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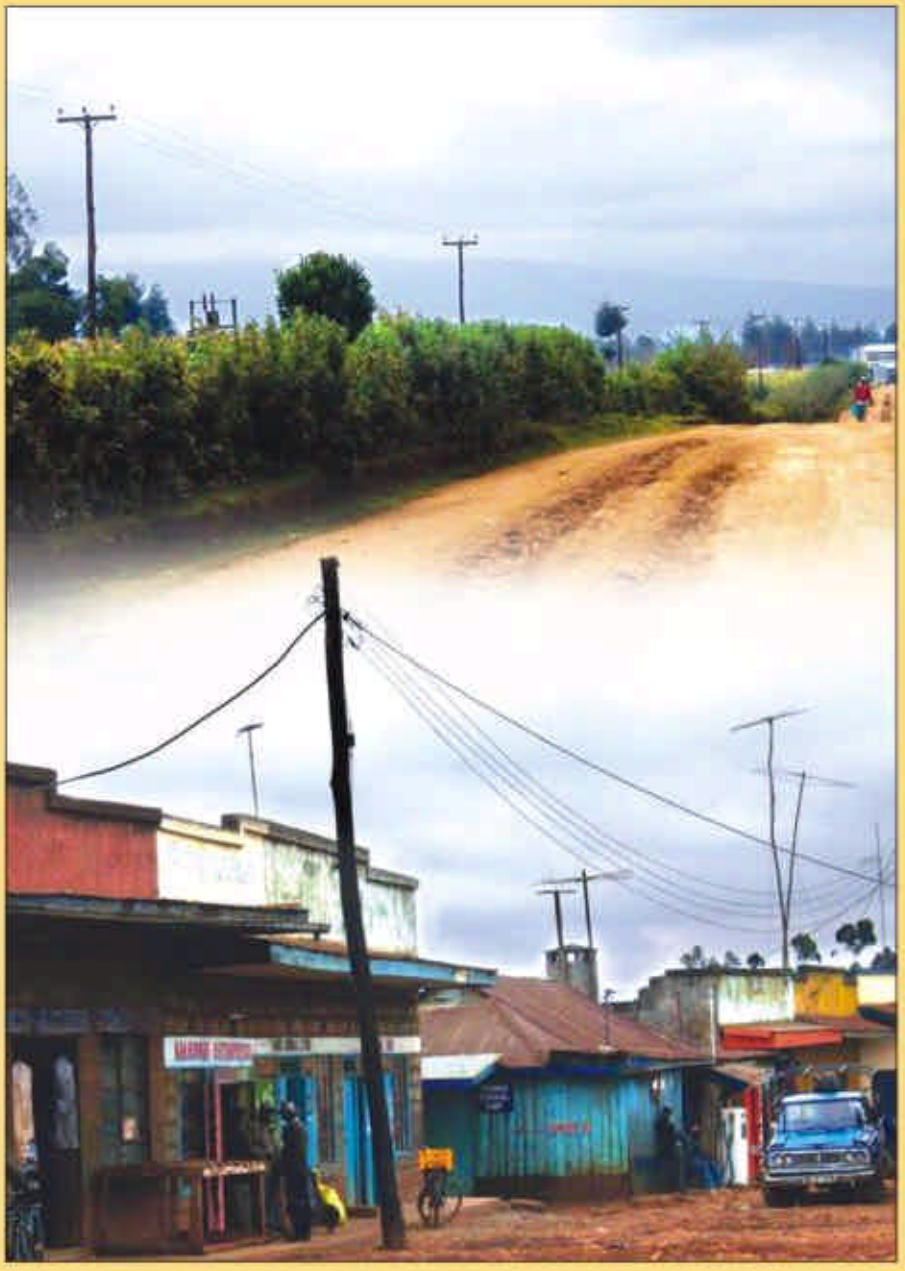

Special issue on power sector reform and its impact on the poor

A collection of articles compiled from case-studies on Kenya, Uganda, Zimbabwe, South Africa, Bangladesh, Thailand, the Philippines, India, Argentina, Peru, El Salvador and Brazil

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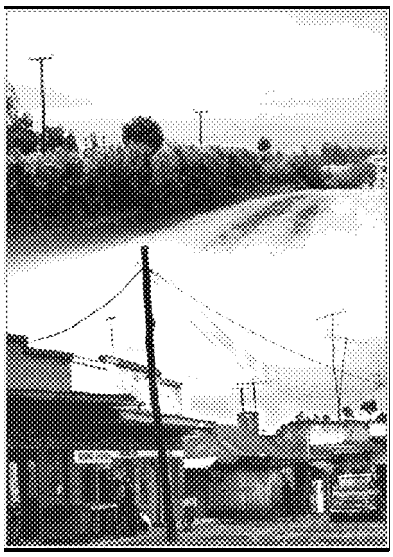
Special issue on power sector reform and its impact on the poor

Energy for Sustainable Development

Cover illustration:

This issue looks at power sector reform and how it has affected electrification for the poor in developing countries. In much of Asia, Africa and Latin America, only small numbers of the poor, especially the rural poor, have access to electricity. For instance, only about 1 % of rural households in Kenya have access to electricity. The illustration shows two scenes of rural electrification in Kenya. See "Have power sector reforms increased access to electricity among the poor in East Africa?", Page 10.



Editors' introduction

Articles

Energy for Sustainable Development

Notes on the preparation of articles, letters, etc.

Authors wishing to have articles, letters, and reviews published in Energy for Sustainable Development should send them to the Editor in Eindhoven, The Netherlands. All other categories of material should be sent to the Executive Editor in Bangalore, India.

Four copies of the material must be sent. The material must not have been sent for publication in any other journal.

Readership: The journal is directed towards all actors involved in the planning, decision-making, financing, establishing, managing, operating and using of energy systems of developing countries. This means that though the preoccupation is with the energy systems of developing countries, the readership is expected to come both from the South and the North.

Scope: The journal will view energy, not as an end in itself, but as an instrument of sustainable development. It will be directed to energy services, rather than the magnitude of energy consumption, as the measure of development.

The editorial board wishes particularly to encourage papers

i) likely to be of interest to more than one professional group.
ii) summarising, at a sufficiently technical level, work done on special projects of interest.
iii) offering extensive critical reviews.

ESD considers the publication of highly specialized work more appropriate to the many professional journals already being published. The criteria for acceptance of papers in the journal are therefore breadth of interest, irrespective of whether the paper reports research or development, theory or experiment, original work or review, and quality of work reported and its presentation (text, diagrams, etc.). It is important that authors write with clarity and simplicity to cater for readers for whom English is just a second language. The contributions (especially articles and letters) will be selected for publication on the basis of editorial assessment and reports from independent referees.

Categories of manuscript:

News: Brief reports highlighting certain happenings in the areas of concern of the journal, including descriptions of meetings/short courses on energy or new products in the field of energy.

Correspondence: Critiques of articles/reports in previous issues or some item of interest to the envisaged readership of the journal.

Articles: These are reports of research or innovative projects that have produced significant results/benefits or exhaustive reviews of research and will be limited to about two or three per issue. Normally the journal expects to commission these, but suggestions from the readers, accompanied by a one-page synopsis, would be most welcome. The length of these is negotiable, but under no circumstance should it exceed 10,000 words with about 50% extra space available for display items such as photographs, cartoons, technical drawings, graphs and tables.

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Product/technology/policy reviews

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Typescript: All parts of the script must be typed double spaced on one side of white bond paper of A4 (297×210mm) or quarto (280×215mm) size. A 4 cm margin must be provided for insertion of printer's instructions.

The text for articles must be divided into sections, generally starting with an introduction before the first section, and ending with ''Conclusions''. The main sections should be numbered 1, 2 etc., sub-sections 1.1, 1.2, etc. It should be preceded by an abstract of about 300 words.

Tables must be numbered consecutively in arabic numerals in the order of occurrence in the text. They should be self-contained and have a descriptive title.

Figures, including photographs which must be glossy prints (preferably black and white), should be numbered consecutively in arabic numerals in the order of occurrence in the text. Line drawings must be in Indian ink on good quality tracing paper or Bristol board, preferably of the same size as the text paper. Only photocopies of the figures and photographs should be sent to the Editor along with the manuscript. The originals should be sent directly to the Executive Editor at Bangalore, India, after acceptance of the article.

Units and associated symbols must invariably follow SI practice.

References should be cited in the text by author and year, not by number. If there are more than two authors, reference should be to the first author followed by et al in the text. References at the end of the paper should be listed alphabetically by authors' names, followed by initials, year of publication, title of the article, name of the journal (abbreviated according to standard practice), volume number, and numbers of first and last pages. References to books should include: name(s) of author(s), initials, year of publication, title of chapter (if any), title of the book, edition if not the first, initials and name(s) of editor(s) (if any) [preceded by ed(s)], place of publication, publisher, and chapter or pages referred to. References to theses must include the year, the title of thesis, the degree for which submitted and the university.

Notes must be avoided if possible but when necessary should be numbered consecutively, and should appear at the end of the article.

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This special issue of *Energy for Sustainable Development* on power sector reform and its impact on the poor comprises articles prepared by institutions in the Global Network on Energy for Sustainable Development (GNESD). The GNESD, created in 2000 at the World Summit on Sustainable Development (WSSD)[1], promotes sustainable development through policies and solutions that expand the poor's access to sound energy services. The articles are based on a study undertaken by GNESD's "Energy Access" Working Group, which has been assessing the impact of reforms on the poor in the developing regions and determining what approaches are more successful in safeguarding their access to energy.

1. Scope and structure of the issue

About 2.7 billion people, close to half of the world's population, are estimated to survive on less than US$ 2.00 per day[2] – the "poor" as defined by international agencies such as the World Bank, International Energy Agency, United Nations Development Programme, United Nations Environment Programme and Organisation for Economic Cooperation and Development [Ravallion, 2004]. A key distinguishing feature of the world's poor is inadequate access to cleaner energy services (Figure 1). The majority of those earning less than US$ 2.00 per day (an estimated 2.4 billion people) rely on traditional biofuels to meet the bulk of their energy needs [GNESD, 2003; WEC, undated].

Furthermore, an estimated 57 % of the world's poor (about 1.6 billion people) do not have access to electricity (Table 1) and a significant proportion have limited or no access to cleaner and more modern fuels such as kerosene, LPG and natural gas.

The poor in developing countries face, inter alia, three key energy challenges:

- reliance on biofuels that harm human health and the environment;
- inadequate access to cleaner energy services, such as electricity, for productive purposes and institutional applications;
- incomes that are too low (as well as limited access to appropriate financing schemes) to allow the poor to procure cleaner and more sustainable energy services, such as electricity, that are more expensive[3].

In the last two decades, developing countries have implemented a wide range of energy sector reform initiatives, which were expected, inter alia, to address some of the above concerns. Initial indications from a wide range of developing countries, however, seem to indicate that few of these reform initiatives have resulted in significant improvement in the provision of cleaner energy services to the world's poor.

What is particularly worrisome about the above challenges is the deterioration in some countries in quality and reliability of energy services available to the poor in spite of numerous energy reform initiatives. This is particularly true in sub-Saharan Africa (and parts of Latin America and the Caribbean, Middle East, and South Asia) where reliance on traditional biofuels is increasing and the proportion[4] of *unelectrified* people (the terms ''electrified'' and "unelectrified'' in this paper and others in this issue are applied to people who live in electrified/unelectrified homes) continues to grow.

Some analysts contend that far from reducing energy poverty, market-oriented reforms may have increased energy poverty in parts of the developing world [Wamukonya, 2003; Lash, 2002; Bouille et al., 2002; Dubash and Rajan, 2002]. The analysts argue that from the onset, energy reforms were not designed to address the energy problems of the poor but were explicitly aimed at improving financial and technical efficiency of utilities, facilitating divestiture and guaranteeing future energy supply in

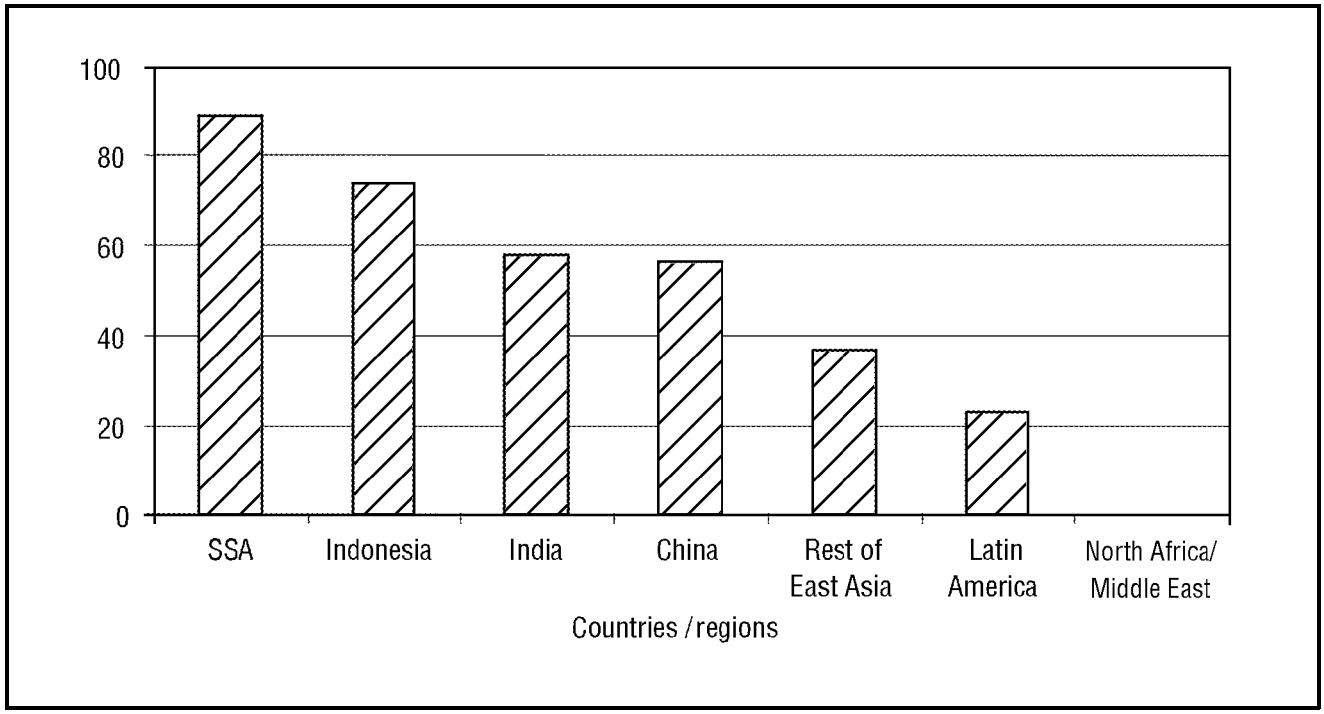

Figure 1. Proportion of population relying on biomass for cooking and heating (2000)

Sources: IEA, 2002; Overend and Craig, undated; Best and Christensen, undated

Note

SSA: Sub-Saharan Africa

Table 1. Urban and rural electrification levels (2000)

	Urban (%)	Rural (%)	National (%)
Developing countries	85.6	51.1	64.2
Middle East	98.5	76.6	91.1
East Asia/China	98.5	81.0	86.9
Latin America	98.0	52.4	86.6
World	91.2	56.9	72.8
South Asia	68.2	30.1	40.8
Africa	63.1	16.9	34.3
Sub-Saharan Africa[1]	48.9	9.9	21.7

Sources: World Bank, 2003; World Bank, 2004; IEA, 2002; GNESD, 2003; EDF Group, 2002.

Note

1. Excluding South Africa

an open globalized energy market [Wamukonya, 2003; Byrne and Mun, 2003; Fall and Wamukonya, 2003; Agbemabiese et al., 2003; Lash, 2002; Bouille et al., 2002; Dubash and Rajan, 2002; Edjekumhene and Dubash, 2002].

An assessment of available literature reveals that, in the past, attempts have been made to study the impacts of energy sector reforms. However, most of these have focussed on the effects of reforms on the performance of power utilities and, to a limited extent, on electricity tariffs. Few studies have attempted to assess the impact of reforms on the poor or to provide empirical evidence of such impacts. The investigations of the GNESD "Energy Access" Working Group[5] have resulted in detailed case-studies designed to address this important gap.

The primary objective of the "Energy Access" Working Group was to examine the impact of energy sector reforms on the poor by responding to the following two key questions.

- Have previous energy policy reforms addressed the "energy access" challenge facing the poor or have the reforms actually contributed to the growing problem of inadequate energy services for the poor in the developing world?
- On the basis of rigorous analysis, which are the proven and robust policy options that would lead to improved, cleaner and more sustainable energy services for the poor in developing countries?

The articles in this special issue are arranged into three sections: (1) case-studies from Africa; (2) case-studies from South and South-East Asia; and (3), case-studies from Latin America and the Caribbean. The key component linking all the articles in this issue is the focus on electricity access among the poor.

2 Case-studies from Africa

There are two articles covering the African region. A total of four country case-studies are drawn from East Africa and Southern Africa.

The first article on East Africa authored by Karekezi and Kimani is based on country case-studies of Kenya and Uganda. The article provides an overview of the status of poverty levels in East Africa. It highlights that poverty levels are very high, particularly in the rural areas.

For instance, in both Kenya and Uganda, virtually the entire (100 %)[6] rural population falls under the US$ 2 per capita per day poverty threshold. Consequently, the rural population has been used as a proxy for the poor in this article.

The article reveals that only 1 % of the rural households in Kenya and Uganda have access to electricity – implying that very few of the poor are electrified. The two country case-studies demonstrate key shortfalls in the provision of electricity to the poor. First and foremost, the amended Electricity Acts do not sufficiently address the issue of the electrification of the poor (e.g., proposing new and innovative initiatives that would increase electrification of the poor). Secondly, the utilities, ministries of energy and regulatory agencies make no attempt to track electrification of the poor. Thirdly, the sequence of power sector reform measures appears to have been detrimental to electrification of the poor. In both countries, the rural electrification challenge was only addressed at the end of the reform process. Fourthly, reforms also appear to have failed to link rural electrification to the overall strategy of improving the performance of the electricity industry. Lastly, current rural electrification targets are very low and would leave well over 80 % of the rural population with no electrification even if the targets were realized.

The East African article highlights the lack of sufficient data to ensure comprehensive assessment and conclusions regarding electricity access among the poor. Nevertheless, from available data it tentatively concludes that although some of the reforms have a positive outcome, the analysis presented demonstrates that they have not led to significant electrification of the poor. As a result, only a comprehensive transformation of ongoing power sector reform efforts could improve the situation and lead to greater electrification of the poor. The article ends with some suggestions on how reforms could be amended to ensure greater access to electricity among the poor in East Africa.

The second article authored by Ogunlade and Mwakasonda presents the Southern Africa case-studies of South Africa and Zimbabwe. In spite of the limited data available on the electrification of the poor, the case-studies offer two different pictures of how government policy intervention can help to improve electricity access among the poor and disadvantaged groups. Both South Africa and Zimbabwe have embarked on power sector reforms against a historical background in which a large majority of their citizens were deprived of electricity and other services on racial grounds. Addressing this deficiency has called for rapid and ambitious electrification programmes.

The South Africa case-study discusses the major changes, including in the energy sector, that the country is going through following the democratic elections in 1994. Government policy in this country is emphatic about addressing the enormous disparities in income levels and living conditions between the different racial groups as a result of apartheid. Consequently, the new government embarked on a rigorous electrification programme whose objective was to increase electricity access among the poor and other disadvantaged groups. This article assesses the impact of the South African government's newly introduced subsidy on electricity consumption targeted at making electricity more affordable by the poor.

In the Zimbabwe case-study, it is noted that the country manifests significant levels of poverty which can be traced back to the country's history of governance by the minority white government. After independence in 1980, the government embarked on policies aimed at redressing imbalances of the past. This led to electrification programmes aimed at increasing electricity access for the previously disadvantaged people through expansion of grid electricity and off-grid electrification.

An emerging trend in South Africa and Zimbabwe is that, in spite of having gained independence during a time when privatization and pro-market reform of the power sector were sweeping the continent, they both did not commence pro-market reforms until after undertaking substantial electrification. This appears to reflect the experience of other countries with high electrification levels such as Mauritius and supports the thesis that it is best to embark on electrification of the poor before (or at least, at the same time as) the initiation of pro-market reforms such as privatisation.

3. Case-studies from South and South-East Asia

This special issue contains two articles on South and South-East Asian case-studies. One of the articles covers India and the Philippines while the other is on Thailand and Bangladesh.

Authored by Sihag, Misra and Sharma, the article on India and the Philippines assesses the impact of power sector reforms on access, quality and reliability of electricity available to the poor. This article investigates these issues in a systematic manner by critically examining the impact of reform processes adopted in three selected states in India and in the Philippines on electricity access among the poor. The article, however, highlights lack of data on the electrification of the poor as a key limitation to carrying out a comprehensive assessment.

On available data and information, the authors observe that the Indian reform legislation has focused on improving financial viability of the ailing power sector at the expense of improving access to electricity. The legislation does not explicitly spell out the provisions for the extension of electricity services to the poor and the need and mechanism for subsidizing marginalized consumers. In contrast, the Philippine reform legislation has provisions for lifeline tariffs, cross-subsidies, subsidies and the expansion of the electricity grid. The Philippine reform legislation stipulates a definite time-frame for the elimination of cross-subsidy and at the same time it ensures subsidized rates for the identified poor.

The article on the Indian and Philippine case-studies recommends proactive legislation that addresses access to reliable and affordable sources of electricity for the poor. For example, the establishment of legislative and policy support for mechanisms such as the provision of lifeline

rates and electrification of special functions such as missionaries is required to effectively meet the electricity needs of the poor.

The second article on South and South-East Asia is authored by Shrestha, Kumar, Sharma and Todoc. It discusses the institutional reforms for rural electrification (RE) in Thailand and Bangladesh. In both countries, rural electrification programmes commenced in 1977. In Thailand, the electrification programme led to an increase in electricity access among rural households from 19 % in 1978 to about 97 % by the year 2000. In Bangladesh, however, rural electrification rose from a negligible level to only 19 %.

The article identifies three key factors affecting the achievements of the rural electrification programmes in the two countries. First and foremost was adequate electricity generation capacity. In Thailand, the generation capacity was sufficient to meet the growing demand from expansion in the distribution network, whereas in Bangladesh, inadequate generation capacity appears to have affected rural electrification.

Secondly, the ability of the electricity distribution utilities to recover their costs appears to have been an important factor. In Thailand, the revenue from electricity sales fully covered the utilities' operational costs, allowing the utilities to use the available financial resources to invest in grid extension. In Bangladesh, the utilities suffered financial losses which affected the availability of financial resources for grid extension.

Thirdly, high economic growth in the case of Thailand appears to have promoted rural electrification by increasing the purchasing power of customers as well as increasing the resource base of the commercial and industrial electricity consumers. On the contrary, economic growth in Bangladesh was low, contributing to low rural electrification levels.

The article alludes to the lack of income-differentiated data to undertake the requisite assessment. However, available data enables the article to reach some conclusions. In Thailand for example, the article concludes that the market-oriented reforms (i.e., privatization of generation and tariff reforms) that took place in the 1990s appear not to have affected the electrification levels and average household electricity consumption among the poor. This is largely due to the fact that market-oriented reforms were introduced at a time when the majority of the poor already had access to electricity.

In Bangladesh, the article concludes, the low rural electrification levels – compared to Thailand – are largely attributed to the poor financial performance of the electrification entities. On one hand, the rural entities had a very large number of domestic consumers paying for electricity at subsidized tariffs. On the other hand, the commercial and industrial customers were too few to provide sufficient revenue to cover the subsidies given to the domestic consumers. Consequently, the electrification entities ended up incurring financial losses, hence having limited resources available for new investment in rural electrification.

4. Case-studies from Latin America and the Caribbean

This is the last section of the special issue and it contains two articles. The first article covers case-studies of Argentina, Peru and El Salvador while the second covers Brazil.

Authored by Kozulj and Di Sbroiavacca, the first article assesses the impact of power sector reforms on the poor. The article highlights the absence of the requisite data to adequately assess the impact of reforms on the poor. In addition, the article discusses other challenges that further complicate the attempt to assess the impact of power sector reforms on the poor.

The first challenge that the article highlights is the peculiar nature of poverty in the Latin America and the Caribbean (LAC) region compared to other parts of the developing world. The peculiarity of the LAC region stems from fact that the number, in absolute terms, of the poor living in urban areas appears to be higher than in rural areas. By contrast, in other parts of the developing world, the bulk of the poor are in rural areas.

Secondly, the authors emphasize the difficulty of analysing direct impacts of power sector reforms on energy access for the poor. This is due to the fact that most of the indicators used in the assessment could be the result of other explanatory variables and not directly linked to sector reforms. For example, the growth of electrification rates could be the result of other factors such as the saturation level of the demand and urbanization processes, and not an outcome of reforms.

On the other hand, indicators of the impact of power sector reforms on electricity consumption and tariffs clearly show the negative effect of reforms on the poor. In addition, the case-studies also reveal more subtle links between energy and macroeconomic reforms. This is particularly so because in this region, monetary appreciation (or overvalued currency) brought about the possibility of artificially establishing high profitability levels for privatized companies. Conversely, the macroeconomic impact of such monetary appreciation was the creation of a large mass of unemployed people as a consequence of the substitution of local production by imported goods. This also led, then, to the creation of foreign debt, unemployment, devaluation and structural poverty. The authors conclude that the incidence of this indirect impact is much more significant than that of the direct impact of power sector reforms on the poor.

The second article on Latin America and the Caribbean is on the Brazilian case-study. The article is authored by Goldemberg, La Rovere and Coelho and argues that the privatization of distribution and generation sub-sectors that took place in the early 1990s paid little attention to the expansion of the services to low-income and rural areas. For example, there were no incentives for electrification of low-income households and rural areas.

An assessment of recent legislation carried out in the case-study provides convincing evidence that explicit and pro-poor measures are required to ensure that power sector reforms protect the interests of the poor. For example,

in 1996, a decree (Law 9427) was passed stipulating that half of the Reversion Global Reserve (RGR) – a fund for grid expansion and rural electrification – be directed to the regions with lowest electrification levels while the other half be allocated to rural electrification, energy efficiency, and electrical power for low-income users.

Another law was passed in 1996 compelling concessionaires to meet the full up-front cost of new connections. Furthermore, Law 10,438 was passed in 2002 to tighten universal service obligations on concessionaires. This law provided for reduction of the tariffs for low-income consumers as well as electrification targets for concessionaires.

This article extensively discusses two initiatives aimed at increasing electricity access among the poor, especially in rural areas. One of the initiatives is PRODEEM, whose mission is to provide viable decentralized electricity services using renewable and other sustainable energy sources. The other initiative is the *Luz no Campo* (Portuguese for "light in the countryside") – an ambitious programme expected to finance grid extension to a million new rural customers.

The article concludes that the power sector reform process did not initially focus on expanding electricity access among the poor, especially through the concessionaries. In addition, the regulatory agency was unable to maintain electricity tariffs within inflation levels. Consequently, significant tariff hikes implied that the poor were severely affected.

5. Key common findings

Virtually all the case-studies stress that the poor quality of data sets dividing electricity consumers specifically into "poor" and "non-poor" categories is an obstacle to the gathering of reliable empirical data on electrification. For some studies, this is interpreted as a strong indication that the poor have generally been overlooked in the reform process. This is a crucial data gap that needs to be filled to allow fully reliable assessment of access to electricity, and to strengthen the basis for policy recommendations.

The limitation in available data implies that the conclusions drawn from the case-studies' findings cannot be fully conclusive. Because of the lack of reliable empirical data on electrification mentioned above, some of the studies used proxies which can only provide general trends. A number of the case-studies assessed only one reform option. This approach is constrained by the difficulty in distinguishing the effects of a single reform option from others put in place, especially where several options have been effected in a short span of time. As stressed by the Argentine case-study, the impact of macroeconomic reforms can cloud attempts to discern the impact of power sector reforms.

From the data and information available in the regional reports, the key common findings and conclusions of the articles in this issue yield some important insights. First and foremost, in spite of the paucity of data mentioned above, almost all the reports tentatively conclude that, on available empirical evidence, market-oriented reforms have had either a neutral or an adverse impact on the poor and should be redesigned especially if the reforms are to be justified under a poverty reduction agenda. The key identified negative impacts on the poor include:

- reduction in electrification rates;
- increased tariff levels; and,
- decline in electricity consumption.

On the other hand, the articles also indicate that not all forms of reforms have been detrimental to the electrification of the poor[7]. Reforms in the Philippines, Thailand and South Africa have produced some positive results for electrification of the poor. Although they have implemented a variety of reforms and have used different systems to manage delivery of services, they have in common a high level of government involvement and special focus on protecting the interests of the poor.

Secondly, reforms introduced rural electrification funds and other mechanisms for financing capital investment for rural electrification. In many countries, however, the Acts are not explicit on how the agencies responsible for managing the funds would account for the additional financing resources. In other words, the funds for electrifying the poor have not been protected – "ring-fenced"[8]. Among the country case-studies examined in the "Energy Access" study, Brazil and South Africa emerge as model examples of how to ring-fence the funds for electrification of the poor.

Third is the question of whether it is best to embark on wide-scale electrification of the poor before privatisation or vice versa – privatising and thereafter launching an electrification programme. Although the GNESD "Energy Access" study was not designed to address this question, the findings of some of the regional studies provide some indication that the sequence of reforms is important.

Fourthly, with the exception of a few countries, reforms in most of the countries examined by the articles in this issue did not provide an explicit focus on the poor. This finding is shared by other analysts who argue that, generally, past reforms have not been designed to address the energy problems of the poor.

Lastly but by no means least, a key finding of the articles is that, apart from ensuring explicit focus on the poor, involvement of the poor in the electrification process appears to be equally important. With the exception of South and South-East Asian countries, there appears to be limited involvement of the poor in other regions covered by the articles in this issue.

To sum up, the various countries studied in this special issue appear to be at different stages of reforms as well as levels of electrification. This provides a useful opportunity for different regions to learn from each other. Specifically, the key findings of most articles provide valuable lessons for sub-Saharan Africa (and, to some extent, South Asia) – the least electrified region which is yet to implement many of the reforms effected in other regions of the developing world.

An important lesson from the Asian case-studies is that the sequencing of reforms is key: the establishment of structures and mechanisms for increased electrification of

the poor, particularly in rural areas, ought to be in place before (or at least at the same time as) initiation of large-scale market-oriented reforms such as privatization. Thailand and the Philippines initiated market-oriented reforms such as privatization well after establishing independent rural electrification agencies that ensured rapid rural electrification.

Secondly, the poor should be involved in the electrification process to ascertain that their concerns are addressed. This could be undertaken through different approaches. One way of involving the poor would be to ensure that the governing boards of the rural electrification agencies include representatives of the poor. Another approach that appears to have yielded positive results in Bangladesh is the rural electricity cooperatives approach. *Palli Biddut Samity* (local cooperatives) ensured grassroots participation and ownership of the electricity distribution infrastructure and management.

To ensure that the objective of increasing access to the poor is achieved, the funds for the electrification of the poor should be "ring-fenced", in other words, protected. Brazil and South Africa provide good examples on how the protection of electrification funds could be undertaken.

Finally, the analysis of the situation in some Latin American and Caribbean countries reveals that the links between energy and macroeconomic reforms may be due to the subtle unsustainable policies which directly create poverty. This issue has not been dealt with in the current literature, but it points out the challenge of considering it seriously in future research. The recent energy crisis in Argentina, for example, demonstrates the weakness of the reforms, their flawed design and the social vulnerability that the poor are exposed to.

The case-studies focus on selected examples of reform and do not pretend to close the debate on the nature of energy sector reforms. Nevertheless, they do point to an overarching conclusion: when reforms are introduced with the sole intention of improving the performance of utilities, the expected and hoped-for social benefits do not necessarily follow. Where governments have not maintained a role of instigator or at least regulator of improved access to electricity for the poor, tariffs have tended to increase, and levels and rates of electrification have tended to drop. This strongly indicates that if the interests of the poor are to be adequately protected in the reform process, their needs must be taken into account when designing reforms, and this must be backed by political commitment. ■

Stephen Karekezi, John Kimani, Roberto Kozulj and Nicolas Di Sbroiavacca

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Notes

1. WSSD is commonly referred to as the Johannesburg Summit.
2. For some countries, US$ 2.00 per day may represent a relatively high income. For example, in Argentina, a family that currently gets US$ 240 per month (based on 4 persons each receiving US$ 2.00/day) is not a poor family [Bouille, 2002]. This is also true of many sub-Saharan African countries where well over 90 % of the population survives on less than US$ 2/day.

   It is important to note that there is an emerging debate on the validity of the method used to estimate the poverty threshold by the World Bank and other international agencies (i.e., using household surveys). Critics of this technique claim that the poverty levels it depicts appear to be higher than likely reality and they suggest the use of national accounts data as a more appropriate method of estimating poverty levels [Ravallion, 2004; The Economist, 2004].
3. Up-front costs of associated devices and appliances for cleaner and renewable energy options are often prohibitive for the poor.
4. In other words, although the absolute number of people with electricity is increasing, the rate of electrification is outpaced by population growth [Radka, 2002]. This is especially true of many sub-Saharan African countries where electrification rates are below population growth rates.
5. Phase I of the "Energy Access" study involved eight centres assisted by an interim secretariat provisionally located at the UNEP Collaborating Centre on Energy and Environment (GNESD Secretariat) in Risoe, Denmark. The centres involved in the "Energy Access" Working Group (WG) and their respective regional coverages are listed below.
   - African Energy Policy Research Network (AFREPREN/FWD) – East Africa
   - Asian Institute of Technology (AIT) – South and South-East Asia
   - Energy and Development Research Centre (EDRC), now Energy Research Centre (ERC) -- Southern Africa
   - Energy Research Institute (ERI) – China
   - Environnement et Developpement du Tiers Monde (ENDA-TM) -- West Africa
   - Federal University of Rio de Janeiro (COPPE/UFRJ) – Brazil
   - Fundacion Bariloche (FB) – Latin America and the Caribbean
   - The Energy and Resources Institute (TERI) -- South and South-East Asia
6. Stated as 100 %, as the few individuals with incomes higher than US$ 2/day constitute a tiny total that adds up to a fraction of a decimal point (effectively, a rounding-off error).
7. In some countries, some of the reforms with anticipated positive impacts on the poor are yet to be implemented. For example, a number of the rural electrification agencies in Eastern and Western Africa stipulated in the amended Electricity Acts are not yet operational and financing of their electrification programmes is not fully assured.
8. The term "ring-fencing" refers to ensuring that funds are strictly accounted for and protected from any misallocation.

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International Energy Initiative and its mission

Energy is of critical importance to development, economic growth, balance of payments, peace, national and regional environmental protection and the global climate. The efficient production and use of energy in an environmentally sound way is essential to tackling these concerns and defining a path to sustainable development based on equity, empowerment (self-reliance), environmental harmony and economic efficiency.

Since no international institution had as its sole objective the promotion of the efficient production and use of energy, a new International Energy Initiative (IEI) was established in September 1991.

IEI is a small, independent, international, non-governmental, public-purpose organization. It is a South-North partnership, Southern-conceived, led and located. It networks with those concerned with energy.

IEI's mission is Information, Training, Analysis, Advocacy and Action (INTAAACT) and the systems integration of these components.

IEI's objective is to promote – initiate, strengthen and advance – the efficient production and use of energy for sustainable development.

IEI's strategy is:

- focusing on developing countries;
- disseminating the new approach to energy, in which the level of energy services is taken as the measure of development, rather than the magnitude of energy consumption and supply;
- increasing energy services through a rationally determined mix of "hardware" – "cleaner" centralized/decentralized sources of energy and end-use efficiency measures;
- addressing the "software" issues – policies, institutions, financing, and management involved in the implementation of such a "hardware" mix;
- providing rigorous assessments and promoting the dissemination of emerging technologies of end-use efficiency improvement and of decentralized renewable sources (including modern biomass-based technologies);
- initiating and strengthening technological capability in energy analysis, planning and implementation in developing countries; and
- promoting the improvement of existing energy institutions and efforts and the design of new ones.

Find out more about IEI on the Internet at www.ieiglobal.org.

Have power sector reforms increased access to electricity among the poor in East Africa?

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This article focuses on power sector reforms in East Africa and attempts to assess their impact on the poor. Specifically, the article examines the extent to which the amendment of the Electricity Act – a key pillar of power sector reform – has influenced the electrification of the poor. The article is based on the case-studies of Kenya and Uganda undertaken under the auspices of the Global Network on Energy for Sustainable Development's "Energy Access" Working Group.

Poverty levels in the East African sub-region are very high, particularly in the rural areas. For instance, in both Kenya and Uganda, virtually the entire (100 %)[1] rural population falls under the US$ 2 per capita per day poverty threshold. Consequently, the rural population has been used as a proxy for the poor in this article.

This article reveals that only 1 % of the rural households in Kenya and Uganda has access to electricity – implying that very few of the poor are electrified. The two case-studies demonstrate key shortfalls in the provision of electricity to the poor. First and foremost, the amended Electricity Acts do not sufficiently address the issue of the electrification of the poor (e.g., proposing new and innovative initiatives that would increase electrification of the poor). Secondly, the utilities, Ministries of Energy and regulatory agencies make no attempt to track electrification of the poor. Thirdly, the sequence of power sector reform measures appears to have been detrimental to electrification of the poor. In both countries, rural electrification was only addressed at the end of the reform process. Fourthly, reforms also appear to have failed to link rural electrification to the overall strategy of improving the performance of the electricity industry. Lastly, current rural electrification targets are very low and would, within the next decade, leave well over 80 % of the rural population with no electrification even if the set targets are realized.

The article concludes that although some of the reforms have had some beneficial impacts on the region's electricity industry, the analysis presented demonstrates that they have not led to significant electrification of the poor. As a result, only a comprehensive transformation of ongoing power sector reforms could lead to greater electrification of the poor. The article ends with some suggestions on how reforms could be amended to ensure greater access to electricity among the poor in East Africa.

1. Background

This article examines power sector reforms in eastern Africa and attempts to assess their impact on the poor. Specifically, the article examines the extent to which the amendment of the Electricity Act – a key pillar of power sector reforms – has influenced the electrification of the poor. The article is based on a two-country study (Kenya and Uganda) carried out as part of a wider global study undertaken under the auspices of the Global Network on Energy for Sustainable Development's "Energy Access" Working Group.

The two countries were chosen for three principal reasons. First, they have roughly comparable socio-economic, demographic and energy characteristics. Secondly, the two countries closely co-ordinate their national economic policies, a reflection of a high levels of trade between them[2] as well as common membership of the East African Community and the Common Market for Eastern and Southern Africa (COMESA), the two leading trading blocs in the region. Thirdly, the pace of power sector reform implementation significantly differs between the two countries, thus providing a unique opportunity to obtain empirical evidence of contrasting impacts of reforms.

In addition, there is substantial energy data and information from studies undertaken by AFREPREN (African Energy Policy Research Network) in the two countries. Because of their socio-economic similarities, lessons learnt from the two countries are relevant to other eastern African and Horn of Africa countries of Tanzania and Ethiopia.

The methodology used in analysing the impact of power sector reforms is based on a common methodological approach developed by the "Energy Access" Working Group. The East African study adopted the following key

common methodological elements.

In order to identify the extent of impact of reforms on the poor, it was necessary to establish a distinction between the poor and non-poor. Because of the absence of income-differentiated electrification data, one way of differentiating the poor and non-poor was to use the lowest tariff band (for instance 0-50 kWh) as a proxy for the poor. The assumption is that the consumers within the 0-50 kWh tariff band are poor whereas those in other tariff bands above it are non-poor. Unfortunately, this approach could not be used because of the unavailability of time-series data in the required format. In addition, this approach would not have captured the overwhelming majority of the poor who are not electrified.

The authors, therefore, had to use other proxies to distinguish the two groups. Electricity data for rural areas[3] was used as a proxy for the poor because income and expenditure levels in rural areas are much lower than in urban areas. It is, therefore, assumed that virtually all the inhabitants of rural areas in Kenya and Uganda are poor. The authors, however, realise that this assumption has limitations as it effectively ignores the urban poor and the fact that not all rural households are poor. In addition, it fails to recognise that the majority of the rural population with access to electricity are probably not poor[4] [Bailis, 2003]. In spite of the above limitations, the proxy provides a fairly accurate assessment of the impact of reforms on the poor in the two countries.

2. An overview of the poor in East Africa

In general, rural-dwellers in East Africa are worse off than their urban counterparts. This can be demonstrated by comparing the expenditure and proportion of those living under the respective World Bank-defined poverty thresholds of US$ 1 and US$ 2 a day per capita.

Data from the 1997 Kenya Welfare Monitoring Survey provides the expenditure for rural and urban areas, divided by quintiles, from the lowest expenditure (Q1) to the highest (Q5) (Table 1).

Table 1 demonstrates that in rural areas, only the population in the uppermost quintile (20 %) live above the poverty line of US$ 1 a day per capita. Using the US$ 2 a day per capita threshold, virtually all (100 %)[5] of the rural population live below US$ 2 a day. Thus, the overwhelming majority of the rural population can be considered poor. The reverse is true for urban areas. Only the lower two quintiles (40 %) live below the poverty line, while the remaining three upper quintiles (60 %) live on more than US$ 1 a day and are thus non-poor. The upper quintile (20 %) is relatively wealthy, living on an average of US$ 5 a day per capita.

For example, in Kenya, rural households spend much less than their urban counterparts. Estimates from the 1997 Welfare Monitoring Survey conducted in Kenya show that rural areas in Kenya have a mean monthly household expenditure of approximately US$ 63.82. The absolute poverty line for rural areas used by the same survey stood at US$ 94.87[6]. In contrast, for urban areas, the absolute poverty line stood at US$ 147.80[7] with a mean monthly household expenditure of approximately US$ 151.56. This implies a significantly higher prevalence of poverty in rural areas compared to urban areas, where the mean household expenditure is above the absolute poverty line[8].

Table 1. Mean per capita expenditure in rural and urban areas by expenditure quintiles in Kenya (1997)

Expenditure quintile	Rural			Urban		
	Monthly		Daily	Monthly		Daily
	Kshs	US$	US$	Kshs	US$	US$
Q1	454.8	7.2	0.2	1,048.4	16.7	0.6
Q2	710.7	11.3	0.4	1,636.9	26.1	0.9
Q3	998.1	15.9	0.5	2,255.1	35.9	1.2
Q4	1,431.2	22.8	0.8	3,541.5	56.5	1.9
Q5	3,568.8	56.9	1.9	9,396.2	149.9	5.0
All	1,716.4	27.4	0.9	4,298.6	68.5	2.3

Sources: Republic of Kenya, 2000; World Bank, 2003a

This higher poverty level in the rural areas is also confirmed by a recent UNDP report on Kenya [UNDP, 2001], which showed that agriculture accounts for 90 % of rural incomes in Kenya, yet contributes only 9 % of the total private and public sector earnings in the country. Consequently, the rural population, the majority of whom are employed in agriculture, have much lower earnings.

This argument strengthens the point put forward earlier for defining poverty on the basis of rural and urban areas, the approach also adopted in this article.

In Uganda, a similar situation exists and the rural-urban split can be used as a proxy for the poor and non-poor. The majority of Ugandans living in rural areas are poor compared to those living in urban areas. This is demonstrated by using the mean per capita expenditure quintiles and the World Bank poverty threshold of US$ 1 and 2 per capita per day.

Firstly, data on mean per capita expenditure from the Uganda National Household Survey 1999-2000 demonstrates that rural households are relatively poor compared to their urban counterparts. Table 2 provides the mean per capita expenditure for rural and urban areas, divided by quintiles, from the lowest expenditure (Q1) to the highest (Q5).

As in the Kenyan case, virtually the entire (100 %)[9] rural population lives below both the US$ 1 a day and US$ 2 a day per capita thresholds. The overwhelming majority of the rural population can thus be considered poor. The reverse is true for urban areas, where only the lowest three quintiles (60 %) live below the poverty line, while the remaining two upper quintiles (40 %) live on more than US$ 1 a day and are thus non-poor. The highest quintile (20 %) is relatively well off, living on an average of US$ 3.5 a day per capita, which is considerably higher than the US$ 2 a day threshold.

Therefore, in the Ugandan case, the rationale for defining poverty on the basis of rural and urban areas, the

Table 2. Mean per capita expenditure in rural and urban areas of Uganda by expenditure quintiles

Expenditure quintile	Rural			Urban		
	Monthly		Daily	Monthly		Daily
	Ushs	US$	US$	Ushs	US$	US$
Q1	7,718.8	4.7	0.2	17,524.3	10.7	0.4
Q2	12,717.3	7.7	0.3	30,565.5	18.6	0.6
Q3	17,409.9	10.6	0.4	45,654.5	27.8	0.9
Q4	24,052.4	14.6	0.5	70,290.1	42.7	1.4
Q5	50,929.9	31.0	1.0	170,608.3	103.7	3.5
All	24,953.3	15.2	0.5	75,763.4	46.1	1.5

Source: UBOS, 2001; World Bank, 2003a; World Bank, 2003b

Notes

Exchange rate (2000): US$ 1 = UShs 1644.5

Using 1 month = 30 days

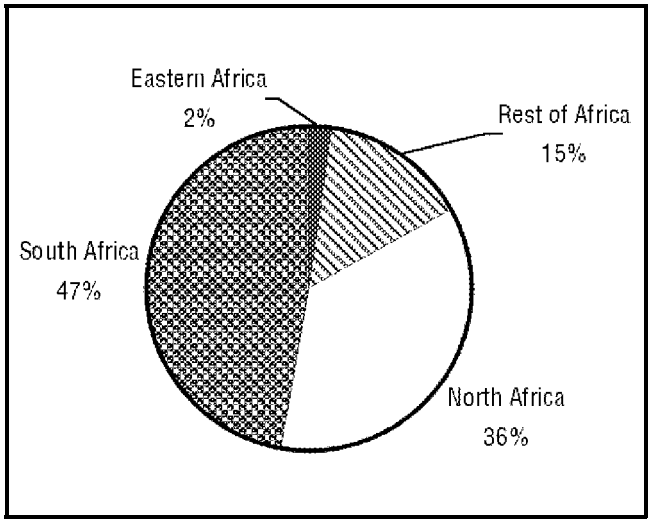

Figure 1. Share of installed capacity in Africa (2000)

Sources: World Bank, 2003b; IEA, 2002; AFREPREN, 2004

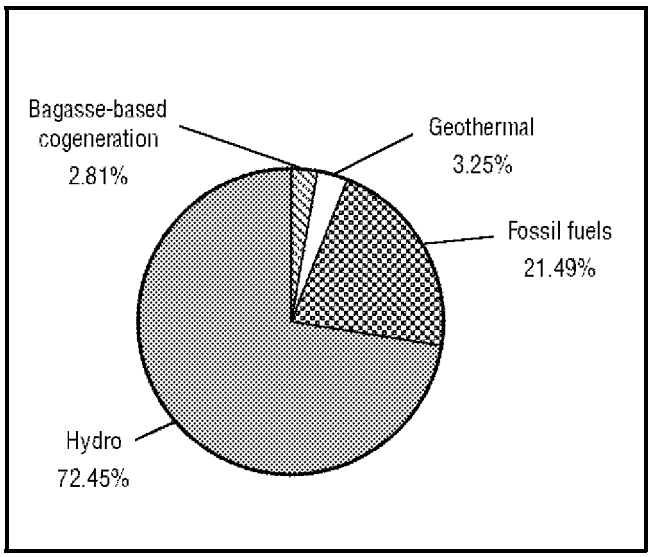

Figure 2. Electricity production in Eastern Africa (2000)

Sources: Karekezi et al., 2002; AFREPREN, 2002; AFREPREN, 2004; IEA, 2002

approach also adopted in this article, is, to a significant degree, valid.

Before delving into the impact of reforms on the poor, a brief overview of the region's electricity industry is presented in the next section.

3. An overview of the electricity industry in the region

The supply segment of the electricity industry in eastern Africa[10] is relatively small compared to that in other regions of the African continent. Eastern Africa contains only 2 % of the total installed capacity in Africa. As shown in Figure 1, North and South Africa contribute 83 % of the total installed capacity, while the rest of the countries account for 15 %.

Electricity production in eastern Africa is heavily dependent on hydro, with close to 73 % of the production coming from large and small hydro generating units (Figure 2). The balance is shared between thermal generating units, geothermal and bagasse-based cogeneration. Cogeneration capacity is mainly found in Mauritius. Geothermal energy is in its initial stages of exploitation, with only Kenya and Ethiopia having attempted to use it for electricity generation.

A comparison with other low- and middle-income regions of the world shows that the eastern African region has very low levels of electricity consumption per capita (Table 3).

Until recently, the electricity industry in eastern Africa was characterized by a monopoly structure, dominated by vertically integrated, state-owned power utilities. This is true for almost all countries, with the exception of Uganda and Kenya, which have recently unbundled their power utilities. This monopoly structure is thought to be a large contributor to the under-performance of the region's power utilities. With the exception of Mauritius, power sector institutions are mainly characterized by unreliability of power supply, low capacity utilization and availability factor, deficient maintenance, poor procurement of spare parts, and high transmission and distribution losses.

Again, with the exception of Mauritius, all eastern African countries record national electrification levels of 10 % or less (Table 4). This is very low compared to other developing regions such as Asia and Latin America, where many countries record an electrification level as high as 70 % [Shrestha et al., 2003].

The uniquely high electrification levels in Mauritius can be attributed to its early start and political commitment to rural electrification. In 1961, following a major cyclone that severely damaged the system, the government obtained a US$ 7 million loan from the World Bank, which, among other uses, financed an intensive electrification of rural communities throughout the island [Veragoo, 2003]. This effort was maintained and over 40 years later the entire population has access to electricity. It is only now after achieving 100 % electrification coverage that Mauritius is embarking on market-oriented power sector reforms.

The financial performance of eastern African utilities is

unsatisfactory. Development and expansion of the sector has been hampered by the inability to mobilize sufficient investment capital. With the exception of Mauritius, most public utilities have been unable to collect revenues from consumers in a timely fashion, contributing to poor financial performance.

The need to address this poor performance of utilities has been a key driver for the far-reaching structural, legal and regulatory reforms that are being implemented in the power sector of the eastern African sub-region. The next section discusses the status and trend of power sector reforms in the sub-region.

4. Status of power sector reforms

Compared to the other regions of the world, eastern Africa's power sector reforms have been slow. The majority of the countries have corporatised/commercialised their power utilities. With the exception of Ethiopia, the key reform measure implemented by most countries has been to facilitate the entry of independent power producers (IPPs) primarily to meet shortfalls in electricity generation. Limited progress has been registered with respect to unbundling of vertically-integrated state utilities and the establishment of independent regulatory agencies.

Perhaps the most significant impact of power sector reform in the region is the increased involvement of IPPs. With the exception of Kenya, the capacity of IPPs (both implemented and proposed) in eastern Africa is greater than the prevailing national installed capacity (Figure 3).

Many of the IPPs came into operation very recently. However, most of the IPPs are predominantly fossil fuel-based, with the exception of Mauritius, where all the IPPs include a renewable energy component (i.e., bagasse-based cogeneration) and Kenya and Uganda which have recently encouraged geothermal-based and hydro-based IPP developments, respectively.

In overall terms, Uganda and Kenya appear to have effected the most far-reaching changes. The two countries have implemented a large number of reform measures with the exception of fully privatising the generation and distribution segments (see Table 5 and Appendix A).

Power sector reforms involving corporatisation/commercialisation of the power utilities have significantly improved the financial performance of the state-owned utilities. The introduction of new management teams has also improved the financial performance of utilities. For example, in Uganda, the former Uganda Electricity Board had for a long time consistently registered huge financial losses. However, a change in management led to a Ushs. 4 billion[11] profit and an increase of 20 % in debt collection [Bidasala, 2001] in under two years. Last year, citing the Ugandan success, the Tanzanian Government hired a private company, Netgroup Ltd., to manage TANESCO[12] (the national utility in Tanzania), on a contract management basis.

With regard to reforming the legal and regulatory framework, only two countries, Uganda and Kenya, have established independent regulatory agencies. However, in 2001, Tanzania passed an Act of Parliament for the establishment of the Electricity and Water Utilities Regulatory Authority, which is yet to be constituted. Ethiopia established the Electricity Agency in 1997. Unlike the Ugandan and Kenyan regulatory agencies that could be considered "independent", the Electricity Agency in Ethiopia was designed to work closely with its parent ministry, the then Ministry of Mines and Energy [Teferra, 2002].

A review of the amended Kenyan and Ugandan Electricity Acts reveals that the Kenyan Act addresses the question of "access" only to a limited extent. For example, rural electrification is mentioned in only three "miscellaneous" paragraphs of the Kenya Electricity Act – a clear indication of limited policy interest. The Kenyan Electricity Act amended in 1997 empowers the Minister of Energy to re-establish the Rural Electrification Programme Fund

Table 3. Electricity consumption per capita for selected developing regions of the world

Region	Annual electricity consumption per capita (kWh) in 2000
Latin America and the Caribbean	1,528
East Asia and the Pacific	760
South Asia	323
Sub-Saharan Africa[1]	432
Eastern Africa	60

Sources: World Bank, 2003a; AFREPREN, 2002; UEB, 1999; UNDP, 2002.

Note

1. The figure for sub-Saharan Africa appears to be high because it includes South Africa which, if excluded, would reduce this figure by half.

Table 4. Electrification Levels in eastern Africa[1]

Country	National electrification levels (%) in 2001
Ethiopia	2
Uganda	4
Kenya	6[2]
Tanzania	10[3]
Mauritius	100

Sources: AFREPREN, 2002; Karekezi et al., 2002; Republic of Kenya, 2002; Okumu, 2003; Kinuthia, 2003

Notes

1. The data provided in this table might differ from other sources [e.g., MoE, 2002; DHS, 2004] mainly due to the difference in the methodology adopted for the estimation of electrification levels, i.e., some sources use the proportion of the population electrified while others use the proportion of electrified households. In addition, some sources use the total number of connections (both household and non-household) while others only use the total number of household connections to estimate electrification levels. In this article, only grid-based electricity is counted while in other sources electrification data includes illegal connections as well as electricity from decentralized options such as photovoltaics and gensets.
2. This figure only refers to the proportion of households connected to the electricity grid and may differ significantly from that obtained from other sources which indicate the proportion of electrified population derived from the total number of grid electricity consumers.
3. 2002 data

Table 5. Status of power sector reforms in Eastern African countries (2003)

Reform measures	Mauritius	Ethiopia	Tanzania	Kenya	Uganda
Amendment of the Electricity Act		ϕ		ϕ	ϕ
Corporatisation/commercialisation		ϕ	ϕ	ϕ	ϕ
Establishment of independent regulator				ϕ	ϕ
Restructuring (unbundling)				ϕ	ϕ
Independent power producers	ϕ		ϕ	ϕ	ϕ
Privatisation of generation					ϕ[1]
Privatisation of distribution					ϕ[2]

Source: Compiled by authors

Notes

1. Concession awarded to Eskom in 2002
2. Concession awarded to a consortium of Eskom and CDC-Globeleq in 2004

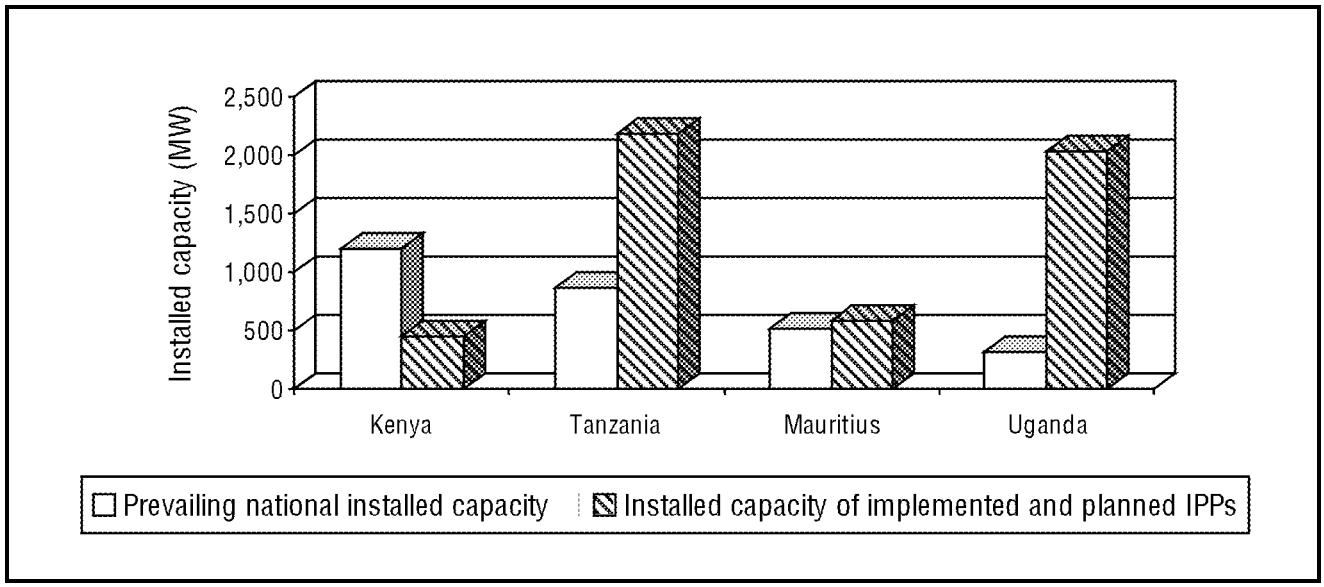

Figure 3. National installed capacity compared to installed capacity of implemented and planned IPPs[1] for eastern African countries (2002)[2,3]

Sources: Adapted from Karekezi et al., 2002; Okumu, 2003; Kinuthia, 2003; Veeragoo, 2003

Notes

1. In many cases, planned IPPs are often cancelled.
2. There has been no IPP development in Ethiopia to date.
3. Data for Tanzania pertain to 2001

to support electrification in rural areas and other areas considered economically unviable for electrification by public electricity suppliers. Furthermore, the Minister may impose a levy of up to 5 % on all electricity consumed in the country, the proceeds of which go into the Rural Electrification Programme Fund.

The major limitation of the Act is that it is explicitly not in favour of subsidies (which would, otherwise, benefit the poor). It stipulates that [Republic of Kenya, 1997, p. 81]:

"All rates or tariffs charged by a public electricity supplier for electrical energy supplied ... shall not give any undue preference or be discriminatory."

Compared to the Kenyan Electricity Act, the Ugandan Electricity Act (amended in 1999) places more emphasis on the question of electricity access in rural areas. The Electricity Act also empowers the Minister for Energy to undertake the following [Republic of Uganda, 1999]:

a) Prepare and submit a sustainable and coordinated Rural Electrification Strategy and Plan for Uganda to the Cabinet for approval;
b) Once each year, submit to Parliament, an annual report on the progress and achievement of the Rural Electrification Plan;
c) From time to time, with the approval of Cabinet, amend the Rural Electrification Strategy and Plan;
d) Establish the Rural Electrification Fund;
e) Determine the criteria and the appropriate level of the subsidy; and,
f) Maintain a national rural electrification database to assist in the monitoring of progress and establishment of the rural electrification targets.

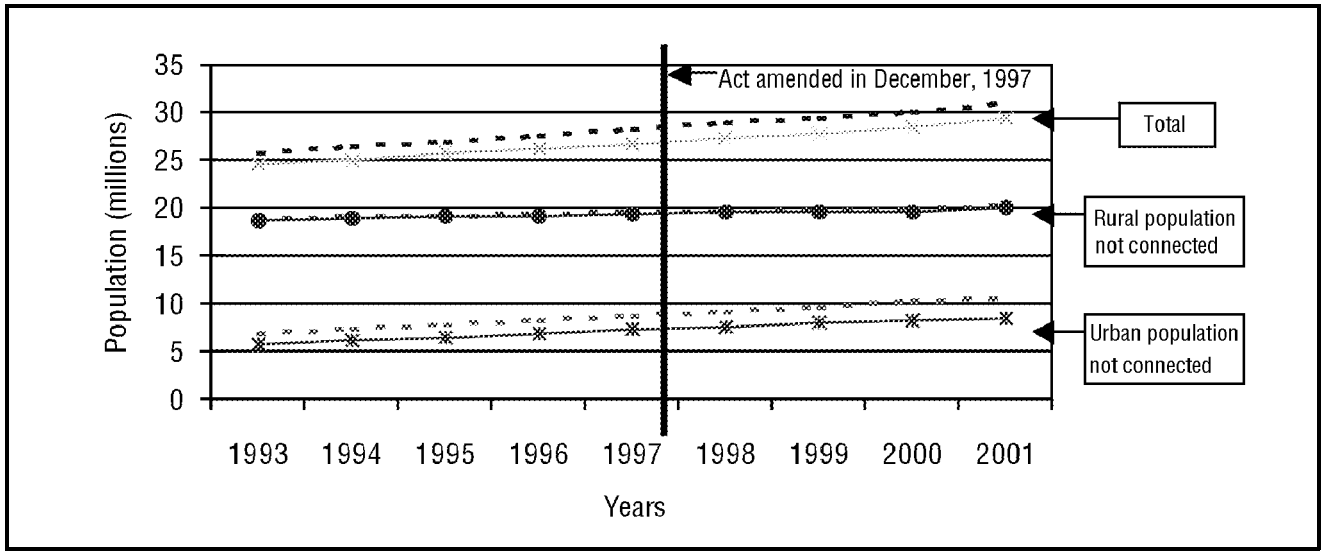

Figure 4. Status of population without access to electricity in Kenya

Sources: Computed by the authors using data from World Bank, 2001; KPLC, 1992, 1997, 2002; Kinuthia, 2003; AFREPREN, 2004

Note:

Dotted lines depict the respective total populations.

5. What has been the impact of reforms on the poor's access to electricity in Kenya?

This section assesses the impact of the amendment of the Electricity Act[13] on the poor before and after the amendment of the Electricity Act, by analysing the electrification levels[14] and electrification rates[15]. Although the selection of the amendment of the Electricity Act as the principal reform option may not be fully accurate, it is adequate for the purpose of this article. This reform option is selected primarily for three reasons. First and foremost, the Electricity Act sets out the structure and operations of the electricity sector as a whole in both countries. Consequently, the amendment of the Act is one of the primary drivers of power sector reforms and determines the direction reforms take.

Secondly, the issue of electricity access, which is the focus of this article, can be traced back to the Act. The Acts of both Kenya and Uganda provide for, in some cases, modalities to increase access to electricity. For instance, in both Kenya and Uganda, the Electricity Acts provide for the Rural Electrification Fund (REF)[16], whose objective is to finance electrification of rural areas. As mentioned earlier, the Ugandan Electricity Act, in addition, empowers the Minister for Energy to undertake a range of critical tasks aimed at accelerating rural electrification [Republic of Uganda, 1999].

Lastly, since the amendments took place in the late 1990s, there is some useful pre- and post-reform data that can enable empirical analysis of the impact of the amendment of the Acts on electricity access.

As mentioned earlier, the key weakness of the available time-series data sets is that they do not differentiate the poor and non-poor. Consequently, the proxy used for the poor is electricity data for rural areas on the assumption that the majority of urban residents are not poor[17]. The rationale is that income levels in the rural areas are much lower than in urban areas (virtually the entire (100 %) rural population is under the internationally recognised US$ 2/day poverty line).

5.1. Electrification levels

A decade after initiating power sector reforms, one would expect to see a significant decrease in the population not connected to grid electricity, among other improvements in the sector. This is, however, not the case in Kenya. As shown in Figure 4, for the last 10 years, no signifiant changes to electrification levels have been registered. As before, almost the entire population had no access to electricity. Effectively, power sector reforms do not appear to have an impact on electrification levels.

Figure 4 reinforces the view held by critics of reforms who insist that power sector reforms have largely focussed on the development of IPPs and improving the financial status of state-owned utilities (mainly to lure the IPPs and other private investors to the sector), at the expense of electrifying the country's poor.

The data presented in Figure 4 also demonstrates that the amendment of the Electricity Act in 1997 did not improve access. The population without access to electricity continued to increase.

In percentage terms, pre- and post-reform electrification levels of households (national, urban and rural) have been relatively constant (Figure 5). National electrification levels have only risen by 2 % over an 8-year period. This is lower than the average annual national population growth rate of 2.6 % [UN Habitat, 2004], implying that the unelectrified proportion of the population is growing. Similarly, both urban and rural household electrification levels rose by an insignificant proportion during the same period. To date, 30 years after the establishment of the Rural Electrification Fund, less than 1 % of rural households have access to electricity (see Figure 5).

Implications for the poor: The trend in electrification levels of households (national, rural and urban) seem to

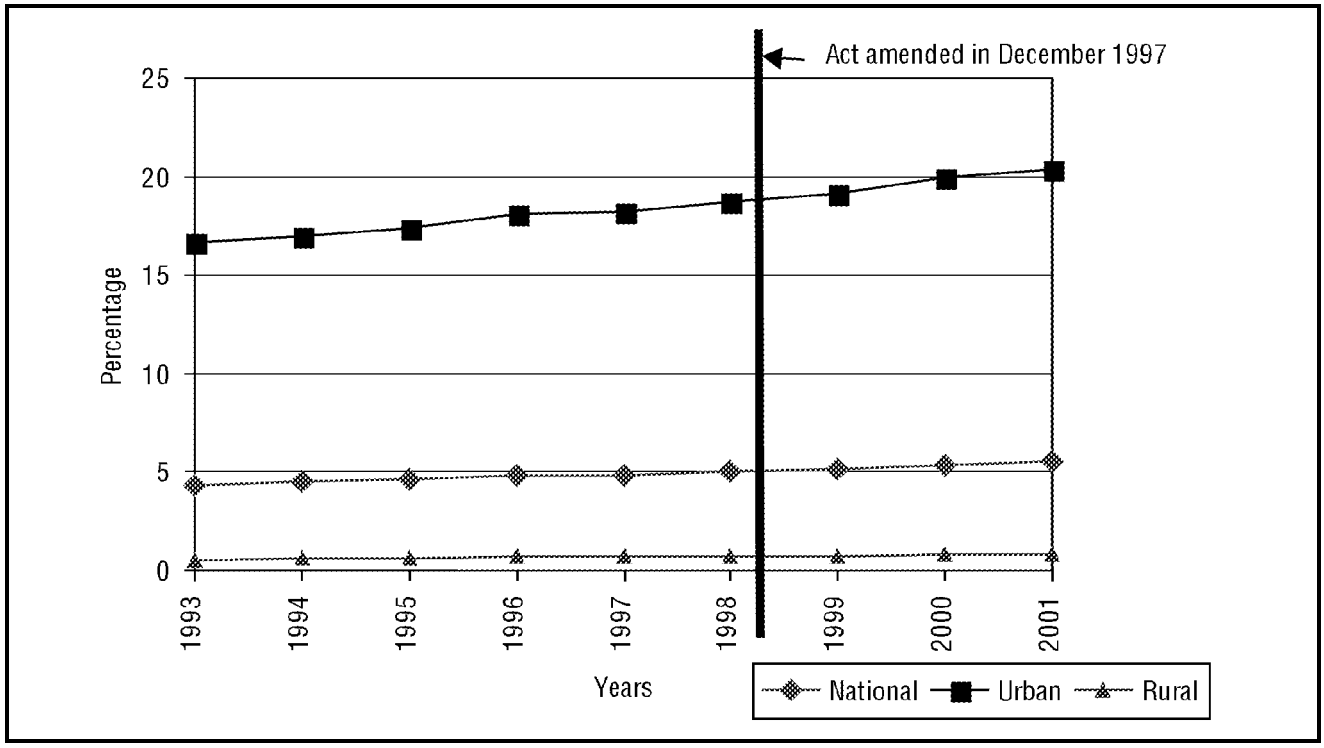

Figure 5. Household electrification levels in Kenya

Sources: Computed by the authors using data from World Bank, 2001; KPLC, 1992, 1997, 2001-2002; Kinuthia, 2003

Table 6. New household connections

	1993	1994	1995	1996	1997	1998	1999	2000	2001
Urban	11,729	12,179	12,697	18,480	11,827	16,997	17,155	24,640	19,054
Rural	2,775	3,283	1,942	3,951	2,564	1,784	3,238	4,477	3,156

Sources: Kinuthia, 2003; KPLC, 1997, 2001-2002; AFREPREN, 2004

indicate that the Electricity Act (amended in 1997) has not had a significant impact on electrification levels. Using the data on electrification levels of rural households as a proxy for the poor, it appears that for the foreseeable future, the overwhelming majority of the poor will not have access to grid electricity.

The Electricity Act does not address this problem. The only reference made to electrification is with regard to the Rural Electrification Fund, but the Act does not provide guidance on how the rural population (who form the bulk of the poor in Kenya) will be electrified.

5.2. Electrification rates

The electrification rate indicator refers to the number of new domestic connections in a specific year expressed as a percentage of total domestic connections for the previous year. This indicator is used to determine the extent to which the reform option accelerates (or retards) access to electricity among the poor. Figure 6 shows the trend in electrification rates at the national level as well as in rural and urban areas of Kenya.

Overall, the household electrification rates (national, rural and urban) have been low (Figure 6). An interesting trend is that the national electrification rate and the urban electrification rate have been almost the same (varying between 5 and 7 % for most of the years under review). The similarity in the trend between the national and urban household electrification rates could be explained by the fact that most of the new household connections are in urban areas, with very few in the rural areas as shown in Table 6.

As shown in Figure 6, during the four years preceding the amendment of the Act, rural electrification rates dropped dramatically from a high of 16 % to a low of about 9 % in 1997. Four years after the amendment of the Act, the rural household electrification rates further dropped to 8 %.

As shown in Figure 7, the revenue of REF grew steadily from about US$ 3.72 million in 1993 to over US$ 9.13 million in 2001. However, the annual number of new consumers has been fluctuating, and on average the annual increase in consumers has been fairly constant. Interestingly, the number of new connections in 1993 when revenue was about US$ 3.72 million was the same as in 2001 when the REF received about US$ 9.13 million, nearly 2.5-fold increase in revenue. In other words, in 1993, the cost per connection was about US$ 738, while in 2001, it rose to US$ 1,809. This shows that in spite of a substantial increase in funding, there was no significant increase in the number of consumers added to the programme each year.

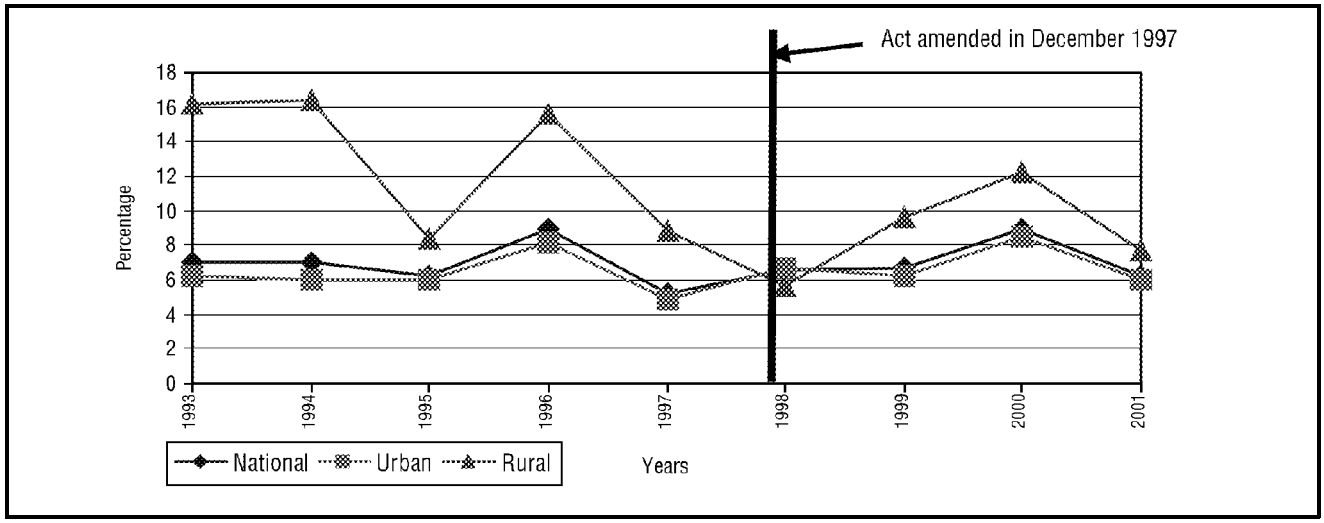

Figure 6. Household electrification rates in Kenya

Sources: Computed by the authors using data from KPLC, 1992, 1997, 2001-2002; Kinuthia, 2003

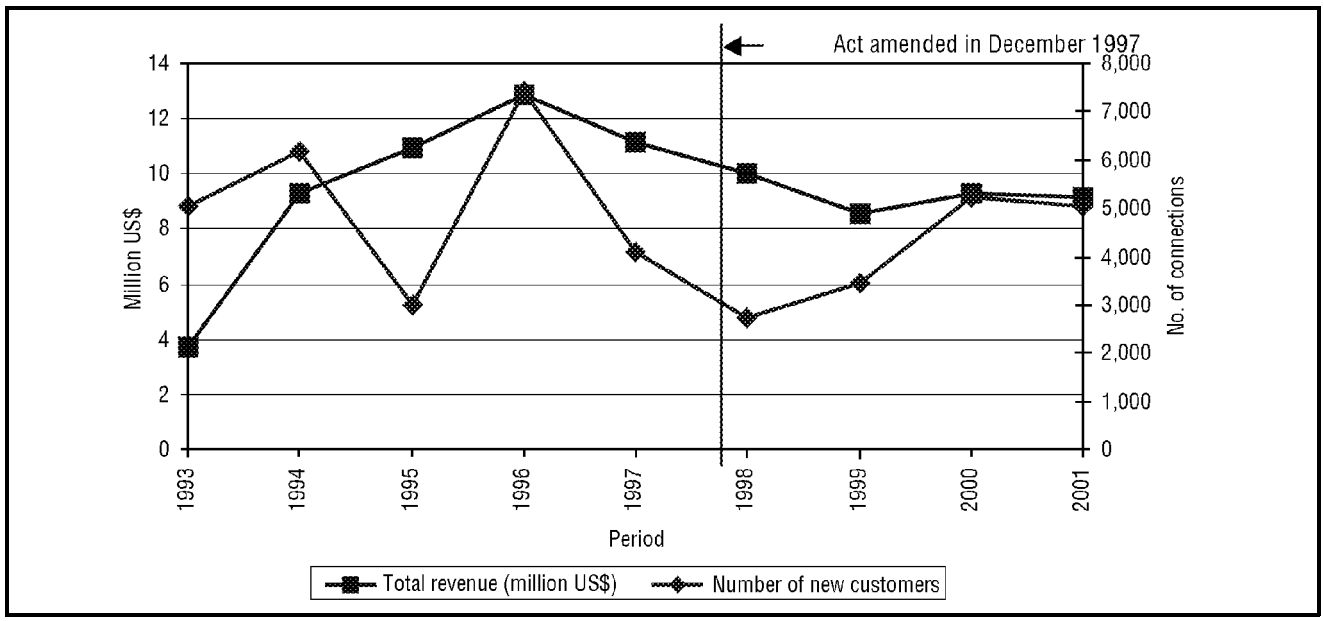

Figure 7. Rural Electrification Fund revenue[1] and number of new rural consumers[2]

Sources: KPLC, 1997, 2001-2002; Republic of Kenya, 2003; AFREPREN, 2004

Notes

1. REF revenue is adjusted to account for inflation and exchange rate fluctuations. Before 1997 the REF sourced its revenue from KPLC's revenue. From 1997 onwards a 5 % levy on every consumer's electricity bill was imposed to finance the REF, as stipulated by the Electricity Act.
2. Refers to consumers of all categories including households, farms, industries, institutions and others.

An assessment of the management of the REF could, in part, provide useful insight into the cause of the insignificant increase in rural connections. The agreement between the Government of Kenya and KPLC – the official rural electrification implementation agent – is that KPLC obtains funding from the REF to finance the capital investment associated with grid extension in the rural areas. In addition, the REF also finances any resultant operating losses incurred by KPLC. However, over the past decade, the proportion of the REF financing KPLC's operating losses has grown dramatically from about 12 % in 1993 to about 54 % by 2002, thus hindering capital investments in new connections.

Implications for the poor: The sharp decline in rural electrification rates before and after the amendment of the Electricity Act has important implications for the poor. First, it indicates the declining interest on the part of government to increasing electricity access among the poor. Secondly, the assessment of the REF management illustrates its growing ineffectiveness, which has led to minimal or no increase in electrification of the poor. Since the Act sets no explicit targets for rural electrification, it is not surprising that the advent of the Act has not led to higher electrification rates.

5.3. Preliminary conclusions

There are several important observations that emerge from the Kenyan case-study.

First and foremost, data on the electrification of the

poor in Kenya is inadequate. As a result, the authors had to use a proxy for the poor. This limitation implies that the findings presented in this article are not conclusive, but indicative.

It appears that rural electrification was relegated to the bottom of the priority list of reforms. This is confirmed by the fact that the establishment of a rural electrification agency has come at the tail-end of the reform process. In fact, the creation of this agency appears to be an afterthought, given that it is not provided for in the Electricity Act.

Secondly, the *de facto* distribution monopoly enjoyed by the Kenya Power and Lighting Company (KPLC) limits the increase in rural electrification. The fact that KPLC holds distribution licences covering most of Kenya, if not the whole of it, implies that no other entity can establish a rural mini-grid or decentralized system without express permission from KPLC. Given that KPLC was only recently salvaged from near-bankruptcy by the government [Mogusu, 2004], it is likely to take a while for the utility to upgrade its overloaded distribution system before embarking on the improvement of its rural electrification programme.

A short-term response to the above problem is to make additional amendments to the Act to reflect a more substantial commitment to electrification of the poor. The Electricity Regulatory Board has prepared a set of regulations in an attempt to minimise KPLC's monopoly. However, the approval of these regulations as well as the amendment of the Act may take a while to be effected. This is because Kenya is in the midst of a massive constitutional amendment process, which is still ongoing. Therefore, for the next 2-3 years, legislators are unlikely to be keen to take on small amendments to existing Acts.

Lastly, the rate of rural electrification declined during the reform period. The electrification rate has been outpaced by the population growth rate. The amended Electricity Act, essentially the pillar of all power sector reforms, does not provide any new or improved mechanism for increasing electricity access for the majority of the poor.

The idea of establishing an autonomous rural electrification agency was mooted by a Ministry of Energy task-force in 2003 – somewhat as an afterthought to the reform process. The proposed rural electrification agency is, however, faced with a number of limitations. Firstly, the involvement of ministry officials could stifle the requisite autonomy of the agency. Secondly, the proposed representation of the key stakeholders in the rural electrification agency may not be adequate as the poor appear not to be represented. Lastly, it is unclear whether the Rural Electrification Fund will be "ring-fenced"[18] to ensure the agency does not mismanage the fund as KPLC reportedly did.

Close examination of the issues discussed above shows that the future of electrification of the poor in Kenya is bleak. This is exacerbated by the fact that, in spite of the government's directive that KPLC ensures 100,000 new connections every year, these will largely cover urban areas and most likely target non-poor households.

6. What has been the impact of reforms on the poor's access to electricity in Uganda?

As in the Kenyan case-study, the above question is answered by assessing the impact of the amendment of the Electricity Act on the poor before and after the amendment of the Electricity Act, using the following indicators:

- electrification levels; and
- electrification rates.

Access to the relevant data for Uganda proved to be difficult. For instance, rural and urban data sets – our proxy for the poor and non-poor, respectively – are not readily available. The Uganda Electricity Distribution Company Limited (UEDCL) (as also its predecessor, Uganda Electricity Board, UEB) does not categorise its data into urban and rural consumers. With guidance from an expert from the UEDCL, the authors reassessed the entire UEDCL consumer list and treated the capital city of Kampala and all major municipal centres as urban areas, and all other areas as rural.

Although this approach may to some extent not be absolutely accurate, it does not significantly affect the analysis because Uganda is the least electrified East African country, with only 4 % of the total population electrified, and about 99 % of the rural population without access to electricity.

6.1. Electrification levels

Figure 8 presents the number of people not connected to electricity in Uganda. The figure shows that virtually all rural households have no access to electricity. A comparison between 1996 and 2001 indicates a slight drop in the number of the unelectrified population for the national and urban indicators. However, closer examination reveals that the change at the national level is primarily due to the increase in urban electricity access.

National household electrification levels in percentage terms present a deceptively positive picture that shows an upward trend. However, the largest share of electrification is in the urban centres (Figure 9).

Available data shows that a few years before implementation of the Electricity Act, there appears to have been a marginal increase in electrification levels at the national level. In 1999, national household electrification levels were about 3 % and appear to have risen marginally to about 4 % in 2002. This may, however, be due to the formalisation of illegal connections following "Operation Sigma" in 2001-2002[19]. Thus there may have been no real new connections. In effect, the utility recorded "new" connections whereas in reality the number of physical connections remained unchanged.

Similarly, disaggregated data on rural and urban household electrification levels shows a marginal increase. For instance, urban electrification levels appear to have risen to about 19 % in 1998, then dropped to 16 % in 2000, followed by an increase to slightly under 20 % in 2002. In the case of rural electrification, the levels have been hovering around 0.8 %, with no major increases.

Implications for the poor: The stagnant electrification levels for the poor imply that they have been left out as far as access to electricity is concerned.

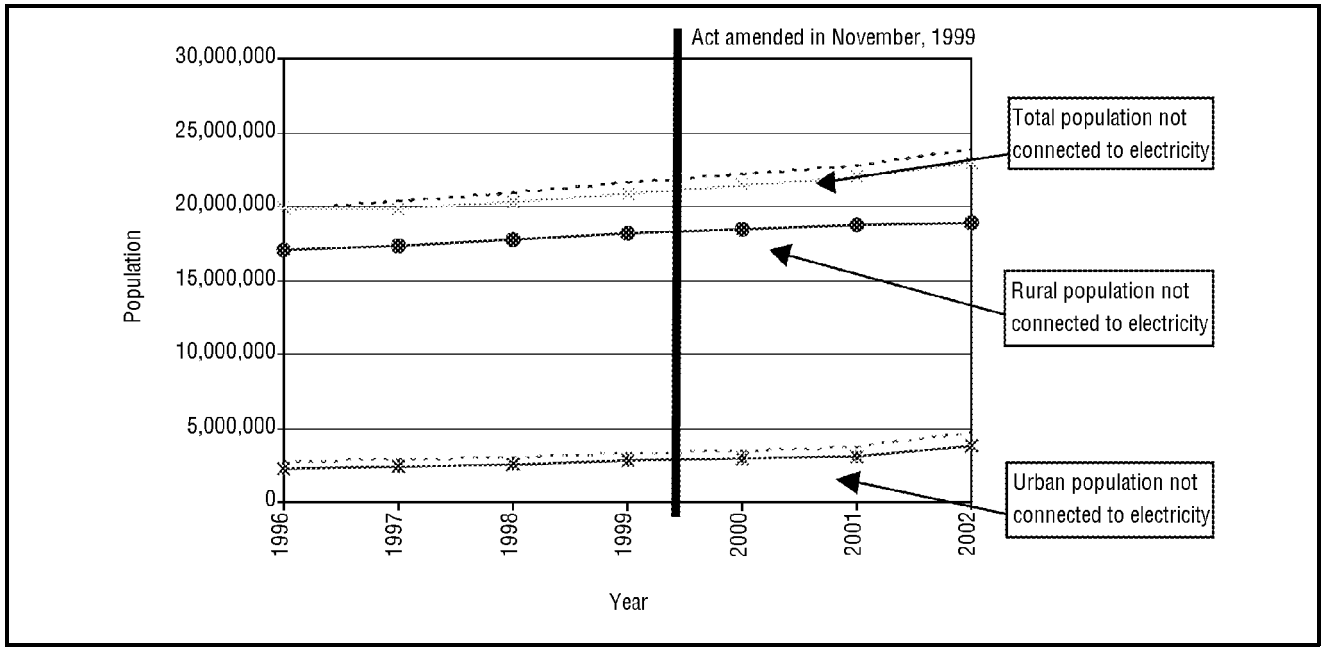

Figure 8. Number of people not connected to electricity in Uganda

Sources: Okumu, 2003; Kyokutamba, 2002a, b; Engurait, 2001; AFREPREN, 2003

Note

The dotted lines refer to the respective population levels.

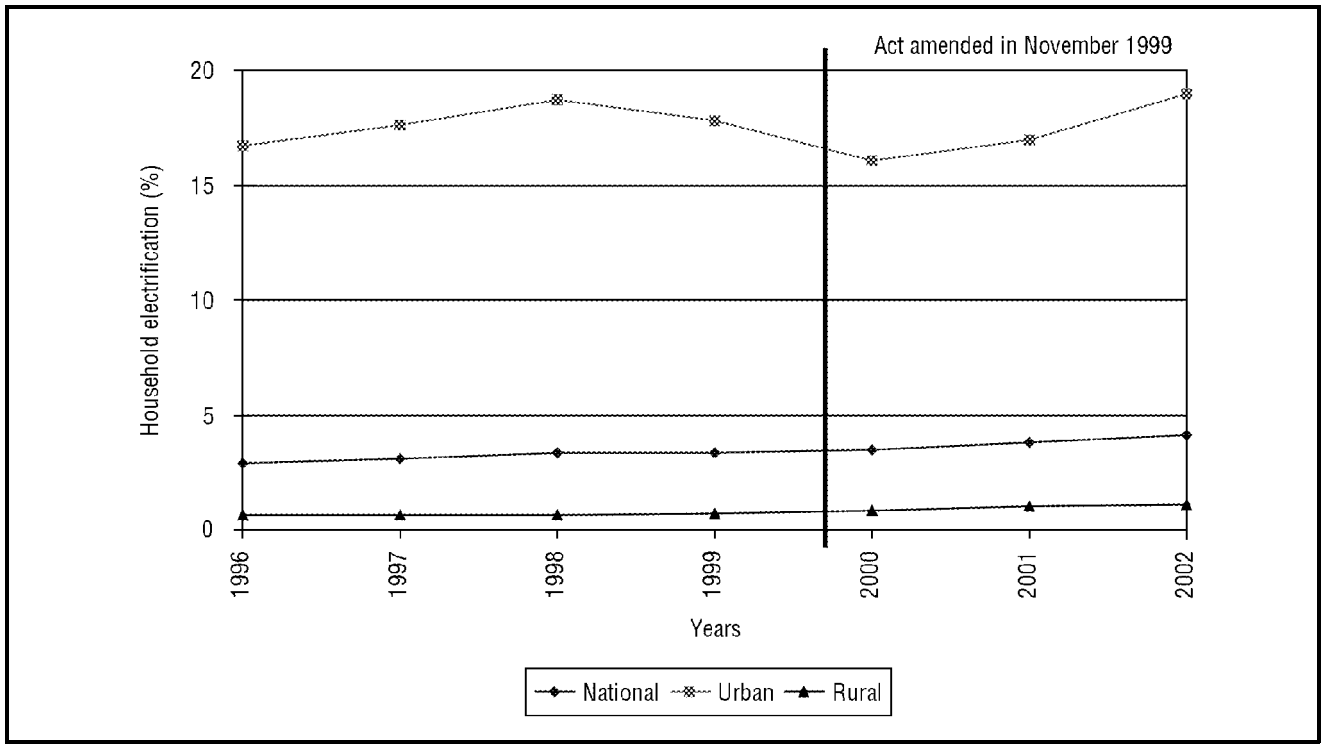

Figure 9. Household electrification levels in Uganda

Sources: Okumu, 2003; Kyokutamba, 2002a, b; Engurait, 2001; AFREPREN, 2003

The Government of Uganda is, however, in the process of implementing the Energy for Rural Transformation Project whose objective is to increase rural electrification levels to about 10 % by the year 2012 [Okumu, 2003]. This target is too low given that at the end of the next 10 years, the vast majority of the poor (90 %) will still have no access to electricity. Data from other African countries (South Africa, Zimbabwe and Ghana) shows that for the same period of time (or even shorter), it is possible to achieve much higher increases in electrification levels. For example, South Africa recorded an 18 percentage-point increment in 7 years; Zimbabwe's rural electrification increased by 19 percentage points in 8 years, and Ghana's rural electrification went up by 30 percentage points in 10 years [NER, 2003; Gboney, 2001; Kayo, 2002; Dube, 2002].

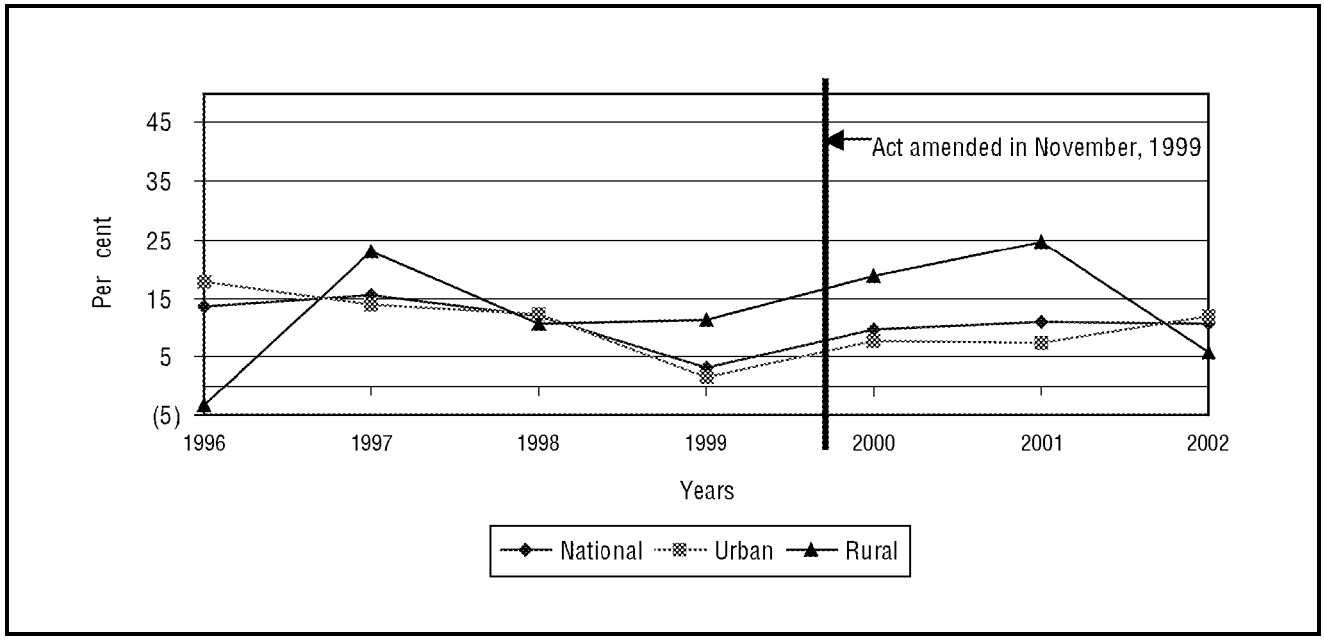

Figure 10. Household electrification rates in Uganda

Sources: Okumu, 2003; Kyokutamba, 2002a, b; Engurait, 2001

6.2. Electrification rates

The household electrification rates provided in Figure 10 enable us to better understand the reason for the low electrification levels shown in Figure 9.

The national and urban household electrification rates before the amendment of the Electricity Act were generally on a downward trend. However, during the post-reform period under consideration, an increase in electrification rates was registered. Nevertheless, the 2002 post-reform rates are considerably low compared, for instance, to the 1997 rates.

Rural household electrification rates recorded significant slumps in 1997 and 2002 because of operations initiated by the utility targeting illegal connections ("Operation Thunder" in 1996-1997 and "Operation Sigma" in 2001-2002). Both operations resulted in massive disconnections. In addition, tariffs were increased in 2001, leading to further disconnections for non-payment, especially in rural areas.

It is worth noting that for both rural and urban areas, the rates of electrification went up at some point after the amendment of the Act in 1999. In rural areas, the electrification rates appear to be very positive (see Figure 11). However, this trend is distorted by the very high fluctuations caused by massive disconnections and reconnections[20]. In addition, the modest positive trend in rural electrification is unlikely to result in significant increase in overall electrification levels of the poor because of rapid population growth (see Figure 11).

At the prevailing rural electrification rates, even the government's very modest target of 10 % by 2012 will not be realized. Projections computed by the authors (see Table 7) based on the historical annual average electrification rate of 16 % (1996-2002) show that by the year 2012, the government's 10 % target for rural electrification levels will not be met.

For the government target of 10 % to be achieved, the total number of households electrified needs to be increased by 348,611 (nearly 35,000 annually).

6.3. Preliminary conclusions

The Uganda case-study demonstrates the low priority given to rural electrification. The utility does not even keep track of data on rural electrification, which confirms the lack of interest in the electrification of the poor. Conclusive findings are, therefore, difficult to develop without this kind of data. There is need to track and develop an income-differentiated database on electricity access, both in rural and urban areas. The database would be useful for the newly-formed Rural Electrification Board to monitor its performance in meeting the government's 10 % electrification target by 2012.

Although power sector reforms in Uganda are at an advanced stage, the reforms appear to have been undertaken primarily to prepare the utility for privatisation, with limited attention given to increasing the poor's access to electricity. Implementation of rural electrification programmes as provided for in the Electricity Act began after privatisation of the utility was almost finalised. However, the regulatory and policy instruments that are in place seem to provide incentives for rapid rural electrification – certainly the rhetoric is encouraging.

The Electricity Act appears to place some emphasis on rural electrification. However, it only provides for a rural electrification agency resembling the conventional rural electrification programmes which have been unsuccessful elsewhere, such as in Kenya and Zambia. For example, the Rural Electrification Board (REB) is headed by the Permanent Secretary in the Ministry of Energy and Mineral Development (MEMD). This not only limits the autonomy of the board but could also stifle its performance, given that the person heading the institution provides inputs on a part-time basis. This has been considered

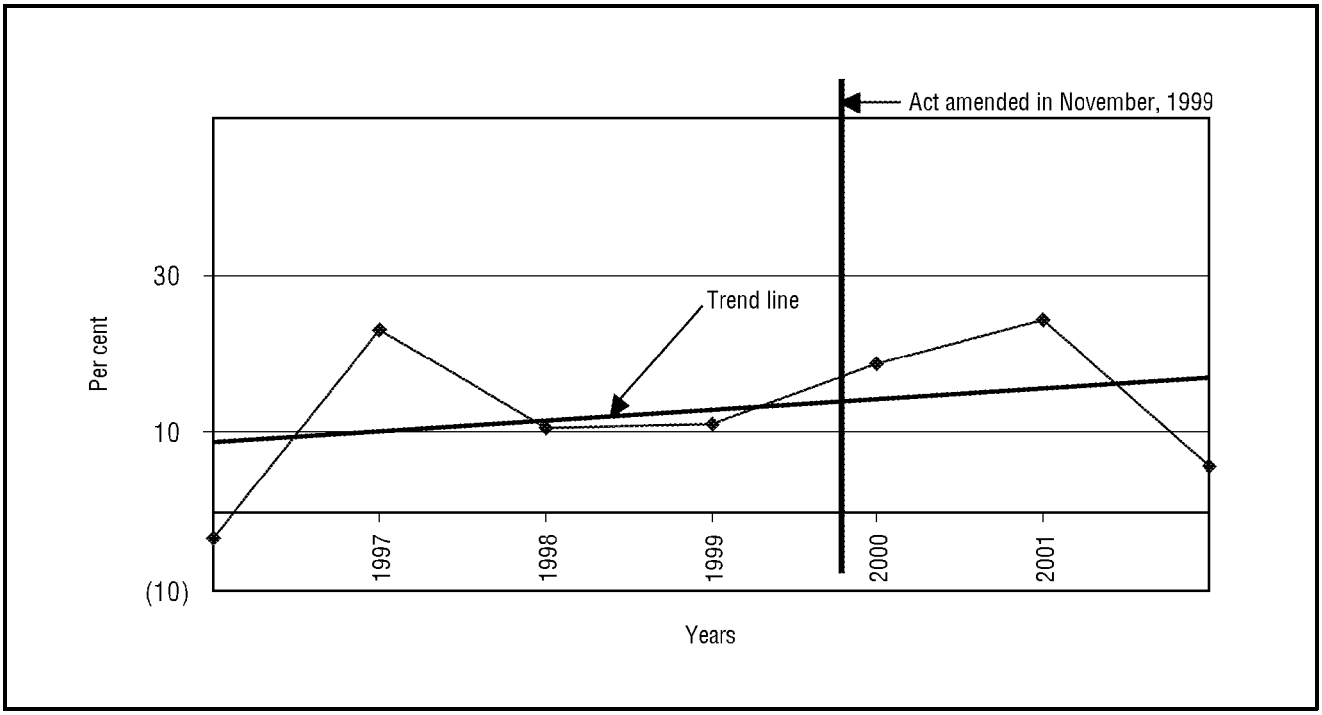

Figure 11. Trend analysis of the rural household electrification rates in Uganda

Sources: Okumu, 2003; Kyokutamba, 2002a, b; Engurait, 2001

Table 7. Projected targets for rural electrification levels for 2012

	Current status	Authors' projections	Government target
	2002	2012	2012
No. of rural households	4,008,695	5,387,351[1]	5,387,351[1]
No. of rural household connections	43,098	190,124[2]	538,735
% rural household connections	1.1	3.5	10

Sources: Okumu, 2003; AFREPREN/FWD, 2002.

Notes

1. Projected at 3 % growth rate per annum
2. Projected at a historical annual average of 16 % rural electrification rate for the period 1996-2002.

a key contributor to the failure of Kenya's Rural Electrification Programme which was also headed by a Permanent Secretary from the Ministry of Energy [MoE, 2003].

The Electricity Act also appears not to provide for "ring-fencing" of the funds allocated for rural electrification. As witnessed in the Kenyan case, inadequate protection of the Rural Electrification Fund hobbles attempts to reach the poor. Another important aspect not adequately addressed by the Act is that it does not explicitly provide for the representation of the poor on the Rural Electrification Board.

7. Key findings and recommendations

7.1. Findings

In general, the findings of this article appear to indicate that the vast majority of the poor in East Africa still have no access to electricity. In both countries, reports from the utilities, Ministries of Energy and the regulatory agencies make no attempt to track electrification of the poor. In Uganda, this is exacerbated by the fact that the distribution utility does not classify consumers into rural and urban categories. It is, therefore, difficult to comprehensively assess the impact of reforms on the poor without access to adequate data[21].

Close examination of the amended Electricity Acts of Kenya and Uganda indicates that neither Act proposes new and innovative initiatives that would ensure increased electrification of the poor. For example, the Kenyan Electricity Act does not provide for a rural electrification agency, while the Ugandan one does not protect the autonomy of the Rural Electrification Board. In addition, both Acts are silent on "ring-fencing" of electrification funds for the poor and on the representation of the poor on the board of the rural electrification agency.

The sequence of power sector reform measures in Kenya and Uganda appears to have been detrimental to electrification of the poor, particularly in rural areas. In both countries, initiatives aimed at increasing rural electrification were started at the end of the reform process. Other developing countries such as Thailand, Bangladesh

Table 8. Successful national electrification initiatives in selected African countries

Country	Pre-initiative national electrification levels (%)	Post-initiative national electrification levels (%)	Percentage-point increment	No. of years
South Africa	50 (1995)	68 (2002)	18	7
Zimbabwe	20 (1991)	39 (1999)	19	8
Ghana	15 (1991)	45 (2001)	30	10
Uganda (rural) – planned	1 (2002)	10 (2012)	9	10

Sources: NER, 2003; Gboney, 2001; Kayo, 2002; Eremu, 2003; Kayizzi, 2003; Dube, 2002; Okumu, 2003

and the Philippines initiated reforms after establishing an independent rural electrification agency that ensured rapid rural electrification before the advent of market-oriented sector reforms [Shrestha et al., 2003].

Reforms also appear to have failed to link rural electrification to the overall strategy of improving the power sector performance. For example, the issue of lucrative licences and concessions is not closely linked to the ability of the licensee/concessionaire to increase electricity access for the poor. In addition, the newly unbundled (and privatised) distribution utilities do not appear to have rural electrification targets that are linked to future tariff adjustments.

The practice of linking improved access to licensing has been successfully implemented in the mobile telecommunication sector in Kenya. Operators are licensed on the basis, among other prerequisites, of a demonstration of their ability to significantly increase the number of mobile telephone connections and the geographical coverage. The licence awarded to successful operators includes a target number of new connections and geographical coverage over a specified period. Subsequent renewal of the operator's licence largely depends on the extent to which the operator has met the initial target [CCK, 2003].

Uganda's rural electrification target for 2012 is a paltry 10 %. This is a very low target and unlikely to make a significant difference. Data from other African countries shows that in the same period of time (or even shorter), it is possible to achieve much higher electrification levels.

Table 8 shows increments in national electrification levels for selected African countries within a decade or less. With the exception of Zimbabwe, the key driver for high national electrification levels was rigorous and well-managed rural electrification programmes. In some countries, the increase in rural electrification levels was higher than that of the national level. For example, in South Africa, rural electrification levels rose from 21 % to 50 % in seven years (1995-2002), indicating an increase of 29 percentage points compared to an increase of 18 percentage points at the national level [NER, 2002].

In a nutshell, although some of the reforms have had a positive outcome such as improved financial performance in the Ugandan utility and an improvement (albeit for a limited period) in the general technical performance of the electricity industry in Kenya, the analysis presented in this article demonstrates that reforms have not led to significant electrification of the poor. On current trends, electrification for the poor is unlikely to take place in the foreseeable future. In addition, the current institutional and legal framework does not provide any special incentives for the electrification of the poor. As a result, only a comprehensive transformation of ongoing power sector reforms could lead to greater electrification of the poor in East Africa.

7.2. Recommendations

Firstly, there is an urgent need to establish reliable databases on the electrification of the poor. This is absolutely essential for monitoring rural electrification programmes. The utilities, Ministries of Energy and the regulatory agencies should develop databases that track the electrification of both urban and rural households (categorized by income) and include the data in their annual reports.

Secondly, the newly established Rural Electrification Board in Uganda as well as the proposed Rural Electrification Authority in Kenya should avoid the pitfalls of previous electrification initiatives that largely became an avenue for revenue collection for utilities with no clear link to expanded electrification of the poor. To avoid this pitfall, the autonomy of the bodies responsible for rural electrification – an important stipulation not provided for by the Electricity Acts – should be strengthened.

The Acts should also provide for the appointment of the governing boards of rural electrification agencies by Parliament, thereby strengthening their independence. To further enhance the autonomy, the Electricity Acts should be amended to ensure that the funds for financing electrification of the poor are "ring-fenced". The board of the rural electrification agency should include representatives of the poor to ensure that the concerns of low-income communities are addressed.

The performance of the electrification agencies should be evaluated by the number of new connections, particularly in rural areas and among the urban poor. Significantly higher rural electrification targets than those currently set should be established. The targets should include explicit and ambitious goals for the electrification of the poor.

Thirdly, it is recommended that other countries in the sub-region whose reforms are not at an advanced stage (e.g., Ethiopia and Tanzania) ensure that they establish structures and mechanisms for increased rural electrification before embarking on large-scale privatisation

reforms. Evidence from other developing countries indicates that high rural electrification levels have been achieved when rural electrification initiatives precede major market-oriented reforms such as privatisation.

Lastly, reforms should adopt innovative approaches to promote wider electrification. One approach could be to link electrification targets to the purchase of attractive distribution rights. For example, the purchase of attractive city distribution rights can be linked to the mandatory electrification of low-income urban settlements as well as selected low-income rural settlements. This will ensure that private investors are simply not cherry-picking the most profitable portions of the electricity industry and leaving the unprofitable portion (e.g., rural electrification) to the state.

Another approach of ensuring that reforms support the electrification of the poor would be to ascertain that a significant proportion of the proceeds from licence fees, concession fees and sale of utility assets directly contribute to the rural electrification fund. ■

Notes

1. Stated as 100 %, as the few individuals with incomes higher than US$ 2/day constitute a tiny total that adds up to a fraction of a decimal point (effectively, a rounding error).
2. Kenya is Uganda's leading regional source of imports.
3. In both Kenya and Uganda, the rural population is defined as those people living in the areas outside administrative boundaries of urban local authorities (i.e., county councils, municipalities and city councils). The data on the rural population is drawn from the government statistical authorities – Central Bureau of Statistics (Kenya) and Uganda Bureau of Statistics.
4. Another important limitation of the assumption is that when purchasing power is considered, the urban poor may not be significantly better off than their rural counterparts because of the lower purchasing power of money in urban areas.
5. Stated as 100 %, as the few individuals with incomes higher than US$ 2/day constitute a tiny total that adds up to a fraction of a decimal point (effectively, a rounding error).
6. This is calculated using adult equivalent figures and an average household size of 4.8.
7. This is calculated using adult equivalent figures and an average household size of 3.5.
8. Another important limitation of the assumption is that when purchasing power is considered, the urban poor may not be significantly better off than their rural counterparts because of the lower purchasing power of money in urban areas. The UN projects that Kenya's urban population will exceed its rural population within 10 years [UNPOP, 2001; 2002]. In addition, a recent assessment of national poverty in Kenya finds that in 1999, roughly 2.3 million urban-dwellers, 46 % of the total, were poor by national standards. This is a full 20 % of the country's poor population [CBS, 2003]. Essentially, the findings of this article apply to rural populations, which include the majority, but not the entirety of the East African poor as the analysis does not cover an estimated 20 % of the population that is urban and poor.
9. Stated as 100 %, as the few individuals with incomes higher than US$ 2/day constitute a tiny total that adds up to a fraction of a decimal point (effectively, a rounding error).
10. The term eastern Africa as used in this article refers to Ethiopia, Kenya, Uganda, Mauritius and Tanzania. East Africa, in the context of this article, refers to Kenya and Uganda.
11. Exchange rate (2001): US$ 1 = Ushs. 1,757.
12. TANESCO is the Tanzania Electricity Supply Company.
13. The Kenyan Electricity Act was amended in 1997, while the Ugandan Act was amended in 1999.
14. Electrification level refers to the estimated proportion of the households that have physical access to electricity. The most common technique of estimating electrification level is using the total number of electricity connections (including non-domestic consumers). This technique has a major flaw in that it does not differentiate between domestic and non-domestic connections. Consequently, it masks the real problem of access by generating higher domestic electrification levels than there actually exist. It is for this reason that this article only utilizes domestic connections to estimate household electrification levels.
15. Electrification rate refers to the number of new domestic connections in a specific year expressed as a percentage of total domestic connections for the previous year.
16. In Kenya, rural electrification dates back to 1967. The Rural Electrification Fund was initiated in 1972 and the Rural Electrification Programme was started in 1973. In Uganda, the Rural Electrification Fund was established in 2001 but its operation is still in its embryonic stage.
17. As mentioned earlier, this assumption has a major flaw as it ignores the urban poor accounting for a not insignificant 20 % of the national population of Kenya. In addition, the urban population is expected to surpass the rural population by 2012 [UNPOP, 2001; 2002; CBS, 2003].
18. The term "ring-fencing" refers to ensuring that funds are strictly accounted for and protected from any undue misallocation.
19. This was an exercise by the utility aimed at formalizing illegal connections as well as stopping fraudulent acts such as bypassing and/or tampering with electricity meters.
20. The data available does not differentiate between reconnections and new connections. Reconnections are considered new connections (new consumers).
21. This article overcame this constraint by a judicious use of proxies and careful reassessment of utility customer list.

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Appendix A. Evolution of power sector reforms in Kenya and Uganda

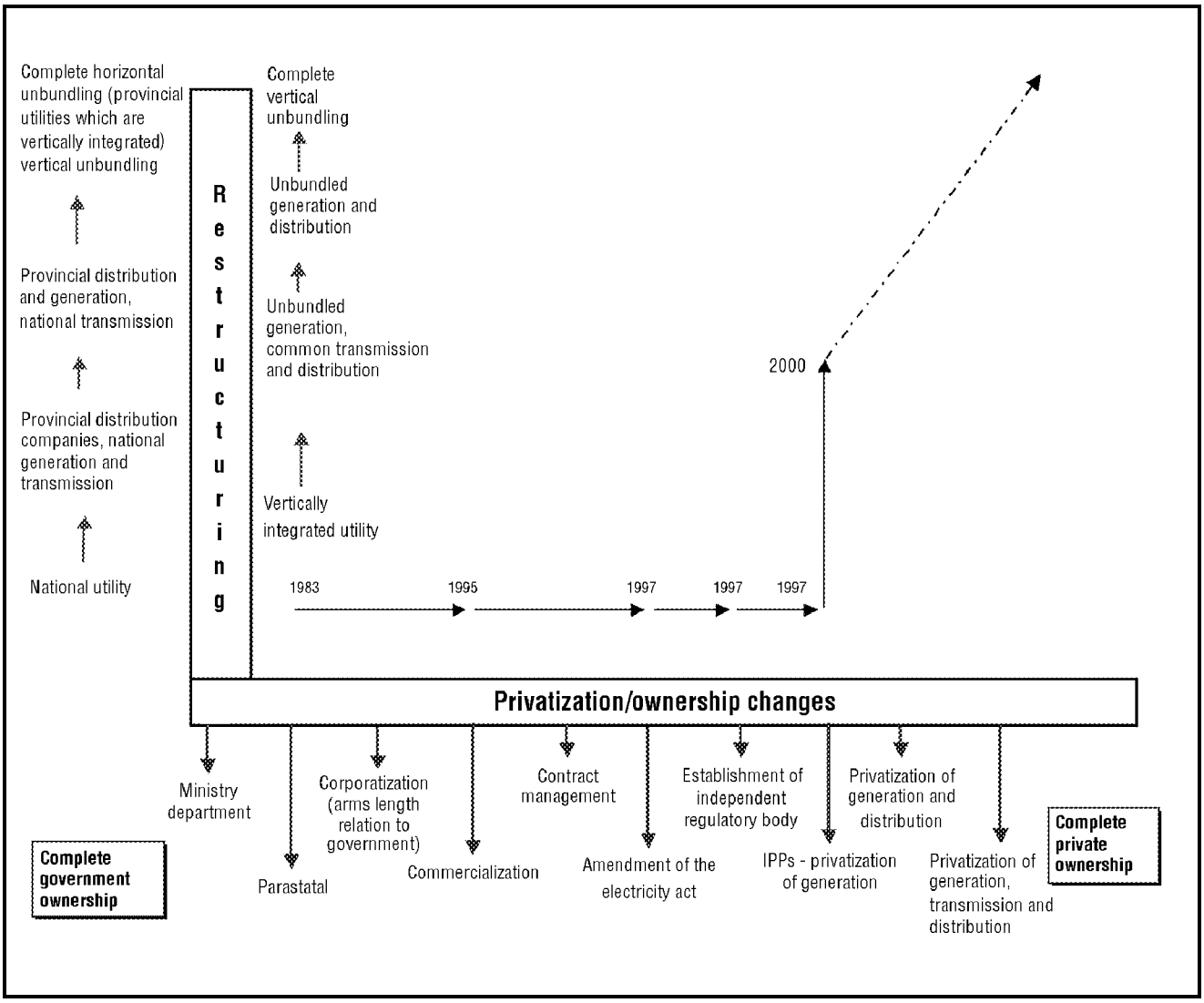

Figure A1. Reforms in Kenya's power sector

Sources: Karekezi and Mutiso, 2000; Nyoike, 2002

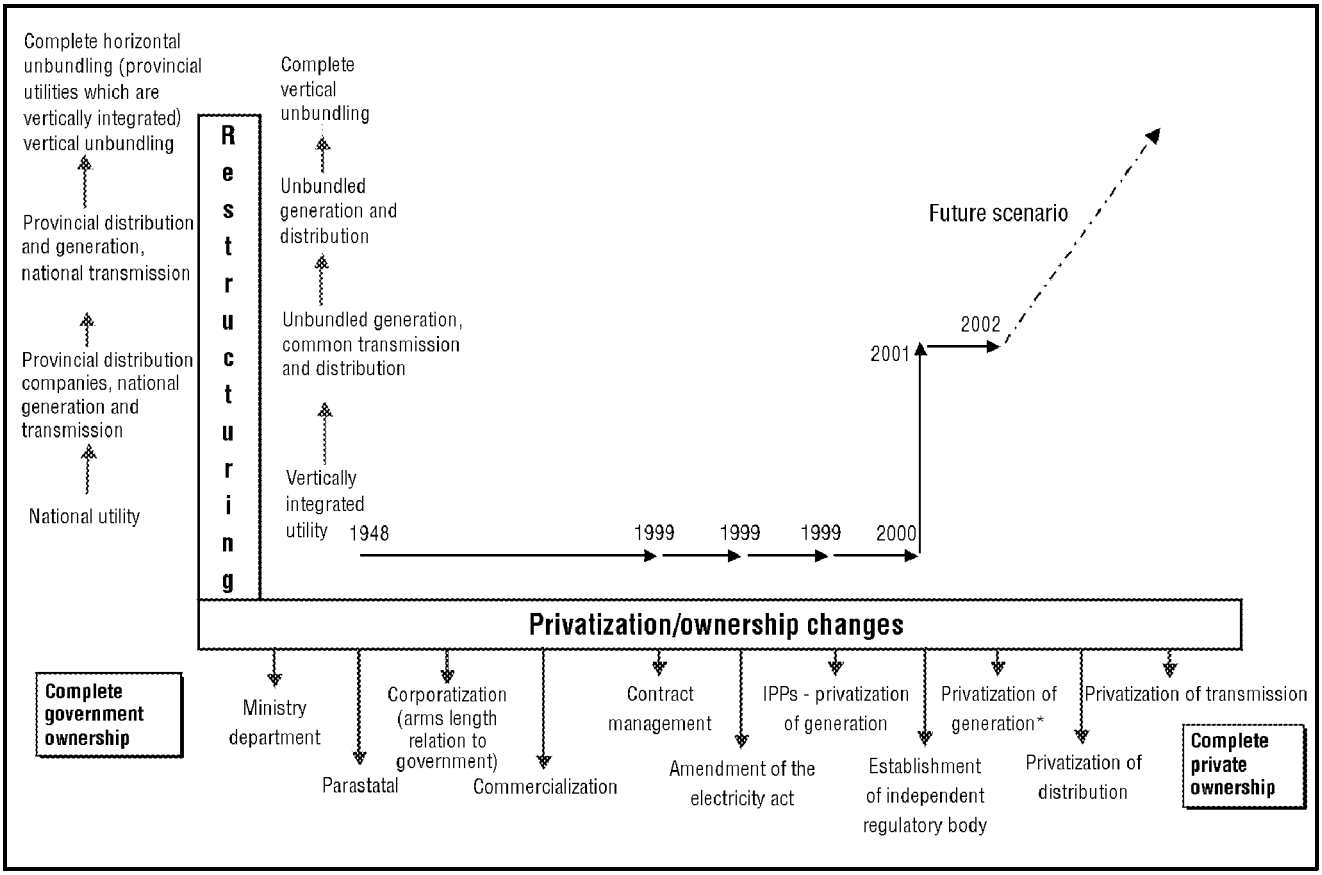

Figure A2. Reforms in Uganda's power sector

Source: Compiled by authors

Note

The asterisk * indicates concession awarded to Eskom Enterprises of South Africa

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Electricity access for the poor: a study of South Africa and Zimbabwe

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Electricity access in sub-Saharan Africa is only 17 %, the lowest worldwide, but is even worse for the rural areas that house most of its poor, where it is estimated at around 5 %. This paper looks at this issue for two countries in Southern Africa, Zimbabwe and South Africa.

South Africa and Zimbabwe present two different cases of how government policy intervention can help to improve access to modern energy services. The energy policies in South Africa and Zimbabwe evolved under different sets of national circumstances. South Africa is a highly industrialised country in Africa endowed with a wide variety of natural resources. The country is currently going through major changes in many spheres of its economy, including energy, following the democratic elections in 1994, with emphasis placed on redirecting key aspects of government policy to address the enormous disparities in income levels and living conditions between the different racial groups, a result of apartheid. Zimbabwe, on the other hand, is a landlocked country with an economy that relies heavily on agriculture, with higher levels of poverty that are closely related to the country's history of governance by the minority white government. After independence in 1980, the Government of Zimbabwe embarked on policies aimed at redressing the economic imbalances of the past, including reforms in the power sector. These included increasing electricity access to previously disadvantaged people through grid electricity expansion and off-grid electrification.

The paper examines the impact of power sector reforms on the poor, with specific reference to the electrification programmes in the two countries.

1. Introduction

Most African countries including those in the Southern sub-region face a major challenge in trying to achieve their development and social obligations because of acute lack of modern energy services. Electricity access clearly demonstrates this deficiency because it is only 17 % for sub-Saharan Africa as a whole and less than 5 % in rural areas [Davidson and Sokona, 2002]. This situation calls for major changes not only because of development demands but for the region and its sub-regions to be competitive with other developing regions of the world.

Another area of regional concern is the strong links between modern energy service provision and poverty reduction in the region. For the region to achieve the Millennium Development Goals (MDGs) it agreed to at the World Summit on Sustainable Development (WSSD) held in Johannesburg in 2002, it needs substantial increase in modern energy service provision, especially affordable, reliable and adequate electricity. Improving on the current high infant mortality, low life expectancy, and high illiteracy and fertility rates of the region [World Bank, 2003] will require substantial electricity provision, particularly for the poor who are very much deprived of these services.

Unfortunately, a recent report suggests that the proportion of the poor in the region is growing and may continue to do so if no major policy intervention is introduced [Davidson, 2000]. Increase in poverty has been mainly a result of neglect in rural areas and growing numbers of urban poor as a result of high migration rates. Developing policies, especially in the energy and power sector, to cope with these challenges is very important for the overall net productivity of the region as whole.

Providing electricity to the poor in Southern Africa, to which this paper confines itself, poses unique policy challenges because although the sub-region has abundant fossil and renewable energy resources, exploiting these resources remains a daunting task because of major technological, institutional and financial obstacles, but financial obstacles remain the most important. Inadequate energy investments, an underdeveloped downstream energy sector and poor management are some of these barriers, and the poor are the most affected. Furthermore, overseas development assistance (ODA), which has been traditionally used by many countries in the sub-region on pro-poor programmes, is dwindling [OECD, 1998]. However, in recent times there has been a call from both

donors and recipients for new approaches to ODA programmes including those relating to energy [Davidson and Zheng, 2003].

Because of the sub-region being fragmented into many countries, this paper will concentrate on the two most industrialised countries in the sub-region. Together, they account for over 50 % of the population and 80 % of the electricity produced and used. However, the findings and general remarks will include comments on the sub-region as a whole. The paper discusses briefly the background of electricity production in the two countries before looking at their reform programmes. The impact of these programmes on the poor is analysed using five indicators as guide. Three of these are more associated with access, viz., levels of electrification, rates of electrification, and consumption, while the other two, tariffs and expenditure, are related to affordability. Limitations on the availability of data in the sub-region restricted the level of analysis but empirical methods were utilised to reduce this deficiency.

1.1. Background on Zimbabwe and South Africa

Zimbabwe is landlocked, with a population in 2003 estimated at 13 million and a land area of 390,800 sq. km. Its economy is heavily dependent on agriculture and mining. Zimbabwe obtained its independence in April 1980 and inherited all the ills of a racially divided society, but with a developed industrial sector and a better infrastructure than most of its neighbours. The economy is heavily dependent on agricultural crops, such as tobacco, cotton and sugarcane, and on manufacturing industries such as steel, textiles and sugar production. Mining is a major activity, primarily gold. The Zimbabwean economy continued to perform quite well after independence, in spite of constraints due to several internal and external problems, including the disparities in access to resources. However, the country has suffered from persistent droughts which have had negative impacts on its economy.

According to a recent census, South Africa has a population of about 45 million people living on a land area of 1.2 million sq. km. It is well endowed with natural resources, including coal, gold, diamonds, metals and other minerals. Its economy is in part reliant on energy production and use, with coal accounting for 75 % of the fossil fuel demand and for 91 % of electricity generation. South Africa is more industrialised than Zimbabwe, in fact the most industrialised country in Africa. Like Zimbabwe, it is still undergoing profound changes after the democratic elections of 1994 which led to the transformation from an apartheid system to a non-racial democratic form of government, resulting in new directions in almost all aspects of government.

The development history of these two countries is similar in some ways, having had a serious impact on poverty, though their overall income levels are different. The GNP per capita of South Africa in 2001 was US$ 2,820, which is far higher than the average for sub-Saharan Africa (just below US$ 500), while the GNP per capita in Zimbabwe in 2001 was US$ 688. However, in both countries the per capita incomes between the different races differ significantly, especially in South Africa which became independent more recently. For example in South Africa, average monthly incomes for black households in 2000 were half those of coloured households and about a quarter of those of the whites [SSA, 2002].

Table 1. Household access to energy sources in Zimbabwe (%)

Energy source for cooking	Urban areas		Rural areas		National	
	Poor	Non-poor	Poor	Non-poor	Poor	Non-poor
Electricity	73.1	81.9	2.1	11.0	19.0	52.8
Kerosene	39.7	33.7	1.0	13.5	10.2	25.4
Wood or coal	12.7	5.4	98.6	80.6	78.1	36.3

Source: CSO, 2001.

These differences in South Africa link poverty strongly to the wide disparities of income levels of different racial groups. In general, the rural areas are far more impoverished than urban areas, mainly as a result of the past system of separate development defined by race. The South African government defined the minimum standard of living as ZAR 709 (US$ 273) a month in 1990, which was equivalent to about US$ 9/day using the 1990 exchange rate. In 2002, ZAR 8.00, which is equivalent to US$ 2.54/day, was used to describe poor households. This clearly shows that using the internationally common poverty standard of US$ 1/day as baseline will lead to discrepancy in the analysis.

Poverty issues in Zimbabwe are closely related to the country's history of governance by the minority white government, which resulted in economic and political benefits to the whites, while ignoring the black majority. Economic inequality still pervades the Zimbabwean economy. After independence, the government embarked on policies aimed at redressing economic imbalances against a background of the private sector remaining in the hands of minority whites and multinational companies. The social sector was accorded a high proportion of government expenditure, including access to modern forms of energy, with the hope of redressing past inequalities. In Zimbabwe as in most African countries, access to modern energy services is very income-dependent, as shown in Table 1.

2. The electricity industry

Electricity generation in the 13 countries that form the Southern African region is dominated by thermal generation, about 81 %, with hydropower accounting for around 15 %, the rest being nuclear. However, the consumption of the electricity generated within the region is largely skewed, with South Africa accounting for about 35 GW of the total 43.8 GW generated in 1997 and Zimbabwe 2.07 GW, the remaining 11 countries only 6.6 GW [USDOE, 2000]. Also, coal, which dominates power production, is mainly produced by South Africa and Zimbabwe. Hence, studying the electricity situation in these two countries will cover over 80 % of electricity production and use in the sub-region. A unique feature of the

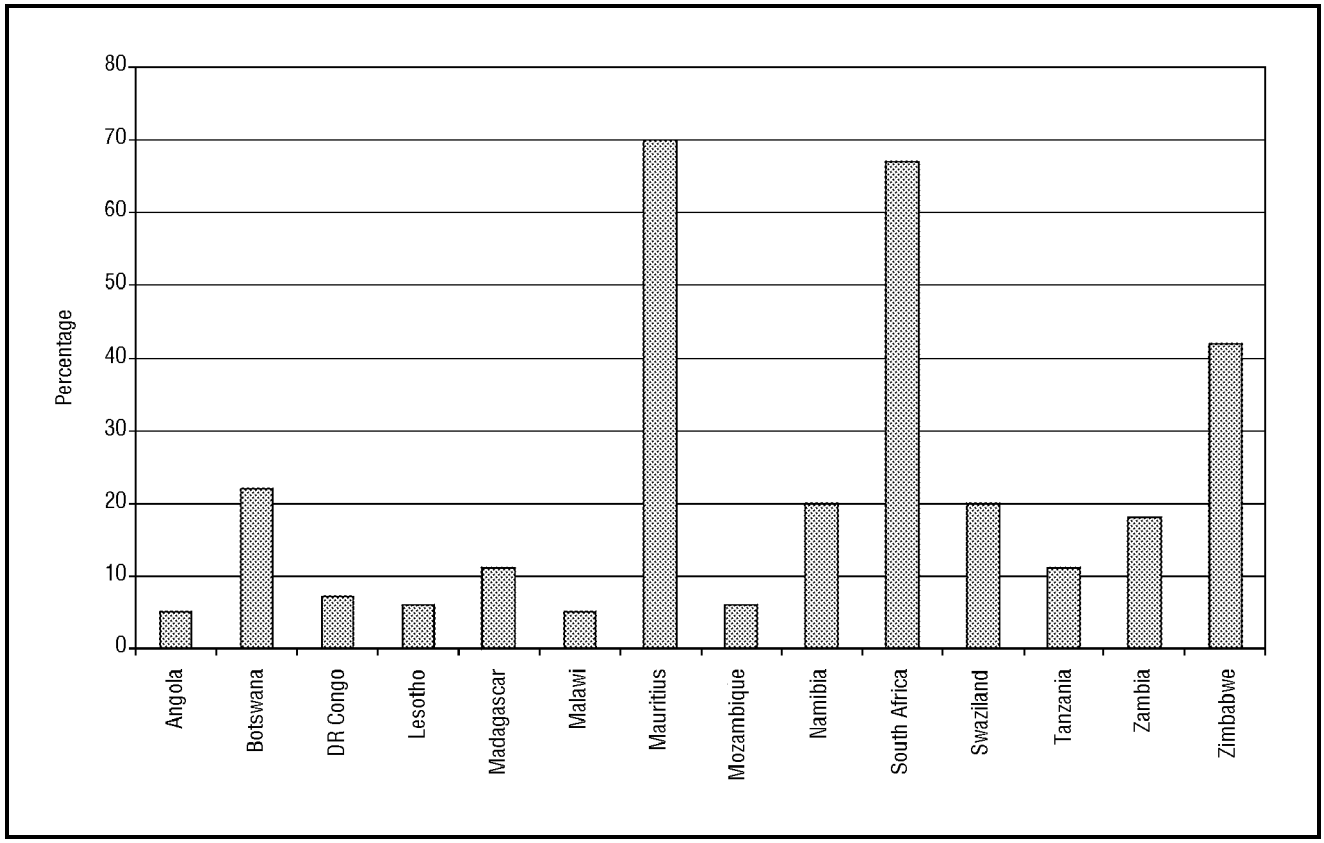

Figure 1. Access to electricity in selected sub-Saharan African countries

Source: O'Sullivan and Hamaide, 2002

Table 2. Energy parameters of South Africa and Zimbabwe

Indicator	South Africa (2000)	Zimbabwe (2001)
Population (million)	42.80	12
Energy production (PJ)	6472	8.7 (2000)
Electricity consumption (TWh)	194.02	9.813
TPES/GDP(ppp)	0.29	0.96
Electricity consumption/pop. (kWh/cap)	4533.12	910

TPES - Total primary energy supply

Sources: IEA, 2002; SSA, 2002; Helio-Zimbabwe, 2002

Table 3. South Africa's electricity production profile, 2001

Source	Net energy transmitted (GWh)				% of total
	Eskom	Municipal	Private	Total	
Coal	175,222.8	609.6	7,440.0	183,272.6	93.7 %
Nuclear	10,718.6			10,718.6	5.5 %
Pumped storage	-769.2	-67.5		-836.8	-0.4 %
Hydro	2,194.0	9.6	14.2	2,218.0	1.1 %
Bagasse			306.8	306.8	0.2 %
Gas	-0.7	5.7		4.9	0.003 %
Total	187,365.5	557.5	7,761.2	195,684.3	

Source: NER, 2001.

energy sector in the sub-region is the relatively active energy committee of the Southern Africa Development Community (SADC). This has led to many sub-regional energy programmes such the Southern African Power Pool (SAPP), which will be discussed later. Access to electricity in the sub-region is very low except for a few countries, as is shown in Figure 1. Only three countries have access to electricity significantly above the average for sub-Saharan Africa, which is 17 %: Mauritius, South Africa and Zimbabwe. However, as previously mentioned, this paper will be restricted to South Africa and Zimbabwe.

The key parameters describing the energy sectors of both countries are summarised in Table 2.

2.1. The power sector in South Africa

An overview of South Africa's electricity sources is presented in Table 3. Eskom, the national power utility, accounts for 96 % of the country's electricity generation [NER, 2001]. About 93 % of this is from coal, representing a total generation capacity of 37,678 MW [Eskom, 2002]. The shares of other sources of power generation are nominal, for instance, a single nuclear power station which accounts for under 6 % of total electricity capacity. Natural gas plays a very small role but there are plans to expand its contribution substantially soon with gas from Mozambique expected in 2004.

However, South Africa is interested in the development of different energy resources for electricity production in the wider Southern African region. These sources include hydropower from the Grand Inga river in the Democratic Republic of Congo (DRC), estimated at over 40,000 MW

potential. Most interest is in the massive power exports within the SADC region, within the SAPP which was created in 1995 with the aim of establishing a single electricity grid in the sub-region. At present, SAPP comprises utilities from Angola, Botswana, DRC, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe, and its vision is to become a power exchange facility in SADC.

2.2. The power sector in Zimbabwe

The Zimbabwe Electricity Supply Authority (ZESA) has been responsible for the generation, transmission and distribution of electricity in Zimbabwe for a long time now. It has five major power stations, with a total capacity of 1,961 MW [Karekezi et al., 2002]. These facilities do not meet the country's electricity demand. As a result, Zimbabwe imports 41 % of its electricity from neighbouring countries, including DRC, Mozambique, Zambia and South Africa (as shown in Table 4). Electricity generation in Zimbabwe is mainly from coal and hydro plants, the former with a capacity of 1,170 MW. The largest hydro plant is Kariba, which generates 500 MW [ZESA, 2001]. An overview of internal electricity supply in Zimbabwe is shown in Table 5.

3. Power sector reforms

3.1. Power sector reforms in South Africa

Under the apartheid system, which prevailed until 1994, development progressed on racial lines, and this pattern pervaded the energy industry. Consequently, the focus of electricity provision was on heavy industry, mining and white households which comprised about 12 % of the total population. The ANC government which won the democratic elections held in 1994 made the provision of electricity to the disadvantaged, mostly blacks, the cornerstone of its development policy under the slogan "Access to electricity for all". This promise was perceived as *grid* electricity for all – including people in the remote areas of the country. The Energy White Paper released in 1998 [DME, 1998] provided a framework and guidelines for the government to achieve national energy objectives, of which one was universal household access to electricity (with priority to the poor) while alleviating negative environmental impacts.

3.1.1. Rationale for power sector reforms

According to the White Paper, the broad energy policy of the government is as follows:

1. addressing the energy requirements of the poor;
2. enhancing the competitiveness of the economy by providing low-cost but high-quality energy inputs to industrial, mining and other sectors;
3. achieving environmental sustainability of natural resources; and,
4. attracting foreign energy investments.

The key policy problems and challenges in the electricity sector as identified by government are the following.

- Approximately 40 % of all homes in South Africa, and tens of thousands of schools and clinics, are without ready access to electricity supply.
- The distribution sector of the industry is highly fragmented – with more than 120 municipalities that had less than 1,000 consumers and more than 90 municipalities with annual revenues of less than ZAR 1 million, resulting in low efficiencies, high costs, wide disparities in tariffs, and the problem of financial viability among distribution entities. Also, the industry is experiencing high levels of non-payment and electricity theft, resulting in increasing arrears and payment defaults.
- The electrification programmes of most municipal distributors are constrained by difficulties in accessing financing. Hence, the need for higher electrification expenditure.
- Coal-based electricity generation results in significant pollutant emissions, with potential long-term effects on the environment.
- Major inefficiencies exist in the electricity sector, thus wasting scarce energy and capital resources.
- Although electricity demand is only projected to

Table 4. Zimbabwe's power imports

Country	Interconnection voltage (kV)	Maximum capacity (MW)	Available capacity (MW)
Mozambique	400	500	500
South Africa	400	500	150-500
Zambia	330	700	100-200
DR Congo	220 (to Zambia)	250	150

Source: Karekezi et al., 2002.

Table 5. Overview of internal electricity supply in Zimbabwe

Station	Kariba	Hwange	Harare	Bulawayo	Munyati	Total
Plant type	Hydro	Coal	Coal	Coal	Coal	
Capacity (MW)	750	920	80	90	80	1,920
Available capacity (MW)	500	760	55	85	75	1,475
Net energy generated (GWh)	2,998	4,809	22	48	44	7,926
Plant load factor (%)	64.61	47.66	3.44	6.50	5.42	49.18
Efficiency (%)	91.42	27.80	20.18	20.91	18.38	53.77

Sources: Karekezi et al., 2002; ZESA, 2001

exceed generation capacity around the year 2007, medium-term strategies for capcity expansion msut be in place in order to meet the needs of the growing economy.While a number of the aforementioned challenges could stimulate inflationary pressures on prices, the government has to maintain the competitive advantage of low, stable and cost-reflective electricity prices.

The reforms which were put in place were nationally initiated and financed. The components of these reforms are mainly the governance of Eskom, distribution industry and regulation.

3.1.2. National Electricity Regulator (NER)

The government established the National Electricity Regulator (NER) in April 1995 as a successor to the Electricity Control Board, established under Act No. 41 in 1987, to regulate the electricity supply industry in the country. NER was given national jurisdiction and it exercises its power through the licensing of generators, transmitters and distributors across the country. Its role is "to regulate the electricity supply industry to ensure that it meets customer requirements". Among the initial tasks of NER was the development of financial models for the National Electrification Programme, which led to the establishment of a national electrification target of 2.5 million household connections by the end of 1999 as stated in the Reconstruction and Development Programme (RDP). As a contribution to the RDP, Eskom set itself a target of delivering 1.75 million household connections at the rate of 300,000 per annum.

3.1.3. Eskom's governance

The government embarked on corporatisation of parastatals, including those of the power sector. Under this arrangement, a policy to restructure the electricity assets of Eskom through the Eskom Conversion Act was formulated. According to the Act, the government intends to restructure the electricity supply industry (ESI) by selling off 30 % of Eskom's generating assets by 2006 without compromising the social and development goals of the country.

The rationale for restructuring was not only to increase efficiency but also provide the opportunity to correct the previous imbalances in management and operations of the electricity sector. This Conversion Act may pave the way for new independent power producers. In parallel to in-country changes, Eskom has embarked on certain strategic initiatives aimed at making its energy and related services a business institution in Africa, and is now involved in 39 other African countries.

3.1.4. Reforms in the distribution industry

The electricity distribution industry was to be reformed to address the constraints to achieving the primary objective of meeting electrification targets, and ensuring high-quality supply at low cost and equitable price to all consumers. The objectives of restructuring the distribution industry were stated as:

1. ensuring that agreed electrification targets are met;
2. providing low-cost electricity;
3. facilitating better price equality;
4. improving the financial health of the industry;
5. improving quality of service and supply;
6. fostering proper co-ordination of operations and investment capital; and
7. attracting and retaining competent employees.

3.1.5. National Electrification Programme in South Africa

The South Africa National Electrification Programme (1994-99) was a government-financed initiative. The programme was implemented by Eskom and the municipalities with the key objective of raising national electrification levels to about 66 % by 2001 with 46 % rural and 80 % urban [NER, 2002a]. The targets of the programme were mainly the formerly disadvantaged and rural areas, and all schools and clinics. This implied providing electricity to an additional 2.5 million households. This programme provided the basis of looking at the electrification levels and rates for the poor of South Africa.

The new connections were mostly extended by Eskom and the municipalities, but large-scale farmers also connected their farm workers where necessary. However, Eskom accounted for about two-thirds, while the municipalities only accounted for about 6 %, as shown in Figure 2. However, there has been a slight drop in new connections, which averaged around 450,000 households per year between 1994 and 2000, to 397,000 in 2001. The decline is due mainly to the drop in new connections by Eskom.

3.2. Power sector reforms in Zimbabwe

Since attaining independence in 1980, Zimbabwe has embarked on various sector policy reforms, including energy sector reforms. The government has sought to increase energy access to previously disadvantaged people through both grid extension and off-grid electrification. The national energy policy has five main objectives [Munjeri, 2002]. Two of the objectives focusing on rural development and small/medium-scale enterprises have an explicit emphasis on the poor:

1. ensuring accelerated economic development;
2. facilitating rural development;
3. promoting small/medium-scale enterprises;
4. ensuring environmentally friendly energy development; and
5. ensuring efficient utilisation of energy resources.

Zimbabwe's power sector has undergone a number of changes since independence. Generally speaking, four main drivers have been behind power sector reforms in Zimbabwe [Turkson, 2002] with one of the drivers explicitly focussed on the needs of the poor:

- restructuring as a component of the general economic reforms;
- reforming parastatals to empower historically marginalised groups;
- enhancing power sector efficiency; and
- mobilising finance for capital investments in the power sector.

In 1985, the government reformed the structure of power utilities under the Electricity Act. Five publicly-owned power utilities were amalgamated to form the current Zimbabwe Electricity Supply Authority (ZESA) with the aim of streamlining the administration of the electricity sector,

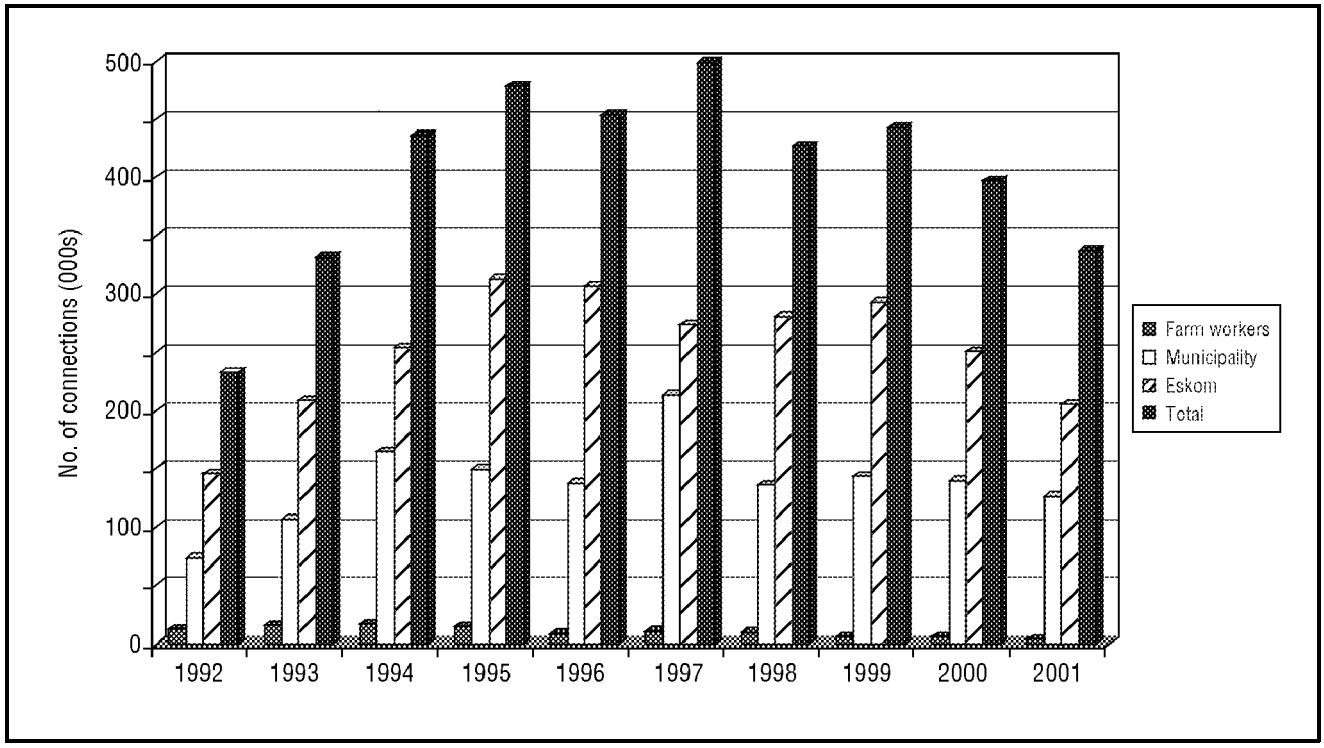

Figure 2. Annual new household electricity connections in South Africa, 1992-2001
Source: NER, 2001

improving efficiency, standardizing tariffs and reducing duplication of functions. ZESA became the only legal entity with the right to generate and transmit electricity. It had the option of licensing independent power producers to generate electricity and also the right to set the purchase price of electricity from the producers. The Act did not provide room for third party access, nor for other uses of the grid by third parties [ESMAP, 2000].

In 1992, the Performance Improvement Programme (PIP) was implemented with the assistance of Electricité de France (EdF). The programme consisted of a set of simple maintainable targets that were tied to contracts of a new management team covering finance, customer services and management, distribution system, generation plants and system, transmission system, other technical services, and human resources management. Implementation of the programme resulted in ZESA reversing its past trend of losses and achieving net surpluses in the years that followed [Dube, 1999].

In 1996, the government revised the Electricity Act in order to create room for independent power producers. The response was poor, probably because the Act still required independent producers planning to generate more than 100 kW to seek approval from the government and ZESA. In addition, the pricing, expenditure, capital budgets, procurement and staffing were to be regulated by the government.

In 1996, the privatisation and expansion of the Hwange power station was proposed. For this project to be economically viable, it was recommended, the long-run marginal cost (LRMC) principle should be adopted. The LRMC of the power station was estimated at 6-7 US¢/kWh and the average tariff then was 2.47 US¢/kWh. The government agreed, in principle, to adopt the LRMC, but did not implement the recommendation. This was compounded by allegations of lack of transparency in negotiations. As a result, initiatives to privatise several power stations, including the Hwange project, were abandoned [Karekezi et al., 2002].

In 1999, power sector reform programmes under consideration consisted of unbundling of the electricity sector, establishing a regulator, privatisation, and establishing a Rural Electrification Fund, based on a 1 % levy on all electricity bills. The Rural Electrification Fund helped in the extension of grid electricity to rural households by contributing towards initial capital investments [Karekezi et al., 2002]. However, since its inception in 1999, implementation of rural electrification under the fund has been slow, with only 14 of the targeted 54 projects having been completed by April 2000. The failure to achieve the target was attributed mainly to the narrow contractor base used for the rural electrification programme rather than to lack of funds, since the fund had, by then, an excess of ZB$ 460 million [Kayo, 2001].

In November 2001, the Zimbabwe cabinet approved a Rural Electrification Fund Bill that was to pave the way for establishment of the Rural Electrification Fund/Agency to spearhead the Rural Electrification Programme. The cabinet also approved the commercialization of ZESA by adopting the Electricity White Paper which provided for power sector reforms [ZESA, 2001].

In January 2002, a new Electricity Act and a Rural Electrification Act were passed, whereby the power sector was to have a regulatory commission (Zimbabwe Electricity Regulatory Commission, ZERC) and a Rural Electrification Agency (REA). This set in motion the

commercialisation of ZESA, and generation, transmission and distribution services were to be unbundled. The Electricity Act of 1985 was to be repealed when these new institutions were established [Mangwengwende, 2002; ZESA, 2001].

4. Impact of electrification programmes on the poor

4.1. Impact of electrification programme on the poor in South Africa

In 1993, only 36 % of the population had access to grid electricity, but since the introduction of the National Electrification Programme mentioned above, electrification rates have been increasing steadily, as shown in Figure 3. Though the target was put at about 66 % by 2001, it was exceeded, with 2.75 million connections achieved in Phase 1 [Borchers et al., 2001]. At the end of 2001, the National Electrification Programme recorded more than 3.4 million new connections since 1994. According to the Department of Minerals and Energy (DME), about 70 % of the households are currently electrified. The government is continuing the programme with the intention to electrify 300,000 homes annually. An interesting feature to note is that the cost of connection was declining steadily during the programme. In spite of the major achievements – such as being self-financed by the country – of the programme, nationwide about 30 % of the population (primarily composed of the poor) is yet to be electrified (20 % urban and 50 % rural). Figure 3 shows the trends of electrification in both rural and urban households. It shows that the programme essentially targeted the rural areas that housed mostly the poor and disadvantaged.

An off-grid electrification programme was launched in March 1999, aimed at providing 350,000 solar home systems (SHSs) in seven concession areas. However, this was later revised to five concession areas, and a sixth was recently awarded by the government. Under this programme, the government provides a subsidy of ZAR 3,500 to the concessionaire for each installation and the users pay a monthly service fee of ZAR 58 for maintenance. The system provided was rated at $50W_p$ capacity, which can power four lights, a radio and a black-and-white TV, estimated to consume about 6 kWh/month. Recently, the government initiated a subsidy programme of ZAR 40 to low-income users to help alleviate the burden of the monthly service charge, motivated by the recently instituted poverty tariff system that led to a discrepancy in benefits between the users of SHSs and grid electricity. The most advanced concession in the programme is the Shell/Eskom joint venture, which installed 6,000 systems by 2000 [DME, 2001]. However, the implementation of the programme has encountered many operational problems.

The Schools and Clinics Electrification Programme has provided off-grid energy services using SHSs. By 2000, about 1,852 schools and an unspecified number of clinics had been connected [DME, 2001]. However, the programme has had mixed results. Only 6 % of the 1,400 systems installed in 1996 and 1998 were found partially operational in 2000 [Oldach et al., 2001]. In an EU-funded project that installed 1,000 systems, 40 % were not operating within a year after installation [Mapako and Afrane-Okese, 2002]. The programme, however, was seen to have had more success in the electrification of clinics than schools.

In the White Paper on Energy Policy, the government recognised that household access to adequate energy services for cooking, heating, lighting and communication is

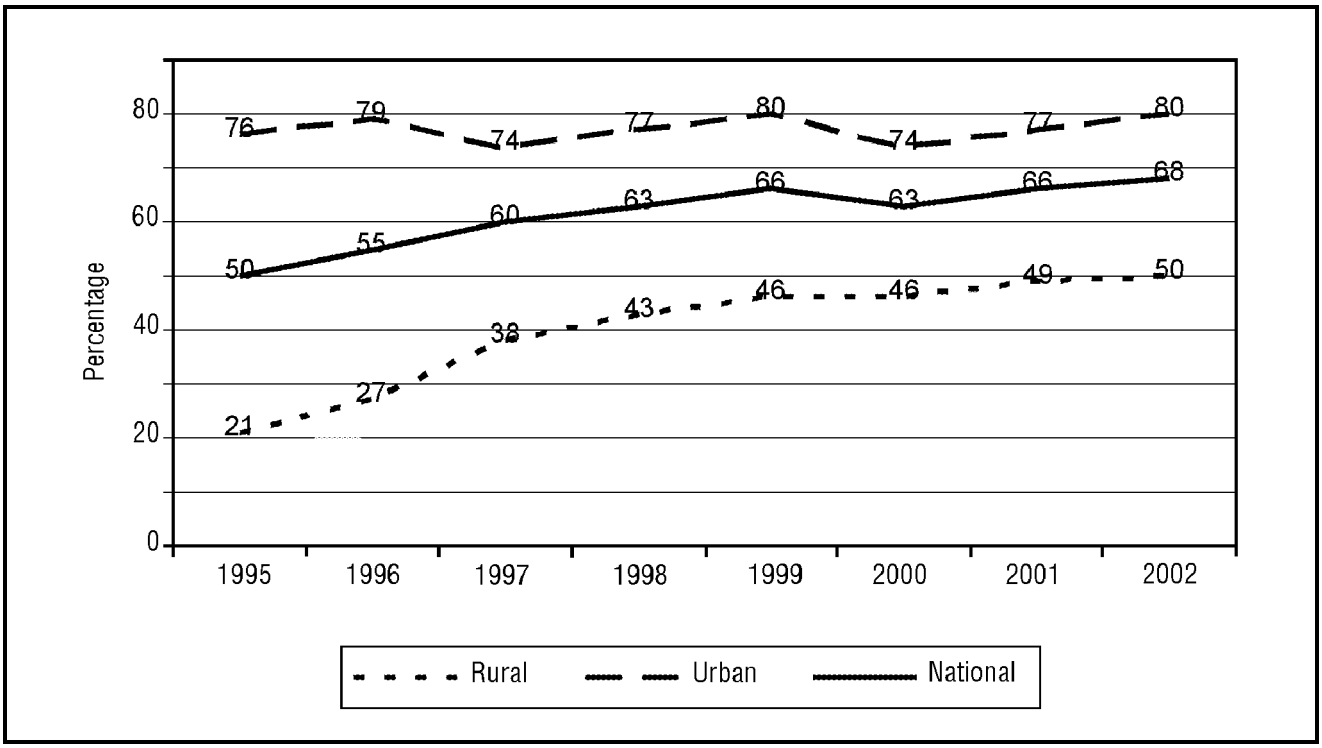

Figure 3. Trends in electrification of households in South Africa, 1995-2002

Source: NER, 2002b

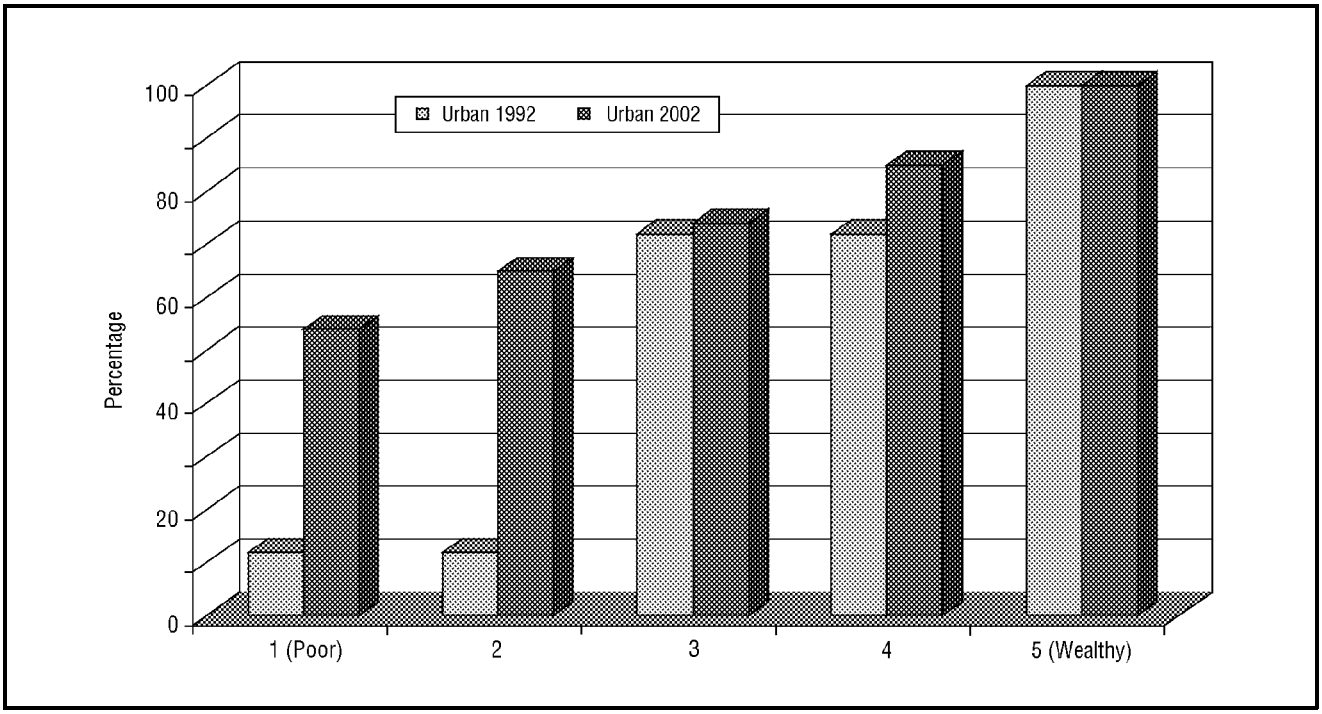

Figure 4. Trends in urban electrification in South Africa, 1992 and 2002

a basic need. While these needs could be met by various fuel-appliance combinations, without access to electricity human development potential will be constrained. The government has committed itself to implementing legislative and other measures to progressively realise universal household access to electricity by 2010.

In general, the welfare of poor communities with access to electricity has improved significantly under both off-grid and grid programmes. However, the levels of improvement differ between off-grid and grid-connected users since the services to the former are limited to only lighting and media. The welfare benefits were greater for grid-connected users, but lower than what was anticipated because the consumption levels were also lower than expected at the start of the programme [Borchers et al., 2001].

Electrification of the poor has also resulted in several additional benefits. These include reduction of fire incidents, particularly in low-income urban areas, from the use of paraffin and candles, and reduction of local and indoor air pollution from firewood use, especially in areas where these fuels are used extensively for cooking and heating. Electrification of clinics and schools has yielded significant benefits for improved health-care service provision, involvement of schools in evening adult education, and improved efficiency of school operations through use of equipment, such as photocopiers and computers. In certain cases, electric street lighting may have contributed to reduced crime levels.

Lack of data prevent showing the trend in urban and rural electrification rates, but using empirical data for South Africa, this trend is shown in Figures 4 and 5.

4.2. Impact of the Rural Electrification Programme on the poor in Zimbabwe

The first Rural Electrification Programme (REP) was initiated by ZESA in the 1980s, but it had to be abandoned in 1990 because of cash-flow problems and the lack of a comprehensive policy on rural electrification. In 2001, the Expanded Rural Electrification Programme (EREP) was initiated, following the introduction of a 1 % levy on monthly bills of all electricity accounts. Under the EREP, it became mandatory for the government, through ZESA, to allocate resources towards a widespread rural electrification drive [Munjeri, 2002]. The vision of this programme was the total electrification of the country, thereby contributing to poverty alleviation by stimulating economic activities that create wealth. However, its coverage was limited to the economically feasible rural growth points.

The long-term objectives of the initial EREP were stated as:

- improving access to electricity by all rural communities;
- improving the quality of life through the delivery of modern social services, such as health and education;
- stimulating investment in rural areas so as to create employment and increase incomes;
- improving the general economic and social status of people in rural areas; and
- helping in reversing urban migration and energy-related environmental degradation.

4.2.1. Electrification levels

The Performance Improvement Programme (PIP) initiated by the government in 1992 had the objective, among others, of total electrification of the country [Mangwengwende, 2002]. As a result, access to electricity grew from 20 to 39 % between 1991 and 1999 [Kayo, 2001]. Between 1999 and 2001, electrification grew from 39 to 42 % [World Bank, 2003]. Currently, ZESA connects an average of 21,839 new domestic consumers every year [Dube, 2003]. Figure 6 shows the national urban and rural

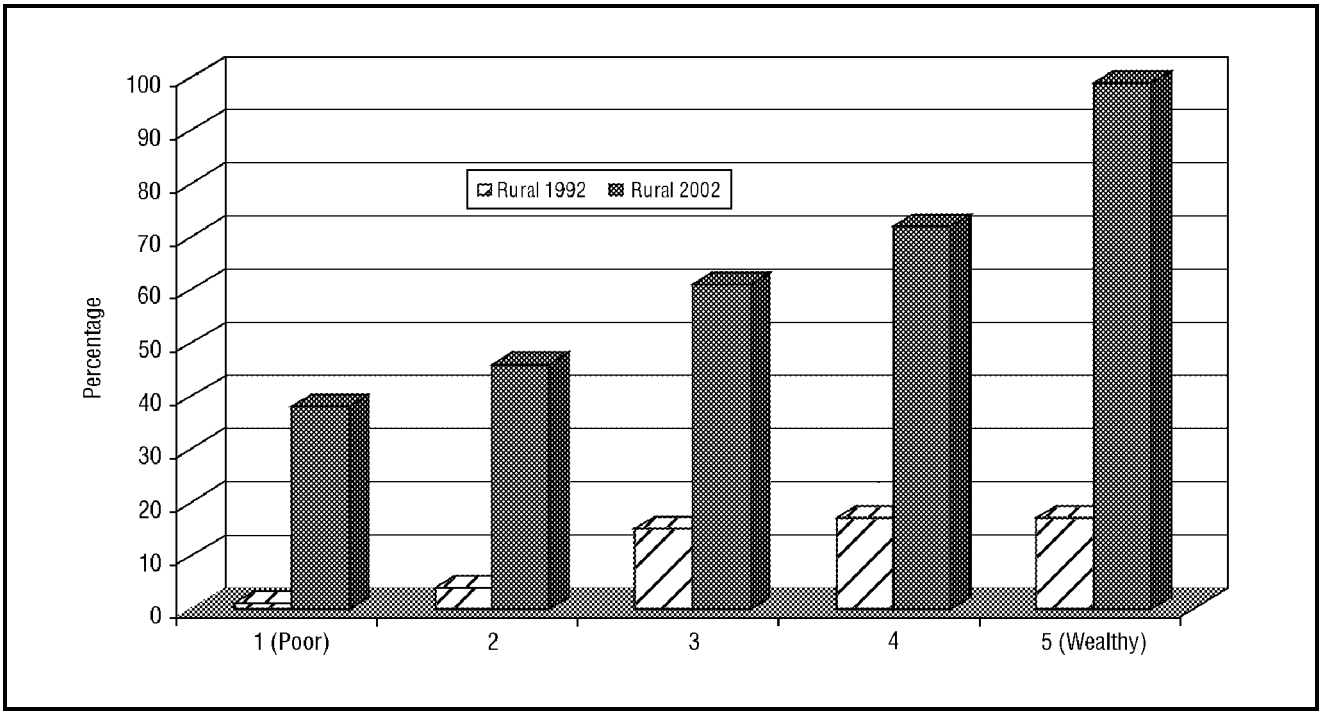

Figure 5. Trends in rural electrification in South Africa, 1992 and 2002

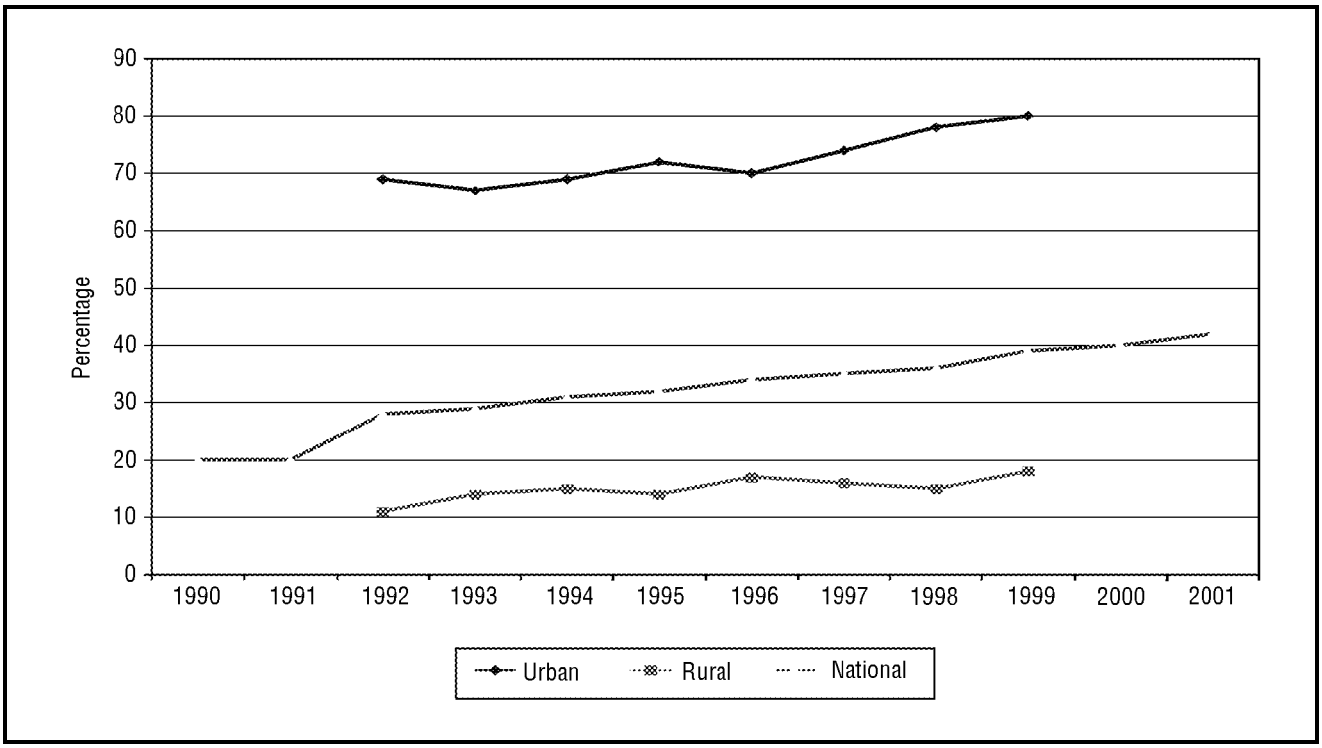

Figure 6. Electrification levels in Zimbabwe, 1990 and 2001

Sources: World Bank, 2003; Kayo, 2002

electrification levels from 1990 to 2001.

Recently, greater emphasis has been placed on rural electrification, as reflected in the Rural Electrification Charter of 2002 whereby ZB$ 24 billion is to be devoted to rural electrification under a five-year project. By 2003, about 100 rural centres were being electrified per month by this initiative [Dube, 2003].

Zimbabwe has an off-grid electrification programme that is mainly based on solar home systems (SHSs). Current estimates indicate that there are about 85,000 SHSs in the country, making it the country with the largest number of such systems in the continent [Mapako and Afrane-Okese, 2002]. One reason for this has been the low-cost silicon-type solar modules imported from Botswana and South Africa. Some companies in Zimbabwe have also been known to sell do-it-yourself solar kits, thus making

the dissemination of solar technology user-friendly. A major GEF-supported SHS project contributed to this large number of installations.

Zimbabwe's experience with off-grid electrification initiatives (mainly SHSs) has not been satisfactory when compared to the grid-based Rural Electrification Programme. Although a significant number of these systems have been disseminated in rural areas, the high cost of solar panels and the high failure rate of the systems have marred the achievements.

In response to the high cost of solar panels, the government waived duties on solar technologies, resulting in an increased demand for the systems. Subsequently, however, duties were reintroduced and this had an adverse effect on the rate of dissemination of SHSs [Karekezi et al., 2002]. With regard to the performance of the installed systems, Zimbabwe has recorded mixed results from the various projects. For example, two years after installation of SHSs under the GEF project, about 30 % of the systems had failed [Mapako and Afrane-Okese, 2002]. In general, it was observed that donor-funded projects were more prone to failure than privately implemented projects.

Biomass is another potential source of electricity in the country. Zimbabwe has an estimated 200 biogas digesters, and in the south there are two sugarcane-crushing mills that use more than 1.3 million tonnes of bagasse to generate electricity used by the sugar factories [Karekezi and Ranja, 1997].

5. Electricity tariffs, subsidies and expenditure

5.1. Electricity tariffs in South Africa

Average electricity tariffs in South Africa are comparatively lower than in many countries, but according to DME, this is due to coal which is relatively cheap being the base energy source, early investments and declining debts of Eskom, the main utility. However, prices may be increased in the medium to long term, as is being advocated by Eskom to the government. The need for replacement of generating facilities by 2007 has been cited as the reason for the tariff increase sought as existing surplus capacity will be utilised by then. In general, Eskom tariffs are classified according to many factors, but there are different charges and tariffs for rural and urban areas.

5.2. Electricity expenditure and consumption by poor households in South Africa

Data limitations have restricted the depth of the analysis on the energy consumption and expenditure patterns of the poor. However, there are a few case-studies which can be used to make preliminary assessments of these indicators. One is a study carried out recently by the University of Cape Town on the impact of electricity basic services support tariff (EBSST)[1]. However, the study sampled only a few areas in the KwaZulu-Natal province and cannot be seen as representative of the country. Nonetheless, the results of the study can provide some useful insights into electricity expenditure and consumption among poor households.

The study consisted of two case-studies of Umgaga, a long-established peri-urban settlement located about 35 km from the centre of Durban, and Antioch, a village located about 180 km from the city of Pietermarizburg [UCT, 2002]. Although both communities were by South African standards relatively poor, there are major disparities in their electricity expenditure and consumption levels (as shown in Tables 6 and 7). The average household income in Antioch is at the margin of poverty standards set by the government, while that in Umgaga is twice as much. The difference is reflected in the amount of electricity consumed, but the poorer Antioch community spends a substantially higher proportion of its income on energy.

Table 8 shows that in rural Antioch, 23 households' (56 %) electricity consumption was in the range of 0-50 kWh, while in peri-urban Umgaga, only 2 households (4.5 %) consumed this little electricity. Also, the study further shows that households use less than 25 kWh per month for lighting and radios.

Another study [Thom and Mohlakoana, 2001] shows that poor households use between 20 and 30 kWh per month for two lights for three hours each day; one light for 1.5 hours each morning, and one radio for 16 hours

Table 6. Household monthly income and energy (electricity and fuels) expenditure: Antioch and Umgaga, 2001

Attribute	Antioch	Umgaga
Average number of household occupants	6	6
Average total household income (ZAR)	817	1,678
Minimum total household income (ZAR)	223	0[1]
Maximum total household income (ZAR)	1,770	6,120
Total energy expenditure (ZAR)	107	97
Minimum energy expenditure (ZAR)	20	15
Maximum total energy expenditure (ZAR)	303	255
Energy expenditure as % of total household expenditure	17	12

Note

1. No formal regular income, occasional charity

Source: UCT, 2002

Table 7. Monthly household electricity expenditure and consumption, 2001

Attribute	Antioch	Umgaga
Average electricity expenditure (ZAR)	26	65
Minimum expenditure (ZAR)	3	15
Maximum expenditure (ZAR)	100	200
Average consumption of electricity units (derived from expenditure) (kWh)	68	170
Minimum consumed units (derived from expenditure) (kWh)	8	39
Maximum consumed units (derived from expenditure) (kWh)	265	520
Average consumption (measured) (kWh)	61	-
Minimum consumption (measured) (kWh)	6	-
Maximum consumption (measured) (kWh)	242	-

Source: UCT, 2002

Table 8. Distribution of household electricity consumptions, 2001

Electricity consumption (kWh/month)	No. of households in Antioch (based on measured load)	No. of households in Umgaga (based on reported expenditure)
0-25	14	0
25-50	9	2
50-75	5	7
75-100	6	5
100-150	3	11
150-200	2	4
200-300	2	11
300-400	0	0
400-500	0	2
> 500	0	2
Total	41	44

Source: UCT, 2002

each day. This study also shows that the consumption levels of the poor are constrained by affordability.

5.3. Electricity subsidies for the poor in South Africa

The government established the National Electrification Fund (NEF) to subsidise a large part of the capital costs of electricity connections under the electrification programme. The fund derives its income not only from the electricity industry, but also from fiscal allocations, grants and other sources. The cost of the programme was ZAR 8 billion, of which Eskom contributed ZAR 5 billion and local authorities ZAR 2 billion, with Eskom being exempted from corporate taxes. A total of ZAR 1 billion came from other sources.

In previous electrification initiatives, resources were allocated every year to the electrification programme through the mechanism of internal cross-subsidies and a surcharge included in the electricity price of Eskom and local authority distributors. These mechanisms have been considered non-transparent, with little room for government influence over the collection and allocation of the surcharge [DME, 1998]. The surcharge included in the electricity price is to be replaced by an electrification levy. This and other changes are not intended to affect the amount of funding for electrification or the level of the electricity tariff. The NEF extends its support to non-grid electrification in areas where grid electrification will not be viable for some time.

In 2000, the government announced its intention to provide the poor with free basic water and electricity services [DME, 2003]. It was recommended that 50 kWh per month be provided to all poor households connected to the national electricity grid. The decision to use the threshold level of 50 kWh was arrived at because 56 % of the connected households in the country consume an average of less than 50 kWh/month, and this is expected to meet the needs for lighting, media access, limited water-heating and basic ironing or cooking for a poor household. It was, therefore, seen as an initiative that will alleviate the burden on the poorest sector of the population. Since the government recognised there might be difficulties in applying this recommendation, the policy includes some flexibility over a range of 20-50 kWh per month.

There are numerous tariffs in South Africa, making it difficult to translate the 20-50 kWh into monetary terms. Using the Eskom tariff for domestic consumers, the 50 kWh subsidy in 2002 translated to about ZAR 20 per month. Applying this subsidy to Eskom tariffs, and assuming that 40 % of domestic consumers (7.1 million in 2001) would be targeted for EBSST, the cost of the subsidy would result in a revenue loss (excluding VAT) of about ZAR 630 million per year [UCT, 2002]. The government has recently committed itself to spending more than ZAR 500 million every year on this programme.

While the primary objective of EBSST was to help alleviate poverty, some key issues need to be resolved. These include identifying the real target and analysing the benefits including improvement in living conditions of the poor. The EBSST can provide a good case-study for assessing the effectiveness of subsidy schemes. It was designed to provide basic lighting and media access services plus very limited cooking service. It was expected to play an important role in poverty alleviation by providing appropriate conditions for education and learning, health, and access to news and information.

The results of two studies that investigated the ownership of electric appliances in electrified rural areas showed that most households were using electricity for appliances including radios, televisions, irons, electric kettles, hotplates/stoves and geysers [Davis and Ward, 1995; Hansmann et al., 1996].

On the basis of results in Table 9, a general framework of power requirements for a household owning some basic electric appliances is shown in Table 10. It has been assumed that use of an electric stove would be minimal for such a household.

The EBSST is expected to provide poor households free electricity in the range of 20-50 kWh per month, but as Table 10 indicates, 50 kWh constitutes about 59 % of the electricity consumption of an average poor household per month for lighting, television, radio, ironing and an electric kettle. Using a one-plate stove would exceed the amount of the units given under the EBSST. The EBSST study recommended that basic free electricity for poor households should be adequate for two 60 W lamps for 6 hr/night; one radio for 10 hr/day; and one 1.600 kW hot-plate for 0.7 hr/day. This would translate to 60 kWh of electricity consumption per month, above the maximum EBSST free electricity. However, the use of efficient compact fluorescent lamps (CFLs) and LPG stoves, if promoted along with the EBSST initiative, could reduce the consumption from 85 kWh to about 33-40 kWh per month. The LPG stove would replace the electric stove and efficient lighting (15W CFL) would consume 7 kWh per month. A comparison of monthly costs between use

of LPG or electric stove for such households would be necessary.

A study was also conducted to monitor the impact of EBSST on the consumption of electricity in two villages. The results are summarised in Table 11.

While it is recognised that there was a tariff increase from 2001 to 2002, the results of the study show a general decrease in electricity expenditure after the introduction of EBSST. This may be due to many factors. For instance, the average electricity consumption of most poor households may have reached a saturation point based on the affordability of electrical appliances, or the lack of money. The reason for the decrease in electricity expenditure could be unused electrical appliances because of affordability problems. This aspect was studied and the results are shown in Table 12.

Table 12 also shows that some households responded to EBSST by buying and/or using electrical appliances previously not used. For such households, EBSST would probably have resulted in the same expenditure on electricity, but with a broader array of electricity services. What is of particular interest is that there were some households with electrical appliances that were used only with the introduction of EBSST.

Continued suppression of electricity use in the presence of EBSST would imply savings on electricity expenditure, which would enable households to spend more on other goods such as food and clothing. In 2002, 50 kWh of electricity were equivalent to about ZAR 25 at current electricity prices. The average monthly saving on electricity expenditure was ZAR 7.50, a 5 % decrease in total household expenditure.

In general, the EBSST has started showing positive signs though it is in its early stages. The results of an evaluation by the University of Cape Town show an increase in average monthly saving in household income of about ZAR 21.0 per person per month [UCT, 2002], a slight saving but one which can be significant in communities with limited monetary transactions. In some communities, about 30 % of the households have added lights in previously non-electrified rooms. Some households started using appliances they owned but were not able to use before the programme was implemented. Responses about the benefits have been as follows:

- able to use more electric light;
- able to cook more efficiently;
- able to use electricity for the whole month;
- able to use more electrical appliances;
- school children able to study for longer periods with better lighting;

Table 9. Appliance ownership by electrified households in rural areas of South Africa

Appliance	% of all households	% of households with per capita monthly income of:		
		ZAR 130	ZAR 130-270	ZAR 270
Geyser	5	0	2	8
Stove/hotplate	37	10	27	53
Kettle	32	12	25	85
Fridge	43	12	28	65
Television	47	19	33	67
Radio/hi-fi	87	79	85	91

Source: Davis and Ward, 1995

Table 10. Electricity consumption of a household with common electrical appliances

Appliance	Units	Electrical rating (W)	Hours of use/day	Units/ month (31 days) (kWh)
Light bulbs	3	60	5	28
Television (black & white)	1	50	6	9
Radio (portable)	1	6	4	1
1-plate stove	1	1,000	1	31
Iron	1	1,000	¼	8
Kettle	1	1,000	¼	8
Total monthly units				85

Source: adapted from [Cowan, 2003]

Table 11. Expenditure on electricity in two villages, 2001-2002

Expenditure		Garagopola (rural)		Antioch (rural)	
		Before May 2001	After Feb-Sep 2002	Before Oct-Nov 2001	After Oct-Nov 2002
Expenditure on electricity (R/month)	Mean	47.3	39.8	28.4	20.7
	Std dev.	28.4	41.0	23.2	28.2
Expenditure on energy including electricity (R/month)	Mean	92.3	81.1	123.8	98.8
	Std dev.	68.1	77.7	87.7	109.1
Energy as % of total household expenditure	Mean	17.9	12.2	17.6	12.0
	Std dev.	19.3	9.5	8.7	9.9

Source: UCT, 2003

Table 12. Use of previously unused electrical appliances as a result of EBSST

Previously unused electric appliances	Garagopola (households)			Antioch (households)		
	Count	Yes	No	Count	Yes	No
Has the household been able to use previously unused appliances since EBSST?	50	4 (8.0 %)	46 (92.0 %)	27	9 (33.3 %)	18 (66.7 %)
Has the household bought new appliances since EBSST?	50	6 (12.0 %)	44 (88.0 %)	28	11 (39.3 %)	17 (60.7 %)

Source: UCT, 2003

Table 13. Electricity tariff trend, 1990-2001

Year	Average price (US¢/kWh)	Year	Average price (US¢/kWh)
1990	2.50	1996	3.29
1991	2.48	1997	3.49
1992	2.29	1998	1.40
1993	3.74	1999	2.35
1994	2.89	2000	4.06
1995	2.94	2001	4.86

Source: Karekezi et al., 2002

Table 14. Electricity tariffs for the domestic sector

Consumption block	Tariff/kWh (ZB$)	Tariff/kWh (US$)
2001		
Up to 50 kWh	0.99	0.018
Up to 300 kWh	1.10	0.020
Up to 1,000 kWh	3.09	0.056
Above 1,000 kWh	3.21	0.058
October 2002		
Up to 50 kWh	2.78	0.050
Up to 300 kWh	3.06	0.055
Up to 1,000 kWh	7.18	0.130
Above 1,000 kWh	7.45	0.135
November 2003		
Up to 50 kWh	5.48	0.007
Up to 300 kWh	6.01	0.007
Up to 1,000 kWh	14.09	0.017
Above 1,000 kWh	14.60	0.018

Source: adapted from Dube, 2003, 2004

- able to use radio and television for longer periods;
- able to spend money saved from electricity on food; and
- indoor pollution reduced due to fuel substitution.

5.4. Electricity tariffs and subsidies in Zimbabwe

Understanding the situation in Zimbabwe requires an examination of the trend in the exchange rate of national currency against the US dollar because of major changes that have occurred in recent years. These have significant impacts on electricity tariffs and subsidies. The Zimbabwe dollar depreciated by five-sixths of its value within a relatively short period from 1995 to 2001, with steep reductions occurring from 1998 onwards.

The government has final control on setting tariff levels, and there have been occasions when the government has rejected tariffs recommended by external consultants. Nonetheless, Table 13 shows that tariffs have been changing every year.

In August 1999, an automatic tariff adjustment formula was introduced whereby the tariff-setting is based on several variables with different weights:

- exchange rate: 71 % weightage
- inflation: 11 % weightage
- fuel: 8 % weightage
- autonomous: 10 % weightage

Subsidies that apply to the poor in the tariff structure include the following:

- lifeline tariff for lighting and small power applications, about 50 kWh per month; and
- lifeline tariff for lighting, small power applications and basic heating – e.g., hot-plate/stove, ironing, up to 300 kWh per month.

These tariffs are based on an assessment of ability to pay and the cost of alternative fuels. The ability to pay is taken to be about 5-10 % of take-home pay [Karekezi et al., 2002]. There is a limit, however, on the level of subsidies that can be given to domestic consumers, based on the need to balance protection of the poor with limiting the cost on high-income groups.

Lifeline tariff subsidies in Zimbabwe entail preferential pricing to domestic consumers with lower consumption (as shown in Table 14). Connection fees are also subsidized for the poor as ZESA charges below the true connection cost. However, higher consumption groups also benefit from implicit subsidies. For example, a flat rate of ZB$ 3.21 is charged to consumers above the 1,000 kWh block, but this charge is less than the ZB$ 4.13 per kWh required to meet the cost of service and the financial returns from system expansion. Total ZESA annual electricity subsidies are reported to be in the range of 53 % of the total revenue [Dube, 2003].

5.5. Electricity consumption and expenditure in Zimbabwe

According to a study on electricity expenditure in urban areas [Dube, 2003], poor households spent a higher proportion of their income on electricity than non-poor households did (as shown in Table 15). On the basis of electricity consumption patterns and the available subsidies to domestic consumers, Dube [2003] concluded that the removal of subsidies

would result in an increase in the share of electricity expenditure in total household income by 41 % for the non-poor, 92 % for the moderately poor and 78 % for the extremely poor (as shown in Table 16).

6. Key findings

In both countries examined, primary data on the electrification of the poor are almost non-existent – and this constitutes a key limitation of this study. Although, for instance, the National Electricity Regulator in South Africa keeps track of rural electrification levels, the data are not categorised by poor and non-poor users. Therefore, this study has relied on secondary sources, mainly studies undertaken by research institutions such as Energy Research Centre (ERC) and the University of Cape Town for the South African case-study, and AFREPREN in the case of Zimbabwe. Because of these data limitations, the findings and conclusions of this study should not be regarded as fully conclusive. As far as has been possible, the assessment of the impacts of power sector reforms on the poor has been carried out by using a set of five indicators. Whilst data has been available to make some use of these indicators, it has not been possible to check the robustness of the primary research, the consistency of definitions and the accuracy of the collected data.

The comparisons between South Africa and Zimbabwe indicate that the policy environment that will encourage and enable the provision of energy services for the poor needs to be designed for the specific needs of the country. Both South Africa and Zimbabwe have a history of apartheid and it is the respective governments' policies to redress the inequalities of past racial prejudice that form the basis of their reform programmes. The reforms undertaken to enhance access to electricity had positive outcomes, particularly under the grid-based electrification programmes. In South Africa, national electrification levels more than doubled from 34 to 70 % between 1994 and 2001, as they also did in Zimbabwe, growing from 20 to 42 % between 1980 and 2001. The government-funded electrification programme in South Africa took a shorter time and has reached a much larger proportion of the population than the programme in Zimbabwe.

In an attempt to reach the poor in remote locations, both countries have focused on the establishment of off-grid programmes which have been mostly centred on SHSs powered by solar PV technology. However, evaluations of the PV-based off-grid programmes have raised some fundamental questions over both the performance and relevance of this option. The PV-based off-grid programmes in both countries have encountered serious technical problems and high failure rates.

Even if all the operational and financial problems are resolved, off-grid programmes based on solar PV home systems require an urgent review as they are focused on lighting, which is not the highest priority for the poor [Davidson and Sokona, 2002]. Designing energy programmes for the poor must address household cooking and water-heating needs as a priority over lighting, which would, for example, reduce dependence on fuelwood. Similar priority should be attached to the provision of electricity for motive power which would support small-scale rural industries for income-generating activities, and other services such as water-pumping.

In both countries, the reforms have attempted to make electricity affordable to the poor. South Africa has introduced special subsidies on electricity consumption including some free electricity. Zimbabwe has established a rural electrification fund to subsidise rural electrification schemes. These initiatives appear to have been instrumental in supporting electrification programmes and increased access to electricity for the poor.

The EBSST subsidy in South Africa, which supplies 20-50 kWh of free electricity to the poor in selected areas, seems to have realized direct benefits for the poor. It had some positive impact on poverty alleviation as it reduced electricity expenditure. However, this is a very recent development and additional studies are required to assess the feasibility of the subsidy because of its high cost and

Table 15. Electricity consumption patterns of urban households

Household category	Electricity consumption (kWh)	Monthly cost as % of income
All households	426	6.4
Non-poor households	574	4.6
All-poor households	335	7.6
Moderately poor households	350	5.2
Extremely poor households	302	10.4

Source: adapted from Dube, 2003

Table 16. Significance of electricity subsidies

Household category	Electricity cost without subsidy (ZB$)	Subsidy amount (ZB$)	Subsidy as % of energy expenditure	Subsidy as % of total income
All households	1,695	681	67	4
Non-poor households	2,285	662	41	2
All poor households	1,333	600	82	7
Moderately poor households	1,393	666	92	6
Extremely poor households	1,202	527	78	8

Source: adapted from Dube, 2003

potentially adverse impact on the government's finances.

The reforms in both countries have ensured the protection of funds for financing the electrification of the poor by requiring transparency and accountability, albeit in different ways. In South Africa, the National Electricity Regulator (NER) aggressively monitors and makes public the progress of the National Electrification Programme through the NER's annual reports. In Zimbabwe, the Performance Improvement Programme includes explicit rural and urban electrification targets that the utility is obliged to meet.

In order to meet the electrification challenge in rural areas, a diverse set of technical and institutional approaches will be needed – covering large-scale grid connected extension and new developments, together with smaller-scale distributed energy systems using both conventional and renewable energy sources. This study has not undertaken a full review of the technologies for energy services for the poor in rural areas. Nevertheless, off-grid and small-scale conventional and renewable energy sources will have important roles to play in rural energy provision. In particular, measures which help to promote the uptake of sustainable energy services such as renewable energy through regulatory and legal structures are needed.

Strong institutions are the backbone of an efficient and effective energy sector. National policies that create the right enabling environment for investment and business-led market growth are going to be essential.

This paper recommends the following for further investigations:

- income-differentiated electrification current and trend data;
- more detailed understanding, through participatory approaches, of the associated social and economic characteristics of energy consumption patterns of the poor;
- innovative technological approaches to reduce connection fees and distribution costs, to reduce the overall cost of increasing access to electricity for the poor;
- further assessment and review of the use of renewable energy, especially SHSs, as a poverty alleviation tool in off-grid electricity supply; and
- exploration of public-private management schemes that could benefit the poor. This should include an assessment of the role of independent power producers and energy service providers. ■

Note

1. In 2000, the government announced its intention to provide the poor with free basic water and electricity services [DME, 2003]. It was recommended that 50 kWh per month be provided to all poor households connected to the national electricity grid.

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Institutional reforms and electricity access: lessons from Bangladesh and Thailand

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This paper discusses the institutional reforms for rural electrification (RE) in Thailand and Bangladesh and analyzes the impacts of private sector participation in electricity generation and tariff reforms on the poor in Thailand. The RE program in Thailand, initiated in 1977, increased electricity access for rural households from 7 % in the early '70s to 97 % by 2000. In Bangladesh the RE program, initiated in 1977 when electricity access for rural households was almost negligible, could increase the access to only 19 % of rural households by 2000. Financial resources for investment, electricity generation capacity and economic growth were identified as key factors affecting the achievements of the RE programs in the two countries. In Thailand the electrification level and average household electricity consumption were found to be unaffected by private sector participation in electricity generation and tariff reforms during the 1990s.

1. Introduction

Access to sustainable energy is identified as an important factor in alleviating poverty. The majority of the poor rely on traditional biofuels to meet bulk of their energy needs and have no access to electricity[1]. About 37.8 % of the total population in South Asia and 59.2 % in South-East Asia do not have access to electricity [IEA, 2002]. The electrification level in the rural areas of South and South-East Asia is 30.1 % and 50.8 %, respectively, compared to 68.2 % and 89.9 % in the urban areas [IEA, 2002; Hewett and Montgomery, 2001].

Access to electricity in the rural areas, where the incidence of poverty was higher than in urban areas, was emphasized as a tool for development and poverty alleviation. To increase electricity access in the rural areas, developing countries undertook a number of institutional measures in the past. Most of these rural electrification efforts were implemented through the government-owned utility. There is a wide variation observed in the success of the rural electrification efforts of different countries.

In the recent past many developing countries have undertaken a number of institutional and tariff reforms that include unbundling of generation, transmission, and distribution; increasing private sector participation in generation; and restructuring of electricity tariffs to gradually remove subsidies. One of the prevailing views is that privatization of the utilities and tariff reforms will affect the access to and consumption of electricity by the poor [Karekezi and Kimani, 2002]. On the other hand it is felt that efficiency improvements in the use of resources will benefit the poor directly and indirectly [Albouy and Nadifi, 1999].

This paper analyzes achievements of the institutional measures for RE in Bangladesh and Thailand. The RE programs in both countries were implemented under similar institutional structures but registered different levels of achievement. Also, the economic development in the two countries is quiet varied (Table 1). The paper also discusses the factors that affected the achievements of the RE programs in Bangladesh and Thailand.

Private sector participation in electricity generation and tariff reforms were undertaken in Thailand, starting 1990. The paper analyzes the impact of these reforms on the poor.

Section 2 discusses the RE programs in Bangladesh and Thailand and presents similarities and differences between the programs. The achievements of the RE programs in the two countries are evaluated through comparison of electrification in the rural and urban areas using three key indicators, viz., electrification level, electrification rate, and electricity consumption. Section 3 presents the achievements of the RE programs in the two countries. Section 4 presents a discussion of the factors that influenced the outcome of the RE programs in the two countries. Section 5 presents the private sector participation in electricity generation and tariff reforms in Thailand and analysis of the impact of these reforms on the poor. The impacts on the poor are analyzed through comparative analysis of the impact of the reforms on the electricity tariff, electricity consumption, and electricity expenditure for the poor with those for the non-poor.

2. Rural electrification programs in Bangladesh and Thailand

Only 7 % of the rural households in Thailand had access to electricity in the early '70s, whereas, in Bangladesh rural areas had practically no access to electricity as the

Table 1. Economic and demographic indicators of Bangladesh and Thailand

Indicator	Country	
	Bangladesh	Thailand
Population (in million) in 2001	133.3	62.8
Annual population growth in % (1975-2000)	2.4	1.7
GDP per capita (US$), 2000	320.3	1874.1
GDP (PPP billion US$), 2000	209.9	388.8
GDP per capita annual growth rate, % (1990-2000)	3.0	3.3

Sources: UNDP, 2002; World Bank, 2003; IEA, 2002.

distribution network was limited to urban and suburban peripheries. The RE programs in both the countries were initiated to address the low level of electricity access in the rural areas.

The RE program in Thailand was implemented through the Provincial Electricity Authority (PEA), which is responsible for electricity distribution in the provinces. The Provincial Electricity Organization (PEO), the predecessor of PEA, was established in 1954 with the responsibility of generating and distributing electricity to all areas of Thailand except the Bangkok Metropolitan Area. It was renamed PEA in 1960. The Metropolitan Electricity Authority (MEA) was responsible for distribution in the Bangkok Metropolitan Area. In 1969 the Electricity Generating Authority of Thailand (EGAT) was established by consolidating different organizations generating electricity to meet the growing electricity demand[2], with a mandate for generation and transmission of electricity in Thailand. With the creation of EGAT, PEA and MEA responsibilities were limited to the distribution of electricity in their respective jurisdictions. EGAT, PEA and MEA are state enterprises. In 1992, independent power producers (IPPs) were allowed to generate electricity and sell it to EGAT. EGAT continues to be the sole agency responsible for transmission.

PEA started the rural electrification program in 1977 based on the 25-year "National Plan for Accelerated Rural Electrification" (ARE). The long-term plan was divided into five-year plans in line with the five-year national economic and social development plans (NESDPs) of the country. Each plan set specific targets for increasing electricity access in rural areas [Chullakesa, 1992]. The Office of Rural Electrification (ORE) was established by PEA for planning and implementing the ARE program.

In Bangladesh the Rural Electricity Board (REB) was established in 1977 with a mandate to develop rural distribution networks and supply power to end-users. Before the establishment of REB, the Bangladesh Power Development Board (BPDB), a public sector organization and vertically integrated utility, was the sole agency responsible for generation, transmission and distribution of electricity throughout Bangladesh. In 1991 the Dhaka Electricity Service Authority (DESA) was established to operate and manage distribution in the Dhaka Metropolitan and adjoining areas. Further, the Dhaka Electricity Supply Company (DESCO) was carved out of DESA to manage distribution in some of the areas previously under DESA. BPDB is presently responsible for generation, transmission and distribution in areas other than the Dhaka Metropolitan and adjoining areas and areas covered by REB. In 1996 IPPs were allowed to generate electricity and the Power Grid Company of Bangladesh (PGCB), a subsidiary of BPDB, was established to operate and develop the transmission system.

The RE program in Bangladesh is two-tiered. REB was responsible for planning and developing the distribution network and devolved the management responsibility of distribution to end-users to the electricity cooperatives or *Palli Biddut Samities* (PBSs). REB prescribes the by-laws for the PBSs as well as operational technical and administrative standards for rural electrification. Additionally, REB assists the PBSs in planning and designing the distribution network; conducting initial organizational activities relating to institutional development; constructing substations and electric lines; providing training to PBS staff; and monitoring management, financial and system operation activities. Each consumer is a member of the PBS that serves him/her. The PBS is responsible for preparing a master plan on electrification of its members and for forecasting load growth. The PBS also manages financial and operational activities. In 2002, 67 PBSs supplying 4.2 million electricity connections were operational.

The RE programs in the two countries displayed a number of similarities. The first similarity is the creation of an entity with specific responsibilities to implement the RE program. In Thailand ORE within PEA was responsible for rural electrification. ORE was responsible for planning and developing the distribution network for villages. In Bangladesh REB was established with specific responsibility for developing the distribution network in rural areas. The distribution in provincial towns and municipal areas was the responsibility of BPDB.

The second similarity in the RE approaches of the two countries is involvement of the end-users in the distribution network planning process. In Thailand PEA undertook consultations with the local community before electrifying a village, to discuss its electrification plans as well as issues such as right-of-way, financial contributions, communities' needs and constraints. In Bangladesh, each PBS is a cooperative comprising all the consumers within its area of responsibility. The end-users were thus directly involved in the planning and management of the distribution network.

The third similarity in the RE programs of the two countries is financing of distribution network development. The creation of the distribution network, by REB in Bangladesh and PEA in Thailand, was funded through grants and low-interest-rate loans from the government as well as bilateral/multilateral agencies [Sikdar, 2003; Chullakesa, 1992]. In Thailand the end-users had the option of contributing towards the cost of developing the distribution network. The expansion of the distribution network

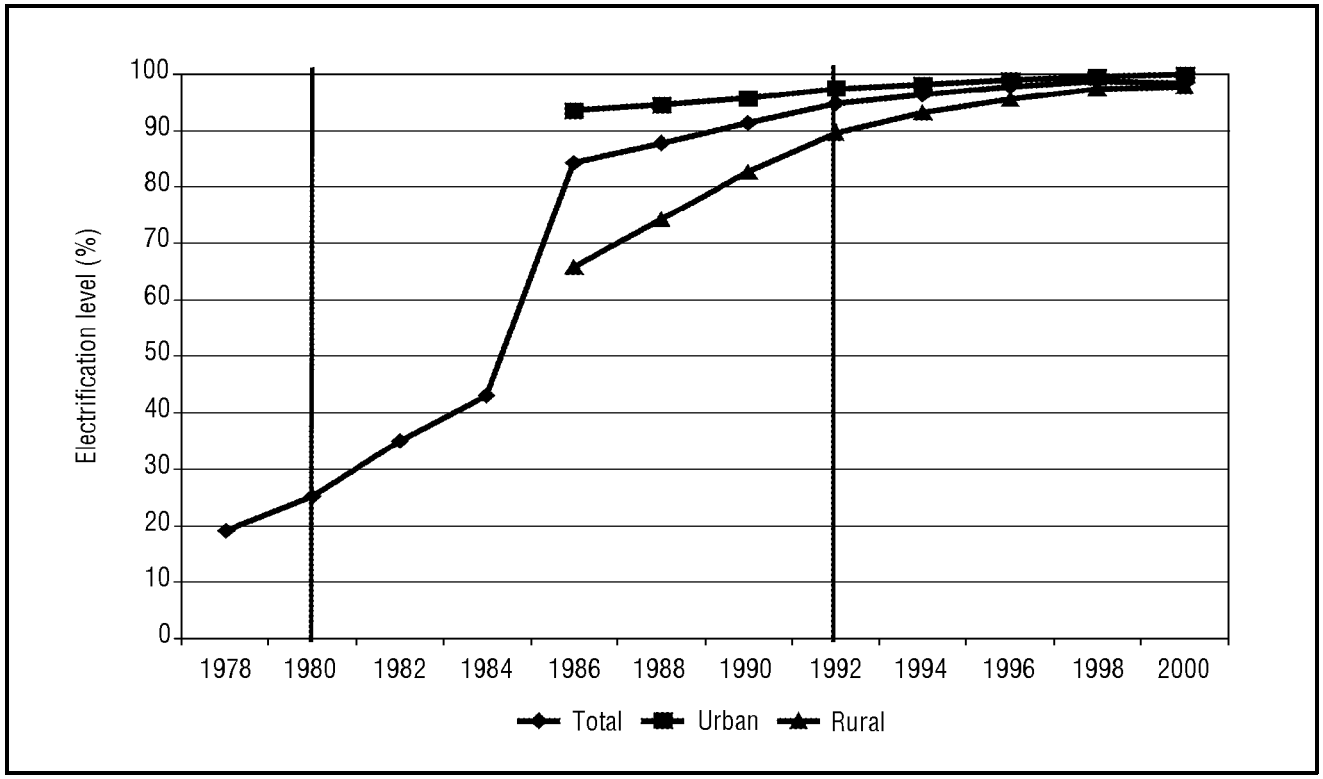

Figure 1. Electrification level, 1978-2000, in Thailand

Sources: NSO Household Socio-economic Survey (various editions), PEA Annual Report (various issues), Chulalongkorn University via http://www.chula.ac.th/INSTITUTE/IPS/

to new areas in Thailand was prioritized on the basis of a number of factors including the expected load, proximity to the grid, and income levels. End-users (villages) willing to bear part of the cost or the whole cost of developing the distribution network were moved up the priority listing depending on their contribution. A 30 % contribution to the cost accorded the village a higher priority and 100 % contribution led to immediate electrification of the village, though a significant part of the funds contributed by the end-users (villages) was in fact local government contributions.

The fourth similarity in the RE programs of the two countries is the use of subsidies to residential consumers. In Thailand, PEA received electricity from EGAT at a lower tariff compared to MEA. Further, PEA supplied electricity to its residential consumers at a lower tariff compared to its commercial and industrial consumers. In Bangladesh, REB received electricity from BPDB at a concessional bulk supply rate for resale to PBSs[3]. PBSs sold electricity to their residential consumers at a lower tariff than to their commercial and industrial consumers. Additionally, in Bangladesh, PBSs receive grant funds from the government during the initial years of operation to meet the revenue shortage vis-à-vis their expenses [Sikdar, 2003].

An important difference between the RE programs of the two countries was in operation and management of the distribution network. In Thailand, the PEA local office was responsible for the operation and management of the network, which was planned and developed by ORE. PEA was also responsible for the distribution in municipal areas of the provinces. On the other hand, REB in Bangladesh was responsible for distribution in the rural areas only and the responsibility of distribution in the municipal areas and towns was with BPDB or DESA and DESCO. Therefore, the PEA consumer base in Thailand consisted of consumers in the rural areas as well as consumers in the municipal areas of the provinces. In Bangladesh the PBSs' consumer base is limited to the rural areas alone. Therefore, PEA in Thailand had a larger consumer base to recover the cost of developing the rural distribution network than PBSs in Bangladesh.

3. Rural electrification – the achievements

As described in the last section, a number of similarities existed in the RE programs of the two countries – e.g., involvement of end-users in planning, decentralized management, use of subsidy for residential consumers to enable access to electricity. This section presents achievements of the RE programs in the two countries. The achievements are evaluated by comparing the effect of the RE program on electrification in rural areas vis-à-vis the developments in urban electrification. The pace of electrification was studied using two indicators, viz., electrification level (defined as percentage of households electrified), and electrification rate (defined as growth rate of electrified households). In the case of Thailand data for PEA areas, used as a proxy for rural areas, is used to estimate the electrification level and electrification rate in the rural areas, whereas, data from MEA, proxy for urban areas, is used to estimate electrification level and electrification rate in the urban areas. In the case of Bangladesh, the data is from various published reports and papers.

Table 2. Electrification level (%) in Bangladesh

	1976	1982	1991	2000
Total	3.0	5.1	15.1	31.0
Rural	-	0.2	3.7	19.0
Urban	34.1[1]	40.7	73.7	80.0

Sources: ADB, 1983; BBS, 1976, 1985, 1993, 1997; Temple, 2002.

Note

1. Estimated by authors.

Table 3. Number of electrified households in Bangladesh

	1976	1982	1991	2000
Total	411,664	842,482	2,983,414	8,143,623
Rural	No data	25,972	610,330	4,064,197
Urban	411,664	816,510	2,373,084	4,079,429

Sources: Authors' calculation based on [ADB, 1983; BBS, 1976, 1985, 1993, 1997; Temple, 2002]

3.1. Electrification level

In Thailand, rural electrification efforts during the 1960s were through use of decentralized diesel generation plants. The growth of electrification was relatively low during this period and only 7 % of the rural households had access to electricity in the early 1970s. In 1978, a year after initiation of the ARE program, only 19 % of all households had access to electricity. By 1984 this percentage had increased to around 43 %, by 1986 to 86 % and by 1990 the electrification level was more than 91 %. Figure 1 shows the electrification level in Thailand.

Figure 1 also shows that more than 90 % of urban households had access to electricity by 1986, as compared to 65 % of the rural households. By 1992, approximately 90 % of the rural households had access to electricity as compared to 98 % of the urban households. By 2000 the percentage of households having access to electricity in rural and urban areas differed by a very small percentage.

About 3 % of the total population in Bangladesh had access to electricity in 1976, mainly in the urban centres and suburban peripheries. The vast rural areas, containing 91.2 % of the population in 1974[4], had practically no access to electricity [REB, 2002]. By 1982 about 26,000 households or 0.2 % of the rural households were using electricity, whereas, 40.7 % of the urban households had access to electricity (Table 2). By 1991, the electrification level of the rural households increased to 3.7 %. The next 10 years (i.e., 1991-2000) saw a marked improvement in the electrification level of the rural households. By 2000, 19 % of the rural households and 80 % of the urban households had access to electricity. In terms of number of households, the rural households with access to electricity were of the same order as the urban households with access to electricity (Table 3).

As the electrification level is a static picture, the electrification rates for the countries were analyzed to see whether the RE programs accelerated the access to electricity in the rural areas.

In Thailand, the overall electrification rate peaked during 1984-1986 (Figure 2). The RE program accelerated the electrification coverage, as is reflected by the electrification level. The electrification rates, however, have been generally declining over the years. This overall declining trend is a reflection of the increasing level of electrification in the rural and urban areas in the country. The electrification rate has remained higher for the rural areas during the period 1988-2000, except for the period from 1994 to 1998.

Table 4 presents data on the electrification rate in Bangladesh. The annual average electrification rate in the rural areas during the 1980s and 1990s was four to five times the electrification rate in the urban areas. The REB/PBS reform did accelerate the rate of electrification in the rural areas. The higher electrification rate is partially due to the initial low level of electrification in the rural areas. But in the 1990s the total number of households with access to electricity supply in the rural areas was larger than that in the urban areas.

The RE program in Thailand was able to provide a high degree of electricity coverage. In Thailand more than 80 % of the rural households were connected to the grid by 1990, over a period of 15 years. Increased rate of electrification in rural areas due to the RE program also led to decrease in the gap in electrification level between rural and urban areas.

Bangladesh, despite following a similar RE model to Thailand's, achieved only a modest improvement in electrification of the rural areas. Only 19 % of the rural households have access to electricity as compared to 80 % of the urban households. REB has been able to establish 67 PBSs covering 90 % of the effectively rural area, but the number of households having access to electricity remains low [Dhakal, 2003][5]. The REB model can be considered successful to the extent that it created the distribution backbone for providing access in the rural areas. But the achievements are low compared to those in Thailand in terms of household connectivity.

4. Why was the rural electrification program more successful in Thailand than in Bangladesh?

Despite a very similar approach to RE, the achievements in Thailand and Bangladesh differ. Two central features of the RE programs were financial resources for expanding the distribution network and subsidy to residential users from commercial and industrial users. The availability of financial resources, either from domestic sources or bilateral/multilateral donors, was therefore critical to success. A greater commercial and industrial consumer base provides greater resources to subsidize the residential consumers, thus increasing affordability. Another important factor is growth in the economy, as it increases the industrial and commercial consumer base as well as availability of financial resources for investment. It is also important to create adequate electricity generation capacity in the system to meet the demand from the growing distribution network. A number of other factors, such as skills to build a power network and investment climate in the country,

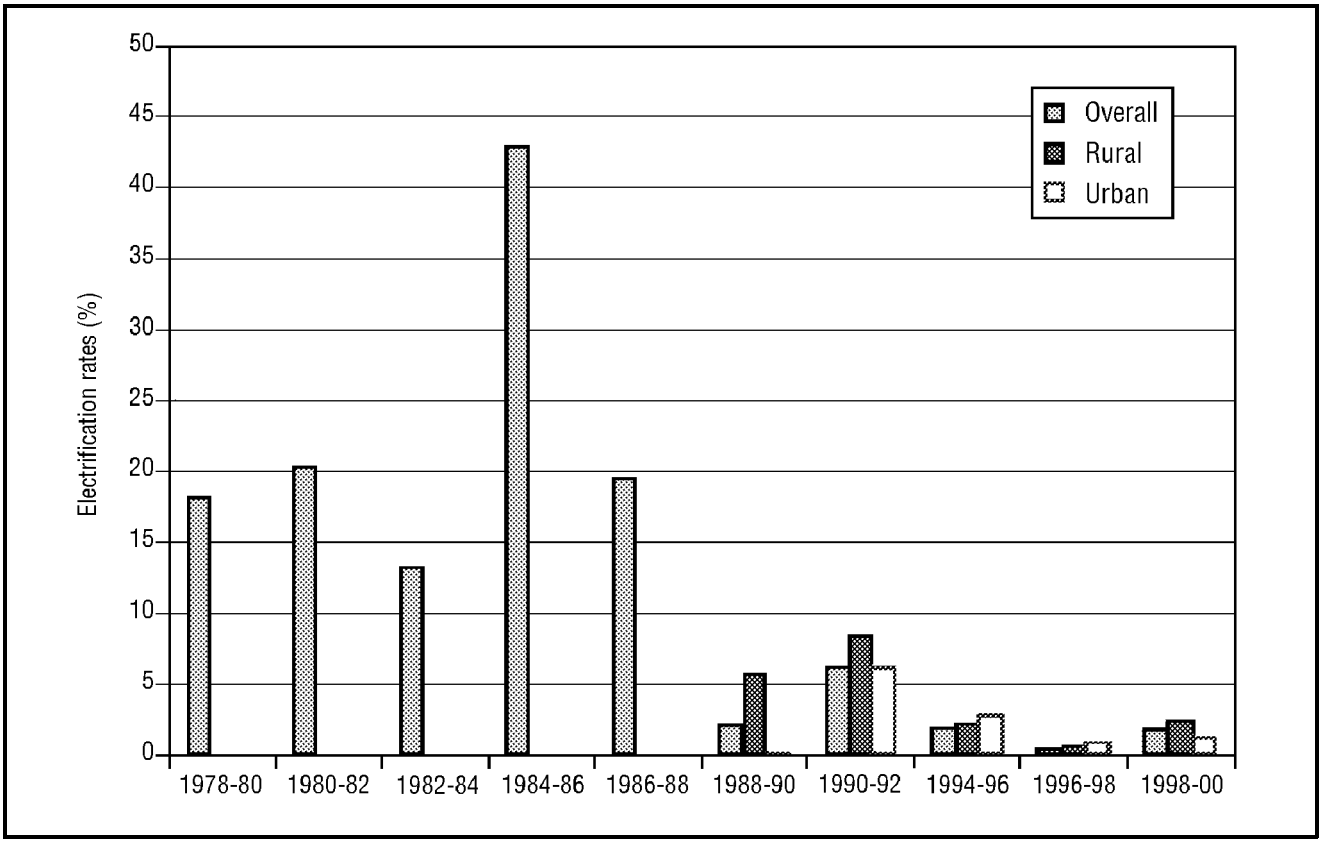

Figure 2. Electrification rates[1] from 1984 to 2000 in Thailand

Sources: NSO Household Socio-economic Survey (various editions), PEA Annual Report (various issues), Chulalongkorn University via http://www.chula.ac.th/INSTITUTE/IPS/

Note

1. Compounded annual growth rate during the given period

play a role in the successful implementation of the program but are not discussed in this paper. The influence of the three major factors, i.e., financial resources, adequacy of generation capacity, and economic growth is analyzed in this paper to understand the variance in achievements of the RE programs in the two countries.

4.1. Financial resources

The Thailand case-study shows that cost recovery by power sector institutions was an important factor in utilizing scarce domestic as well as external financial resources for new investments, and attracting resources from bilateral/multilateral agencies. As mentioned earlier, the RE programs in both countries were financed through government allocations as well as bilateral/multilateral agencies. Financial losses in the system partly use up the new resources to meet losses and continued losses can affect the credibility needed to generate resources for investment.

PEA in Thailand was able to cover its operational cost through revenue generation from sale of electricity. This enabled PEA to use new resources allocated for rural electrification for the expansion of distribution. PEA partially used cross-subsidy from its commercial and industrial consumers to residential consumers (Table 5). PEA also received significant resources from EGAT for lowering tariffs to rural areas. EGAT sold power to PEA at a lower tariff compared to its other consumers (Table 6). EGAT recovered the resources transferred to PEA by charging a higher tariff to MEA, thus ensuring that revenues from sale of electricity covered operational costs. Resources for subsidizing rural residential consumers from PEA's non-residential consumer base and EGAT's non-PEA consumer base implied the public resources that would have been otherwise used to subsidize the rural residential consumers were available for new investments.

Table 4. Annual average electrification rates (%)[1] in Bangladesh

	1976-1982	1982-1991	1991-2000
Total	7.8	15.1	10.2
Rural	NA	42.0	21.6
Urban	7.4	12.6	4.6

Sources: Authors' calculations based on [ADB, various years; BBS, various yers; REB, 2000]

Note

1. These are compounded annual growth rates between the given periods.

PBSs in Bangladesh also subsidize their residential consumers vis-à-vis their commercial and industrial consumers. But in most cases the PBSs are not able to meet their operational costs. Khan [2003] observed that only 57 % of the PBSs are viable, whereas Dhakal [2003] reported that of the 67 operational PBSs only 25 % are self-sustaining. The Government of Bangladesh (GoB) gives funds to PBSs to meet the revenue deficit. In the absence of data, it is not possible to estimate total losses generated

Table 5. Subsidy received by the poor through cross-subsidization from other PEA consumers in Thailand

	2003	2002	2001	2000	1999
Electricity consumption by poor (GWh)	14,402	13,647	13,388	10,869	9,678
Sale price to poor (baht/kWh)	2.18	2.14	2.11	1.84	1.69
Overall average sale price	2.43	2.41	2.38	2.15	2.03
Subsidy received by the poor (million baht)	1,588	1,676	1,735	1,865	1,933
Subsidy as % of cost paid by poor at overall average sale price	9.93	10.94	11.47	14.65	16.65

Source: Basic data from various annual reports of PEA. Calculations by authors.

Table 6. Subsidy received by PEA from EGAT in Thailand

	2000	1999	1998	1997	1996	1995	1994
Sale price to PEA (baht/kWh)	1.0728	1.0666	1.1796	1.1316	1.091	1.091	0.963
Average sale price of EGAT (baht/kWh)	1.7761	1.5908	1.7123	1.4596	1.3698	1.3087	1.1971
Power purchase by PEA (GWh)	56,173	51,822	51,401	50,192	44,981	40,164	34,303
Total subsidy received by PEA (million baht)	39,506	27,165	27,381	16,462	12,540	8,743	8,030
Subsidy as percentage of total PEA cost	39.60	32.95	31.11	22.47	20.35	16.63	19.56

Sources: Basic data from various Annual Reports of EGAT. Calculation by authors.

Table 7. Subsidy over average sale price of BPDB to its consumers in Bangladesh for fiscal year 2002

	Sales (GWh)	Current tariffs (Tk/kWh)	Subsidy over average tariff	Total subsidy (million Tk)
Domestic	2,017	2.52	-0.18	-363.06
Irrigation	130	1.8	0.54	70.2
Industry (LT)	525	3.62	-1.28	-672
Religious institutions	103	3.16	-0.82	-84.46
Commercial	515	5.03	-2.69	-1,385.35
Bulk (11 kV)	1,361	3.44	-1.1	-1,497.1
Bulk (DESA 132 kV)	8,469	2.01	0.33	2,794.77
Bulk (33 kV)	416	3.31	-0.97	-403.52
REB (33 kV)	2,668	1.75	0.59	1,574.12
REB (11 kV)	71	1.84	0.5	35.5
Municipalities	101	3.45	-1.11	-112.11
Total/avge.	1,6376	2.34		

Source: Authors' calculations based on [Temple, 2002]

by PBSs or funds provided by GoB to meet the operational losses. REB/PBSs in Bangladesh also receive power from BPDB at subsidized rates. Table 7 gives estimates of subsidy by BPDB to its various consumers. As can be seen from the table, REB received 1,609 million takas (Tk) of subsidy during 2002. DESA, distributor in Dhaka Municipality, too received a subsidy, unlike MEA in Thailand.

Temple [2002] estimated that the average cost of electricity supply to BPDB in the fiscal year (FY) 2002 was Tk 3.08 per kWh. Thus the average selling price of BPDB was below its cost of supply, providing a total subsidy of Tk 12.17 billion to its customers in the year 2002.

The losses of BPDB have been attributed to three factors.

- *Low average tariff:* Average BPDB tariff has been lower than the long-run marginal cost (LRMC). World Bank [1984] reported that power tariff covered only 75 % of the LRMC and the situation continued into the 1990s as reported by ADB [1997].
- *High system losses of BPDB:* World Bank [1984] reported that system losses of BPDB were 38 %, of which 60 % were due to technical factors and 40 % were due to non-technical factors (including pilferage, non-billing, non-payment of bills, etc). ADB [1997] reported that system losses of BPDB between 1987 and 1992 were more than 40 %. Alam et al. [2004] report that losses in the distribution network of both BPDB and DESA are in the region of 30 %. They state that technical losses can at the most be 10 %, the rest (20 %) being non-technical losses. The non-technical losses in the system during 1999-2000 are estimated to have resulted in a loss of Tk 7.763 billion (134 million US$).
- *Low rate of bill recovery [World Bank, 2000]:* Outstanding electricity bills in Bangladesh are estimated to be Tk 57.693 billion (1,012 million US$) [Alam et al., 2004, citing Rahmatullah, 2001]. DESA has also been running into losses. Table 8 reports data on losses for BDPB and DESA. Losses in DESA affected its capacity to pay BPDB for power purchase and further increased BPDB's losses. In view of the fact that BPDB has been in losses, unable to recover its operation cost through sales revenue, the subsidy to REB/PBSs comes from public funds rather than cross-subsidization from BPDB's other customers. These

losses implied that allocation to BPDB by the government could not be fully utilized for capital investment for expanding the electricity infrastructure. Also it is likely that this affected the resources available with the government for allocation to the RE program.

Unlike in the case of BPDB, the average tariff of EGAT covered the LRMC. World Bank [1999] reported that between 1981 and 1991 the average tariffs for EGAT were at LRMC levels. Table 9 offers a comparison of average electricity revenue and rate of return for EGAT and BPDB. As observed from the table, the average tariff rate of EGAT allowed it to cover its operational cost through sale of electricity (Table 10).

The losses to BPDB in Bangladesh also adversely affected availability of financial resources from multilateral institutions as they withdrew from financing the power sector in Bangladesh during 1990-1995. The review of the Fourth Five-Year Plan of Bangladesh states:

> *"... due to high system loss, large account receivables, the poor management and inability to rationalise tariff rate and introduce other reforms, concessional loan for the power sector from the multilateral development partners was not available in the Fourth Plan period. Consequently, needed investments for generation, transmission and distribution of electricity could not be made during 1990-95. Hard term suppliers' credit and inadequate government resources made it possible to add only about 581 MW of generation capacity in the following power plants during the Fourth Plan Period."*[6]

4.2. Generation capacity

Inadequate electricity generation capacity is likely to affect expansion of the distribution network. It has been reported that inadequate generation capacity affected REB/PBSs in providing greater electricity access to rural households [Murphy et al., 1999][7]. This is also indicated by the fact that compounded annual growth rate (CAGR) of rural households electrified was 21.6 % as compared to 1.8 % CAGR of total electricity consumption by rural households (Table 11). The lack of adequate generation capacity resulted from slower expansion in the electricity generation capacity compared to the projected increase in the demand. Table 12 compares actual capacity additions in different years with projections of required capacity additions for the corresponding years in Bangladesh. Capacity additions by BPDB fell short of projected capacity requirements. As discussed earlier, the losses of Bangladesh's electricity utilities affected the availability of resources for expansion of generation capacity[8]. Generation was opened to private sector participation in 1996 to address the shortfall in investment. At present, IPPs account for 29 % of the total generation capacity in Bangladesh.

Unlike BPDB, EGAT in Thailand was able to expand generation capacity to meet the projected demand. Table 13 compares actual generation capacity with the projected generation capacity requirement in different years. Thailand too opened up generation to private investment in 1992. IPPs presently account for 40 % of total electricity generation in Thailand. The generation capacity in Thailand was not a barrier to expanding access to rural households in the case of PEA, whereas, low reliability of power due to inadequate generation capacity could be one of the factors for low rate of growth in electricity access in rural areas of Bangladesh.

Table 8. Net profit/loss[1] of BPDD and DESA (billion taka) in Bangladesh

	1995	1996	1997	1998	1999	2000	2001
BPDB	-4.8	0.6	-1.3	-0.1	-3.2	-3.9	-6.2
DESA	-2.0	-1.4	-1.4	-1.5	-1.8	-2.3	-3.2

Source: Temple, 2002

Table 9. Average power revenue and financial performance of EGAT and BPDB

	1980-1987	1987-1994
Average electricity revenue ($/kWh)		
EGAT	0.067	0.068
BPDB	0.058	0.052
Rate of return (%)		
EGAT	6.01	5.73
BPDB	2.36	-0.12

Source: ADB, 1997

Table 10. Net profit of EGAT (billion baht) in Thailand

	1983	1990	1994	1998	2002
Electricity sales	24,352	49,296	76,190	146,572	207,101
Operating expenses	16,068	30,085	51,248	124,085	174,677
Net income (loss)	8,284	19,211	24,942	31,422	36,128
Interest charges	1,666	4,340	6,422	11,112	8,778
Net income (loss)	6,618	14,871	18,520	20,310	27,350

Source: Various annual reports of EGAT.

Table 11. CAGR of total electricity consumption and population electrified between 1991 and 2000 (%)

	Electricity consumption (%)	Population electrified (%)
Rural	1.8	21.6
Urban	12.6	4.6

Source: Authors' calculations based on [BBS, various editions; REB, 2000]

4.3. Economic growth

High economic growth implies higher incomes, greater paying capacity and therefore increased demand for access to electricity and higher consumer density. Consumer density is an important factor in the viability of distribution expansion. A low consumer density in the network implies high development cost per consumer and, hence, larger subsidies per consumer to make access viable to the households. Higher economic growth also implies

Table 12. Planned vs. actual capacity expansion in Bangladesh

	1984	1989	1994	2000	2005
Actual total installed capacity (MW)	1,121	2,305	2,608	3,603[2]	4,680[3]
Effective generation capacity[4] (MW)	1,018	1,834	2,135		4,368
Estimated capacity based on demand projections (MW)			3,390[1]	5,073	7,200
Actual gross generation (GWh)	3,966	7,115	9,785	13,872[2]	16,332[3]
Estimated demand (GWh)			13,005[1]	20,039	25,600

Source: [ADB, 1997] unless mentioned otherwise (in notes below)

Notes

1. These are projections made by BPDB, as reported in [World Bank, 1995]. The demand represents actual consumption by consumers and not gross generation.
2. Source: http://www.sdnbd.org/sdi/statisticapocketbook/Chap07/0701.htm. The figures refer to the year 1998-99.
3. Source: Website of BPDB. The data is for 2003. The installed capacity includes capacity addition of 1260 MW by IPPs.
4. Source: Fifth Five-Year Plan (1997-2002) of Bangladesh. Figure under the column 2005 is for 2003 and from BPDB website.

Table 13. Planned vs. actual capacity expansion in Thailand

	1984	1989	1996	2000	2005
Actual total installed capacity (MW)	5,921	6,967	14,973[1]	22,269[1]	23,755[1]
Estimated capacity based on demand projections (MW)			15,506[2]	19,248	22,396
Actual gross generation (GWh)	20,392	35,966	85,924[1]	96,780[1]	108,389[1]
Estimated demand (GWh)				93,147	110,030

Source: [ADB, 1997] unless mentioned otherwise (in notes below).

Notes

1. Source: Various annual reports of EGAT. The generation capacity includes the capacity of IPPs. The figures for actual capacity and generation under column 2005 refer to 2002.
2. Source: Malhotra et al., 1994

Table 14. GDP and GDP per capita growth rates (%)

Bangladesh	1970-80	1980-90	1990-2000
GDP growth	2.8	3.7	4.8
Per capita GDP growth		1.2	2.5
Thailand	**1976-86**		**1986-97**
GDP growth	6.0		8.7
Per capita GDP growth	3.7		7.2

Sources: BBS, various editions; World Bank, 1999.

Table 15. Power market share of domestic and commercial/industrial consumers

	1980	1989	1994
Thailand			
% consumption by domestic consumers	22.9	21.4	20.6
% consumption by commercial/industrial consumers	76.2	77.8	72.5
Bangladesh			
% consumption by domestic consumers	16.2	25.8	37.7
% consumption by commercial/industrial consumers	77.4	58.5	54.8

Source: ADB, 1997

larger non-residential consumer base and consumption. As discussed in earlier sections, non-residential consumers are a resource for providing subsidy to residential consumers, increasing affordability and possibly the demand for household connections. Table 14 compares GDP growth and per capita income growth for Bangladesh and Thailand. The per capita income growth was considerably higher for Thailand as compared to Bangladesh over the period of the RE program implementation. The poverty levels in Thailand are very low (< 2 %) as compared to 36 % in Bangladesh in 2000[9]. The high poverty level in Bangladesh implies a larger fraction of consumer base with very low paying capacity compared to that in Thailand.

Higher economic growth in Thailand also resulted in a larger expansion of commercial and industrial activities and, hence, larger non-residential consumer base of PEA. Khan [2003] reported that PBSs' viability was affected by subsidy to residential consumers as PBSs have a high proportion of residential consumers, resulting in low revenues. In Bangladesh, 57 % of PBSs are financially non-viable. On the other hand, in Thailand, the share of residential consumers decreased over the years (Table 15). This provides PEA with an adequate resource base for subsidizing its residential consumers. Smaller non-residential resource base was a factor that seems to have inhibited the electrification rate in Bangladesh.

The expansion of infrastructure for generation to match the growing demand enabled Thailand to further expand

electricity access in the rural areas. EGAT and PEA in Thailand maintained a net positive income, enabling the use of financial resources received as grants and loans for new investments. The lack of viability in Bangladesh partially put a strain on resources available for new investments. This seems to have affected the expansion of generation capacity and partially inhibited the pace of rural electrification. In the case of Bangladesh there is evidence that financial losses in electricity utilities affected availability of foreign capital resources to the power sector.

5. Institutional and tariff reforms in Thailand and their impact on the poor

The institutional and tariff reforms in the power sector are aimed at moving towards commercial operation of the sector. The reforms are expected to increase the tariff [Karekezi and Kimani, 2002]. Albouy and Nadifi [1999] state that the tariff increases in countries that have undertaken reforms are observed for consumers paying less than the cost of supply before reforms. It is generally claimed that the higher tariff due to power sector reforms affects the electricity consumption of the poor adversely. Proponents of the reforms claim that power sector reforms enable delivery mechanisms that increase access [Albouy and Nadifi, 1999], whereas Karekezi and Kimani [2002] have argued that reforms in Africa have not increased the electricity access of the poor. In this section the impact of private sector participation in generation and tariff reforms on the poor in Thailand is analyzed.

Institutional and tariff reforms in Thailand were initiated in the early 1990s with the aim of privatizing the power sector. Two major reforms were undertaken, viz., tariff reforms to reflect cost of supply in the tariffs and opening of the generation sector to private investment. The tariff reforms undertaken in Thailand are: the introduction of time-of-day tariffs in 1990 (applicable to large industrial/commercial consumers); the adoption of automatic adjustment formula in 1991; the introduction of time-of-use tariffs in 1997[10]; and the removal of cross-subsidies from MEA to PEA in 2000. In 1992 laws were amended to allow independent power producers (IPPs) and small power producers (SPPs, with less than 90 MW capacity) to generate electricity. EGAT remained the sole buyer of electricity generated by the IPPs and transmitter of electricity in the country. As of August 2003, 60 SPPs generated close to 3,800 MW and sold more than 2,000 MW to EGAT[11]. In 2002, the Very Small Renewable Electricity Power Producers Programme was also launched to allow small-scale power producers to sell electricity to the grid. This is aimed mainly at the pig farms and food processing industries in the rural sector with generation capacities of under 1 MW. The changes in Thailand's electricity sector as a result of these reforms are summarized in Table 16.

Reforms in Thailand did not affect rural electrification.

Table 16. Status of the power sector institutional reforms before and after 1992

	Before 1992	After 1992
Generation, transmission	EGAT was fully responsible for generation and transmission	Private sector (SPPs and IPPs) was allowed to generate power. EGAT however remains the sole purchasing agency of electricity and transmission.
Distribution and retail services	MEA was responsible for distribution in Bangkok Metropolitan area and two adjoining provinces. PEA was responsible for the remaining provinces in the country.	MEA and PEA[1] retain monopoly in distribution and retail in their franchise areas.
Regulation	Since the three utilities are state enterprises, the government through the Prime Minister's Office indirectly controls its management. The government however directly controls the pricing and investment policies of these utilities as mandated in their respective acts, EGAT Act, MEA Act and PEA Act.	Status quo, though the government is in the process of setting up a regulatory body.
Tariff	▪ Introduction of time-of-day tariffs in 1990 ▪ Adoption of automatic adjustment formula in late 1991	▪ Time-of-use tariff was introduced in 1997 ▪ Removal of cross-subsidies in 2000 ▪ Current tariff (2002) is set by taking into consideration the following: – Marginal costs – Load pattern – Revenue requirement based on the rate of return – Revalued asset at the level of 8 % – Uniform tariff for each individual category of consumers to be applied nationwide by retaining the subsidy for consumers under the residential category whose consumption volume is small.

Source: Authors' compilation

Note

1. PEA has initiated an internal organizational restructuring to prepare for its eventual privatization. The key approach of the model chosen to privatize and restructure PEA is to separate the business of operation and maintenance of its distribution networks from the retail sales business. Aside from this, work force plans including personnel management system were reviewed to achieve well-defined roles, responsibilities and accountabilities. The redeployment arrangement was planned in line with the new structure [PEA, 2001].

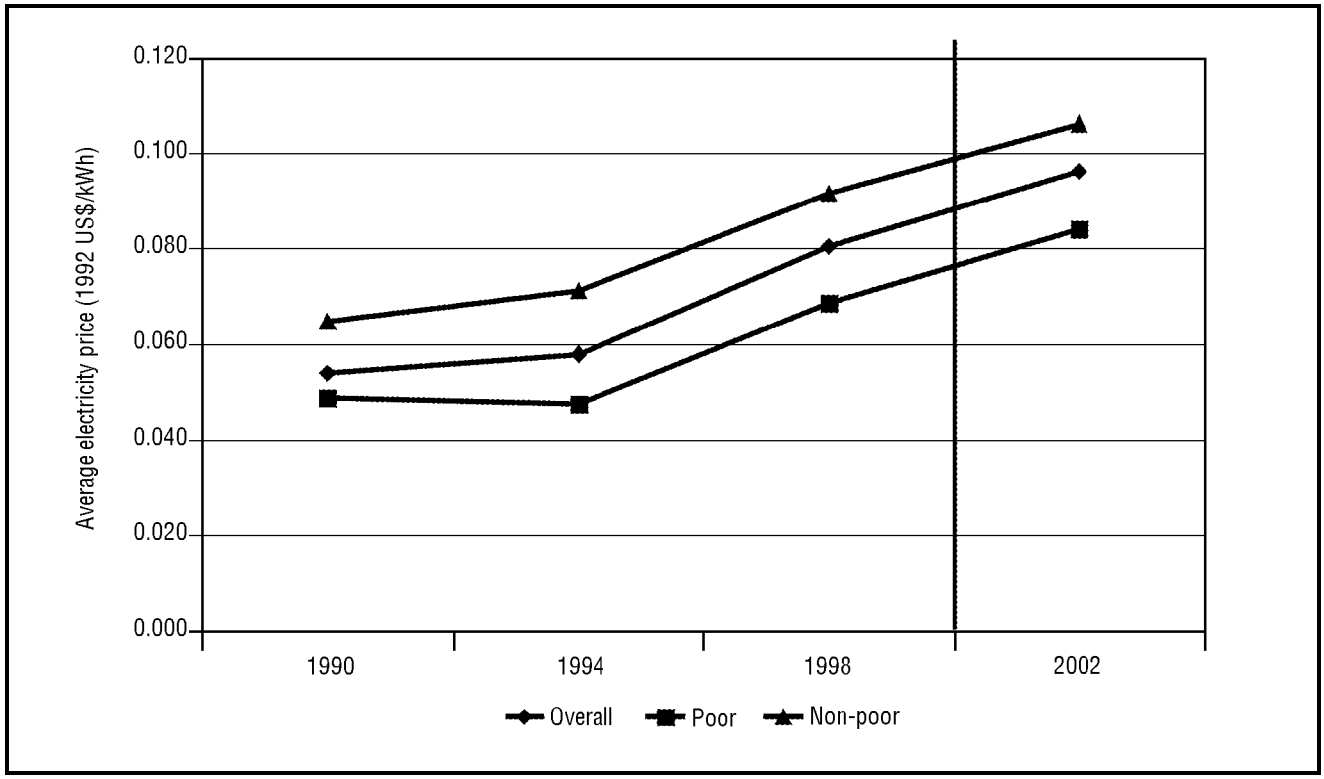

Figure 3. Electricity tariffs during 1990-2002 in Thailand

Source: PEA Annual Report (various issues)

Table 17. EGAT bulk supply tariff to the distribution utilities (US¢/kWh) in Thailand

	Before Dec 1991	Dec 1991-1994	Jan 1995-Sep 2000	Oct 2000-Dec 2000
MEA	3.5	3.5	3.5	4.2
PEA	2.5	2.3	2.6	4.2

Source: NEPO, 2000

Note

1 US$ = Baht 42 as of December 2002.

82.7 % of the rural households had access to electricity by 1990. As discussed in Section 3, the electrification level in the rural areas increased during the 1990s, and by 2000, 97.7 % of rural households had access to electricity. The reforms also did not affect the electrification rate in the rural areas, which was higher compared to that in urban areas.

The impacts of reform on the poor in Thailand are analyzed using three indicators, viz., tariff, electricity consumption, and electricity expenditure. PEA and MEA maintain records of electricity sold to the residential consumers in two categories, those consuming less than 150 kWh per month and those consuming more than 150 kWh per month. It is assumed that those consuming less than 150 kWh per month represent the poor and those consuming more than 150 kWh per month represent the non-poor.

Figure 3 presents the electricity tariff trend for the poor and the non-poor during 1990-2002. The average tariff for each group is calculated as the total sales revenue for each category divided by the total electricity consumption for that category.

The figure shows that for the period from 1990 to 1994 the tariff for the non-poor increased and tariff for the poor slightly decreased, whereas, the tariff for both the poor and the non-poor increased at almost the same rate during 1994-2002. Starting 2000, cross-subsidy from MEA to PEA was stopped. But PEA continued to receive subsidy from the government. This is reflected in the relative tariff for the poor and non-poor, which remained unchanged before and after 2000. Table 17 provides a comparison of the average tariffs at which EGAT sold power to PEA and MEA, highlighting the subsidy received by PEA from MEA.

The tariff has increased after the implementation of tariff reforms. The data also indicates that the rate of increase in tariff post-reforms has been higher for both the poor as well as the non-poor. Though the tariff for the poor has increased after the implementation of the reforms, they are still subsidized compared to the non-poor.

To assess whether the increase in tariff affects electricity consumption, analysis of the consumption pattern of the poor and the non-poor was undertaken. Figure 4 presents the index numbers of electricity consumption of the poor and the non-poor during 1990-2003. Average household consumption[12] per month of the poor in 2003 was 63.8 kWh as compared to 248 kWh for the non-poor. The consumption of the poor is approximately one-fourth that of the non-poor, and this ratio has remained within a narrow band (3.7 to 4) over the 1990s. Changes in index of electricity consumption of the poor and the non-poor show a similar trend, with the consumption of the poor growing at a slightly higher rate compared to the consumption of the non-poor. The trend in growth also indicates that

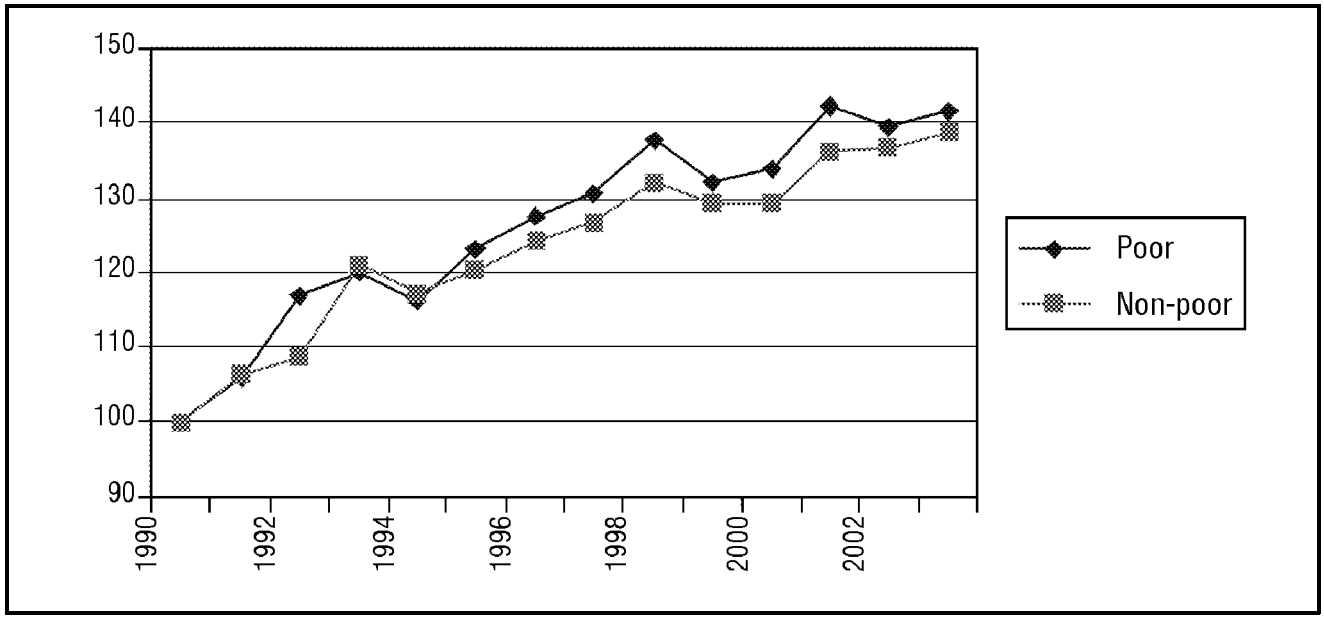

Figure 4. Index numbers of electricity consumption per household during 1990-2003 in Thailand (1990=100)
Source: Various annual reports of PEA

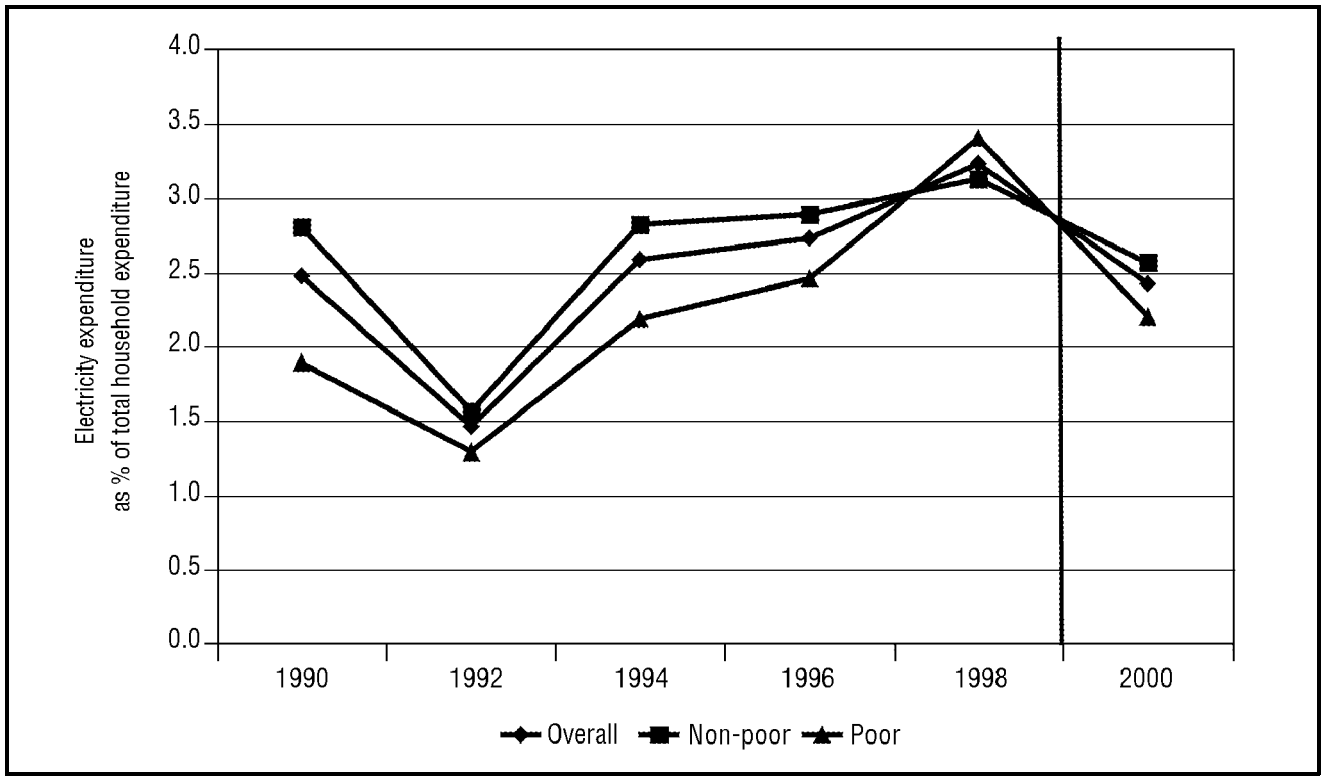

Figure 5. Electricity expenditure as % of total household expenditure in Thailand
Source: NSO Household Socio-economic Survey (various editions)

growth rate in consumption over the period 1990-1994 for both the poor (3.83 %) and the non-poor (4.01 %) was higher compared to that in the period 1994-2003, with 2.20 % and 1.90 % respectively for the poor and the non-poor. One could say that tariff increase has slowed the growth in consumption. Also the impact on growth in per capita consumption is greater for the non-poor than for the poor. The dip in per capita consumption after 1998 could be because of the economic crisis in Thailand.

What has been the effect of increase in tariff on electricity expenditure? Figure 5 presents trends in expenditure on electricity as a percentage of total household expenditure. The data is based on National Statistical Organization's (NSO) household expenditure surveys conducted every two years. The data collected by NSO is categorized by municipal and non-municipal areas. The expenditure for non-municipal areas is taken as a proxy for the poor and that of municipal areas is taken as a proxy for the non-poor. The electricity expenditure as a percentage of total expenditure for the poor has increased

Table 18. Compounded annual growth rate of average income, average total expenditure, and average electricity expenditure per household between 1990 and 2000 in Thailand

	Average income per household	Average total expenditure per household	Average electricity expenditure per household
Poor	7.78 %	11.8 %	13.51 %
Non-poor	7.28 %	10.5 %	9.55 %

Source: NSO, various years

over the decade although there are wide variations across the years. In the case of the non-poor the electricity expenditure share in total expenditure was slightly lower in the year 2000 compared to the 1990 level. The variations are much greater for the non-poor over the years. Table 18 presents growth rate of income and expenditure for the poor and the non-poor. The growth in expenditure on electricity for the poor was far greater compared to the growth in income or total expenditure, which is reflected in increase in share of expenditure on electricity. The opposite was found in the case of the non-poor.

Increase in the tariff as well as consumption has resulted in increase in the total expenditure on electricity for the poor as well as the non-poor. The increase in expenditure of the poor on other goods and services grew slower than that for electricity, whereas, for the non-poor, the growth rate of expenditure on other goods and services was higher than that for electricity, and hence the percentage share of electricity expenditure has declined.

The income of the poor during the 1990s has also increased at the same rate as that for the non-poor. This signifies that the income effect has negated the price effect on electricity consumption. The income growth during 1990-1994 was higher for both the poor (10.0 %) and the non-poor (10.8 %) compared to the growth rate in 1994-2000, with 6.3 % and 5 % for the poor and the non-poor, respectively. This points to the fact that lower growth rate in electricity consumption during 1994-2003 as compared to 1990-1994 could partly be explained by increase in the tariff and partly due to lower rate of increase in income. The increase in tariff may not affect consumption if the economy is growing, as seen in the case of Thailand.

6. Conclusions

The RE programs in Bangladesh and Thailand used a similar approach. Like in many developing countries, RE programs in both countries were financed through subsidized loans and grants. Despite the similarities in approach, the achievements of the RE programs were more significant in Thailand, where the RE programs increased electrification from 7 % in the early 1970s to 97 % of rural households by 2000, whereas in Bangladesh only 19 % of households were electrified by 2000. REB/PBSs have covered 90 % of the area with basic distribution infrastructure but the household connectivity is still very low. Three factors that appear to have influenced the divergence in achievements of the RE programs in the two countries are the following.

1. *Adequate electricity generation capacity:* In Thailand generation capacity to meet the growing demand from expansion in the distribution network was not a barrier, whereas inadequate generation capacity appears to have affected rural electrification in Bangladesh
2. *Cost recovery by utilities:* In Thailand the utilities recovered the cost of operations from sales revenue which allowed use of available financial resources for new investments, whereas losses in Bangladesh utilities affected the availability of financial resources for new investments.
3. *Higher economic growth:* Higher economic growth in Thailand seems to have affected rural electrification by increasing the purchasing power of consumers as well as increased resource base in terms of commercial and industrial consumers. On the contrary economic growth in Bangladesh was lower, a factor which would have affected the availability of investment resources for expanding generation capacity and grid extension. The lack of generation investment was also partly affected by the non-recovery of cost by utilities in Bangladesh.

Though the differences in achievements of RE in Bangladesh and Thailand are partially explained by the above factors, there are a number of other factors that might also explain the differences. Some of these include necessary skills and competencies to build a power network, adequate transmission network, and financial/investment climate. These factors may be considered in a future study.

In Thailand, the tariffs increased post-private sector participation in electricity generation and tariff reforms. The reforms were introduced at a time when a high level of electrification had already been achieved in the country. Thus, these reforms did not affect the average household consumption of the poor and non-poor as well as the electrification level. Also, the increase in income of the poor and non-poor resulted in an increase in average household consumption. ■

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Notes

1. http://www.gnesd.org/rationale.htm (30 June 2004)
2. In the early 1960s, the government established various other agencies to provide and distribute electricity to some areas: (1) The Lignite Authority (LA) in 1960 to supply electricity in the far north and south of Thailand; (2) the North-Eastern Electricity Authority (NEEA) in 1962 to provide electricity in the North-East where a hydroelectric plant was situated; (3) private franchises which were managed as electric utilities by private concessionaires in their concerned areas.
3. http://www.orierc.org/docs/BANGLADESH.pdf (21 July 2004)
4. http://www.bbsgov.org/ (30 June 2004)
5. http://www.bangladeshgov.org/reb/about_reb.htm on 13th June 2004
6. http://www.sdnbd.org/sdi/metadata/fifth5-yesr-plan/252.htm (21st July 2004)
7. On the utility side, there are also a number of problems leading to low utilization and inadequate access to electricity [Murphy et al., 1999]: load-shedding and voltage variation that discourage individuals and firms from accessing and consuming electricity; operating inefficiencies; high system losses; poor bill collection; inadequate tariff structures leading to financial losses; and lack of funds for expanding the distribution system and new connections.
8. Fourth Five-Year Plan, http://www.bbsgov.org/

9. Population earning less than US$ 1 a day [UNDP, 2003].
10. Time-of-day (TOD) tariff system divided the day into three time zones – peak, partial peak and off-peak. The consumers under this regime paid demand charge for electricity on the basis of usage in each time zone classification and a service charge. In the time-of-use (TOU) system, consumption was charged on the basis of consumption during peak and off-peak hours. The concept of partial peak applicable in TOD was dropped. The consumers pay energy charge based on time of use and a fixed service charge.
11. Most SPPs generate for own use and sell excess electricity to EGAT.
12. Average household consumption for each category was calculated as total consumption in that category divided by total number of consumers in the category.

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Impact of power sector reform on the poor: case-studies of South and South-East Asia

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Electricity is one of the key inputs for socio-economic development. Efficient provision of electricity contributes to poverty reduction by fuelling economic growth and enabling the fulfilment of the basic human needs of health and education. Provision of electricity is thus crucial for improving living standards, supporting development and job opportunities, and fostering social activities. To meet the challenges of ever-increasing demand for electricity different models for reforming the power sector have been adopted across the developing world. Following a decade of energy sector reforms in many developing countries, it is appropriate to ask to what extent these reforms have benefited the poor, in particular, their impact on access, quality and reliability of electricity available to the poor. This paper investigates this question in a systematic manner by critically examining the impact of reform processes adopted in selected states in India and in the Philippines on access to electricity for the poor.

It is observed that the focus of Indian reform legislation has been more on improving financial viability of the ailing power sector than on improving access to electricity. The legislation does not explicitly spell out the provisions for the extension of electricity services to the poor and the need and mechanism for subsidizing marginalized consumers. In contrast, the Philippine legislation has provision of lifeline rates for the poor and defines an approach to cross-subsidy, subsidy and the expansion of the network. The Act stipulates a definite time-frame for the elimination of cross-subsidy and at the same time it ensures subsidized rates for the identified poor. This paper brings out the need to have a proactive legislation that addresses issues linked to access to reliable and affordable sources of electricity. To effectively meet the electricity needs of the poor, legislative and policy support for mechanisms such as the provision of lifeline rates and special functions like missionary electrification needs to be put in place.

1. Introduction

Electricity is one of the key inputs for socio-economic development. Efficient provision of electricity not only contributes to poverty reduction indirectly through economic growth, but, being central to the basic human needs of health and education, electricity access also has a direct bearing on poverty reduction. To meet the challenge of ever-increasing demand for electricity different models for reforming the power sector have been adopted across the developing world. Power sector reforms generally involve commercialization, setting-up of independent regulators, restructuring, and privatization of the electricity sector. Ensuring that power sector interventions are designed so as to benefit the poor is vital both for social equity and sustainability of the reform process. Following a decade of energy sector reforms in many developing countries, it is appropriate to ask to what extent these reforms have benefited the poor. There is often a concern that these reforms disadvantage the poor. This paper is an attempt at investigating this question in a systematic manner by critically examining the reform processes adopted in selected states in India and in the Philippines vis-à-vis their impact on access to electricity for the poor.

2. Background on electricity services for the poor in South and South-East Asia

The demographic indicators of electricity services in South and South-East Asia show a wide variation. There is a large variation in the per capita consumption of electricity in the region, Singapore leading with per capita consumption of 6,641 kWh per year, and Nepal at the other end at 47 kWh per year. According to recent estimates, the per capita consumption of electricity in India at 379 kWh is one of the lowest in the world. Similar unevenness is prevalent in electrification levels, with Thailand having the highest electrification level of 97 % and Bhutan only 11 %. While the Philippines is at the high end of the regional electrification spectrum (87 %), India is in the middle (46 %). Propelled by rising income and electrification levels, electricity demand in the South and South-East Asian region is projected to rise sharply in the future. To meet this challenge many developing countries in the region embarked on restructuring their electricity industry by adopting different models for restructuring, privatization and competition (Table 1).

Countries such as Indonesia, Malaysia, Singapore, the Philippines and Thailand have already introduced

Table 1. Power sector reform in South and South-East Asia

No.	Country	Old structure	Restructuring	Corporatisation	Unbundling	Independent regulator	Privatisation	Competition
1.	Bangladesh	○		○				
2.	Bhutan	○						
3.	India	○	○	○	○	○	○	
4.	Indonesia		○	○	○	○	○	○
5.	Malaysia		○	○	○	○	○	○
6.	Maldives	○						
7.	Nepal	○				○		
8.	Pakistan	○				○		
9.	The Philippines		○	○	○	○	○	○
10.	Singapore		○	○	○	○	○	○
11.	Sri Lanka	○		○		○		
12.	Thailand		○	○	○	○	○	○

Source: Authors' compilation, 2002.

competition in the power market, whereas in countries such as Bangladesh, Bhutan, Nepal, Pakistan, and Sri Lanka, the reforms are in the early stages. In India, power sector restructuring and setting-up of independent regulators started in the late 1990s. Therefore, it would be useful to assess the experience of other countries and also draw from it useful lessons for the reform process.

3. Selected case-studies in South and South-East Asia: the Philippines and India

This paper analyses the impact of power sector reforms on the poor through case-studies of India and the Philippines. To assess the impact of power reforms on the poor, it is essential to calculate the electricity indicators separately for poor and non-poor groups in society. International comparisons of poverty data entail both conceptual and practical problems. Different countries have different definitions of poverty, and consistent comparisons between countries can be difficult. Local poverty lines tend to have higher purchasing power in rich countries, where more generous standards are used than in poor countries. The conventional definition of poverty equates it with income or expenditure levels that enable an individual to satisfy a certain minimum consumption level. The proportion of population not able to attain the specified level of expenditure is then designated as poor. Using such an approach the Planning Commission, Government of India, has been estimating the head count ratio of the poor at state level, separately for rural and urban areas, for over three decades. It currently uses minimum consumption expenditure anchored in an average (food) energy adequacy norm of 2,400 and 2,100 calories per capita per day to define state-specific poverty lines, respectively for rural and urban areas [PC, 2001b]. As per the 55th National Sample Survey [NSS, 1999-2000], the poverty line for urban areas was Rs. 854.96 (US$ 19.02) per capita per month and for rural areas Rs. 486.07 (US$ 10.82) per capita month. According to this definition, 26.1 % of Indians fall below the poverty line. In the Philippines, the poverty line is defined in terms of a least-cost consumption basket of food that provides 2,016 calories and 50 g of protein per day and of non-food items consumed by families in the lowest quintile of the population. The poverty threshold for the Philippines in 2000 stood at 967 pesos (US$ 21.88) per capita per month [NSCB, 1997 and 2000]. Therefore, in nominal dollar terms, the Indian poverty line is less than that of the Philippines. As of 2001, 40 % of the total population were officially considered poor in the Philippines. Table 2 compares the socio-economic, demographic, and electricity characteristics of the Philippines and India.

On the reform front, in India, unbundling and privatization of distribution has taken place in two states, vertical unbundling and restructuring has taken place in seven states, and 21 states have established independent regulatory commissions. The Philippines has gone a step further by moving towards competition in the sector. An independent regulatory commission has also been put in place to regulate and supervise the sector to ensure stakeholders' interests.

4. Methodology and data issues

In the Philippines, the Republic Act 9136 was passed in 2001 with the mandate of setting up an independent regulatory commission, promoting rural electrification, and undertaking sectoral restructuring. In the case of India, the Electricity Regulatory Commission Act was passed in 1998 for setting up independent regulatory commissions with the objective of tariff rationalization, that is, aligning tariffs with the costs of delivery of power by reducing cross-subsidies. Electricity being a concurrent subject in India, where both the centre (i.e., the federal government) and the states can formulate policy, there is a significant variation with respect to the progress of reforms across

Table 2. Socio-economic, demographic, and electricity characteristics compared between the Philippines and India

Indicator	The Philippines	India
Population, total (millions)	77.02	1033.39
Population growth (% per annum)	1.88	1.70
% population below poverty line	40.00	26.10
GDP (current US$ billion)	71.44	477.55
GDP growth (% per annum)	3.40	4.50
Illiteracy rate, adult male (% of population ages 15 and above)	4.52	42.34
Inflation, GDP deflator (% per annum)	6.67	6.00
Life expectancy at birth, total (years)	69.27	62.80
Infant mortality rate (per 1000 live births)	30.72	69.20
Electric power consumption (TWh)	34.97	391.65
Exchange rate of currency per US$ (January 2002)	51.20	48.56
Per capita GNP (US$)	1050	460
Per capita consumption of electricity (kWh)	454.00	379.00
Electrification level (%)	87	46

Source: www.worldbank.org

Table 3. Reform options

No.	Country/state	Reform option	Mandate
1.	The Philippines	Reform Act, 2001	Restructuring, privatization and competition, rural electrification, setting-up of independent regulatory commission
2.	India	Reform Act, 1998	Legislation spelling out the role, objective, functions of independent regulatory commissions at the central and state level
2a	Karnataka	Reform Act, 1999	Restructuring, unbundling, and setting-up of independent regulatory commission. The government is planning to privatize the distribution business.
2b	Himachal Pradesh	No Act	Setting-up of independent regulatory commission under the Federal Act
2c	Orissa	Reform Act, 1995	Corporatization, unbundling, privatization, setting-up of independent regulatory commission

Source: Authors' compilation

the states. This often makes the task of implementing reforms much more complex in India than in the Philippines where the central government has complete jurisdiction over organization and reform of the power sector. In India, three states representing different phases of the reform process have been taken up for this study.

- Orissa: Orissa was the first state in India, in fact the first region in South Asia, to corporatize and unbundle its state-owned electricity industry and privatize the distribution while establishing an independent regulatory body. Orissa's experience offers lessons not only for other Indian states but also for other developing countries that are in the process of reforming their power sector.
- *Karnataka:* Karnataka has a four-year-old regulatory reform history with the recent unbundling of the sector. However, distribution has not been privatised in Karnataka.
- *Himachal Pradesh:* The reform process in Himachal Pradesh is in its nascent stage with a newly-established regulatory commission. The electricity utility is yet to be corporatised or unbundled.

In all these three cases, the need for direct subsidy and the role of the government in the provision of electricity for the poor is discussed (Table 3). The paper also looks at the legal and policy framework governing power sector reforms in the Philippines and India.

Since the study seeks to identify the extent of the impact of reforms on the poor, it is necessary to make a distinction between the poor and the non-poor. Various options available to distinguish electricity access for the poor and the non-poor along with their merits and demerits are discussed below.

- *Electricity access for BPL (below poverty line) population:* The ideal option would be to study electricity access for the poor as defined by the national poverty line or other income definitions of the poor. However, often data on this is not available directly. The Government of India launched the KJ (Kutir Jyoti) Programme in 1998-99 for extending single-point light connections to the households of BPL rural families. Since the KJ programme was designed to target the BPL population, the number of KJ connections has been used for identifying electricity access to the BPL population. This methodology has a limitation that barring a few states, the scheme excludes the urban poor. Nevertheless, under the existing data constraints, linking KJ consumers with the BPL population provides the best approximation for the electrification levels of poor households.
- *Linking rural population with the poor population:* A second option is to use the electricity data for rural access as a proxy for the poor. The rationale for using this proxy is that the income levels and access to electricity in rural areas are significantly lower than those in urban areas. The limitation of this approach is that it implies that the whole population in rural areas is poor and ignores the urban poor. In India, utilities compile data according to different categories of

consumers, and not according to urban or rural areas. Because of non-availability of the data, this approach has not been adopted in this paper.

- *Considering lowest-tariff-band consumers as poor consumers of electricity:* The third option is to use the utility's data and identify the number of consumers in the different consumption bands. The consumers in the lowest consumption band, usually 1–50 kWh, can be taken as a proxy for the poor, while consumers in other consumption bands are considered non-poor. However, this proxy for the poor may not prove useful in some cases. The low consumption may be due to low penetration of electrical appliances or less supply of electricity from the utility. The limitation of this approach is that while it covers the affordability dimension of access at the lower end of the consumption, it ignores the population of those poor who do not have connections.

Because of these limitations of various approaches the following definitions and supplementary proxies have been used to distinguish between the poor and the non-poor:

- In the Philippines, the regulatory commission identifies the marginalized end-users after conducting a simulation exercise on the paying capacity of the poor. The marginalized consumers are referred to as low-income household electricity consumers who cannot afford to pay at the full rate. In this study, marginalized consumers have been taken as a proxy for the poor. Also, remote village electrification has been taken as a proxy for the electrification of the poor.
- In Orissa, the number of KJ connections has been used as a proxy for the poor households electrified in rural areas. For this study, the urban poor in Orissa have not been considered, which is not a serious limitation as 85 % of the poor population in Orissa lives in rural areas.
- In Karnataka, the number of BJ (Bhagya Jyoti) connections has been used as a proxy for the poor households electrified. The BJ scheme is the same as the KJ scheme, except that it includes both the rural and the urban poor.
- In Himachal Pradesh, a single light connection is provided to the BPL population. However, there is no separate consumption slab or tariff slab for these consumers. The lowest-tariff-slab consumers have been considered as a proxy for the poor. Data on rural and urban populations has also been linked with the poor and non-poor populations. This methodology has certain limitations, as the Government of India defines rural and urban areas according to the number of inhabitants, non-agricultural workforce, and density of population, and not according to the income. Nevertheless, as the per capita expenditure of rural households is far less than the per capita expenditure of urban households, any policy or any programme to improve access in the rural areas would have a pro-poor bias. Therefore, the proxy of rural areas for the poor is reasonably justified.

To assess the impact of reforms on the poor the following indicators linked to access and affordability of electricity have been used.

Indicators for "access"

- *Electrification levels:* Use of electrification levels is probably the simplest indicator of electricity access. This indicator provides an estimate of the proportion of the households that have physical access to electricity.
- *Electrification rate* (i.e., the rate at which new connections are being made): This indicates to what extent a particular reform is accelerating (or possibly retarding) access to electricity.
- *Electricity consumption:* This indicator can provide some pointers as to how reforms affect the poor; it, however, depends on changes in tariffs, types of appliances used, and supply constraints, if any.

Indicators for "affordability"

- *Electricity tariffs:* When combined with income data, tariffs can indicate to what extent various groups in society can afford electricity.
- *Cross-subsidy:* An additional indicator on cross-subsidy has been used in this study. In India, one of the reform mandates was to introduce cost-reflective tariffs. In practical terms, this has meant designing tariffs in such a manner that the average realization from each category converges with the overall average realization. To measure the extent to which this has been done, TERI has developed the following index:

$$\text{CI (Convergence index)} = \sqrt{\left\{\sum_{C=1}^{N}\left[\left(AR_c/AR_o\right)-1\right]^2/N\right\}}$$

Where AR_C = Average realization from category C
AR_O = Overall average realization
N = Number of categories

This implies that if the average realization from each category equals the overall average realization the CI would be zero, indicating that no category of consumers cross-subsidizes another with reference to the average realization. Therefore, a reduction in the CI is an indicator of a reduction in the cross-subsidy.

5. Assessment of selected reform option: Indian case-study

5.1. Power sector reforms in India – historical perspective till 1995

Electricity is covered under the concurrent list in the Constitution of India, implying that both central and state governments have the power to legislate for the sector. The structure of the power industry in India has evolved considerably post-independence (1947). In the pre-independence era, the Indian Electricity Act, 1910, governed the electricity industry. The Act provided for private participation in the generation and supply of electricity and the industry comprised a large number of independent private or municipal electricity utilities.

In the post-independence era, via the Electricity Supply Act, 1948 (with various amendments therein) and the Industrial Policy Resolution, 1956, private participation

Table 4. Household access to electricity in India in 2001-02 (%)

Total access[1]	46
Rural access[1]	33
Urban access[1]	82
Rural population as % of total population[2]	72
Urban population as % of total population[2]	28

Notes

1. Source: PC, 2001a
2. Source: Census, 2001

Table 5. Chronology of events in electricity sector reforms in India

1991	Electricity Laws (Amendment) Act allows private sector participation in generation with foreign investors allowed 100 % ownership.
1992-97	Eight projects given "fast-track" approval status and sovereign guarantees by the central government.
1995	Orissa Electricity Reform Act establishes the Orissa Electricity Regulatory Commission and provides for unbundling of the Orissa State Electricity Board.
1996	World Bank support for Orissa power sector restructuring project approved.
1996	Chief ministers' conference formulates a Common Minimum National Action Plan for electricity.
1997	Electricity Regulatory Commission Ordinance notification provides for the establishment of a CERC (Central Electricity Regulatory Commission) and SERCs (state electricity regulatory commissions)
1998	Andhra Pradesh, Karnataka, and Uttar Pradesh proceed with the preparation of electricity reform acts. World Bank prepares and approves projects supporting reforms in each of these states.
1999-2001	Energy Conservation Bill passed by Parliament.
2001	Draft central government Electricity Bill prepared and introduced in Parliament.
Till December 2002	Establishment of independent regulatory commissions in 21 states.

Source: Authors' compilation

diminished progressively. The sector gradually assumed its current form of vertically-integrated statewide public sector utilities – the SEBs (state electricity boards). The Electricity Supply Act also created the CEA (Central Electricity Authority) with the mandate of efficient techno-economic system planning. Till the onset of the 1990s, the electricity industry was regulated and owned by various government agencies and organizations with the role and participation of the private sector being limited to specific areas of small jurisdiction and consumer base. Thus, the government performed the multiple roles of developer, promoter, and regulator of the power industry.

5.2. Growth of the sector

The demand for electricity has grown rapidly since independence, with the per capita consumption of electricity increasing at a CAGR (compounded annual growth rate) of 6.04 % [TERI, 2002]. This sustained growth is the result of economic development and has been accompanied by structural shifts in the consumption pattern. In spite of this growth per capita electricity consumption in India is 379 kWh per annum, far below the world average of 2,252 kWh. Close to 90 % of India's villages are electrified officially. However, only 46 % of the Indian population has access to electricity (Table 4).

5.3. Description of various reform initiatives

Historically, the policy and regulatory regime in India's power sector made significant efforts to bring energy services to its vast population. Several efforts were made in the form of national programmes for rural electrification, and promoting renewable energy technologies such as biogas, improved cooking stoves and solar cookers. However, in spite of the existence of these programmes for a long time, access to modern energy services in rural areas remains a challenge. Besides, to meet the energy needs of some sections of the population both subsidies and cross-subsidies, and particularly the latter, were used. However, these policies led to problems and bred inefficiency in the sector. As the industrial and commercial consumer categories subsidized the agricultural and domestic consumer categories, the resultant high tariffs for industrial consumers led to shifting or closure of industries in many cases. The power sector continued to suffer from considerable defaults on payments of dues from various entities. Poor fiscal health and lack of capability to invest in the sector compelled the government to look for private sector participation. Reforms were initiated by the central government in 1991, when it introduced the policy of liberalizing the sector and promoting private investments (Table 5). This policy initially focused on the generation aspect of electricity. Its main objective was to add generation capacity in a short time-frame through private capital by making the sector attractive for investments. Later, it was perceived that the private power policy for generation projects would not succeed unless it was preceded by extensive reforms in the distribution of electricity. Unless the industry provided a strong base of commercial working at the point of sale of electricity, it would not be able to attract the requisite capital investments in generation, transmission, and distribution projects and other related inputs. It was recognised that fundamental organizational changes would have to be effected to restore the financial viability of the sector. Private investment was not forthcoming for undertaking generation as the SEBs were in no position to pay for power purchases. Hence, the need for restructuring the electricity sector was felt.

The goal of restructuring was to increase transparency, accountability, and viability of the industry, facilitate private sector participation, and promote a competitive market. The responsibility for ensuring efficient operations of the industry would gradually shift to an independent regulator, and the government would continue to be responsible for long-term planning, legislation, and evaluation of the sector's performance. Unfortunately, improving electricity access was not recognised explicitly as an objective

of the restructuring exercise and the regulatory legislation, which is perhaps a major lacuna in the Indian reform process.

5.4. Reform mandate

5.4.1. Establishment of regulatory commissions

In 1996, the central government, along with the state governments, decided on the Common Minimum National Action Plan to initiate steps to improve the performance of the electricity sector at the central and state level. Accordingly, the central government passed the legislation enabling the setting-up of independent and autonomous regulatory bodies at the central and state levels in July 1998. Broadly, the roles of these regulatory commissions as envisaged in the ERC (Electricity Regulatory Commission) Act, 1998 are: (1) setting retail tariffs; (2) gradual elimination of cross-subsidy and improving efficiency levels; (3) setting performance standards in the supply of electricity; (4) setting performance standards in the promotion of efficient use of electricity by consumers; (5) promotion of competition; and (6) creation of a conducive environment for private sector participation.

5.4.2. Cost of supply and tariff

The regulatory commissions in India have been mandated to phase out the cross-subsidies in tariff. The ERC Act, 1998, stipulates that tariff should progressively reflect the cost of supply of electricity. However, the Act does not clearly define a path or time-frame to achieve tariff alignment, nor does it mandate any lifeline or subsidized rates for the poor. The Electricity Act (2003) mandates a national electricity policy. The draft tariff policy, however, does not address key issues such as the time-frame for the elimination of cross-subsides and effective mechanisms for delivering support to the targeted consumers.

5.4.3. Efficiency improvements through reduction in T&D losses

The link between transmission and distribution (T&D) losses and electricity access for the poor is indirect but important. In India, a large part of electricity loss is due to pilferage by residential, commercial, and low-voltage industrial consumers. Agricultural and poor residential consumers are not metered and often the consumption by these categories is inflated to mask the operational inefficiencies and high distribution losses. Thus, actual availability and consumption of electricity by these categories is lower than what the statistics would imply. The reform mandate requires reduction in T&D losses but does not specify any means for achieving this reduction such as 100 % metering and curbing of thefts and pilferage. The Electricity Act (2003) addresses this lacuna to some extent by provides for penalties for power theft.

5.4.4. Government support

The reform mandates that if the state government wants to subsidize some consumers, then it would bear the burden through budgetary support and fully compensate the utility for it. This requires smooth communication and coordination between the state government, the utility, and the commission. Sometimes the decision of the government regarding the grant of subsidy has come after the issuing of the tariff order, leading to a partial roll-back of the announced tariff increase. Often the committed government support is not provided. The new Electricity Act (2003) addresses this by explicitly prescribing that the government support is provided in advance.

5.5. Rural electrification in India

The Rural Electricification Corporation (REC) provides financial assistance to SEBs, state power corporations, electricity departments of the state governments and rural electric co-operatives for various rural electrification schemes. The setting-up of REC has definitely acted as a catalyst for rural electrification in India. Of the 509,000 villages electrified in the country, about 305,000 villages have been electrified under REC-financed schemes. Schemes financed by REC include the KJ (Kutir Jyoti) scheme, Dalit Basti scheme, hamlet electrification, pumpset energisation, system improvements, small generation, and rural electric cooperatives. Some of the achievements of the KJ scheme of REC are discussed below.

5.5.1. Kutir Jyoti Programme

The Government of India in 1988 launched the KJ Programme–89 for extending single-point light connections to the households of rural families BPL (below the poverty line). Under this scheme, a one-time cost of internal wiring and service connection charges is provided by way of 100 % grant by REC to the states. According to REC, till March 2002, 4.85 million households of the BPL rural poor have benefited under this programme and a grant of over US$ 65.28 million has been drawn by the implementing agencies.

5.5.2. Challenges in rural electrification

With 78,240 villages still awaiting electrification much needs to be done. The overall pace of rural electrification as well as energization of pumpsets received a setback in the last reform decade. The poor financial health of the SEBs, increasing reluctance to move to rural areas because of high costs and low returns, is largely responsible for this trend [Gokak, 2002]. The Gokak study also points out that the financial burden imposed by the programme of rural electrification, which is subsidized, is enormous. The net subsidy after accounting for amounts received from state governments was US$ 1.034 billion in 1991 and increased to US$ 4.711 billion in 1999–2000.

In view of these problems, the Government of India has taken new initiatives for rural electrification. This is reflected in the Electricity Act (2003), which envisages stand-alone systems for generation and distribution of power and decentralized management of distribution through *panchayats* (village local self-government bodies), users' associations, and co-operatives or franchisees.

6. Power sector reforms in Orissa

6.1. Description of the reform process

Orissa was the first state in India to initiate power sector reforms with the enactment of the Orissa Electricity Reforms Act in 1995. As a part of the reform programme, the OSEB (Orissa State Electricity Board) was unbundled. The generation business was hived off into two corporations – the OPGC (Orissa Power Generation Corporation),

Table 6. Chronology of events in Orissa power sector reforms

November 1993	Chief Minister of Orissa confirms the state government's commitment to power sector reforms
April 1995	GRIDCO (Grid Corporation of Orissa Limited) and OHPC (Orissa Hydro Power Corporation) incorporated under Companies Act, 1956
January 1996	Orissa Electricity Reforms Act (1995) is notified in Official Gazette
April 1996	Reform Act comes into force
	GRIDCO takes over T&D business from OSEB (Orissa State Electricity Board)
	OHPC takes hydro projects from OSEB and DoE
	OERC (Orissa Electricity Regulatory Commission) becomes operational
	Management contract awarded to BSES in respect of central zone
	OERC issue licence to GRIDCO
	Management contract to BSES terminated
November 1997	Chief Minister of Orissa announces the privatisation of four DISTCOs
	GRIDCO incorporates four wholly-owned subsidiary companies
November 1998	Four distribution subsidiary companies become operational
Jan-April 1999	OERC issues separate transmission (to GRIDCO) and distribution (to four DISTCOs) licences
April 1999	BSES takes over WESCO (Western Electricity Supply Company of Orissa Limited), NESCO (North Eastern Electricity Supply Company of Orissa Limited), and SOUTHCO (Southern Electricity Supply Company of Orissa Limited)
September 1999	AES consortium takes over CESCO (Central Electric Supply Company of Orissa Limited)
August 2001	Following AES pull-out, OERC vests management of CESCO in a chief executive officer

Source: Authors' compilation

Table 7. Shares of rural and urban population in Orissa

Year	Urban %	Rural %	Rural population % BPL (below poverty line)	Urban population % BPL (below poverty line)
1991	13.38	86.62	49.72	41.64
2001	14.97	85.03	48.01	42.83

Source: Authors' compilation from [Census, 2001] and tariff orders

which took over thermal plants of the erstwhile OSEB, and the OHPC (Orissa Hydro Power Corporation), which took over the hydro plants. The transmission and the distribution businesses were entrusted to GRIDCO (Grid Corporation of Orissa Limited), which is the successor organization of the OSEB. The distribution business was privatised in 1998-99 and has been divided into four zones.

The OERC (Orissa Electricity Regulatory Commission) was established in 1996 as a part of the reform process. The powers and functions of the regulatory commission include issue of licences, enforcement of licences and regulation of licensees, promotion of economic efficiency and safety in transmission, distribution, and use, regulation of bulk supply and retail supply tariffs, collection of data and forecasting, and promotion of competition.

6.2. Identification of the reform process

The following reform processes can be identified in Orissa (Table 6): (1) corporatization of the electricity board; (2) management contract; (3) establishment of an independent regulatory commission and issuing of four orders; (4) vertical unbundling into separate generation, transmission, and distribution companies; and (5) privatization of four distribution zones in Orissa. The period after the privatization of distribution is considered the post-reform period (1999-2003) and 1996-1999 the pre-reform period.

6.3. Definition of the poor and policy context

Orissa has a population of 36,706,200 with an annual growth rate of 1.4 %. Only 14.97 % of the total population in the state is urban. It is one of the poorest states in India with the highest percentage of BPL population (47.15 %) (Table 7).

To encourage electrification of BPL households, Orissa adopted the KJ (Kutir Jyoti) programme in 1988-89 for extending a single-point light connection to the households of BPL rural families, including Dalit (formerly untouchable caste) and Adivasi (tribal) families. For the purpose of this study, the number of KJ connections has been linked with the rural poor BPL households.

6.4. Assessment of the impact of the reforms in Orissa on the poor

6.4.1. Electrification levels

Electrification level provides an estimate of the proportion of the population that has physical access to electricity. The electrification levels for the non-poor in Orissa increased from 47.60 % in 1999-2000 to 56.06 % in 2001-02, whereas electrification levels for the poor decreased from 3.67 % to 3.31 % in the same period (Figure 1). The reason for this could be disconnection of installations because of payment default. Also, when OSEB was restructured and distribution companies were privatised, the rural electrification wing was disbanded and the focus on rural electrification was lost. As a result, the number of villages electrified in Orissa declined from 800 in 1997-98 to a mere 42 in 2000-01.

The electrification levels for the non-poor and the poor before reforms were growing at a CAGR (compounded annual growth rate) of 7.5 % and 1.6 % respectively. After reforms the tempo for electrification for the poor

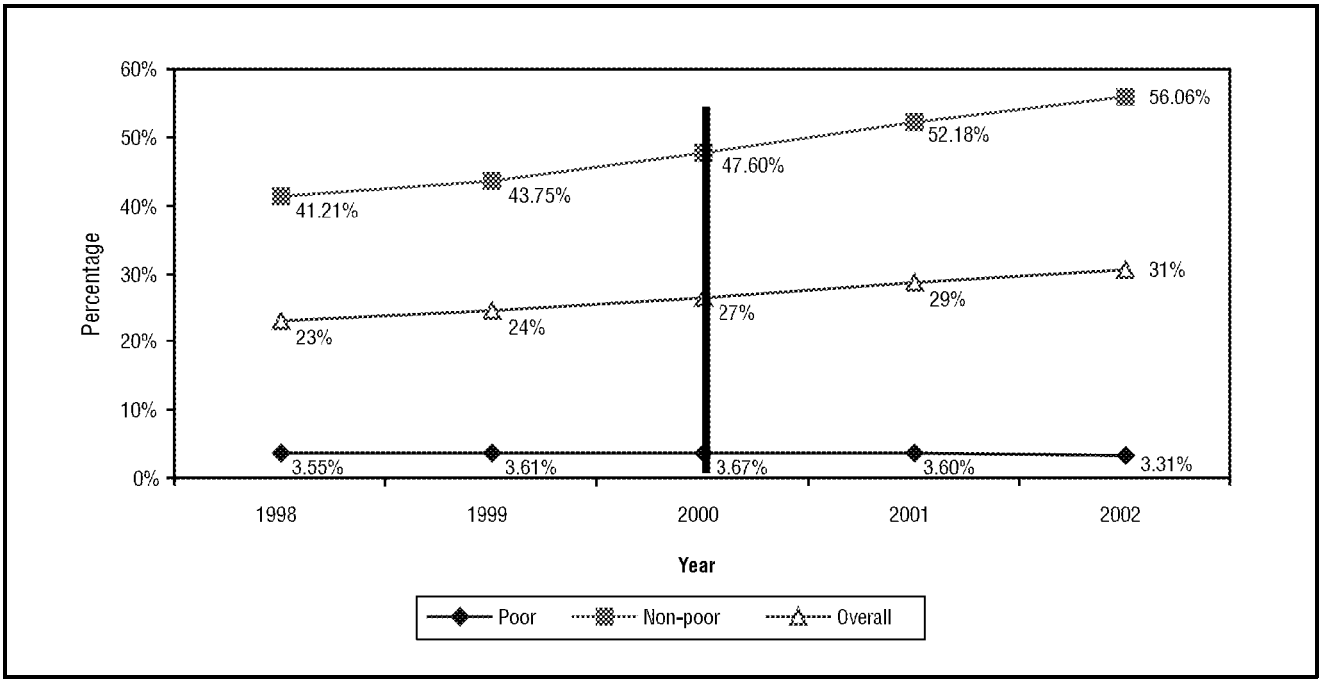

Figure 1. Electrification levels in Orissa

Source: Authors' compilation from [Census, 2001] and tariff orders

has gone down drastically, while electrification levels for the non-poor have increased by a CAGR of 8.5 %. The deterioration in the electrification levels of the poor after the reforms could be due to the incentivisation of the private utility to try to minimize loss by discouraging new connections for the poor.

6.4.2. Electrification rates

The electrification rate measures the pace of electrification. This indicator is used to determine the extent to which the reform option accelerates access to electricity, especially among the poor. The electrification rates for the poor in Orissa have gone down drastically during the post-reforms period (1999-2000). With the advent of the reform process, electrification rates for the non-poor households in Orissa increased from 7.7 % in the year 1998-99 to 9 % in the year 2001-02 (Figure 2). The reasons for the de-electrification of the poor consumer could be that many of them opted out because of relatively higher charges.

6.4.3. Electricity consumption

Electricity consumption is another important indicator for analysing the impact of reforms on the poor. The electricity consumption per household for the poor households in Orissa shows a sharp decline of 41 % between 1998-99 and 2002-03. Thus, the fall in consumption in the case of the poor consumers has been quite substantial (Figure 3).

6.4.4. Electricity tariff

Over the years, poor consumers in Orissa have had to pay a fixed charge of 61.78 US¢ per month (Table 8) irrespective of their actual consumption of electricity. Thus, the poor consumer pays the same amount for consuming 10 kWh per month and 50 kWh per month, which is regressive.

6.4.5. Subsidy and cross-subsidy

Before reforms, the Government of Orissa was providing subventions to OSEB under Section 59 of the Electricity Supply Act (1948). This practice was withdrawn in the immediate post-reform period on the assumption that the utility on its own would start earning profit from the year 1997-98. By this, the Government of Orissa saved subsidy payments of about Rs. 27.70 billion (US$ 1 = Rs. 48) during the period 1995-96 to 2000-01. One of the fundamental objectives of setting up an independent regulatory commission was to rationalize the tariff and eliminate cross-subsidy. However, since the inception of the reform process, cross-subsidy has increased, which is not consistent with the stated objectives of reforms.

6.5. Conclusion

Over the years the electrification level for the poor in Orissa has shown a considerable decline. The electrification rate for the poor consumers has declined after reforms, whereas for other domestic consumers electrification rates have risen [Kanungo, 2001]. The per capita consumption for the KJ consumers has shown a sharp decline. Given the large rural population in Orissa, this raises concerns about the reform process addressing the consumption needs of the poor in the state. Electricity reforms in Orissa have led to neglect of rural electrification, which in turn has had an adverse impact on the consumption needs of the poor in the state. There is a need for clear policy directions, as the reform Act does not explicitly make any provision for serving the electricity needs of the poor.

7. Power sector reforms in Karnataka

7.1. Description of the reform process

In tune with the reforms initiated by the Government of India to improve the performance of the power sector, the Government of Karnataka enacted the Karnataka Electricity Reforms Act in June 1999. The Act mandated major corporatization and restructuring of the Karnataka

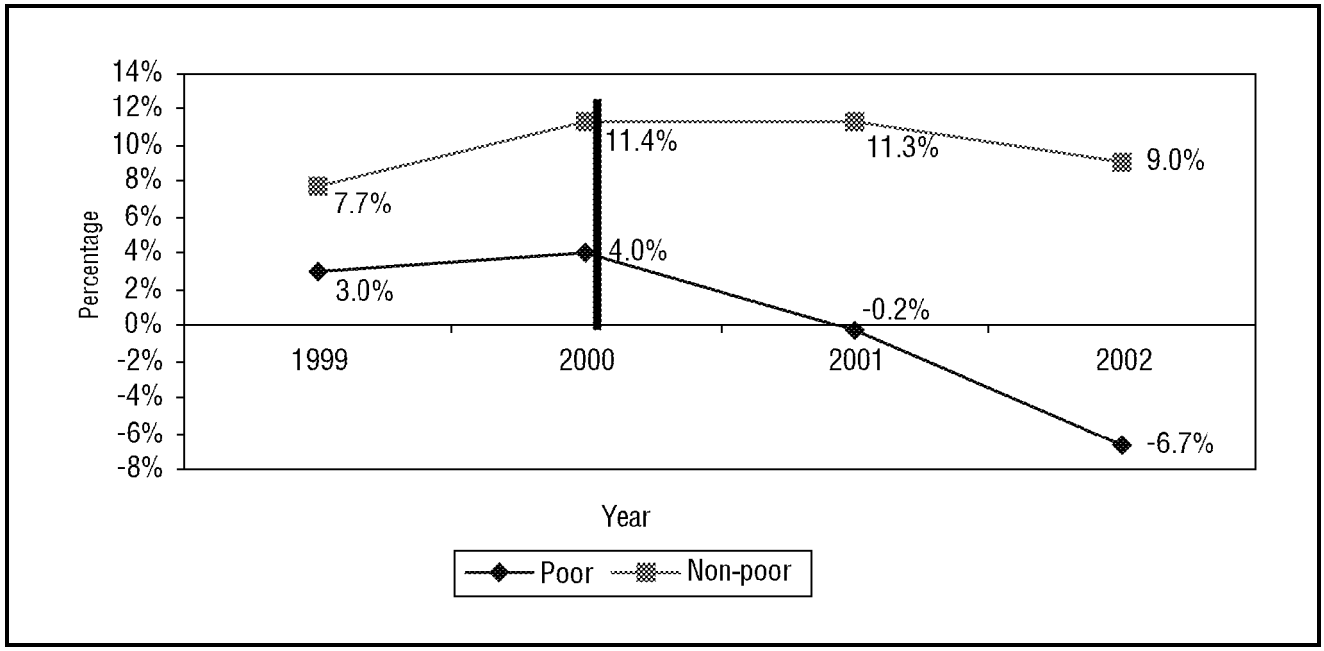

Figure 2. Electrification rates in Orissa

Source: Authors' compilation from [Census, 2001] and tariff orders

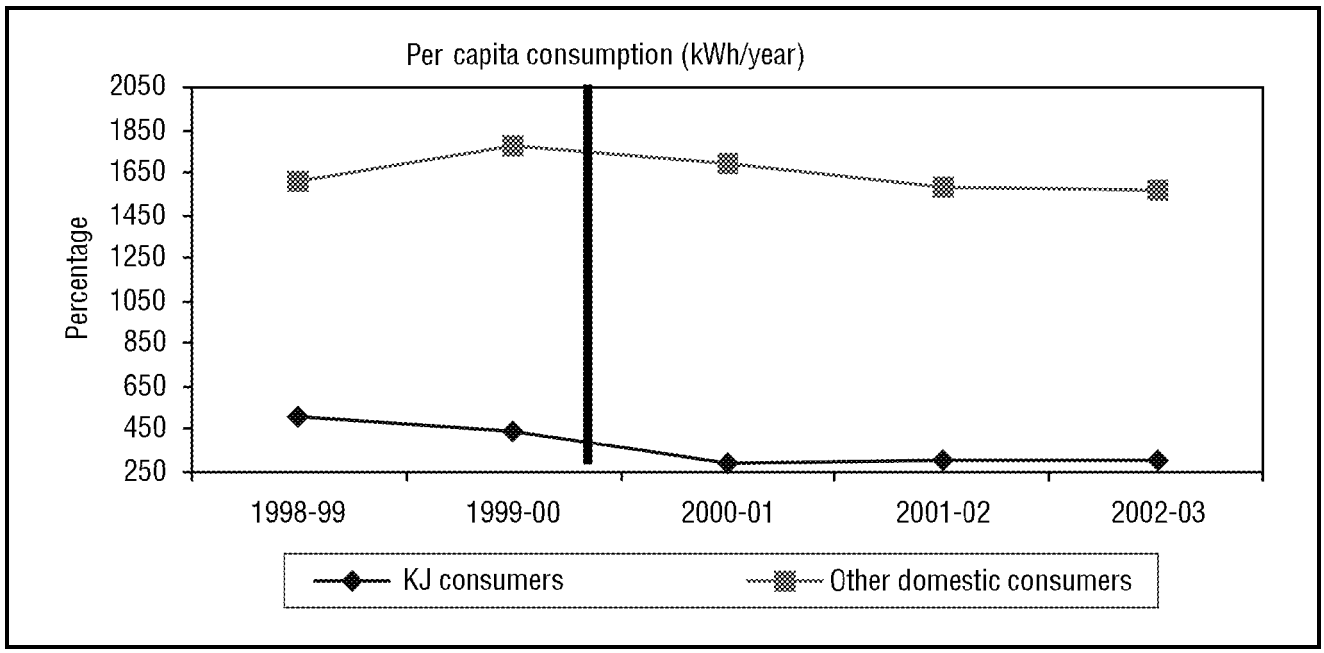

Figure 3. Electricity consumption in Orissa

Source: Authors' compilation from [Census, 2001] and tariff orders

Electricity Board. The Board was split into a T&D utility, KPTCL (Karnataka Power Transmission Corporation Limited) and the generation entity VVNL (Visvesvaraya Vidyuth Nigam Limited) in August 1999.

The Act also provided for the setting-up of an independent regulatory commission which would introduce tariff reforms. The Act specifically mentioned that, to the extent small rural consumers and the rural poor need to be protected, cross-subsidies might have to continue in the retail tariff structure in the short-to-medium term, but these have to be gradually eliminated. Accordingly, KERC (Karnataka Electricity Regulatory Commission) was established in March 2000. The government has also expressed its intention to take steps to make the newly-formed ESCOMs (electricity supply companies) regulated by the KERC completely independent without any hand-holding by either the KPTCL or the government.

7.2. Identification of the reform steps

The following steps in the reform process can be identified (Table 9): (1) establishment of an independent regulatory commission and issuing of three tariff orders; (2) corporatization of the electricity board; and (3) vertical unbundling into separate generation, transmission, and distribution companies. The Karnataka Electricity Reform Act (1999) has been taken as the main reform option for this study. The period 2000-2003 is considered

the post-reform period.

7.3. Definition of the poor and policy context

Karnataka has a population of 52,733,958, with a decadal growth rate of 17.25 %. Of this, 34,814,100 people reside in the rural areas (Table 10). During the liberalization period the share of rural population in the state declined by 3 %.

The proportion of population living below the poverty line is 20.04 %. For improving electricity access to the poor in Karnataka, the BJ (Bhagya Jyothi) scheme was started in the late 1970s for a single-bulb installation for the BPL families. In this study, households with a BJ connection have been considered poor consumers of electricity.

7.4. Assessment of the impact of the reforms in Karnataka on the poor

7.4.1. Electrification levels

While the electrification level for the poor was growing at a CAGR of 6.4 % before reforms, the tempo for the electrification levels for the poor in Karnataka has gone down substantially to 3 % post-reforms (Figure 4). On the other hand, the CAGR for the electrification levels for the non-poor increased from 1.7 % before reforms to 2.4 % post-reforms. The deterioration in the electrification levels of the poor after the reforms can be linked to the utility's intention of minimizing losses by discouraging new connections for the poor and encouraging new connections to more lucrative areas.

7.4.2. Electrification rates

At the beginning of the 1990s, the electrification rate for the poor in Karnataka was very high. However, it has gradually declined. The electrification rate for the poor, which was as high as 45.88 % in 1992, declined to 12.10 % in 1997 and further to 9.48 % in 2001. Post-reforms this rate for the poor declined further and has now stagnated (Figure 5). In contrast, for the non-poor, this rate increased sharply in the year 2002.

7.4.3. Electricity consumption

The per household electricity consumption is obtained using the data provided by the utility by dividing the amount of electricity consumed by the number of electricity consumers. In the post-reform era (2000-2003), the electricity consumption of non-poor in Karnataka increased by a CAGR of 3.83 % and over the last one year it has increased by over 7 % (Figure 6).

As against this, the electricity consumption levels for the poor households in Karnataka stagnated at 216 kWh per year after the establishment of the regulatory commission, but this is more a reflection of the lack of metering and authentic data on consumption. In the circumstances, the commission has been using the normative figure of 216 kWh. The data on actual consumption by this category are not available. The utility in its tariff filing (2002) reported that the average per capita consumption by the poor was 27 units per month. However, the commission did not take this consumption level at its face value, as, being unmetered, the consumption could serve to hide T&D losses. According to the commission's analysis, the earlier norm of 18 units per month was more realistic.

Table 8. Tariff for the poor and non-poor

	Per unit charge for other domestic consumers (US¢ per kWh)	Access charge per month for Kutir Jyoti consumers (US¢ per month)
1997-98	2.74	61.78
1998-99	3.48	61.78
1999-00	3.53	61.78
2000-01	4.20	61.78
2001-02	4.20	61.78

Source: Authors' compilation from [OERC, 1999; 2002]).

Table 9. Chronology of events in Karnataka power sector reforms

January 1997	Policy statement announced
June 1999	Promulgation of KER (Karnataka Electricity Reform) Act (1999)
August 1999	Restructuring of the Karnataka Electricity Board and its corporatization. As part of the corporatization, the Karnataka Electricity Board ceases to exist and KPTCL (Karnataka Power Transmission Corporation Limited) to look after transmission and distribution in the state and VVNL (Visvesvaraya Vidyuth Nigama Limited) to look after the generating stations.
March 2000	Establishment of KERC (Karnataka Electricity Regulatory Commission)
December 2000	First tariff order issued
October 2001	Privatisation strategy paper prepared
May 2002	Second tariff order issued
October-March 2003	Four separate distribution companies operationalized
	BESCOM (Bangalore Electricity Supply Company Ltd)
	MESCOM (Mangalore Electricity Supply Company Ltd)
	HESCOM (Hubli Electricity Supply Company Ltd)
	GESCOM (Gulbarga Electricity Supply Company Ltd)
March 2003	Third tariff order issued

Source: Authors' compilation

Table 10. Population distribution in Karnataka

Year	Urban %	Rural %
1991	30.92	69.08
2001	33.98	66.02

Source: Author's compilation from [Census, 2001] and tariff orders

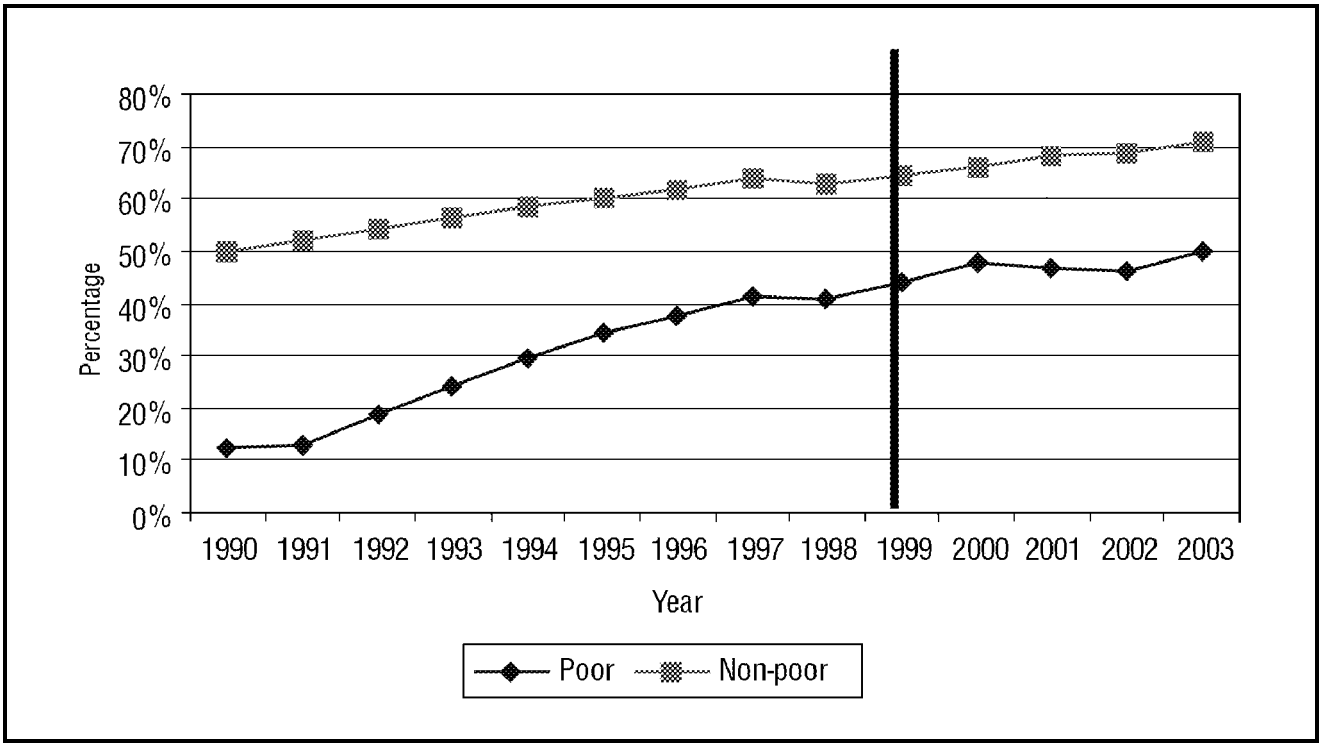

Figure 4. Electrification levels in Karnataka

Source: Authors' compilation from [Census, 2001] and tariff orders

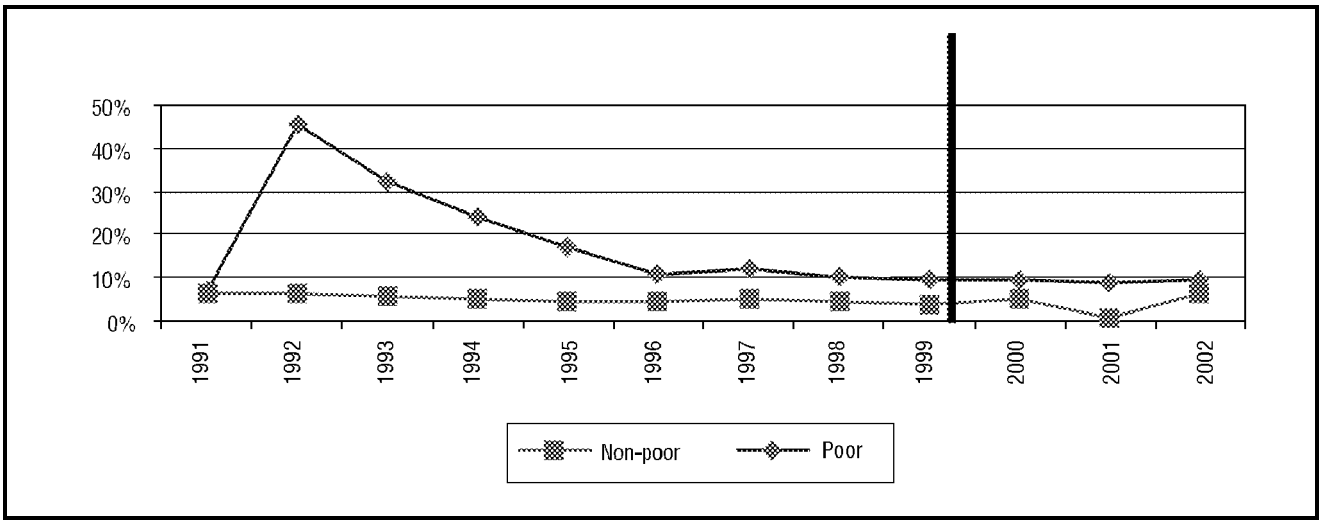

Figure 5. Electrification rates in Karnataka

Source: Authors' compilation from [KERC, 2000; 2001; 2002]

7.4.4. Electricity tariff

The tariff in the beginning of the BJ scheme was Rs. 2.50 per month (US¢ 5.15) towards energy charge and Rs. 1.61 (US¢ 3.32) per month as connection charges towards the investment made in extending the facility. The rates charged from the poor consumers were kept at very low levels till the advent of the reform process (Table 11).

The commission in its first order (2000) observed that the rates charged to the poor consumers (BJ installations) had been kept very low. Further, the Commission observed that according to the KRC (Karnataka Regulatory Commission) Act, the tariff should progressively reflect the cost of supply and the cross-subsidy in the tariff structure had to be reduced. Considering these facts the commission increased the rate for poor consumers to Rs. 10 (20.6 US¢) per month including recovery towards the capital loan portion and also mentioned that this tariff is only 19.4 % of the average cost of supply and needs to be increased in the future tariff orders. The tariff for the poor increased by a CAGR of 35 % in the post–reform era as against a CAGR of a mere 2 % in the pre-reform era. However, the average tariff for the non-poor has increased by a CAGR of 13 % during the reform period. This is because the Act mandates reduction in cross-subsidy in tariff. This is also evident from the fact that the ratio of the poor to the non-poor tariff has increased drastically during the post-reform period, which is again a clear reflection of reduction in cross-subsidy in tariff (Figure 7).

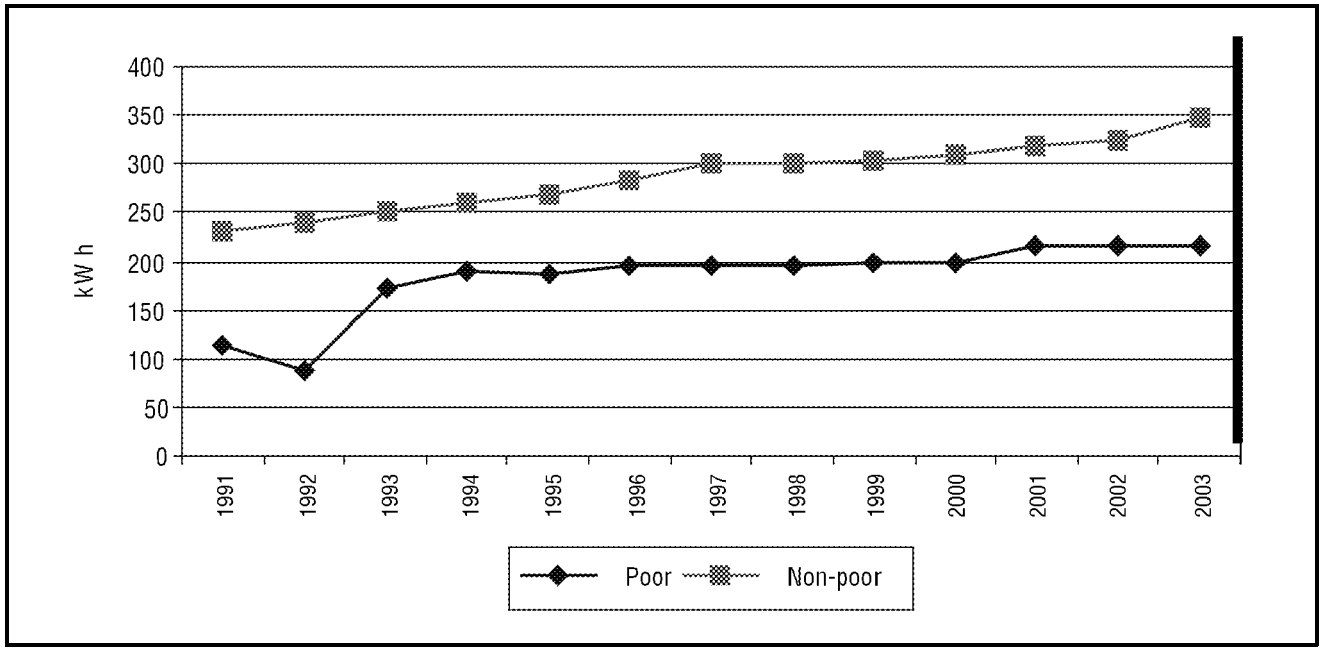

Figure 6. Electricity consumption per household per year in Karnataka
Source: Authors' compilation from [KERC, 2000; 2001; 2002]

7.4.5. Subsidy and cross-subsidy

7.4.5.1. Cross-subsidy

As discussed in Section 4, the CI indicator is used in the study for the analysis of trends in cross-subsidy reduction. The CI has been calculated for Karnataka at the existing tariff in the year 2000 and also at the revised tariff approved by the commission (Table 12). Over the years in Karnataka, the CI has gone down, which is reflective of a reduction in cross-subsidy in the tariff structure.

7.4.5.2. Subsidy

Two salient features emerge from Karnataka's power sector reforms. One, the subsidy provided by the government budget has increased drastically over the years. In the year 1997-98, the subsidy claimed from the government was US$ 78.28 million and in the year 2002-03 the claim rose more than eight-fold to a figure of US$ 652.26 million. One reason for this trend is that the tariffs for agricultural and residential consumers have still not been aligned with the cost of supply.

The second aspect is that the subsidy amount outstanding from the Government of Karnataka has risen sharply. It increased from US$ 2.49 million in the year 1997-98 to US$ 336.26 million in the year 2001-02. For the year 2002-2003, the government has committed itself to providing US$ 575.72 million, thereby reducing the outstanding amount to US$ 76.54 million. The commission expressed its concern over the outstanding amount, which has an impact on the ability of the utilities to meet their liabilities in a timely fashion. The commission has urged the government to release subsidy payments at least in equal quarterly instalments.

7.5. Conclusion

Post-reform, there has been a substantial decline in the growth of electrification levels and electrification rates for the poor in Karnataka. In view of the fact that the Act makes no explicit commitment to the extension of electricity access for the poor, this is not surprising. It is difficult to comment on the average consumption by poor households in the absence of 100 % metering which makes the current estimates of consumption unreliable. However, the increase in tariffs in the post-reform era can only contribute to decline in the electricity consumption levels of the poor in the future. From the point of view of tariff, the fact that the tariff for the poor has increased more than the tariffs for the non-poor implies that cross-subsidy has decreased, which is actually in conformity with the reform mandate. However, the Act ignores the fact that poor consumers cannot afford the true cost of supply and therefore tariffs for the marginal consumer need to be subsidized. The Karnataka government is planning to

Table 11. Amount charged under the BJ (Bhagya Jyothi) scheme till the reform process

	Energy charge per month (US¢)	Fixed charge per month towards investment (US¢)	Total amount payable per month (US¢)
1979-Feb 1981	5.15	3.32	8.46
Feb 1981-April 1981	4.43	3.32	7.74
April 1981-Aug 1981	4.43	4.51	8.94
Aug 1981-Sept 1986	4.35	4.51	8.86
1986-1987	4.35	5.35	9.70
1987-1992	5.15	5.35	10.50
1992-93	5.15	5.77	10.91
1993-98	5.15	6.28	11.43
1998-2000	5.15	6.80	11.94

Source: KERC, 2000

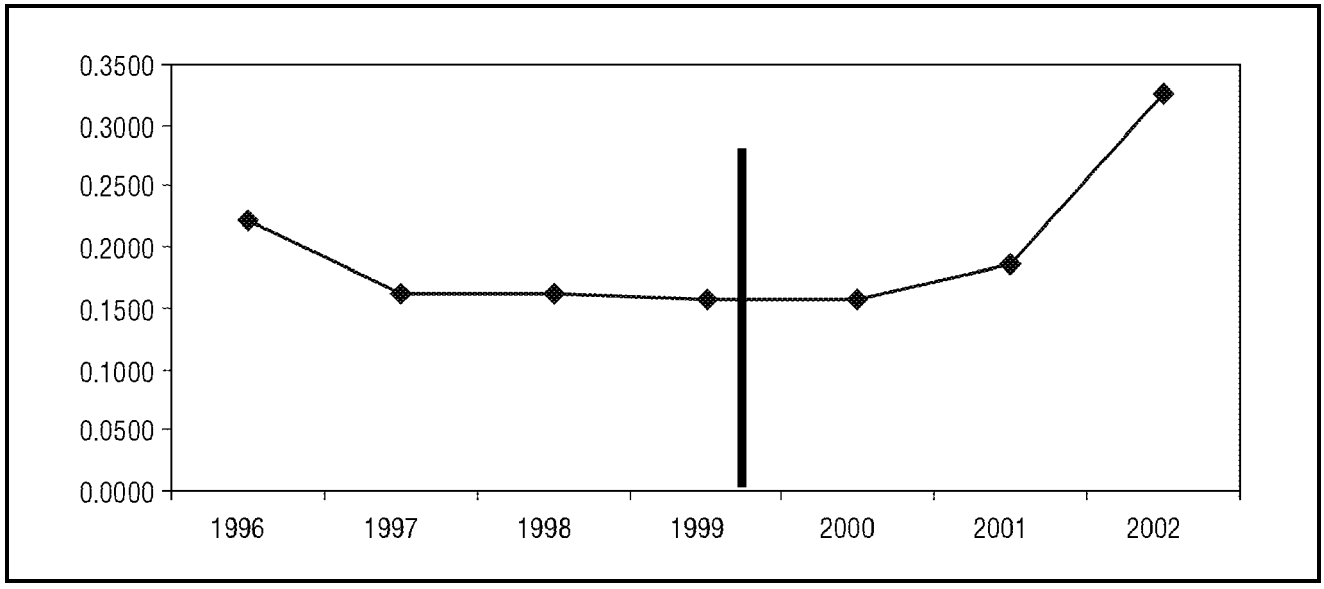

Figure 7. Ratio of poor to non-poor tariffs in Karnataka

Source: Authors' compilation from [KERC, 2000; 2001; 2002]

Table 12. CI (convergence index) for Karnataka

Description	
CI in FY 2000	0.6236
CI in FY 2003	0.4671

Source: Authors' analysis from [KERC, 2000; 2001; 2002]

Table 13. Rural and urban population shares in Himachal Pradesh

Year	% urban	% rural
1991	8.69	91.31
2001	9.79	90.21

Source: Authors' compilation from Census of India 2001 and tariff orders

privatise its distribution. However, as mentioned earlier, private companies on their own would be neither willing nor able to improve access, unless a clear policy regarding lifeline rates and subsidy from the government is formulated.

8. Power sector reforms in Himachal Pradesh

8.1. Description of the reform process

In Himachal Pradesh, power sector reforms were initiated with the establishment of the HPERC (Himachal Pradesh Electricity Regulatory Commission) in December 2000. The commission is a single-member regulatory authority assisted by technical and administrative staff. Its role is to regulate the working of the electricity industry in the state of Himachal Pradesh. Its mandatory functions include determination of tariff for wholesale, bulk, grid, or retail electricity; transmission tariff; gradual phasing-out of cross-subsidy; and promoting competition, efficiency, and economy in the activities of the electricity industry.

8.2. Identification of reform steps

Here the term "reform" should be understood in its wider meaning to include institutional changes (that is, setting-up of an independent regulatory commission) aimed at improving the sector's performance. This reform option is analysed in the context of the role of the regulatory commission in improving electricity access for the poor.

8.3. Definition of poor and policy context

Himachal Pradesh has a population of 6,077,248, with a decadal growth rate of 17.53 %. Of these, 5,482,367 reside in the rural areas and 594,881 are urban-dwellers. The urban population in the state increased from 8.69 % in the year 1991 to 9.79 % in 2001. Himachal Pradesh is the state with the lowest proportion of urban population in India (Table 13). Even with the highest proportion of rural population, only 7.63 % of the population is below the poverty line in Himachal Pradesh [Census of India, 2001], for whom a single-light connection scheme was started in 1973. Under this scheme, the REC and the Welfare Department provide the capital cost of installation. However, there is no separate tariff or consumption slab for these consumers. For the purpose of analysis, consumers falling in the lowest band of consumption and tariff are considered poor.

The lowest slab of consumers in Himachal Pradesh consists of those consuming less than 45 kWh per month and 77 % of the electrified households fall under this category. However, all consumers falling in this category need not be income-poor. The commission came up with the approach of targeting subsidy to the poorest of the poor, as defined later.

8.4. Assessment of the impact of the reform option on the poor by various indicators

8.4.1. Electrification levels

Till 2000–01, the state electricity board did not maintain any data on the number of consumers in various consumption categories. Because of this constraint it is not possible to estimate the number of poor and non-poor households electrified in Himachal Pradesh (as defined in Section 8.3). However, with the setting-up of the independent regulatory commission in 2001, the board has started maintaining category-wise data on consumers and sales

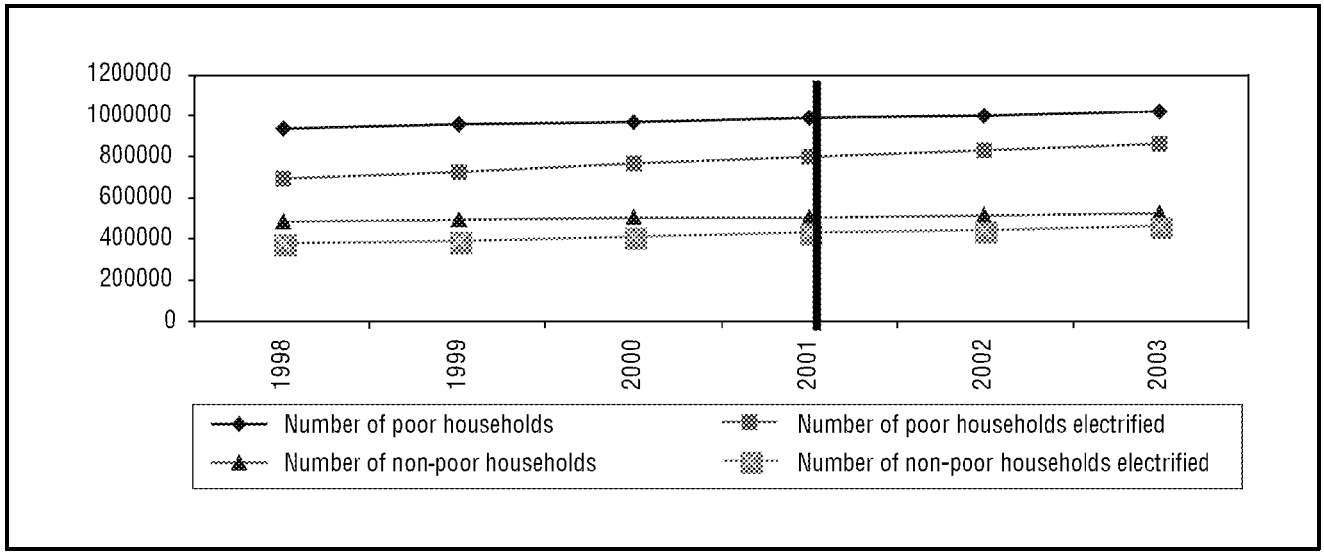

Figure 8. Electrification levels in Himachal Pradesh
Source: Authors' compilation (from HPSEB data)

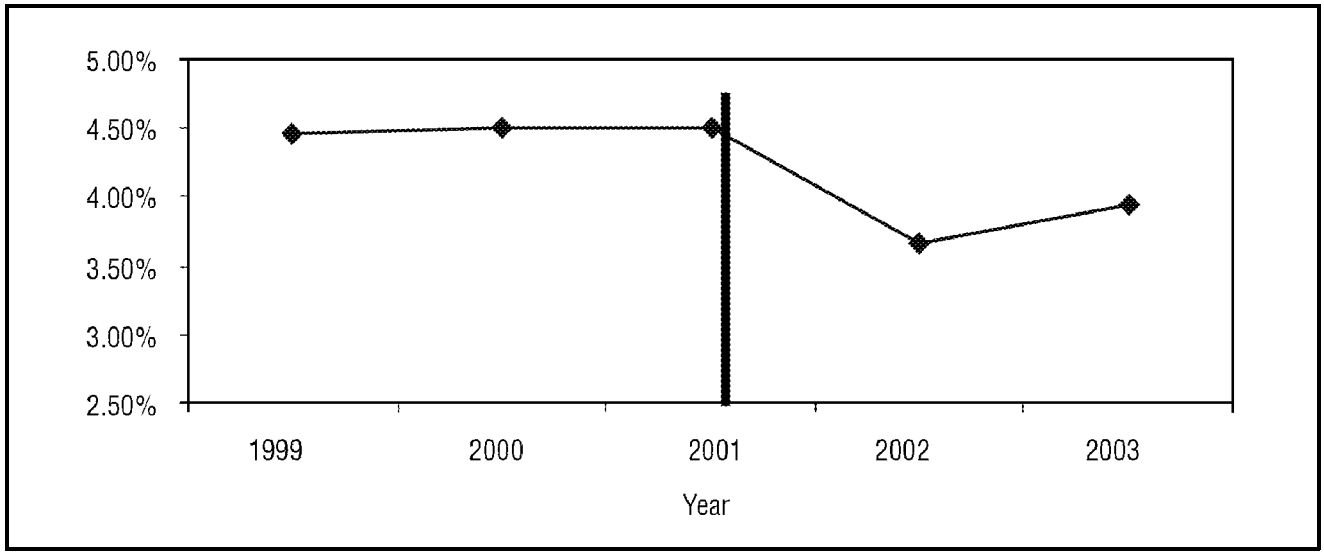

Figure 9. Overall electrification rates in Himachal Pradesh
Source: Authors' compilation (from HPSEB data)

for the year 2001-02. In the absence of pre-reform data, it has been assumed that the proportions of poor and non-poor consumers has not changed from the pre-reform to the post-reform period.

Using this assumption, it is observed that the electrification levels for the poor have increased from 74.32 % in 1997-98 to 84.27 % in 2002-03, whereas electrification levels for the non-poor have increased from 77.58 % in the year 1997-98 to 87.97 % in 2002-03. (See Figure 8 for absolute numbers of electrified poor and non-poor households.) Thus, the setting-up of the independent regulatory commission in 2000 has not had a negative impact on electrification levels. However, the percentage of increase in the electrification levels has gone down after the reform process. Overall electrification levels increased with a CAGR of 6.81 % during the pre-reform era and by merely 3.8 % in the post-reform era.

8.4.2. Electrification rates

Data on the number of consumers falling under the lowest category of consumption is not maintained by the utility, making it difficult to estimate the electrification rate. Nevertheless, if we analyse the overall electrification rate over the years, it is observed that it has gone down from 4.5 % in 1999 to 3.6 % in 2002 (Figure 9).

The commission issued its first tariff order in 2001-02, and it is possible that because of the tighter norms on expenditure this area was neglected.

8.4.3. Electricity consumption

The electricity consumption per household for the non-poor has risen more than for the poor households. Electricity consumption levels for the non-poor have increased by a CAGR of 1.77 % during the reform period (2001-03), whereas in the same period, the consumption levels of the poor have increased by a CAGR of only 0.88 %. In contrast, the electricity consumption for the poor and non-poor was increasing at a CAGR of 8.14 % and 9.07 %, respectively, during the pre-reform period (1998-2000) (Figure 10).

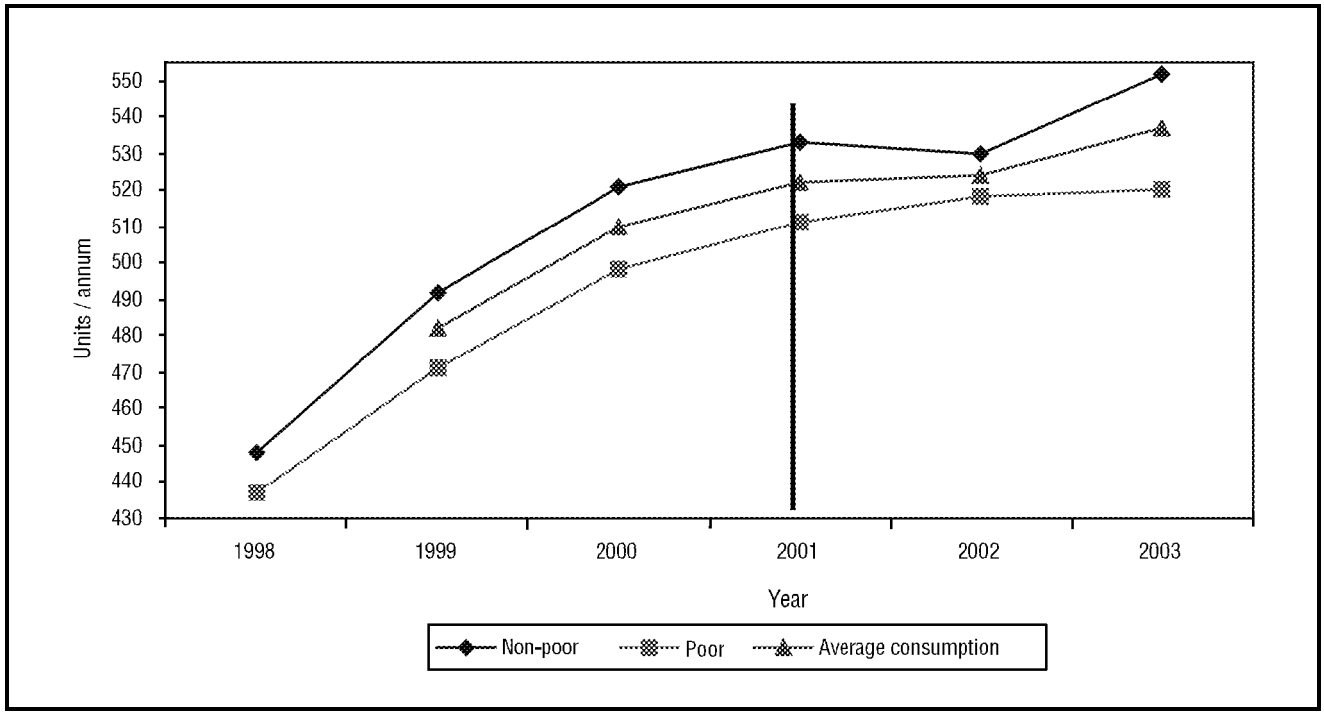

Figure 10. Electricity consumption in Himachal Pradesh

Source: Authors' compilation from Census of India 2001 and tariff orders

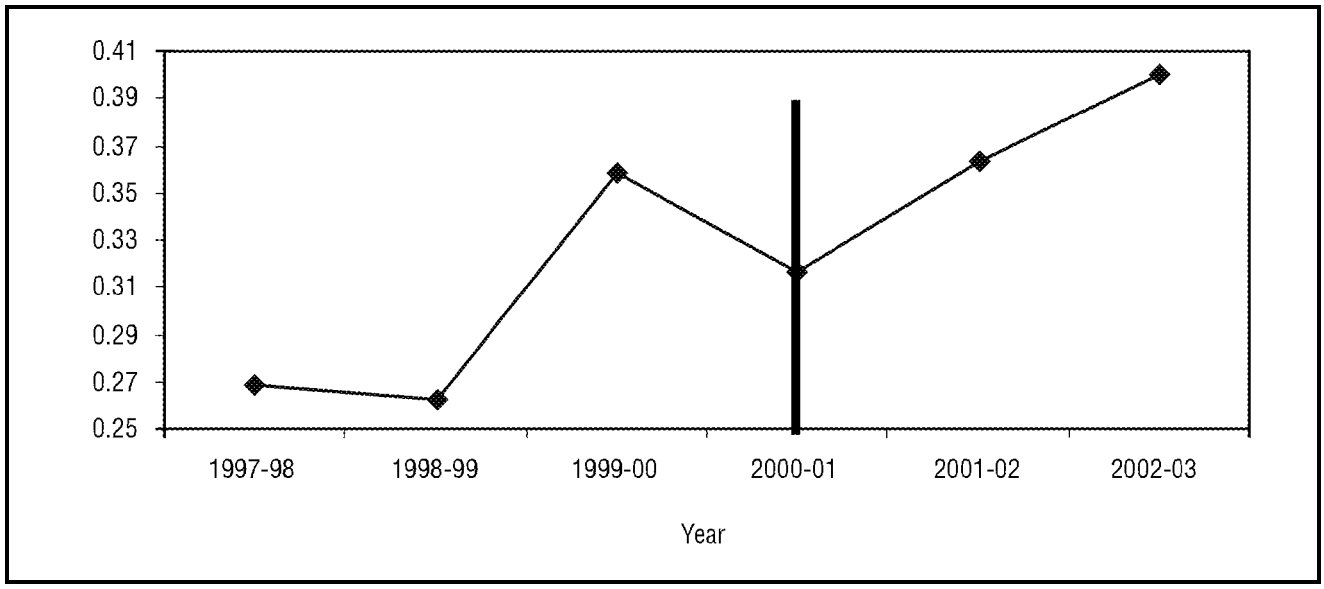

Figure 11. Ratio of tariff for the poor to average tariff

Source: Authors' analysis based on [HPERC, 2001]

8.4.4. Electricity tariff

Electricity tariffs determine the affordability of electricity for various income groups. As discussed earlier, the lowest band of consumers paying the lowest tariffs has been considered poor for this case-study. However, currently 77 % of the domestic consumers fall under this category and therefore it becomes difficult to offer preferential tariff to such a large segment. Therefore, in its first tariff order the commission introduced a separate lifeline slab for families identified under the AAY (Antyodaya Anna Yojna) scheme of the Government of Himachal Pradesh within the domestic category. The benefit of the concessional tariff would be available to those families consuming up to a maximum of 45 units per month. If this limit is exceeded, the normal domestic tariff would apply to the entire consumption. However, following directions of the state government the new tariff slab was withdrawn and the old slab reintroduced. According to the reform mandate, the commission has increased the tariff for the poor as compared to the average tariff to reduce the cross-subsidy. This is evident from the increase in ratio of tariff for the poor to the average tariff (Figure 11).

8.4.5. Subsidy and cross-subsidy

The commission in its tariff order recognised that the burden of high tariffs for industrial consumers has led to shutting-down of industries and has impeded the economic

development of the state. Hence, the commission intended to reduce the cross-subsidy in the tariff for different consumer categories. This can be concluded from the decline in the CI after the revision in tariff (Table 14).

However, the tariff revision for residential consumers (other than the consumers under AAY) was withdrawn at the instance of the state government, as the government was reluctant to scrap the lifeline rates for consumers other than Antyodaya families. The government also assured the utility that it would provide subsidy support to cover the revenue gap due to this tariff roll-back. However, no support was provided till the end of the financial year. The net impact of this roll-back on HPSEB's finances was around US$ 1.07 million. This amount could have been utilized for providing an additional 28,831 connections to the poor households.

8.5. Conclusion

Post-reforms, the overall electrification levels and the electrification rates in Himachal Pradesh have gone down. Electricity consumption by the non-poor has increased more than that by the poor while the electricity tariff for the poor has increased more than that for the non-poor. However, it would be inappropriate to deduce that the consumers consuming less than 45 units per month are income-poor and cannot afford to pay the cost of supply. As of now, neither the commission nor the utility has conducted any study on the affordability of electricity for these consumers or their willingness to pay. Identification of the poor and a government policy on targeting of subsidy would be useful. Linking lifeline rates with the income-poor was an innovative concept that helped in targeting subsidy to the poorest of the poor. However, because of the government's apprehension over the scrapping of lifeline rates for non-Antyodaya consumers, the scheme was withdrawn.

9. Summary and conclusion of Indian case-study

In India, the reform process was carried out without any specific legislative provisions for enhancing electricity access for the poor. Neither the central Act (ERC Act, 1998) nor the individual state reform acts/policies explicitly mentioned the universal service obligation for electricity.

It is evident from the Orissa case that electricity access for the poor has declined after the privatisation of electricity distribution. The policy did not provide incentives to the private utilities to supply electricity to the poor and at the same time no government support was provided to enhance access to electricity.

In the case of Karnataka, the regulatory commission is pursuing the mandate of aligning the tariff with the cost of supply. The budgetary support from the state government has increased in the post-reform era. The Government of Karnataka is planning to privatise electricity distribution. Some lessons can be learnt from Orissa before going ahead with privatisation.

In Himachal Pradesh, the lowest tariff slab is set at too low a consumption cap to meaningfully distinguish between the poor and the non-poor. This case also shows that the movement towards an independent regulatory tariff-setting process is shaky. This is evident from the roll-back in the tariff increase announced by the commission without timely subsidy to the utility.

Table 14. Convergence index for Himachal Pradesh

Description	
CI at existing tariff	0.08672
CI at revised tariff	0.08515

Source: Authors' compilation (2002)

10. Assessment of selected reform option: the Philippine case-study

10.1. Description of the reform process

In 1936, the NPC (National Power Corporation) was created in the Philippines to develop the country's hydroelectric resources. NPC has also been responsible for transmitting electricity to distributors and large industrial consumers via high-voltage wires, and for constructing the transmission grid highway interconnecting the main islands nationwide. Distribution of electricity to end-users has been carried out by investor-owned electric utilities, notably the Manila Electric Company (Meralco), a few local government-owned utilities, and numerous electric co-operatives that sell to households as well as commercial and industrial enterprises located within their franchise areas. The DoE (Department of Energy) is entrusted with the responsibility of setting policy directions for the energy industry, while the NEA (National Electrification Administration) is responsible for providing financial and technical assistance to electric co-operatives.

The Philippines sustained severe power outages and brown-outs during 1992–93, compelling the government to look again at the reform of the power sector. In response, BOO (build-own-operate) or BOT (build-own-transfer) contracts were signed between NPC and independent power producers (IPPs) to enable quick expansion of power generation capacity and improve the quality of electricity supply. However, in 1997, a number of problems emerged with IPP contracts. The electricity prices NPC agreed to pay under the power purchase agreements (PPAs) were nearly twice the cost of power from NPC plants. This led to a huge financial crisis for NPC, which was unable to meet its liability.

Subsequently, two major reforms were envisaged in the late 1990s – the restructuring of the electricity supply industry and the privatisation of the NPC. These two reform processes aimed at encouraging greater competition and attracting more private sector investments in the power industry. It was conceived that a more competitive power industry would in turn result in lower power rates and more efficient delivery of electricity supply to end-users.

The Electric Industry Reform Act (EIRA), passed in 2001, mandates restructuring of the electric power industry and privatisation of the state-owned NPC. The legislation also aimed to prevent the creation of a private monopoly by capping the maximum market share for any one generator. It also opened a wholesale spot market for

generators. EIRA also aimed to lower the electricity rates (among the highest in the region) and increase the generation capacity to avoid an electricity shortage projected for 2005. This Act enabled the creation of an independent regulator in 2001. (See Table 16 for a chronology of power sector reforms in the Philippines.)

10.2. Rural electrification co-operatives

The Government of the Philippines passed EIRA (The Republic Act 9136) in June 2001 [ESMAP, 2002]. The new legislation laid the foundation for the privatization of the Rural Electricification Corporation (REC) and setting-up of an independent regulatory commission which would ensure rural electrification, lifeline rates for marginalized consumers, and levy of universal charge for rural electrification programmes. The Government of the Philippines has aimed at total electrification of all villages by the year 2006. It has embarked on an ambitious electrification plan, which aims to utilize new and renewable energy to bring electricity to remote and relatively inaccessible *barangays* (villages). Dubbed "O-I Law Programme", the programme consolidates the regular programmes undertaken by NEA/electric co-operatives, NPC SPUG (Small Power Utilities Group), and DoE and other agencies of the government and seeks to maximize participation of the private sector in rural electrification projects. The O-I Law Programme has set specific targets for rural electrification till the year 2006 (Table 15). Options that are being considered are installation of stand-alone photovoltaic systems for lighting and battery-charging stations, micro-hydro systems and wind generators. Extension of electricity grid lines is also being considered according to feasibility.

10.3. Reform mandate

10.3.1.Cost of supply and cross-subsidy

The Act mandates that the rate structure reflect the true cost of serving each consumer class. Thus, rates determined are to be free from all inter-grid and intra-grid subsidies. The Act also provides for lifeline rates for low-income end-users to balance the social impact of the rates on the marginalized sections of the society. The Act exempts this class of consumers from the cross-subsidy phase-out for at least the next 10 years, extendable by law. The legislation also stipulates creation of a universal fund by levying on other consumers a universal charge that will be used for subsidizing the lifeline rates and the extension of electricity services to remote and unelectrified areas.

10.3.2. Efficiency improvement and government's role

Under the Act, the utilities are required to establish separate retail rates for each category of service. This requires the unbundling or separation of all elements of the revenue requirement calculation so that transparent retail rates can be determined for each category of service. According to the ERC (Energy Regulatory Commission), this would be the first step towards efficient and transparent pricing. This clause has helped to reduce the rates by 0.59 US¢/kWh for residential consumers. The system losses of the utilities are to be maintained and capped as prescribed in the earlier Act.

Table 15. Performance and implementation schedule for O-I Law Programme during 1999–2006

Year	Barangay electrification level (%)
1999 (actual)	76.9
2000 (actual)	80.1
2001 (actual)	83.1
2002 (targeted)	87.0
2003 (targeted)	91.0
2004 (targeted)	95.0
2005 (targeted)	97.6
2006 (targeted)	100.0

Source: Department of Energy, the Philippines

Table 16. Chronology of events in the Philippines power sector reforms

1900s	Integrated electric utilities
1936	NPC (National Power Corporation) created
1970	Electric co-operatives created
	NPC develops nationwide grid
	Generation nationalized to NPC
1980s	National Electricity Administration created to control rural co-operatives
	Massive blackouts in late 1980s
1990s	BOT (build-operate-transfer) law passed
	Luzan and Visayas created
	IPPs negotiated
2001	Power Reform Act passed
	• Creation of National Transmission Company
	• Creation of Power Sector Asset and Liabilities Management Corporation
	• Creation of WESM (wholesale electricity spot market)
	• Privatisation of the NPC
	• Open access subject to preconditions
	• Creation of a new energy regulatory commission
	• Competitive generation through creation of several generating companies
February 2002	• Regulated transmission and distribution: unbundling of electricity rates for transparency
June 2002	• Competitive retail electricity providers through opening-up of high-voltage transmission for easy access of distributors and large consumers
	• End-users: open access of distribution lines for competitive consumers
	• Promulgation of WESM rules

Source: Authors' compilation

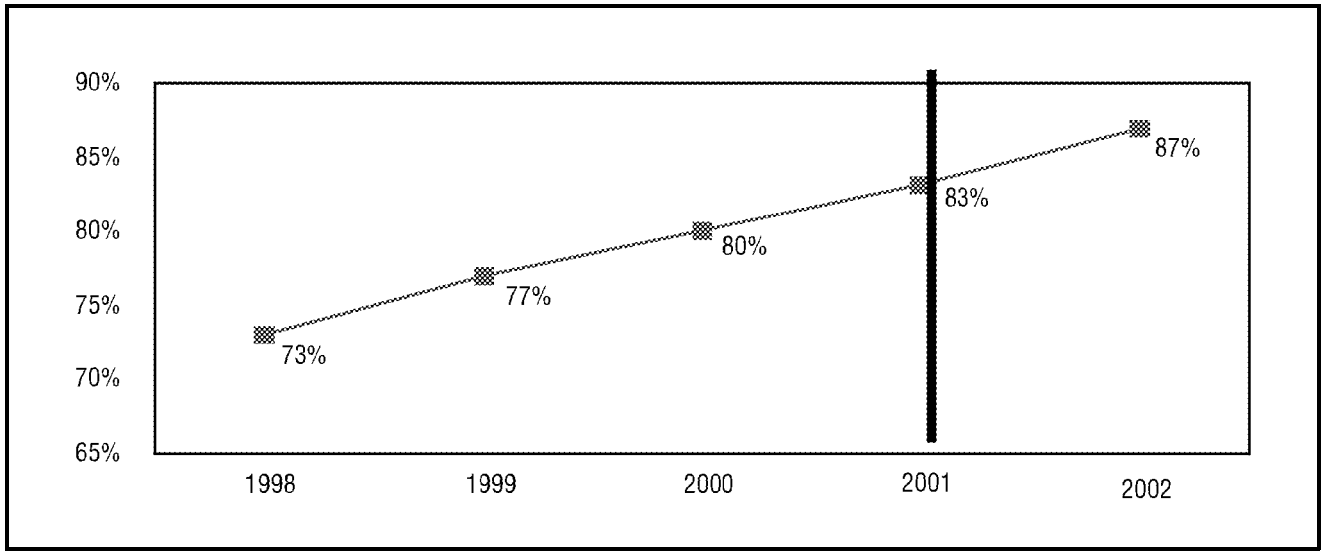

Figure 12. Overall Electrification levels in the barangays

Source: [MREP, 2002] and authors' compilation from information received from ERC

The reform Act also mandates expansion and upgradation of electrification in the Philippines. For this, the Act empowers NPC to own and control corporations to perform the missionary electrification function through SPUG (Small Power Utilities Group) and to be responsible for providing power generation and its associated power delivery systems in areas that are not connected to the transmission system. The missionary electrification function shall be funded from the revenues from sales in missionary areas and from the universal charge as determined by the ERC. The provision of electric service in remote and unviable villages that the franchised utility is unable to service for any reason shall be opened to qualified third parties. For improving the financial viability of REC, all outstanding financial obligations of electric cooperatives to NEA and other government agencies incurred for the purpose of financing the rural electrification programme shall be assumed by the government-owned PSALM (Power Sector Assets and Liabilities Management Corp).

10.4. Assessment of the impact of the reform option on the poor using various indicators

10.4.1. Definition of the poor and policy context

In this study, the marginalized end-users have been considered the poor consumers. These consumers are the low-income, captive, household electricity consumers, who cannot afford to pay at full cost and have levels of electricity consumption below a threshold level. This threshold consumption level might differ area-wise according to the socio-economic scenario of the region. The ERC has the mandate to determine the threshold level of consumption.

The Act provides for a socialized pricing mechanism for these marginalized end-users called a lifeline rate, which is to be set by the ERC. A lifeline tariff enables the poor who use minimal amounts of electricity to pay a lower price than better-off households using higher levels of electricity. It is the responsibility of the ERC to monitor the compliance to specific guidelines and the implementation of the lifeline rate.

10.4.2. Electrification levels and rates

In the absence of sufficient data on the marginalized consumers and other residential consumers, the electrification level of barangays has been considered a proxy to assess the impact of reforms on the poor. The barangay electrification level in the Philippines has gone up from 18 % in the early 1970s to 73 % in 1998. In the post-reform era, this figure has grown substantially to 87 % (November 2002). This illustrates the positive impact of the Accelerated Rural Electrification Programme undertaken by the Government of the Philippines (Figure 12).

Reforms have had a positive impact on electrification rates of barangays. The electrification rates, which were gradually declining in the pre-reform period have, increased post-reforms (Figure 13).

Since its inception in 1999, the O-I Law Programme has been able to energize barangays at the rate of 1,000 per year. This is double the average rate of 500 barangays/year accomplished before the creation of the O-I Law Programme. Apart from this, the private sector showed interest in taking part in the programme through the establishment of the FREED (Foundation for Rural Electrification for Economic Development).

10.4.3. Per capita consumption

For assessing the electricity consumption in the pre-reform period the results of a survey carried out in six barangays in the area covered by the Philippines' largest distribution company Manila Power Corporation (Meralco) have been used. The survey results pointed out that the average electricity consumption was 891.6 kWh/annum (or about 75 kWh/month) in 2000. During the post-reform era, the per capita consumption of the poor has been determined by the ERC and it differs across areas, according to the economic scenario of each region. For instance, for two provinces, ZAMSURECO II and SORECO I, the commission set the maximum lifeline consumption level at 18 kWh/month. On the other hand, the maximum lifeline consumption level set by the commission for two

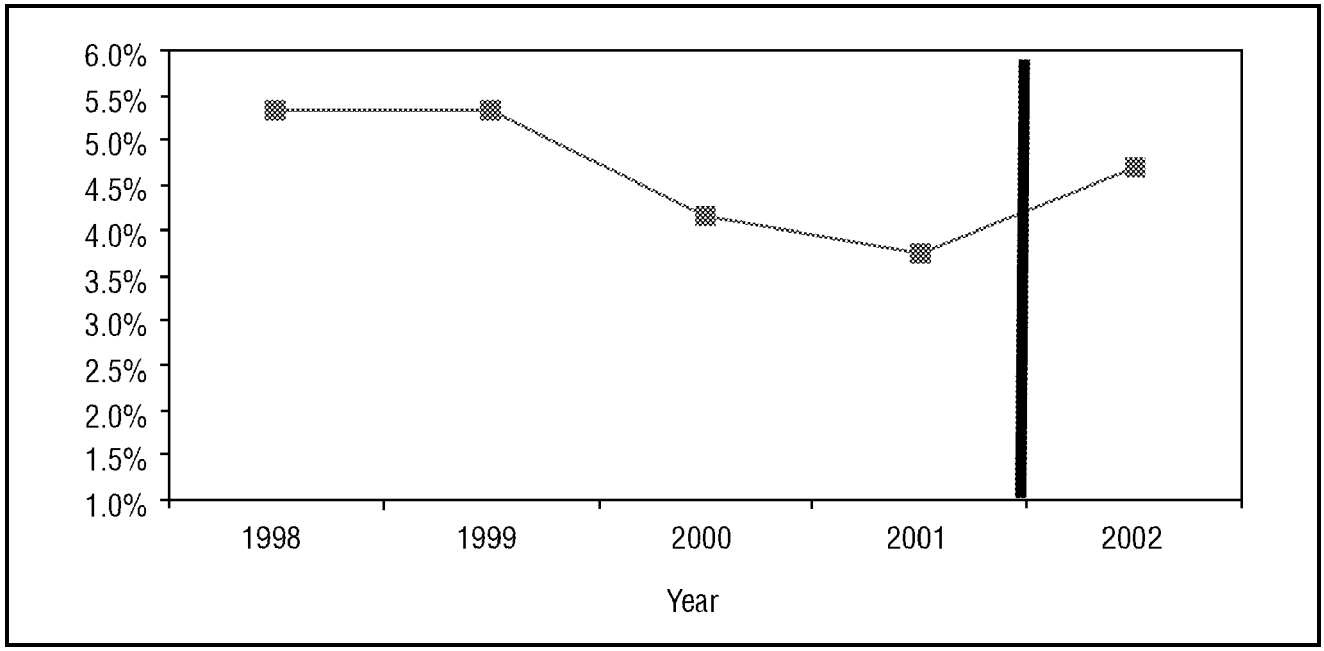

Figure 13. Overall electrification rates in barangays

Source: [MREP, 2002] and authors' compilation from information received from ERC

Table 17. Consumption and discounts offered to marginalized consumers

	ZAMSURECO II	SORECO I	PELCO I	PANELCO I
15 kWh and below	20 %	25 %	50 %	30 %
16 kWh	15 %	20 %	40 %	25 %
17 kWh	10 %	10 %	30 %	20 %
18 kWh	5 %	5 %	20 %	15 %
19 kWh			10 %	10 %
20 kWh			5 %	5 %

Source: [MREP, 2002] and authors' compilation from information received from ERC

other provinces, PELCO I and PANELCO I, was at 20 kWh/month. Similarly, in the case of the private distribution utility (VECO), the commission fixed the reasonable threshold level of consumption at 50 kWh per month. Further, tariff analysis carried out by the commission for various provinces shows different consumption levels for the poor and the non-poor residential consumers. On an average, the consumption by the marginalized consumers is about 20 kWh per month or 236 kWh per year, whereas for the non-marginalized consumers the consumption is 205 kWh per month. So there is a substantial variation in the consumption levels for the poor and the non-poor consumers. Comparing the pre- and post-reform average consumption per household in the Meralco area, it is observed that the average consumption level has increased substantially during the post-reform era.

10.4.4. Electricity tariff

In determining the lifeline consumption level for the marginalized end-users in the electric co-operatives area, the commission calculates the probable load requirements of a typical low-income consumer by considering two lighting facilities at 20 W each and a 50 W radio that are being used for a reasonable number of hours. As the number of hours of electricity supplied varies across areas, accordingly, the marginalized consumption level also varies in these areas. After determining the consumption, the commission conducts simulation models to find out the average paying capacity of the consumer in an area. Accordingly, different discount levels are determined for the marginalized consumers. These discounts vary across the areas and between the consumption levels (Table 17).

In the case of the private distribution utility (VECO), the commission found its proposal for the threshold level of 56 kWh per month to be reasonable (Table 18).

For the above utilities, the data on tariffs in the pre- and post-reform period is currently not compiled. However, some estimates for the Philippines' largest distribution company, Manila Power Company (Meralco), are available and could be used as a proxy. The average rate for the Meralco area has increased from 10.73 US¢ per kWh in December 2001 to 12.12 US¢ per kWh in June 2003 (Table 19).

The commission in the tariff order [ERC, 2003] mentioned that the marginalized consumers with a minimal consumption of less than 50 kWh per month are projected to receive a hefty discount of almost 100 pesos (US$ 1.95)

a month because of the lifeline rate policy. Further, in March and May 2003, the ERC (Energy Regulatory Commission) issued provisional authorities to 17 rural electric co-operatives directing them to reduce the rates being charged to all consumer classes. Therefore, we can conclude that during the post-reform era the electricity tariffs for the poor have gone down.

11. Summary and recommendations

The Indian economy has undergone a structural change over the past decade with a liberalized policy for many sectors. Liberalization first opened up power generation for private sector participation. However, it was later realized that the private power policy for generation projects would not succeed unless preceded by extensive reforms in the distribution business. Thereafter, a new legislation was formulated which paved the way for the setting-up of independent regulatory bodies in the power sector. Many states also restructured and unbundled the sector through appropriate legislation. Unfortunately, electricity sector reforms in India have invariably neglected the poor. The focus of reform legislation has been more on improving the financial viability of the ailing power sector than on improving access to electricity. The legislation does not explicitly spell out any provisions for the extension of electricity services to the poor and the need and mechanism for subsidizing marginalized consumers. Until recently, the Indian reform legislation did not even contemplate rural electrification. This lacuna in the Indian reform model needs to be addressed through appropriate policy and legislative changes to meet the electricity needs of the large poor population of the country.

It is also important to note that electricity being a concurrent subject in India, both the centre and the states can formulate policy. This often makes the task of implementing reforms much more complex in India than in the Philippines, where the central government has complete jurisdiction over organization and reform of the power sector. Nevertheless, there are valuable lessons to be learnt from the Philippine reform legislation in terms of addressing electricity needs of the poor.

In contrast to the Indian reform legislation, the Philippine legislation has provision for lifeline rates for the poor and the treatment of cross-subsidy, subsidy and expansion of the network. The Act stipulates a definite time-frame for the elimination of cross-subsidy and at the same time it ensures subsidized rates for the identified poor.

The Philippine Act mandates expansion of electricity services to the rural areas and compulsory levy of universal charge for meeting the subsidy requirement for the electrification of the poor. The Philippine government has also embarked on an electrification plan, which aims to utilize new and renewable energy sources to bring electricity to remote and relatively inaccessible barangays.

Indian policy-makers can draw useful lessons from the Philippines' experience to enhance electricity access in the country. There is need to have a legislative commitment to address the issues of access to reliable and affordable sources of electricity. Innovative mechanisms such as the provision of lifeline rates and special functions such as missionary electrification to meet the electricity needs of the poor need to be developed. ■

Table 18. Consumption levels and discounts for the area served by the private utilities

	VECO I
50 kWh and below	35 %
51 kWh	30 %
52 kWh	25 %
54 kWh	20 %
55 kWh	15 %
56 kWh	10 %

Source: Authors' compilation from information received from ERC

Table 19. Average tariff rate (US¢/kWh) for the Meralco area

ERC order 2001	ERC order 2003	% increase
10.73	12.12	12.88

Source: Authors' compilation from information received from ERC

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Assessment of energy sector reforms: case-studies from Latin America

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This article discusses three main issues. The first is the particular nature of poverty in Latin America and the Caribbean (LAC) related to the growing importance of the urban poor. The second is the difficulty of analyzing the direct impact of energy reforms on the poor because most of the indicators studied could easily measure the impacts of phenomena other than those directly resulting from the reforms. The third is the reforms' indirect impact on poverty, which results from many of them having been carried out through macroeconomic schemes that caused local currencies to appreciate significantly. This monetary change undermined the productive system and increased foreign indebtedness and structural unemployment in these countries, leading to an increase in poverty.

1. Introduction

This article is based on the results from Phase I of the project *Energy Access: Assessment of Energy Reform – Case Studies for Latin America and the Caribbean (LA&C)* [Kozulj et al., 2003a] within the framework of the Global Network on Energy and Sustainable Development (GNESD). The research reported here analyzes the direct and indirect impacts of reforms in the Argentinean, Peruvian, and Salvadoran electricity sectors.

The methodological guidelines agreed upon by the global project [Karekezi, 2003] proposed five indicators of the impact of reforms, and grouped these indicators under two headings: *Access* and *Affordability*. Three indicators were proposed for evaluating access to energy: (1) national electrification levels, (2) national electrification rates, and (3) electricity consumption per capita. Affordability was to be measured by (1) electricity tariffs and (2) household electricity expenditures as a percentage of total household income. The methodological guidelines, which were intended to facilitate the comparability of the varied cases analyzed by the research centers in the different regions, suggested that the indicators be evaluated for both poor and non-poor users.

Our research revealed some limitations to these indicators. Some of the indicators – which are also suggested in current literature [Foster, 2001; Alexander, 2000] – may not accurately measure the impacts intended, especially the indicators under the *Access* heading. The rate of new connections and average household consumption levels may reflect behavior that is a consequence of factors completely unrelated to the success or failure of the reforms. For example, if a system is about to reach saturation in a densely urban area, the rate of new connections will necessarily decrease relative to the past, whether reforms were carried out or not. In addition, a high rate of connections may indicate that users who previously had illegal connections "regularized" their service after the reforms. This is not a sign of increased access. Before the reforms, these users simply had access to the service illegally, without paying. Finally, official data for poor and non-poor users for periods before and after reforms are not available, nor are they recorded by energy distribution companies [Kozulj, 2002]. All of these limitations suggest that these indicators may not accurately reveal the reforms' effects on the access of the poor to electricity service.

The indicators listed under the *Affordability* heading, by contrast, were more effective in our study. The data for these indicators are generally available if we assume that the poor are those whose electricity consumption is low. The results in the three cases analyzed indicate that higher tariffs in absolute and relative terms adversely affected low-consumption users.

One of the dominant ideas of the reform was the removal of subsidies and the design of tariffs following the theory of marginal value. This approach – mainly supported by the World Bank – was based on the deficits borne by the state utilities before the reforms because of general subsidies and cross-subsidies. The deficits led to an inflationary tax that mainly affected the poor, and they also resulted in an inefficient allocation of resources.

Nevertheless, as will be demonstrated below, the confusion between the concept of subsidy itself and the notion that a subsidy is defined by considering domestic prices different from prices at the border had macroeconomic consequences. Energy costs rose higher after reform than they had before. The result was an absolute increase in poverty levels, a rising foreign debt, and a direct negative impact on rates for low-income consumers. Because the incomes earned by the poor did not increase after the reforms, increased electricity charges directly affected family budgets.

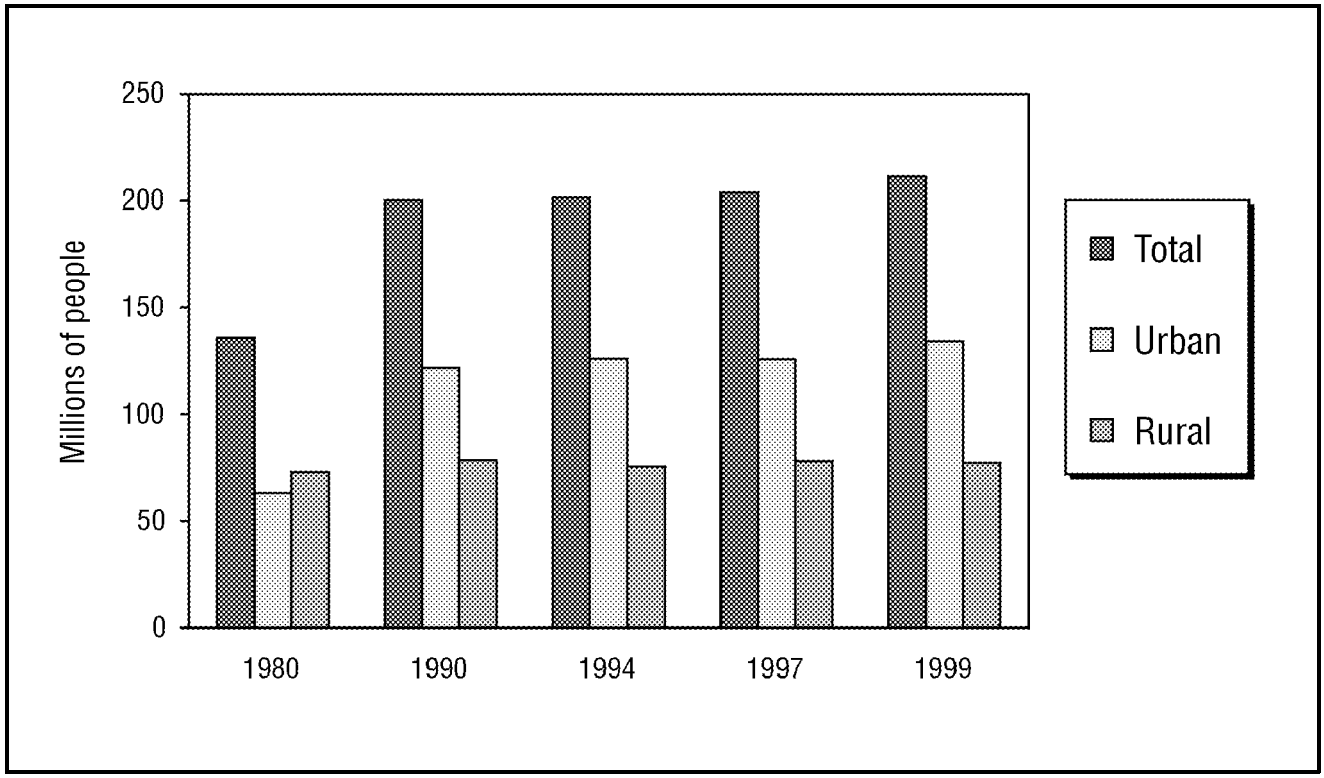

Figure 1. Characteristics of the evolution of poverty in LAC
Source: authors' estimates with ECLAC data; CEPAL, 2001b, Figure 1.3, p. 38

The dominant philosophy during the 1990s in LAC concerning subsidies was to regard any price below international levels as constituting a subsidy. The privatization that took place with the reforms aimed at levelling the prices of domestic services with the relevant international prices. In the case of basic prices that determine energy services (e.g., gas and fuel prices), strategies such as income redistribution of natural resources among producers and consumers have been mistaken for subsidies. Production costs, which are the only valid criterion for determining whether there is a real subsidy or not (a subsidy occurs when a product or service is priced below its true production cost), have been completely overlooked [UNEP, 2003]. Because the cost and price structures of domestic economies were sometimes distorted, the levelling of domestic and foreign prices was implemented by overvaluing the local currency, which led to increased poverty, unemployment, and foreign debt levels. It is almost impossible not to relate these macroeconomic mechanisms to the financial success of the reforms and accompanying privatization of energy companies, especially in Argentina. The indirect impact turns out to be more important than the effects measured by the indicators defined by the global project for this study; this article addresses this indirect impact in detail.

Our study also notes the particular evolution of urban poverty as a characteristic feature of Latin America. This phenomenon poses a challenge to energy policies that include the goal of energy access for the poor. Although our research addresses the electricity sector in particular, many of its conclusions could apply to the other commercial energy sources consumed by the poor.

2. The importance of energy access and the unique features of poverty in Latin America and the Caribbean

Access to clean and efficient energy sources by the poor has been defined as one of the highest political priorities in various world forums and analyses [RISO-UNEP, 2002; WEC, 2000; Kozulj et al., 2001; Wodon et al., 2000]. The goal is that approximately 2 billion inhabitants of developing countries should be able to access energy sources in a context where around 2.8 billion people live on less than $ 2 a day [Karekezi, 2003; RISO-UNEP, 2002]. It is hoped that this access can be created under desirable economic and environmental conditions that can be maintained over the long term.

Many poor people find it difficult to access energy sources, and even when they do, they have difficulty maintaining continuous and regular energy service supply because they lack adequate income and/or stable and well-paid employment. Appropriate subsidy and promotion policies are also lacking.

2.1. The evolution of poverty in LAC

The total number of people living below the poverty line in the year 2000 in LAC is estimated at 211.4 million (43.8 % of the total population), of which 89.4 million people (18.5 % of the total population) were destitute [CEPAL, 2001a].

The proportion of poor people in urban areas in LAC in relation to the total population increased significantly during the 1990s compared with the 1980s. The number of poor people in urban areas in 1980 was 14 % lower than the number of poor people in rural areas, but in 1999 the number of urban poor was 74 % higher than the

Table 1. Total population classified according to area of residence and degree of poverty

Country				Population below the poverty line			Population below the indigent line		
	Total population in thousands of inhabitants	Urban	Rural	Country total	Urban	Rural	Country total	Urban	Rural
Argentina	37032	90 %	10 %	27 %	27 %	30 %	7 %	7 %	8 %
El Salvador	6276	55 %	45 %	50 %	38 %	64 %	22 %	13 %	33 %
Perú	25939	72 %	28 %	49 %	38 %	76 %	22 %	12 %	50 %
LAC total	488547	76 %	24 %	42 %	37 %	59 %	17 %	12 %	34 %

Source: Author's estimations with ECLAC data, LAC Statistical Yearbook 2001, Figure 123, and *Panorama Social de América Latina 2001-2002,* Figure 14, Annex 2002PDF

number of rural poor [CEPAL, 2001a]. In 1980 the urban poor accounted for 46 % of the total poor population in the region; in 1999 that proportion was 63.5 % (Figure 1).

Paradoxically, the investigation of energy and poverty in LAC has typically focused on the energy problems of the rural poor rather than the problem of access to energy services for the urban poor. This has been partly because, at least in the case of electricity, non-technical losses or energy theft was overlooked when service was provided by state-run companies. This issue has only recently been addressed overtly.

The energy problems of the urban poor have also been given scant attention because of the complexity of urban poverty. Lacking an adequate and stable income, the urban poor may suffer a greater shortage of goods than the rural poor, and/or this shortage may be different from that faced in rural areas because the urban poor face different consumption standards (i.e., those established during the modernization process) [Kozulj, 2001; Kozulj et al., 2003b].

The radical energy sector reforms implemented in some LAC countries, which have constituted a substantial part of structural macroeconomic reforms, have had direct and indirect effects on the poor and on poverty levels. Care needs to be taken not to reduce analysis of the consequences of these reforms to only a few direct indicators whose links to explanatory variables may be weak, doubtful, and difficult to prove rigorously.

2.2. Poverty in the three case-studies

Table 1 shows poverty data for the three cases analyzed: Argentina, Peru, and El Salvador.

An analysis of these data reveals different degrees of urbanization and poverty. These differences, together with the differing nature of the reforms and the varied geographic regions involved, mean that the three cases differ, in keeping with the diversity of the region.

3. Description of electricity sector reforms

The electricity sector reforms in the three cases, though not identical, are not very different. The general reform model applied in all three countries consisted of the vertical unbundling of the electricity industry, the total or partial privatization of energy companies, the introduction of competition in generation, and the creation of regulatory bodies for the industry segments constituting natural monopolies, such as distribution [Kozulj et al., 2003a]. The general guidelines for the electricity sector reforms were consistent in the following features: (1) de-monopolizing the electricity sector, which was run by public entities before the reforms; (2) unbundling generation, transmission, and distribution activities, with several degrees of limitation imposed on the vertical integration of the system; (3) creating competition at the generation level and creating spot markets; (4) creating relatively independent regulatory bodies or tariff regulatory commissions; (5) privatization; (6) modifying the criteria for cost allocation among users and increasing the average tariff level; (7) totally or partially removing subsidies and banning cross-subsidies among categories of users.

In some cases, especially Peru and Argentina, macroeconomic reforms focused strongly on privatization of most public services, especially in the energy sector. Monetary appreciation schemes were used to reduce the foreign debt-GDP ratio and increase the dollar profitability of privatized services. Because capital goods were granted to new private companies at a cost much lower than the replacement value of the assets (quoted in US dollars), the higher income in terms of foreign currency (as a result of the overvaluation of the domestic currency) yielded an extraordinary profit to the companies acquiring the assets. The process also involved capitalization of foreign and domestic debt bonds that were practically in default. Tariffs were set for distribution and transmission costs based on the replacement value of the grids and for generation costs based on capital costs and fuel prices that were close to international levels.

In the case of Argentina, the regulatory framework did not address the obligation to invest in electricity system infrastructure. In other words, the rules of the game were set in such a way that energy companies could act as financial companies instead of being committed to the energy sector for the long term. In Peru, many of the investments remained in the hands of the state.

Although the deadlines and depth of the reforms in the three countries varied, mostly in response to the existing governments and institutions, the underlying philosophy was the same in all cases, and World Bank guidelines were followed.

3.1. The Argentine case

When reforms took place, mainly in 1992 and 1993, the Argentinean electricity sector was made up of public companies with almost exclusive federal or provincial jurisdiction. Global socio-economic phenomena throughout the 1980s seriously undermined public companies, especially

Table 2. Numbers of participants in the Wholesale Electricity Market (MEM) in Argentina[1]

Actors	1993	1994	1995	1996	1997	1998	1999	2000	2001
Generators	22	27	33	38	40	40	40	39	39
Self-generators	2	5	9	9	11	12	12	13	11
Co-generators	-	-	-	-	2	3	3	3	3
Commercialization agents	-	-	-	-	-	1	2	3	4
Distribution agents	21	21	23	25	28	28	47	54	58
Major large users	9	69	189	246	331	373	390	379	364
Minor large users	-	-	207	458	793	1497	1541	1430	1828
Private large users	-	-	-	-	-	-	26	58	51

Source: CAMMESA, Annual Report 2001

Note

1. As of December 31 of each year

federal ones. Delayed increases in electricity charges because of anti-inflationary policies and unfair contracts with the private sector caused a rapid rise in indebtedness and created a severe financial imbalance, which had to be covered by national treasuries. This, in turn, increased inflationary pressures that became difficult to curb [Kozulj, 2002].

Toward the end of the 1980s, the Argentinean electricity system was virtually insolvent, and simultaneously overcome by service shortages caused by drought, technical problems in a nuclear power plant, and serious deterioration of the thermal energy supply because of poor maintenance. Although these problems were real, the magnitude of the crisis was overstated to ensure that the reforms would be readily accepted.

The main reforms included the vertical unbundling and horizontal separation of the system (especially of activities associated with generation and distribution), the transfer of emerging companies to the private sector, and the establishment of the principle of free access of third parties to transmission and distribution networks. Legally independent productive units were created out of the large power plants that belonged to the former national companies, and these units were then privatized separately.

Although the legislation then in force aimed at the vertical unbundling of the companies and the clear separation of the electricity market into the different participant categories – generators, transmission agents, commercialization agents, distribution agents, and large users – in practice it meant a process of vertical reintegration into dominant commercial corporations. This integration was strengthened among the different energy chains, especially those connected with oil and gas and electricity generators, which participate in transmission and distribution.

Table 2 shows the evolution of the participants in each activity in the electricity chain, and Table 3 shows the evolution of installed capacity in Argentina. These tables make clear that reforms in the electricity sector, together with those in the rest of the energy sector, brought about strong private investment in generation.

This private investment and the reduction of generation costs to competitive international levels were two of the key outcomes of electricity reform in Argentina. However, low-consumption, captive users did not benefit. Other users sharply increased their consumption because of the relative price policy, which meant that prices were low in the domestic market but high in terms of dollars as a consequence of the overvalued *peso.* This increase in consumption can mainly be attributed to excessive growth in demand, facilitated by mass imports of inexpensive household electrical equipment. In this context, companies maximized the net present value of their investments because it was clear that the currency overvaluation was unsustainable in the long run, as became evident after the successive recession crises starting in 1999 and finally in the financial crisis of 2001, ending with the devaluation in 2002.

Table 3. Installed capacity (MW) in public service electric power plants before and after reforms in Argentina

Plant owner	1991	2001
Agua y Energía	4,703	
HIDRONOR	2,660	
SEGBA	2,601	
CNEA	985	985
Binational ownership	1,220	2,655
Provincial bodies	2,366	1,851
Others	162	
Private actors		17,340
Total	14,696	22,831

Source: IDEE on the basis of CAMMESA data

3.2. The Peruvian case

Economic growth in Peru had been healthy until 1987, with an average GDP growth rate of 3.8 % per year between 1970 and 1980 and 3.1 % per year between 1970 and 1987. However, the collapse of the industrialization process caused by the stagnation of the import substitution and urbanization process left the country unable to cope with growing foreign debt, a decrease in the prices of exports, and the negative effects of the El Niño phenomenon, which is important for Peruvian agriculture and fishing.

Table 4. Changes in generation capacity and ownership in Peru (in MW)

	1995	2001
ELECTROPERÚ	3,186	1,027
State-run corporations		632
Private agents		3,044
TOTAL	3,186	4,703

Source: based on data from [MEM, 2001]

At the beginning of the 1990s, Peru went through a serious crisis. The country's decision not to repay its foreign debt and its handling of financial policy created an inflationary spiral that reduced average real incomes. Between 1985 and 1990, per capita GDP fell by around 18 %. The purchasing power of the minimum legal salary was reduced by 50 %, and social expenditure per inhabitant was also considerably reduced during this time.

The traditional political parties were accused of leading the country into a serious political, economic, and moral crisis [Becerra, 2002]; as a consequence, Alberto Fujimori won the 1990 presidential election and implemented a neo-liberal economic program that was very popular from political, social, and welfare perspectives. As in Argentina, the energy reforms implemented in Peru were strongly influenced by global macroeconomic conditions; there was a return to primary production and a worsening of poverty as the recession deepened.

Between 1993 and 1997, Peru went through a period of high GDP growth. However, since 1997, the country's economy has stagnated, and the high growth rate during the mid-1990s was more a consequence of the deep previous recession than of the success of the macroeconomic reforms. (GDP in 1997 was only 9.6 % higher than GDP in 1987.) The reforms led to strong foreign indebtedness: between 1990 and 1996 public foreign debt rose by 48 %.

Similar to many other Latin American countries, Peru had state-owned companies in sectors that were considered strategic, including energy. During the 1960s and most of the 1970s, the state expropriated oil and electricity service companies from foreign owners. Until 1992, the three segments of the Peruvian electricity system – generation, transmission, and distribution – as well as the commercialization segment were operated by the state-run company ELETROPERÚ.

In the electricity sector, a regulatory model was established by the 1992 Law of Electricity Concessions, based on adaptations of the Chilean and Argentinean models as well as a model adopted by the United Kingdom. The Peruvian model entailed vertical unbundling, separating generation, transmission, distribution, and commercialization activities. Between 1993 and 1998, the main generation and distribution units were privatized.

As a result of privatization, a high degree of horizontal and vertical unbundling was achieved, which was evident in the creation of a large number of companies. When the reform was implemented, the number of companies rose to 40: 16 generators, 20 distributors, and four transmission entities. However, in spite of this increase, there was a high level of market concentration in the generation and distribution segments.

In 1995, installed capacity in public sector electric power plants totalled 3,186 MW. In 2001, this capacity reached 4,703 MW, 36 % of which belonged to the state and the remaining 64 % to the private sector (Table 4).

Privatization of distribution companies started by mid-1994, but the state still retains total control and ownership of transmission systems except for the lines leased under the build, own, operate, and transfer (BOOT) scheme. The state provides electricity to 50 % of the national market.

In contrast to the Argentinean case, the Peruvian reforms did not involve an increase in generation capacity but only a transfer of ownership. Like in the Argentinean case, however, tariffs rose considerably, especially in the household sector, and the reforms also led to an increase in the number of participants in the system.

3.3. The Salvadoran case

In the Salvadoran case, the reforms were of a slightly different nature from the Argentinean and Peruvian cases. The process in El Salvador encompassed previous reforms aimed at increasing electrification levels and a recent removal of subsidies.

Until 1997, the electricity system was operated by a monopolistic scheme. CEL was an autonomous, vertically-integrated national service company, controlling all phases of energy supply, from production to distribution. The Ministry of the Economy determined end-user tariffs by means of decrees. CEL was in charge of awarding rights for exploitation of natural resources and owned the transmission and distribution grids. The operation and dispatch of electric power was centralized and carried out by the CEL Operations Center, which also operated hydroelectric power plants in a centralized manner. Distribution companies could freely acquire all the energy they needed to cater for the demands of their end-users at the price determined by established tariffs.

When the General Law of Electricity was passed, it limited CEL's responsibilities in the energy sector, making it a company exclusively devoted to electric power generation. Within the scope of the new scheme that was implemented in January 1998, competition started; several horizontally-integrated generation and distribution companies had free access to the transmission and distribution networks. These generation companies resulted from the restructuring of CEL and the sale of the electric power distribution companies to the private sector. Today, the system is controlled independently by the "Transaction Unit" (a body that runs and coordinates the electricity supply), according to a commercial and operational criterion to ensure the quality and reliability of supply.

The General Law of Electricity established an open competition scheme to develop Salvadoran thermal generation capacity. The new legal framework established prices that follow the natural balance between supply of and demand for electric energy. The law established free concessions, for any operator that requests one, for the exploitation of natural resources. The fees are fixed by

Table 5. Evolution of electricity capacity and energy balances – El Salvador, 1980-2000

Year	Capacity in MW		Reserve		Energy in GWh								
	Installed capacity	Maximum demand	(MW)	% of max. demand	Public net generation	Private generation buying	Exports	Imports	Available	Rationing	Sales	Losses (%)	Load factor
1980	440.0	269.0	180.9	67.2	1427.8	0.0	0.0	0.0	1427.8	14.0	1261.4	11.7	60.5
1985	631.8	318.0	313.0	98.4	1650.6	0.0	0.0	0.0	1650.6	33.3	1439.6	12.8	59.2
1990	650.4	412.0	238.4	57.9	2164.3	0.0	9.4	10.8	2165.7	81.3	1828.2	15.6	60.0
1994	817.5	566.0	251.5	44.4	3075.3	0.0	43.3	32.0	3064.0	21.6	2586.7	15.6	61.8
1995	908.5	592.0	316.5	53.5	3071.0	200.0	64.9	29.7	3235.8	15.1	2832.7	12.5	62.4
1996	943.4	626.0	317.4	50.7	2686.2	654.0	21.0	41.7	3360.9	13.8	2926.2	12.9	61.3
1997	943.4	666.0	277.4	41.7	2622.9	925.0	18.2	106.3	3636.0	15.3	3184.5	12.4	62.3
1998	943.4	694.0	249.4	35.9	2804.6	933.0	22.7	60.7	3775.6	7.4	3375.1	10.6	62.1
1999	988.4	718.0	270.4	37.7	2319.4	1319.0	207.8	458.2	3888.8	7.0	3276.0	15.8	61.8
2000	1102.5	758.0	344.5	45.4	2465.0	912.0	111.7	807.7	4073.0	0.0	3436.0	15.6	61.3

Source: IDEE/FB, 2001

the General Superintendent of Electricity and Telecommunications (SIGET), which is the regulatory body, on the basis of electric power market behavior.

SIGET is in charge of ensuring compliance with all laws and regulations related to the electricity and telecommunications sectors in El Salvador. SIGET is an autonomous institution; its top official is the General Superintendent, appointed by the President of the Republic with a tenure lasting seven years. SIGET responsibilities include: fixing maximum tariffs for household end-users with low electricity consumption levels, approving the tariffs established by distribution companies in their own distribution areas, guaranteeing compliance with all regulatory requirements in the electricity sector, penalizing those who do not comply with these regulations, and settling conflicts between operators.

Given that under this new legal framework the decision to expand the electricity grid is entirely up to the transmission or distribution agents, the National Investment Fund for Electricity and Telephone System (FINET)[1] was created to promote the development of electricity supply, particularly in rural areas. This fund will finance electricity services for the rural and lower-income sectors where distribution and transmission agents are unlikely to expand the system because of the difficulties of doing so.

Table 5 shows the evolution of electricity capacity and energy balances from 1980 to 2000. The effects of the new legal framework established in 1996 and of the General Law of Electricity[2] can be seen in this table.

Table 6 shows the evolution of installed capacity and electricity generation by participant type (public or private).

Table 6. Evolution of installed capacity (MW) in El Salvador according to type of participant, 1996-2000

Actor	1996	2000
CEL	943	806
Private agents		300
Total	943	1106

Source: Authors' estimate on the basis of [SIEE-OLADE, 2003]

4. Critical analysis of access indicators and research results in the three cases

This section discusses the advantages and disadvantages of the indicators used to measure the impact of energy reforms on the poor. The results of the analysis for the three cases are summarized briefly and compared to evaluate the direct impact of the reforms on the poor.

4.1. Analysis of the proposed indicators

The proposed indicators of the impact of energy reform are: (1) national electrification levels; (2) national electrification rates, (3) per capita electricity consumption; (4) electricity tariffs; and (5) household electricity expenditures (as a percentage of total household income). The advantages and drawbacks of these indicators must be considered from several viewpoints, including: (1) their ability to represent the effects of the reforms on the poor; and (2) the difficulties in obtaining the data necessary to employ these indicators as well as the relevance of the data or the proxies used when the data are not available, especially for comparing the poor and non-poor.

In LAC, energy-related data that enable us to distinguish between the poor and non-poor sectors are scarce. Except for information related to tariff levels (assuming that the poor are represented by households with low energy consumption), data do not exist regarding impacts of reforms on household incomes and energy products used. This lack of data is underscored by the fact that, before the reforms, a significant number of the urban poor used electricity services illegally.

In the literature on the impact of reforms on the poor [Foster, 2001; Alexander, 2000], it is assumed that reforms and their impact on the poor can be analyzed in causal terms, expressed in the behavior of indicators such

as those suggested here and that a comparative analysis of different countries will permit us to draw valid, universal lessons. This assumption depends on an oversimplification: that the same reforms will yield more or less similar results wherever they are applied or, even worse, that the causal links between reforms and results may be reduced to indicators. However, in developing countries, the behavior of these indicators may result from many phenomena completely unrelated to the reforms. So, although the search for a set of indicators that can represent the impact of the reforms in different countries is legitimate and desirable, simply extrapolating from traditional indicators is not an appropriate strategy if these indicators do not address the numerous causal factors that may be at work in a given country. Each of the suggested indicators is analyzed in detail below.

4.1.1. National electrification levels

This indicator measures the proportion of households that have access to electricity service. In general, it is possible to obtain information for urban and rural areas. However, data are not available to allow us to classify households into poor and non-poor categories. To address this limitation, we have defined poor users on the basis of low electricity consumption: households that use 50 kWh/month or less, or 100 kWh/month or less, are used as proxy for the poor. All others are defined as non-poor.

Other limitations must be considered in analyzing the significance of this indicator. For each case analyzed, it is necessary to take into account to what extent the electricity system was developed when the reforms were implemented. If the system was well developed, the reforms should not have major effects because electrification levels have always depended to a large extent on the development and speed of urbanization. If reforms are implemented at the same time that significant urbanization is under way, the likely increase in electrification might be wrongly attributed to the reforms rather than the growth of urban areas. Furthermore, if the indicator is analyzed on the basis of consumption bands and the reforms have caused average household consumption to increase, the indicator might reveal a decrease in the number of poor users given that our definition of "poor" users is based on low consumption. Likewise, if those who were illegal consumers of electricity before the reforms become legitimate users after the reforms, an increase in electrification rates may partly reflect the statistical inclusion of previously uncounted users.

4.1.2. National electrification rates

This indicator measures the rate of growth in new electricity connections. For the same reasons as for the previous indicator, the values of this indicator before and after the reforms are not in themselves very revealing.

4.1.3. Electricity consumption per capita

This indicator assesses the impact of the reforms in quantitative terms at a national level and at the level of poor and non-poor users if they can be differentiated. If data for poor and non-poor users are not available, defining these categories on the basis of consumption levels as described earlier will show whether the average per capita consumption has moved up or down but will not reveal much useful information about the impact of reforms on the poor. The impact on average consumption may be a result of fluctuations in prices, income, equipment ownership, and so on.

4.1.4. Electricity tariffs

This indicator reflects the cost of electricity before and after reforms. Costs may be subdivided into average costs by consumption category or band; connection cost; and addition or removal of subsidized charges for bands of poor consumers. In general, this indicator is clear and can be applied and interpreted in direct terms. However, indirect impacts should be considered when prices have depended on sharp fluctuations of external and internal relative prices because such variations almost always affect the poor and increase their number.

4.1.5. Household electricity expenditure as a percentage of total household income

This indicator measures the impact of electricity expenditures on the family budget before and after the reforms. Data on electricity expenditures are generally obtained through household surveys.

4.2. Data surveyed and comparative analysis of the cases

Table 7 shows a series of indicators selected from the research results, corresponding to the three cases analyzed in this study.

As noted above, indicators related to electrification levels and growth rate of new connections are not totally appropriate to measure the impact of the reforms. A key problem is that data are not available to compare the poor and non-poor. Although energy companies may have such information at least indirectly (for example, poor and non-poor geographical areas[3] could be identified), it is unlikely that these data would be processed in a systematic way. Moreover, even if the data were recorded, they would probably not be available to researchers because private companies are in general reluctant to provide information that might be counter to expectations (e.g., contrary to the "pro-privatization" ideology) or might be considered confidential.

Despite the shortcomings of the indicators, the data show an increase in the electrification levels in all countries (especially in Peru) after the reforms. However, the trend in electrification rates indicates a decline during the post-reform period.

All three cases show a noticeable decrease of total losses as a result of regularization after privatization of previously illegal connections. It should be noted that this is not a true increase in access as the consumers who "regularized" their service after reforms had access before the reforms even if that access was illegal. In addition, if global reforms worsen the problem of poverty, as happened in Argentina and El Salvador, then the apparent improvement in the form of regularization of previously illegal service may be countered by a reduction in real tariff collection from users who do not have sufficient income to afford some or all of the cost of the service. In Argentina, this problem is being accepted even by

Table 7. Comparative results of the analysis for some indicators selected from the three case-studies

Selected indicators	Argentina		Peru		El Salvador	
	Pre-reform	Post-reform	Pre-reform	Post-reform	Pre-reform	Post-reform
Total electrification level (%)	91	95	38	62[1]-72[2]	62	76
National electrification rate (% per year)	2.0	1.0	7.8	5.8	6.6	4.1
National average per capita electricity consumption (kWh/month)	113	174	31	50	36	47
Average household sector electricity consumption (kWh/month)	155	205	136	106	104	112
Poor households' lifeline tariff *proxy* (in US$/month)	4.35	11.77	6.8	17.2	4.8[3]	8.6[4]-16.8[5]

Source: Kozulj et al., 2003a

Notes

1. Data from SIEE-OLADE
2. Data from the Household Survey
3. Data related to the 1979-1993 average of household average charges equivalent to the consumption band subsidized between 1998 and 1999; the variability coefficient (average/standard deviation) is 20.7 %.
4. Value corresponding to 1998 with subsidy
5. Value corresponding to 2001

private participants in the electricity industry, who, in spite of claiming higher tariffs after the devaluation in 2002, admit that the increases could not be applied to low-consumption users, identified as equivalent to poor consumers [Kozulj et al., 2003b][4].

In the case of the household consumption level indicator, there is a decline in Peru, stagnation in El Salvador, and an increase in Argentina. The decline and stagnation are related to inadequate equipment and insufficient income to pay the higher cost of energy after the reforms. The increase in consumption in Argentina resulted from the lower price of electricity in terms of the local currency for consumers with average and high consumption. However, the mechanism of resorting to an overvalued currency to make the reform feasible is the reason for the destruction of the production system, which is the main cause of poverty (through unemployment as well as the negative effect of the corrective devaluation on the cost of living and incomes as explained above) [Kozulj, 1995, 2002; MEP, 2004; Frenkel, 2003; Krueguer, 1984; Dornbusch and Fischer, 2003].

Indicators connected with prices and impacts on household budgets clearly show the deeply regressive nature of the reforms. Not only has electricity service become more expensive for low-consumption users, but the real income of the population has declined or remained unchanged [Arza, 2002].

5. Indirect impact of energy sector reforms

Apart from the direct impact of reforms, this analysis emphasizes that the indirect impact of energy sector reforms, which are closely linked to the macroeconomic policies that were applied, has been more severe than the direct impact. The reforms have affected the capacity for generating employment, increased foreign indebtedness, and inevitably led to corrective policies that have further worsened the problem of poverty. The Argentine case is especially relevant as it reveals that there may have been covert subsidies for producers by way of subtle mechanisms whose impact on the poor and on future generations is very serious.

In the three cases analyzed, monetary appreciation increased the current income of privatized service providers while leaving the cost structure, which was dominated by capital costs, practically unchanged. In the case of privatization, these capital costs were below replacement values, always expressed in foreign currency regardless of the relation between local and foreign currency. This practice of making prices and tariffs viable at values close to those of developed countries while ignoring the average income differences of their respective populations distorts the entire relative price structure of the economy, favouring importers, the financial sector, and privatized public service companies to the detriment of productive sectors.

Table A1 in Appendix A gives the Argentine price and tariff values for several energy products before and after the reforms. These values are expressed in local currency and in dollars and show the splitting process that prices went through after the structural reforms suggested by the World Bank and the International Monetary Fund were applied.

Figure A1 also shows the level of currency overvaluation related to reforms, compared with currency values in previous periods. The objective presentation of overvaluation is an answer to the general neglect or denial of this effect. It also shows that devaluation has meant a return to historical values in Argentina regarding exchange rates.

Once the positive effect linked to price stability and access to credit for consumption dissipated, a running-down of the productive system was inevitable. This was manifested in growing unemployment and a deepening recession. The reform plans ended up producing strong recessions and an increase in poverty levels and social inequality. At the same time, the remittance of privatized company benefits required foreign loans, which in turn

increased the foreign indebtedness of the affected countries, making the continuation of monetary appreciation infeasible. Devaluation followed, and its negative impact on living costs increased poverty. The best example of this recurring and dramatic cycle is the Argentinean case, but the same dynamic is evident in El Salvador and, to a lesser extent, in Peru, where a recession had already existed for three years, or even longer.

It is curious that current literature on the topic of subsidies does not consider these issues in its critical analysis. On the contrary, several approaches present overly broad definitions of subsidies, regarding the deviation of prices and tariffs from "market values" as a subsidy without any reference to the question of costs. In those cases, the distribution of one part of the energy rent to users is taken as constituting a subsidy, when a subsidy should clearly mean a product or service that is sold at a price below production costs, including all the stages of production and a normal profit on the capital invested.

The cycle described above is highly relevant for discussions of sustainable development in developing countries because such development is not possible if, in order to sell energy products at international prices, it is necessary to resort to permanent monetary appreciation, which will lead to destruction of the country's economic base. In the case of Argentina, for example, the foreign debt level rose from around $ 60 billion to more than $ 140 billion in only one decade. Such a level of indebtedness can be explained, to a large extent, as a consequence of the remittance of privatized company profits abroad and the systematic payment of higher prices for imports than for exports, a behavior that is linked to the exchange parity level in both cases [Kozulj, 2002; Frenkel, 2003; Dornbusch and Fischer, 2003][6]. Peru also increased its foreign debt but managed to correct its debt growth as a result of recession, which did not occur in Argentina until 1999 although the unemployment and lack of competitiveness brought about by currency overvaluation started to be felt as early as 1994. What is relevant for the purpose of this research is the need to recognize that these new policies can legitimately be seen as producer subsidies that have not promoted electricity access, but have instead had negative effects on prices and household budgets.

Negative macroeconomic effects have been much more serious than the direct negative impact of the energy sector reforms. Overt and covert unemployment rates in Argentina increased from almost 10 % to almost 25 %. As a consequence, the number of poor people increased just as much as the gap between minimum and real incomes, driving a large proportion of the population to levels very close to the poverty line [INDEC, 2004]. The struggle between productive sectors and privatized services has become almost impossible to resolve, which gives rise to the need for new energy sector reforms and strong public intervention.

When the utilization of debt is analyzed, it is possible to verify the subtle mechanism of producer subsidies. As can be observed in Appendix A (Table A2), the interest paid and the remittance of company profits abroad represented 41 % of foreign indebtedness between 1992 and 1999, and a significant part of this can be attributed to privatized companies. Some considerations are necessary here: 27 % of that indebtedness corresponds to the negative balance of trade, and trade between companies of the same group is responsible for a significant proportion of this [Kosacoff et al., 2002]. Also, 19 % of the debt increase corresponded to the increase in reserves that made the monetary appreciation scheme feasible. If all these elements are taken into account, the conclusion is that foreign debt financed the profitability of the private companies. The situation is even more serious when we take into consideration that the whole of that increase in reserves was sent abroad between March and November 2001 through the financial system (banks and pension funds), which is closely linked to privatized companies.

If the magnitude of the financial and social imbalance brought about by the reforms is taken into account, it is obvious that it has by far exceeded that of the 1980s, which constituted the critical foundation for the reforms of the '90s. Thus we see the importance of analyzing its implications for structural poverty in the region.

In the case of Peru, the evolution of employment has been clearly unfavourable, with all employment indicators revealing a worsening tendency. Although Peru still experiences serious structural poverty problems resulting from productive stagnation, the reforms were accompanied by state measures that prevented them from having an even worse impact, which would have been felt had these welfare measures not existed.

In the Salvadoran case, the impact of energy reforms was not so closely connected to macroeconomic guidelines until privatization began in 1997. Since then, as was the case in Argentina, the reforms had a negative impact on the poor and on the country's general poverty level in particular, because the reforms were accompanied by a harmful monetary appreciation process. Income distribution measures reveal that the relative gap between the poor and the rich has widened in El Salvador. The Gini coefficient rose from 0.72 in 1977 to 0.74 in 1992, and it can be assumed that this value was even more unfavourable in 2000.

The argument that subsidies to users must be avoided because they generate fiscal deficits and an inflationary tax, which in the long term is harmful for the poor, should be considered in the context of the negative impact that overvaluation has had on local currencies. Ignoring the fact that this overvaluation had a purpose closely linked to privatization during the 1990s may not only be inappropriate but also tremendously dangerous. This question has not been comprehensively debated at a regional level, and participants in the energy system appear to ignore these connections. Solutions such as subsidies for specific sectors are still based on old arguments.

6. Conclusions

In all three countries studied, electrification levels increased. However, the growth rate of new connections decreased in the post-reform period as compared with the pre-reform period.

All three cases recorded growth in average consumption per inhabitant along with an increase in tariffs. This apparent contradiction is explained by several factors. First, average consumption per inhabitant grew on a par with the growth in global electrification and urbanization, which meant an increase in electricity consumption in the service and industrial sectors. Even more importantly, changes in tariff schemes reduced commercial and industrial electricity charges relative to electricity rates for households, which explains the growth of consumption per inhabitant in the three cases. Second, tariff increases in dollars reflected the general monetary appreciation[5] discussed earlier.

The analysis of the three cases revealed a decrease in electrification rates and a substantial increase in prices and tariffs for low-consumption users. Because consumption levels were used as a proxy for the poverty of users, the results show that the situation has worsened. Not only are tariffs higher, but electricity costs also represent a higher proportion of poor families' expenditures because real incomes have declined as a result of the severe recession in the region.

The indicators used in this study to measure the direct impact of energy reforms on the poor and to facilitate the comparability of the results with those from other regions turned out to be unsuitable for evaluating access to energy services but effective for assessing the impact of tariffs and their effect on household budgets of the poor in the LAC region. The lack of specific data for the poor and non-poor in the pre- and post-reform periods was a major barrier that prevented the formulation of more precise research conclusions than those presented here. It is hoped that the difficulties in applying them and criticism of the results will lead to improvements in the methodology for future phases of the research.

Apart from the direct impact of reforms, this article emphasizes that the indirect impact of energy sector reforms, which are closely linked to the macroeconomic policies that were applied, has been more severe than the direct impact. The reforms have affected the capacity for generating employment, increased foreign indebtedness, and inevitably led to corrective policies that have further worsened the problem of poverty.

A significant element of future research should be analysis of indirect global impacts, which will capture the complex links between energy reform and its impact on the poor in specific countries as well as its impact on global poverty levels. ■

Notes

1. Decree 354, Official Gazette, San Salvador, 29 July, 1998.
2. Legislative Decree 843, Official Gazette, San Salvador, 25 October, 1996.
3. The geographical area criterion has in any event proved difficult to implement as different social levels co-exist in the same neighborhood or settlement. Analyzing each dwelling would require a previous survey and identification of each with its address and meter number. The companies do not have this kind of systematic information, and it has not been possible to obtain it, even for more specific studies [Kozulj et al., 2003b].
4. The many attempts to determine a social rate and the work of one of the authors within UNIREN (Contract Renegotiation Unit, Ministry of Economy) and as consultant to the Argentine Committee to the World Energy Council support such a statement.
5. By the monetary appreciation process, we understand the rising evolution of internal prices parallel to the stability of the US$ or other foreign currency. It is synonymous with an overvalued currency, defined in objective terms by the degree of distance from balanced exchange parity – in other words, that which does not yield a constant divergence in terms of rising external debt.
6. The correlation between the actual exchange rate and the trade balance yields R^2=0.86, all statistical parameters being reliable [Kozulj, 2002]. Hence, it proved impossible to pay off the debt. To pay off the debt by means of fiscal accounts required cutting expenses, which brought fiscal income down because of the restrictive effects of the cuts [Frenkel, 2003]. The literature provides a record of the criticism of the financial policies implemented by Argentina [Krueguer, 1984; Dornbusch and Fischer, 2004]. Several articles in local newspapers warned about the dangers of overvaluing the local currency during "the convertibility plan": Diario Clarín, suplemento económico, 10-10-1993, R. Frigerio y M. Lascano notes; W. Rhodes (from Citycorp), "Banqueros preocupados por la sobrevaluación del peso", Clarín, 26-4-1994; Ámbito Financiero, 1-6-1995; Ámbito Financiero, 12-6-1995, p. 20; Ámbito Financiero, 3-12-1997, p.13, Ámbito Financiero, 16-05-1998, p. 6.

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Appendix A. The relationship between macroeconomic reforms and energy reforms: critical evidence from the Argentina case-study

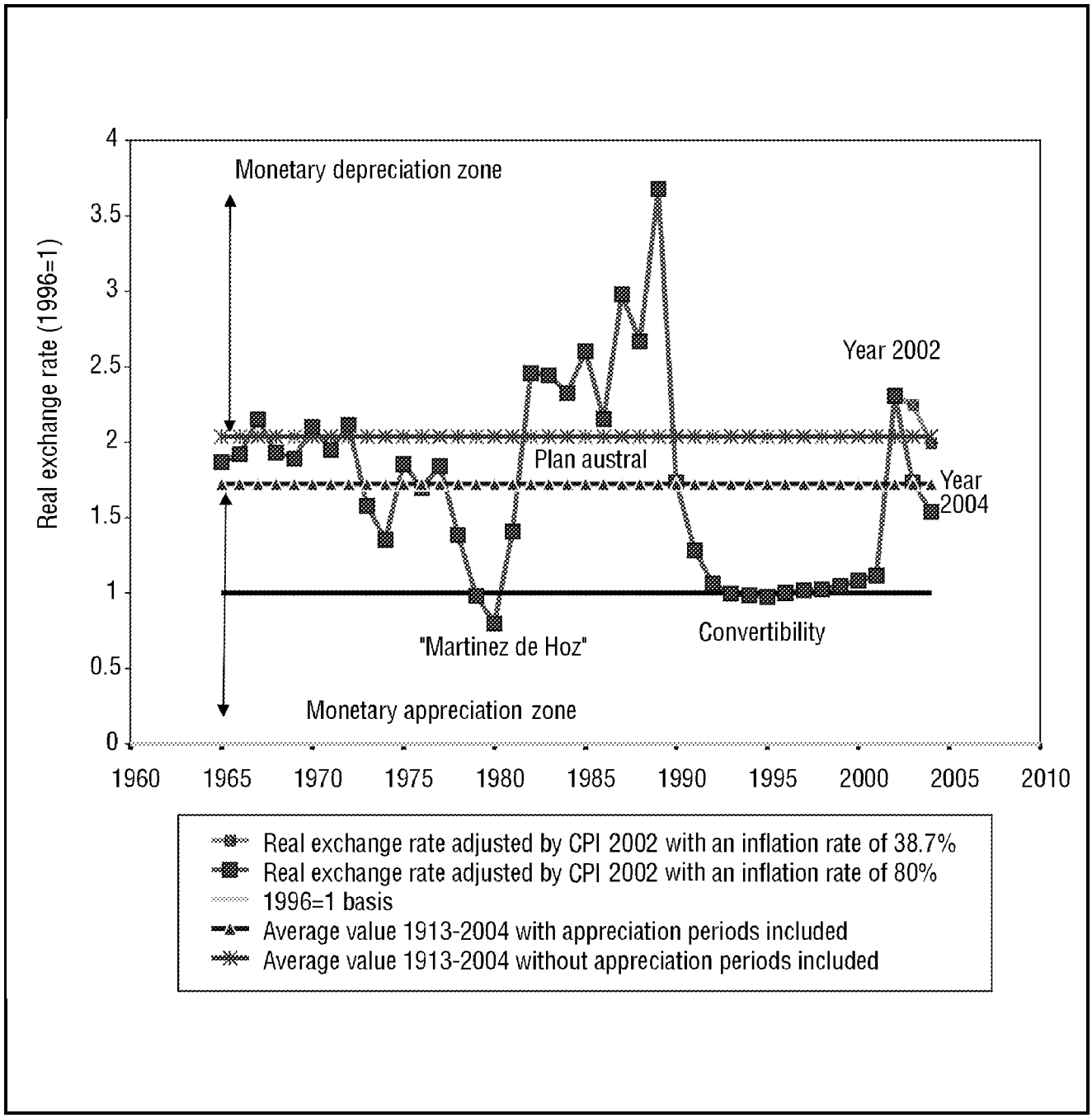

Figure A1. Evolution of real exchange rate in Argentina, adjusted by inflation in the USA, 1965-2002

Source: estimations with INDEC and BCRA data, on the basis of data from Techint News Bulletins

Table A1. Argentina: energy price fluctuations after the reforms in local constant currency and foreign currency

Natural gas	**Household (75 m^3/ 2-month period)**	**Household (250 m^3/ 2-month period)**	**Household (500 m^3/ 2-month period)**	**Commercial (450 m^3/ 2-month period)**	**2500m^3/ day**	**200,000 m^3/day**	
1984-1989/1993-2000 in domestic prices	60 %	29 %	-1 %	-11 %	-14 %	-45 %	
1984-1989/1993-2000 in dollars	300 %	219 %	146 %	122 %	112 %	35 %	
Oil derivatives	Regular gasoline (l)	Premium gasoline (l)	Kerosene (l)	Gas Oil (l)	Diesel Oil (l)	Fuel Oil (k)	Price of the compound (l)
1984-1989/1996-2001 in domestic prices	-38 %	-34 %	-21 %	-31 %	-32 %	-55 %	-25 %
1984-1989/1996-2001 in dollars	83 %	95 %	134 %	108 %	100 %	33 %	123 %
Electric energy (GBA)	Household tariff 100 kWh/2-month period	Average household tariff	Average commercial tariff	Average industrial tariff	Average global tariff		
1984-89/1990-92 in pesos	-33 %	-13 %	18 %	44 %	11 %		
1984-89/1990-92 in dollars	3 %	30 %	78 %	119 %	67 %		
1984-89/2001 in pesos	28 %	-39 %	-51 %	-44 %	-49 %		
1984-1989/2001 in dollars	270 %	83 %	47 %	71 %	55 %		

Source: IDEE/FB on the basis of data from several studies on energy price policies in Argentina, COPED Network and R. Kozulj, *Balance de la Privatización de la Industria Petrolera en Argentina y su impacto sobre las inversiones y la competencia en los mercados minoristas de combustibles,* ECLAC, Recursos Naturales e Infraestructura Series No. 46, Santiago de Chile, July 2002, and *Resultados de la reestructuración de la industria del gas en Argentina,* ECLAC, Recursos Naturales e Infraestructura Series No. 14, Santiago de Chile, November 2000.

Table A2. Composition of foreign indebtedness in Argentina between 1992 and 1999 and its relationship with the monetary overvaluation and privatization processes

Areas of currency demand	**1992-1999 period**	
	in millions of U$S	**in %**
Negative balance (goods)	22327	27.3
Total amount of interest paid	14000	17.1
Interest (privatized)	5830	7.1
Total profits and dividends	19594	23.9
Profits (privatized)	7536	9.2
Average increase in reserve level	15336	18.7
Rest of foreign financing	10631	13.0
Total foreign debt increase	81888	100.0

Source: Authors' estimates with data from [Ongaro et al., 2001]

Corrigendum

The following error, present in the original text received by us, was noticed by one of the authors but pointed out too late to be corrected before our last issue, Volume VIII, No. 3, June 2004, went to press.

In the legend in Figure 1 in the leading article, on Page 8, the solid line with diamond-shaped data points was labelled "Ethanol cumulative production". It should correctly have been labelled "Ethanol price".

We deeply regret the error.

– Editorial Team

Expanding access to electricity in Brazil

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In 1993, the Brazilian electricity sector initiated a restructuring process by unbundling the generation, transmission, and distribution components of the existing companies. This ultimately led to the privatization of most distribution assets and some of the generation assets. However, little attention was paid in the process to the expansion of services to low-income and rural areas. This paper characterizes the main policy, institutional and regulatory barriers that have negative impacts on electricity supply to low-income consumers in rural and urban areas in the country. It also analyzes the effect of the power sector reform and discusses existing institutional arrangements that may affect the policy goal of universal access to electricity. Finally, it provides recommendations for feasible developments in policy, regulatory and institutional arrangements that would facilitate the expansion of electricity supply to low-income consumers and rural areas.

1. Introduction

The Brazilian power sector is divided into two large systems, the interlinked one and the isolated one [Goldemberg et al., 2002]. The first one, with 80,000 MW of installed power, includes the Northeast-Southeast-South transmission line[1]. The isolated system includes small local grids, mainly in the northern Amazon.

The energy supply of off-grid systems is based on diesel generators. There is an enormous consumption of diesel in the electricity generation and fuel transportation within the region. There are presently nearly 1,000 power plants supplying electricity for isolated cities and villages in the Amazon using diesel oil. Almost 700 units have an installed power capacity below 500 kW [Goldemberg, 2000]. The high overall fuel consumption is due not only to the electricity generation itself, but also to the local transportation, which relies exclusively on boats.

The 1988 Brazilian Constitution considers the distribution of electricity to be an essential public service for which the federal government assumes full responsibility, either directly or through designated concessions or permits. There is a consensus emerging in Brazil related to the imperative need to supply electricity to all of the population as a basic public service. However, lack of electricity access is a fact of life for many rural and also urban households.

The difficulties related to servicing the low-income markets, either urban or rural, are intrinsically characteristic of these markets. Low consumption per unit significantly reduces the recovery time for initial investments. This is aggravated in the case of rural markets by high dispersion, which requires higher initial investments. This situation, which was already difficult under state-owned companies, has become more serious after the privatization process, which intended to maximize the value of assets to be sold and to minimize obligations to future concessionaires. Once private distribution companies were in place, weaknesses in the framework became evident. In particular there was a lack of incentives and obligations to implement rural electrification programs to improve supply to low-income consumers and to sustain existing off-grid projects.

This paper identifies and characterizes the main policy, institutional and regulatory barriers that have negative impacts on the electricity supply to low-income consumers in rural and urban areas in the country. It analyses the effect of the power sector reform, and discusses existing institutional arrangements that may affect the policy goal of universal access to electricity. Finally, it provides recommendations for feasible developments in policy, regulatory and institutional arrangements that would facilitate the expansion of electricity supply to low-income users.

Table 1. Access to electricity of the urban and rural population in 2000

	Permanent private households			Permanent population		
	Total	Urban	Rural	Total	Urban	Rural
Total (million)	44.78	37.37	7.41	168.45	136.98	31.47
With electric lighting	42.33	37.04	5.29	157.46	135.74	21.72
Without electric lighting	2.45	0.33	2.12	10.99	1.24	9.75
Electrification rate (%)	94.5	99	71	93	99	69

Source: IBGE (2001a).

Note

Privately-owned housing unit: household composed of one person or a group of persons, where relationships are established by family ties, domestic dependence or rules for living together. The private housing unit is classified as permanent when it is a house, apartment or room.

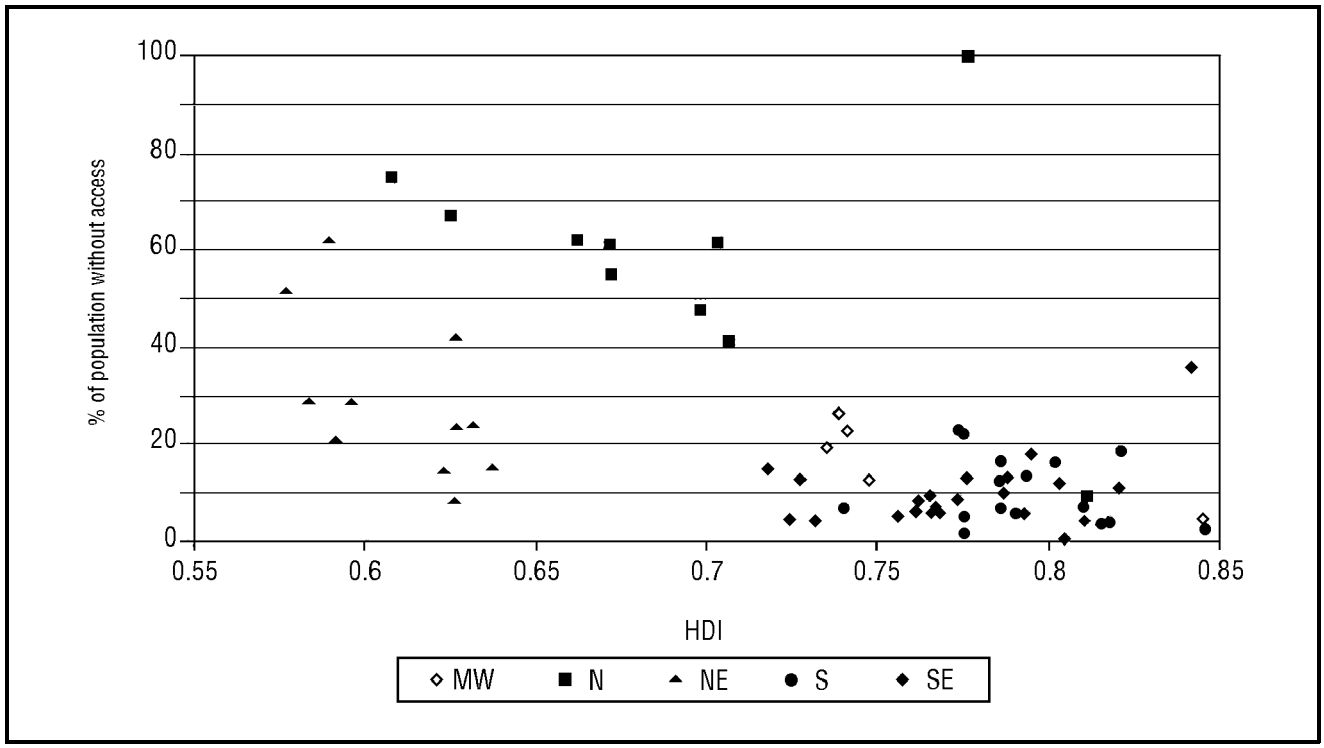

Figure 1. Electricity access in Brazilian regions versus human development index (HDI)

Source: IBGE, 2001a,b

Notes

The human development index (HDI) is a non-dimensional factor. The three essential components of HDI calculation are life expectation, adult literacy rate and per capita income. According to the United Nations Development Programme (UNDP), HDI indicates where a country stands development-wise. Countries with an index over 0.800 are part of the high human development group; between 0.500 and 0.800, of the medium human development group; and below 0.500, of the low human development group.

2. Electricity access in Brazil – an overview

Electricity supply plays an important role in the raising of living standards because it enables high-quality lighting, clean water, health care, and communications. A frequently mentioned figure for a minimum consumption level is 600 kWh per household per year (or 50 kWh per household per month). However, different electricity consumption levels have been proposed as adequate minimum standards to be targeted for the Brazilian poor.

There is a close relationship between poverty and low electricity consumption, in parallel to the relationship between poverty and lack of electricity access. The 2000 Census [IBGE, 2001a] shows that 64 % of households without access to electric lighting have a family income below two minimum wages[2]. Considering up to three minimum wages, this figure increases to 89 %. Out of the 5,507 Brazilian municipalities, only 214 have 100 % of households with electricity [IBGE, 2001b]. Table 1 shows data concerning access to electricity of the urban and rural population in 2000.

Although residential consumption of electricity per inhabitant is not an absolute indicator of quality of life, it can indicate some important differences among regions. This is the case in Brazil, where there are significant regional differences. While only 68 % of the rural population in the North-eastern Region had access to electricity, in the developed South-east this share was 98.7 %. Rural electrification levels vary from 96 % in the southern Santa Catarina state to 0.8 % in the northern Amazonian Para [IBGE, 1998]. The North and North-east regions are

the ones most lacking in electric lighting, and the municipalities there have the worst human development indices in the country [UNDP, 2003]. Their metropolitan areas are the poorest and have the highest rates of "electrical exclusion". Figure 1 consolidates data by Brazilian regions (MW: Mid-west, N: North, NE: North-east, S: South and SE: South-east).

Table 2 shows the progress in terms of electricity access for the Northern region and its states, compared to the national average. Access to electricity in Brazil has evolved from 89 % of households in 1992 to nearly 96 % in 2001, but some 1.8 million households lacked access in 2001 (Figure 2).

Electricity is a crucial factor for the development of a region, but not enough by itself to ensure it. It is also necessary to create economic conditions for the local population to have electricity access and use it in a productive way, in order to be able to afford the cost of electricity supply. The electrification of small isolated communities using conventional supply presents significant barriers such as high costs of the transmission lines, transportation of diesel oil and the low income of the community residents.

While many electrification efforts have concentrated on rural areas, the urban poor with no access to electricity are often neglected. In peri-urban areas such as slums *(favelas)*, connection costs are up to seven times lower than in rural areas, as households are more concentrated and close to the existing grid. The overwhelming barrier to expanding access to electricity here is poverty.

In poor urban areas, the proximity to the low-tension grid can lead to high non-technical losses such as illegal connections, tampering with meters, corruption of meter-readers and non-payment. Solutions include fees for service arrangements, advance payment for consumption, down payments, or working through local wholesalers with better knowledge of consumers' true ability to pay.

3. Existing rural electrification programs in Brazil

The federal government and other donors support a variety of initiatives designed to promote rural electrification. Federal programs include *PRODEEM* (managed by the Ministry of Mines and Energy) [MME, 2003c], *Luz no Campo* (managed by Eletrobrás), and *Luz para Todos,* which expects to provide full electrification in the country by 2008 [MME, 2003b]. There are also rural electrification activities under several non-sectoral and decentralized initiatives. In addition, the National Bank of Social and Economic Development (BNDES) is structuring credits to finance electrical interconnection to rural households that already incur significant expenditures on kerosene and

Table 2. Electricity access in 1991 and 2002 for urban and rural households

	Coverage (%) in 1991			Coverage (%) in 2002		
	Urban	Rural	Total	Urban	Rural	Total
Acre	95.0	13.0	70.0	98.5	32.6	80.4
Amazonas	96.0	16.0	79.0	97.8	27.2	85.4
Amapá	94.0	42.0	89.0	99.3	52.0	95.6
Pará	91.0	37.0	71.0	97.6	39.0	82.2
Rondônia	90.0	20.0	68.0	98.5	58.8	85.7
Roraima	97.0	30.0	82.0	98.9	42.4	88.6
Tocantins	81.0	14.0	64.0	95.2	37.9	82.4
Northern Region	92.0	54.0	75.0	97.6	40.3	83.9
Brazil	97.0	49.0	87.0	98.8	73.2	96

Sources: IBGE, 1992; MME, 2003a

Note:

The table uses the Demographic Census 2000 population and electricity access data projected to 2002 according to historical growth rate of each municipality.

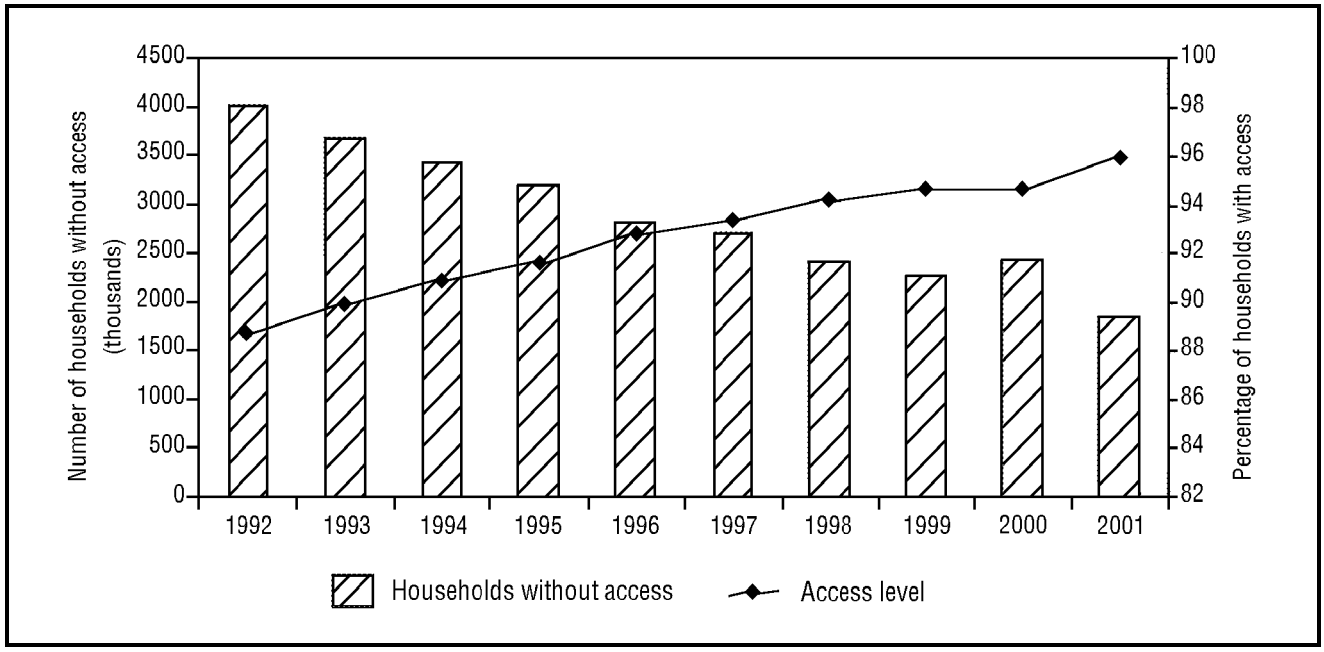

Figure 2. Electricity access in Brazil, 1992-2001.

Source: IBGE (Census 2000 and PNADs)

batteries and could afford a R$ 12 (around US$ 4) per month electricity bill.

Diesel oil consumed for electricity generation in isolated areas is subsidized through the Fuel Consumption Account – *CCC (Conta de Consumo de Combustível)*. This account is funded by energy utilities from special taxes on electricity bills for households in the interlinked system. The CCC helps to expand electricity access in isolated communities. In 1998, the CCC was extended to renewable energy projects in isolated communities which totally or partially substitute diesel thermal generation.

3.1 The PRODEEM program

The *Programa de Desenvolvimento Energético de Estados e Municípios – PRODEEM* (Energy Development of States and Municipalities Program) – is the main government-sponsored program that aims to promote off-grid electrification of villages. Established by a presidential decree in 1994, PRODEEM is sponsored by international donors and is implemented mainly through Brazilian utilities. It consists of several pilot off-grid electrification initiatives using photovoltaic (PV), wind or hybrid systems, and also conventional fossil fuels in remote villages. From 1996 to 2000, PRODEEM provided 3 MW in solar photovoltaic (PV) panels to 3,050 villages, benefiting 604,000 people on the basis of a total investment of R$ 21 million from National Treasury funds. The total budget was R$ 60 million for 2001, when 1,086 systems were installed, and another 3,000 community systems were put out to tender by way of international bidding (with a winning bid of R$ 37 million for equipment and installation, plus operation and maintenance for three years).

PRODEEM is a centralized project that uses a top-down approach to identify sites and install equipment. The federal government procured photovoltaic panels that were allocated free of charge to municipalities upon demand. Instead of electrifying individual households, the program focuses on schools, health facilities and other community installations. Traditionally focused on PV systems, more recently PRODEEM has started to sponsor mini-grid pilot projects (with hydro and biomass generation) to test different service provision models.

A recent evaluation of the first phase of PRODEEM surveyed its impact on 43 villages in ten states. Only 44 out of the 79 systems (56 %) were actually operating. Problems with PRODEEM include the following:

- a top-down approach, with installations sometimes made in unskilled and unorganized communities;
- absence of schemes for cost recovery, resulting in a lack of funds for maintenance and hence unsustainable service;
- lack of responsibility of local communities and states for the equipment (even under the new system requiring operation for three years);
- occasional lack of coordination with grid expansion programs; and
- difficulties in identifying suitable locations for equipment purchased in bulk.

3.2. The ''Luz no Campo'' program

The problems with PRODEEM prompted both the executive and legislative branches of the federal government to start parallel initiatives to create incentives and obligations for the new concessionaires to invest in rural electrification and to supply services to low-income consumers. In 1999, *Eletrobrás* (a state-owned holding of other federal companies), under the coordination of the Ministry of Mines and Energy, launched an ambitious program, *Luz no Campo* (Light in the Countryside), to finance the electrification of one million rural consumers over a three-year period exclusively through grid extension.

This program was a response to the evident standstill that beset rural electrification after the restructuring of the power sector. It aimed to provide electricity to five million people living in one million rural households by 2007, using funding of R$ 1.77 billion (US$ 650 million) from reserves (the so-called *Reserva Global de Reversão – RGR)* dedicated to electricity generation, transmission and distribution [Eletrobrás, 2003].

In 1996, Law 9427 decreed that 50 % of the resources of RGR should be directed to the North, North-east, and Mid-west regions. Half of these resources were supposed to be allocated to programs for rural electrification and energy efficiency for low-income users. In the same year, a further law made concessionaires responsible for the cost of providing services to new consumers. Consumers would only have to meet tariffs.

In April 2002, the Brazilian Congress passed Law 10438, which provided for the reduction of tariffs to low-income consumers, the establishment of targets for concessionaires, and the granting of permission to permit-holders to provide full coverage. The law also created a national fund, the Energy Development Account *(CDE – Conta de Desenvolvimento Energético)*, to promote universal access and use of innovative sources of energy. *ANEEL (Agência Nacional de Energia Elétrica* – the National Electricity Regulatory Agency) is expected to pass the necessary regulation to implement the law, whereby concessionaires must provide full coverage under a target plan. In parallel, the Ministry of Mines and Energy is preparing a program to accelerate universal access by ensuring additional resources and by creating rules for use of CDE.

Financial resources from CDE can be granted to accelerate the achievement of the targets. ANEEL will monitor the progress and the results achieved by utilities in the implementation of electrification programs. Those not meeting the targets will be subject to sanctions, mainly a reduction in the tariff increase, when the tariffs are periodically reviewed by ANEEL.

Despite the help of CDE, huge investments will be required from the distributors, particularly in the case of the municipalities whose current rate of electrification is below 75 %. The income loss from defaults on energy bills is one the main concerns of distributors, as this loss reduces the distributor's capacity to invest. Consequently, the universal access targets defined by ANEEL may become increasingly difficult to achieve.

As of September 2002, 480,000 connections had been

made through the Luz no Campo program, and another 125,000 were in progress. The main problems of the program are:

- the lack of incentives for utilities to execute low-cost grid connections or off-grid projects; and
- competition for the financial resources available from the CDE, which are also being used for the extension of the natural gas distribution [ABRACE, 2003].

3.3. The ''Luz para Todos'' program

In November 2003 the Brazilian government announced the *Luz para Todos* (Light for All) program to supply electricity throughout Brazil to 12 million people as yet unconnected to any transmission grid. The main objective of Luz para Todos is social inclusion through access to electricity supply. It is an important step towards achieving the much-longed-for dream of universal access to electrical energy services. This program will be implemented through partnerships between the federal government, the state governments and the concessionaires.

The first stage of the program has scheduled investments of US$ 843 million[3] funded by the federal government (US$ 543 million), concessionaires (US$ 188 million) and state governments (US$ 112 million). Upon signature of contracts, 10 % of the value of the contracts is made available to concessionaires. Eletrobrás will monitor the progress of the work. In this first stage, 567,000 new connections will be made, giving 2.8 million people access to the regular electricity supply. The plan is for 12 million people to be reached by 2008.

Besides accelerating universal access to electric energy, Luz para Todos will allow for the generation of about 115,000 indirect and direct jobs, according to an estimate by the Ministry of Mines and Energy.

3.4. Non-sectoral or decentralized initiatives

The amendments included in the national budget through the Ministry of Agriculture are another important source of funding for rural electrification. These funds are provided by the federal budget to the municipal administrations on a non-refundable basis and are subject to a certain amount of political bargaining. The funds finance grid extensions for productive uses.

Operating under a different name in each state, the Rural Poverty Alleviation Program *(RPAP)*, established in 1993 and sponsored by the World Bank[4], has been another important source of investment. The program provides grants to the local associations to finance projects that have been previously approved by the Municipal Committee. To date the program has financed essential infrastructure investments for a total of 42,750 community associations in 1,400 of the 1,600 rural municipalities in North-east Brazil. Communities make their own development decisions through a process that promotes and depends on community organisations. The projects include grid-connected rural electrification projects and off-grid solar systems, in addition to a plethora of other rural development projects.

A key issue related to these projects is sustainability. Unless the associations are strongly organized, their projects are difficult to maintain. The case of grid-connected systems is less troublesome as they are absorbed by concessionaires, who are obliged to maintain them.

Table 3. Main characteristics of Brazilian electricity sector pre- and post-reform

Pre-reform	Post-reform
A few state-owned companies	Privatization and a large number of agents
Vertically bundled industry	Vertical unbundling of the industry
Regional/state monopolies for generation, transmission and distribution	Competitive generation and distribution, regulated monopolies on transmission systems and shared distribution
Ban on foreign investors	Restrictions on foreign investors lifted
Centralized planning	Indicative planning
Equalization of tariffs	Regulated prices and tariffs
Captive market	Gradual easing of restrictions on consumers

Source: BNDES, 2002

4. Brazilian electricity sector reform and electricity access

Beginning in 1993, the structure of the electricity sector's institutional model was significantly altered by the federal government, with the aim of stimulating competition and attracting private sector investors. The characteristics of the new model for the sector are shown in Table 3.

A new institutional framework was established by creating three regulatory agencies: ANEEL (Agência Nacional de Energia Elétrica – National Electricity Regulatory Agency), *ANA* (*Agência Nacional de Águas* – National Water Agency) and *ANP* (*Agência Nacional do Petróleo* – National Oil Agency). ANEEL was established in 1996 to regulate all operations of the power sector.

Little attention was paid in the restructuring process to the expansion of electricity services to low-income and rural areas. Several federal laws have tried to oblige utilities to guarantee electricity access, but their results have not yet proved positive. In 1997, Law 9478 stipulated that national energy policies must aim to identify the most suitable solutions to supply electricity to the different regions. It also established a national council for energy policy *(CNPE – Conselho Nacional de Política Energética)*, one of whose responsibilities is to propose measures to supply energy to remote areas. Lack of enforcement has detracted greatly from the effectiveness of these measures. In addition, the obligation to provide full coverage was not included in contracts between ANEEL and new concessionaires.

The 2002 Law 10438 established rules for strengthening the universal service obligations of distribution concessionaires and introduced a series of changes in the structure of the Brazilian energy sector, including:

- the definition of the low-income consumer as having monthly consumption up to 80 kWh, plus a second group up to 200 kWh under special conditions to be defined by ANEEL;

- the establishment of the Energy Development Account, CDE, discussed above;
- special incentives to renewable energy sources through the *PROINFA* program (discussed further below); and
- an extension of RGR until the end of 2010 to ensure resources for the continuation of the Luz no Campo program.

Concerning rural electrification, ANEEL is to impose targets for full coverage on concession- and permit-holders. Consumers falling within low-income groups would not be required to pay anything on top of the tariffs. Households would be able to accelerate their service connections by paying a part of the full investment, and the concessionaires would be required to reimburse them when the target for electricity access is met. Even accelerating investments by public entities will have to be reimbursed. The achievements of targets would be surveyed by ANEEL during the tariff revision process.

In an attempt to accelerate full coverage, ANEEL would be able to initiate open bidding within the concession areas to award permits whenever no exclusive provisions are present in contracts with existing concessionaires. Permit-holders would be able to use either the conventional grid or establish partnerships with renewable energy dealers, distributors, or IPPs (independent power producers).

Several problems may be solved if Law 10438 is properly implemented. One of the initiatives should be a study on the impact of the law's obligations on tariffs. Pressure for substantial tariff increases is expected. If they are not attached to suitable mechanisms such as cross-subsidies, high tariffs will retard the attainment of universal access.

Decree 4336/2002 authorized the loaning of RGR resources to concessionaires to cover their losses due to the introduction of subsidies for lifeline tariffs to low-income consumers. The loans would be in effect up to the date of revision of the tariffs of the concessionaires. This decree would result in an annual reduction of R$ 500 million (US$ 180 million) in the RGR funds, significantly reducing the resources available for Luz no Campo. Law 10604 has minimized this impact via the identification of other sources to cover the subsidies to low-income consumers, but RGR can still be used as a back-up source for these subsidies.

Decree 4541/2002 established rules for the use of CDE, but there are very limited resources left from that account for promoting universal access. Analyses of the amount of resources that will be collected in that account show that these funds will not initially be spent on other programs that the account is supposed to promote (e.g., renewable sources, natural gas), and thus could be reallocated to promote universal access.

A step required to accelerate universal access is establishment of the rules for implementing Law 10438/2002 through a review of Decree 4541/2002. It is important to assure additional resources for promoting universal access and to clarify some points of the law's implementation. Also needed are a series of resolutions by ANEEL that will establish rules for concessions and permits.

Resolution ANEEL 219 (April 2003) offered a discount of 50 % for electricity tariffs to consumers of electricity generated from wind and biomass – a benefit that was already enjoyed by consumers of electricity from small hydro. ANEEL has also issued Resolution 223, regulating aspects of Law 10438/2002 related to targets for universal access to electricity in Brazil. Expenses related to the connection to the grid will be borne by utilities, and not the consumers. All utilities are to submit to ANEEL within determined deadlines their programs to expand access to electricity. Targets were defined in order to reach the goal of full coverage established by the federal government.

A new institutional model of the electric sector is being proposed by MME through a technical report presented for discussion in December 2003[5]. It aims to provide affordable tariffs and to guarantee universal supply. The new model has the following elements:

- restructuring medium- and long-term planning and contracting;
- utilization of the lowest-tariff criteria;
- monitoring of services provided;
- two contracting environments, one regulated and another free;
- the institution of a regulated contracting pool;
- separation of distribution from any other activity;
- provision of contingency reserves to re-establish the balance between supply and demand; and
- the return of the executive as conceding power (instead of ANEEL).

This proposal has drawn some criticism from specialists[6] for being too centralized and having too many amendments.

5. The impact of the reforms on electricity access and consumption of poor urban and rural households

According to ANEEL, from January 1995 to October 2001, residential consumers faced an average rise in electricity price of 30 % above inflation. The situation worsened after 1999, when a 70 % devaluation of the Brazilian currency occurred[7]. Such price increases tend to inhibit the access of the population to electricity, especially the lower-income groups. They have placed a heavy burden on the budgets of the low-income section of the population. Moreover, the high price of electricity and liquefied petroleum gas (LPG) has negative environmental side-effects, since the poorer people switch to the use of cheaper options for their energy needs, leading to deforestation from the excessive use of wood fuels.

Under Brazilian electricity tariff structures, domestic and commercial consumers cross-subsidize rural, public lighting, and low-income consumers. For households, the discount is tapered according to the consumption level, so that those consuming up to 30 kWh per month pay only 35 % of the overall tariff, and those consuming up to 100 kWh per month pay 60 % of the overall tariff. The discount declines to zero for those consuming more than 220 kWh per month. The overall tariff and regional limits vary from concession to concession.

The discounts for low-income households tend to affect the financial health of the distributors, particularly the

smaller ones. Current plans point to a greater number of consumers paying reduced tariffs. In this situation, the competence of the distributor's performance may well define its financial health, or even its survival in the domestic energy market.

The restructuring of the Brazilian power sector exhibited a generous policy of profit-sharing with the new owners. While most electricity was produced by already amortized hydro plants, tariffs were calculated on the basis of the financial costs of new projects. Before privatization, the state-owned utilities could supply energy to low-income consumers at extremely low tariffs (or even free of charge) through a policy of cross-subsidies in which the tariffs of the highest consumers are slightly increased. This policy could be introduced by the privatized utilities.

Table 4 shows some key indicators, comparing the situation of Brazilian consumers in 1994 (before the reform) and in 2000 (after the reform). It is too early to definitively evaluate the implications of the power sector reform for expanding access to electricity in the country, but this table allows some preliminary discussion. Electrification levels in rural areas have progressed from 68 % to 74 %. The most striking change is the increase in the average electricity tariff, which more than doubled in this period. This increase limited growth in per capita electricity consumption.

6. The potential of renewable energy technologies to expand access to electricity

There is significant potential for increasing electricity access in isolated systems through the use of renewable energy. Renewable energy sources, such as PV, biomass, and small hydro, can be provided with local resources to remote communities, can guarantee the supply, have much lower environmental impacts, and allow energy independence [Goldemberg, 2002]. These aspects are significant for remote systems.

Comprehensive data on the potential of renewable energy to supply electricity to remote rural communities in Brazil is not fully available. General figures report the overall national potential, but further detailed studies are required for some regions.

Table 4. Electricity indicators pre- and post-reform

Indicator	1994 pre-reform	2000 post-reform
National electrification (%)		
Total electrification	92	95
– Rural areas	68	74
– Urban areas	98.5	99.2
Residential electricity consumption per capita (kWh/year)		
National average	442	499
Rural population	390	440
Urban population	560	576
Electricity tariffs		
Average residential tariff (US$/kWh)	0.098	0.179
Connection fees & charges (US$/connection)	810	970 (2002)

Sources: BNDES, 2002; IBGE, 2001a, 2001b; ELETROBRAS, 2003

Until 2001, there were no significant incentives for renewable energy technologies in Brazil, and therefore it was difficult for operators of small renewable energy projects to become established. A first important step was the enactment of Resolution 24/2001, which created the Emergency Program of Wind Energy *(PROEÓLICA)* and intervened in the market via price regulation. Later on, with the *PROINFA* Law (10438/2002), a general policy to promote renewable electricity in the interlinked system started. PROINFA provides that the following resources will be added to the grid by 2006: 1,100 MW from wind, 1,100 MW from biomass and 1,100 MW from small hydro plants. In the next 20 years, a target of 10 % of such sources in the electricity mix is to be achieved.

6.1. Photovoltaic (PV) energy

Although PV technology has been used in Brazil for almost two decades, only in the last few years is PV being seen as an alternative for electricity supply for basic needs in remote areas. Government programs, electricity distribution utilities, private entrepreneurs and a few NGOs are gradually paving the way for broader dissemination of the PV technology. Large initiatives are already under way but still need very close attention in this initial stage. The installation of PV systems is not enough to guarantee their proper operation and maintenance. It is necessary to train operators and to provide long-term technical assistance.

6.2. Biomass energy

As a large tropical country, Brazil has a high potential for the use of biomass. The main modern biomass sources are sugarcane products (ethanol and bagasse) and wood from reforestation. The use of bagasse for electricity production in sugar mills yields a considerable energy surplus potential of up to 4,000 MW, but in 2003 only 400 MW of surplus was produced. Use of this resource requires connection to the interlinked system.

In isolated regions, residues from agricultural activities, forest residues (branches, leaves, etc.) and sawmill residues (sawdust, wood chips, etc.) can be used as fuel to generate electricity with technologies commercially available in the country, such as gasification and small-scale steam cycles. However, there are still some difficulties related to the technical availability of small-scale systems. In Brazil at present there are several prototypes under development aiming to solve this problem.

Another huge opportunity for biomass use in remote villages is electricity generation from *in natura* vegetable oils. The Amazon region in Brazil has an enormous diversity of native oil plants, as well as favourable conditions of soil and weather for the cultivation of highly productive exotic oil plant specimens.

The use of animal wastes is also a technical and economically viable renewable energy source. The biogas produced can be utilized for heating, refrigeration, illumination, incubators, feed-mixers, electric energy generators, etc.

6.3. Small hydropower plants (SHP)

There are 297 small hydro plants (each less than 30 MW of capacity) operating in Brazil, totaling 802 MW. Another 465 MW are under construction. According to Eletrobrás, small hydro has a potential of 9,456 MW (12 % of the total installed power capacity in the country). The true value may be higher, given that there is still a paucity of information about small hydro. Properly located, this technology significantly reduces adverse environmental impacts compared to large hydro plants, helping the recovery of areas alongside rivers.

6.4. Wind power

There are several large regions in the country that have favourable wind conditions and are naturally suited to wind farms. The installation of these systems in sites with high annual yield factors would allow them to reach competitive generation costs. At present, there are 21.2 MW of wind power installed. Wind power has recently witnessed impressive development in Brazil and has potential for large-scale use in grid-connected generation.

6.5. Barriers to the use of renewable energy in off-grid power systems

The technical barriers to renewable energy use in isolated villages are not significant. In most cases it is a matter of adapting technologies already in use in other developing countries. The important aspects in relation to isolated areas are their small electricity demand, the lack of skilled people, and difficulties in properly operating and maintaining power equipment. In consequence, power systems for these areas must be of small capacity and as simple as possible. Also, technical assistance and training must be provided on a long-term basis. An additional problem for renewables is that investors consider the risks to be greater, so financial agents may reject projects or impose higher interest rates for loan approvals. An indirect barrier to the implementation of renewables is the current environmental legislation for stationary sources in Brazil. It does not cover highly polluting small-scale diesel electricity generators, which amounts to an indirect subsidy for these systems.

Worldwide, the main economic barriers to renewable energy projects include high initial costs and the small-scale production of equipment and systems. To overcome these barriers the creation of a market of minimum size is essential. The successful implementation of renewables has been based on tax incentives, but the Brazilian government has never formulated a comprehensive and long-term policy for renewables with this kind of incentive. Instruments such as tax reduction for imported devices of higher efficiency, credits on taxable income and accelerated depreciation have also been helpful elsewhere [CENBIO, 2000].

In general terms, regulatory actions by ANEEL address important issues, but there are many doubts concerning their effectiveness as tools for fostering renewable electricity in Brazil. In the event that the mandatory market is approved with no corresponding action regarding economic and science and technology policies, an external dependence on equipment suppliers will be created in several renewable energy sectors.

7. Final considerations and recommendations

Nearly 31 % of the Brazilian rural population, or 6.5 % of the total population (12 million people out of 165 million), have no access to electricity services. Low-income populations in peri-urban areas also lack access. These households either have to pay for the most expensive electricity (from batteries) or have very poor quality lighting.

Power sector reform has discouraged provision of electricity to rural and low-income areas because of its emphasis on the maximization of proceeds from privatization. The initial reform process did not focus on expanding access to electricity through concessionaires' actions. In addition, the regulators were not able to protect electricity tariffs from substantial increase, and as a result, increased access to electricity by the poorest section of the Brazilian population has slowed down. In this context, PRODEEM, Luz no Campo and Luz para Todos are important government initiatives to achieve universal access.

It is recognized that the power sector restructuring has not yet improved access to energy services. It can even be argued that privatization has contributed to reducing the pace of rural electrification and to increasing the cost of grid extension, becasue of new standards introduced, and to the freezing of incipient renewable energy projects based mainly in solar home systems. A concerted effort by the Ministry of Mines and Energy, ANEEL and Eletrobrás is vital to change the situation. The following are suggested.

- Regarding rural electrification, the full implementation of Luz no Campo program is necessary, as is an increase in the funding of PRODEEM.
- To improve the performance of the Luz no Campo and Luz para Todos programs, lessons learned from the PRODEEM implementation should be taken into account.
- Rural electrification through grid connections is generally not economically feasible. Energy supply in these cases must be decentralized, and there is an excellent opportunity for the introduction of renewable energy.
- Institutional models such as the permanence of the CCC program for renewable energy are needed to assure the sustainability of off-grid solutions.
- The permanence of RGR must be assured, and CDE funds that show a preference for renewable electricity sources must be supported.
- Electrification targets for universal access that have been recently established must be actually implemented and should give priority to remote areas with precarious energy access. It is important that the rules for award of permits within concession areas be clearly defined.
- Incentives such as the PROINFA program must be created to stimulate concessionaires to diversify their supply alternatives.
- Community participation in electricity management is fundamental in remote areas to reduce O&M costs.
- The social and economic benefits must be maximized to rural/remote communities through the implementation of sustainable local activities. ■

Notes

1. Of the 80,000 MW of installed capacity in Brazil, about 81 % is hydropower. The remaining electricity generation comes from poor-quality coal and an ever-increasing supply of domestic and imported natural gas. Small northern and larger southern electric grids were interconnected in January 1999 into one grid that serves 98 % of the country.
2. The minimum wage in Brazil in that year was around US$ 83 per month.
3. The exchange rate was US$1 = R$ 3.131.
4. http://lnweb18.worldbank.org/ESSD/sdvext.nsf/61ByDocName/Brazil-RuralPovertyAlleviationProgram
5. http://www.mme.gov.br/Noticias/2003/dezembro/Modelo_11.dez.03_Final1.pdf
6. Peter Greiner, former Secretary of Energy of Ministry of Mines and Energy (source: "Ex-secretário vê risco deredução de competição", *O Estado de São Paulo,* Sábado, 13 de dezembro de 2003)
7. The maxi-devaluation also made even more expensive the price of imported capital goods and fuels, such as the Bolivian natural gas supplied under a take-or-pay contract in dollars.

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Title index

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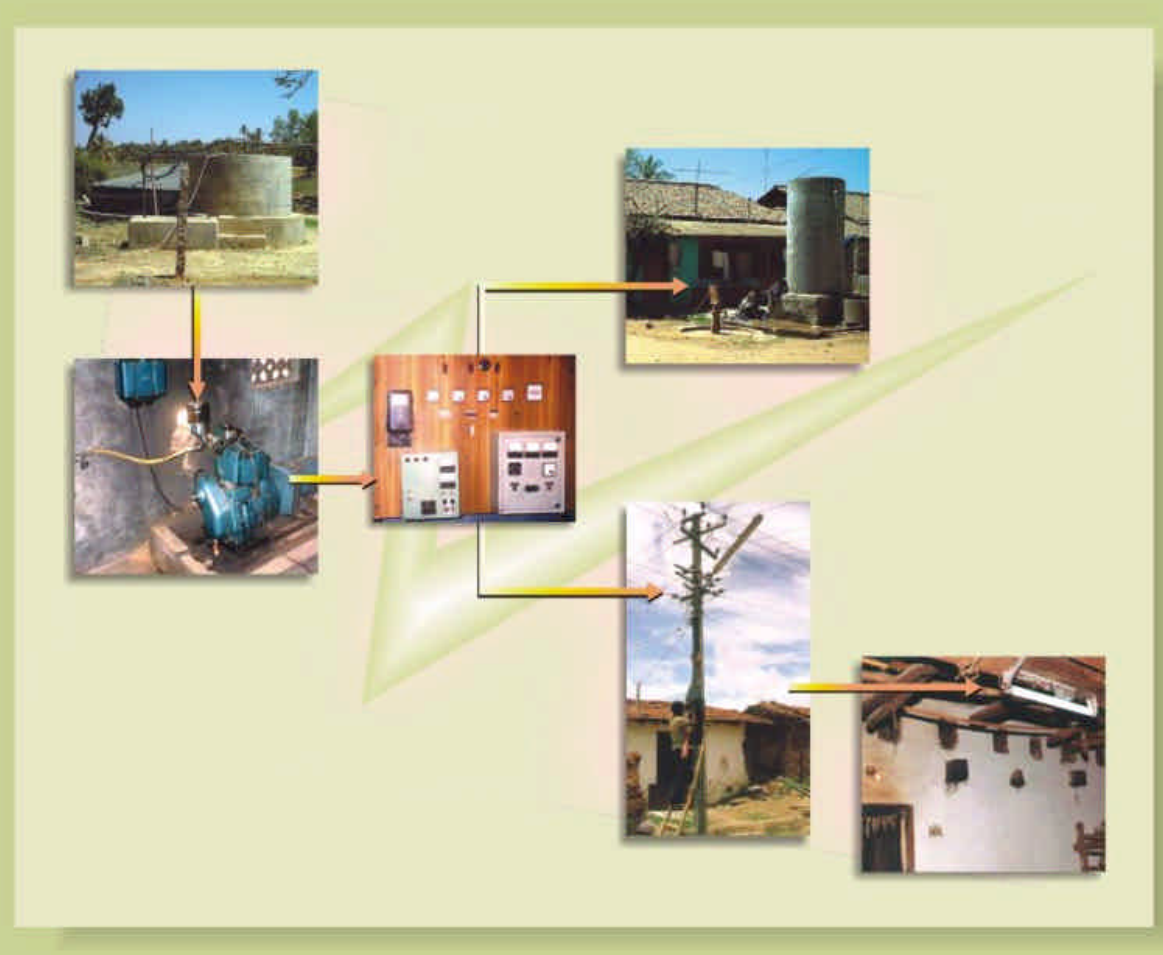
Author index

The sequence of entries is as follows: Author (in alphabetical order), title, department of the journal, issue no. and publication date, page(s).

Basic electricity services can make a big difference to the quality of life of the poor



Almost half the world's population is poor by the standards of international agencies, and large numbers of them have no access to electricity. In developing countries, particularly in the rural areas, where most of the people are poor and most of the poor live, efforts to provide them access to electricity have achieved slow progress. This issue of *Energy for Sustainable Development* is devoted to the findings of a project that assessed the impact of power sector reforms on access to electricity for the poor in a wide selection of developing countries.

The diagram shows a decentralised electrification scheme implemented by an NGO at village level in India. Biogas from a biogas plant is used in an engine with a generator to produce electricity. This in turn runs a pump to supply water to homes and is also distributed to homes where it offers basic lighting. Such initiatives have only made a small dent in the problem. National electrification programmes have had mixed success, and many power sector reform policies have paid insufficient attention to the need to protect essential access to electricity for those who can barely afford it.

Basic access to electricity can be a lifeline for the poor, and economic reforms must take care not to weaken or break the lifeline.

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