUNTRIES
Corporatization	7	2	5	2	1	17
Electricity law	7	6	3	2	2	20
Establish regulation	3	5	5	5	2	20
First IPPs	3	—	3	3	11	20
Restructuring	—	3	3	5	4	15
First privatization	—	3	1	3	13	20
Wholesale competition	—	—	—	—	9	9

Note: These countries are Argentina, Bolivia, Brazil, Chile, China, Colombia, Czech Republic, El Salvador, Hungary, India—Orissa, Indonesia, Jamaica, Malaysia, Morocco, Pakistan, Panama, Peru, the Philippines, Poland, and Thailand.

Source: Derived from Jamasb 2006.

Tactical issues for sequencing concern the implementation of a reform program.

These issues include the number of stages to a reform program, how much improvement to entities slated for private ownership or concessions should be attempted before handing the entities over to the private sector, the timing of tariff increases relative to service improvements, and the order of privatizing distribution and generation entities. Although generic sequences can be put forward for strategic sequencing issues, such an approach would not be useful in the case of tactical sequencing issues, given the wide variety in starting conditions for power market reform found among developing countries. Tactics should be specifically designed for each set of local conditions.

Government should incorporate its strategic and tactical decisions in an explicit policy for reforming its power sector.

This step should be undertaken at the start of the reform process to ensure that all parties to the reform have a clear and common understanding of the planned reform, to carry out the consultations needed to develop consensus for supporting the reform, and to develop the roadmap for implementing the reform. The reform policy should be developed under the guidance of a senior member of the cabinet to ensure cooperation among the numerous ministries and government agencies involved in the reform. The policy should be documented and presented to the legislature for discussion and to obtain political support. Once this is obtained, the policy should be officially published. Nigeria is a good example of this process (The power reform policy document, "Federal Republic of Nigeria: National Electric Power Policy Adopted by the Electric Power Sector Reform Implementation Committee and Approved by the National Council on Privatisation," can be found on the Nigerian Bureau of Public Enterprises, Web site (http://www.bpeng.org) under Publications/Power/Sector Policy/Electric Power Policy.).

This document can then be used as the blueprint for drafting the legislation needed for introducing some of the radical reforms, such as the abolition of a legislated monopoly for the state-owned power utility, the establishment of new regulatory arrangements, and the introduction of private service providers.

Some countries in Eastern Europe and the FSU were able to attract considerable investor interest by following sound sequencing of reforms.

In Hungary, Poland, and to some extent Moldova, privatization followed substantial improvement in the sector's commercial performance on the basis of an appropriate market structure and transparent competitive procedures, and resulted in substantial privatization receipts. Hungary, Poland, and Turkey (as well as Lithuania and Moldova to some extent) focused on (a) improving their laws on electricity supply and theft, (b) establishing professional and competent regulatory bodies to improve the levels and structure of tariffs to cover costs of supply, and (c) comprehensively commercializing the operation of their utilities. With these reforms, they met with reasonable success in restructuring their sector, attracting private investors and moving toward competitive markets.

Other countries in Eastern Europe and the FSU were not able to attract significant investor interest because of poor sequencing of reforms.

In Georgia, Kazakhstan, and Ukraine, privatization of poor commercial performers was conducted by direct negotiation on the basis of an impractical market structure, and resulted in poor privatization receipts, chaotic market conditions, no palpable improvement in sector performance, and eventually in disinvestments by disenchanted investors.
These countries did not focus adequately on creating the right conditions before embarking on privatization. Consequently, they have been facing investor disenchantment and disinvestments, and stalled privatization programs (Krishnaswamy and Stuggins 2003).

The sequencing of tariff increases with investments to improve the quality of service is often problematical.

Probably the most contentious reform issue is raising the overall level of tariffs to cover supply costs—even efficiently incurred costs—and removing most of the heavy cross-subsidy to households and other subsidized consumer groups (such as farmers in India) from industrial and commercial consumers (Subsidies do not run universally to households from industries. In Brazil, for example, the cross-subsidy runs to large industries from other consumer groups.). From the consumers' viewpoint, matching tariff increases to actual service improvements has economic merit, but it causes investors to face the difficulty of raising the large amounts of funding required for investments to upgrade service quality while tariffs remain below cost.

The sequencing of private investment in the power sector depends on conditions in the power market.

In the conditions of many developing countries, investment in new generation capacity alone is insufficient in the absence of the institutional capacity needed to manage retail operations, and efficiency improvement in customer service usually requires substantial investment in upgrading supply capacity. These relative needs, however, indicate the following basis for sequencing the introduction of private participation:

- Private participation is steered first to investments in power generation if more physical capacity is the priority, usually to meet rapidly growing demand for electricity, as in East Asia, since this segment of the power supply chain accounts for 60–70 percent of the total investment in the power sector.
- Private participation is steered first to the distribution sector of the power supply chain if increased efficiency is the priority, because of huge losses—both technical and non-technical—as in Latin America. This divergence in priority for private participation is shown in the differences between East Asia and Latin America in composition of private investment that took place between 1990 and 2002 (given below). This table shows that these Asian countries attracted much more private investment in power Greenfield projects (around US$68 billion) than the Latin American countries (around US$29 billion) over the same period. In total private investment in power, however, the Latin American countries attracted about US$10 billion more than the Asian countries because of high receipts from privatization of state-owned assets and businesses in the power sector.

Private Power Investments in Latin America and Asia 1990–2002 (US$ million)

COUNTRY	DIVESTITURES CONCESSIONS	GREENFIELD PROJECTS	TOTAL PPI INVESTMENT
LATIN AMERICA			
Brazil	34,644	9,913	44,557
Argentina	11,046	5,070	16,116
Chile	4,163	4,330	8,493
Colombia	4,348	2,210	6,557
Peru	3,166	1,137	4,303
Mexico	n.a.	3,897	3,897
Dominican Republic	1,208	1,101	2,309
Guatemala	651	782	1,433
Panama	937	128	1,065
Total	60,163	28,568	88,730
ASIA			
China	4,084	15,599	19,684
Philippines	2,683	10,730	13,412
India	378	11,960	12,338
Indonesia	n.a.	9,960	9,960
Thailand	1,545	6,471	8,016
Malaysia	1,395	6,296	7,691
Pakistan	291	5,646	5,937
Bangladesh	n.a.	1,040	1,040
Total	10,376	67,702	78,078

n.a. Not applicable.
Source: World Bank PPI Database.

The privatization sequence for poorly performing power sectors should start with distribution entities.

A prerequisite for implementing reforms in these sectors is to stem the accumulation of operating losses and enable sector revenues to exceed sector operating expenditures (PA Consulting Group 2005). Investors will pay more for generation assets when they see good prospects for selling their output to solvent purchasers, which usually occurs when the distribution entities are passed into private management. Latin American countries that privatized generation entities after they privatized distribution entities obtained greater privatization receipts than Latin American countries that privatized in the reverse order (This finding is based on unpublished research conducted within the World Bank and IFC.) In Brazil, for example, privatization began with distribution entities to realize the quickest available productivity gains where the power system had been most abused politically, and to create creditworthy buyers of energy for generators in preparation for their privatization (Brown 2002).

For a power sector with loss-making utilities or distribution entities, the choice of sequence involves whether to improve the commercial performance of these entities before bringing in private participation.

If it is difficult to improve the commercial performance of distribution entities under current managements, the preferred alternative is for private participation through the use of leasing or concession arrangements. However, if attracting private participation in any form is not feasible for some time, a reform strategy should address how to improve the performance of these entities before attempting to attract private participation, as happened in the case of the Indian State of Andhra Pradesh (discussed before).

Even in a situation of bulk power shortages, investments in new generating capacity should follow investments in distribution when the distributors are insolvent, for the following reasons:

• Distributors do not generate sufficient cash revenue to pay fully for the costs of power from new generation capacity in their current operating condition.
• Commitments to significant additions to new generation capacity should be deferred until the level of economically effective demand can be assessed reliably (System load can be pushed above effective demand by a combination of tariffs that are well below supply cost for some consumer categories, and uneconomical consumption that is encouraged by unmetered supply and high losses that arise from theft and poorly designed distribution networks. However, system load can be depressed below effective demand by tariffs that are well above supply cost for other consumer categories, but below the cost of own-generation, and by supply interruptions caused by lack of maintenance and by inadequate feeder and substation capacity in the distribution network.). Technical improvements to reduce technical and commercial losses are usually the least-cost means of closing the shortfall of supply relative to demand.
• The incumbent utility should not sign many long term power off-take agreements with IPPs to avoid overcomplicating the restructuring of its PPAs when it is restructured.
• IPPs are more likely to seek credit support on terms that impede market reform, such as escrow of revenues from the best-paying customers of distributors, when they sell power to insolvent distributors. The economically rational priority is to deal with tariff distortions, theft, metering, and local capacity bottlenecks through relatively low-cost investments to improve the performance of distributors, while creating a sound regulatory framework to govern future tariff changes.
The need for additional generating capacity should be assessed once the response of demand to these measures becomes evident.

Governments have to make tradeoffs in choosing their reform sequence for distribution businesses that cover urban and rural service areas.

Their options depend primarily on their ability to bear the political and financial costs for creating the conditions for attracting private participation, the risks that they should accept during the transition period, and the prevailing investor interest in such assets. The scale of the challenge in meeting these conditions is illustrated by the slow progress to date of many countries in reforming their distribution businesses, even with options for dealing with investors concerns about risk. In this situation, a government can choose from the following options for phasing the reform of distribution entities:

• *Concurrent privatization of all distribution companies with mixed urban-rural areas as soon as practicable.*

This is the most direct approach for meeting reform objectives, but it runs the risk of failing to sell the weaker distribution companies. Substantial amounts of commercial and regulatory risks would probably have to be ring-fenced from the investors during the transition period.

• *Sequential privatization of distribution companies with mixed urban-rural areas over time.* This approach might be suitable for achieving some privatization soon if not all distribution entities were performing sufficiently well to be privatized without the government assuming too much risk during a transition period.

• *Sequential privatization of distribution companies in separate urban and rural areas.* This approach might come into contention if the other options are infeasible. A possible transition path would be (a) management contracts, (b) concessions (perhaps investment management contracts), and finally (c) divestiture of assets. Smaller rural areas may be concessioned off to rural entrepreneurs or community organizations. Although performance-based returns should be built into these contracts, innovative measures to bring in the capital needed also have to be developed.

• *Full privatization could be tried later.* This approach provides time for meeting the conditions for attracting private participation and only if government wanted to privatize all the distribution entities at the same time. It requires government to credibly maintain a strong political commitment to reform. This approach works if the distribution entities would be able to access the debt markets on the strength of their balance sheets once they have been substantially commercialized and the tariff regimes (including social protection measures) are appropriate.

The Transition Stage for Power Market Reform

The transition stage from the old power market to the new power market is a vulnerable period when derailment of the reform process is possible.

Under the starting conditions for the power market found among most developing countries, the transition stage usually covers intermediate reform stages. For the market structure, transition concerns the less than full unbundling of the industry structure and the adoption of a single buyer trader for wholesale power. For private sector participation, transition focuses on private sector roles that fall short of full risk taking, such as management contracts and other forms of private participation, with temporary risk mitigation mechanisms, such as ring-fencing, vesting contracts, and political risk guarantees. Transition arrangements to provide credibility for a new regulatory regime revolve around regulation by contract.

The Importance of Starting Conditions

Starting conditions in the power market are important for designing power reform strategies.

They critically influence the main parameters of a reform, such as the roles of public and private sectors, the new market and industry structures, and the design of the regulatory framework. Given the wide range of starting conditions among developing countries, power market reforms are also likely to vary, as shown by the experience to date with reform. These conditions include the size of the country and its power system and market, the country's location relative to other power markets, its income level and macroeconomic condition, its political situation, and the capacity of its domestic financial markets and institutions.

The extensive range of economic and institutional endowments found across developing countries rules out "cookbook" solutions for reforming their power sectors.

This lesson applies regardless of the choices made for the roles of the public and private sectors in power supply arrangements. Reforms based on substantial market restructuring that may be adapted to large middle-income countries would be infeasible for small low-income countries. Conversely, modest reforms designed for the weak economic and institutional capacities of small low-income countries would have unacceptably low reform outcomes in large middle-income countries.

Countries in the lower-income group with small power systems typically have the weakest starting conditions for reforming their power markets.

Electricity prices are well below costs in many of these countries, but they are near to cost-recovery levels in others, which give rise to politically sensitive concerns about affordability of electricity for low-income households. Access rates to electricity by the population are low. Poor quality and shortage of public power supply cause numerous consumers to install private power generators. Poor governance of state-owned power utilities leads to poor technical and financial performance, the need for substantial credit support, very low operating efficiency that drives up unit supply costs under lack of maintenance, theft of electricity and utility property including cash, inefficiency in collecting revenues owed to utilities, and lack of investment caused by the inability of utilities (and governments) to mobilize financing. These countries have very low ratings for corruption and country creditworthiness.

Countries in the middle-income group with larger power systems tend to have better starting conditions for reforming their power markets.

Access rates to electricity by the population are higher than among the low-income small system group. Power systems are sufficiently large for breaking up their power generation and distribution sectors, as well as vertically unbundling their supply arrangements. Rapidly rising power demand requires large investments in expanding power supply capacity. Households and other favored or influential consumer groups benefit from substantial subsidies and cross-subsidies through the structure of power prices. Many of these countries have low ratings for corruption and governance. Some countries have local institutional investors, but generally investors face substantial political risk.

The composition of power market reform should therefore be adapted to starting conditions in countries.

This policy is illustrated below for the two groups of developing countries—large middle-income countries and small low-income countries—described above.

	DEVELOPING COUNTRY GROUP	
	SMALL LOW-INCOME COUNTRIES	LARGE MIDDLE-INCOME COUNTRIES
COUNTRY STARTING CONDITIONS		
Power system size	Very small	Small to large
Access to electricity	Low	High
Investment climate	Too poor to rate	Low to medium
Institutional capacity	Very weak	Low to good
Governance rating	Poor	Poor to good
INITIAL REFORM CHARACTERISTICS		
Market structure	Limited vertical unbundling. Single buyer with some simple bilateral trading for wholesale power.	Substantial vertical and horizontal unbundling. Bilateral trading or a central exchange for wholesale power.
Regulation	Semi-autonomous regulatory agency mainly responsible for oversight of concessions.	Autonomous regulatory agency with power to issue licenses and approve retail tariffs and trading arrangements.
Role of private sector	Mainly IPPs in generation; concessions in distribution under public-private partnerships.	Privatized generators and IPPs. Privately owned and financed distributors under long-term licenses.
Role of public sector	Continued ownership of most power supply facilities. Primary responsibility for financing sector development.	State ownership in sensitive generation sectors (hydro, nuclear), transmission, and nonviable distribution service areas.
Role of competition	Limited to bidding for PPAs by IPPs and by private operators for distribution concessions.	Competitive bidding for wholesale power contracts under bilateral trading or bidding into a power exchange.

Quick versus Gradual Approaches to Reforming Power Markets

Strong regional patterns influence the time taken to accomplish the transition stage.

In Latin America, where reform has generally been the most comprehensive among the regions, the time taken to cover the transition stage has been the shortest. In contrast, countries in Asia have been tentatively reforming their power markets for long periods without advancing far. Countries in Eastern Europe fall between the two other groups in the rate of their reform progress. This pattern is evident among the sample of 20 countries whose reform sequences are summarized in table above - Sequence of Power Market Reform Measures in 20 Developing Countries (Jamasb 2006).

- Eight Latin American countries in the sample took between one and four years from the passage of an electricity law to restructuring the supply chain, establish the regulatory framework, privatize a substantial proportion of the power supply business, and set up competitive wholesale trading arrangements for power.
- Among the three Eastern European countries in this sample, Hungary's performance corresponds to that of the Latin American countries with a transition stage of four years, while the other two countries (the Czech Republic and Poland) have carried out most of the reforms since the early 1990s, but have yet to complete the transition stage. Bulgaria and Romania are now proceeding along the same reform path relatively quickly.
- Finally, the seven Asian countries in the sample (counting India as a whole instead of just Orissa) have progressed least among these countries, despite also starting their reforms in the early 1990s, partly because of weak commitment to the reform vision adopted by Latin American countries.

The design of the transition stage should never lose sight of the fiscal reasons for reform, because an overly cautious approach runs the risk of delaying real reform benefits and losing political momentum for reform.

Consumers expect much more from private companies than from state-owned enterprises. Consumers understandably lose patience if tariffs go up immediately, but service improvements lag behind. When this happens, the regulators are blamed. Therefore, it is not surprising that most regulators, when faced with this situation, will try to find a way not to raise tariffs, especially if their legal mandate consists of nothing more than principles, goals, and objectives change language (Bakovic, Tenenbaum, and Woolf 2003). The preservation of protective features, such as "lifeline" rates, may be necessary, even though they would likely mean the continuation of subsidies within income classes, as well as from industry to residential consumers.

Pressures for rapid results, however, should not obscure the point that power market reform is designed for the long haul and requires patience.

Kazakhstan shows the risks of not following a well-planned and sustainably paced reform sequence. It unbundled its electricity supply functions, tried to establish a wholesale power market, and privatized much of its generation and distribution assets at rock bottom prices. It did so at the height of an economic crisis with low retail tariffs and cash collections in the power market and before establishing a credible regulatory framework for investors. As a result of this, power trade became chaotic, and investors pulled out (Kennedy 2002).

The gradual approach of incremental reform may succeed by helping reformers develop the necessary support, at least according to one theory.

This approach helps reformers create an initial constituency of early "winners" who sense real benefit in further reform, while lulling "losers" into believing they have achieved a good compromise. These initial winners develop into an interest group with a stake in reform, and provide the politician with confidence to push further. The "losers" begin to cede ground, and over time lose members to the "winners' side." The advantages claimed in theory for this process are that it allows government to plan and sequence its reforms coherently, ensure democratic buy-in, prevent policy reversals, and make all major political parties associate themselves with the reform agenda through the election cycle.

The advantages claimed for the gradual approach may be less elegant in practice and do not conform to sanitized theories of transparent, consultative, democratic functioning, or good governance.

These advantages enable reformist politicians to use skills and networks to keep their own incentives in the process alive by enabling them to devise rules and stratagems that will augment their own resources and reward their supporters or collaborators. Furthermore, they gain time for politicians to divide, lull, or inveigle opponents of the reform; to resolve, avoid, defer, or shift conflict through compromise, obfuscation, deal-making, blame-shifting, or stalling; and to identify and harness incipient supporters of the reform who will help push subsequent reform. This explanation recognizes that much of reform is politically unmarketable either because it runs up against powerful interests, does not coincide with the politician's time cycles, or fails to address legitimate concerns. Implementing reform thus depends on stealth, ambiguity, and following the path of least resistance (The views given in this paragraph and the preceding one is taken from an unpublished paper by Sumir Lal entitled "Political Factors Affecting Power Sector Reform in India.").

The relative merits of the quick approach versus the gradual approach to reforming power markets have yet to be settled. This is because the outcomes of these approaches are still evolving in developing countries.

In the reformed power sectors of Latin America, the quick approach worked effectively for reforming the power market structure, but most of these countries have had to revisit several aspects later in an effort to address concerns about processes for market regulation and social issues under weak or nascent institutions (Benavides 2003). The gradual approach followed in Asia allows time to develop institutional capacity and public consultation about the proposed reforms and their social impacts, as well as to integrate environmental concerns into policies for the new power market (World Resources Institute 2002). This approach, however, could prolong the reform process and perpetuate the culture of poor governance, leading eventually to its collapse from political intrigue and public skepticism, as shown by India's early reform experience (see below).

India's Experience with a Gradual Approach to Power Market Reform

India has generally followed a gradual approach to reforming its power market. Trained on broad reform goals, the detailed steps required to unravel the old system were worked out along the way through trial and error. Much of the gradual structural reform focused on the State Electricity Boards (SEBs)—the vertically integrated dominant power suppliers at the state level—because they were particularly inefficient and created huge losses for which the state governments were ultimately liable. From the mid-1980s, under an economy wide approach for state-owned enterprises in general, the central government had attempted to improve the efficiency of SEBs by giving them greater managerial autonomy and increasing their access to capital, with the hope that they would become more entrepreneurial.

The central government adopted a new approach in 1991 because of India's financial crisis, under which it sought immediate remedies. Since many years would be needed to rectify the SEB's inefficiencies, the new approach focused on the immediate problem of meeting the shortfall in generating capacity that had been perpetuated by the SEB's poor finances. The government hoped that private investors would provide large amounts of efficient and inexpensive power capacity, even though there was little track record in developing countries to provide credibility for this approach. A focus on private investors was also consistent with the reformist agenda of attracting foreign direct investment. There was a broad consensus supporting this approach to reform because of the lack of viable alternatives. The central government created the legal conditions needed to attract private investors in electricity generation, and it set tariff rules that would be particularly attractive to investors, with a guaranteed 16 percent return on equity (after tax) and full repatriation of profits in dollars. To jump-start the process, the government awarded "fast track" status to eight projects (many with foreign participation), promising rapid clearances and central government repayment guarantees to assuage investors' concerns about selling their output to insolvent SEBs. Most of these projects included a cost-plus PPA between the operator and an SEB. Only three of the fast track projects, however, have produced power more than a decade after the fast track initiative. Despite promises of rapid regulatory approval, many of the fast-track projects became mired in controversy.

The projects were touchstones for anti-globalization lobbies that used protests and public interest litigations on environmental grounds to slow approvals until investors withdrew. Although hundreds of Letters of Intent or even

Memorandums of Understanding were signed in the early to mid-1990s for projects without fast-track status; most of them did not result in serious investment. In addition to the obvious failure to attract much new capacity, this first wave of reforms yielded electricity from private plants that was much more expensive than power from the SEB's existing plants and even from new plants built by state-owned enterprises. Take-or-pay clauses in the PPAs, high rates of return, and a contracting structure that gave upside earnings potential to investors and saddled the SEBs with fuel and currency risks, were all the product of a power at any cost mentality. After this experience, India reverted to a gradual approach to power sector reform.

Source: Tongia 2003.

The Debacle of the Dabhol Power Company

Another noteworthy example is Enron's Dabhol power project in Maharashtra.
Dabhol Power Station is located at Anjanwel Ratnagiri district, 160 km south of Mumbai. The plant was a built by Dabhol Power Company, an investment company owned by Enron, General Electric, Bechtel and Maharashtra Power Development Corporation. Construction of the power plant which was the biggest foreign investment in India at the time started in 1992. Due to the political controversy of the project, the operation of Dabhol power station was interrupted on several occasions.
Construction was planned in two phases. Phase one was set to burn naphtha, a fuel similar to kerosene and gasoline. It would produce 740 megawatts and help stabilize the local transmission grid. Construction started in 1992 and finally completed in May 1999. Phase two would burn liquefied natural gas (LNG). At its height, the power plant in Dabhol employed 15,000 people. Production and construction stopped in May 2001. In May 2006 Ratnagiri Gas and Power took over the power station.
In 2000, it was selling electricity to the Maharashtra Electricity Board for Rs. 4.67/kwh. While the Board was only charging residents of Maharashtra Rs. 1.89/kwh.In 2001 it was shut down, after the Maharashtra SEB, refused to pay the bills for Nov 2000 and Dec 2000.

Why Was the Workout So Difficult?

1. *Poor economic assumptions.* It is an unenviable fact that all the stakeholders in Dabhol, whether debt, equity, or government guarantor, miscalculated, perhaps badly, concerning the assumptions and financial model they believed would produce enough revenue under the power purchase agreement to run the plant, service and repay the debt, provide a sufficient return on equity, and provide for future capitalization. The financial agreements called for the $2.9 billion project to be funded by $1 billion in equity from Enron (80 per cent), Bechtel (10 per cent), and GE (10 per cent);
$1.2 billion of project debt was to come from the Indian Banks, $160 million from OPIC, and the remainder from a syndicate of offshore lenders and export credit agencies. Had any stakeholder opted out, as the World Bank did based on their study that concluded the project was likely to fail, that stakeholder would have saved time, money, and economic opportunity lost by those stakeholders who stayed in the project.
2. *Failure of the GOI.* When Enron, Bechtel, and GE secured the impressive guaranties and economic concessions from the GOI, it's hard to imagine that they foresaw the upcoming failure of the GOI to honor its financial and contractual obligations, much less the GOI's course of conduct that was deemed expropriatory by an American arbitration panel. In addition to failing to honor its counter-guaranty, the GOI also, through its judiciary, improperly thwarted international arbitration panels from proceeding. Most importantly, however, the GOI refused to commit the resources to solve the problems raised through the project's failure. For four years, the GOI presence consisted of representatives without sufficient negotiating authority who frequently were replaced by new representatives, who similarly lacked negotiating authority.
3. *Failure of the GOM.* The government of Maharashtra was the sole purchaser of power under the PPA, and was also, ultimately, a 15 per cent equity holder in the project. Through its subsidiary, MSEB, the GOM was a prime mover in every aspect of the deal's

completion, and was the chief beneficiary of the PPA due to the state's energy starvation. When it refused to honor its financial obligations, including a direct, unlimited financial guaranty, the GOM threw a massive obstacle in the path to a fair workout. This unforeseen contractual breach was followed by the GOM's participation in important arbitrations and lawsuits, sometimes willingly, sometimes not. The GOM also utterly failed to participate or assist the long workout efforts. Their absence was as confounding as it was difficult to work around.

4. *The positions of GE and Bechtel.* The differing negotiating positions of the sponsors during the workout cut both ways on this issue. They took an aggressive stance in litigation and arbitration, pursuing claims against the GOI, GOM, MSEB, and MPDCL through a variety of causes of action and venues.

The comparison between quick versus gradual approaches to reform reflects views about the leadership of the reform process and the need for a public consensus.

The quick approach reflects a view that economic reforms must be carried out by a strong executive, unhampered by the need to consult or seek consensus, in order to stop vested interests from obstructing a reform agenda. From this perspective, although reforms may be rational for society as a whole, myopia on the part of the general public and a collective irrationality nonetheless can obstruct reform. However, this autocratic approach, even if tied to good economics, can make for undesirable politics by undermining democratic institutions. The gradual approach reflects the opposing view about the central importance of forging a social consensus around reform. This consensus requires consultation to improve policy and, by addressing the concerns of the general population, to increase the probability of continued public support for the reform program and support for democratic institutions. The distinction between these two approaches is blurred somewhat by noting that while the initiation of reforms may require a firm and autonomous executive with a relatively free hand, consolidation of reforms may rest in building consensus (World Resources Institute 2002).

Summary and recommendations:

1. *The following valuable policy lessons have been learned from experience with implementing reforms to power sectors in developing countries (discussed before):*

- *The role of the private sector in the power market should be suited to the prevailing country and sector conditions*
- *Competition in the power market is open to serious abuse of market power and is best started by limited forms under the conditions generally found in developing countries*
- *The form of the regulatory framework should be chosen to produce credibility and predictability for private investors and operators*
- *Power market reform should take account of the needs of the poor on the grounds of equity and political sustainability*

2. *Reform strategies must address a generic set of interrelated challenges.*
3. *Reform of power markets should cover the whole power market—not just discrete parts.*
4. *Developing countries face many formidable priorities for reviving power investor interest in their power markets in a challenging global environment.*
5. *Arranging the large amounts of financing for covering the costs of power market reform can be a major challenge.*
6. *Governments have important roles and responsibilities in reforming their power markets.*
7. *Governments should address the challenges for reforming power markets in ways that credibly show commitment to the reform strategy.*
8. *A good indicator of a government's political commitment is its day-to-day support to distribution companies and regulators.*
9. *there are many important elements to the Government's implementation strategy*
10. *Governments have to radically change their roles to support reform strategies based on private sector participation.*
11. *One of government's key roles is to facilitate the development of power markets. This role carries several responsibilities.*
12. *Decisions about the level of government financial support should be consistent with decisions about power market development and electricity prices.*
13. *Government's responsibilities do not cease at privatization.*
14. *Sequencing of power market reform raises both strategic and tactical issues.*
15. *The privatization sequence for poorly performing power sectors should start with distribution entities.*
16. *For a power sector with loss-making utilities or distribution entities, the choice of sequence involves whether to improve the commercial performance of these entities before bringing in private participation.*
17. *Even in a situation of bulk power shortages, investments in new generating capacity should follow investments in distribution when the distributors are insolvent.*
18. *Governments have to make tradeoffs in choosing their reform sequence for distribution businesses that cover urban and rural service areas.*

19. *The transition stage from the old power market to the new power market is a vulnerable period when derailment of the reform process is possible.*
20. *The extensive range of economic and institutional endowments found across developing countries rules out "cookbook" solutions for reforming their power sectors.*
21. *Countries in the lower-income group with small power systems typically have the weakest starting conditions for reforming their power markets.*
22. *Countries in the middle-income group with larger power systems tend to have better starting conditions for reforming their power markets.*
23. *The composition of power market reform should therefore be adapted to starting conditions in countries.*
24. *Strong regional patterns influence the time taken to accomplish the transition stage*
25. *The design of the transition stage should never lose sight of the fiscal reasons for reform, because an overly cautious approach runs the risk of delaying real reform benefits and losing political momentum for reform.*
26. *Pressures for rapid results, however, should not obscure the point that power market reform is designed for the long haul and requires patience.*
27. *The gradual approach of incremental reform may succeed by helping reformers develop the necessary support, at least according to one theory.*
28. *The advantages claimed for the gradual approach may be less elegant in practice and do not conform to sanitized theories of transparent, consultative, democratic functioning, or good governance.*
29. *The relative merits of the quick approach versus the gradual approach to reforming power markets have yet to be settled.*
30. *The comparison between quick versus gradual approaches to reform reflects views about the leadership of the reform process and the need for a public consensus.*

Reform Road Map

A road map is a vital component of the reform process.

It shows how the key strategic and tactical reform issues will be handled under a coherent reform strategy. This includes showing how a commercially oriented business environment will be developed and how other reform objectives will be achieved. The road map sets out the sequence of reform and shows the process for changing governance by restructuring the institutional, regulatory, industry, and market arrangements for power supply. It covers what, when, and how the reform will be done; who will do what; and how the substantial costs of reform will be financed (see below - Road Map for Power Market Reform). A road map is, of course, specific to a particular reform for a power market. It can take many forms depending on the institutional arrangements for reform. For example, a road map can be developed in a series of resolutions recorded in the minutes of a reform management committee that are supported by working papers prepared by technical task forces and technical reports prepared by consultants.

Road Map for Power Market Reform

A road map for power market reform answers the following questions:

- *What business-enabling environment will be created through legal, regulatory and competitive frameworks?*
- *What markets are being created, and how will property rights be protected?*
- *What roles will be taken by the private and public service providers, respectively?*
- *How will the new businesses be managed and financed from tariff revenues and funding for capital expenditure and how will the subsidies that are needed to meet social objectives be provided in ways that do not undermine the commercial incentives and orientation of sector governance?*
- *What transition path will be taken from the starting conditions to reach the desired end conditions with regard to, for example, corporate and market restructuring or change in governance arrangements for financing?*
- *Who will mitigate the risks and soften the tradeoffs associated with the transition?*
- *How will any required financial restructuring of the state-owned power utility be undertaken?*
- *What options will be considered for dealing with unexpected developments during the transition period that delay progress?*
- *How will the reform process be organized in relation to allocating responsibilities for implementing reform stages, such as corporate and financial restructuring, transacting sales to private investors and operators, mobilizing resources needed to carry out reform, and retaining technical experts?*
- *When and how will consultation take place with interested and affected stakeholders?*
- *What points in the reform process will trigger key actions and milestones?*
- *What is the basis for checking that proposed reform steps conform to the overall reform strategy?*

The road map should be adapted during reform implementation in response to unexpected developments.

The following examples of such developments have been encountered:

• Unexpectedly strong and persistent opposition of the power utility's labor force to new employment conditions that make them accountable for performance.

• Failure of the regulatory process to perform consistently with expectations because of political interference in tariff filing, regulatory bodies being subject to political interference, or governments nullifying regulators decisions by offering additional subsidies in lieu of tariff increases (which in effect postpones the hard decisions needed for private sector participation and commercialization).

• Absence of budgetary discipline at the level of the power utility that undermines incentives to commercialize.

• Difficulties in recovering the costs of operational inefficiency (typically large technical and commercial losses) under tariff orders, both for losses incurred in the year covered by the order and for unrecovered losses in previous years.

• Unexpectedly severe disruptions to power supply, such as a drought in a predominantly hydropower system (as in Cameroon three years after privatization of the power utility) or typhoons that wreck networks (as in the case of Orissa shortly after privatization of the distribution companies).

• A change of government that threatens to hold up key stages of the reform or even require substantial changes to significant elements. Reforming power sectors is a long-term process that carries many political risks for governments.

Glossary

Access: Access for a household to electricity services from a public supplier encompasses a connection from a local distribution network to the place of residence and a legally valid agreement between the supplier and the householder for the supply of electricity services.

Affermage: An extension of the management contract approach, of French origin, which involves the award of a concession (by competitive bid or by negotiation) to a private enterprise to run a state-owned power (or other) system usually for a long term (up to 20 years). It differs from the management contract insofar as the concessionaire receives all the revenue and costs of the operation, and it usually allows a greater degree of freedom for the managers to determine the commercial strategy.

Affordability: With regard to access for a household to electricity, affordability refers to the ability of the household to finance the charge levied for a connection to public electricity supply, taking account of available subsidies and credit support. With regard to the consumption of electricity by a household, affordability refers to the ability of the household to pay for a desired amount of electricity under prevailing tariff rates—including subsidies. It is usually expressed as a share of total household expenditure, which is assessed against an empirical upper limit to this share.

Ancillary services: Services provided by power producers in addition to energy and capacity for the operation and stability of the power system. These services cover the regulation of frequency, black start capability, cold reserve, fast reserve for emergencies and contingencies, and the production or absorption of reactive power.

Average cost: The revenue requirement of a utility divided by the utility's sales. Average cost typically includes the costs of existing power plants, transmission, and distribution lines, and other facilities used by a utility to serve its customers. It also included operating and maintenance, tax, and fuel expenses.

Barriers to entry (or exit): These barriers are how incumbent firms keep out competitors. The main sorts of barriers include (a) a big firm with economies of scale that may have a significant competitive advantage because it can produce a large output at lower costs than can a smaller potential rival, and (b) an incumbent firm that may make it hard for a would-be entrant by incurring huge sunk costs, which any rival must match to compete effectively, but which have no value if the attempt to compete should fail.

Base load: The minimum average electric load on a given system over a given period.

Bilateral contracts: A contractual system between a buyer and a seller to obtain generation or ancillary services, or both, of a given type, duration, timing, and reliability to pre-established specifications over a contractual term.

Brownfield project: A project in which productive facilities—including power generation plants—are constructed on sites once occupied by industrial or commercial installations. In many cases, these sites require substantial cleanup because they were developed and in operation before current environmental regulations came into in effect. See Greenfield projects.

Build-own-operate-transfer (BOOT): A contract whereby an investor undertakes to finance, construct, operate, and maintain a project for producing or providing an infrastructure service for a specific period. The investor may be permitted to charge user fees during the period of operation of the project as specified in the contract. The investor is required to transfer the project to an agency in accordance with the contract after the expiry of the period of operation. This contractual concept has a number of variations, including build-operate-transfer (BOT), Build-Own-Operate (BOO), Build and Transfer (BL), Build-Lease-Transfer (BLT), Build-Transfer-Operate (BTO), Rehabilitate-Operate-Transfer (ROT), Rehabilitate-Operate-Maintain (ROM), and Supply-Operate-Transfer (SOT).

Bulk power supply: The aggregate output of electric generating plants, transmission lines, and related equipment. This term is used interchangeably with wholesale power supply.

Capacity: The maximum power that a machine, such as an electrical generator or a system, such as a transmission line, can safely produce or handle.

Capacity factor: The measure of the energy production of a generating plant during a period compared to the total energy production if the plant had operated continuously at full output during the period. This factor is usually expressed as a percentage.

Capital intensive: A production process that involves comparatively large amounts of capital to other factors of production, such as labor. Electricity generation is a good example of this type of process.

Captive customer: A customer who does not have realistic alternatives to buying power from the local utility, even if that customer had the legal right to buy from competitors.

Central dispatch: The process of scheduling by the market operator and issuing direct instructions to electric power industry participants by the system operator to achieve the economic operation of the transmission system while maintaining its quality, stability, reliability, and security.

Cogeneration: The simultaneous generation of electricity and usable heat for industrial processes, or the use of “waste” heat from electricity generation in an industrial process.

Combined cycle: A two-stage electrical generation process. In the first stage, electricity is generated by a gas turbine. The waste heat is then used to generate more power by steam turbine.

Combined heat and power: See cogeneration.

Commercialization: The application of commercial principles to a state-owned enterprise, as far as possible.

Competitive bidding: The process of acquiring supply-side or demand-side energy resources from private or public sector companies or organizations.

Competition for the market: One way of bringing competitive forces to bear on natural monopoly segments of an industry is to delineate a monopoly franchise and auction it off to the bidder offering the lowest price to consumers (or the best bid in relation to another output variable, such as a number of new connections). Monopoly franchises, however, especially long-term ones, still involve regulation—indeed, some commentators argue that this form of competition is simply a way of facilitating regulation. Prices and related terms of the franchise (often known as a concession) have to be adjusted in response to events.

Competition in the market: Competition to provide electricity services among two or more rival providers in the same service area. In the power market, it typically applies to competition in a wholesale power market, whereby distributors and large users of electricity purchase electricity directly from generators they choose either in a power exchange or bilaterally, and transmit this electricity under open access arrangements over the power networks to the points of electricity consumption. Independent power suppliers are allowed to compete with distributors for the custom of large users.

Concession: An arrangement in which a firm obtains from the government the long-term right to provide a particular service under conditions of significant market power. Unlike a management contract, a concession involves considerable private capital expenditure. It is a legal arrangement suitable for creating competition for the market.

Contestable market: A market in which an inefficient firm, or one earning excess profits, is likely to be driven out by a more efficient or less profitable rival. A market can be contestable even if it is dominated by a single firm, which appears to enjoy a monopoly with market power, and the new entrant exists only as potential competition.

Contract for differences: A financial instrument negotiated between the buyer and seller of electricity for an agreed quantity of electricity at a specified price (the contract price or strike price). In the energy pool, the generator of electricity always receives the clearing price, and the purchaser always pays the clearing price. With a financial instrument, if the market clearing price is below the contract's strike price, the purchaser pays the difference to the generator. If the clearing price is above the strike price, the generator pays the difference to the purchaser. This mechanism creates an agreed profile of prices for the contracted quantity of electricity for the duration of the contract.

Corporate governance: The relationship of a company to its shareholders or, more broadly, to society, especially in terms of how to secure and motivate efficient management of corporations by the use of incentive mechanisms, such as contracts, organizational designs, regulation, and legislation.

Corporatization: Subjecting a state-owned enterprise to the principles of corporate law. This is often accompanied by a range of other initiatives, including providing greater management autonomy and clear commercial objectives, performance monitoring, and competitive neutrality.

Corruption: The abuse of public office for private gain, either illegally or unethically.
Cost of capital: The amount a firm must pay the owners of capital for the privilege of using it. This includes interest payments on corporate debt, as well as the dividends generated for shareholders. It is used as the rate of return that an investor would otherwise be able to earn at the same risk level as the rate of return on the selected investment.

Demand: The amount of a good or service that people are both willing and able to buy.

Demand-side management (DSM): The measures taken by a utility to encourage conservation of electric usage or to reschedule electric usage for more uniform usage throughout the day or year so as to reduce the cost of generation.

Deregulation: The process of removing legal or quasi-legal restrictions on the amount of competition, the sorts of business done, or the prices charged within a particular industry.

Developing country: A country with a relatively low standard of living, undeveloped industrial base, and moderate to low development of health and education standards. These countries are classified by the World Bank on their per capita income, namely low-income countries (US$765 or less), lower-middle-income countries (between US$766 and US$3,035), and upper-middle-income countries (between US$3,036 and US$9,385).

Distribution Company (disco/discom): The regulated entity that constructs and maintains the distribution wires connecting the transmission grid to the final customer. The disco can also perform other services, such as aggregating customers, purchasing power supply and transmission services for customers, billing customers and reimbursing suppliers, and offering other regulated or non-regulated energy services to retail customers.
The “wires” and “customer service” functions provided by a distribution utility could be split so that two totally separate entities are used to supply these two types of distribution services.

Distributed generation: Small amounts of generation located on a utility’s distribution system for the purpose of meeting local (substation level) peak loads or displacing the need to build additional (or upgrade) local distribution lines, or both.

Distribution margin approach: A method of providing a predictable, performance-based payment to equity investors for providing electricity distribution services during a transition period for privatizing a distribution entity. It gives for first charge of distribution entity's revenues to the equity investors, typically consisting of a base revenue component and incentive charge component.

Divestiture: A private entity buys an equity stake in a state-owned enterprise through an asset sale, public offering, or mass privatization program.

Econometrics: Mathematics and sophisticated computing applied to economic data in search of economic relationships that have statistical significance.

Economic rent: The difference between what a factor of production is paid and how much it would need to be paid to remain in its current use, which is a measure of market power.

Economies of scale: Reduction in the average cost of a product in the long term, resulting from an expanded level of output. One reason is that overheads and other fixed costs can be spread over more units of output.

Economies of scope: The situation that arises when the cost of performing multiple business functions simultaneously is more efficient than performing each business function independently.

Energy services: The benefits produced by using energy supplies. They include lighting, heating, cooking, motive power, mechanical power, transport, and telecommunications. They can be generated from a variety of primary energy sources—oil, gas, coal, and renewables. They can be delivered using different energy carriers and systems for the transformation and transportation of energy, ending with the delivery of energy services within the operation and regulation of energy markets.

Externality: Costs or benefits arising from an economic activity that affect somebody other than the people engaged in the economic activity and that are not reflected fully in prices.

Fiscal policy: One of the two instruments of macroeconomic policy, the other being monetary policy. It comprises public spending, taxation, and any other government income or assistance to the private sector (such as tax breaks) and consumers (such as subsidies).

Fixed costs: Production costs that do not change when the quantity of output produced changes, for instance, the cost of production overheads and debt servicing. Contrast with variable costs.

Force majeure: An unexpected and disruptive event that may relieve parties to a contract from some or all of their obligations under the contract.

Forward contract: A contract that commits the user to buying or selling an asset at a specific price on a specific date in the future.

Future: A forward contract that is traded on an exchange.

Generation Company (genco): A regulated or non-regulated entity (depending upon the industry structure) that operates and maintains power generating plants. The genco may own the generation plants or interact with the short-term market on behalf of plant owners.

Governance: The traditions and institutions by which authority in a country is exercised for the common good.
This includes the process by which those in authority are selected, monitored, and replaced (the political dimension); the government's capacity to effectively manage its resources and implement sound policies (the economic dimension); and the respect of citizens and the state for the country's institutions (the institutional respect dimension).

Greenfield project: A project in which a private entity or a public-private joint venture builds and operates a new facility for the period specified in the project contract. The facility may return to the public sector at the end of the concession period.

Grid code: The set of rules, requirements, procedures, and standards that users of the transmission system must follow to ensure the safe, reliable, secured, and efficient operation, maintenance, and development of the high-voltage backbone transmission systems and its related facilities.

Gross power pool: A power pool in which all energy generated and consumed is included in the system operator's settlement process. In a gross pool, all contracts for commodity energy must take the form of contracts for differences.

Horizontally integrated: A situation in which all or most of the capacity within a segment of production—such as generation—is owned by a single entity.

Horizontal unbundling: The breakup of the capacity of a dominant seller in a segment of electricity supply, such as generation or distribution, into multiple entities.

Incentive regulation: See performance-based regulation.

Independent power producer (IPP): An entity that owns facilities to generate electric power for sale to utilities and end users and that has no affiliation to a transmission or distribution company.

Independent system operator (ISO): A system operator that is independent from control by any single market participant or group of participants, and therefore has no financial interest in generating facilities.

Independent power supplier: An entity that specializes in energy trading, but does not own or operate distribution networks.

Lease: A form of concession of shorter duration that can involve both public and private financing of investments, where applied to infrastructure services.

Liberalization: Relaxation of government restrictions, usually in areas of social or economic policy. In the context of electricity supply, removal of a legal or de facto monopoly by opening electricity market to entry by rival service providers under arm's length regulation and competition, with unbundling of the monopolist's functions.

Lifeline rate: A lower rate than the general rate charged to households for electricity consumption that helps low-income households afford a level of consumption considered nondiscretionary for their social and economic needs (such as a minimum requirement for lighting of 30–50 kWh per month). Higher charges are levied on electricity consumption above that level.

Management contract: An arrangement under which operational control of an enterprise is vested by contract in a separate enterprise that performs the necessary managerial functions in return for a fee. It can involve a wide range of functions, such as technical operation of a production facility, management of personnel, accounting, marketing services, and training.

Market failure: When a market left to itself does not allocate resources efficiently. Its presence is the main justification for regulation. Four main sorts or causes of market failure are identified: the abuse of market power, the presence of externalities, the existence of public goods, and existence of incomplete or asymmetric information or uncertainty.

Market power: When one buyer or seller in a market has the ability to exert significant influence over the quantity of goods and services traded or the price at which they are sold.

Merit good: A good that is under-consumed if provided by the market mechanism because individuals typically consider how the good benefits them as individuals rather than the benefits that consumption generates for others in society. In economic terms, this is because the positive externalities of the good are not internalized by consumers. To increase efficiency, the state may choose to encourage greater production or consumption of a merit good through regulation or subsidies, or may choose to produce the good itself.

Merit order dispatch: The process of meeting the demand on a power system at least cost by dispatching electricity from generating units connected to the system under a merit order. This order ranks units according to their variable operating costs with the lowest cost units ranked first for dispatch, and other units ranked in ascending order of variable operating cost so that the highest cost units are dispatched last.

Monopoly: The only seller in a market that controls sales in that market.

Monopsony: A market dominated by a single buyer. See single buyer.

Natural monopoly: A market in which demand can be satisfied at lower cost by a single firm rather than by multiple firms. Natural monopolies occur in industries that exhibit decreasing average long-term costs because of size (economies of scale).

Net power pool: A design of the power pool under which power buyers and sellers can choose to trade under bilateral contracts outside the pool.

Obligation to serve: The concept governing the retail or end-use provision of electric service in which a utility is required to serve all customers who request service and are willing to pay nondiscriminatory prices for that service. This obligation is rendered in return for the granting of exclusive rights to serve a geographic area at the retail level.

Opportunity cost: The true cost of producing or acquiring a good or service. This cost includes not only the money spent in this process, but also the economic benefits that are foregone from the use of the resources consumed (including time) in this process.

Performance-based regulation: A process by which a utility's rates are set by linking rewards (generally profits) to desired results or targets, as opposed to setting rates based on cost plus an allowed return on investment. These rates, or components of rates, can be based on external indices, rather than on a utility's cost-of-service. Also, known as incentive regulation.

Power pool: A wholesale electricity market in which electricity produced by generators and the electricity required by distributors and other suppliers is "pooled" in a power exchange. The pool establishes short-term market-clearing prices based on bids by suppliers and purchasers. It provides price bids to the system operator, who may then use the sets of price bids provided by the power exchange to establish congestion prices, match actual demand to available supply, and facilitate the efficient short-term operation of the integrated generation and transmission system. A separate pool for ancillary generation services may be established in parallel.

Power purchase agreement (PPA): A legally binding contractual agreement by which an entity, such as a single buyer or a distribution company, undertakes to purchase the power generated by an independent or affiliated power producer under specified terms for a multiyear period.

Power utility: A regulated entity that exhibits the characteristics of a natural monopoly. For the purposes of electric industry restructuring, "utility" refers to the regulated, vertically integrated electric company. “Distribution utility” refers to the regulated owner or operator of the distribution system that serves retail customers.

Price cap regulation: Price cap regulation of power utilities—whether they are vertically integrated utilities, transmission entities, or distribution entities under long-term concessions—fixes the prices (or the price paths over time) for their electricity services. The entities thus bear the risks associated with varying exogenous input prices and shifting demand. At the same time, the entities have full incentives to reduce their costs, as their prices are not adjusted downwards when they succeed. This contrasts with rate-of-return regulation or cost-of-service regulation, where prices track observed costs closely.

Private sector participation: Private sector participation in power supply is generally classified in four categories: management contracts, concessions, Greenfield projects, and divestitures.

Privatization: The transfer—usually by sale—of assets or service delivery from the public sector to the private sector.

Project financing: An arrangement in which a lender provides the needed capital to build a facility, and the security for the lien is the value of the project itself, rather than the security being the full faith and credit of the owner of the project.

Public good: A good that can be consumed by everybody in a society, or by nobody at all. It has three characteristics: one person consuming it does not stop another person from consuming it; if one person can consume it, it is impossible to stop another person from consuming it; and people cannot choose not to consume it even if they want to. It can be beneficial—as in the cases of clean air and the judiciary—and harmful—as in the case of an epidemic of a disease.

Public interest: In the specific case of power market reform, it refers to the interest of power consumers in particular and to all members of society in general that are affected by the production, transportation, trade, and use of electricity. In the course of these activities, acting in the public interest covers such aspects as protecting public health and safety, detecting or exposing crime or serious impropriety, exposing misuse of public funds or other forms of corruption by public bodies, and correcting misleading public actions or statements.

Public-private partnership: Use of a private firm to provide a public service under contract with a public agency. The public sector can have a financing or a risk-bearing role, or both, by means of investment financing and provision of subsidies. The main forms of this type of partnership are management contract, lease, concession, and divestiture.

Public utility: A utility providing essential services to the public, such as water and electricity, usually involving elements of natural monopoly.

Purchasing agency: See single buyer.

Rate-of-return regulation or cost-of-service regulation: This form of regulation caps a power utility's realized rate of return on capital employed in the business by making the utility's prices track its observed costs closely. The utility faces lower risks than under a price cap regulation, but it is unlikely to earn excess profits for long. The downside is that the utility has little incentive to pursue efficiency gains because the profitability of such activity is reduced by the expectation that its prices will be cut by the regulator in response.

Regulation: Rules governing the activities of enterprises, particularly private sector enterprises. Regulation is often imposed by government, either directly or through an appointed regulator. However, some industries and professions impose rules on their members through self-regulation. Regulation is often introduced to tackle market failure.

Regulatory capture: The theory that regulation is a process by which interest groups seek to promote their private interest by obtaining over time some influence—or even dominance—over the agencies that regulate them.

Regulatory failure: A situation in which regulation generates more economic costs than benefits.

Regulatory risk: A risk faced by private sector firms that regulatory changes will hurt their business. In competitive markets, regulatory risk is usually small, but in natural monopoly industries, such as electricity distribution, it may be huge.

Rent: The commonplace definition is the income from hiring out land or other durable goods. See also economic rent.

Rent-seeking: Trying to make more money without adding any value, such as producing more for customers. Examples of legal rent-seeking include lobbying the government for tax, spending, or regulatory policies that benefit the lobbyists at the expense of taxpayers or consumers or some other rivals, and a labor union demanding higher wages without offering any increase in productivity. Illegal rent-seeking activities are usually classified as corruption.

Retail competition: A system under which more than one electric service provider can sell to retail customers, and retail customers are allowed to buy from more than one provider.

Ring-fencing: The internal separation of business functions within an enterprise for management and accounting purposes. In the context of power market reform, this type of separation can be used to limit a contractor's exposure to financial or regulatory risk.

Risk: The possibility of outcomes not turning out as expected.

Risk premium: The extra return required by investors to hold a risky asset instead of a risk-free one, or the difference between the expected returns from a risky investment and the risk-free rate.

Single buyer—also known as a **purchasing agency:** An entity that is granted—sometimes by law—an exclusive right to purchase and sell power in a wholesale electricity market. It generally has a monopoly for supplying distribution companies and large power users. It can manage competition for long-term market share among generators and IPPs. The functions of this agency are carried out by many types of entities in different countries, including a national vertically integrated utility, a national generation entity, a national transmission entity, a national distribution entity, a combined national generation and transmission entity, and a combined national transmission and distribution entity.

Spot price: The price quoted for a transaction made in a spot market that is to be made on the spot—that is, paid for now for delivery now. Contrast spot prices with forward contracts and futures, where payment or delivery, or both, will be made at some future date. Also contrast with a long-term contract, such as a concession to provide a public service, in which a price is agreed for repeated transactions, such as the sale of electricity under a tariff over an extended period.

Stakeholders: All the parties that have an interest, financial or otherwise, in a company or a market, including shareholders, creditors, bondholders, employees, customers, management, the community, and government.

Stranded costs: Liabilities incurred before the reform of the electricity industry and which cannot be recovered in a new market environment. Examples are un-depreciated generating facilities and pre-established long-term contractual obligations.

Strategic investor: In the context of power markets, a major corporation—which can also include a state-owned entity—that invests in the power sectors of many countries according a defined strategy of business development. Such a strategy can seek opportunities for business growth outside the corporation's home market, or be a defense against the aggressive business strategies of rival corporations in its home market. It often seeks to leverage the corporation's strengths, such as in project development, financing, construction, and management.

Subsidy: Money paid, usually by government, to keep prices below what they would be in a free market, or to enable businesses to remain viable in providing unprofitable, but socially desirable services, or to make a service affordable to a particular group of consumers, or generally to make activities happen that otherwise would not take place, such as the development of new forms of service delivery.

Supplier: Any person or entity licensed to sell, broker, market, or aggregate electricity to end users, that is registered with the market operator as a customer.

System operator: The party identified as the system operator pursuant to the grid code that is the party responsible for generation dispatch, the provision of ancillary services, and operation and control to ensure safety, power quality, stability, reliability, and security of the grid.

Sunk costs: Costs that have been incurred and cannot be reversed or reclaimed by resale. Investments in most immovable infrastructure assets that have no alternative use to a particular infrastructure output or service fall into this category of costs.

Supply: The amount of a good or service that is available at any particular price.

Take-or-pay: The terms of an agreement between a buyer and seller in which the buyer pays an agreed amount even if it is does not accept the product or service. In the power market, this arrangement used to prevail in power purchase agreements with IPPs, under which an off-taker—typically a power utility or a single buyer—agreed to pay for a prescribed level of electricity produced by the IPP in a defined period—usually a year—even if the off-taker actually took less electricity.

Tariff: A document, approved by the responsible regulatory agency, listing the terms and conditions, including a schedule of prices, under which utility services will be provided.

Third party access (TPA): Open access for parties other than a vertically integrated power utility to use its transmission system, which enables independent power producers to sell power directly to suppliers and consumers and end users, and allows suppliers and end-users to purchase electricity directly from the wholesale market rather than through a local distribution utility.

Transition economies: The formerly centrally planned economies of the former Soviet Union and Central and Eastern Europe that are becoming market economies.

Transmission Company (transco): The Corporation organized pursuant to an electricity law to acquire, operate, and maintain transmission assets.

Transmission system: The system used to deliver electric power at higher voltages in bulk quantity from generating facilities to local distribution facilities (and a few large industrial customers), for final retail use.

Transaction cost: A cost incurred in making an economic exchange, such as for buying and selling electricity, in addition to the price at which the exchange is made. It can cover the costs of search and information, negotiation, monitoring, and enforcement.

Two-part price: A price structure under which one part is a periodic availability charge that covers fixed costs and the other part is applied to the actual amount of service that is provided and covers variable costs.

Unbundling: The act of disaggregating the total electric service provided by a power utility into its basic components and offering to sell each service separately with separate rates for each component. Thus, generation, transmission, and distribution services could be functionally unbundled into separate entities and offered as discrete services. (See vertical unbundling and horizontal unbundling.)

Unserved energy: The expected amount of energy curtailment caused by power demand that exceeds available capacity.

Utility: A regulated entity which exhibits the characteristics of a natural monopoly. For the purposes of electric industry restructuring, “utility” refers to the regulated, vertically integrated electric company. “Distribution utility” refers to the regulated owner or operator of the distribution system that serves retail customers.

Variable costs: Part of a firm’s production costs that change according to how much output it produces. Contrast with fixed costs. Examples include purchases of fuel in the case of electricity generation. In the long term, most costs can be varied.

Vertical integration: An arrangement whereby the same company owns all the different aspects of making, selling, and delivering a product or service. In the electric industry, it refers to the historically common arrangement whereby a power utility owns its own generating plants, transmission system, and distribution lines to provide all aspects of electric service.

Vertical unbundling: The functional separation of the vertically integrated utility into smaller, individually owned business units (that is, generation, dispatch or control, transmission, and distribution).

Vesting contract: A contract that fixes the price of power traded between generators and distributors for a set period (up to five years in some cases) before an open bulk power market goes into operation. It removes trading price uncertainty for investment in the early years of power market reform, thereby providing a significant advantage for financing the renovation of dilapidated and undersupplied power distribution systems, as well as for dilapidated generation plant, which helps sell these businesses, provided that the contracts are in place at the time of sale. These contracts are a transition mechanism that should eventually be replaced by trading arrangements that give stronger incentives for distributors to be efficient buyers of power.

Wholesale competition: A system whereby a distributor of power would have the option to buy its power from a variety of power producers, and the power producers would be able to compete to sell their power to a variety of distribution companies.

Wholesale power supply: See bulk power supply.

Yardstick competition: See yardstick regulation.

Yardstick regulation: A form of incentive regulation that involves comparison of a measure of the actual performance of a power utility or utilities against a reference benchmark performance. It can be used to promote indirect competition among regulated entities operating in geographically separate markets, under which the performance of a regulated entity is contrasted to that of a group of comparable entities.

A Roadmap for Maharashtra

Short and medium term

Since the new Electricity Act of 2003, unbundling the state power utilities has been the more practical thing to do. Most of these government owned organizations were suffering appalling financial losses and had very unproductive operations. However, with the directive from the new Act, this problem seems to have alleviated to a certain extent - the genco, transco and disco units are much more sorted out in terms of function, operation and management. This unprecedented move on part of the Government has implied that more and more private participation in the sector would be welcome. However, a very worrying concern is that just unbundling does not seem to have solved all the problems related to the Electricity Markets in Maharashtra. In fact, there are newer and complex situations that have arisen since the unbundling. The following is a preliminary attempt to list down the possible aspects in the Electricity Market that the State should look into. It also will try and recommend probable solutions.

1. *Rationale of the reforms* – the first thing that comes to mind is who designs reforms for the Maharashtra Electricity Markets and what the rationales are behind these attempted improvements. It would be realistic to suppose that the drawing of such sea changes would be motivated by persons or an organization that understand ground realities of the market at hand and are trained to gain insights about the good and the bad that drive this market. However, surprisingly, we have no idea as to who are fuelling these thoughts, why and how they are to be implemented. Of course, at the centre-level, we know that the Planning Commission is in charge of the "thought and planning" bit. However, at the state-level we really have no idea as who thinks, why and what in terms of changing the Maharashtra Electricity Markets towards better efficiency. Maybe an able-bodied organization to formulate and implement the reforms should be put in place. The body can invite recommendations from the general public as well, who may have solutions for their own problems but do not know how to tackle them in terms of actionable outcome. This body can integrate its own rationale with that of the public's viewpoints and check for their viability - socially, economically and environmentally. The body could be a subgroup in MERC (The Maharashtra Electricity Regulatory Committee) itself or an independent body, as per feasibility.

2. *The monitoring of the reforms scheme* – Throughout chapters 5-9 of this piece of work, the primary focus has been reform and governance of the Electricity Markets, worldwide. We have argued about the sequence of reforms, the specific types of reforms for different shapes and sizes of the sector in different nations, socio-economic concerns that come with change, etc. and many more. The very first concern in this debate is that a nation (in our case, the State of Maharashtra) must map the haves and have nots within the sector – where it stands currently, where

would it like to be and how that gap can be bridged. This by itself is a mammoth task and yet a very vital one, given that we are looking the fulfilling the promise of "power for all". Is somebody or some organization in the State doing this? We do not know that. It is very important that the reforms are sequenced in a certain manner; they are implemented in phases so that the significant changes can be coped with in a systematic and efficient way. And not only that, all reforms have to be monitored and their outcomes measured - otherwise, they is no way of knowing which change brought about a positive result, which reform needs to be reassessed or which ones can be done away with beyond a period of time. Again, the recommendation would be to set up a body to look into this or maybe integrate this aspect of the effort with the persons who could be in charge of the first point discussed here.

3. *Dos and don'ts for the Maharashtra Electricity Sector –* again, a humongous task but very crucial. Having said that reforms need to be rationalized, monitored, measured and assessed, there must be a clear list of things that the State should and should not follow. This should be a policy level decision so that even if political parties in power/government change, these bench marks will be maintained despite that. However, exactly what the list should contain will only be ascertained through a complete SWOT analysis of the sector by experts in the field and then mapping immediate and long term deliverables, as the case may be. Nebulous, as this sounds at this stage, this is a very important task at hand and must be undertaken in all seriousness. But again, who will do this is a plaguing question.

4. *Competition rules* – A major problem in India is that the nation does not have specific laws for market structures and monopolistic players. Though there is the MRTP Act (Monopolies and Restrictive Trade Practice) to prevent monopolistic practices, it is not adequate to prevent the occurrences such things from happening in the Electricity Markets. This is because the market dynamics are differently established from a regular buyer and seller model. Also, the trade practice is different because of the uniqueness of the commodity in question. It is imperative that concrete and water-tight rules are drawn out for the players in the Electricity Sector of Maharashtra. Else, we will end up with instances such as the recent Tata Power-RInfra fiasco.

5. ***Setting up Derivative Trading rules for Electricity*** – Since the setting up of the Power Exchange Boards, electricity is being bought and sold through Derivative Markets. The Derivatives Market in India, per se, is very young and underdeveloped compared to many nations where such trading for electricity is extensive. It is essential that India develops clear cut rules and regulations for derivative trading with specific concerns for the Electricity Sector. Because electricity cannot be stored, or how much is desirable cannot always be predicted – it is difficult to take care of trading risks and manage price bands. Such volatile markets can shun off players and the commodity can end up with huge price spikes which may not be absorbable by the buyers. This in turn will affect tariffs adversely. As far wholesale and retail markets are concerned, again, categorical norms have to be put in place in context of electricity trading. This can be done by adopting lessons learnt from other countries (some of which have been discussed in chapters 5 and 6 of the work) and with the help of financial market experts. Ideally, The SEBI (The Securities and Exchange Board of India) should be

involved in formulating these rules and regulations or have a state level representation of the SEBI to tackle specific financial markets' issues pertaining to Electricity (or at the regional level as it already exists – Ahmadabad has the Western Regional Office of SEBI in India.). An alternative to this would be that, the MERC could build a separate vertical for this purpose and collaborate with the SEBI to sort out this aspect of the problem.

6. ***Public-Private-Partnerships (PPP)*** – a clear understanding of public-private partnerships in the Energy Sector needs to be drawn out for Maharashtra. What should be the investment and reinvestment scheme? What should be the profit scheme? What should be the tax scheme? What should be the subsidy scheme? Would the commercial understanding be different for urban and rural areas? What kind of benefits can be given to the private players for attracting their presence in the rural areas? How will land be acquired? How will local resources be used? At what cost will the locals be compensated? The list for such concerns is endless and evolving. It needs very careful consideration such that the private players are not discouraged from entering the market and yet there is enough discipline that the stakeholders will not get hurt perpetually. The site http://www.pppinindia.com/opportunities-power.php gives us a brief overview as to what the Central Government has in mind for the Power Sector in general, concerning PPPs and the objectives and opportunities that they present to the public and private sectors. However, it is clear that this is the tip of the iceberg and a general guideline to address these issues for national and international private players have to be put in place clearly before we think of taking "unbundling" and "open access" any further.

7. ***Legal concerns*** – The ATE (Appellate Tribunal for Electricity) is apparently not the final institution to pass judgments in the case of disputes. This was evident in the recent TATA Power-RInfra case where the ATE had passed a verdict in favour of Reliance and the Supreme Court superseded the same with a decision passed in favour of TATA Power. This, somehow means, that legal cases of such nature can be fought on endlessly in vicious circles till one player gives in. Maybe the ATE could be granted categorical legislative authority, so that they may have the final word in such cases. Else, circumstances that are exceptional need to be spelt out such that the Supreme Court can get involved. This will help cut down the red-tape and increase efficiency in the legal proceedings related to such issues.

   The advisory functions of the MERC – Amongst its other functions, the MERC has a State Advisory Committee which is supposed to, as per "Section 87 of the EA, 2003 mandates the Commission to constitute a State Advisory Committee to advise the Commission on major questions of policy, matters relating to quality, continuity and extent of service provided by the Licensees, compliance by Licensees with conditions and requirements of their licence; protection of consumer interests, etc.". Though the Planning Commission of India is in charge of forming policies and suggesting reforms for the Power and Energy Sector of India – the specific reforms and policy changes that are in context to the States of India – have to be handled by the State Regulatory Committees. If this is the directive, then the MERC Advisory Committee can actually be given the tasks concerning points 1-5 of this probable roadmap. Or at least, the Advisory Committee should partner with other organisations such as SEBI, ATE, the Planning Commission, etc. to ensure that the reforms are Maharashtra's Electricity Sector specific and their execution path is clearly defined and justified. Also, if working in tandem with Central Authorities/Bodies for these specific concerns, the extent of power that the MERC may be given to regulate such affairs should also be made amply clear.

8. *Monitoring the monitor* – Should the MERC take up so many roles and responsibilities (as proposed above) under different verticals, it will need an internal assessment system in place to measure deliverables and their success rates. The key result areas need to be agreed upon and examined from time to time. Is this a viable arrangement? Should MERC have a monitor to watch its self? Outside or inside the organisation? – Not a pressing requirement at this stage, given the other burning issues, the MERC may think of this at a subsequent date, if it hopes to spruce up its functions and achievements.
9. *The issue of cross subsidies* – The EA 2003 says that cross subsidies need to be reduced significantly. There sure many options for this exercise (as mentioned in chapters 4, 6 and 7). It is a suggestion that a marginal price based tariff structure or a multi part tariff structure may help bring down cross subsidies eventually without burdening any group of consumers to a comparatively higher degree. The MERC should surely take this up on a war footing and assess its efficacy. There have been recommendations made by MERCADOS to MERC about the same but it does not say in clear terms, how this will be achieved.
10. *Installing new meters* – The concept of meters that measure consumption on the basis of "time of use" and "time of day" principles and ability to pay - multiple tariffs (variable rate) meters, smart meters, prepaid meters - such meters are being rampantly installed by not the richer nations but also the developing nations. These meters are more equitable in terms of consumption and billing. Some utilities allow residential customers to pay hourly rates, such as Illinois, which uses day ahead pricing. The problem, however, lays in the fact that changing meters across Maharashtra maybe a very financially difficult task. The underdeveloped nations, in many cases, have taken loans from the World Bank, etc. for this purpose. We could begin by installing these new variants in small sections of society and see if it works for us. The supplying company and the consumers in that area, as well as the government, could start by sharing costs. However, it is imperative that first the scheme of cross subsidies and tariff structures have to worked on to optimum efficiency and equity (Chapter 8 has various recommendations for this).
11. *Two way grids* – The opportunities for PPP in India, pertaining to the Power and Energy Sector says that India eventually aims at privatising electricity distribution "through bidding for the privatisation of distribution in thirteen states that have unbundled/corporatised their State Electricity Boards - expected to take place over the next 2-3 years." To this can we add that a "smart grid" would be an excellent idea as well, to be put in place? A smart grid delivers electricity from suppliers to consumers using digital technology with two-way communications to control appliances at consumers' homes to save energy, reduce cost and increase reliability

and transparency. It overlays the electrical grid with an information and net metering system.

This smart grid could also be a PP initiative. In the same spirit of the above suggestion, it may also be a possibility to allow various smaller licensed private players to be connected to the Distribution Grid through hubs located at strategic points in the system. This will allow import and export of electricity through one single grid where residential societies, communities, captive power plants, electricity co-operatives and such likes can put the surplus power that they may have generated in to the grid to be used by electricity deficit consumers.

12. *Metering incoming and outgoing electricity through a common grid* – Many customers across the world are installing their own Electricity Generating Equipment, whether for reasons of economy, redundancy or environmental. When a customer is generating more electricity than required for his own use, the surplus may be exported back to the power grid. Customers that generate back into the "grid" usually must have special equipment and/or safety devices to protect the grid components (as well as the customer's own) in case of faults (electrical short circuits) or maintenance of the grid (say voltage potential on a downed line going into an exporting customers facility).

    This exported energy may be accounted for in the simplest case by the meter running backwards during periods of net export, thus reducing the customer's recorded energy usage by the amount exported. This in effect results in the customer being paid for his/her exports at the full retail price of electricity. Unless equipped with a detent or equivalent, a standard meter will accurately record power flow in each direction by simply running backwards when power is exported. Such meters are no longer legal in the first world nations but instead a meter capable of separately measuring imported and exported energy is installed. Where allowed by law, utilities maintain a profitable margin between the price of energy delivered to the consumer and the rate credited for consumer-generated energy that flows back to the grid. Lately, upload sources typically originate from renewable sources (e.g., wind turbines, photovoltaic cells), or gas or steam turbines, which are often found in cogeneration systems. Another potential upload source that has been proposed is plug-in hybrid car batteries (vehicle-to-grid power systems). This requires a "smart grid," which includes meters that measure electricity via communication networks that require remote control and give customers timing and pricing options. Vehicle-to-grid systems could be installed at workplace parking lots and garages and at park and rides and could help drivers charge their batteries at home at night when off-peak power prices are cheaper, and receive bill crediting for selling excess electricity back to the grid during high-demand hours.

    The question is: can Maharashtra undertake such a project financially and in infrastructural terms? If yes, even though over a period of time, this could prove to be a phenomenal change in the entire dynamics of how we get our Electricity supply.

13. ***Permission to contribute in the grid –*** In support of the idea that the distribution grid should be two-way, we must also have units/bodies/organisations that will contribute to the grid by supplying electricity. There are two concerns here.

One, should entities such as SEEPZ, the SEZs, MIDC, MHADA, big housing complexes, IT parks, other captive power plants etc. be encouraged to generate their own electricity requirements? In such an event, they will be self sustained as far as power is concerned. Two, other than this sustainability, these bodies could then contribute to the main distribution grid as and when they generate surplus electricity.

14. *Electricity Co-operatives: are they any good?* – Many rural communities owe their initial electrification to Electricity Co-operatives. However, historical and new Electricity Co-operatives can still continue to bring benefits to the local societies. These co-operatives have local or regional characters, so they can easily employ local DG technologies (Distributed Generation (DG) is the generation of electricity at or close to its use). This will add extra value to and multiply the services offered. The benefits could be divided into several categories. (please refer to Appendix A below)

    In Maharashtra, the benefits of introducing cogeneration in the sugar mill co-operatives can be summarized as follows:

    - Diversification of energy sources and additional revenue
    - Reduction of carbon dioxide emissions, since bagasse is the fuel
    - Additional power capacity for satisfying the sharply increasing demand
    - Efficient use of the fuel and avoidance of T&D losses.

    Despite the benefits mentioned, cogeneration in sugar co-operatives has not achieved its full potential. The following are the barriers to cogeneration in co-operative sugar mills:

    - Their financial weakness prevents financial institutions (public and private) from further lending to them
    - Management's competitiveness and risk-taking attitude
    - Procedural difficulties - i.e. co-operatives carry out transactions exclusively with certain businesses
    - Risk of unexpected policy change by new elected management.

    Removal of the above barriers is absolutely necessary for the full implementation of cogeneration in Maharashtra's sugar sector.

    There are two organizations that could be characterized to monitor the electricity co-operatives. One, electricity co-operatives need to keep in pace with technological change. And two, organizations need to listen to communities' environmental and energy problems and to help them to act accordingly. If these bodies are set up at the local levels in rural Maharashtra, the co-operative system may well just work.

    Another example is the ***Mula-Pravara Electric Co-operative Society Ltd***. This has been the longest sustaining of the five pilot co-operative projects in India for this sector. However, it is now riddled with financial trouble and does not seem so viable and exciting anymore, as an option. Long term power purchase agreements, a more aptly designed tariff and non-crippling subsidies may also be the answer to such eventualities.

15. ***The need for training and education*** – Another very important recommendation is that of training and educating. The Electricity Act, 2003 provides that the CEA (Central Electricity Authority) shall perform such functions and duties as the Central Government may prescribe or direct, inter-alia, to promote measures for advancing

the skill of persons engaged in the electricity industry and promote research in matters affecting the generation, transmission, distribution and training of electricity.

A National Training Policy for the Power Sector has been formulated by the Planning Commission of India. The salient features of the Policy are:

- All organizations should adopt a formal written training policy to ensure training for all personnel for a minimum period of one week annually.
- A comprehensive training plan should be formulated by each power utility based on periodic training needs analysis
- A minimum of 1.5% of the salary budget of the organization may be allocated for training to begin with this should gradually be increased to 5% of the salary budget
- Networking amongst various organizations under the Ministry and other reputed institutes should be done for optimal use of training infrastructure and intellectual resources.
- Induction level training should be made mandatory for transmission & distribution (T&D) personnel similar to the generation personnel
- Adequate infrastructure for training including hydro power, transmission and distribution and non-conventional energy should be developed
- Simulator training at suitable intervals should be made mandatory for operation staff of the power plants.

The policy emphasizes the idea that money spent on training is an investment not and expenditure. The National Training Policy (NTP) also highlights the need for planning for training as an integrated Human Resource Development (HRD) activity with a commitment to imparting training for all in the power sector at entry level as well as in-service.

Though this directive is in place, how much of it is being carried out is highly suspect, especially for the State of Maharashtra. It is very important that the office holders understand the sector and its peculiarities before taking on to policy changes and reforms as a long term objective. Who decides, what do they decide and why, how does that affect stakeholders in the short, medium and long term are very crucial considerations for such level of office holders.

In fact, Green Earth would like to conduct a pilot survey amongst the top level personnel of the various institutes and organisations of the Maharashtra Power and Energy Sector, to be able to get a feel of how much do they understand the ground realities and problems of the Electricity Market and would they be able to offer sustainable solutions for the same.

The Maharashtra Energy Development Agency (MEDA) is responsible at the state level for this purpose. However, organisation mainly looks at alternative and renewable energy sources and its development and awareness. It may be given the added role of general awareness creation of Electricity Markets. Alternatively, SEB and MERC can take this responsibility in collaboration with experts and consultants that may be outsourced.

16. ***Other miscellaneous recommendations*** – There are other various concerns that can be addressed in the short and medium run. To list a few:

- Captive power plants (an entire report on its feasibility and advantages has been published at the central level – don't know the exact name of the publication – please mention), may be another solution in Maharashtra not only at the urban but rural levels.
- As mentioned in the main body of the work, Nepal, Bhutan, Bangladesh, etc. are using photovoltaic cells in technical collaboration with international agencies. These are facilitated and monitored at the local levels by public representatives, interest groups or even specialized NGOs.
- Reducing connection costs and subsidizing the player rather than the consumer, at initial levels may also be an option worth trying. Again, the problem of designing the right kind of tariff and a justified phasing out principle and time for such subsidies need to be drawn out clearly.

Long Term

17. ***Private investments and FDIs*** – An attractive investment climate has to be created in the sector at a state level. This may require socio-economic, legislative, legal and political realigning and rehauling. A lot of this is subject to the level that public awareness is doled out and the individual policy changes, the parties in power, would like to implement. A sound and stable government, high ease of doing business, control of corruption at various levels, stability of the currency; steady industrial output and GDP growth may affect the attraction to be a private participant in the state. In short, business risk mitigation is of essence here.

    There are no private players in distribution other than TATA Power and RInfra. There are some 40 licensees – please correct this – who have been given permission for generation in the Maharashtra State. However, they seem to be riddled with issues such as using of local resources and compensation to local land owners and farmers. Perhaps, a clear cut rule to reallocate local resources for the generation of electricity needs to be assessed as soon as possible. Also, since we are looking at a significantly greater installed capacity in the near future, can we trade with nearby nations such as Pakistan, Sri Lanka, etc. or even other states through the power exchange boards?

    The PPP advises foreign direct investment in the Power and Energy Sector. As of now, there are only two players, nationally – China Light and Power (which has no presence in Maharashtra) and Marubeni Corporation (which has a regional office in Mumbai but their commercial role in the western region of India is largely in terms of exim of various petroleum products and does not have a direct bearing in the Electricity Sector in Maharashtra). This means, that the foreign investment is paltry and insignificant. In the light of privatizing, this fact may raise a concern for fund inflows to improve efficiency.
18. ***Long term financial viability*** – Due to its capital intensive nature and the heavy subsidies that the government has allowed all this while, the players have incurred significant losses. This is especially so for the MSEB. A review of subsidies, tariffs and cross-subsidies, other than budgetary discipline is a must. This has to be a long term

sustainable effort that is made apt with changing circumstances. Even though on a trial and error basis, the reforms recommended for this (Chapters 6, 7 and 8) are worth exploring. Not all of them may be applied and implemented but depending on the suitability, they are worth their while.

19. ***Disaster management*** – last but not the least, a very vital consideration in the long run should be to manage calamities in the Electricity Sector. Take the recent example of Leh, or the perpetual example of Orissa, or the tsunami hit coastlines of India: Could we have a system where there are backup alternatives when natural disasters strike? Well, the answer is obscure at this point but someday may be we will be so technologically and economically advanced as an Electricity Market that this thought may no longer be unbelievable.

Appendix A

How electricity co-operatives affect us socially, economically and environmentally:

Social: Democratic decision-making, social integration and education are crucial benefits that co-operatives can offer to local societies. As a rule social participation is not part of the decision-making process of the centralized energy system. On the other side, co-operatives permit the local communities to participate in the decision-making process as far as technological, economic and other important aspects of energy production and use are concerned. Therefore communities can satisfy their energy needs according to their social values and priorities. Technologies employed could be influenced by broad social acceptance, reducing social conflicts and eliminating 'NIMBY' (not in my back yard, see: *en.wikipedia.org/wiki/**NIMBY***) effects. The boundaries between producer and consumer become blurred. Electricity co-operatives participate in all local social activities, so they are recognized by local society as a welcoming home-grown entity. For example, electricity co-operative in Spain organizes sports trophies, conferences and seminars, concerts and other cultural events. These are important social elements that contribute to the quality of social life. Finally, electricity co-operatives can educate communities and increase their awareness about energy problems, so that problems are converted into a local social issue.

Economic: Since electricity co-operatives are not profit-pursuers, they provide electricity without the need to make large profit margins a priority. They could be the cheapest electricity suppliers. Any profits made are reinvested in the co-operative's infrastructure or are returned to its members either as dividends or as a social contribution, such as for cultural and community welfare purposes. Additionally, the creation of a decentralized power system can significantly improve the power quality, especially in the developing countries. This could be translated to certain economic benefits for the electricity end-users.

Furthermore, the modularity and short lead-time of distributed generation reduces the upfront capital expenditures. Also, electricity co-operatives provide a valuable contribution to their regions and communities. Electricity co-operatives usually employ personnel from local population, and, given that their customers belong to the founding local community, money is recycled within the community or its region so that the community itself may decide where and how the money should be reinvested or spent. Finally, the establishment of a global emissions trading system will help the electricity co-operatives using efficient cogeneration and renewable energy technologies to increase their income. Thus, communities - especially those in developing countries - can enjoy additional economic benefits by selling their ‘green certificates’ to the industrialized regions.

Environmental: The environmental benefits are related to the power technology used rather than to the type of the entity employing it. The efficient use of fuel (satisfying more energy needs from a given quantity of fuel) reduces the emission of greenhouse gases and delays depletion of fossil fuels. Furthermore, the implementation of decentralized technologies eliminates the T&D losses, which can reach 10% of the electricity transferred. If they choose to, electricity co-operatives can have strong political and social influence. Subsequently, they can demand rigorous environmental and energy policies at the regional or national level. All in all, the environmental benefits could be twofold: local and global. Electricity co-operatives can reduce the impacts of their activities to the local environment as well as help humanity to meet its environmental targets.

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