PRICING ENERGY IN DEVELOPING COUNTRIES

A Report of the World Energy Council

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5th Floor, Regency House
1-4 Warwick Street
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United Kingdom

CONTENTS

FOREWORD

WEC is indebted to Hydro Québec for the secondment of Daniel Dumas for two years as Manager of Studies for the 1999–2001 Work Cycle. In particular, Mr Dumas ably directed the study "Pricing Energy in Developing Countries" under the chairmanship of Rajendra Singh of India and is principally responsible for this report. The other members of the Study Group are listed in the Annex to this report.

I warmly thank the Chairman for his leadership in this difficult work, during which he also served as Secretary to the WEC Indian Member Committee and helped organise a very successful WEC Executive Assembly in New Delhi in November 2000.

Mr Dumas was assisted in case work by both government and industry people in several developing countries, and he built good working relationships with the International Energy Agency and the Asia Pacific Energy Research Centre. I want to thank all of them for their support. In particular, I would like to thank Dr Anil K Sood, Member of Faculty, Administrative Staff College of India, Hyderabad, and Jens Weinmann, London Business School, for their hard work and efforts.

The Chairman and Mr Dumas drafted Part 1 of this report based on their wide reading of answers to detailed questionnaires and their consultations with other organisations. Nine detailed Case Studies were drafted on the responsibility of the Member Committees of the countries concerned, and they are included in this report as Part 2. WEC does not take responsibility for their contents, but the Chairman of the study and Mr Dumas made a series of inputs and suggestions on their content. Several other countries also sent in useful data which helped shape the analysis and conclusions.

In the course of this work WEC held a symposium in New Delhi on pricing energy in developing countries which picked up on the goals and actions of *Energy for Tomorrow's World – Acting Now!* which was published as the WEC Statement 2000. The symposium allowed WEC to draw certain observations from the analysis and to define a set of principles which link pricing and subsidy issues with WEC's views on market reform and appropriate regulation. These were published as the WEC Statement 2001 and are included in this report as Part 3.

Gerald Doucet

Secretary General

June 2001

1. INTRODUCTION

1.1 Background

This Report draws upon the three energy goals identified in the World Energy Council's millennium statement, *Energy for Tomorrow's World – Acting Now*, published in April 2000. These three goals of energy accessibility, availability and acceptability (the "three A's" of sustainable energy systems) are closely interlinked and should be the pillars of energy pricing policies, not just in developing countries but in any market.

Because of the special problems which they face, this report focuses on pricing practices in developing countries. From an examination of specific cases, it draws basic principles for better pricing policies which can help developing countries to achieve the three A's. However, this report is not a survey of energy prices or, even less, a comparative study of prices. Nor is it an evaluation of the economic, environmental and social effects of subsidies.

One of the lessons learned in the process of doing this work was that inter-country comparisons, especially among developing countries, can be very misleading. Other organisations and researchers have attempted such comparisons using different approaches, mostly based on partial or general equilibrium macroeconomic models. In contrast, the Study Group for this report concluded that it could not add anything new on this issue and agreed that, from a theoretical point of view, any interventions affecting the "natural" equilibrium of a market (or optimum allocation of resources) were bound to have a negative impact. It seemed to the Study Group that it was more important to understand the assumptions which lie behind various pricing models.

1.1.1 A Little Economic Theory

The purpose of an economic system is to allocate limited resources for the production and consumption of goods and services to meet the needs of all actors in the economy. Ever since Adam Smith, debate about the virtues of a competitive pricing mechanism to optimise this allocation of resources has centred on the "laissez-faire" approach.

What is often forgotten by supporters of the laissez-faire approach is that the supposed optimisation depends upon a series of conditions and circumstances which are more stringent than those likely to exist in the real world, and especially in developing countries. Theories about the "perverse" effect of subsidies and non-market based pricing mechanisms flow from this reality. The inefficiencies of imperfect market mechanisms and the existence of market failures have to be addressed.

The failure of the price system to allocate resources efficiently, in all situations and for all actors, is of interest for various reasons. It implies that market prices do not necessarily reflect marginal social benefits or costs, and that market profitability does not necessarily reflect net social benefits and costs. Also, the failure of markets to allocate resources efficiently provides reasons to consider supplementary mechanisms, interventions or corrective devices to induce markets to function more efficiently. The two best known and commonly used intervention

devices are taxes and subsidies, which consequently makes them of major interest in the context of energy markets, where market reform must go hand in hand with appropriate regulation.

This recognition of the need for appropriate regulation is not, however, a clarion call favouring government interventionism in energy systems at all times and in all places. What is needed in most cases to achieve appropriate regulation is a stable energy policy, which sets long-term goals and fosters clear rules for the assessment of each particular case of market failure and possible solutions for it. In many cases government intervention may improve the allocation of resources, but in others it may not.

On this issue, a clear distinction has to be made between a developed country and a developing one. The latter will very often lack the necessary conditions for an efficient energy market. The circulation of information may not be effective; the consumer may not yet be empowered to choose, or may not have the individual property rights needed for the generation of domestic savings for investment or purchases; and, for a host of reasons unrelated to energy, the country may not have adequate access to capital markets. Often, the uncertainties of the political and economic situation in a developing country may distort or undermine the impact of interventions, resulting in wide disagreements over whether these interventions are beneficial or harmful.

There are well-known instances where government intervention has strengthened relatively liberalised markets: public goods, externalities, increasing return to scale, risk and uncertainty, tax distortions, universal service obligation, are some which come to mind. “Pure” economic efficiency is not the only criterion that may be used for utility pricing, and many policymakers and prominent economists have argued that equity or income distribution ought to be taken into consideration as well. Others have argued that taxes such as progressive income tax are much better suited for some purposes than taxing and subsidising energy commodities.

1.1.2 Markets and Prices

That markets work is taken for granted. Yet behind this statement lie some deep assumptions about economic theory, some of which raise issues of significant practical importance.

Why has the economic performance of markets been so much superior to that of central planning? Among economists, there are two principal explanations. One is that market mechanisms are efficient because they provide a system of price adjustments to signal where resources are required, and where they are not. The other explanation is that market mechanisms represent a process of natural selection for technology and innovation. Many innovations can be tried, and those which most improve market efficiency will prevail.

Theories about the role of the price system in driving resource allocation in market economies draw inspiration from Adam Smith’s metaphor of the invisible hand. Smith claimed individually selfish behaviour could lead to collectively desirable outcomes. His successors, Kenneth Arrow and Gerard Debreu, received the Nobel Prize in economics almost 200 years later for their development of general equilibrium theory.

General equilibrium theory encapsulates the idea of markets as signalling mechanisms, in which prices rise and fall to reflect scarcities and surpluses. The

most important conclusions of this theory for market efficiency are known as the fundamental theorems of welfare economics. Crucially, these theorems claim that any socially desirable outcome can be achieved by a market provided the initial distribution of rights and resources is appropriate. However, such an appropriate distribution clearly does not exist in most developing countries. Once this is recognised, what does a country with unequal distribution do to make progress towards achieving prosperity for all its people? Transfer payments are one technique, but obviously subsidies are a very appealing and easy method to apply.

There are of course additional complexities. The fundamental theorems of welfare economics depend on other conditions and assumptions. The externality issue (full fuel cost accounting, for example) is a major one for energy systems, but the theorems also require markets to be competitive in the sense that there must be many buyers and many sellers. But in some markets, economies of scale mean there can only be a few producers, and certain services may justify only one supplier. In energy markets, these circumstances often arise even if customer choice, third party access and other features of liberalised markets are in place.

The assumptions of the fundamental theorems of welfare economics also include that both buyers and sellers agree on what they are buying and selling. If there are differences in the knowledge which each party brings to the transaction then the basic results of general equilibrium theory may not hold. Fortunately, energy systems provide quite standardised products and services, at least at the national level (and more and more at the regional multi-energy level), which allows buyers and sellers to have a clear understanding of the terms and conditions of their transactions, thereby putting prices at the centre of the energy efficiency and reliability debate.

1.2 Study Approach

In most developing countries the electricity sector still follows the model of a centralised monopolistic utility. The pricing of energy is a mixture of elements, from social policy and employment considerations to economic spin-offs, basic equity considerations and sometimes political objectives. Very often, many inefficiencies are also visible in the system, such as technical inefficiencies, line losses, or practices which fall short of industry benchmarks.

But there may also be a whole set of hidden inefficiencies, often more important in terms of the cost of delivering reliable and adequate energy services. They are hidden in two ways: in a real sense, they are lost in the intricacies of power economics, cost accounting and technical processes and systems; or they are submerged in the structure of the energy sector, the bureaucracy of government and utility, where they take the form of poorly designed subsidies, price distortions, failures in payment or collection, as well as other omissions or commissions which serve to undermine the energy system in more subtle ways. The expression used to describe the latter is “non-technical losses”.

The primary challenge in developed countries in terms of market reform is usually to bring prices down to the competitive cost of service. However, in developing countries the challenges are to set prices high enough to cover the full cost of delivering the service and to ensure that payment is collected. Of course, this must be coupled with appropriate measures to address specific problems of accessibility and affordability.

In this context, this report takes a twofold approach. The prices of energy services are the result of two pressures: the cost of service on the one hand, and energy policy requirements on the other. These policy requirements relate to the three A's described above and should not be regarded as undesirable in themselves. But it is often the case that policy requirements start to have adverse effects when their goals are unclear or when they are designed to achieve, through the energy sector, objectives related to others sectors of the economy. Before going further, let us take a closer look at the three A's, in relation to prices and pricing.

Accessibility is the provision of reliable and affordable modern energy services to all households in a given market, for which a payment is made. Especially in developing countries, achieving it depends on policies specifically targeted to meet the needs of the poor. The best way for governments to ensure that a growing number of people will be able to afford commercial energy in line with their needs is to pursue policies which accelerate economic growth, trade with neighbouring markets, and a more equitable income distribution. This requires increasing reliance on the market, while addressing cases of market failure with special policies.

An energy tariff reflecting all costs, including external costs such as emissions and waste management, is necessary to secure adequate investment and to encourage energy efficiency and environmentally preferred technologies. However, such a tariff would be unaffordable for many people in developing countries.

There may therefore be a need, in some cases, to subsidise energy technology and delivery for a period of time, without creating price distortions or at least keeping them to a minimum. Variable, maintenance and extension costs need to be reflected in the price paid for energy, but some costs might be handled differently in some circumstances.

Availability covers both quality and reliability of delivered energy. Continuity of energy supply, particularly of electricity, is essential in the twenty-first century. While short-term interruptions may be acceptable in certain circumstances so long as the supply conditions are known and understood by customers, unexpected power cuts impose a high cost on society that cannot be ignored.

The best way to ensure the quality and reliability of energy services is to establish energy policies and regulations which allow energy suppliers to recover their investments in facilities to extract, produce and deliver energy commodities to the end-user. This means not only allowing a reasonable return on current investments but also providing incentives to maintain and expand deliveries to the billions of people who do not have access to commercial energy supplies.

Acceptability addresses environmental goals and public attitudes. Local pollution is a cause of harm to billions of people, especially in developing countries. Global climate change has also become an important concern. Mindful of these two issues, developing countries are concerned about the potential impact of climate change response measures on their economies, and about rising levels of consumer-based household emissions which create local (urban) and regional pollution (e.g. the impact of acid rain on crops and forests).

Energy resources must be produced and used in a manner that protects and preserves the local and global environment now and in the future. Pricing, as a major driver of energy demand and also as a determinant of consumption patterns and choices, is the key to energy efficiency improvements, the transfer of

technologies and the pace of innovation. These are instrumental in moving both producers and users of energy services towards a more sustainable path. Thus, certain types of externalities related to environmental goals or to the depletion of resources are often linked to pricing through energy policy.

1.2.1 Twofold Approach to Prices: Policy vs. Cost of Service

Policy Side

Policy requirements are defined by the economic, social and energy policies that a government might apply to its planning and decision-making process. While it is governments which make laws and set the rules (often via a regulator, who may or may not be at arm's length from the government), many other influences come from various directions.

On the economic and energy policy front, a government might have a policy to encourage private or public consumption of energy from a certain source. This is the case in Iran, where the government heavily subsidises natural gas in order to free additional oil for export to generate income in hard currency. In other cases, policy might aim to promote the use of an indigenous fuel to reduce dependence on an imported one. Governments also sometimes use cheap energy as a means of subsidising domestic production of other resources or to improve the competitiveness of local industry, thereby fostering job creation and employment. As we shall see below, such efforts have not always had their desired effect.

On the social front, governments might establish policies which aim to provide access to energy for the largest possible number of people through subsidised tariffs. They might supply electricity or gas to poor areas, implement rural electrification programmes, or use energy tariffs to favour income redistribution. This approach is often based on the viewpoint that energy or electricity is a public good that should be supplied in sufficient quantity to all members of society by right, whether or not they can or do pay for it. Again, we shall see below why this is a misguided approach, which is often fundamentally counterproductive to the achievement of the three A's.

Pressures which influence a country's energy policy come from both within the country and from outside. External pressures may come from, for example, environmental organisations, the World Bank, the International Monetary Fund, the World Trade Organisation, or UN agencies. From the inside, industry organisations, local energy suppliers, consumer groups and electors dictate certain priorities in policy making.

Government policymakers in developing countries are faced with a huge dilemma. On the one hand, there are external pressures which, in general, push for the removal of energy subsidies, increased tariffs and the creation of a market based on competitive prices and customer choice. On the other hand, there is internal resistance to such policies from consumers and electors, particularly those who feel that energy is a basic human need which should be met at a minimum level whether or not its full costs are recovered.

Cost of Service Side

For an electricity supply service (and similarly for natural gas or liquid fuels), the cost structure can be divided into four parts: generation, transmission, distribution and supply. Generation, including the fixed capital cost of the generating plant and

all the variable costs such as operations, maintenance and fuel, often represents the largest single element in the whole electricity value-chain. Transmission is mostly a fixed cost, while distribution can be a mixture of both fixed and variable elements.

Supply costs comprise everything else, including commercial and collection services, metering, consumer services, etc. Since these costs are more or less fixed per consumer, the supply cost per consumer on a per unit of energy basis also varies quite significantly. However, supply costs represent a small portion of the total cost of service and they include little capital-intensive activity except for metering equipment, so their impact on pricing is much smaller than distribution costs.

The principal feature of distribution is that, of the four components, it is the one which varies the most with customer category, supply voltage, and the level and intensity of consumption within a given area. For example, where domestic consumers with low load factors are widely dispersed in a rural area, the fixed distribution costs will be shared by just a few households each using relatively little energy. Alternatively, within an industrial park there may be several large consumers connected to the grid at a medium voltage level. In this latter case, the load factors are often very high, and the distribution portion of the cost of service is almost nil, except maybe for the use of a sub-station.

Another problem in most rural areas is the large proportion of residential customers, compared to the more balanced mixture of commercial, industrial and institutional demand found in urban areas. Urban areas also tend to have a concentrated peak time, usually in the evening when people turn on the lights and use electrical appliances.

1.2.2 Soft Costs Issue

There is a further set of costs which, in the view of the Study Group, is one of the main explanations for the difference in the cost of service between various countries. These “soft costs” mostly result from losses in the energy chain which cannot be explained from a technical point of view and which directly affect the energy supplier’s revenue.

These costs can be divided in three components: first, metering problems, such as meter by-passing and tampering, or bribing of meter readers; second, illegal connections to the grid and energy theft; third, collection problems and non-payment of bills. The Study Group noted that in some countries the cumulative effect of “soft costs” explains why some energy suppliers are financially non-viable, even where tariffs are set at adequate levels.

In some countries these costs create a situation where a small proportion of consumers has to support the whole system. For example, in Bangladesh the cumulative effect of “soft costs” plus a certain level of technical losses represents 45% of the cost of delivering the electricity. This means that for each unit of electricity actually sold and for which payment is collected, the power company has to generate almost two units.

One reason often mentioned for using energy without paying for it is that the service is of poor quality and unreliable. In many cases, such as in India, one reason for service interruptions is that too many people are illegally connected, overloading the grid and forcing the operator to cut supply in order to let the

system “cool-off”. This is a vicious circle, especially since it is when service is interrupted and there is no current in the lines that it is least dangerous for illegal connections to be made.

1.2.3 Limitations of the Approach

The Study Group discovered that to try to make a comprehensive assessment of energy pricing with a sample of about ten countries was unrealistic. It was impossible to try to reproduce the work of regulators in determining the cost of service from regulated companies in a specific market. Even though, with the goodwill of the study participants, information could be obtained on specific prices in specific situations, the road to a comprehensive picture of energy pricing across many developing country markets was plagued with numerous methodological traps, and by incomplete or inconsistent information. The first but not the least of these methodological problems was to apply a value or a cost for the use of fixed assets in the energy system at a point in time.

To determine the cost of service was therefore a real challenge. Proxies, approximation, and a best-fit approach had to be used. One of the most plausible approaches considered by the Study Group was to evaluate the assets and a fair return on them. Since, in some countries, the real value of an asset from an accounting point of view is almost impossible to determine, it was often necessary to use a reference value. This reference value was the replacement cost divided by the use of the asset.

After trying to apply this cost of service approach, with detailed questionnaires sent to over 40 countries, the Study Group concluded that the task was out of reach and it abandoned this approach. But this exercise was not pursued in vain, for it was discovered that many developing countries do not have a proper costing system. Hence, in these countries electricity prices are set with no reference to the actual cost of delivering the service. The only way it can be concluded that these prices are not high enough is because the energy supplier is consistently losing money and seeking further government support for repairs or infrastructure.

One of the main conclusions of this report is, therefore, that developing countries must implement proper costing systems before determining the prices based on these costs. There is no other way to determine the real extent of subsidies given to consumers than to understand the full cost of service.

1.2.4 Subsidies

Without a proper estimation of costs, the major questions regarding subsidies are what they are and where they are. The concept of subsidy is an elusive one, and the debate about this has contributed to the confusion. The simplest form of subsidy is obviously a transfer or direct concession from the government. But sometimes subsidies take a more subtle form, such as government intervention via energy policies, as described above.

Many people argue, however, that failure by governments to intervene in order to address externalities should also be regarded as a subsidy. Inadequate recovery of the cost of depletion of certain energy resources or the cost of environmental degradation could also be considered as subsidies.

What is regarded as a subsidy in one country may not be considered one in another. Researchers within international organisations have often used a much

broader perspective than governments in determining the full alternative economic opportunities that have been foregone.

That being said, the definition of a subsidy can be stated in simple terms: a subsidy exists when the costs incurred in supplying products or services, including a fair return on investment, are not fully recovered by the revenues raised from the delivery and payment for those goods or services. Whether the price is higher or lower in one country than another is not considered relevant.

In this report the primary focus is on consumer subsidies, since they are the kind most often present in developing countries. Producer subsidies are more prevalent in developed countries. In general, producer subsidies should be avoided. There are two main reasons for this: they are usually not well targeted, and they may create harmful distortions in energy markets.

However, this is not always the case. In Thailand, for example, a balance was achieved between business interests and the need to serve the rural population (see "The Case of Thailand" in Part 2). The company responsible for the rural electrification programme was allowed to purchase power from the generator at a lower price than the Bangkok distribution company. Moreover, based on consumer load patterns, the rural distribution company implemented a consumer tariff structure with lower prices for small users. This allowed Thailand to extend electricity service to more than 90% of its population.

Although the focus of the Study Group was on consumer subsidies, it realised that sometimes these are disguised as producer subsidies; that is, the shortfall in revenue is not reflected in lower prices but takes the form of mandated direct support to other industries. This is where it becomes difficult to draw the line. If the subsidy is aimed at improving the competitiveness of a particular industry relative to imports or in export markets, then it is a subsidy to that industry in order to keep it alive or competitive and is not directly a consumer subsidy. If, on the other hand, the subsidy is aimed at maintaining consumer prices artificially low, it is really a consumer subsidy.

Subsidies are generally justified on grounds of equity or of efficiency, or both. Almost all governments recognise the need for some form of income redistribution, or relief for the poorest. In developed countries this is achieved mostly by differential direct taxes on income, by taxes on capital gains or on "luxury" goods, and/or by a social security system offering certain public goods such as education and healthcare freely or at reduced cost (with or without claw-back provisions). Although these instruments may create distortions in the labour market, for example, they are generally the best way to achieve income redistribution since they do not distort prices, reduce the efficiency of competitive markets, or affect the market behaviour of consumers and producers.

In developing countries, however, the situation in general is quite different. Governments often lack the revenue base to proceed with differential income taxes. Poor people in developing countries are very poor; they often do not have "official" (i.e. taxable) incomes, and may subsist by doing work here and there, sometimes for cash, sometimes in a barter agreement. Social benefits systems are often very limited, if they exist at all. The cost of administering redistribution programmes in order to exclude middle class or upper middle class individuals is often in excess of the savings. Hence, subsidies can be seen as a convenient second-best way to provide the lowest income groups with a minimal essential

service, directly related to their well-being and indirectly related to health, education and other goals.

But subsidies are often blamed for several perverse effects on both the economy and the environment. They distort prices and incentives, and lead to non-optimal consumption and production patterns. They are also often said to benefit the wrong economic groups, such as the upper middle class, while the poorest segments of the population are left behind.

Thus, removing or at least reshaping subsidies could lead to substantial benefits in terms of economic efficiency, environmental preservation and social equity. Their redesign could also free resources to allocate to other urgent needs that are prevalent in developing countries.

1.2.5 Criteria for Subsidy Programmes

Three elements are key when evaluating the structure of subsidy programmes: efficiency, targeting and administrative cost. The efficiency of a specific subsidy represents the welfare gain for the consumer balanced against its distorting effects, if any, and the cost of the subsidy itself. Such a cost-benefit analysis should always be carefully carried out to measure the effectiveness of a subsidy programme. As discussed earlier, all subsidies can be considered to create distortions, and the real question is their net value when all the benefits and costs are known.

The second element is targeting. Well-targeted subsidies go to those who really need them and for whom they were put in place. Two types of error can be made here: errors of inclusion and errors of exclusion. The first occurs when consumer groups not targeted by the subsidy succeed in appropriating its benefits for themselves. The Study Group calls this problem “subsidy capture” and believes it is the main reason why various groups recommend the removal of subsidies. Subsidies that may appear relatively efficient in terms of their net benefits, as described above, can become extremely inefficient and lead to perverse effects, distortions and heavy costs when appropriated by the wrong group.

On the other hand, to ensure that the problem of subsidy capture will not arise, subsidies may sometimes be designed in such a restrictive way that even the targeted group encounters great difficulties in benefiting from them. Often the costs of such errors of exclusion can be high, and must be taken into account in the administrative element.

The third element to be considered is the administrative cost of a subsidy. This is not the cost of the subsidy itself, which should be considered under efficiency as discussed above, but rather it is the cost to put in place and manage the subsidy programme, including monitoring. In principle, the more expensive the programme administration, the better should be the targeting. However, the administrative cost of a subsidy programme may become excessive, even exceeding the total cost of the subsidies themselves. Such a situation is not sustainable and a compromise is the best approach, i.e. a certain level of subsidy capture must be accepted in order to avoid an excessive administrative burden.

The Study Group believes that in many countries subsidy capture is a bigger problem than administrative costs, and that in many cases better monitoring systems are warranted.

1.3 Approaches to Pricing

1.3.1 Historical Cost Recovery Pricing & Cost of Service Ratemaking

In broad outline, cost of service ratemaking (price setting) involves the determination of a valid rate base for each service provider, which reflects the allowable investment cost of plant and equipment, and a fair return on that investment. Such determinations require many different issues regarding the continued economic significance of the original costs of plant and equipment over time to be resolved. There are many different economic and regulatory theories with regard to the various aspects of rate base determination.

Prices are adjusted to allow the service provider to recover full operating expenses and depreciation, and earn a fixed rate of return on investment in the rate base. This approach to price setting is widespread, and provides a sustainable way to set tariffs.

This approach is often used when there is no possibility to introduce competitive market pricing (for example, in electricity distribution), and where the level of assets is very significant compared to the additional investments required each year. It allows for recovery of oil exploration expenditures or the cost of building a pipeline, for instance.

The pipeline example, where the cost recovery approach makes more sense than a marginal cost approach, is based on the premise that the capacity of a pipeline is fixed and the marginal cost of an additional consumer would be a new pipeline. At the same time, the short-run marginal cost of operating a pipeline is so low compared to the investment required that it would not make sense to use this cost in pricing, since for each customer it would be next to zero.

The determination of a fair return on investment is generally bound at the lower end by the level that is minimally acceptable to the investors in the equipment, and at the higher end by the maximum level that can be justified to the ratepayers receiving the service. Within this range there are a number of factors to be considered, including price stability and predictability, levels of risk, the need to attract capital, and income tax and social policies.

This approach has numerous advantages. Once the rate of return is determined, the cost of production can be easily calculated. However, one of the disadvantages of this system is that it does not reward the supplier for efficient capital investment management, since the return will be higher (in absolute terms) the wider the capital investment base is (this is known as the Ayear-Johnson effect). The approach also creates an incentive for firms to increase the proportion of their costs in fixed assets rather than in variable costs, since they are being remunerated for the former but not for the latter.

Because they are natural monopolies, distribution companies (whether in gas or electricity) remain subject to price regulation even in liberalised markets. However, while still using economic regulation, regulators are increasingly moving towards performance-based ratemaking rather than purely cost-based. This creates an incentive for the regulated entities to improve their efficiency and performance, since the savings arising from efficiency improvements are shared between them and the ratepayers.

Determination of Specific Rate Structure

The next step in the conventional cost of service ratemaking process is the determination of a specific rate structure, which is the complex process of developing specific rates for different customer classes. The rate structure determination involves a range of conflicting standards of fairness and efficiency criteria in setting the separate rates for individual customer classes. There are a series of general criteria adopted by governments and regulatory experts to assess the attributes of a sound rate structure.

Historically, it has generally been the case with utility regulation that the rate structure is designed to achieve various social and economic goals, which require some deviation from strict adherence to the principle of setting rates purely on the basis of the cost of service to the customer class. One of the most useful methods to help determine the correct rate structure is to look at marginal costs for each customer group.

1.3.2 Marginal Cost Pricing

According to economic theory, the optimal allocation of resources is reached when marginal price is equal to marginal cost. In the short term, one is better off running a power plant if the short-term marginal cost is lower that the price paid for the energy.

The short-run marginal cost covers all variable costs of energy production, including fuel, labour and maintenance. Marginal cost pricing is used in countries where there are still vertically integrated government-owned utilities. In theory, prices will tend to converge towards a point where short-term marginal revenue is equal to short-term marginal cost in the market. In this situation, competitive market pricing will be optimal, from a short-term point of view.

The problem with short-term marginal cost pricing is that it does not take into account capital costs, since they are assumed to be fixed in the short run. But energy investments have a long lifetime and, in the long run, marginal costs should include the capital cost of replacing or expanding capacity. Problems can emerge if the investment cost (or its depreciation) is not recovered.

However, this approach has numerous advantages, both from a practical and a market efficiency point of view. Final prices will not be “perfect” in a market clearing sense under this approach, but it should at least be used as a benchmark by policymakers in the longer run. It can also be very useful in determining rate structure on a relative basis because it gives, from a marginal cost point of view, the allocation of costs among various customer categories, helping the utility to set the structure of its services accordingly.

1.3.3 Opportunity Cost Pricing

Opportunity cost pricing is based on the value the energy would have if it could be offered and purchased outside the country rather than consumed within. This approach allows the setting of a standard on which policymakers can rely. In Mexico, for example, in the determination of the internal price of oil, a calculation is made to determine what would be the net income if the barrels of oil were sold in the United States, taking into account transportation and quality.

Although the Study Group does not think energy pricing should be based exclusively on this method, it does provides a good “sanity check” to make sure

the internal pricing is not totally out of line, especially with neighbouring countries. However, because some countries benefit from site-specific advantages in terms of energy supply (although they may be disadvantaged elsewhere), the Study Group recognises that some countries may be "blessed" by their access to less expensive energy resources, and that consequently prices may not always reflect the opportunity cost.

1.3.4 Market Pricing

More and more countries are moving towards the design and creation of electricity markets, especially at the wholesale level. Although WEC recognises markets as the most efficient way to allocate resources, it also calls for appropriate regulation to address specific market flaws, including those which might emerge between wholesale and retail sectors. Externalities, barriers to entry, oligopolistic market structures and non-competitive behaviour sometimes create situations where intervention in the market would be beneficial. Markets do not always provide affordable access to energy for the poorest people, or for the impact of cross-subsidisation. It is in the area of appropriate regulation that issues of energy taxation and the role of subsidies find their true home.

1.4 Issues in Pricing

1.4.1 Cash Transfer vs. In-Kind Transfer

For the poorest people in a specific market where energy prices are set to cover full costs, targeted subsidies can make a minimum amount of energy service affordable. If the population was given the same amount of cash as the value of the subsidies, economic theory says that in a "perfect" world they would consume the same quantity of energy. But in reality, income elasticity and price elasticity of demand for energy in developing countries will vary widely, as can be seen from experience in economies in transition and developed countries.

The distortions created by subsidies are mostly due to the substitution effect. If a commodity is subsidised, people will have the incentive to buy more of this commodity and move away from a substitute. Well-designed subsidies can play a role in enticing people away from, for example, inefficient and polluting wood-burning stoves with their associated health hazards, or kerosene lamps, which are much more expensive in the long run and have a poorer light intensity than electric lights.

1.4.2 Subsidising Transport

Various estimates have been made to calculate the level of subsidies allocated to transport. But this calculation is not limited to the fuel (oil) itself. Once you start to include the subsidies to private road transport, you have to include uncovered costs of providing road users with road space and associated traffic services. These costs do not include all the externalities such as local pollution, congestion, climate change impact, accidents, etc. Subsidising transportation in developing countries almost certainly benefits the non-poor disproportionately. Removing these subsidies, except on public transport, is therefore likely to have limited or no impact on the poor.

1.4.3 Removal of Subsidies

It is important to understand that subsidy elimination in the short to medium term, without major social disturbance and political unrest, will be feasible if and only if alternative policies are successfully implemented to bridge the gap between the cost of delivering the energy and the true household ability to pay.

In some countries, the partial removal of subsidies has directly translated into an increase in non-collection of billed accounts and some other increases in non-technical losses. While the first effect may lead to an increase in disconnections from the service (which in some cold countries could lead to death), the second effect could lead to an increase in prosecutions and even in accidental electrocutions.

1.4.4 The Case for Industrial Customers

Some argue that the reason why, in many countries, industrial customers benefit from cross-subsidies is that they have more market power than single domestic consumers. Unlike residential customers, industrial users can often find substitute supplies, either from the grid or from on-site generation. Furthermore, if the industrial process requires heat or steam, the company can optimise its use of fuel by using a combined heat and power plant.

In addition, industrial customers have a lower cost of service because they use supplies at a much higher voltage than residential users, and there are consequently savings in the avoidance of the cost of a sub-station. The economies of scale for industrial customers are also enormous for the delivering utility. To sell the same quantity of energy to residential customers, especially in developing countries where household energy consumption is often minimal, the utility has to connect thousands of customers, implying additional costs for distribution lines, maintenance, metering, billing and collection. But, most importantly from a supply perspective, industrial customers are ideal customers, since their load factor is often very high compared to residential customers. The latter often consume most of their electricity at the same time (typically between about 1800 and 2100 hours). Managing peak load demand is much easier in the industrial sector than the residential sector and, so, the cost of service is lower leading to lower rates. In addition, industrial customers are often willing to negotiate interruptible service to lock in such lower rates.

1.5 Pricing Barriers

Households in developing countries are becoming smaller, a trend already observed in developed countries. So, even though some countries show increasing per capita income, this is not necessarily translated into higher income per household, since there are fewer salary earners in each family. This means that even where energy consumption per capita is increasing in developing countries, this might not be the case on a per household basis.

This will accentuate the fact that although wealthy households spend more on electricity than poor ones, the latter end up spending a larger share of their income on energy. In addition, since low income households consume a relatively small amount of energy, the high initial cost of connecting them to the network, and the high costs of monitoring and implementing the customer service system (metering, billing, etc.), affects the profitability of grid-based solutions in some developing

countries, and in certain markets within all of them. The role of renewable energies and distributed generation in solving this dilemma has emerged essentially in response to energy pricing concerns.

1.5.1 Solutions for Implementation

The Study Group acknowledges that, when it comes to energy service, sometimes the poor do not have the necessary choice, and governments must take steps to encourage rational market behaviour, in terms of a minimum level of access, reliable service and affordable prices.

Even for the poorest of the poor in any market, the full cost of energy ought to be known and revealed, and every energy consumer should be put in a position to pay for what they consume. Pricing policies are one of the ways that governments can do this, and subsidies have a role to play. The possible solutions are quite numerous, including:

- Baseline tariffs, with lower prices up to a certain level of consumption. These are still present in various developed countries, so why should they not be acceptable in developing countries where the baseline is much lower? Surprisingly, baseline tariffs are still quite rare in developing countries.
- Loans for 4–5 year periods to allow new consumers to pay connection charges. These can be repaid through monthly billing.
- Direct participation by local populations in the management of the system. In some countries, power is sold to local communities for distribution to the population. The community is responsible for collection of payments and for keeping non-technical losses to a minimum.
- Second-best solutions for remote populations, with cross-subsidies from high density areas for the additional fixed costs.

With such measures in place, the problem of energy accessibility might be more of a financing issue than a capacity to pay issue. Once electricity is available the cost of lighting, for example, could be lower than with a kerosene lamp or dry batteries. Uganda spends an estimated US$100 million per year (1.5% of GDP) on dry cell batteries to power radios, flashlights and other appliances. The average Ugandan spends an estimated US$70 per year on batteries, equivalent to about US$400/kWh.[1]

Unlike consumers in developed countries, who have the financial capability and the information to access various energy and consumption choices, the poor in a developing country face choice constraints. These prevent them from making rational decisions on a medium-term basis about their energy consumption patterns. In this sense, the inclusion of externalities in the cost of commercial fuels, similarly to the removal of subsidies without adequate compensatory measures, would probably lead to a worse situation. The poor would continue to rely on traditional fuels and non-commercial sources of energy, with all the negative consequences linked to them.

1.5.2 Does Cheaper Mean Better?

For the poor to benefit, lower production costs must be passed on as lower prices. But in many developing countries, tariffs have risen following market reform as

1. Uganda: Rural Electrification Strategy Study, World Bank, 1999.

subsidies have been withdrawn, since the value of the subsidies was greater than the cost reductions in the energy system. The paradox is that while badly designed energy subsidies tend to benefit the well-off more than the poor, because the former use more energy (particularly electricity), the reduction in subsidies could benefit the poor in fiscal terms if the savings on the government balance sheet were redirected to compensatory social support measures or growth-oriented programmes.

1.5.3 Funding of subsidies

The funding of subsidies derives essentially from four sources:

- First, funding from the government, with transfer payments directly to the poor. While this avoids price distortions and generally has good targeting, the better the targeting the higher the administrative cost, as discussed above.
- Second, funding mandated by the government by requiring the utility to sell at a price below its costs, thereby reducing its profitability or even resulting in losses. This option is obviously unsustainable in the long run, but it is unfortunately the present situation in many developing countries.
- Third, regulated cross-subsidisation from one consumer category to another. This can be very effective as long as the demand from the funding customer category is not too price elastic and there is no available substitute.
- Fourth, progressive tariffs within the residential customer category, with higher consumption customers paying a higher tariff than those with low consumption. One advantage of this approach is that the differential in tariffs sometimes does not have to be very great, if the high consumption segment of the customer base is wide enough.

2. CASE STUDIES FOR SELECTED COUNTRIES

Although nine detailed cases are presented here, the Study Group received information from various other Member Committees of WEC. The Study Group is grateful to those countries concerned, many of which faced real difficulties in gathering the data. All of this material was analysed, considered and used in the preparation of this Report, especially its conclusions and recommendations. In particular, Saudi Arabia, Botswana, Croatia, Egypt, Swaziland, Venezuela and Indonesia provided extensive material on energy prices in their countries.

2.1 The Case of Argentina: Providing Affordable Energy Services in a Liberalised Market

Argentina is one of Latin America's biggest energy markets, with a consumption of 1.73 toe per capita in 1997. In Latin America this number was only exceeded by Venezuela with 2.52 toe per capita and lies well above the regional average of 1.18 toe per capita.[2] Argentina has significant reserves of energy resources, including 9% of Latin America's gas reserves and 2% of the oil reserves. Since 1992 the demand for electricity increased at a speed of 6.3% per year, and total energy demand has increased more than 30% between 1990 and 2000. In the beginning of the 1990s Argentina privatised most of its energy sector, including its largest oil and gas company, its electricity generation plants and most of its gas and electricity distribution grid.

2.1.1 Energy Policy

The Argentine ministry that is responsible for the energy sector has initiated a deregulation and liberalisation policy in all energy sectors of the country. Since the beginning of the 1990s Argentina privatised most of its energy assets, including its largest oil and gas company, its electricity generation plants and most of its gas and electricity distribution grid. In the electricity market, generation, transmission and distribution are unbundled. The Argentine government promotes competition as a means to enhance efficiency, attract private investment and protect the consumers.

2.1.2 Institutional Arrangements and Industry Structure

Oil and Gas

Until 1989 the oil and gas exploration activities in Argentina were conducted by the publicly-owned companies Yacimientos Petroliferos Fiscales Sociedad del Estado (YPF SE) and Gas del Estado. In addition to that, a number of private companies, most of them Argentine companies, participated in the exploration. They held a share of 38% in the upstream oil sector and 15% in the natural gas sector and delivered their products under long-term contracts to the state-owned companies.

The reform in the oil sector took place between 1989 and 1991 and included the restructuring of YPF SE into a society (asociacion) called YPF SA, its

2. World Bank (2000), World Development Indicators.

privatisation and a public offering of YPF SE. The new ownership structure included a shareholder participation of 46% private shareholders, 20% the central government, 12% the provinces and 10% the employees. YPF is now part of Repsol. It shares the upstream market with two other companies, Perez Companc and Petrolera Argentina San Jorge, but holds nearly 60% of the country's petrol reserves and about 50% of the petrol production. The downstream oil sector is dominated by three companies, which are Repsol-YPF, Esso and Shell.

The natural gas sector was reformed in 1992 and is now a competitive market with two pipeline companies and eight distributors operating within a regulated monopoly. The transmission companies are obliged to provide free access to their pipeline, but are not allowed to sell natural gas. Large users can freely choose between distribution companies or buy directly from the producers.

Electricity

The restructuring of the electricity sector created the regulatory agencies necessary to supervise and control a competitive and unbundled electricity market. The highest authority in the electricity sector is the Energy Secretariat, which is a subdivision of the Ministry of Economy. Its role is to:

- formulate the general energy policy of the country;
- define the regulatory framework;
- entitle agents to participate in the market;
- authorise cross-border electricity trade.

The Energy Secretariat is not entitled to intervene in actual capacity planning, however, it is in charge of a harmonious development of the whole system.

The mission of the federal regulatory agency (ENRE) is to:

- control the quality of the energy services provided by the agents in the market;
- set and revise the electricity tariffs in the regulated part of the distribution sector;
- intervene if strategic behaviour occurs in the market;
- supervise the compliance to environmental law and regulations;
- protect the consumers and take the role of the mediator in the case of a conflict between agents.

As a consequence of the decentralisation that took place at the beginning of the 1990s, the local and provincial authorities are allowed to set local tariffs for the distribution companies, they can furthermore raise municipal taxes and fees.

Figure 1 shows the general structure of the electricity sector in Argentina.

Generation

The electricity market consists of two components: the spot market and the contracts market, which together constitute the Wholesale Electricity Market (WEM). The agents in the market can either offer and or purchase electricity by direct intervention, or they act indirectly via a specialised financial agency.

In the spot market the electricity prices are fixed on an hourly basis, they are computed according to the price that would occur for an additional kilowatt hour of demand, i.e. according to the short-term marginal costs, a system similar to the England & Wales power pool.

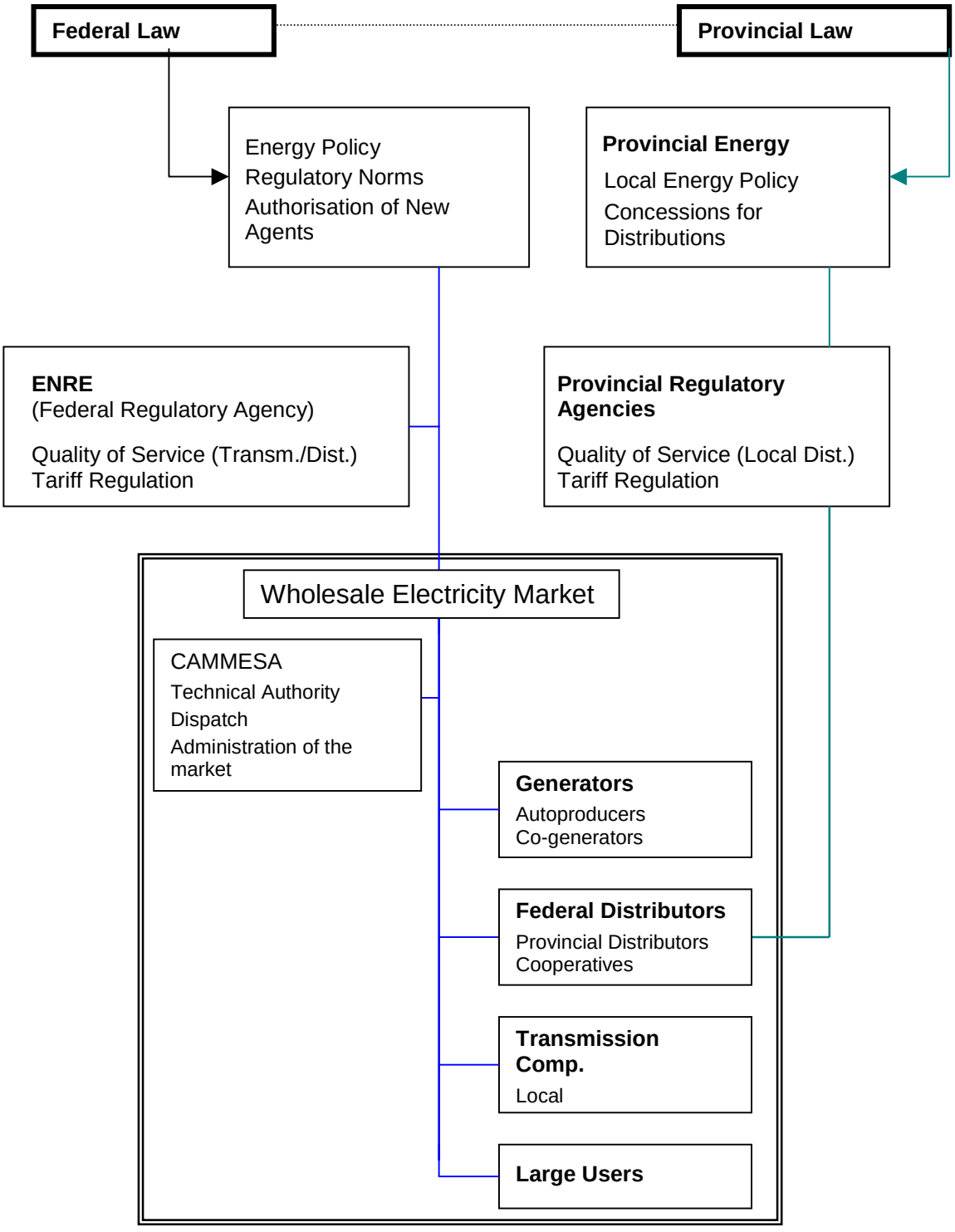

Figure 1. Institutional organisation of the Argentine electricity market (Source: Pistonesi (2000): 24).

For each generator and each client the price is a function of the corresponding node within the grid, too. This component takes the fees for transportation and the losses into account. In the spot market there are two groups of purchasers, the distribution companies and occasional buyers. The latter can be large customers

like industry companies or generators that fail to meet the demand they have sold. The prices for the occasional buyers are based on the hourly price, whereas the prices for the distribution companies are calculated in advance for half a year with a simulation of the despatch. Of course, they are subject to revision if there are drastic changes in the cost structure.

Since the introduction of the spot market, the Argentine regulator has gradually reduced the minimum of required demand for large customers to choose their electricity provider directly, from 5 MW down to 50 kW in the last years, and with the perspective of a completely liberalised market in a few years time.

Figure 2 shows the structure and the agents in the wholesale electricity market.

Transmission and Distribution

Transmission and distribution are still regulated activities and subject to government intervention. The fees for transmission are intended to cover the operation and maintenance costs and provide a reasonable surplus. ENRE, the regulatory agency, revises the fee structure every five years. Grid extensions are planned and co-ordinated by Transener, the government-controlled company in charge of the grid. The expenses for the construction of grid extensions have to be paid by the companies and customers, proportional to their individual benefits. The amortisation of the line has to be accomplished within 15 years.

The distribution sector is still very diversified and consists of two main groups, private distribution companies and the municipal or cooperatively-owned companies. The public ownership in the provincial regions is mainly due to the decreased pace of privatisation and restructuring. The distribution companies are obliged to serve all customers in their area, and if the fail to meet the minimum standards of quality defined in their concessionary contracts they have to pay penalty fees.

The Argentine legislation includes the condition that all the costs of the distribution company have to be covered by the tariffs. This means that a “pass through” effect along the generation, transmission and distribution chain towards the final customer is created. The tariffs are subject to approval by ENRE, the regulatory agency, every five years. However, trimestrial revisions of the purchasing costs adjust the distributors’ expenses on the base of the spot market’s prices. Large independent customers who use the grid of the distributor have to pay a usage fee proportional to their capacity requirements to the distributor. Customers under 100 kW who use the distribution grid have to pay an additional fee for administration and technical services.

2.1.3 Industry Structure

Oil and Gas

Yacimientos Petroliferos Fiscales is now part of the Spanish company Repsol. It shares the upstream market with a number of other companies, which are of both national and international origin. Perez Companc, Petrolera Argentina San Jorge and Brazil’s Petrobras belong to the group of YPF’s competitors, but the former state-owned company still holds nearly 60% of the country’s petrol reserves and about 50% of the petrol production. The downstream oil sector is dominated by three companies, which are Repsol-YPF, Esso and Shell.

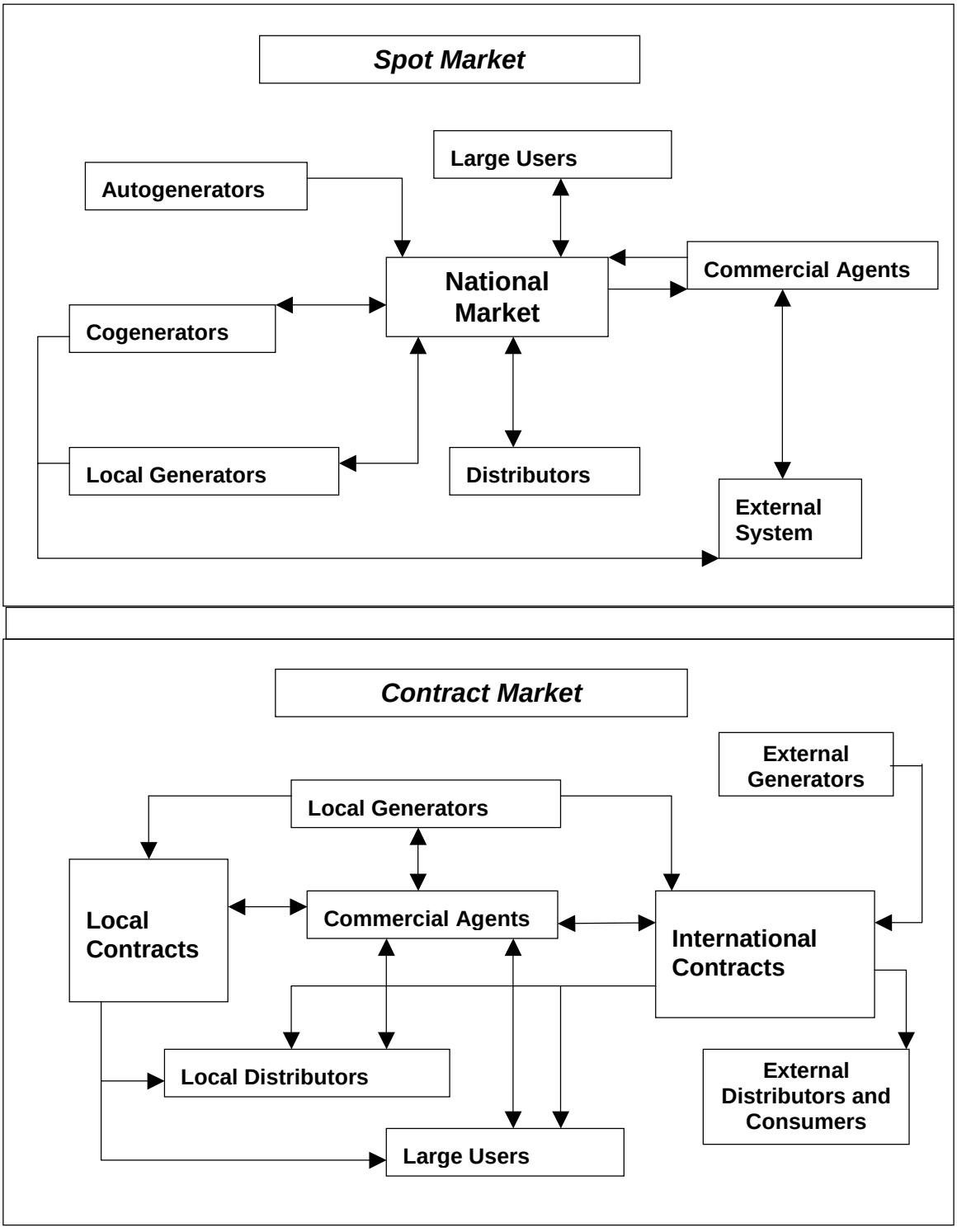

Figure 2. Organisational chart of the wholesale electricity market in Argentina (Source: Pistonesi (2000): 30).

The ownership structure in the upstream gas sector is comparable to oligopoly, with YPF-Repsol holding 65% of the available reserves. However, as the US Department of Energy states,[3] "the company has limited pipeline and transmission assets, and competition regulations prevent expansion in this area".

3. Energy Information Administration, DOE (2000): Argentina – Country Brief.

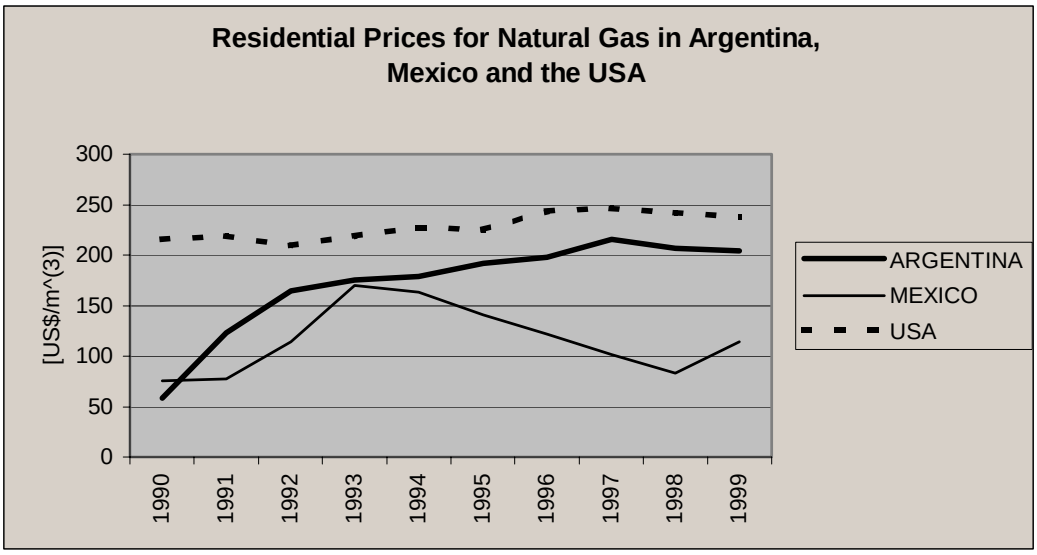

Figure 3. Residential prices for natural gas in Argentina, Mexico and the USA (Source: OLADE, SIEE Database 2001).

Electricity

In the electricity sector 1262 agents were registered in 1999, amongst them 44 generation companies, 50 distribution companies and over 1000 large customers. In the same year, hydropower provided 34% of the total net generation, and the remaining 66% of fossil fuels were split into natural gas, which accounted for 87.9%, fuel oil for 8.2%, coal (3.5%) and gas oil (0.4%). In generation, the five biggest companies provided roughly 53% of the total sales, with the biggest company below a market share of 15%. It can be assumed that the market for generation is highly competitive and there is no immediate threat of strategic behaviour, as it might occur in the oligopolistically controlled gas and oil markets.

The large users bought 22% of the 70 TWh of generated electricity in 1999, the local and regional distributors bought 78%. They purchased half of their energy in the seasonal market, which follows the pricing of the spot market in trimestrial steps, and the other half in the contracts market, whereas the large users preferred the contract market, with roughly two-thirds, to the spot market, with one-third.

2.1.4 Pricing Practices

Natural Gas

Natural gas prices are related to petroleum product prices, but on a competitive basis. The tariffs for natural gas transmission and distribution in the regulated areas are set by the state regulatory agency Enargas. Every six months they are adjusted according to a US index and with a correction factor for seasonal fluctuations.

The development of the residential gas prices in Argentina since 1990 shows a steep increase in the first years of restructuring and privatisation (Figure 3). After 1993 the prices increased steadily until 1997, the year when they first started to drop. The graph indicates that the residential customers must pay nearly double for one cubic meter of gas than the customers in Mexico, and only 14% less than a customer in the United States.

Petrol

The situation in the oil market shows an even more interesting picture (Figure 4). Even before the energy sector liberalisation petrol (gasolina) prices were well above the United States, Mexico and Peru. Argentine consumers continue to pay more than double for petrol than their counterparts in the USA.

In order to fight against strategic behaviour in the upstream and downstream oil market, the government has considered to introduce gasoline and diesel import subsidies in order to bring the prices close to international levels (see EIA/DOE 2000: 3).

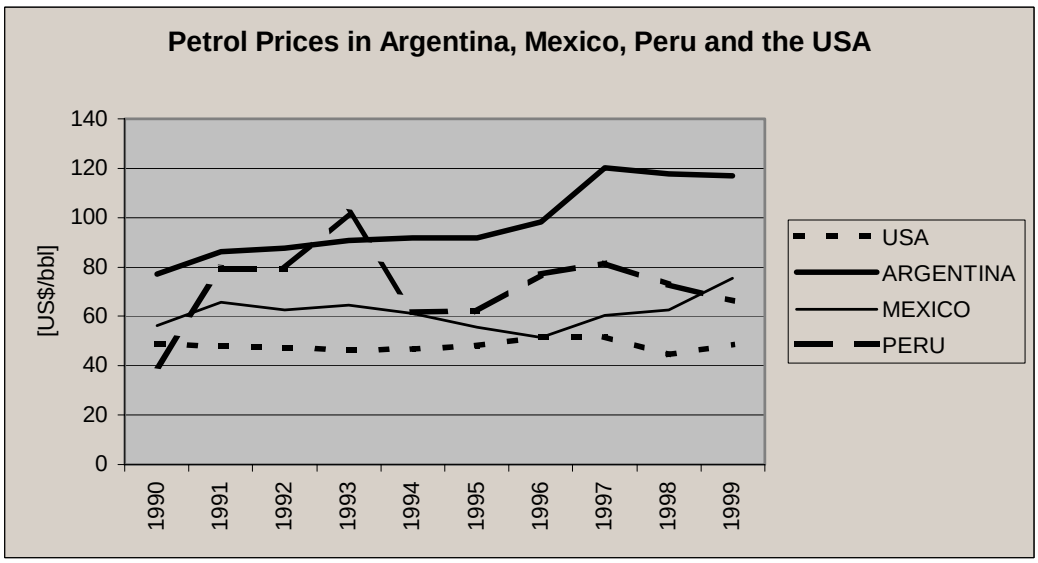

Figure 4. Petrol prices in Argentina, Mexico, Peru and the USA (Source: OLADE, SIEE Database 2001).

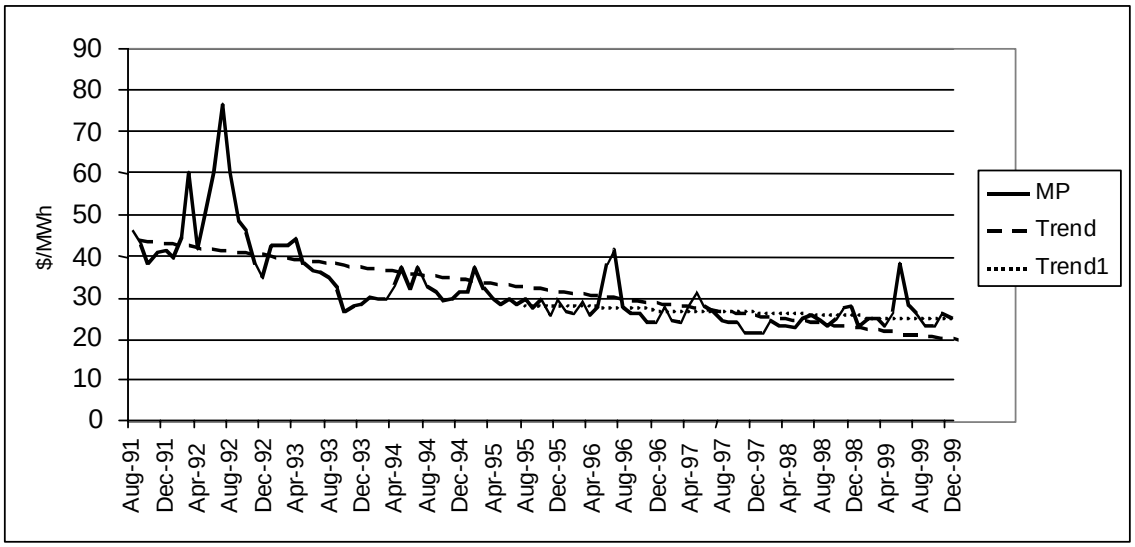

Figure 5. Electricity wholesale market in Argentina – evolution of the compound electricity price (Source: Pistonesi (2000): 42).

Electricity Prices in the Liberalised Market Segments

In 1999, a significant gap between the electricity prices in the spot market and the contracts market. On average, electric power in the contract market was 11% cheaper than power in the spot market. Since 1995, the year when contracts for large users started to gain weight, the average purchase prices for electricity in the contracts market dropped by 27% in real terms until 1999.

The spot market, however, is by far more volatile and shows several peaks (Figure 5). The bad conditions of precipitation and low water levels of hydro basins are responsible for the last peak, which occurred in 1999. It shifted a large part of the hydro generation to more expensive thermal plants. The peak in 1992, just after the liberalisation, was a combination of low hydro inflows and a low availability of the thermal plants. However, the general trend shows a substantial decline in the spot market prices since 1992 and still a steady decline from 1995 onwards.

Electricity Prices in the Regulated Distribution Sector

Before the market liberalisation, equity aspects dominated the pricing structure of the companies. The tariffs increased in blocks according to the amount of consumption. Hence, industrial customers were charged a relatively higher amount for the service. Since the liberalisation two tendencies can be observed: Recently privatised distribution companies like Edenor, which is responsible for the Northern part of Greater Buenos Aires, have converted to a tariff system that decreases with the amount of sold electricity.

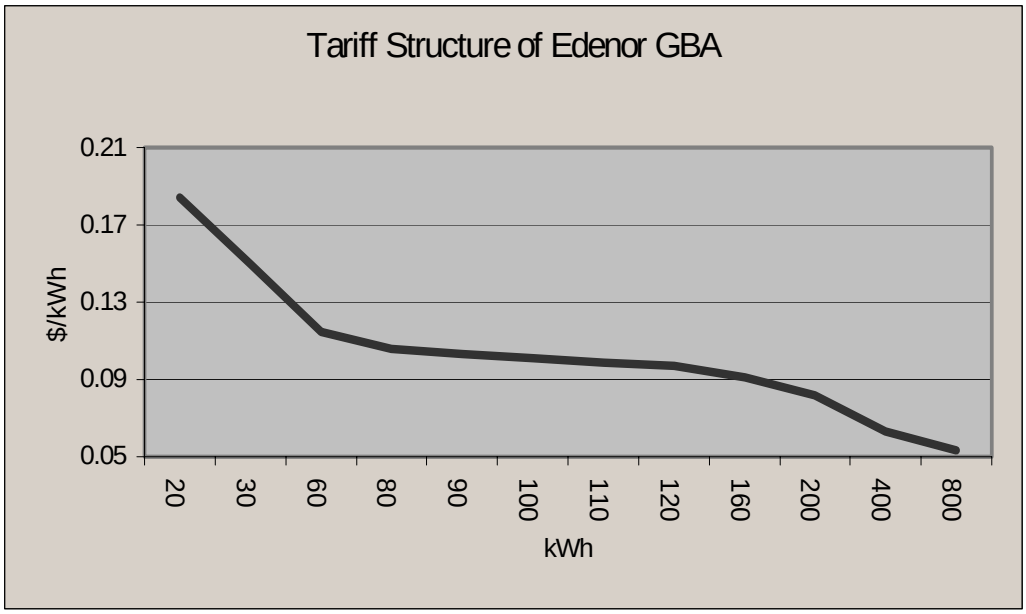

Figure 6. Tariff structure of Edelnor GBA (Source: Pistonesi (2000): 49).

Figure 6 shows the tariff structure applied by Edenor, which starts at a level of 18 US¢ per kilowatt hour and decreases to 5 US¢ per kilowatt hour for larger customers.

On the contrary, the distribution companies that are still under municipal or cooperative administration, mostly in the rural areas, have only in parts adapted

the new pricing scheme. The case of APELP SA, the Administracion Provincial de Energia de la Pampa, indicates that large customers are still charged increasing prices from a certain level of demand onwards (Figure 7). However, the graph also shows that residential customers with a very limited demand have to pay more per kilowatt hour than customers with a medium-sized demand structure.

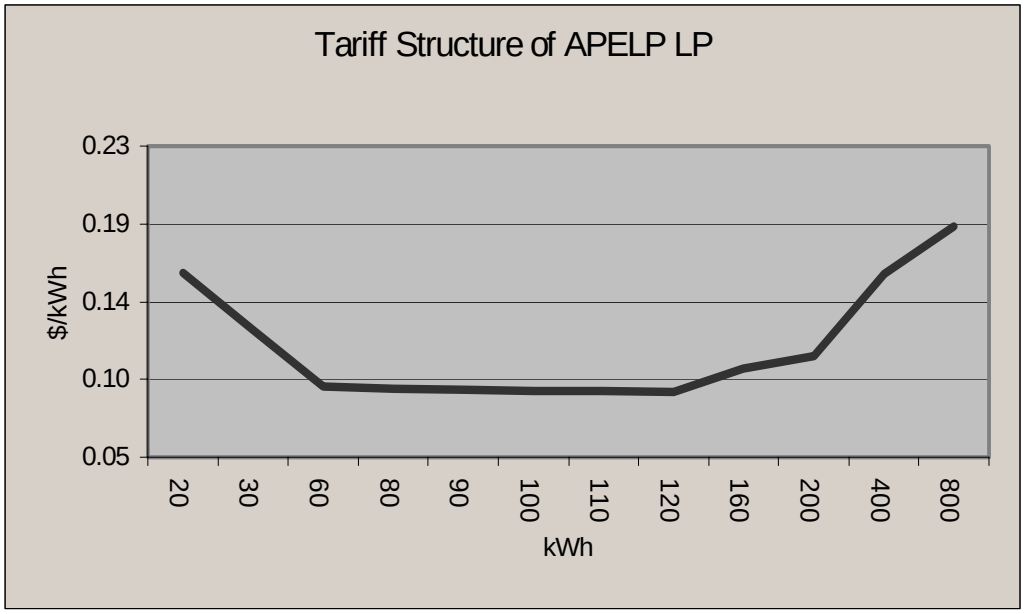

Figure 7. Tariff structure of APELP LP (Source: Pistonesi (2000): 49).

It can be assumed that this tariff structure is based on cross-subsidies from industrial to residential consumers, and the question is how long the provincial authorities are able to maintain it under the pressure of competition in a liberalised market. Furthermore, the regulatory law does not permit the application of cross-subsidies or any rate schedule discrimination.[4]

For the region of Greater Buenos Aires the prices remained relatively stable since the privatisation of the municipal distributor SEGBA and the transformation into two private companies, Edenor and Edesur (as shown in Figure 8). The peaks that occurred in 1993 are related to a sudden but temporary price increase in the spot market, which was then reflected in the trimestrial correction of the base price for the distributors.

In addition to the tariff, residential customers in the City of Buenos Aires (Capital Federal) have to pay a further 28% of the tariff in form of municipal taxes. For customers in the region of Greater Buenos Aires the taxes even rise to 44%, due to special funds for improving the electricity sector infrastructure. For an average tariff of US$82 per MWh in 1999, residential consumers in the city of Buenos Aires paid another US$29 per MWh, and in Greater Buenos Aires US$44 per MWh.[5]

4. Law No. 24065, Section 42, Paragraph e.

5. ENRE (1999), Annual Report 1999: 151.

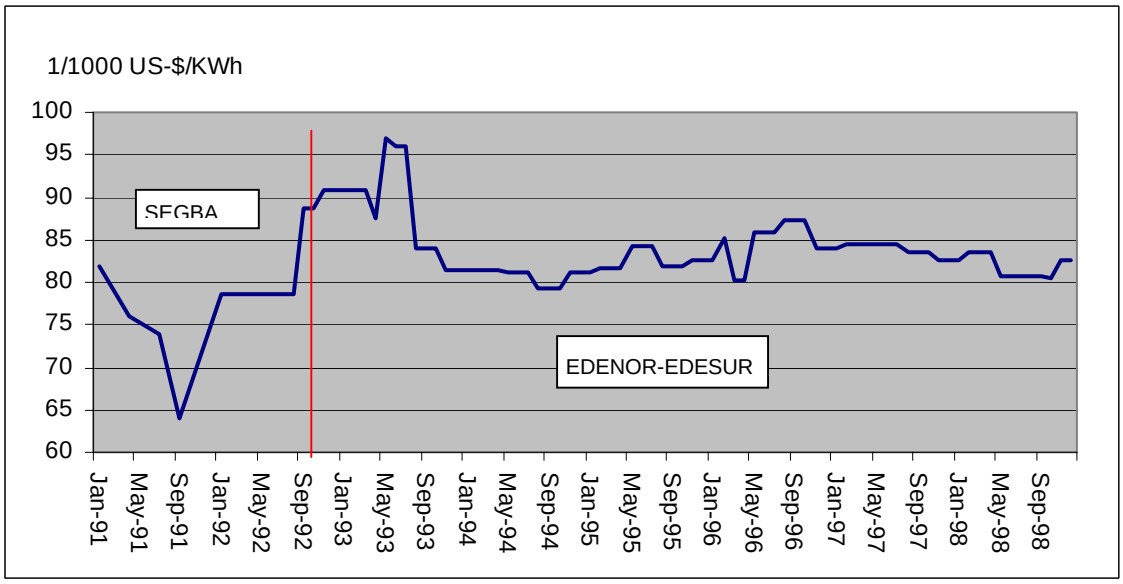

Figure 8. Evolution of average residential electricity tariffs in Greater Buenos Aires (consumption of 200 kWh/month) (Source: Pistonesi (2000): 51).

2.1.5 Pricing Practices: Challenges

Distribution Sector

The distribution sector faces a double challenge. On the one hand, it has to compete with generators who can sell their electricity directly to large customers or to an increasing number of commercial electricity providers who buy the power on the spot market and sell it directly to large customers. On the other hand, it still has a social and economic function, which is to provide electricity services to all its clients, especially to the poorer groups in the Argentine society.

Furthermore, municipal and regional taxes apply to the tariffs of the customers of the distribution companies, whereas commercial agents and generators only have to pay the fees raised by the regulatory agency and the transmission and distribution charges. In 1998, around 18% of the delivered electricity was sold in the "by pass" mode, thus flowing directly from the commercial agents or generators to large consumers.

Outages and Reliability of the System

One major critique of electricity sector liberalisation is the neglect of infrastructure, especially of the grid, if there is not sufficient economic incentive for the market participants to maintain their equipment and to invest in long-term assets. Outages are one possible consequence. An event like this occurred in February 1999, when a fire at one substation of the distribution company Edesur produced an outage that affected instantly 150 000 customers and lasted for 11 days.

The Argentine regulatory agency penalised Edesur to pay a minimum indemnity of roughly four US cents per hour of outage, and a further US$100 for loss of food if the interruption endured longer than 24 hours. The compensation paid by Edesur

equalled the gains of one whole fiscal year of the company.[6] In general, the regulatory agency introduced a penalty and reward system for dysfunctionalities in the transmission and distribution network, which is based on three indicators:

- Duration of the unavailability
- Number of forced outages
- Extra costs that its restrictions bring about in the electricity system

In total, ENRE imposed penalties worth nearly US$40 million on the transmission and distribution companies in the time period from 1994 to June 1999.

Non-Technical Losses

ENRE, the regulatory agency, reports in its first five-year review[7] that an estimated number of 2.5 million habitants in 25 municipalities use the distribution system to illegally gain electricity from the grid. In 1994 a collective action plan was set up by Edesur, Edenor, ENRE and the affected municipalities to combat illegal electricity consumption. The joint effort led to a decrease of non-technical losses from 27% in 1992 to 10% in 1997.

2.1.6 General Conclusions

The residential customers in Argentina have experienced price decreases and an improvement of their services since the initiation of a liberalised electricity sector. Argentina can therefore serve as an example how to install a deregulated market and let consumers benefit from competition. Of course, this is mainly due to the high market fragmentation in the generation of electricity, where the regulatory agency supervises very closely the market concentration and penalises failure of services. However, the similarly privatised oil and gas sectors have not yet shown the same consumer-friendly tendencies, due to the strong concentration in the upstream and downstream sectors of both fuels. It can be concluded that a strong governmental effort in the unbundling and privatisation is needed in order to transfer the gains induced by privatisation to the final customers, and not let strategic behaviour reverse the benefits of liberalisation.

Source Documents

1. US Department of Energy, Energy Information Administration (2000), Argentina – Country Brief (www.eia.doe.gov).
2. ENRE (1999), Annual Report 1999, Buenos Aires: Ente Regulador de Electricidad.
3. ENRE (1998), El Informe Electrico, Cinco Anos de Regulacion y Control, Buenos Aires: Ente Regulador de Electricidad.
4. Pistonesi, Hector (2000), Sistema electrico argentino: los principales problemas regulatorios y el desempeno posterior a la reforma, Santiago de Chile: CEPAL.

6. ENRE (1999), Annual Report 1999.

7. ENRE (1998), El Informe Electrico, Cinco Anos de Regulacion y Control: 27.

2.2 The Case of India: Reforming for Growth in Investment and Efficiency

2.2.1 Economic Background

The evolution of energy sector in India has mirrored the economic growth strategy of the country. In the post-independence India, the political necessity of keeping the country together and the need for large-scale investments in infrastructure and manufacturing industry laid the foundation for government's involvement in the business. Success with government supported agriculture growth policies in the sixties and political pressure to win votes through populist measures resulted in controls being tightened and increased government investment in economic activities.

Consequently, public expenditure continued to grow and the share of public sector in GDP and organised employment increased from 13% and 58% in 1970-71 to 27.1% and 71% in 1988-89, respectively. Public sector investments were financed by government deficits funded through domestic borrowings and printing of currency. Fiscal deficit remained over 8% of GDP in the mid-eighties. During the late eighties, the Indian economic system cracked under the burden of external (large trade and current account deficit) and internal imbalances (inflation and large government borrowings). However, this time the government responded by opening up the Indian economy to domestic as well as international competition. The government realised that the country had missed an opportunity to attract international investment for export-led growth, a strategy adopted by many of the countries in East Asia.

The factors that guided energy policy in India till the eighties were similar to those that determined the role of government in other economic activities. Energy prices were kept artificially low so that the input prices for other sectors would remain low. The concern about provision of subsidies to the deserving and security of energy supply prompted the government to nationalise the energy supply industry to create monopolies in each sector. The policy of creating vertically integrated monopolies was further reinforced by the fact that multi-lateral and bilateral agencies were more comfortable with lending to the government than to private firms.

As part of the reform process, the government identified infrastructure sector as key area for attracting domestic and international private investment. The choice was based on the premise that investment in infrastructure is key to economic growth, as the country has been experiencing supply shortages for all the infrastructure services. Given the level of deficits and the state of public sector, it was not possible to invest the required resources in the government sector.

2.2.2 Energy Sector

In India, energy consumption reflects energy demand constrained by shortages in supply. India is a net importer of energy and imports nearly 70% of its requirements for petroleum and petroleum products. Coal constitutes the main source of commercial energy and accounts for over 60% primary consumption in the country. Oil and natural gas together account for 35% of primary commercial energy consumption in the country.

An analysis of consumption by sectors shows that industry accounts for nearly half of final commercial energy consumption, followed by transport and residential

sectors. However, the share of industry in consumption has fallen by over 2% from a high of 50.4% in 1990-91 to 47.8% in 1997-98. While the share of domestic consumption has remained more or less same, the share of transport sector has gone up by a percentage point. Agriculture accounts for about 5% of consumption. While industry accounts for a large (60%) share of coal consumption in the country, the transport sector consumes nearly 40% of petroleum products.

Energy Policy

Energy policy in India focuses on "energy for all" and intends to build an environment friendly sustainable energy supply industry. Consequently, the country has made large investments in building capacity for utilising renewable energy resources like wind, solar thermal and solar photovoltaics.

In the post-reforms years, the private sector firms can participate in generation as well as distribution activities. An investor is guaranteed 16% post-tax return on equity in the currency of investment. These generation projects also enjoy a tax-holiday (zero-tax for five years and 30% reduction in taxable income for next five years in block of 12 years). India now allows 100% privately owned transmission firms to exist. While private sector firms will own the transmission lines, the operational responsibility is that of the State Electricity Boards and Power Grid Corporation.

In the hydrocarbon sector also the government now allows private sector investment in exploration as well as the refining activities. The government has also set a time frame for dismantling the Administered Price Mechanism (APM) to allow for removal of pricing as well as distribution controls.

In the coal sector, the government has amended the Coal Mines Nationalisation Act to provide for private investment, including 100% foreign investment, in the mining industry. The public sector coal companies have now been given higher amount of freedom to price different grades of coal. While the prices of superior grades are completely deregulated, the prices for low-grade coal can now be changed every six months based on a predetermined formula.

2.2.3 Institutional Arrangements

The institutional structure in the Indian context is undergoing a transition, with setting up of independent regulatory bodies at the federal as well as the provincial level. Central Electricity Regulatory Commission at the federal level and State Electricity Regulatory Commissions at the provincial level have been set up during the last few years. These commissions are assigned with the task of regulating tariffs and promote competition and efficiency in the electricity supply industry in the country.

Figure 9 presents an outline of the institutional structure in the Electricity Supply Industry in India. We may notice that the State Electricity Boards are an important link among different players in the market. Therefore, the efficiency and productivity of state electricity boards and departments is an important factor in determining the competitiveness of the supply sector.

On the other hand, coal and oil sectors continue to be regulated through various government departments, which are part of Ministry of Coal and Ministry of Petroleum.

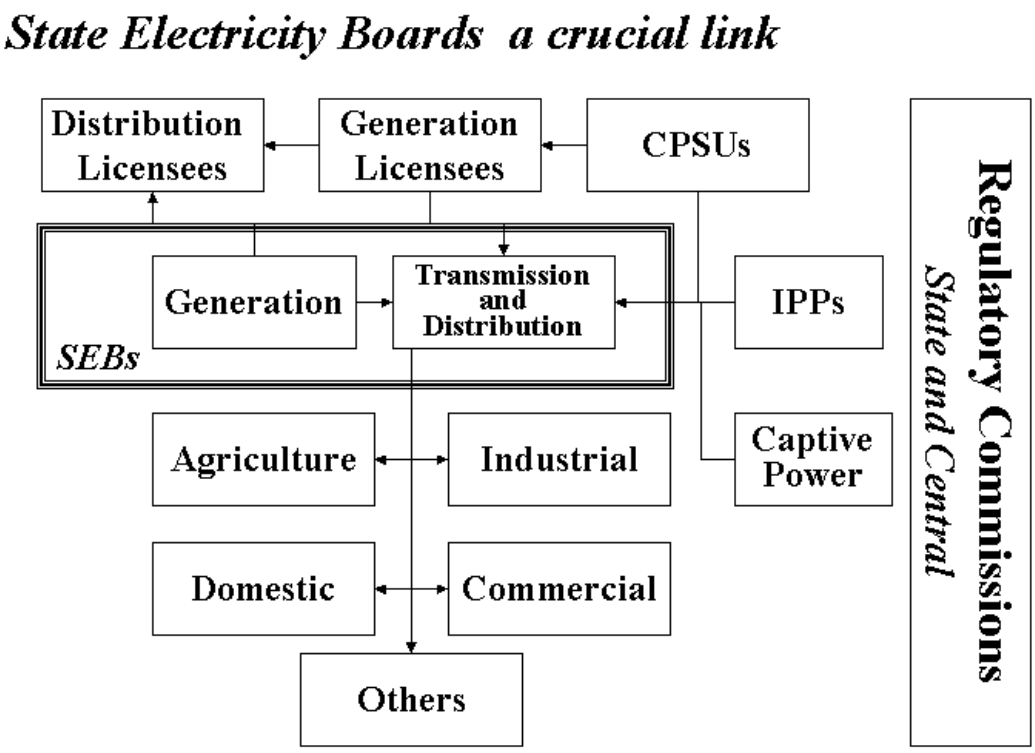

Figure 9. The institutional structure of the electricity supply industry in India.

2.2.4 Industry Structure

Even after a decade of reform effort, the power sector in India is still dominated by public sector firms. Over 90% of generation capacity is still in the public sector, with the share of state sector (mainly state electricity boards) being over 55% at end of March 2000. IPPs contribute only about 2.5% of capacity in India. However, there has been a considerable interest from the private sector for investment in generation capacity. Some estimates show that nearly 30 000 MW of projects are in various stages of finalisation, up to financial closure.[8]

While the country does have private sector distribution firms in the some of the large cities, the investment in transmission activity still comes from the public sector. Power Grid Corporation and State Electricity Boards are the major players in this segment. Most state governments have expressed their intention to privatise at least the distribution activity in the coming few years. Orissa was the first state to actually do it. As for transmission, there is very little interest from private sector in this activity. At present only Kota East and Mangalore Evacuation projects are being actively pursued.

The situation in other sub-sectors is not very different. The two public sector firms, except for a few captive mines in steel and other industries, dominate the coal sector. While the oil sector continue to be dominated by the public sector, there has a significant amount of investment in the exploration as well as the refining

8. The recent non-payment of electricity supply dues by one of the SEBs may slow down investment in this sector.

activities. However, at present, oil and natural gas production in private sector is still less than 5% of country's domestic production. On the other hand, Gas Authority of India Limited, is a monopoly player in the marketing and distribution of natural gas, with fertiliser and power firms being the major users of gas.

2.2.5 Pricing Practices

Pricing practices in India like many other developing countries are influenced by political, social and economic compulsions at the provincial and federal level. One such situation in India arises from the belief that the cost of production for agriculture produce can be kept low by keeping the input (fertiliser, electricity, water, etc.) costs at a low level. For example, it is believed that the country could encourage increased fertiliser usage by keeping its costs low, which in turn requires that the input costs (energy, feedstock, transport, etc.) for the fertiliser plants are kept low. Transport costs could be kept low only if the fuel costs are low. Cost of energy and transport services could be kept low only if the cost of capital is low, as these industries are highly capital incentive. More often than not, it is these beliefs that have been the foundation for energy sector policies in India.

Such indirect ways of providing input subsidies make it impossible to track efficiency across sectors and leave very little incentive for different production agents to be efficient. In situations, where it has not been possible for the government to provide the 'desired' level of subsidies through various production agents, it has often introduced pricing mechanisms, which allow one consumer segment to subsidise the other within a sector or industry. The Indian energy sector offers us many such examples, e.g., diesel, LPG and kerosene being subsidised by petrol, ATF and petroleum products for industrial usage and industrial and commercial consumers of electricity subsidising the agricultural and domestic consumers. However, many of these consumers find ways of circumventing these policies and mechanism, which results in some of them not paying for the services they use or adulteration of one product with another (adulteration of petrol and diesel by kerosene or of diesel by kerosene).

Electricity

The health of state electricity boards in India is an example of what not to do as far as pricing of electricity is concerned. These organisations have accumulated losses to such an extent they are neither able to invest in building the capacity required for meeting ambitious economic growth targets nor are able to pay for inputs to maintain their present level of production. In most cases, the financial condition of these Boards has deteriorated so much that the state budgets are not able to accommodate these losses.

Electricity tariffs in India are structured in a relatively simple manner. While the domestic and commercial customers do not pay any demand charges in most states (West Bengal, Orissa, Karnataka and Kerala being a few exceptions), the industrial customers do pay demand charges depending on their connected load. The price per kWh varies significantly across states as well as customer segments within a state. Tariffs in India are not structured to consider the time of usage and voltage level of supply. In addition to the base tariffs, some of the State Electricity Boards have additional recovery from customers in form of fuel surcharges and electricity duties. Table 1 below provides an analysis of average tariffs across customer segments in different states.

Table 1. Average electricity tariff in India by category (paise per kWh).

State Electricity Board	Domestic	Commercial	Agriculture	Industrial	Railway	Outside State	Average
Andhra Pradesh	167.0	367.8	16.1	330.3	374.3	80.0	188.1
Assam	146.0	297.0	156.6	233.0			216.8
Bihar	109.3	211.0	14.0	275.9	313.0	177.6	210.8
Delhi Vidyut Board	258.7	237.0	116.0	299.4			270.7
Gujrat	254.0	424.0	20.0	396.5	421.0		325.0
Haryana	241.0	341.0	55.0	341.0	341.0	138.0	180.5
Himachal Pradesh	70.0	230.0	60.0	194.0		190.0	172.7
Jammu & Kashmir	40.8	74.0	15.8	59.0			50.0
Karnataka	144.0	545.0	86.0	325.0	330.0		188.7
Kerala	83.4	295.7	55.1	165.9			173.2
Madya Pradesh	74.5	337.5	9.1	385.1	529.4	101.3	168.5
Maharashtra	156.3	365.3	25.4	351.2	363.2	175.8	214.1
Meghalaya	93.3	181.2	50.0	184.7		173.7	156.9
Orissa	141.0	281.0	72.0	277.5	421.0		240.0
Punjab	150.2	278.5		243.2		190.0	146.7
Rajasthan	144.0	308.0	38.0	311.8	320.0	219.5	198.5
Tamil Nadu	166.7	459.4		365.9	380.3	211.3	224.7
Uttar Pradesh	108.9	360.0	46.6	341.6	390.4	7.3	171.9
West Bengal	108.5	246.1	34.1	283.7	328.5	318.3	218.0
Average	**131.1**	**345.3**	**29.7**	**297.5**	**398.9**	**156.7**	**197.9**

Source: Planning Commission, 1999 Annual Report on the Working of State Electricity Boards and Electricity Departments, New Delhi, Power and Energy Division, Government of India

While the tariffs are structured in a simple manner, on an average, the state electricity boards are not able to recover all their costs. That is, the average tariff levels are below the average cost of supply for most of the Boards and the situation has deteriorated over the years (see Tables 2 and 3). As for the tariff adjustment mechanism, even when some of the states have regulatory commissions for tariff review, the decisions to effect changes are still political and there is no automatic adjustment mechanism, which can ensure recovery of costs for the electricity boards.

Besides pricing related concerns, there are issues relating to efficiency of the State Electricity Boards in India. Most Boards have reported transmission and distribution losses to the extent of over 20% of plant availability in fiscal 1999. These losses are far in excess of international average. Some of the unofficial estimates put these losses at about 40%.

In financial terms, the losses are estimated to cost the SEBs an average of Rs 300 billion or US$7 billion. A significant part of transmission and distribution losses is estimated to be losses due to non-metering, pilferage and theft of power. However, a large part of these losses gets hidden in consumption shown against agriculture sector, whereas a significant component of these losses is pilferage and theft of power.

Tables 4, 5 and 6 provide an overview of operating performance and the level of subsidies provided by some of the selected (large states) electricity boards for different consumer categories.

Table 2. Sales realisation as a ratio of cost in India (%).

State Electricity Board	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Andhra Pradesh	94.2	90.5	72.1	62.2	73.1	86.2	80.6
Assam	47.4	49.7	53.9	57.1	53.4	51.2	63.3
Bihar	63.7	73.5	66.4	70.6	63	71.4	78.4
Delhi Vidyut Board	81.7	0	0	72.9	72	72.6	71.1
Gujrat	68.4	76.6	74.6	63.6	81.8	81.9	85.9
Haryana	54	50.4	61.5	98.8	67.4	73.2	64.1
Himachal Pradesh	88.5	74.5	91.9	13.2	101.5	92.7	90.2
Jammu & Kashmir	21.3	16.7	10.3	74.9	10.9	12.2	16.2
Karnataka	96.5	95.3	86.8	69	72.4	86.8	89.9
Kerala	84.7	83.5	79.6	79.5	56.3	63.9	75.1
Madya Pradesh	84	80.7	77.3	91.2	84.9	80.3	72.3
Maharashtra	98.5	88.8	99.4	72.7	96.2	97.9	90.5
Meghalaya	81.3	93.6	71.2	77.1	80.2	77.3	38.7
Orissa	78.1	71.2	80.7	69.7	75.2	80.1	85.5
Punjab	57.6	61.8	66.7	67.8	73.2	61.6	60.9
Rajasthan	76	70.4	67.8	67.8	69.6	75.1	74.5
Tamil Nadu	86	88.7	98.8	97.1	93.4	90.8	92
Uttar Pradesh	70.6	66	69	70.7	64.3	71.6	69.8
West Bengal	71.5	73.4	73.7	78.5	74.3	76.2	78.6
Total	**82.2**	**78.3**	**78.3**	**76.1**	**77.4**	**80.1**	**78.6**
1997-98 are revised numbers and 1998-99 are from annual plans							
Source: Planning Commission, 1999 Annual Report on the Working of State Electricity Boards and Electricity Departments, New Delhi, Power and Energy Division, Government of India							

Table 3. Recovery of cost of supply by category in India (% of cost of supply).

State Electricity Board	Domestic	Commercial	Agriculture	Industrial	Railway	Outside State	Average
Andhra Pradesh	71.37	157.18	6.88	141.15	159.96	34.15	80.38
Assam	34.72	70.62	37.24	55.40	0.00	0.00	51.55
Bihar	40.68	78.67	5.21	102.68	116.48	66.09	78.45
Delhi	70.62	64.70	31.67	81.73	0.00	0.00	73.78
Gujrat	96.95	161.84	7.63	151.35	160.70	0.00	124.06
Haryana	86.46	122.34	19.73	122.34	122.34	49.51	64.76
Himachal Pradesh	39.70	130.45	34.03	110.03	0.00	107.76	97.95
Jammu & Kashmir	16.71	29.95	6.40	23.88	0.00	0.00	20.24
Karnataka	69.38	262.60	41.44	156.60	159.01	0.00	90.92
Kerala	41.38	146.60	27.34	82.31	0.00	0.00	85.93
Madya Pradesh	32.32	161.29	3.95	167.04	229.63	43.94	73.09
Maharashtra	69.01	161.29	11.21	155.06	160.36	77.62	94.53
Meghalaya	22.92	44.52	12.28	45.38	0.00	42.68	38.55
Orissa	50.22	100.80	25.04	98.84	149.94	0.00	85.49
Punjab	63.12	117.04	0.00	102.21	0.00	79.89	61.65
Rajasthan	54.42	116.39	14.36	117.86	120.93	82.59	75.01
Tamil Nadu	68.27	188.16	0.00	149.86	155.40	86.54	92.03
Uttar Pradesh	44.22	146.19	18.92	138.72	158.57	2.96	69.81
West Bengal	39.12	88.74	12.30	102.30	118.45	144.77	78.61
Average	**54.70**	**144.06**	**12.37**	**124.14**	**166.41**	**65.36**	**82.55**
Source: Planning Commission, 1999 Annual Report on the Working of State Electricity Boards and Electricity Departments, New Delhi, Power and Energy Division, Government of India							

Table 4. Transmission and distribution losses in India (% of plant availability).

State	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Andhra Pradesh	22.9	20.3	19.2	19.1	18.9	18.9	30.5	25.0	23.0
Arunachal Pradesh	20.0	28.2	34.9	31.6	31.0	36.0	32.0	30.0	32.0
Assam	24.1	22.7	21.0	20.8	24.9	26.2	24.9	24.0	23.0
Bihar	16.5	18.3	20.5	19.0	24.0	25.9	25.3	23.0	23.0
Daman and Diu	16.9	15.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Goa	25.0	23.8	20.8	21.8	26.2	28.5	26.7	26.0	25.0
Gujrat	23.4	23.6	21.1	21.3	20.0	18.3	18.2	18.0	17.0
Haryana	27.5	26.8	25.4	25.5	28.5	31.4	31.7	32.2	31.1
Himachal Pradesh	21.0	19.2	18.5	17.3	17.4	17.5	17.9	17.4	16.7
Jammu & Kashmir	43.0	50.1	45.3	47.7	46.9	48.6	48.0	47.5	47.0
Karnataka	20.2	19.3	18.7	18.6	18.9	18.5	18.5	18.4	17.4
Kerala	22.4	22.5	21.0	20.2	20.1	20.1	20.0	19.0	18.0
Lakshadweep	18.6	17.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Madya Pradesh	18.0	25.8	22.2	20.2	20.1	19.5	19.3	19.0	18.5
Maharashtra	18.3	18.6	16.4	15.8	15.3	15.4	15.3	15.2	15.2
Manipur	28.0	24.4	22.5	22.5	22.0	21.5	21.5	21.5	21.0
Meghalaya	11.5	11.7	12.2	10.7	18.7	17.8	19.3	16.9	16.0
Mizoram	29.6	34.9	28.1	28.0	28.0	27.0	26.0	26.0	25.0
Nagaland	26.1	23.1	32.4	31.6	30.8	30.0	29.7	29.0	28.5
Orissa	25.8	25.3	23.5	23.4	23.8	46.9	45.1	39.0	35.0
Punjab	19.3	21.8	18.7	18.5	18.3	18.2	18.0	18.0	17.8
Rajasthan	25.8	23.1	24.5	25.2	25.0	28.5	25.3	23.0	22.5
Sikkim	24.5	25.9	21.8	21.5	21.2	21.0	20.2	20.0	20.0
Tamil Nadu	18.0	18.4	17.5	17.3	16.9	17.0	17.0	17.0	17.0
Tripura	29.6	32.0	30.5	30.0	30.0	30.0	30.0	29.8	29.0
Uttar Pradesh	27.1	26.1	24.1	23.2	22.6	22.8	24.6	23.0	21.0
West Bengal	17.7	19.7	23.7	22.4	21.1	20.7	20.1	19.7	18.9
All India (Utilities)	**22.9**	**22.8**	**19.8**	**20.2**	**20.3**	**22.2**	**23.0**	**21.8**	**20.8**
1997-98 numbers are revised and 1998-99 are the estimates									
Source: Planning Commission, 1999 Annual Report on the Working of State Electricity Boards and Electricity Departments, New Delhi, Power and Energy Division, Government of India									

Yet, another aspect affecting the SEB financial performance, is their inability to collect their dues. On an average, the SEBs customers owe them money in excess of three to four months of supply. The Boards, in turn, do not pay their suppliers (mainly public sector undertakings supplying them power of coal).

A review of above figures suggests that in most cases the operating as well as financial condition of most of the SEBs has deteriorated over time and the main cause is the operating performance deterioration and their inability to recover their costs from different consumer segments. In order for the SEBs to achieve a break-even, the State Governments need to make a budgetary provision in excess of 5% of their total revenues. If the SEBs are to earn a commercial rate of return (15–16%) on their assets, the subsidies have to five times more than those needed for break-even, taking the required subsidy, in 1999, to be 25% of the State Government revenues or US$12 billion.

Table 5. Value of subsidy for agricultural consumers in India (million rupees).

State Electricity Board	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Andhra Pradesh	7 259	9 254	13 503	17 477	16 788	18 155	21 428
Assam	62	88	11	87	60	141	163
Bihar	2 676	2 519	2 971	2 995	3 507	3 908	4 478
Delhi Vidyut Board	86	0	0	0	0	0	254
Gujrat	10 554	12 060	12 662	16 468	18 126	25 039	31 806
Haryana	4 563	5 400	4 898	6 123	7 274	7 427	8 898
Himachal Pradesh	10	15	9	7	9	14	16
Jammu & Kashmir	275	534	668	706	907	1167	1319
Karnataka	4 965	6 679	8 707	11 092	9 100	8 252	9 228
Kerala	0	164	230	357	470	517	672
Madya Pradesh	4 211	7 562	11 037	14 164	17 249	18 542	20 463
Maharashtra	10 309	11 309	16 470	22 498	25 536	28 758	33 731
Meghalaya	0	1	1	2	2	2	7
Orissa	207	392	202	303	408	483	574
Punjab	6 871	7 973	7 809	8 285	10 083	14 731	15 532
Rajasthan	3 475	4 684	6 226	8 076	10 550	10 409	11 474
Tamil Nadu	6 425	7 598	9 468	11 333	12 802	15 617	17 823
Uttar Pradesh	10 354	12 274	12 751	14 024	17 623	18 900	2 019
West Bengal	1 042	1 150	1 688	2 065	2 496	3 249	3 916
Total	73 344	89 656	109 311	136 062	152 990	175 311	183 801
1997-98 numbers are revised and 1998-99 are the estimates							
Source: Planning Commission, 1999 Annual Report on the Working of State Electricity Boards and Electricity Departments, New Delhi, Power and Energy Division, Government of India							

Note: The subsidy in 1998–99 works out to be nearly US$4 billion and it has doubled in less than 5 years.

Oil and Gas

The Administered Price Mechanism (APM) came into existence in its present form during 1977. The Ministry of Petroleum and Natural Gas through Oil Coordination Committee administers the scheme. OCC undertakes a cost updating study for each of the oil firms every three years to determine whether they are earning the desired revenue. APM's stated objectives are:

- Optimisation of utilisation of refining and marketing infrastructure by treating it to be the common industry infrastructure.
- Make available products at uniform price ex-refineries (all).
- Ensure that the oil firms earn a reasonable rate of return.
- Ensure stable prices by insulating domestic market from volatility of international prices.
- Achieve socio-economic objective by ensuring availability of certain products at subsidised rates for weaker sections of society and priority sectors in the Industry through cross-subsidisation of products.

The reality is that APM has not led to any significant increases in operating efficiency of public sector plants. A study on APM (R-Group) suggested that improvement in operating efficiency could result in cost savings of over US$500 million.

Table 6. Value of subsidy for domestic consumers in India (million rupees).

State Electricity Board	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
Andhra Pradesh	404	636	1 187	1 593	2 380	2 558	3 682
Assam	372	824	793	901	1 191	1 189	1 635
Bihar	400	563	892	1 189	1 583	1 779	1 929
Delhi Vidyut Board	2 974	0	0	0	0	0	4 227
Gujrat	880	949	1 218	1 361	1 122	921	228
Haryana	956	1 372	1 132	1 231	1 096	110	681
Himachal Pradesh	137	259	232	199	296	451	530
Jammu & Kashmir	495	620	700	938	1 277	1 564	1 630
Karnataka	225	92	353	1 185	2 523	2 207	2 114
Kerala	605	834	1 147	2 040	3 748	3 443	4 830
Madya Pradesh	2 527	2 584	3 154	4 015	5 104	5 929	7 149
Maharashtra	1 516	1 933	1 902	3 257	4 238	2 955	4 574
Meghalaya	14	11	28	59	67	76	296
Orissa	804	1 224	921	1 435	1 963	2 283	2 534
Punjab	543	831	1 081	1 196	1 623	2 521	3 207
Rajasthan	1 833	1 275	1 634	2 207	2 180	2 648	2 979
Tamil Nadu	1 418	1 476	1 586	1 927	2 375	3 046	3 379
Uttar Pradesh	3 318	4 685	5 635	5 575	8 071	9 877	11 354
West Bengal	929	1 140	1 773	1 926	2 588	3 293	3 854
Total	**20 350**	**21 308**	**25 368**	**32 234**	**43 425**	**46 850**	**60 812**
1997-98 numbers are revised and 1998-99 are the estimates							
Source: Planning Commission, 1999 Annual Report on the Working of State Electricity Boards and Electricity Departments, New Delhi, Power and Energy Division, Government of India							

As part of the energy sector reforms, the government has attempted to bring prices for many of the petroleum products (naphtha, furnace oil, LSHS, LDO and bitumen) in line with international prices. The most important achievement has been the linking of diesel prices to international prices and a reduction in subsidy. However, LPG and kerosene, consumed mainly by domestic sectors, continue to be heavily subsidised. The government did attempt to augment the supply by allowing the private sector firms to import these products and sell them directly to the consumers. However, this effort did not bring about the desired result because of lack of infrastructure and continuation of large subsidies on sales made through the public sector firms or the public distribution system.

Subsidies and cross-subsidies have resulted in serious distortions in prices, as they do not reflect economic costs at all in many cases. Total petroleum subsidy has been registering very high increases over the years. At present, the value of subsidy is estimated at Rs 178.5 billion for the year ending March 2000.

2.2.6 Pricing Practices: Challenges

The pricing practices in India have not been able to achieve the stated objectives in most situations and industry segments. These practices have neither been able to bring in the expected efficiency (expected in the oil and gas sector wherein industry assets were expected to be part of common infrastructure) nor they could

ensure that the desired products and services reached the economically and socially deserving segments of population (cases where in we do have electricity supply infrastructure in rural India but rarely electric power). In addition, tendency to maintain prices at a low level through various subsidies encouraged wasteful expenditure and investment, use of diesel and sale of inefficient transport vehicles is a case in point. The country that imports nearly 25% of its energy in form of petroleum products probably produces most inefficient passenger and transport vehicles in the world.

To add to the problem, most public sector organisations in the sector do not have enough resources for investment in expanding capacity for meeting the increased energy demand. At the same time, the consumers have little incentive in using energy efficient equipment as either they pay nothing or very little for their consumption. The country does not have time of use or time of day tariff for electricity, making it expensive to manage peak demand loads.

In situations like this, concepts like price elasticity of energy are rendered meaningless. This is of particular relevance wherein it not necessary that every time there is an increase in prices, the consumer actually pays. Political compulsions ensure that the prices are not adjusted upward or the supply is not metered at all. The challenge today is to attract investment in production, transmission and distribution of energy products and services across the country. The country is not able to attract private investment in long gestation projects in the transmission and distribution activities, as the investors can not choose the customer-mix and the prices are not market determined. Even when the private investors are interested in putting up generation or production facilities, health of transmission and distribution firms (state electricity boards in case of electricity supply industry) is such that it is not possible for the buyers (SEBs) to meet their financial commitments.

The next set of challenges arises from the level of efficiency of the public sector organisations in the country. Most public sector organisations are largely over-staffed, when compared with their counterparts in other countries.

In summary, it may be stressed that pricing practices in the Indian energy sector represent a situation where lack of political will has resulted in the country not being able to raise domestic or international resources to meet its energy requirements. India’s energy demand is more supply constrained than need driven. There is very little incentive for a large segment of users to either use energy efficient equipment or alter their usage to lower the demand for additional investment in building peak capacity. The tariff structure while being simple does not help take prices closer to cost of service. There is large amount of differences in tariffs across different states, both because of base tariff and the state taxes. In most other cases, the level of cross-subsidies leaves prices for some of the products completely out of line with international prices. Tariff adjustment process is usually complex as the adjustment process are bureaucratic by design, wherein expert committees sit in judgement on what is a reasonable cost to be passed on the customers and what is not. Long run marginal costs have a limited role to play as the pricing processes are more often historical cost based.

Source Documents

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2.3 The Case of Iran: Planning for the Future

2.3.1 Economic Background

The Islamic Republic of Iran has an area of 1648 million square kilometres, a population of 62.8 million, and a 1999 GDP per capita of 6.6 million Rials in current prices. GDP per capita in constant prices has increased during the period of the second five-year plan (SFYP 1995–1999) by 4.7% annually. Iran has substantial mineral resources and some of the largest hydrocarbon reserves in the world. Population in Iran increased rapidly before the first five-year plan (3.2% annually), but was controlled after the plan, with the rate of increase reduced to 1.7% in 1999. The GDP structure of Iran is shown in Table 7.[9]

Table 7. Evaluation of GDP 1980-1999 in constant price of 1992 (billion Rials).

	1980	**1990**	**1995**	**1999**
Agriculture	18%	24%	25%	25%
Industry, Mines, Construction	18%	17%	17%	20%
Energy	14%	12%	16%	16%
Services	52%	48%	41%	39%
Total	**9323.1**	**10664.9**	**13844**	**17455.1**

Note: No attempt is made in this case study to convert rials to US$ because various exchange rates are used in Iran. Today, the general rate of 8000 rials to US$1 is mentioned as a rough indicator but in 1992 rials it was closer to 3000 rials to the US dollar.

Oil was the key domestic fuel during 1960–90 and it played a major role as generator of export income and of surplus finance. In the past, annual crude oil production in Iran fluctuated widely, reaching a peak of 6 mb/d in 1974, plummeting to 1.3 mb/d in 1981 and then increasing by the second five-year plan to 3.1 mb/d. The annual level of production is now no longer determined by production constraints, but is regulated by OPEC's quota. This means that the exportable surplus of oil is determined (at least in the short run) by the domestic level of demand. The reduction of oil consumption by energy savings and by fuel substitution therefore has become the most important policy objective in the national energy policy.

In view of this background and due to its vast reserves, natural gas is destined to become the fuel of the future, replacing other fuel use wherever it is economic. Natural gas production started in 1966 for exports to the former Soviet Union. During the 1970s, its use in Iran started to develop as well. Today natural gas is a major fuel in Iran. The annual production of natural gas is about 54 billion cubic meters, of which more than one third is used in power production and the rest is used in the residential and industrial sectors.

9. Analysis for this case study was carried out by officials of the Ministry of Energy of Iran, with input from the World Energy Council.

2.3.2 Energy Sector

Iran's primary resource base includes oil, natural gas, hydropower, coal and solar energy (Table 8). Geothermal is about to be developed at a serious level. The present estimates of proven reserves amount to 90 billion barrels of oil (about 8.5% of the world total) and 24 trillion cubic meters of natural gas (close to 15% of the world total and second largest in the world) respectively. The present estimates show that the proven reserves of coal are about 13 billion tons. Production of primary energy is shown in Table 9.

Table 8. Proven reserves of fuels in Iran (1999).

	Proven (1000 mboe)	**Share**	**Annual Production** (1000 mboe)	**Reserve/prod. Ratio**
Oil	90	30%	1.3	69
Natural Gas	146	49%	0.4	365
Coal	62	21%	--	--
Total	**298**	**100%**	**1.7**	**--**

Table 9. Production of primary energy in Iran (mboe).

	Amount			**Shares (%)**			**Annual growth rate 1987-99 (%)**
	1987	**1993**	**1999**	**1987**	**1993**	**1999**	
Crude oil	891.7	1426.7	1234.1	90.8	86.2	76.8	2.7
Natural gas	69.6	206.7	356.7	7.1	12.5	22.2	14.6
Solid fuels	4.8	3.6	5.7	0.5	0.2	0.4	1.4
Hydro energy	13.1	15.3	7.8	1.3	0.9	0.5	-4.2
Renewables	-	-	0.1	-	-	0.03	-
Non-commercial fuels	3.3	3.1	2.8	0.3	0.2	0.2	-1.4
Total	**982.5**	**1655.5**	**1736.1**	**100.0**	**100.0**	**100.0**	**4.9**

The final demand structure of energy has experienced a decrease in oil and a considerable increase in natural gas shares during last ten years (Table 10). In this period, oil products share in final demand has declined from 79.8% to 62.7% while the natural gas share increased from 7.1% to 28.3%. The residential/commercial sector was the most important energy consuming sub-sector during the 1988-99 period, accounting for more than a third of total consumption; energy demand for transport amounted to more than one fourth of the total.

Iran is one of the few oil producing and exporting countries in the world to carry out programs for improving the energy efficiency of the different consuming sectors. The conventional and "easy" way to improve energy efficiency in a country is to adjust prices of energy products to cover production and delivery costs; moreover, a high tax on energy products is frequently applied in many countries. Due to low prices, population and economic growth, the energy intensity in Iran has constantly increased during the last several years (Figure 10).

Table 10. Energy consumption trends in Iran (mboe).

	Amount			Shares (%)			Annual growth rate 1987-99 (%)
	1987	**1993**	**1999**	**1987**	**1993**	**1999**	
Totals	327.6	512.8	646.2	100.0	100.0	100.0	5.8
By sectors:							
Industry	90.4	125.9	154.8	27.6	24.6	24.0	4.6
Residential & commercial	111.2	189.9	236.2	33.9	37.0	36.6	6.5
Transport	84.6	122.3	170.5	25.8	23.8	26.4	6.0
Agriculture	26.6	31.0	30.4	8.1	6.0	4.7	1.1
Non-energy uses	14.8	43.7	54.3	4.5	8.5	8.4	11.4
By sources:							
Oil	262.9	351.9	381.8	80.3	68.6	59.1	3.2
Natural gas	32.9	113.8	199.2	10.0	22.2	30.8	16.2
Electricity	22.3	37.8	53.0	6.8	7.4	8.2	7.5
Solid fuels	9.5	9.3	12.1	2.9	1.8	1.9	2.0

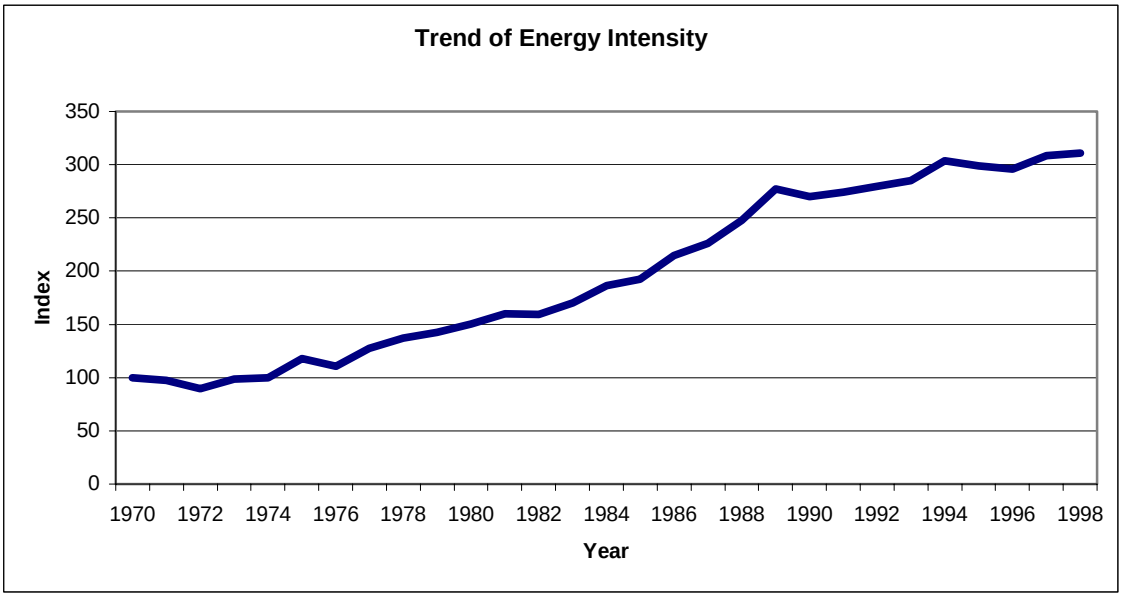

Figure 10. The trend of energy intensity in Iran, 1970 to 1998.

One of the main environmental problems that Iran is currently facing is air pollution, especially in Tehran. The energy-related carbon emissions in Iran have climbed steadily, following very closely the energy consumption (Figure 11). Iran, in recent years, has tried to reduce carbon emissions through utilisation of gas in power plants.

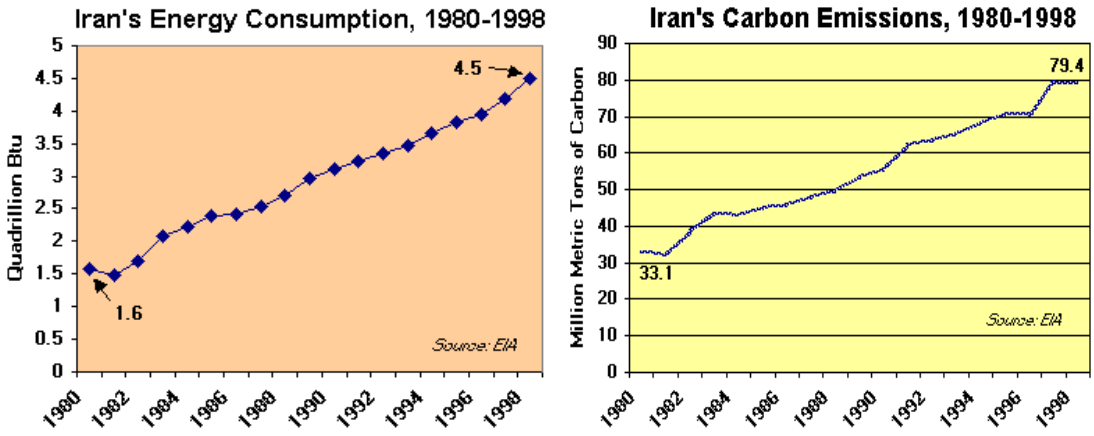

Figure 11. Growth of energy consumption and carbon emissions in Iran.

Electricity Generation

Some of the main figures of the power sector are shown in Table 11. The annual average growth rate of installed capacity, generation, consumption and number of customer are 5.8%, 8.2%, 7.8% and 4.8% per annum during 1989–99 period, respectively.

Table 11. The power sector in Iran.

	1989	1998	1999	Annual growth rate 1989-99 (%)
Installed capacity (MW)	14 442	24 437	25 273	5.8
Generation (GWh)	48 725	97 862	107 207	8.2
Transmission & distribution losses (%)	14.7	15.5	15.7	
Consumption (GWh)	39 956	77 646	84 656	7.8
- Residential (%)	39.5	36.9	35.2	
- Industry (%)	21.2	31.1	31.3	
- Others (%)	39.3	32.0	33.5	
Number of customers (1000s)	9 338	14 128	14 875	4.8
Number of employees	60 740	52 158	51 858	-1.2

According to statistics concerning electricity generation from 1999, the total actual capacity of power plants under the management of the Ministry of Energy was 25 273 MW, out of which 51.9% was produced by steam power plants, 37.9% by gas and combined cycle power plant, 7.9% by hydropower and the rest by diesel generating stations (Table 12). In 1999, electricity generation also increased an average of 3.4% compared to 1998.

In 1999 Iran's power plants, including those under the management of Ministry of Energy and heavy industries, generated 112 TWh of energy, for an annual average growth rate of 7.4% during 1990–99 period (Table 13).

Table 12. Installed capacity of power generation in Iran.

	1988		1994		1999		Annual growth rate (%) 1988-99
	Amount (MW)	Share (%)	Amount (MW)	Share (%)	Amount (MW)	Share (%)	
Steam	7 475	54.6	10 742	52.6	13 115	51.9	5.2
Combined cycle	–	–	3 175	15.6	5 803	23.0	–
Gas	3 489	25.5	3 785	18.5	3 763	14.9	0.7
Hydro	1 914	14	1 953	9.6	1 999	7.9	0.4
Diesel	803	5.9	758	3.7	593	2.3	-2.7
Total	**13 681**	**100.0**	**20 413**	**100.0**	**25 273**	**100.0**	**5.7**

Table 13. Electricity generation in Iran (1978-1999).

Year	Generation (TWh)		Total	Energy Per capita (kWh)
	Min. of Energy	Others		
1978	17 386	2 461	19 847	545
1988	43 775	3 825	47 600	916
1994	77 086	4 933	82 019	1 365
1995	80 044	4 925	84 949	1 388
1999	107 207	5 389	112 596	1 793

2.3.3 Rural Electrification

After the Islamic Revolution in Iran (1979), electrification of the rural areas was carried out on a continuous basis in order to provide more villages with electrical energy as an infra-structural service for further development of the villages as well as for their general welfare, agricultural activities, rural industries and business.

As shown in Table 14, by the end of 1999 electricity was available to 98.4% of the rural population who live in villages with more than 20 households and, in general, 94.6% of the whole rural population has access to electricity.

Table 14. Rural electrification in Iran by the end of 1999.

	Total Villages		Electrified			
			By the end of 1999		% of total villages	
	Villages	House-holds	Villages	House-holds	Villages	House-holds
More than 20 households	36 514	4 077 863	33 726	4 013 668	92.4	98.4
Less than 20 households	31 520	260 634	8 910	90 248	28.3	34.6
Total	**68 034**	**4 338 497**	**42 636**	**4 103 916**	**62.7**	**94.6**

Second Five Year Plan (1995-96 to 1998-99)

The following measures were taken in the second five-year plan to promote the energy conservation policy of the government of Iran:

- To draw up and adopt measures for realising the optimum use of energy.
- To save energy consumption for each type of equipment.
- To modify the energy price policy.

The basic measures of the governmental ministries/organisations to be taken were indicated under relevant Articles in the SFYP. The stipulated basic economic and industry-related measures are as follows:

- To increase the prices of gasoline and other oil products at the start of each new fiscal year beginning in March 1995 until the current prices were doubled, for the purpose of reducing consumption. The selling prices of each litre of the 4 principal oil products, i.e. gasoline, kerosene, gas oil and fuel oil were determined to be 100, 20, 20 and 10 Rials, respectively.
- To increase the sale price of electricity per kWh during the SFYP period on the average up to 20% annually. The average sale price of each kWh of electricity consumed in the agricultural sector was, however, to remain equivalent to that for the year 1993.
- To increase the average sale price of each cubic meter of natural gas based on the year 1994 up to 20% annually.

2.3.4 Pricing Practices

The energy prices are fixed by the Parliament. The average level of the energy carriers' prices would be costly for people, if one takes into account the purchasing power of the people, and this is the main economic, political and social reason for payment of subsidies to consumers.

There is a multi system of energy prices. For example, there is a double system of oil products prices, for power stations and for other consumers. For natural gas and electricity, the sale prices are different by sector (household, industry, commercial and agricultural). The commercial sector pays the highest prices, while the prices for the agriculture sector are the lowest. Also, prices for households are less than industrial customer prices.

For a long time, energy prices were constant. But in the SFYP energy prices increased by an annual average 20% for natural gas and electricity, 37% for gasoline and 50% for other petroleum products. In the case of natural gas and electricity this rate of increase has only marginally exceeded the general rate of inflation so the real impact on consumption has been muted. In the third five year plan (2000-04), the rate of increase in energy prices will be closer to about 10% annually, again below the rate of inflation, so the real impact on consumption will take longer to realise.

The low energy prices in Iran do not reflect economic costs. Further distortions exist in the tariff structures of most energy sources and in their relative prices. It is recognised that price reform is a key policy element for achieving increased energy conservation and fuel substitution.

Energy pricing policies in Iran need to address the following three main issues:

- Rapid increases in domestic consumption of petroleum products may turn the country into a weak oil exporter after the year 2020. Iran needs to promote greater efficiency of energy use and develop demand side management.
- Energy pricing policies influence the behaviour of energy producers and consumers. There are policy trade-offs which need to be clearly addressed. Energy subsidisation may be desirable for equity reasons, but may discourage investment and resource development.
- Energy resources should be priced at their economic values. Greater reliance must be placed on economic principles such as long-run marginal cost and efficiency pricing (shadow pricing), rather than relying on financial analysis alone.

Electricity

Ministry of Energy's procedure for determining the average tariff of electricity is based on the estimate of electricity available for sale and the revenue to be earned for meeting the planned investment and operating cost. Based on the average price thus obtained, the tariff rates to various types of consumers are worked out. The bulk supply tariff of the Iran Power Generation and Transmission Company (TAVANIR) for its sales to the distribution companies is heavily subsidised.

The residential tariff in 2000 started from free supply up to 40 kWh/month and ended with 310 Rials/kWh for consumption above 1075 kWh. The commercial tariffs are presented in Table 15. The average prices by category of consumption are in Table 16.

Table 15. The commercial electricity tariff in Iran (2000).

		Demand charge (Rials/kW)	**Energy charge (Rials/kWh)**
Medium & High Voltage		7200	158
Low Voltage	Less than 30 kW	7200	173
	More than 30 kW	-	103 + 0.12Q *

* Q is consumption by kWh/month; and maximum charge is 303 Rials/kWh.

Table 16. Price of electricity by sectors in Iran (Rials/kWh).

Category	**Average Price**			**Subsidy**
	1997	**1998**	**1999**	**1999**
Residential	28.4	41.4	58.3	299
Commercial	99.6	116.3	210.0	141
Industry	72.1	102.7	113.0	179
Public	44.3	70.3	78.0	230
Agriculture	3.5	8.2	8.8	302
Average	49.5	67.1	80.1	235

Natural Gas

Natural gas is the premium fuel for fuel substitution because of its abundance, its relatively low cost and its environmental qualities. Next to heavy fuel oil, natural gas is the lowest priced fuel in Iran. What can be noted in the structure is the high relative difference between the tariffs charged to power plants and to industry (Table 17).

Table 17. Natural gas tariffs in Iran (Rials/m^3).

Category	1998	1999
Households	36.0	50.0
Commercial	73.2	110.0
Industry	73.2	95.0
Power plants	13.8	18.0

Table 18. Prices of petroleum products in Iran (Rials/litre).

Type	1997	1998	1999
Gasoline, regular	160	200	350
Gasoline, unleaded	160	200	350
Kerosene	40	60	100
Gas oil	40	60	100
Fuel oil	20	40	50

Oil

Prices of all petroleum products are set below the level of international market prices (Table 18). The present level of oil products prices is between 10% (fuel oil) and 50% (gasoline) of the international market prices. The Government has followed a policy of low prices for fuels delivered to the power plants and for kerosene.

Energy Subsidies[10]

Energy is sold to end users at prices lower than border prices of petroleum products in Iran. In recent years the Government has increased energy prices, but they are still very substantially below opportunity costs. Differences between local and border energy prices by sector and energy carrier are set out in Table 19.

According to the above table, the total energy subsidies are about 30 235 billion Rials. The largest subsidy goes to the household sector (about 40% of the total). For the carriers, the first and the second energy carriers with the highest subsidies are electricity and gas oil, 41% and 24% of the total, respectively.

10. In this definition, subsidies are the difference between internal sales prices and exporting prices (for oil products), importing prices (for natural gas), and supply costs (for electricity).

Table 19. Opportunity cost of low local prices in Iran, 1999(billion Rials).

Sector	Gasoline	Kerosene	Gas oil	Fuel oil	Natural gas	Electricity	Total
Household	–	3 327.5	591.5	–	2 038.6	6 347.5	12 305.0
Industry	5.0	15.7	480.6	1 708.0	774.8	2 468.3	5 452.4
Commercial	10.5	146.9	531.0	469.5	170.7	309.0	1 637.6
Agriculture	2.1	55.8	1 314.1	18.4	–	1 732.9	3 123.4
Transportation	1 674.3	–	4 283.0	224.9	–	–	6 182.2
Total	**1 691.9**	**3 546.9**	**7 200.1**	**2 420.9**	**2 984.1**	****12 392.4**	**30 235.4**

** Includes subsidy for public sector.

According to an analysis of 1996 and 1999, the distribution of the energy subsidies between household income groups (especially in the case of gasoline) showed a significant imbalance and was not equitable. But removal of these subsidies will result in some economic and social impacts. The estimates indicate that the removal of all energy subsidies in Iran would lead to an increase in urban and rural household expenditures of 27% and 34%, respectively.

2.3.5 Conclusions

Energy prices in the Islamic Republic of Iran have for several years been below opportunity costs as measured by border prices. Although the Government, in recent years, has increased energy prices, they are still very substantially below opportunity costs and are not sustainable, either in terms of the financial well-being of Iranian energy companies, or in terms of the attractiveness of Iran for foreign capital, or in terms of the monetary and fiscal policy of the government.

Although Iran is one of the few oil producing and exporting countries in the world to carry out programmes for improving the energy efficiency of the different consuming sectors, the energy intensity has increased for a number of years. One of the ways to improve energy efficiency in the country is to adjust prices of energy products to cover opportunity and production costs and to establish separate transfers to the low level income people for poverty alleviation. It should be noted that adequate increases in energy prices (and the removal of subsidies) would have an important impact on cost of living in urban and rural areas unless separate fiscal or social measures were taken to address specific problems of adjustment.

2.4 The Case of Jordan: Investment and Growth

2.4.1 Energy Sector

Jordan depends to a significant extent on import of energy for meeting its domestic needs. Cost of imported oil has constituted between 6-10% of the gross domestic product, depending on prices of oil. Energy consumption has been varying with economic growth in the country and the present per capital consumption is over 1000 kgoe. While Jordan has very limited oil and gas resources, it does have nearly 40 billion tons of oil shale that can be exploited using open pit methods.

The Ministry of Energy and Mineral Resources (MEMR), established in 1984, supervises the energy sector. MEMR defines and implements policy, fixes tariffs and regulates the energy and electricity sectors. MEMR has made an effort to encourage domestic and foreign private investment through BOO and BOT arrangements. The projects included for private investments include power generation, refining capacity expansion, oil and gas exploration and production and, investment for exploiting renewable sources of energy. MEMR is also creating enable environment for private investment in electricity generation and distribution.

The companies working under MEMR's supervision include the Natural Resources Authority for mineral and hydrocarbons exploration and development and Jordan National Electric Company (NEPCO), Jordan Electric Power Company (DEPCO) and Irbid District Electrical Company (IDECO) for electricity generation and distribution. The government intends to keep control over transmission activity. The purpose behind government ownership of transmission is based on the premise that such a network will allow the power companies to take advantage of differences in peak demand periods and reduce the need for installation and maintenance of reserve power generating capacity or provide outlets for surplus power. The country has also established a Power Sector Regulatory Commission under the General Electricity Law, 1999. The Commission is accountable to the Prime Minister.

2.4.2 Pricing Practices

Jordan does have a policy to provide subsidies. Consequently the prices vary across customer segments to a significant extent. The tariffs also vary with the level of consumption and time of usage. These tariffs imply a subsidy of about 10% for small industry, 20-40% for water pumping and agriculture and over 90% for street lighting. Table 20 details the tariff in Jordan across different customer segments over the years.

The prices for oil products also provide for subsidy, which varies by regions and customer segments. However, the subsidies have come down over the years. Fuel oil for electricity production and LPG still continue to be subsidised though to a small extent. Table 21 provides information about level of subsidies across oil products during the last decade.

Table 20. Electricity tariff structure in Jordan by customer segments.

Bulk Supply Tariff			
Electricity Firms			
Peak Load (JD/kW/Month)	2.4	2.4	2.4
Day Energy (Fils/kWh)	19	23.5	29
Night Energy (Fils/kWh)	11.4	14.5	19
Large Industries			
Peak Load (JD/kW/Month)	2.4	2.4	2.4
Day Energy (Fils/kWh)	38	45	47
Night Energy (Fils/kWh)	21	23	32
Retail Tariff			
Domestic			
1-160 kWh/Month	28	28	30
161-300 kWh/Month	52	52	52
301-500 kWh/Month		55	60
More than 500 kWh/Month	60	70	75
Commercial (Fils/kWh)	46	50	60
Medium Industry			
Peak Load (JD/kW/Month)	3.05	3.05	3.05
Day Energy (Fils/kWh)	19	25	33
Night Energy (Fils/kWh)	13	20	21
Small Industries			
1-2500 kWh/Month	32		
More than 2501 kWh/Month	22.5		
Water Pumping (Fils/kWh)	24	30	34
Hotels	39	50	60
Agriculture	21	21	23
Street Lighting	Free	13	20
Monthly minimum charge of JD 1 and 1.25 per month for domestic and other consumers, respectively.			

Table 21. Subsidies for oil products in Jordan (fils per litre, ton or cylinder).

	1990	**1995**	**1999**
Fuel Oil			
Industry	14.50	-	-
Electricity	14.50	13.90	11.20
LPG (Location Specific)		70.00	70.00
Jet Fuel			
Army	29.30	15.00	17.00
Royal Jordanian Airline	29.30	-	-
Foreign Airlines	29.30	59.00	22.00
Gas Oil	16.54	-	-
Kerosene	33.59	-	-
Regular Gasoline (Location Specific)	0.156	0.100	-

In summary, it may be noted that pricing practices in Jordan do recognise the need for balancing different objectives. It is interesting to observe that the level of subsidies, especially for oil products has come down significantly. Differences in rates based on time of usage help lower investment in building peak-load capacity. However, the changes in prices over the years have not been at similar rates. While the rates for low-end users (domestic and agriculture, etc.) have gone up only marginally, the rates for users in the commercial, high usage domestic and industrial segments have gone up significantly.

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2. Website of Ministry of Energy and Mineral Resources

2.5 The Case of Mexico: Growth, Reliability and Coverage

2.5.1 Economic Background

The Mexican economy has done reasonably well during the last five years. Despite many external shocks, the economic policy has been successful in absorbing external shocks without a major adverse impact on production and the international credit worthiness of the Mexican economy. However, inflation and exchange rate situation has not been favourable. Investment, as a percentage of GDP, has continued to grow after a slump during 1995. However, the contribution of domestic savings to gross fixed capital formation has continued to be stable around 17%.

The government revenue tends to be dependent on oil prices, given the contribution by the oil exports to the Mexican economy. However, the government has continued its efforts to maintain the investments for social sectors, despite a slow down in its revenues. Consequently, the budgetary balanced has tended to be negative and is increasing. These economic conditions would tend to put pressure on the government to encourage private investment in energy sector.

2.5.2 Energy Sector

Energy sector in Mexico has played an important role in economic growth in the country. It contributed 2.7% of GDP in 1999. While the energy sector's share has come down from a high of 4% in 1990, it has remained above 2.5% during most of the years. Energy sector has also contributed to other aspects of economic growth in Mexico. For instance, energy exports constitute about 10% of total exports, the sector contributes nearly 20% of total public revenues, and investment in the energy sector is more than 40% of total public sector investment. Given the level of contribution, the sector makes to economic activity in the country, it is not surprising that the country is investing a huge amount of effort in ensuring that the sector becomes internationally competitive and is able to attract private investment for ensuring continuous growth.

As for the sources of energy, oil and gas constitute the largest source, with gasoline contributing towards 50% of consumption (in value terms) and the balance split equally among diesel, fuel oil and LPG.

The electricity supply industry has grown by over 2.5% p.a. during the last two decades. However, the growth rates have varied with the level of economic activity. For instance, the country experienced negative growth in 1995, the peso crisis year. However, the same period has witnessed the per capita consumption being around the same level. Industry and mining and transport are the two biggest consumers, followed by residential and agriculture sectors. The share of different sectors has remained stable over the years.

An interesting feature of the Mexican electricity supply industry is that reliability and productivity of the industry has experienced a regular increased over the last decade. CFE's sales per worker have gone up from 1.3 GWh in 1990 to 2.1 GWh in 2000. At the same time, the interruption time (minutes per user) has also come down from 536 minutes in 1990 to 165 minutes in 2000.

2.5.3 Energy Policy

Energy policy in Mexico intends to achieve the following national objectives:

- Improve the quality of life for all the Mexicans.
- Promote rational use of resources in the context of sustainable development and inter-generational equity.
- Promote investment in productive and feasible projects.
- Generate an elastic supply of hydrocarbons.
- Increase productivity in the sector.
- Achieve a competitive pricing policy.

Consequently, Mexico initiated reform processes in the oil, gas as well as the electricity supply industry. The reforms in the electricity supply industry are intended to meeting the following objectives:

- Guarantee the supply of electricity required to cover growing needs of all Mexicans.
- Continue to supply reliable, high quality and competitively priced electricity for ensuring greater economic growth.
- Attract more investment from all sectors for strengthening the electricity supply industry.
- Broaden the coverage of service and support for those most in need of subsidies and develop a transparent and effective policy of subsidies, with explicit social welfare objectives.
- Create new and better jobs for the workers of electricity supply industry and the economy as a whole.
- Ensure availability of greater public resources for education, health, water and poverty alleviation programmes.
- Reaffirm the role of the State in an electricity supply industry strengthened with greater participation and competition.

The policy proposals for reforms outline the view that private sector participation is necessary for releasing public resources from electricity supply industry to meet other social needs. The reforms intend to transform the industry to ensure wider private participation with effective regulation of participant behaviour. The government has allowed private participation through Build-Lease-Transfer (BLT) and Independent Power Production (IPP) arrangements.

2.5.4 Institutional Arrangements

As mentioned earlier, the public sector firms dominate the Mexican energy sector. However, these firms are regulated by an independent regulatory agency CRE (Energy Regulatory Commission). CRE, set up in 1994, is a professional body with technical and operational autonomy provided by the Law of the Regulatory Commission for Energy.

CRE has the responsibility for technical and economic regulation of the electricity sector, with an objective to protect short-term as well as long-term consumer interests. The issues involved in economic regulation are control of prices, costs, investment and quality of service. The Commission is also responsible for grant of permits and concessions, promoting competition, settling disputes among industry participants, etc.

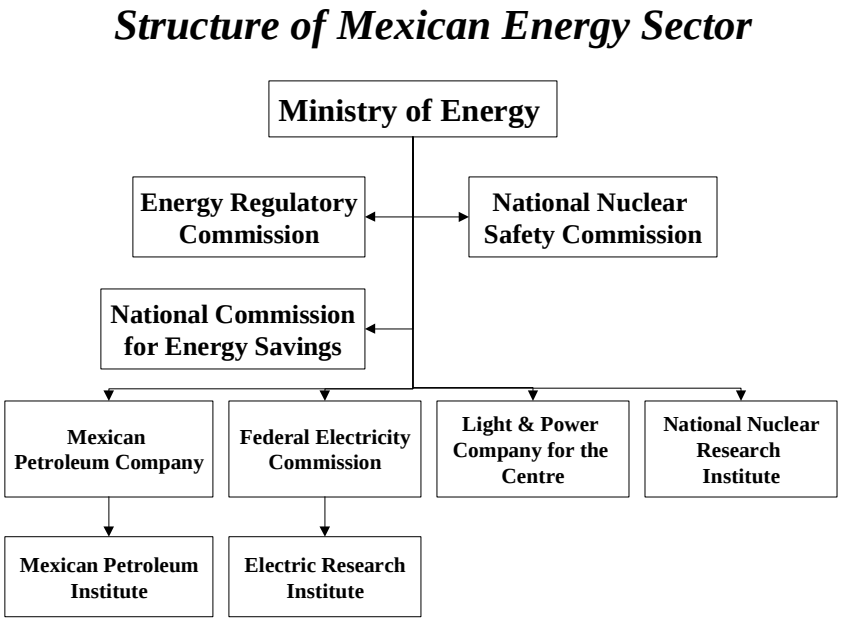

Figure 12. The institutional structure of the energy industries in Mexico.

2.5.5 Industry Structure

As shown Figure 12, the electricity supply industry in Mexico consists of two vertically integrated state monopolies: the Federal Electricity Commission (CFE) and the Light and Power Company for the Centre (LFC). These two firms undertake, on an exclusive basis, the generation, transmission and distribution of electricity across Mexico as a public service.

The present structure emerged out of need for building a national electricity supply system, with coverage across the entire nation. These two firms together own over 90% of the electric generation capacity in the country, with CFE being the largest. PEMEX and a few private sector firms own the rest of generation capacity. CFE also owns nearly 90% of the transmission and distribution capacity in the country. Private generators and co-generators can sell their production only to CFE. IPPs have long-term contracts with CFE. The transmission grid experiences high losses and some of the sections have reliability and capacity problems. However, the CFE as well as LFC have been able to achieve fairly significant improvements in efficiency.

PEMEX (Mexican Petroleum Company) is the oil and gas sector monopoly. In the natural gas sector, exploration, production and first hand sales are reserved for the state sector, whereas transport, storage and distribution activities are now permitted in to be carried out by the private sector firms. Entry of private sector firms is governed by the licensing policy being implemented by the Energy Regulatory Commission (CRE).

Mexico is working towards restructuring the electricity industry to introduce more competition at the generation as well as at the distribution level. However, Mexico's experience with IPPs suggests that the competition remains restricted to the initial contracting stage only. Once the contracts are signed, the IPP works with

a protected price and a guaranteed market, with risks being with the government as CFE is the sole buyer.

2.5.6 Pricing Practices

Given that the public sector firms dominate the energy sector in Mexico, the budgetary importance of the electricity industry generates a conflict between the macro-economic objectives and development of the industry. Tariffs are not set based on cost of supply, but based on their impact on inflation and national budget constraints. Tariff for agriculture and residential sectors are below CFE and LFC's costs. It is estimated that the residential sector enjoys a subsidy of nearly 50% on cost. The residential tariffs have fallen by over 20%, in real terms, during the last few years. Consequently, the government is not able to finance fresh investments in building generation or transmission capacity.

Prices for various energy products and services have varied every month in Mexico. An analysis of Table 22 suggests that though the prices were adjusted on regular basis, the adjustment was not uniform across customer segments. For examples, the prices for domestic customers were adjusted downwards by over 10%, at the same time, the prices for industrial customers were adjusted upwards by 13-15% over the nine-month period.

Table 22. Average tariff by consumer category in Mexico.

	Jan-00	Feb-00	Mar-00	Apr-00	May-00	Jun-00	Jul-00	Aug-00	Sep-00	Jan-Sep
Domestic	0.601	0.587	0.577	0.589	0.573	0.517	0.519	0.532	0.539	
% change		-2.3%	-1.7%	2.1%	-2.7%	-9.8%	0.4%	2.5%	1.3%	-10.3%
Commercial	1.252	1.251	1.252	1.26	1.275	1.275	1.287	1.288	1.292	
% change		-0.1%	0.1%	0.6%	1.2%	0.0%	0.9%	0.1%	0.3%	3.2%
Services	1.015	1.011	1.028	1.03	1.03	1.041	1.063	1.061	1.083	
% change		-0.4%	1.7%	0.2%	0.0%	1.1%	2.1%	-0.2%	2.1%	6.7%
Agriculture	0.273	0.271	0.282	0.283	0.288	0.289	0.289	0.296	0.289	
% change		-0.7%	4.1%	0.4%	1.8%	0.3%	0.0%	2.4%	-2.4%	5.9%
Middle Industry	0.578	0.571	0.565	0.556	0.599	0.626	0.639	0.649	0.652	
% change		-1.2%	-1.1%	-1.6%	7.7%	4.5%	2.1%	1.6%	0.5%	12.8%
Big Industry	0.403	0.374	0.377	0.377	0.415	0.432	0.445	0.472	0.467	
% change		-7.2%	0.8%	0.0%	10.1%	4.1%	3.0%	6.1%	-1.1%	15.9%
Total	0.568	0.551	0.546	0.542	0.567	0.574	0.594	0.6	0.607	
% change		-3.0%	-0.9%	-0.7%	4.6%	1.2%	3.5%	1.0%	1.2%	6.9%

During earlier years also, there have been regular adjustment to tariff across customer segments. However, the adjustments were again different across customer segments, but the variations were not as wide as in the last year.

Similarly, the prices of LPG and natural gas are adjusted regularly. LPG prices are benchmarked against prices at Mont Belvieu near Houston Texas.

The proposed restructuring of the electricity industry will require the prices to be determined by the market. That is, generators are expected to submit their offers for sale of electricity one day prior to dispatch and the minimum price they are prepared to accept for their supplies. These offers will be used to form a supply

curve. The last accepted offer (offer at which demand equals supply) will determine the price payable to all the generators.

In case the system faces transmission constraints, the prices will be determined for each of the locations, depending the cost at which a generator can produce for place in question. Locational prices may encourage efficiency in consumption, as the customers may not like to buy energy when it is in short supply. Locational prices could also be used to determine the level of investment the country could afford to make for building additional transmission capacity. The government is also proposing a capacity payment for generators in order to make sure that the country has sufficient capacity for meeting the peak demand.

Location-specific pricing could be justified by the asset-specificity argument. That is, if certain locations have a cost-advantage in supply of certain products or services, the customers in these locations should be allowed to realise this benefit. This argument is extendible to specific locations in a country or the specific products or services a country produces. At the same time, there should, however, be no entry barriers for producers to enter markets where there is a shortage of supply and customers are willing to pay a higher price.

The transmission and distribution firms will be subject to economic regulation by CRE and will be granted a 30-year concession. The tariff will be reset every 5 years and will be calculated specifically for each of the firms, depending on the its operating costs, investment it has to make and a reasonable rate of return on investment. These tariffs set at the beginning of each period will be adjusted during the tariff review period for inflation, changes in exchange rate and gains from productivity. Transmission and distribution firms will be allowed to keep their savings from additional efficiency gains during the five-year tariff review periods. However, at the end of five-year period, the tariff would stand reduced to the extent of efficiency gains. In general, the price to consumers will be made up of the price of generation and transmission and distribution costs and cost of service will be the basis of tariff calculations for different customer groups.

As for provision of subsidies, the government intends to continue offering subsidies to certain customer segments. Some recent estimates show the electricity subsidy to be in excess of US$3 billion. The recent reforms intend to make them transparent and identify the level of subsidies for each segment specifically. The government intends to provide the customers with information about the level of subsidies through their monthly bills.

2.5.7 Pricing Practices: Challenges

The biggest challenge facing Mexico, especially in view of recent political developments, is whether the Congress will be able to reach an agreement to attract private capital in this sector. It is estimated that the country needs nearly $95 billion of investment for the sector during the next six years. The problem of not being able to attract private investment arises out of the fact that the Mexican Constitution prohibits foreign ownership of national natural resources. In addition to the approvals needed from the Congress, the state legislatures also need to approve these reforms.

Another issue is that of linking domestic prices of energy to the prices in the USA. The main problem in linking Mexican energy prices to those in the USA is that in many situations the Mexican consumers may end up paying prices which are not justified given that Mexico has sufficient domestic reserves to meet its needs. For

instance, price increases in 1996-97 winter were more due to conditions (weather conditions and consequent deficits in supply) operating in the USA rather than those in Mexico.

Consequently, the residential and industrial consumers resorted to strong protests. These problems are expected to worsen, as the price increases produce inflation, social unrest and probably switching of sources of energy. The new government has promised the country that it will not privatise PEMEX or CFE and will try to find alternative financial resources for growth. However, the government's inability to implement constitutional reforms and its decision to lower public investment in the electricity supply industry has led to shortages in supply.

Another interesting aspect is that the government has also decided to run the system with lower reserve margins, resulting in postponement of investment and this reducing pressure on the budget. However, these decisions have further reduced the reliability in supply.

In summary, it may be stressed that Mexico's challenges are in terms of acquiring resources for investment in the energy sector. The government's effort to allow private participation has not borne the desired fruit, mainly because of its inability to implement constitutional reforms. Pricing reforms, linking of domestic prices with US prices, to reflect opportunity cost of resources have hit roadblocks in view of the level of increases such policy has resulted in. While the argument for opportunity cost based prices is a reasonable economic argument, it is equally important that a country, which has the site-specificity advantages, should have its nationals sharing the gains arising out of these resources. In other words, it is not unreasonable for a Mexican citizen to expect lower energy prices, given that Mexico has large natural energy resources in form of oil and gas.

Source Documents

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2.6 The Case of Peru: Re-establishing Financial Viability in the Electricity Sector

2.6.1 Economic Background

Peru's Gross Domestic Product is relatively modest and is situated in the lower third of Latin American economies. The GDP per capita, around US$2500 per person in 2000, is in real terms no higher than in the mid 1960s. However, the Peruvian economy grew at an average annual rate of 5.5% during the period 1994 to 1999, while inflation fell to 3.7% in 1999. Meanwhile, exports and imports increased by an average annual rate of around 9.7% and 8.4%, respectively. Peru's export supply is concentrated in primary and semi-processed products, primarily from mining and fishing activities.

The positive trend in the Peruvian economy's major economic indicators since 1994 has to a large extent depended on a general shift in economic policy and the structural reform process initiated in the early 1990s. Inflation decreased from 7600% at the beginning of the 1990s to one-digit levels of between 3% and 4% by the end of the decade. In 1997, fiscal balance was achieved after a period of deficits surpassing 10% of GDP at the end of the 1980s. The economic recovery was accelerated by Peru's reintegration into the international financial system, the pacification process, a number of structural reforms and an adjustment programme that reduced the Peruvian economy's country risk and resulted in a substantial flow of foreign capital.

In the late 1980s, Peru's economic situation was weakened by hyper-inflation, and between 1985 and 1990 general prices rose 20 000 times. In 1990, a structural adjustment plan and a drastic stabilisation programme were introduced by President Alberto Fujimori. In the private sector, prices and salaries were liberalised. Many of the public enterprises were restructured and later privatised. Financial support from the government largely stopped, which led the enterprises to sharp increases of their prices. Many subsidies were immediately cut, for example, the cost of gasoline rose by 3000% in one day in 1993. Food prices increased by 300% to 400%, and electricity prices quintupled.

2.6.2 Energy Policy and Institutional Arrangements

Structure of the Electricity Sector

In 1999, 81% of the 17.3 MWh electricity was generated by hydro power plants and 19% was produced by thermal plants.

The administrative structure of the electricity sector is hierarchically organised, with the Ministry of Energy and Mines as the main entity to determine sector's policies, concessions and long-term planning (Figure 13). The National Direction of Electricity sets technical standards, issues concessions for market participants and oversees contracts. The Electricity Tariffs Commission carries out the actual calculation of the tariffs and develops optimisation models for the day-to-day functioning of the system, and the OSINERG coordinates new investment plans.

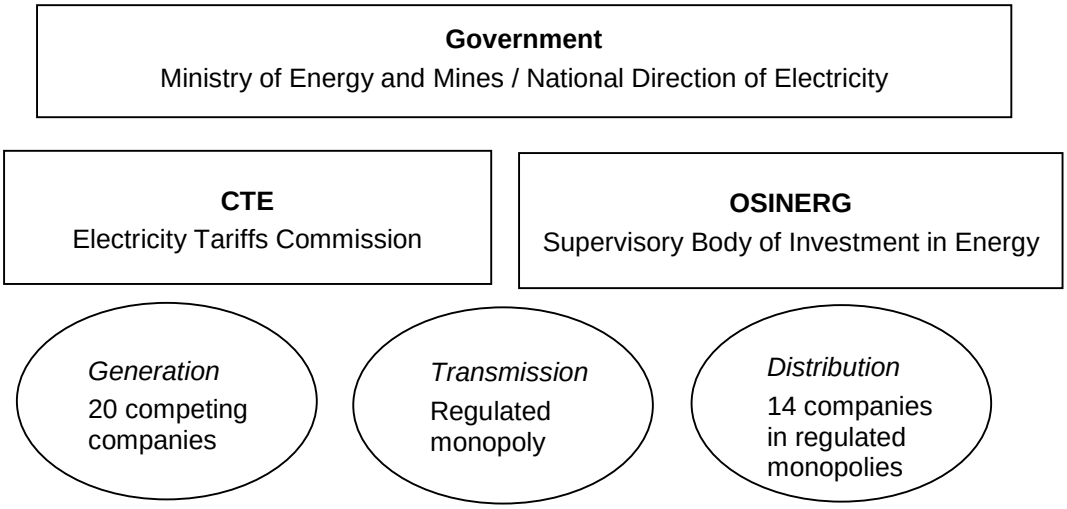

Figure 13. Organisational structure of the Peruvian electricity sector (Source: Inter-American Development Bank (1999), Electricity Sector Country Profiles).

Regulation of the Sector

In theory, generation, distribution and transmission are open to private participation in all the commercial activities. The generation side is quite segregated, with 20 companies competing for large customers and distribution companies in the market. Distribution and transmission are regulated as natural monopolies. In 1999, the most important companies in the generation were Electroperu (39.2%), Edegel (17.8%), Egenor (8.6%), Egasa (7.9%), Enersur (6.8%) and Electro Andes (6.3%). In Peru there exist two interconnected systems, the Sistema Interconectado Centronorte (SICN) and the Sistema Interconectado Sur (SISUR), which have recently been united to an integrated system. There are several isolated regional or local systems. The most important part of the electricity was generated in the SICN (80%), to which Lima, the country's capital, is connected. The SISUR accounted for 17% and the isolated systems for 3%.

The distribution consists of a regulated and of a liberalised part. In the liberalised market contracts can be negotiated freely. Two components are part of the liberalised market: bilateral trading and a spot market. Since the new law of electricity sector reform was initiated, the share of power that has been sold on the liberalised market has increased from 34% in 1996 to 45% in 1999. In 1999, nearly 100% of the electricity on high and very high voltage was traded in the liberalised market, whereas almost all power on the low-voltage grid is purchased under the condition of governmental regulation. On the medium tension grid the amount of electricity was roughly the same for free-market and regulated transactions.

55% of the electricity is sold under the condition of price regulation. All markets for consumers with loads below 1 MW are regulated monopolies, and the distribution companies are obliged to serve all customers within the concession area and those with connecting lines to it. In order to provide an incentive to invest in the construction of new plants, the Electricity Tariffs Commission established the rule that the tariffs in the regulated market segments do not exceed the range of plus or minus 10% of the prices in the liberalised market. This governmental self-

commitment was intended to reduce the regulatory risk imposed on investors. Since September 2000 the Electricity Tariffs Commission abolished this regulation and explained this step with the observation that the regulated tariffs influenced the electricity prices on the liberalised market, and that this influenced be reduced.

On the spot market the prices in the Southern system are significantly above the regulated prices (Table 23). The CTE explains this difference by the high level of thermal generation in the spot market.

Table 23. Comparison of spot prices and regulated prices in the Southern Interconnected System (SIS) at the Socabaya Node (Source: CTE, El Informativo, Sep. 2000).

Year	Spot (US¢/kWh)	Regulated (US¢/kWh)	Ratio (Spot/Reg.)
1997	3.47	2.45	42%
1998	4.14	2.39	73%
1999	4.66	2.97	57%
2000*	4.58	3.18	44%

* only until August 2000.

For the North-Central Interconnected System the proportion was inverse in 1999 and 2000, with the spot prices approximately 38% lower than the regulated prices. In this case the CTE concludes that this was due to the construction of several new and very efficient thermal power plants.

Tariff structure

In 1999, on average customers had to pay the following tariffs (source: OLADE Database 2001):

- Residential: 9.51 US¢/kWh.
- Commercial: 7.14 US¢/kWh.
- Industrial: 5.50 US¢/kWh.

In the regulated market the electricity tariff is composed of costs for generation, transmission and distribution. Generation accounts for roughly 60% of the price, transmission for 5% and distribution for 35%.[11]

The government calculates the electricity tariffs according to the short-term marginal costs. The Electricity Tariffs Commission (CTE) is the government agency that is in charge of calculating the rates for the regulated market. Since the electricity market liberalisation two optimisation models were in use in order to determine the short-term marginal costs. The programmes calculated an optimal use of the hydro basins in monthly intervals and computed the actual value of the water resources. With the connection of the formerly separated North-central and Southern grid via a new transmission line, the commission has introduced a new programme that adequately reflects the occurring costs in each thermal and hydro-

11. Luz del Sur Information Sheets, 2001.

electric power station. In addition to that, it is able to generate different hydrological scenarios.

The electricity tariff of the customer in the regulated price scheme is then composed of the following elements:

- The publicly announced price of generation.
- Fees for the transmission, including fees for transformation and transport, and a standardised charge for marginal losses of capacity and power during transmission.
- A standardised fee for the distribution that compensates for the losses in the middle and low tension grid, for the administration and maintenance costs of the grid, and for new investments.

The customer's bill is furthermore composed of a charge for potency and consumption. This charge varies according to the region. The CTE has classified three different types of regions, namely those with a high density of customers, like Metropolitan Lima, medium density, like Cusco, and low density. According to the type of region, a correction factor is introduced into the bill. This factor increases, the less densely populated the region is, thus adding a higher charge from the rural customers. As in most regulated systems, the bill distinguishes between peak and off-peak demand, in potency as well as in consumption.

Despite the computational assistance, the Electricity Tariffs Commission (CTE) was criticised for its determination of the tariffs during the first years of its operation, because the tariffs have been calculated on the basis of an ideal tariff, which is derived from a model company operating under conditions of standard efficiency and losses.

Of course, many of the generating companies and especially the distribution companies do not comply with these ideal conditions and complain that the standards are set on a too ambitious level (MinerAndina, 26/10/1998). Another point of critique concerns the conditions of payment according to the energy which is actually delivered into the spot market and the additional capacity that is provided in order to guarantee supply for the grid in peak hours. The generators are paid for the provision of capacity on the basis of the capacity of each generating unit. This leads to the situation that under favourable hydrological conditions most of the income of the operators of hydro power plants comes from the delivery of electricity, whereas thermal plant income stems mainly from potency, thus not incentivising the construction of more efficient thermal plants.

The distribution companies get a share of roughly 35% of the final tariff (Figure 14). The distribution company Luz del Sur, which supplies parts of Lima and is by customers the second-largest distribution company, comments that this share is eventually below the share that is granted to equivalent urban distribution companies in other Latin American countries. It draws a comparison to companies in Bogota, Santiago de Chile and Buenos Aires where regulated shares for distribution accounts for 40%, 42% and 45% of the tariffs, respectively.

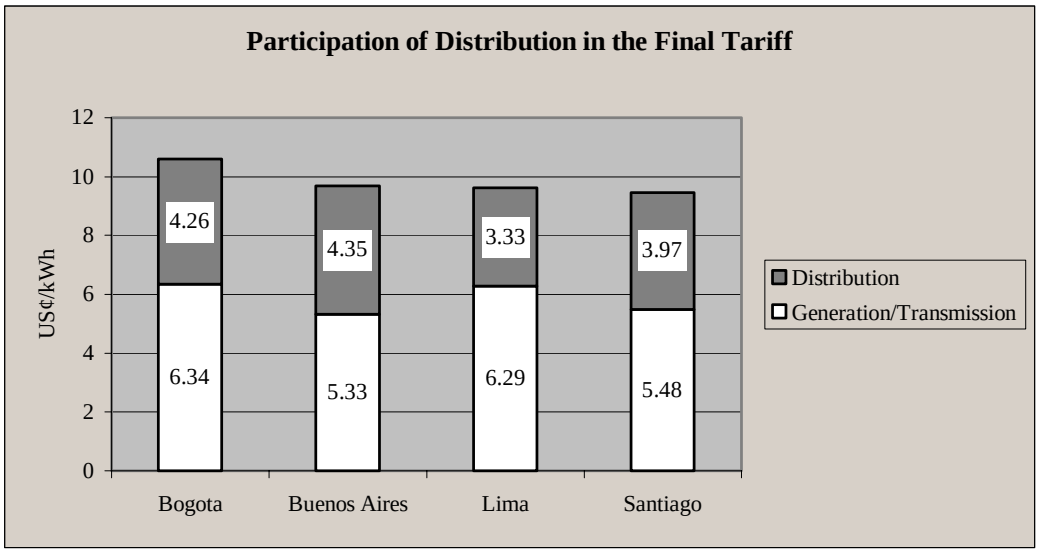

Figure 14. Participation of distribution in the final tariff in Peru (Source: Luz del Sur Information Sheets, 2001).

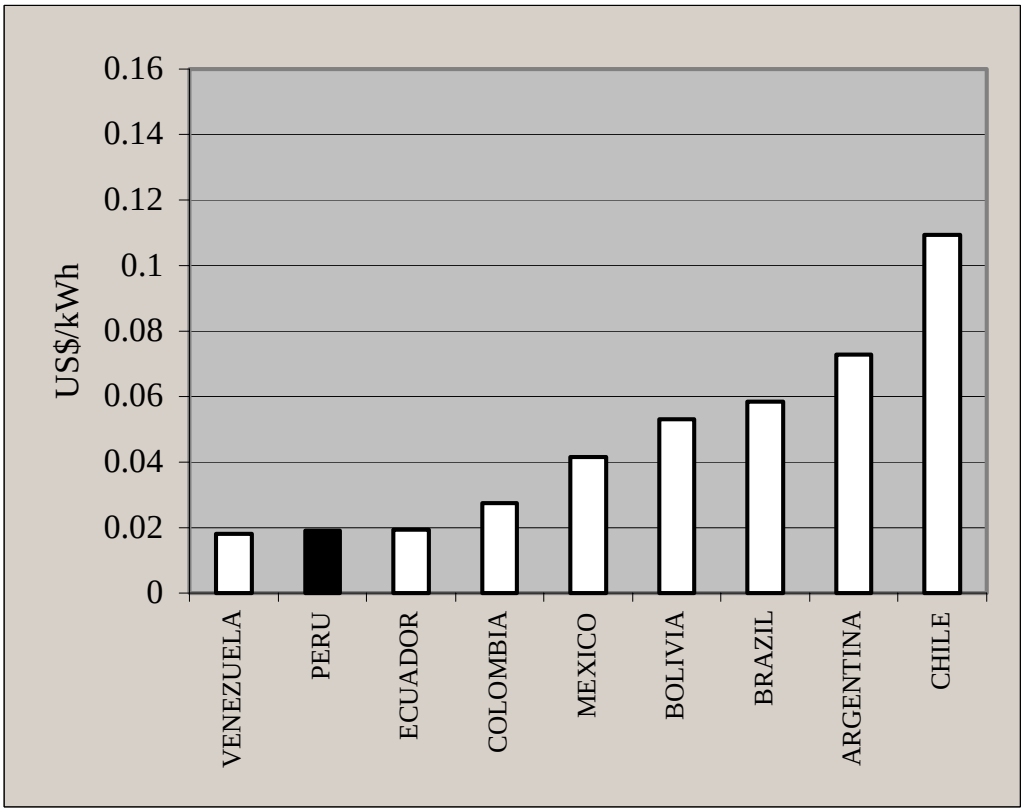

Figure 15. Residential electricity tariffs in selected Latin American countries in 1990 (Source: OLADE Database 2001).

Electricity Pricing Policy

Until the beginning of the Fujimori government in 1993 Peru pursued a low-price policy like its neighbouring countries Ecuador and Bolivia (Figure 15). The electricity sector was government-owned, and the companies were public

enterprises. Two companies, Electrolima and Electroperu, shared the main responsibility for generation, transmission and distribution.

The situation that the electricity sector faced was fairly difficult. Partly due to attacks against the sector's infrastructure in times of the civil war, shortages of electricity were quite common such that, for instance, in 1990 only 26% of the demand could be met.[12] Losses in the distribution system rose to 21.8% in 1993. Between 1986 and 1992 the electrification rate increased only from 44.3% to 48.4%, and Peru had one of Latin America's lowest rates of electrification.

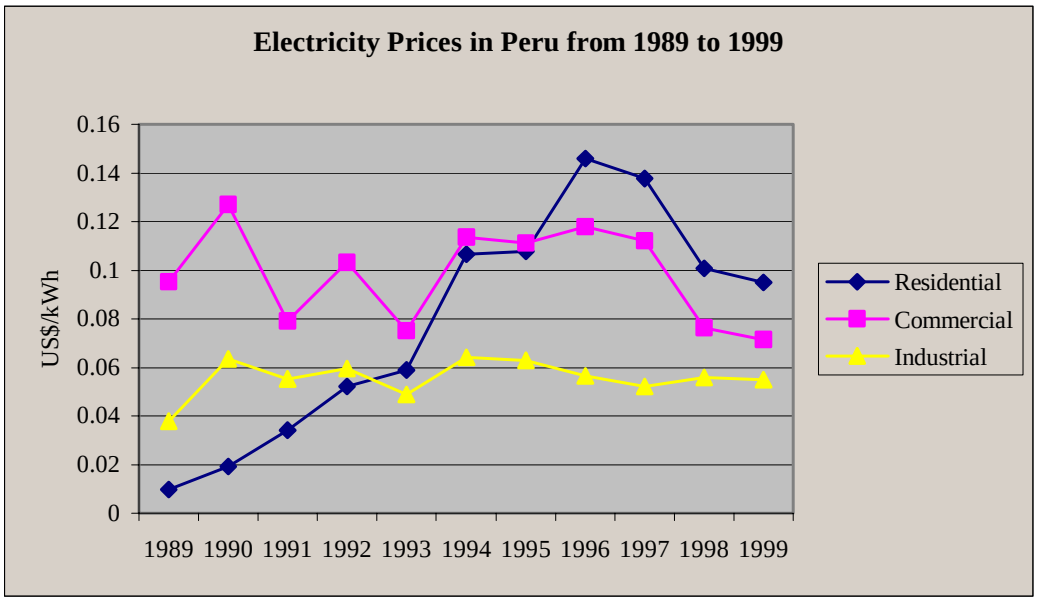

Figure 16. Electricity prices in Peru 1989-1999 (Source: OLADE Database 2001).

As a result of the restructuring and the privatisation of most of the electricity companies, residential electricity tariffs went drastically up during the 1990s, with the last big increase in 1995 (Figure 16). Since 1996, residential electricity tariffs have shown a tendency to fall. However, a comparison of the increase in GDP per capita and the residential electricity tariff (Figure 17) shows that the rise in the tariffs was not accompanied by an equivalent rise in incomes. Between 1989 and 1999 the residential electricity tariffs increased about 970%, whereas the increase in the GDP per capita for the same period was only 19%. During the same period of time, residential electricity consumption per capita even declined from 147 kWh per capita in 1989 to 106 kWh/cap in 1999, a decrease of 28%.

In 2000 the residential electricity tariffs were comparable to prices in the Mercosur countries (Figure 18), even though a significantly lower standard of living in Peru implies that the Peruvians spend relatively more income on energy services. The World Bank states that in 1998 an average Peruvian had expenses of 21% of his total income on fuel and power, whereas an Argentinian spent only 11% and a Brazilian only 3% on fuel and power.[13]

12. CONITE (2000), Evaluation of the Privatization in the Electricity Sector.

13. World Bank, World Development Indicators 2000 (measured in Purchasing Power Parity).

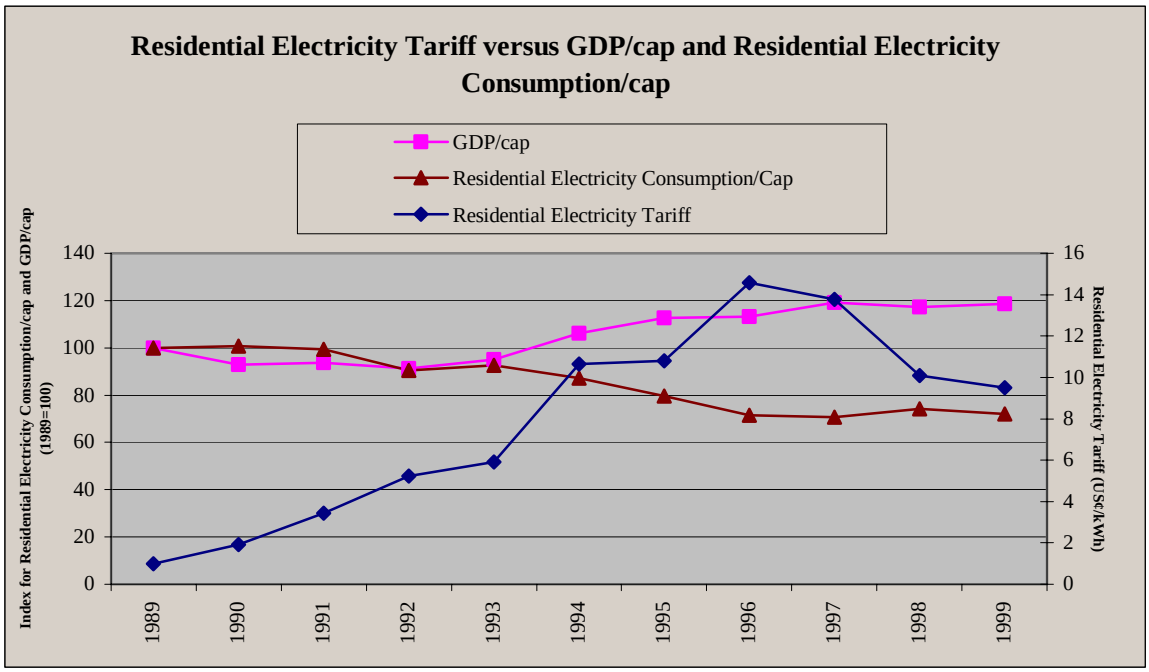

Figure 17. Residential electricity tariffs versus GDP/capita, and residential electricity consumption/capita in Peru (Source: OLADE Database 2001 and Electricity Tariffs Commission, Annual Report 1999).

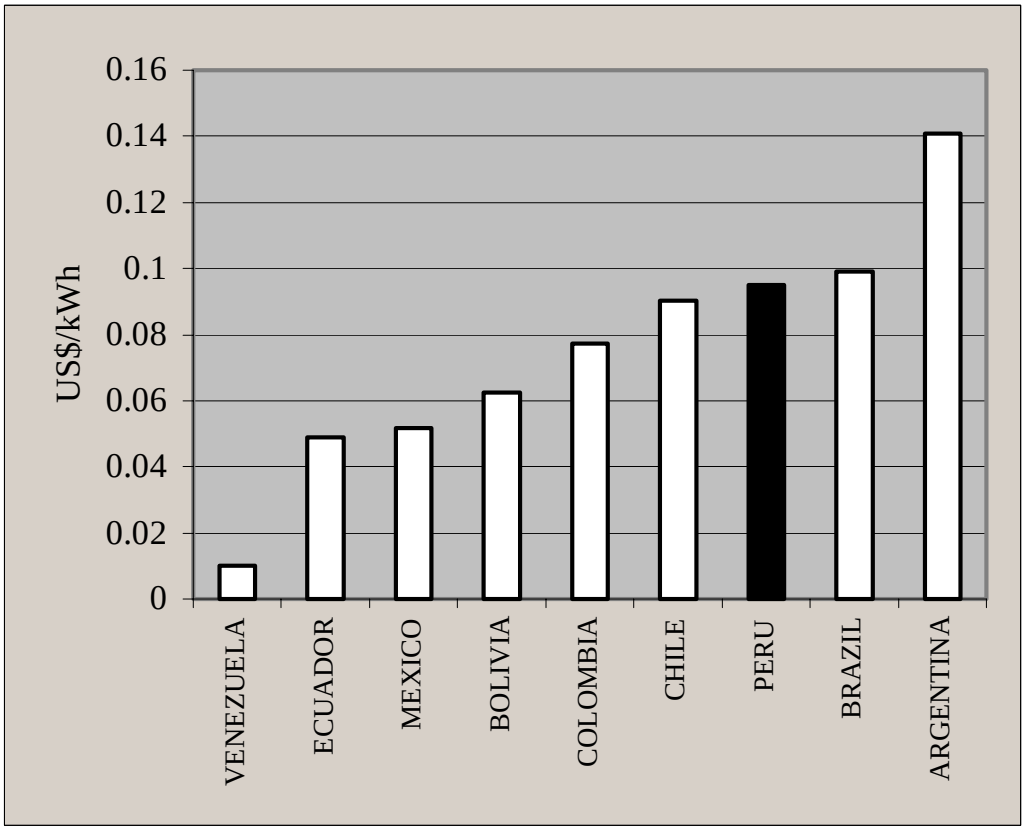

Figure 18. Residential electricity tariffs in selected Latin American countries in 1999 (Source: OLADE Database 2001).

Electrification Coefficient

The national electrification coefficient has increased from 58.5% in 1994 to 70% in 1998 (Table 24). In 1998, there were nearly 750 000 more customers connected to the grid than in 1994.

The privatised companies contributed to the increase with the construction of new distribution lines. For example, the companies EDELNOR and Luz del Sur, whose customers are located in Metropolitan Lima, succeeded in electrifying 100% of their concession areas, up from an electrification coefficient of 76% for both companies in 1994. EDELNOR, that supplies 50.6% of the electric energy of Lima, also undertook steps to electrify poorer parts of Lima. Eventually 83% of EDELNOR's clients belong to the poorer part of the population. In these areas of low-income neighbourhoods the company has connected 225 000 new customers between 1994 and 1998.[14]

Table 24. The national electrification coefficient for Peru, 1989-1998.

Year	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Electrification coefficient	48%	47%	48%	48%	53%	59%	63%	65%	68%	70%
Number of customers (thousands)	1 791	1 862	1 953	2 005	2 105	2 310	2 489	2 778	2 959	3 052

2.6.3 Performance of the Electricity Companies

Before the electricity sector reform, electricity tariffs were set politically below operational costs, leaving the electricity companies without the necessary financial resources to effectively maintain or even extend the system substantially (Table 25). In 1989, electricity rates covered only 39% of average operational costs in the sector. In the same year 1989 the companies had to cope with an operational deficit of US$426 million, roughly three times the money that they earned with their electricity sales.

Table 25. Average price and operational cost of electricity in Peru (US¢/kWh) (Source: CONITE 2000, Evaluation of the Privatization of the Electricity Sector).

Year	Average Price (1)	Average Cost (2)	Ratio (1)/(2)
1985	3.64	3.33	109.3%
1986	3.37	5.11	65.9%
1987	2.28	2.63	86.7%
1988	1.50	2.27	66.1%
1989	1.90	4.83	39.3%
1990	4.57	6.19	73.8%
1991	4.65	5.08	91.5%

14. CONITE (2000), Evaluation of the Privatization of the Electricity Sector.

Despite substantial increases in the residential electricity tariffs after 1991, the transmission and distribution companies still faced significant operational deficits in 1994 (Figure 19). Only the generation side was able to recover the costs.

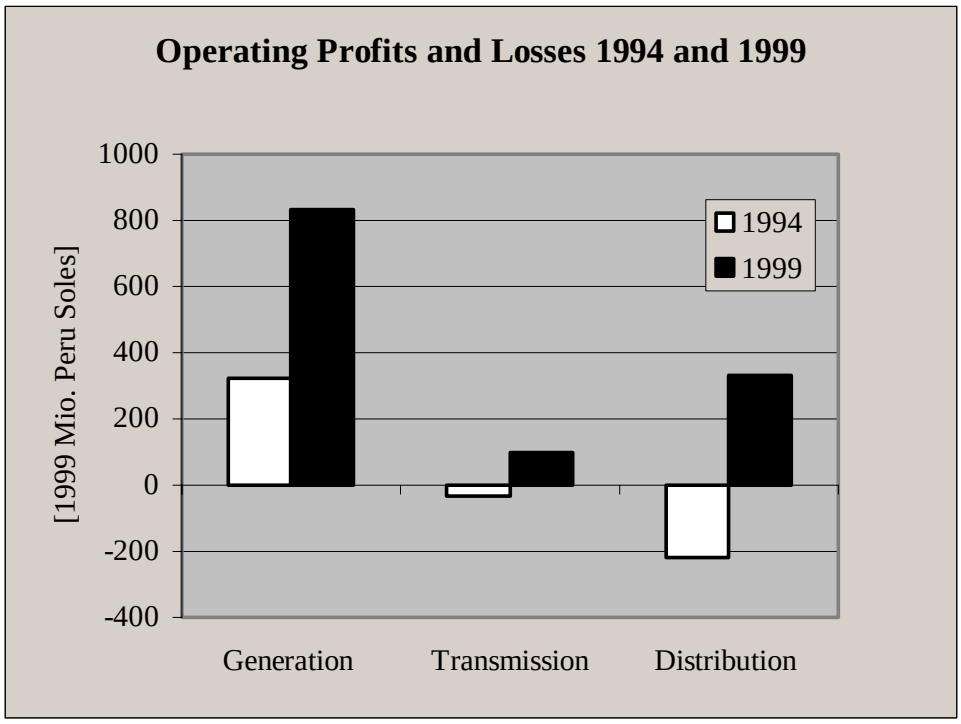

Figure 19. Operating profits and losses in the Peruvian electricity industry in 1994 and 1999 (Source: CTE, Annual Reports 1994 and 1999).

A closer look at the structure of operational expenses in the distribution sector (Figure 20) shows that roughly half of the expenses were used for electricity purchases, the work force accounted for 15% of the expenses, and another 15% were used for financial services.

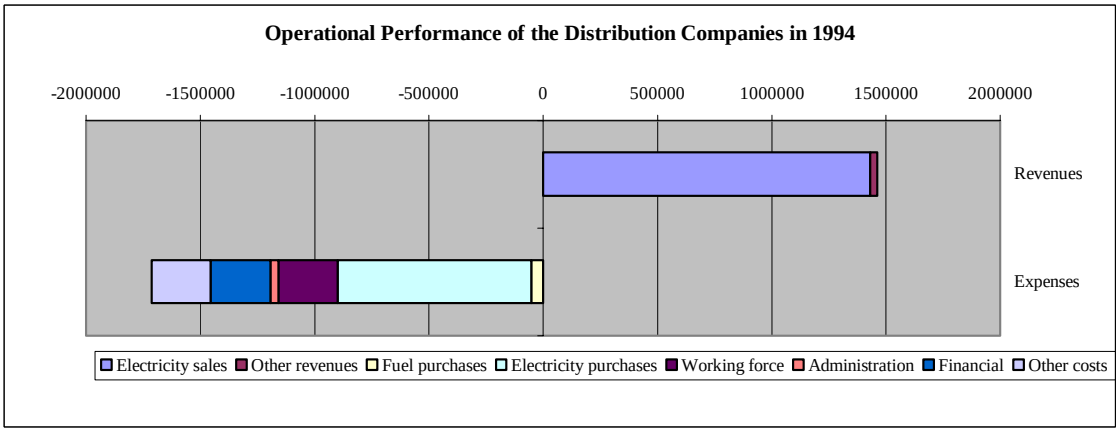

Figure 20. Operational performance of Peruvian distribution companies in 1994 (thousands 1994 Peruvian Soles) (Source: CTE, Annual Report 1994).

The reform in the electricity sector opened the door for foreign direct investments. Via the sale of company shares the government earned nearly US$2 billion of income. However, in many companies like EDELNOR, Edegel or Etevensa it kept a 40% minority of the shares. Since 1994 the newly privatised companies carried out investments of US$682.2 million for improvements of the system's performance, extension of the grid and the construction of new power plants.

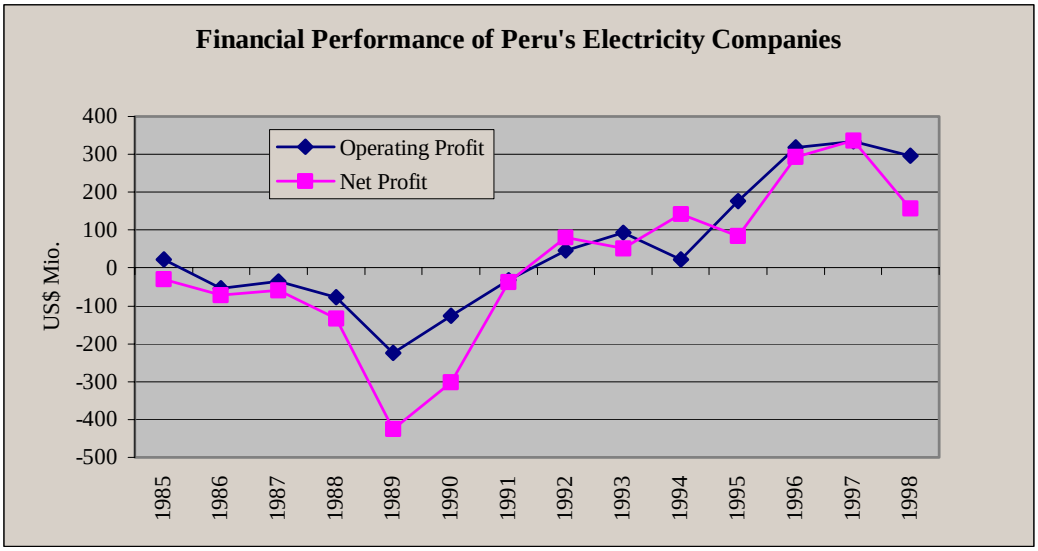

Figure 21. Financial performance of Peru's electricity companies (Source: CONITE 2000, Evaluation of the Privatization of the Electricity Sector).

From 1997 to 1999, the productivity of the companies in the distribution sector, measured in terms of customers per worker, increased from 703 to 1015. EDELNOR reports that in 1994 its productivity was approximately 455 customers per worker and increased until 1998 to about 1100 customers per worker.

In 1999, expenses in the workforce of the companies accounted for 16% in the generation sector and for 18% in transmission and distribution. Electrolima decreased its number of staff around 10% in the period from 1997 to 1999, but increased its man-hours of training 23% in the same period.

In order to improve their performance, many companies have introduced quicker response schemes and a more efficient maintenance and billing system. EDELNOR states that its repair time for electric equipment has fallen from seven days to one day and delays in installing meters have been cut from 45 days to 24 hours. Luz del Sur achieved an average of less than five days to install a new connection in 1999, as opposed to 90 days in 1994. The company has also practically abolished the billing estimates that replaced actual meter reading. The billing estimates have decreased from 7% in 1994 to 0.1% in 1999.

The improved financial performance of Peru's electricity companies can be seen in Figure 21.

Technical and Non-Technical Losses

A major obstacle for the distribution companies are the high levels of technical and commercial losses. Although the overall losses associated with the distribution

sector have declined from 14.6% in 1997 to 11.5% in 1999 (Figure 22), some of the distribution companies still report losses of up to 38.4% (e.g. Chavimochic company). More than a third of the distribution companies states losses above 20%, mainly in the rural or remote areas of the country.

The two major suppliers for Lima, Edelnor and Luz del Sur, have been able to reduce their losses below 10%. However, Luz del Sur still faces commercial losses due to clandestine connections and robbery of around 12% – down from approximately 20% in 1994. The company estimates that it loses revenues of annually more than US$27 million because of clandestine connections, roughly 2% of its overall income.

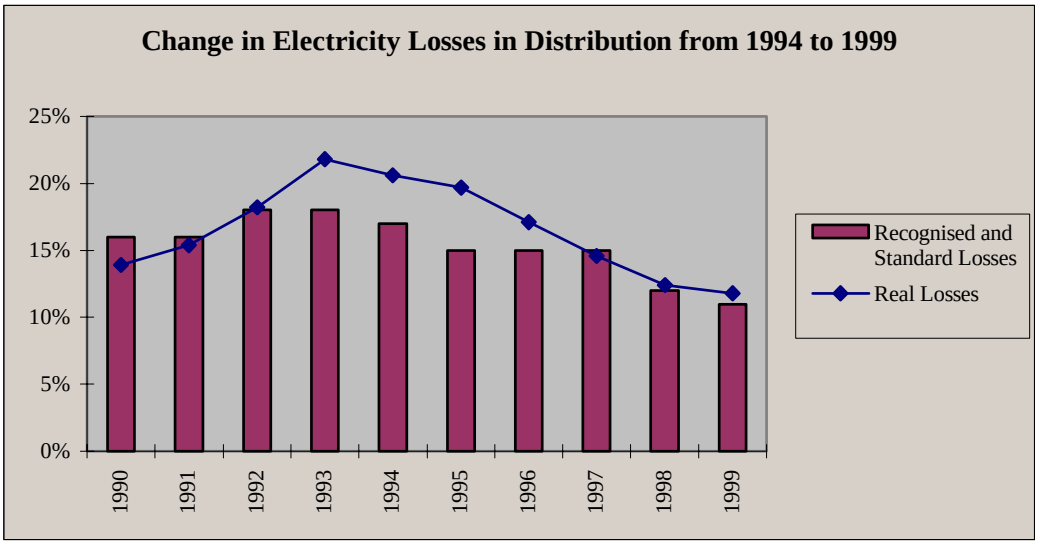

Figure 22. Change in electricity losses in distribution in Peru from 1994 to 1999 (Source: CONITE 2000, Evaluation of the Privatization of the Electricity Sector).

2.6.4 Conclusions

The restructuring of the Peruvian electricity sector shows that liberalisation and the introduction of competition can benefit residential consumers in terms of service quality, reliability and the extension of the grid to poorer customer segments. It therefore contradicts the common assumption that the liberalisation is mainly directed towards cheaper electricity services for the industrial consumers. Peru's electricity companies indeed make an effort to satisfy the needs of their clients.

However, the new structure of the sector implies that the companies follow strict market rules and mechanisms, including transparent accounting systems and common performance measures like shareholder value and return-on-investment. They operate in an environment that does not allow for the cross-subsidisation that took place under the state-controlled administrative framework. In order to guarantee their financial health, they thus have to charge their customers according to the real – and not politically modified or interpreted – costs. This is a fundamental change in the role of both private companies *and* the government, leading to important questions about the affordability of energy services in developing countries.

Energy is a basic need for the development of the residents of a country, since it serves as a tool for an increase in the quality of living, e.g. by the introduction of technical equipment like freezers or lighting. It also contributes to the active participation of the residents in the political life of a country via the information provided by TV channels and radio, which is particularly important in a country like Peru with a long history of political instability, media control and dictatorship.

Since the elasticity of electricity consumption in the poorer customer segments is actually quite high, the level of electricity prices affects the patterns of demand. A worst-case scenario of electricity sector liberalisation would therefore imply that residential customers switch from electricity back to LPG (liquid petrol gas) or even firewood. The barrier to purchase electrical household equipment and information tools increases, and an important part of the population is deprived from significant positive changes in their quality of life.

The United Nations Development Programme (UNDP) addresses this issue[15] in the terminology of an "energy ladder". The energy ladder is defined as a hierarchy of different energy sources with an increasing efficiency and cleanliness. UNDP (1998) states: "Each rung of the ladder corresponds to the dominant fuel used by a particular income group, and different income groups use different fuels and therefore occupy different rungs of the energy ladder. For example, wood, dung, and other biomass represent the lowest rung on the energy ladder for cooking, with charcoal, coal, and when available, kerosene, representing the next rungs up the ladder to the highest rungs, electricity and LPG."

The threat of a gradual decline of the energy consumption characteristics of parts of the population when high quality energy services like electricity become more expensive has to be compensated by governmental measures. Those normative goals of domestic energy policy are exogenous to a liberalised market, whereas they were formerly integrated and implemented in the directives of the state-owned enterprises. The regulatory intervention takes shape in form of specifically oriented programmes or direct subsidies for the poorer parts of the population.

For the electrification of remote rural areas, which also might suffer from the liberalisation of the electricity sector, the government has introduced the "Plan de Electrificación Nacional" and its executive entity, the Dirección Ejecutiva de Proyectos (DEP), which was founded in 1993. This plan consists of a public-private partnership where the burden of the expenses for grid extension is shared by government and private distribution companies. This partnership has the advantage for the government that it is not the sole investor into rural infrastructure, thus reducing the government's financial responsibility, and it simultaneously offers the possibility to gain new customers at reduced cost for the distribution companies. Since its foundation in 1993 the rural electrification has increased from 12% to 35% in 2001.

The case of Peru shows that liberalisation and privatisation can solve financial problems of the electricity sector. However, the social implications of increased prices cannot be ignored, and for further electrification in economically unattractive areas the government still has to participate in the investment.

15. UNDP (1998), Energy After Rio: Prospects and Challenges (www.undp.org/seed/energy/chapter2.html).

2.7 The Case of South Africa: Achieving Efficiency and Transparency

2.7.1 Economic Background

South Africa is one of the largest economies in the African continent. The launch of Reconstruction and Development Programme in 1994 has had a significant impact on social and economic life of people in the country. The government's new macro-strategy – Growth, Employment and Redistribution – focuses on promotion of growth through exports and investments, and redistribution by creating jobs and reallocating resources through budget.[16]

However, the economic performance during the last few years has been extremely variable. The per capita Gross National Income has been fallen continuously since the second quarter of 1997. Gross Domestic Savings have fallen from around 25% of GDP in the mid-eighties to just around 15% at present. The country has also experienced a fall of nearly 20% in private sector employment over 10 years ending 1999. The current account balance has been unfavourable and it has been in the range of 1-2% of GDP during last five years. The foreign debt has been on the increase during the last decade and it is now around 30% of GDP. Given the recent weakness in economic performance, it is essential that the country must focus on improving efficiency in various sectors of the economy.

The government's effort in the energy sector is based on the premise that the sector can contribute significantly to economic growth and employment creation in the country and the sector must become more competitive and efficient.

2.7.2 Energy Sector

In South Africa, the household sector consumes about 24% of the country's energy. Most of this energy is obtained from fuelwood (65%). Illuminating paraffin, coal and LPG contribute the rest of energy consumption. The reason behind such high usage of fuel wood is inability of a household to buy commercial forms of energy and lack of access itself.

Industry, mining and commerce account for over 60% of commercial energy consumption in the country. Low price of coal and electricity has contributed to the development of an energy-intensive primary industrial sector.

Energy Policy

The South African constitution makes it necessary for the government to establish a national energy policy that will ensure that the national energy resources are managed effectively to meet the country's energy needs. It is therefore essential that the government endeavours to provide energy to all the citizens, particularly small businesses, disadvantaged households, schools and clinics, at a reasonable cost. The government also sees an important role for itself in maintaining a balance in use of natural resources, with specific focus on environment impact of energy utilisation decisions.

16. Annual Economic Report from the South African Reserve Bank, 1999 and 2000.

The Energy Policy White Paper, 1998 states the following to be the energy sector policy objectives:

- increasing access to affordable energy services;
- improving energy governance;
- stimulating economic growth;
- managing energy related environmental impact;
- securing supply through diversity.

The government is now encouraging the Electric Supply Industry to restructure in order to meet its energy policy objectives. It has identified the following to be the challenges facing the Electric Supply Industry in South Africa:[17]

- provide access to electric supply for thousands of homes, schools and clinics;
- ensure consolidation of distribution activity to ensure economies of scale and more uniform tariffs across the country;
- improve recovery for supply of industry;
- encourage energy efficiency in usage;
- ensure adequate level of investment in expansion of generation, transmission and distribution capacity.

The government initiatives are also focused on giving customers the right to choose their supplier, introduction of competition (especially in the generation sector), allowing for open, non-discriminatory access to the transmission system and encouraging private participation in the industry.

In order to achieve these policy objectives, the government has, on the recommendations of the Electricity Restructuring Inter-Departmental Committee, taken the following decisions:

- Consolidate the distribution activity into viable and independent regional distributors.
- Introduce cost effective tariff, an independent electrification fund and a capped tax for part funding of municipal services.
- Appoint a full time restructuring team to examine issues relating to and involving major stakeholders in the planning and the transformation process.

2.7.3 Institutional Arrangements: Electricity Industry

Eskom is a government owned statutory body and was set up under Eskom Act 1987. It is governed by the Electricity Council and a Management Board. The Council determines policy and objectives, and controls Eskom's performance. The Minister of Public enterprises appoints members of the council.

National Electricity Regulator (NER) regulates Eskom and the rest of the Electric Supply Industry. NER's board consists of a chairperson and 8 part-time members, who serve in their personal capacities. NER is funded through a cess on generators, which is, in turn, borne by the consumers. This means that the consumers pay NER for protecting their interests. NER's costs are not a part of the general budget.

NER's main role is regulation of:

- pricing, tariff and markets;

17. White Paper on the Energy Policy of South Africa, 1998.

- price increases, appropriate costing and accounting systems;
- contract requirements;
- financing of electrification effort;
- ring-fenced licensed activities for the industry.

NER has advised the government that it must work towards ensuring the existence of viable electric utilities, elimination of monopolies in generation and distribution, creating electricity markets, permitting open, non-discriminatory access to transmission system, encouraging private participation in the industry and creating a level playing field for different participants in the industry.

2.7.4 Industry Structure: Electricity Industry

Eskom is the largest supplier of electricity in South Africa, with its share of generation being in excess of 95%. Only a small number of privately owned co-generation plants and 8 municipalities generate the balance power.

Eskom is a vertically integrated public utility firm. While Eskom dominates generation and transmission businesses, the distribution is a fragmented activity. Eskom and over 400 municipal corporations distribute electricity to customers across the length and breadth of the country. The municipalities serve about 60% of total customers by number and about 40% by their share of consumption. They normally supply in their areas. Consequently, they vary significantly in customer density, size, type of customer base, geographical spread and financial performance.

The current industry structure is presented in Figure 23.

Current Industry Structure: South Africa

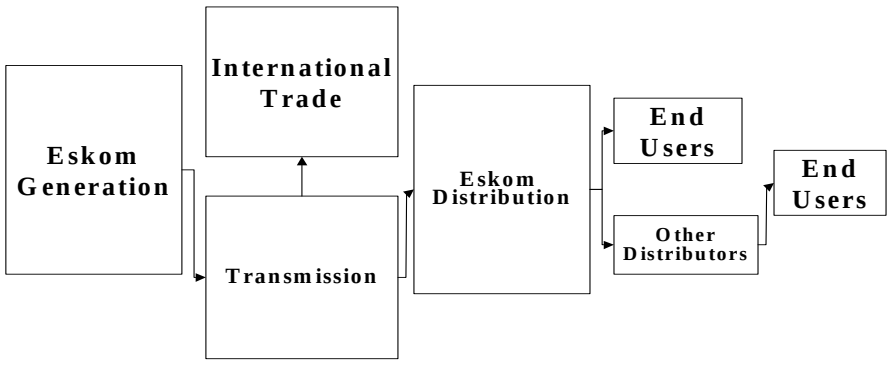

Figure 23. The current structure of the electricity industry in South Africa (Source: Eskom submission to the World Energy Council).

2.7.5 Pricing Practices

South Africa has implemented a reasonably elaborate process for determining the cost of service at different point of value chain in the electricity supply industry. Generation costs are determined by estimating the total revenue requirements (cost of supply plus an appropriate return), including the cost of imported energy. The base costs are adjusted to time of use rates for each period (high, standard, off-

peak and super peak) and for each season (high demand –winter and low demand season – summer). The time-of-use tariffs are based on the contribution each of the seasons makes to the peak demand periods. Cost of service for transmission is calculated taking into account the capacity costs for each Customer Load Network and standard energy loss rates.

As for distribution, there is no national standard for determining the cost of service. However, Eskom has initiated a study, along with other distributors, to suggest a standard methodology for the ESI in South Africa. The study proposed to classify customers into 20 groups, based on the time of use and the load factor. The basic categories are – industrial, commercial, agricultural and bulk. Another two dimensions are added to customer category in terms of geographical location and voltage of supply. The total costs are collected under three categories (delivery purchase costs, network costs, support costs) and allocated under energy, demand and customer cost heads for determining the customer charge. The elements affecting cost of service are fuel, operations and maintenance costs, cost of capital, technical and non-technical losses, technical efficiency, etc.

As mentioned earlier, the distribution activity in the South African Electricity Supply Industry is highly fragmented. Consequently, the country has over 2000 different tariffs. In some cases, the residential areas adjacent to each other often experience wide variations in tariff structure as well as tariff levels. There is effectively no possibility of justifying such variations on economic grounds. Such a wide variation could be one of the factors in reinforcing the culture of non-payment of electricity bills by a large number of consumers. Some estimates show the non-paying customers to be around 20%. The main reason for non-payment was, of course, the political environment prior to 1994, wherein many of the customers did not pay their bills out of protest against the minority government. There are similar variations in tariff in other customer segments. For instance, a mining customer in Gauteng may pay only about 9 to 17 cents per kWh as against a customer in Mpumalanga who could be paying 23 to 32 cents per kWh.

Another distortion in the pricing process comes from monopoly pricing by some of the municipalities for their industrial and commercial consumers. This practice imposes unequal burden on these segments, which could lead to distortion in the customer cost structure and may inhibit industrial and commercial growth in some of these areas.

Eskom funds subsidies to customers from its own revenue, i.e., the government does not provide support for subsidies. The subsidies during the last year were over Rand 2 billion or over US$350 million. Eskom offers many specific subsidies, e.g., connection costs and energy prices are subsidised for many poor and low consumption customers. Farms in rural areas also get a subsidy towards cost of network and the cost of its operations. Eskom has invested nearly Rand 5 billion in the electrification programme for previously disadvantaged households. Yet, another form of cross-subsidy is the voltage level cross-subsidy. While Eskom does charge prices that differ with the voltage level of supply, these prices do not reflect the cost of supply for each of many of voltage levels.

Given the degree of fragmentation, many of the small distributors do not realise any economies of scale. For example, average distribution costs (including purchased energy) may range from 23.9 cents per kWh for distributors of less than 1 GWh to only 13.4 cents for a distributor with an annual sale of 1000 GWh. There are also substantial differences in the financial health of distributors. Four

municipalities earn 50% of the total surpluses being earned by all municipal distributors and additional 18 earn another 25% of the total surpluses. On the other hand, 289 municipalities earn less than 1% of the total surpluses and the bottom 25 loose money on their electricity sales.

As for the cost of supply to the distributors, it depends on the voltage level and the distance of the supplying sub-station from Gauteng/Mpumalanga where most generators are located. At present, Eskom has a national price, which is adjusted by a maximum of 3% in form of transmission charge. The exact transmission charge depends on the distance from Johannesburg. However, the charge does not exactly reflect the geographical variation in transmission costs.

The government is attempting to ensure that cross-subsidies have a minimum negative impact on consumers in the productive sectors of economy. The government is also attempting to make the cost of subsidies more transparent by recovering specific levies for each of its subsidy programmes. For example, it proposes to recover the past electrification investment through Past Electrification Capital Debt Levy. It proposes a similar method of recovery for future electrification costs and remote rural farm subsidy.

Price control in the liquid fuel sector is based on keeping parity with imported prices (in-bond landed cost) at the refinery gate. The profitability at wholesale and retail levels is controlled through fixing of margins at these levels. In addition, the country has formulated a Service Station Rationalisation Plan (a voluntary agreement between the government and the wholesale and retail industry), which guides the development of the retail sector. The purpose of this agreement is that the industry could realise economies of scale by restricting the number of retail outlets in the country.

Coal industry, on the other hand, has operated as a competitive market since 1992. Coal production and beneficiation is completely in the hands of the private sector. The government's role is restricted to monitoring of the industry's performance to determine whether the coal resources are used optimally to meet the national priorities. Since coal is expected to continue to be a major source of energy, the government intends to make sure that it does not have significant negative environment impact.

The advantage of coal prices being determined by market forces is that it does not introduce any distortions in cost structure of downstream industry like electricity. This is particularly important in view of the fact that over 85% of power generated in the country is from coal-based stations. However, only a small quantity (2%) of coal is purchased through short-term contracts, implying that Eskom may not have flexibility in coal costs if the demand does not keep in line with projections made at time of entering into coal supply contracts.

2.7.6 Pricing Practices: Challenges

A key issue arising out of consolidation of distribution activity into smaller number of independently operating firms is the revenue municipalities are earning from distribution of electricity. Some of them use the surplus from this activity to subsidise other local government activities. Some reports estimate the revenue from electricity distribution by municipalities to be around Rand 2.4 billion for the

year 1999/2000.18 These estimates are based on an earlier ERIC report, which had estimated the revenue to be Rand 1.4 billion in 1994. One solution being suggested is that the local governments will continue to get this revenue even after the distribution gets consolidated under a few Regional Electricity Distributors (REDs). This revenue could come to the municipalities in form of a levy and dividend on their share of capital in REDs.

The results from analysis in the above referred report suggests that REDs could be established as a viable distribution industry only if:

- Prices could be increased by over 50% from their present level for domestic customers.
- Government is able to provide funding for electrification of small customers.
- Local governments are able to recover a levy in the range of 6-7% of customer bills (except for very large and electrification customers).
- REDs could reduce their operating costs by 3% p.a., in real terms, for next 10 years.
- REDs could buy from Eskom at rates which are lower by 30-50% from the presently applicable rates.
- Cost of capital for the REDs is kept low, just 100 basis points above the long term government bonds.

The government is also aware of the fact that levies and taxes make up a high proportion of the retail price of some fuels and not so much for others. For instance, coal attracts just the Valued Added Tax, whereas petrol attracts many taxes that together constitute 50% of its retail price. The government intends to remove such large disparities, which run counter to its energy policy objective of making the energy market competitive.

Yet another challenge is the availability of resources for providing access to commercial forms of energy. Some estimates show the industry needs to charge a levy of one-cent per kWh for next ten years. This is expected to be about 5% of the average bill in the country. These resources would allow the industry to provide access to about 450 000 houses per year. Another alternative that is being considered is to let the costs be borne by Eskom. However, this would affect Eskom's profitability and thereby the ability to sell Eskom shares to private investor. Eskom's ability to subsidise these investments may get affected further when it may have to pay taxes on its income. In case any of these alternatives do not get implemented, the government will have to make provision in its budget for providing resources for capital investment in the access programmes.

In summary, it may be noted that although the energy policy is result of the historical context where access to commercial energy was limited only to a certain part of population, the government has not lost sight of other objectives like the viability and competitiveness of the industry. The government is particularly concerned with the impact of inefficiency in the energy industry on economic development across other sectors. The effort being made in consolidation of distribution activity in the electric supply industry is one such step in the right direction. However, the consolidation has its costs. As mentioned earlier, the government will have to agree to large increases in tariff, get a commitment from

18. EDI Restructuring Project, Working Paper 5 on Tariffs, Levies and Financial Transition Strategies.

the distribution firms to improve productivity, lower the price for Eskom and keep the interest costs close the return on government securities. The government is also determined to make subsidies transparent, even when they are not part of the government budget. These changes will require strong political will as well as continuous effort to implement an efficiency driven plan.

Source Documents

1. South African Reserve Bank, 2000: Annual Economic Report, 2000.
2. South African Reserve Bank, 1999: Annual Economic Report, 1999.
3. Ministry of Minerals and Energy, 1998: White Paper on the Energy Policy of South Africa.
4. PricewaterhouseCoopers and Others, 2000: Tariffs, Levies and Financial Transition Strategies, Working Paper 5, Electricity Distribution Industry Restructuring Project.
5. Electricity Supply Department, Eskom, 2000: Submission for the World Energy Council Study on Pricing Energy in Developing Countries.

2.8 The Case of Thailand: Economic Restructuring and Rural Electrification

2.8.1 Economic Background

Economic growth in Thailand, during the last three decades, has been led by growth in its external sector. While Thailand has a long history, dating back to 1961, of private sector participation in economic activity, the infrastructure sectors are dominated by public sector presence. During this period, Thailand transformed itself from an agricultural economy to an industrial economy, which is reflected in the share of industry in GDP increasing to nearly 40%. Despite these efforts, the Thai economy experienced a crisis during 1997, mainly due to lack of adequate safeguards in the financial system.

A key effort, following the crisis, is the State Enterprise Reforms. The country has formulated a Master Plan for increasing effective private sector participation in the economy. The focus of reform effort is on building a competitive structure across infrastructure industries like communication, transportation, water, energy and other manufacturing and services sectors. The Master Plan states: "The goal of the government's reform program is to help increase the efficiency of the economy, to provide a basis from which Thai companies can compete internationally, and to ensure quality goods and services are available to the Thai public at the least cost."

2.8.2 Energy Sector

The rapid economic expansion, prior to 1997, contributed to a significant growth in the energy sector in Thailand. Energy consumption grew by over 10.0% p.a. till the Thai economy was hit by the crisis. In 1998, the country experienced a negative growth in energy consumption, measured in terms of primary consumption of commercial energy, and it was barely positive during 1999. Many of the sub-sectors are characterized by excess capacity. Economic slowdown has also affected a consumer's ability and willingness to pay for market-based prices for energy.[19]

As for the share of different sources of energy, the share of petroleum products, measured in terms of crude oil equivalent, has fallen from a high of 71.1% in 1995 to 67.6% in 1999. Electricity, solid fuels and gas have all gained at least a percentage point in share during the same period. This is not surprising in view of the fact that Thailand imports over 90% of its petroleum product needs.

An interesting feature of energy consumption in Thailand is that the Metropolitan area accounted for over 40% of the total electricity consumption in the country till 1995. However, the economic crisis has led to the electricity consumption falling significantly in the Metro area. Share of Metro areas in consumption has fallen by 4% during the last four years.

Another important aspect of consumption pattern is that the industrial and business sectors account for nearly 45% and 24% of electricity consumption in the country. The share of these two sectors has fallen from over 72% in 1995 to nearly 70% in 1999. Electricity consumption among the residential customers has gone up from

19. Analysis in this section is based on data available on National Energy Policy Office's website and information provided to World Energy Council.

about 20% in 1995 to over 23% in 1999. While the share of consumption by residential customers in the metro areas has remained stable around 8%, the share of provincial residential customers has increased by 3% in this period. We observe similar trends in consumption in other segments of the market.

Thailand has been promoting the use of cleaner fossil fuels like oil and gas in electricity generation. It has been able to reduce the consumption of lignite to produce energy by limiting production at some power plants. In addition, it has installed pollution control equipment at some other coal-based plants in the country.

Energy Policy

Given these characteristics, the Energy Policy focuses on development of domestic sources to adequately meet the demand for energy in different sectors and build an efficient energy production and distribution system. Under the Master Plan, it is planned that the energy industry is competitive and efficient. The Royal Thai Government intends to improve the competitiveness of its energy sector by increasing the degree of private participation in the sector. Consequently, the regulatory system in Thailand is also being reviewed to ensure that the energy market works under competitive conditions.

Institutional Arrangements

The economic crisis has brought the institutional structure in the energy sector into focus. A slump in energy demand is leading to under-utilization of existing capacity and rendering the proposed capacities not so useful in the near future. The changes in the exchange rate regime led to the risk of investment projects going up in a very short period and the cost of energy in local currency going up significantly. The factors contributing to these price escalations are dependence on imported fuels and international borrowings.

The present institutional structure of the Thai electricity supply industry is presented in Figure 24.

Thai Electricity Supply Industry

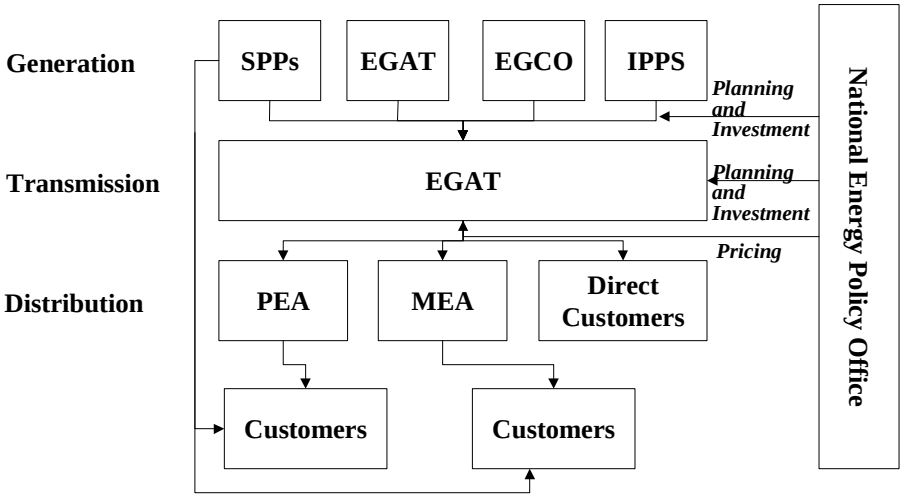

Figure 24. Current structure of the electricity supply industry in Thailand.

National Energy Policy Office (NEPO) is at the core of the institutional structure in the Thai energy sector. NEPO is the operating arm of the NEPC (National Energy Policy Council). NEPC and NEPO are responsible for all policies related to IPPs, privatisation and tariff structure. It is expected that NEPO will be able to build institutional capability to be an independent regulatory body by 2003 and would thereafter carry out all the regulatory functions in the energy sector.

National Energy Policy Council (NEPC) is the final authority that makes the strategic decisions on energy policy in the country. For example, the current policy of privatisation is based on a number of resolutions passed by the NEPC in 1997. NEPO serves as the implementation arm of the Council.

Thailand has taken a series of initiatives to restructure its institutional arrangements in the energy sector to make the sector more competitive. The initiatives are based on the premise that the deregulated markets and best practice private investment is better positioned to deal with a crisis.

Post crisis, the Royal Thai Government set a Committee on the Electric Power Tariff Restructuring to deal with the problem of devising a sustainable tariff policy in view of the recent experiences. However, Thailand does not have a comprehensive Electricity Law in practice but it has drafted the Act recently.

2.8.3 Industry Structure

Electricity supply in Thailand is the responsibility of three public sector firms at this stage. EGAT (Electricity Generating Authority of Thailand) is responsible for generation and transmission and MEA (Metropolitan Electricity Authority) and PEA (Provincial Electricity Authority) for distribution in the Metropolitan (Bangkok, Nonthaburi and Samut Prakan) and Provincial (rest of the country) areas, respectively. EGAT is also responsible for supply to some large customers.

EGAT does have some local and foreign power producers supplying about 20% of its electricity requirements. EGCO is the biggest supplier with its share being over two-thirds of EGAT's purchases. EGAT is responsible for the operation and development of the country's transmission system including the load dispatch control.

The industry structure of ESI in Thailand could be characterised as one in transition, wherein the value chain has been unbundled, but there is hardly any competition in the industry. The challenge is in ensuring that the unbundled value chain is managed effectively by multiple competitive and monopoly entities simultaneously in the industry.

Price regulations are still in place and some of the customer segments are being provided cross-subsidies. However, the privatisation initiative is expected to focus on economic efficiency and financial viability of the energy supply industry. While the tariffs are regulated, Thailand has adopted differential tariffs to reflect the usage characteristics in terms of the timing, voltage and connected load.

2.8.4 Pricing Practices

At present, the tariff policy is supervised by the NEPC. Post crisis, the Royal Thai Government set a Committee on Electric Power Tariff Restructuring. The Committee is assigned with the task of formulating a pricing policy, which would be suitable in a competitive market situation. The Tariff Restructuring Committee

is working with the objectives of defining the tariff structure, tariff levels and the tariff adjustment mechanism.

Tariff Structure

Thailand's policy of uniform tariff across the country requires EGAT to supply energy to PEA at rates lower than MEA, even when the cost of supply to PEA is higher than that for MEA. That is, the metropolitan consumers are expected to subsidize the provincial consumers. EGAT supplies electricity to MEA and PEA at Bulk Supply Tariff (BST). The present rate, fixed in July 1997, varies with time of usage, day of the week and the voltage level. While the Bulk Supply Tariff is a uniform rate, MEA pays a surcharge of 0.2577 Baht/kWh and PEA gets its supplies at a discount of 0.1205 Baht/kWh. The actual tariff, of course, includes the charges arising out of Automatic Adjustment Mechanism, described later in this case study.

Like the BST, MEA and PEA have a schedule of Base Retail Tariffs, which vary by consumer category. The categories and nominal average level of base tariff in each consumer category have largely remained the same since 1991, except for some changes in the structure within a consumer category. Thailand has defined the following consumer categories for this purpose:

- Residential, subdivided into two categories of consumers – first set of consumers with monthly consumption below 150 kWh per month and the second set with consumption being more than 150 kWh per month. Residential consumers pay a fixed amount for first consumption block and then an increasing rate of Bahts/kWh for each of the subsequent consumption blocks.
- Small General Services (SGS), defined as customers having 15 minute maximum integrated demand of 30 kW. Tariff is similar to that of residential customers with consumption exceeding 150 kWh, except that the SGS customers pay a higher minimum and first block charge
- Medium General Services (MGS), defined as customers having 15 minute maximum integrated demand of between 30 to 1999 kW and an average energy consumption below 355 000 kWh. These customers pay a demand as well as energy charge, which vary with voltage level. Customers with consumption exceeding 250 000 kWh can choose to pay a Time of Use tariff, with payment being specified in form of demand charge, energy charge and a fixed monthly service charge. All the charges are once more linked to the voltage level. The minimum charge for these customers is fixed at 70% of the maximum billing demand charge of last 12 months. The same tariff applies to government institutions with average energy consumption of 250 000 to 355 000 kWh.
- Specific Business Services (SBS), comprise of hotels and other lodging facilities having a maximum integrated demand of 30 kW or more. These customers pay the same tariff as the MGS customers, except that demand charge for them is higher about 20-25%.
- Large General Services (LGS), defined as having a 15 minute maximum integrated demand of 2000 kW or more or average energy consumption of more than 355 000 kWh. These customers, except for those registered after October, 1997, can choose between Time of Use Tariff of MGS and Time of Day Tariffs defined specifically for LGS. Those classified as LGS after October, 1997 have to accept the TOU tariff of MGS.
- Government and Non-profit Organisations include customers with consumption levels not exceeding 250 000 kWh. These customers pay an

energy charge linked to the level of consumption and voltage. They also have a minimum charge defined for them.

- Pumping and agricultural consumers pay a minimum monthly charge and an energy charge based on consumption levels.

In addition to these tariffs, Thailand has stand-by tariffs for customers with own generating facilities but may need to buy power in the event of breakdowns or maintenance of their own facilities. They pay a below normal demand charge and the same energy charge as the normal tariff. Thailand has also fixed interruptible supply tariff for those customers who have a demand of at least 5000 kW with an interruptible load of more than 1000 kW. The tariff is linked to voltage level and is payable in form of demand and energy charges.

The retail tariff structure reflects the long-run marginal costs of supply at different voltage levels and by the time of day and time of use. The average tariff is fixed at 80% of long-run marginal cost.

While the country does recognise the need for marginal cost based pricing, it has not been able to fully implement these prices in view of the need to subsidize provincial and small energy consumers. It is particularly difficult to implement the LRMC based pricing completely given the post-crisis economic hardships faced by a large number of Thai consumers, especially in the Metropolitan area.

In summary, the present tariff structure effectively supports two levels of cross subsidies – metropolitan consumers providing a subsidy to provincial customers and large users subsidizing the smaller consumers.

Tariff Level

Tariff levels in Thailand are expected to provide electric utilities a pre-specified level of return on investment. The present structure specifies this return to be 8.00% per annum. However, EGAT is not expected to remain profitable in year 2000 due to under-utilization of its own capacity and the compulsion to buy electricity from Independent Power Producers even when the demand is below the available supply. To over come these problems, the Thai government has advised PTT (state-run oil company) to charge lower prices for fuel supply to EGAT.

Some of the studies show that EGAT has a reasonably sound investment planning methodology for its generation as well as transmission activities.[20] Similarly, the study finds that MEA and PEA work with a reasonable basis for drawing their investment plans. However, there is scope for improving the efficiency of EGAT's generation and transmission activities. The study observes that the employee productivity in generation and transmission activities in Thailand is lower than the productivity in the UK before privatisation. However, the operations and maintenance costs, other than employee costs, are in line with other international firms. Figures 25 and 26 below show a comparative picture of efficiency of transmission systems across different countries.

While there have been improvements in productivity in the range of 5-7% per annum at MEA and PEA, there is still some scope for improvement in system reliability.

20. National Energy Policy Office Study on Review of Electric Power Tariff.

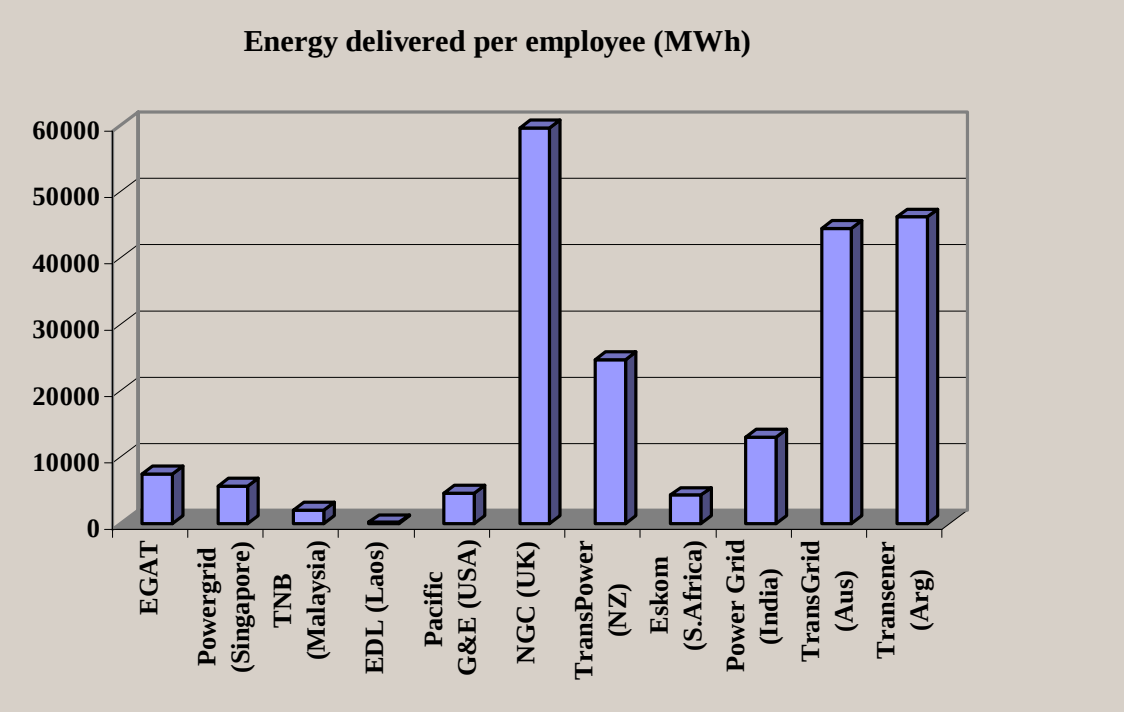

Figure 25. Energy delivered per employee for utilities in selected countries.

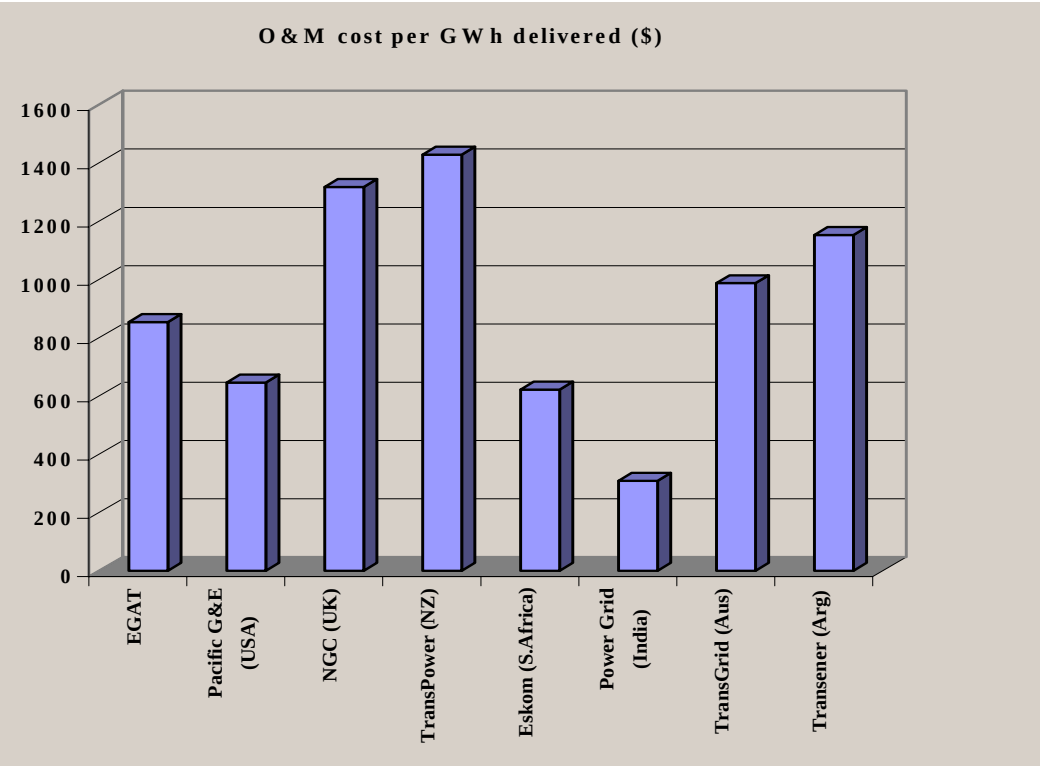

Figure 26. Operations and maintenance costs per GWh delivered for utilities in selected countries (US$).

Automatic Tariff Adjustment Mechanism

The Thai tariff structure provides for Automatic Tariff Adjustment Mechanism (AAM), which allows electric utilities to recover certain input-cost increases without obtaining prior approval. AAM allows EGAT to recover the following additional costs through monthly adjustments:

- Changes in fuel costs and energy purchases.
- Part of DSM expenses till they are in included in EGAT's annual plans.
- Differences in actual average revenue and planned average revenue, arising out of changes in the customer-mix.
- Actual exchange rate losses on foreign debt.
- Variance in actual and forecast inflation values used in determining transmission, distribution and supply operating costs, but only after accounting for savings through operational efficiency.

The changes in transmission and distribution costs are recovered through annual adjustments. The mechanism allows the utilities to recover an increase in cost only if it is above 2 stangs per kWh. The smaller increases are to be absorbed by the firm.

Table 26 provides the details of fuel adjustments effected during the last few years. We notice from the table that from 1998 onwards the adjustments have been consistently large.

Table 26. Fuel-related adjustment under the Automatic Tariff Adjustment Mechanism in Thailand (stang/kWh) (Source: National Energy Policy Office).

Month	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
January	-	8.39	6.91	7.50	18.10	18.28	42.40	50.71	56.32
February	-	8.39	6.91	7.50	18.10	18.28	42.40	50.71	56.32
March	-	8.39	3.56	14.85	18.10	26.73	42.40	50.71	56.32
April	-	5.32	0.36	14.85	22.87	26.73	50.45	32.61	61.52
May	-	5.32	9.53	14.85	27.84	26.73	50.45	32.61	61.52
June	-	5.32	2.80	17.35	22.50	26.73	50.45	32.61	61.52
July	-	3.24	2.80	24.70	25.82	26.73	50.45	32.61	61.52
August	-	-1.86	-0.53	19.95	25.82	26.73	55.77	37.92	64.52
September	6.17	-1.86	7.50	23.82	25.82	26.73	55.77	37.92	64.52
October	6.17	-1.86	7.50	18.10	20.42	26.73	55.77	37.92	64.52
November	6.17	-1.86	7.50	18.10	25.60	42.40	55.77	37.92	64.52
December	6.17	-1.86	7.50	18.10	25.60	42.40	50.71	56.32	
Average	**6.17**	**2.92**	**5.20**	**16.64**	**23.05**	**27.93**	**50.23**	**40.88**	**59.29**

2.8.5 Pricing Practices: Challenges

The biggest challenge for ESI in Thailand at present arises out of slowdown in demand for energy and the consequent excess capacity. Since the slowdown is mainly in the MEA areas, the industry's ability to cross-subsidise the PEA customers has been adversely affected. Some of estimates show that the excess

capacity will continue to exist till 2011.[21] The existence of excess capacity (due to slowdown in demand) and introduction of competition makes determination of marginal costs more complex than if the industry was regulated or it have high capacity utilisation. An NEPO commissioned study estimates that stranded costs for EGAT may range from Baht 51 to 147 billion under different economic recovery scenarios.[22]

Another factor affecting the tariff structure, in the short-term medium term is the perception about investment risk in post-crisis Thailand. In many earlier investments in generation assets, the PPAs required the costs and payments to be determined in Baht. Depreciation of Baht and the consequent increase leaves the cash inflows not being sufficient for meeting the outflow requirements. The new investments may come only if the investor cashflows are dollar denominated. This will make tariff structure more complex and the tariffs may have to adjust more frequently to reflect the changes in exchange rate for Baht.

Thailand has also made an effort to reduce its dependence on imported fuels by using domestically available natural gas. This lends higher degree of flexibility to the tariff structure, as the gas-based power plants can adjust their level of output more easily. However, if the gas industry is not competitive, it may make the fuel costs to be less transparent. During the crisis period, we have seen that PTT was advised by the government to charge lower fuel prices to EGAT. This is particularly important in view of the fact that the automatic tariff adjustment mechanism provides for actual cost of fuel to be recovered. Consequently, EGAT may not have any incentive to minimize its fuel costs by ensuring optimal dispatches or maximizing availability of lower cost plant or by improving efficiencies.

Under the Master Privatisation Plan, Thailand expects to be reorganise its ESI by creating independent entities for generation, transmission and distribution and by encouraging private participation in these activities and providing freedom to different customer groups to purchase their energy requirements from different distribution firms. However, the present tariff structure in Thailand reflects the structure of Electricity Supply Industry in the country. That is, EGAT's ownership of generation and transmission facilities results in the prices of generation and transmission services not being determined separately, which is essential for deciding on "use of system" charges.

Table 27 provides an analysis of what the tariff could be for different categories of consumers, based on cost of service for each of the groups. The table is adapted from the "Review of Electric Tariff Study", referred to earlier. The calculations are based on the following assumptions:

- Current retail Ft (1999 average level): 0.41 Baht/kWh.
- Conversion from FY1999 to FY1998 prices: 1.05.
- MGS, Specific business customers are on "normal tariff".
- "All retail tariffs" includes street lighting, provided free of charge.

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21. Review of Electric Power Tariff Study, referred to earlier, commissioned by National Energy Policy Office observes that Thailand is expected to have a reserve margin ranging from 25% to 52% during the next decade. The study also suggests a reserve margin of 18% is a more reasonable level, given the size of industry in Thailand.

22. Thailand Power Pool and Electricity Supply Industry Reform Study, commissioned by National Electric Power Office.

These tariffs are based on the Bulk Supply Tariff (BST) being nationally uniform. In order to recover the marginal costs, the BST needed to be scaled upwards by 15% for generation business and downwards by 30% for transmission business. The average national marginal distribution costs are allocated for each voltage level but are scaled down by 70% to meet the combined financial needs of MEA and PEA businesses.

In addition, the marginal customer related costs are scaled up by 340% to meet the combined financial requirements of MEA and PEA's retailing businesses. Consequently, the average marginal cost based tariff turns out to be lower than the current tariff. However, the marginal cost based tariff is significantly different across customer categories.

Table 27. Comparison between "current" and marginal cost based retail tariffs (FY 1998 prices).

Tariff Category	Average Unit Cost in Baht/kWh of Sales		Excess of Current Tariffs over Marginal Cost
	MC based Tariffs	Current Tariffs	
Residential	2.08	2.03	-2.10%
SGS	2.24	2.44	8.40%
MGS	1.71	1.79	4.91%
LGS	1.66	1.96	15.18%
Specific business	1.55	1.79	13.32%
Government	2.08	1.96	-6.07%
Agricultural pumping	2.13	1.49	-43.24%
Temporary	1.89	3.39	44.15%
Streetlighting	1.59	0.00	-100%
All retail tariffs	1.84	1.99	7.29%

In summary, it may be mentioned that the Thai electric supply industry faces an important challenge in transforming itself into a competitively structured efficient business. Thailand's policy of uniform national tariff requires that metro areas cross-subsidise other geographical areas in the country. The tariff structure also provides for cross-subsidies across the customer groups also.

The Thai electricity industry has been largely successful in developing a base-line tariff (Bulk Supply Tariff), which is valid across the entire nation and still making a provision for providing subsidies to different customer groups. The cross-subsidy mechanism has been used successfully to provide commercial forms of energy to rural customers. However, the ability to provide cross subsidy is now being constrained by economic slowdown in metro areas, which were providing the necessary resources for cross-subsidy.

The past performance of the industry has reflected that EGAT, MEA and PEA have been reasonably efficient in their operations. While the efficiency could still be improved to make the industry internationally competitive, these firms have large amount of stranded costs arising out of excess capacity.

Given that the excess capacity is expected to exist for a decade, the industry and the government face a considerable challenge to ensure that the industry remains profitable and can continue to attract fresh investment. It may be essential for the government to find resources for meeting these stranded costs, as the customers may not be able to bear them, given slowdown in economic activity.

Source Documents

1. National Energy Policy Office, 2000: Submission for the World Energy Council Study on Pricing Energy in Developing Countries.
2. National Energy Policy Office, 2000: Review of Electric Power Tariff, Prepared by PricewaterhouseCoopers.
3. National Energy Policy Office, 2000: Thailand Power Pool and Electricity Supply Industry - Reform Study, Prepared by Arthur Andersen and others.
4. Dr. Pacudan, R., 2000: Electricity Pricing in Southeast Asia, Energy Programme, Asian Institute of Technology.

2.9 The Case of Turkey: Conserving to Grow

2.9.1 Energy Sector

Turkey has focused on improving the availability of energy, considering the environment impact of growth in the sector. Turkey's energy strategy is aimed at satisfying demand without any adverse impact on economic growth in the country. Therefore, energy conservation is one of the important objectives of energy policy in Turkey. Turkey set a National Energy Conservation Centre (NECC) in 1992. In 1995, NECC helped create an energy efficiency regulation for industrial establishments. The regulation requires industrial establishments, with energy consumption of more than 2000 toe, to install energy management systems in their plants. According to an NECC study of 1997, energy saving potential is estimated to be 14 million toe annually.

Turkey imports nearly 50% of its energy requirements. The country spends around 40-50% of its total export income to import fuel, mainly crude oil and natural gas. Oil and natural gas meet nearly 60% of energy demand in the country, with coal constituting nearly 25% of supply. However, the recent years have seen a substantial increase in consumption of gas and electricity. The Turkish government has also been investing in building a nuclear plant.

The government has also focused on increasing domestic production by utilising public, private and foreign investment in improving the efficiency of existing plants. In order to release the constraints arising out of inadequacy of domestic investment, Turkish government has used arrangements like BOT (Build Operate Transfer), BOOT (Build Own Operate and Transfer) and TOOR (Transfer of Operating Rights) in the electricity industry. In 1997, the Turkish Parliament voted a law providing for these schemes. Consequently, the country has provided licences for building new plants and transferred operating rights for government owned thermal plants and distribution firms.

Turkey has also worked towards privatisation of its major petroleum distribution firm Petrol Ofisi (POAS), by selling its shares to public as well as strategic investors. Price of gasoline is subsidised to maintain artificially low prices, but they being increased off late to reduce the burden on the government budget and other consumers.

Pricing Practices

Turkey has two state owned electricity firms – Turkish Electricity Generation and Transmission Corporation (TEAS) and Turkish Electric Distribution Company (TEDAS). Operating rights for both these companies are expected to be transferred to the private sector. TOR is being used to privatise regional distribution system. The company doing own generation (auto-production) can sell their excess production to other regions in the country. Transmission charges are 3% for a distance up to 100 km and 1.5% for each additional 100 km, with maximum charges being 10.5%. In case a distribution company is involved in transfer, a 6.5% flat rate is paid to the distribution company.

Electricity prices in Turkey vary considerably across segments, which are in themselves large and varied. The tariff categories include:

- Housing.

- Industry (single-term tariff subscribers and double-term tariff subscribers).
- Induction and arc furnaces.
- Drinking and using water suppliers.
- Commercial building (traders and professionals, government offices, building sites and temporary subscribers).
- Religious foundations, public health and sports facilities, culture fishery.
- Lighting of worship houses, public places and highways.
- Agriculture.

Tariffs set by a distribution firm come into force only after the government has approved them. Tariffs are expected to cover yearly operating costs, which include cost of purchased energy, fuel costs, material costs, personnel costs, maintenance and repair costs, costs of right of using water, etc.

Turkey has differential tariff structure for different customer segments. The tariffs vary across geographical areas. For instance, the provinces under development has a significantly (nearly 40-50%) lower tariff than other provinces. The country has established capacity and energy tariffs, which vary by voltage of supply and time of usage. Agriculture and government organisations pay lower tariffs than industry and residential customers. The household tariffs are significantly higher than industrial and other customer segments. There is also a very substantial difference in tariffs across time of use. For instance, the off-peak tariff is one-third of the peak-tariff. The household sector also pays a differential tariff based on level of consumption. Tariff levels are adjusted regularly to account for changes in cost levels. Tables 28 and 29 provide an overview of the tariff structure in Turkey.

In summary, the pricing practice in Turkey does take into account the main energy policy concern of conservation in usage, given that Turkey is a net importer. It has also made an effort to lower investment needs by introducing time of day tariffs, which could help reduce peak-demand and thus reducing the need for building large peak capacity. It has also used innovative arrangements like TOR for improving the efficiency of electricity generation and distribution industry through an active private participation in its management. Its tariff policy allows for the domestic users to help generate resources for providing cross-subsidy to agriculture and government service organisations.

Source Documents

1. Turkish National Committee, WEC, 2000: Submission for the World Energy Council Study on Pricing Energy in Developing Countries.
2. US Department of Energy, 2000: An Energy Overview of Republic of Turkey.
3. Website of Turkish Electricity Distribution Corporation.
4. Minister of Energy, 2000: The Priorities of the Next Five Years in Turkey, Speech at the Second Annual Turkish Energy Conference in Ankara.

Table 28. Electricity tariff structure in Turkey, January 2000 (Turkish lira).

	Active Energy	Peak Tariff			Power	Excess Power	Reactive Energy
		17/22	22/06	17/06			
Double Term Tariff							
Industry							
Provice under Dev	29 340	45 950	16 580	27 870	1 787	2 680 500	14 670
Others	32 240	53 100	16 500	30 630	1 965	2 947 500	16 120
City Water Supplies							
Provice under Dev	25 870	37 360	16 580	24 580	1 420	2 130 000	12 935
Others	28 350	43 500	16 580	26 930	1 560	2 340 000	14 175
Treatment Plant							
Provice under Dev	14 670	21 320	16 580	16 580	949 000	1 423 500	7 335
Others	16 120	24 880	16 580	16 580	1 043 000	1 564 500	8 060
Single Term Tariff							
Industry							
Provice under Dev	34 280	57 670	16 870	32 570			17 140
Others	37 670	66 050	16 870	35 790			18 835
City Water Supplies							
Provice under Dev	29 460	45 770	16 870	27 990			14 730
Others	32 370	52 970	16 870	37 750			16 185
Treatment Plant							
Provice under Dev	17 140	26 580	16 870	16 870			8 570
Others	18 830	30 750	16 870	17 890			9 415
Commercial and Government	45 650	85 760	16 870	43 370			22 825
Cold Storage for Agriculture							
Household							
Provice under Dev	37 740	54 290	16 870	31 270			
Up to 150 kWh							
More than 150 kWh							
Others	38 180	62 350	16 870	34 360			
Up to 150 kWh							
More than 150 kWh							
Hospitals, Sports Centre, etc.	28 060	42 310	16 870	26 660			
Ministry/Corporation Pers.							
Provice under Dev	20 900	32 570	16 870	18 750			
Others	22 900	37 410	16 870	20 620			
Up to 150 kWh							
More than 150 kWh							
Agriculture Irrigation	20 660	24 030	16 870	19 630			

Table 29. Electricity tariff structure in Turkey, January 2001 (Turkish lira).

	Active Energy	Peak Tariff			Power	Excess Power	Reactive Energy
		17/22	22/06	17/06			
Double Term Tariff							
Industry							
Provice under Dev	40 350	62 700	23 950	38 300	2 471 000	37 065 000	20 175
Others	44 330	71 700	23 950	42 100	2 715 000	40 725 000	22 165
City Water Supplies							
Provice under Dev	37 860	55 200	23 950	35 950	1 983 000	29 745 000	18 930
Others	41 670	64 550	23 950	39 600	2 220 000	3 330 000	20 835
Treatment Plant							
Provice under Dev	20 250	23 950	23 950	23 950	1 322 000	1 983 000	10 125
Others	22 200	24 900	23 950	23 950	1 452 000	2 178 000	11 100
Single Term Tariff							
Industry							
Provice under Dev	47 220	78 350	24 900	44 850			23 610
Others	51 800	89 050	24 900	49 200			25 900
City Water Supplies							
Provice under Dev	43 200	66 850	24 900	41 050			21 600
Others	47 460	77 350	24 900	45 100			23 730
Treatment Plant							
Provice under Dev	23 680	26 600	24 900	24 900			11 840
Others	25 960	30 750	24 900	24 900			12 980
Commercial and Government	62 380	114 250	24 900	59 250			31 190
Cold Storage for Agriculture	47 460	77 370	24 900	45 100			23 730
Household							
Provice under Dev							
Up to 150 kWh	48 000	72 200	24 900	43 200			
More than 150 kWh	72 000						
Others							
Up to 150 kWh	52 580	83 550	24 900	47 300			
More than 150 kWh	78 870						
Hospitals, Sports Centre, etc.	41 180	61 900	24 900	39 100			
Ministry/Corporation Pers.							
Provice under Dev							
Others							
Up to 150 kWh	31 750	50 100	24 900	28 400			
More than 150 kWh	47 650						
Agriculture Irrigation	30 540	35 600	24 900	29 000			15 270

3. OBSERVATIONS, PRINCIPLES, AND CONCLUSIONS

During the course of this Study, and from the case analysis, literature review and other activities, the Study Group made a series of Observations from which a set of Principles on Pricing were established.

3.1 Observations

1. ***Pricing structures and subsidies which are not carefully designed create distortions.*** Developing countries tend to subsidise energy prices on the consumer or end-user side, while industrialised countries and economies in transition still employ certain practices aimed at providing support on the producer side. Producer subsidies take many forms, such as tax credits, special transportation tariffs, and energy technology R&D expenditures by government agencies. The objectives of such subsidies are usually to guarantee a certain level of revenues, to reduce the cost of producing energy, or to assure technical progress.

   Poorly designed subsidies have various negative effects that could overwhelm the social benefits of improving accessibility for the poorest segment of the population. The report of the International Energy Agency, *Looking at Subsidies: Getting the Prices Right*, for example, has concluded that energy price subsidies which encourage energy consumption by keeping prices below costs impose heavy burdens on economic efficiency, environmental quality and government budgets.

2. ***Pricing should be related to costs.*** The WEC Study Group suggests that the most pressing issue in many developing countries is the failure of energy providers to recover full costs. Such a situation hinders development, prevents investment in energy accessibility and availability, and in certain cases draws government resources away from other needs.

   During the information-gathering phase of WEC's study it became obvious that many countries still do not have a clear idea of their cost structure, let alone costs for each customer category. There are normally three elements of cost involved in the establishment of a pricing structure for electricity and gas:
   - First, a one-time payment to be connected to the grid.
   - Second, a standing or fixed charge (usually monthly), not related to the amount of the commodity consumed, to support costs such as metering and billing.
   - Third, a usage cost related to the amount of the commodity consumed, to cover the production of the commodity itself and the variable costs of delivering it to the end user.

3. ***Subsidy Capture has the most perverse effects.*** The lack of transparency in most consumer subsidies gives rise to another major problem, which the WEC Study Group calls "subsidy capture". This refers to the issue of who really benefits from consumer subsidies; often non-targeted groups of consumers, sometimes the wealthiest individuals or companies in a country, tend to benefit substantially.

The Study Group believes, for example, that "flat rate" pricing systems (in which consumers pay the same amount of money, no matter how many kWh they use) should be avoided. Such systems create over-consumption, discourage energy efficiency, and lead to "leakage" to other uses or consumers.

In many countries subsidies have important adverse effects, not because they are "bad" *per se*, but rather because the way they are designed allows them to be captured by the wrong group of consumers, or at a level considerably above what was intended. The WEC Study Group believes that such subsidies hinder economic development for at least three reasons:

- First, they cost a country strapped for funds an uncontrollable amount of money.
- Second, groups not needing subsidies benefit from them, while those who do need them fail to gain in terms of an increased share in the prosperity of the country.
- Third, they result in energy waste and related negative impacts on the environment.

4. ***Non-technical losses and non-collection rates are too high.*** One of the preliminary findings of the ongoing WEC study suggests that, for many countries, the reason why energy providers lose money is very often not that prices are set too low, but rather that non-technical losses and non-collection rates are too high. In some countries, these two elements taken together represent up to 50% of the total costs of the energy providers. Such a level of losses often outweighs the total of producer and consumer subsidies in such markets.

   In WEC's view there is no larger and no worse subsidy, in practice, than that which occurs when no payment is made for an energy product or service.

3.2 Some Principles on Pricing Energy in Developing Countries

With these observations in mind, WEC has identified some principles to improve energy pricing and subsidisation in developing countries.

Full Cost Recovery and Adequate Cost of Service Determination

In all circumstances, prices should be set at a level which allows energy providers to recover the long run marginal cost of delivering the service, including a fair return on investment. In order to accomplish this, governments, regulators and utilities (whether publicly or privately owned) must implement cost of service determination to calculate the actual long run marginal cost of delivering energy to each customer category, based on usage patterns, in order to quantify tariffs for each category. Lack of costing transparency and an inadequate costing structure are major hindrances to achieving a sustainable energy system.

Full fuel cost accounting should be applied to all energy sources so that all availability and acceptability costs are included in consumer prices. For fossil fuels, for example, this ought to include the costs of emissions mitigation or sequestration. There are several techniques that may be considered for the incorporation of such costs in final energy prices, including taxation, regulatory charges and consumer levies.

WEC does not favour carbon taxation because the cost of carbon is not yet measurable. As the heavy taxation of some petroleum products in certain markets shows, it is often very difficult to manage such tax revenue for dedicated environmental or other purposes, or to respond quickly to an upward shift in international prices (especially for oil). Impartial, transparent regulatory charges, such as those applied to nuclear power to provide for waste management and decommissioning costs, are a simpler route. Such charges are determined by regulators, and are fully reflected in the price of the power or energy service. The revenues raised appear in the balance sheets of the energy companies, and it can be ensured that they are used for the specified purpose.

Marginal Cost Pricing and Opportunity Cost Pricing

The concept of marginal cost pricing is useful in attempting to optimise the allocation of resources. However, the higher tariffs that may result from the application of this principle could be detrimental to a country's industrial competitiveness or might deprive lower income consumers of an essential service. In any case, marginal cost valuation provides valuable guidance in establishing the tariff structure even if the level of marginal costs is not totally recovered in the average tariff.

To provide an extra assurance that prices are not out of line with neighbouring or international markets, the opportunity cost (especially for globally or regionally tradable commodities) should be verified and considered. Once the role of opportunity cost is acknowledged, it is important to recognise that some countries or suppliers may benefit from site-specific advantage, meaning that they are naturally endowed with abundant or more accessible energy resources. Provided energy prices are consistent with long run marginal cost, selling such energy at a lower price domestically than might be paid in neighbouring markets should not be automatically considered a subsidy.

Metering, Billing and Collection

A major issue in many developing and transitional economies is not that electricity tariffs are set too low but rather that there are major deficiencies or incapacities in metering the energy consumed, billing the energy delivered, and collecting payment. The maximum possible reduction in non-technical losses and non-collection rates represents the best "return" in terms of addressing the financial health of the energy provider, the efficiency of the energy system, and the prosperity of the country.

Action on metering (established collectively for a defined market or for individual households, depending on the cost) and separate per user billing and collection would increase receipts for numerous utilities in developing countries and economies in transition by between 25% and 50%. This would allow a reduction in tariffs for industrial users and new residential connections, or, at the very least, would allow increases in tariffs within a programme of market reforms to be held to a minimum.

Producer Subsidies

Producer subsidies should be avoided. They are generally more difficult to justify than consumer subsidies since they are targeted at a limited interest group. They are usually defended on the grounds that they help maintain energy security or

certain levels of domestic production, that they counter certain natural monopoly effects, that they ensure a diversification of energy sources, or that they maintain local employment.

Some argue that producer subsidies for renewables may be justified in terms of energy availability (increased diversity of energy portfolios) or energy acceptability (mitigation of emissions). It is also recognised that the relatively high capital cost and low operating cost structure of most renewable technologies compared to most non-renewables puts them at a disadvantage in terms of risk structure, financing and competitiveness, especially in deregulated markets. WEC would only add that if such subsidies are implemented, they should have a firm sunset provision and the cost of backup electricity for intermittent renewables must be taken into account.

Consumer Subsidies

Some types of temporary consumer subsidies can be justified in specific market situations if the goal is to ensure energy accessibility and acceptability for the two billion people in the world without commercial energy, especially for the very poorest people in developing countries. Where governments have social equity in mind, they may seek to provide a basic supply of commercial energy to all of their people at an affordable tariff. Depending on the country, revealed end-user prices are not the only consideration. One ought also to look at the percentage of disposable income that people spend on energy, in terms of purchasing power parity. If the lower-income section of the population cannot afford basic energy services, a situation which creates negative impacts on health, education and economic development, then temporary "lifeline" rates might be required.

In order to break the cycle of inefficient energy supply or traditional fuel use, the fixed costs of extending the gas or electricity grid, or of providing distributed generation where no grid exists, might be borne by the government through dedicated funding, and connection costs might be partially or totally absorbed by the service provider. Beyond the cost of connection, subsidisation of the commodity component, if required, should be carefully designed within baseline tariffs and applied to a limited number of units (using capacity meters, for example) to prevent overuse and waste. In-kind subsidies should be avoided, as consumer subsidies often result in perverse effects when usage cost is not related to actual consumption.

Well-defined cross-subsidisation might be justified in order to extend access and affordability. This can occur through tariff standardisation within a given customer category (for example, there is an implicit subsidy when rural consumers pay the same price as urban consumers, because the cost of delivery is much higher for rural areas) or through progressive tariffs within a category. Subsidies between customer categories are also frequent, but have the disadvantage of not taking into account ability to pay or the level of consumption. Accurate definition of the beneficiary category is hence of utmost importance. It is important to note, however, that cross-subsidies aimed at keeping prices low for one sector of the economy could result in harmful distortions not only in the energy market but also in other sectors of a country's economy. In most countries covered by the WEC study, the pattern of cross-subsidies suggests that the commercial sector carries the burden for the agricultural sector, rather than for the residential sector.

The danger of subsidy capture can be addressed by transparency and diligent monitoring, to ensure that the subsidies are going to those who need them most and to control their overall cost. The application of some type of sunset provision to every subsidy established, especially in terms of new connections and affordability, would allow for periodic publicly debated checks. Hence, consumer subsidies, if they can be justified, should be explicit, targeted and transparent.

3.3 Conclusion

Energy pricing in developing countries should be based on the principles of the recovery of the long run marginal cost, of including environmental and other externalities where they are identified and measurable, and of providing commercial energy access for everyone. Such pricing will affect demand in the medium and longer term, and will contribute to rational energy use, to an increase in economic efficiency, and to greater prosperity.

Marginal and opportunity cost pricing provide a rationale for appropriate energy tariff levels and structures. Social, economic and fiscal measures (based on the taxation and distribution policies of governments) are important in offsetting the impact on the most vulnerable segments of the population of increases in energy prices which might result from market reforms.

It is a priority for governments in developing countries to work with energy providers to establish a payments system for energy services and to reduce or eliminate non-technical losses. The main issue, in varying degrees, is to ensure that all energy users perceive that the regular payment of their energy bills is an unavoidable obligation, however small the amount charged.

Government or regulatory intervention in energy pricing mechanisms may be justified to address certain externalities or to achieve certain social or long-term goals. Energy subsidies, which may be necessary, must benefit those who really need them and should enhance the accessibility, availability and acceptability of energy services. Such subsidies should be visible in terms of their size, transparent in terms of their sources and beneficiaries, and subject to review within a prescribed time period.

ANNEX I. STUDY GROUP MEMBERS

Rajendra Singh	Chairman of the Study Chairman, Gujarat Positra Port Infrastructure Ltd., India
Daniel Dumas	Director – World Energy Council
F Abdallah Abu-Neima	Planning & Economic Studies, Managing Director, Ministry of Electricity & Energy, Egypt
Yves Albouy	Energy Adviser, World Bank/IBRD
Eng. Ahmad Bashir	Secretary General, Ministry of Energy & Mineral Resources, Egypt
Mohsen Bakhtiar	Vice Director General, Ministry of Energy, Iran
Juan Vega Cervera	Professor, University of Extremadura, Spain
Deon Conradie	Electricity Pricing Manager, ESKOM, South Africa
Latsoucabé M. Fall	Secrétaire Général, Comité National Sénégalaise/CME, Senegal
Derrick Fielden	Manager, Commonwealth Development Corporation, UK
Dominique Finon	Directeur, IEPE, France
Kwok Wing Ho	Acting Int. Bus. Admin. Manager, CLP Power Hong Kong Limited, Hong Kong, China
Hermann Holfeld	Director, Siemens Nuclear Power, Germany
Syaiful Bakhri Ibrahim	General Manager, PT. PLN (Persero) Centra Java Division, Indonesia
Yonghun Jung	Asia Pacific Research Centre, Japan
Cetin Kayabas	Assistant Manager, TEAS Corporation, Turkey
Mico Klepo	Energy Management & Organisation, Head, Hrvoje Pozar" Energy Institute, Croatia
Habib M'Laouah	Directeur, S.N.D.P. AGIL, Tunisia
Andres Matas	Director, Planning Manager, CVG Electrificación del Caroni C.A., Venezuela
Fanile Mathangwane	Principal Energy Officer, Energy Affairs Division, Botswana
Norberto de Franco Medeiros	Financial Director, FURNAS-Centrais Eletricas S.A., Brazil
Vedamoorthy Namasivayam	Partner, Price Waterhouse Associates Private Ltd., India
Ratanapong Jongdamgerng	Director, Electricity Generating Authority of Thailand, Thailand

Renato Soares Sacramento	ELETROBRAS S.A., Brazil
Henry D Shongwe	Senior Energy Officer, Ministry of Natural Resources & Energy, Swaziland
Venislav Tsanov	Budget, Price & Tariff Policy, Director, Committee on Energy, Ministry of Energy, Bulgaria
Adrian H M Verkooijen	Director, Delft University of Technology, Netherlands

ANNEX II. PRICING APPROACHES UNDER DIFFERENT MARKET STRUCTURES:
ELECTRICITY SUPPLY INDUSTRY

	Monopolistic		**Transition**	**Competitive**	
	Administered Prices	***Price Control Regulation***	***Reregulation Process***	***Wholesale Competition***	***Retail Competition***
Industry Structure	▪ Vertical integration of generation, transmission and distribution ▪ Vertical integration of generation and transmission only.		▪ Unbundling of generation, transmission and distribution segments of the industry. ▪ Competition in generation.	▪ Generation, transmission and distribution are unbundled. ▪ Competition in generation; access to transmission network; electricity pool.	▪ Generation, transmission and distribution are unbundled. ▪ Competition in generation; access to transmission and distribution network; electricity pool.
Utility ownership	▪ Public sector ownership is dominant.		Increase in private sector participation.	▪ Private sector ownership is dominant.	
Price Regulation Regimes	▪ Generation and retail prices	▪ Generation and retail prices are regulated by the government ▪ Rate-of-return (ROR) ▪ Price-cap (PC) ▪ Revenue-cap (RC) ▪ Sliding Scale (SS) ▪ Hybrid (H)	Generation, transmission and retail prices are regulated. Adoption of a transparent price regulation regime. In many developing countries undergoing transition or considering transition, price-cap regulation appears to be popular.	▪ Generation prices are either regulated or not regulated; transmission prices are regulated; retail prices are regulated; based on the existing price regulation regime.	▪ Generation prices are either regulated or not regulated; transmission and distribution prices are regulated; retail prices are not regulated. ▪ Regulation is based on the prevailing price regulation scheme.
Pricing Objectives	▪ Seek to balance the following objectives: economic efficiency, financial viability and social policy objectives.		In pursuit of economic efficiency and financial viability.	▪ Economic efficiency and financial viability.	
Price Discrimination	▪ Price is determined by the government, price determination is either transparent or opaque. ▪ In transparent schemes, they are indexed either on LRMC or average costs and sometimes adjustments are made to accommodate SRMC changes (TOU or TOD). ▪ In opaque schemes, prices are sometimes influenced by the social objectives in energy pricing. For instance, prices are subsidized.	▪ Rate-of-return - Electricity price corresponds to the operating cost plus the allowed asset rate of return. ▪ Price-cap - Costs are based on either average cost or LRMC. Future price is set based on the adjustment factor CPI-X. ▪ Revenue cap - Fixed amount of revenue is allowed. ▪ Sliding scale - excessive profit or abnormal loss is shared by regulator and utility. ▪ Hybrid - Mixed elements of other regimes.	▪ Electricity prices are unbundled. ▪ Generation, transmission and retail prices are determined according to the type of price regulation adopted by each country. ▪ In the transition phase, cross-subsidies are normally removed. ▪ TOU or TOD schemes are sometimes introduced.	▪ Wholesale prices are market-determined which approaches to SRMC. ▪ Peak-period price adjustment is sometimes done to reflect "reliability adjustment". ▪ Other components of electric industry are price regulated - according to the type of price regulation adopted by each country. ▪ Stranded costs recovery are also provided.	▪ Wholesale and retail prices are market-determined which approaches to SRMC. ▪ Peak-period price adjustment is sometimes done to reflect "reliability adjustment". ▪ Other components of electric industry are price regulated - according to the type of price regulation adopted by each economy.
	In developing economies, either prices are administered or regulated, cross subsidies (either among consuming sectors, geographic regions, or between rural and urban consumers) are prevalent. In several developing countries, a price adjustment mechanism is put in place to automatically adjust electricity prices due to the fluctuation of input prices.				

Source: Overview of Energy Pricing Practices in the APEC Region