Institutional Reforms and Electricity Access:

Lessons from Bangladesh and Thailand

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Abstract

The paper discusses the institutional reforms for rural electrification (RE) in Thailand and Bangladesh and analyses the impacts of private sector participation in electricity generation and tariff reforms on the poor in Thailand. RE program in Thailand, initiated in 1977, increased electricity access by rural households from 7% in early 70s to 97% by 2000. In Bangladesh the RE program, initiated in 1977 when electricity access by 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 electrification level and average household electricity consumption were found not affected 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. Majority of the poor rely on traditional biofuels to meet bulk of their energy needs and have no access to electricity.[2] About 37.8% of total population in South Asia and 59.2% in Southeast Asia do not have access to electricity [IEA, 2002]. The electrification level in the rural areas of South and Southeast Asia is 30.1% and 50.8%, respectively, compared to 68.2% and 89.9% in the urban areas [IEA, 2002 and Montgomery, 2003].

Access to electricity in the rural areas, which had higher incidence of poverty compared to 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.

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 Karimi, 2002]. On the other hand it is felt that

efficiency improvements in 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 structure but had varied achievements. 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.

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

Source: UNDP (2002); World Bank (2003); IEA (2002).

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 in 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 RE programs in the two countries. Section 4 presents discussion on 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 impact of these reforms on the poor. The impacts on poor are analyzed through comparative analysis of impact of reforms on the electricity tariff, electricity consumption, and electricity expenditure for the poor with that 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 distribution network was limited to urban and sub-urban peripheries. The RE programs in both the countries was initiated to address the low level of electricity access in the rural areas.

The RE program in Thailand was implemented through Provincial Electricity Authority (PEA), which is responsible for electricity distribution in provinces. Provincial Electricity Organization (PEO), predecessor of PEA, was established in 1954 with the responsibility to generate and distribute electricity to all areas of Thailand except the Bangkok metropolitan areas. 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[3], with mandate for generation and transmission of electricity in Thailand. With 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 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". The long-term plan was divided into 5-year plans in line with the 5-year national economic and social development plans (NESDP) of the country. Each plan set specific targets for increasing electricity access in rural areas [Chullakesa, 1992]. Office of Rural Electrification (ORE) was established by PEA for planning and implementing the ARE programme.

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. Prior to establishment of REB, the Bangladesh Power Development Board (BPDB), a public sector organization and a vertically integrated utility, was the sole agency responsible for generation, transmission and distribution of electricity throughout Bangladesh. In 1991 Dhaka Electricity Service Authority (DESA) was established to operate and manage distribution in the Dhaka Metropolitan and adjoining areas. Further, 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 City and its 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 transmission system.

The RE program in Bangladesh is two tiered. REB was responsible for planning and developing the distribution network and divested the management responsibility of distribution to end users to the electric cooperatives or *Palli Biddut Samities* (PBS). REB prescribes the by-laws for the PBS 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 PBSs staff; and monitoring management, financial and system operations activities. Each consumer is a member of the PBS. PBS is responsible for preparing master plan on electrification of its members and forecast load growth. PBS also manages financial and operational activities. In 2002, 67 PBSs supplying 4.2 million electricity connections were operational.

The RE programs in both countries had a number of similarities. The first similarity is 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 the 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 approach 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 PEA's electrification plans as well as issues such as right-of-way, financial contributions, communities needs and constraints. In Bangladesh, PBS is a cooperative constituting of all the customers 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 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 cost of developing the distribution network. The expansion of distribution network to new areas in Thailand was prioritized based on a number of factors including the expected load, proximity to grid, and income levels. End users (villages) willing to bear partial or complete 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 lead

to immediate electrification of the village. Though a significant part of the funds contributed by the end users (Villages) were in fact local government contributions.

The fourth similarity in the RE programs of the two countries is the use of subsidies to residential customers. In Thailand, PEA received electricity from EGAT at a lower tariff compared to MEA. Further, PEA supplied electricity to its residential customers at a lower tariff compared to its commercial and industrial customers. In Bangladesh, REB received electricity from BPDB at a concessional bulk supply rate for resale to PBSs.[4] PBSs sold electricity to its residential customers at a lower tariff than its commercial and industrial customers. Additionally, in Bangladesh, PBSs receive grant funds from government during initial years of operation to meet the revenue shortage vis-à-vis its expenses [Sikdar, 2003].

An important difference in the RE programs of the two countries was operation and management of the distribution network. In Thailand, 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 customer 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 customer 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 customers to access electricity. This section presents achievements of the RE programs in the two countries. The achievements are evaluated by comparing the effect of 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 % of household electrified), and electrification rate (defined as growth rate of electrified households). In 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 case of Bangladesh, the data is from various published reports and papers.

3.1.Electrification Level

In Thailand, rural electrification efforts during the 1960s were through use of decentralized diesel-generating plants. The growth of electrification was relatively low during this period and only 7% of the rural households had access to electricity in early 1970s. In 1978, a year after initiation of the ARE program, only 19% of the total households had access to electricity.

By 1984 this percentage had increased to around 43% and by 1986 to 86% and by 1990 electrification level was more than 91%. Figure 1 shows the electrification level in Thailand.

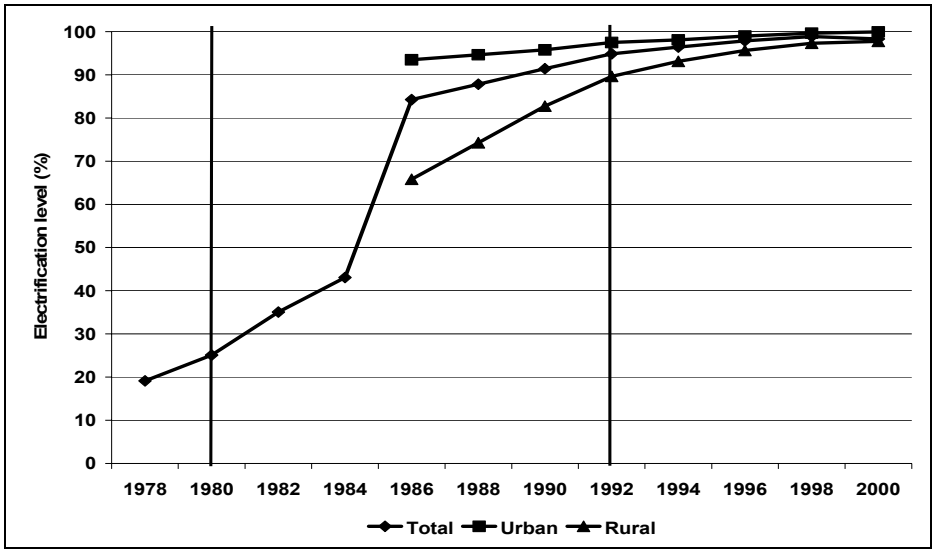

Figure 1. Electrification Level from 1978-2000 in Thailand

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

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 household has access to electricity as compared to 98% of the urban household. By the year 2000 percentage of household 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, comprising 91.2% of the population in 1974,[5] 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, 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).

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*	40.7	73.7	80.0

Source: ADB (1983); BBS (1976, 1985, 1993, 1997); Temple (2002).

*: 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

Source: Author's calculation based on ADB (1983); BBS (1976, 1985, 1993, 1997); Temple (2002).

As the electrification level reflects 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 to 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 1994 to 1998.

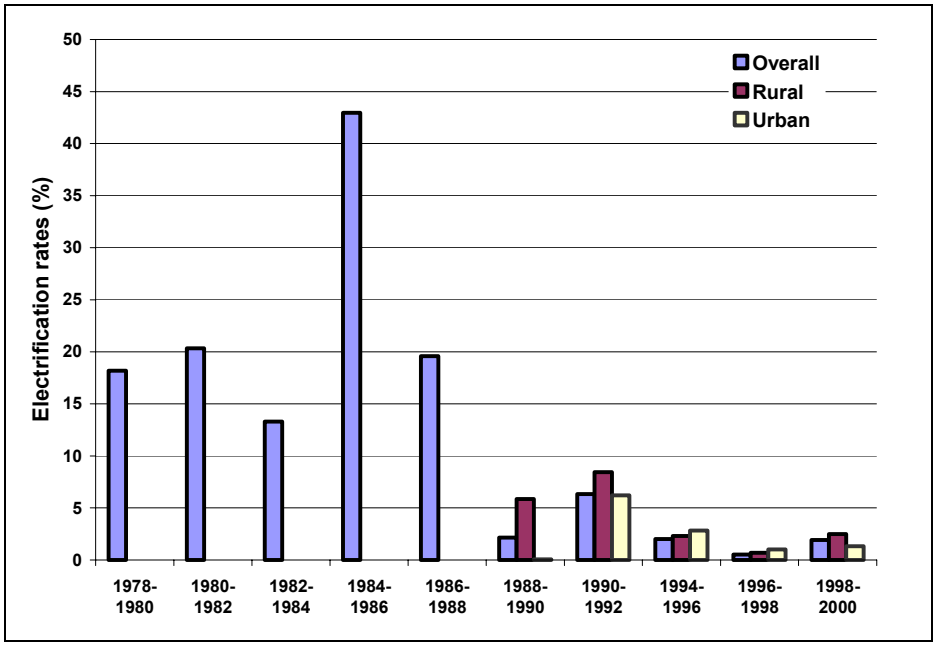

Figure 2. Electrification Rates* from 1984-2000 in Thailand

*Compounded annual growth rate during the given period

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

Table 4 presents data on the electrification rate in Bangladesh. The annual average electrification rate in the rural areas during the decades of 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 area. The higher electrification rate is partially due to low level of initial electrification in the rural areas. But in the decade of 1990s the total number of households with access to electricity supply in the rural areas was larger than that in the urban areas.

Table 4. Annual Average Electrification Rates (%)* 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

Source:Author's calculations based on ADB (various years); BBS (various editions) REB (2000)

*These are compounded annual growth rate between the given periods.

The RE program in Thailand was able to provide a high degree of electricity coverage. In Thailand more than 80% of the rural household 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 of electrification level between rural and urban areas.

Bangladesh, despite following a similar RE model as Thailand, achieved only a modest improvements 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 effective rural area, but households having access to electricity remains low.[6] 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 Thailand in terms of household connectivity.

4. Why was rural electrification program more successful in Thailand than 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 customers, 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, investment climate in the country, etc., 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 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 use allocated new resources for rural electrification for the expansion of distribution. PEA partially used cross-subsidy from its commercial and industry customers to residential customers (Table 6). 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 customers (Table 5). 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 customers from PEA's non-residential customer base and EGAT's non-PEA costumer base implied the public resources that would have been otherwise used to subsidize the rural residential customers were available to be used for new investments.

Table 5. 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 (mill kWh)	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

Source: Basic data various Annual reports of EGAT. Calculation by authors.

Table 6. Subsidy received by the poor through Cross-subsidization from other PEA Consumers in Thailand

	2003	**2002**	**2001**	**2000**	**1999**
Electricity consumption by poor (mill kWh)	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 various annual reports of PEA. Calculations by authors.

PBS in Bangladesh also subsidizes its residential customers vis-à-vis its commercial and industrial customers. But in most cases the PBS are not able to meet their operational costs. [Khan, 2003] observed that only 57% of the PBSs are viable, whereas, [Dhakal, 2003][7] reported that of the 67 operational PBSs only 25% are self sustaining. The Government of Bangladesh (GoB) funds to PBS to meet the revenue deficit. In absence of

data, it is not possible to estimate total losses generated by PBS 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 BPDP to its various customers. As can be seen from the table REB received 1,609 million takas of subsidy during year 2002. DESA, distributor in Dhaka Municipality too received a subsidy unlike MEA in Thailand.

Table 7. Subsidy over average sale price of BPDB to its customers in Bangladesh for FY02

	Sales (GWh)	**Current Tariffs** Tk/kWh)	Subsidy over average tariff	Total Subsidy (million takas)
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 Inst.	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 (33KV)	2,668	1.75	0.59	1,574.12
REB (11KV)	71	1.84	0.5	35.5
Municipalities	101	3.45	-1.11	-112.11
Total/Avg.	**1,6376**	**2.34**		

Source: Author's calculation based on Temple (2002)…

[Temple, 2002] estimated that the average cost of electricity supply to BPDB in FY2002 was taka 3.08 per kWh. Thus the average selling price of BPDB was below its cost of supply, providing a total subsidy of 12170 million taka 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] study.
- High system losses of BPDP: [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 range of 30%. They state that technical losses can at the most be 10%, rest (20%) being non-technical losses. The non-technical losses in system during 1999-2000 are estimated to have resulted in a loss of Tk 7,763 million (134 million USD).
- Low rate of bill recovery [World Bank, 2000]: Outstanding electricity bill in Bangladesh is estimated to be Tk 57,693 million (1,012 million USD)[Alam et.al., 2004 citing Rahmatullah, 2001]. DESA has also been running in 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 come 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 in expanding electricity infrastructure. Also it is likely that this affected the available resources with the government for allocation to the RE program.

Table 8. Net Profit/Loss* BPDD and DESA (billion Takas) 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).

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

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.

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".[8]

4.2.Generation Capacity

Inadequate electricity generation capacity is likely to affect the expansion in 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].[9] This is also indicated by the fact that compounded annual growth rate (CAGR) of rural household 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 corresponding years in Bangladesh. Capacity additions by BPDB fell short of projected capacity requirements. As discussed earlier, the losses in Bangladesh electricity utilities affected the availability of resources for expansion of generation capacity.[10] The 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.

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) and REB (2000).

Table 12. Planned v/s Actual Capacity Expansion in Bangladesh

	1984	1989	1994	2000	2005
Actual total installed capacity (GW)	1,121	2,305	2,608	3,603[2]	4,680[3]
Effective generation capacity[4] (GW)	1,018	1,834	2,135		4,368
Estimated capacity based on demand projections (GW)			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.

1:These are projections made by BPDB, as reported in World Bank (1985). The demand represents actual consumption by customers and not gross generation.

2: Source: http://www.sdnbd.org/sdi/statisticapocketbook/Chap07/0701.htm. The figures refer to year 1998/99.

3. Source: Website of BPDB. The date is for year 2003. The installed capacity includes capacity addition of 1260 MW by IPPs.

4: Source: Fifth Five year plan (1997-2002) Bangladesh. Figure under column 2005 is for year 2003 and from BPDB website.

In contrast to 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 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 13. Planned v/s actual capacity expansion in Thailand

	1984	1989	1996	2000	2005
Actual total installed capacity (GW)	5,921	6,967	14,973[1]	22,269[1]	23,755[1]
Estimated capacity based on demand projections (GW)			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.

1. source – various annual reports of EGAT. The generation capacity includes the capacity of IPPs. The figures for actual capacity and generation under year column 2005 refer to year 2002.

2: Malhotra, Sinsukpraser, and Eglington (1994)

4.3.Economic Growth

A high economic growth implies higher incomes, greater paying capacity and therefore increased demand for access and higher consumer density. Customer density is an important factor in viability of the distribution expansion. A low customer density in the network implies high development cost per consumer and, hence, larger subsidies per customer to make access viable to the households. Higher economic growth also implies larger non-residential customer base and consumption. As discussed in earlier sections, non-residential customers are a resource for providing subsidy to residential customers, 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 RE program implementation. The poverty levels in Thailand are very low (< 2%) as compared to 36% in Bangladesh in 2000[11]. High poverty level in Bangladesh implies a larger fraction of consumer base with very low paying capacity compared to that in Thailand.

Table 14. GDP and GDP per Capita Growth Rates (%)

	1970-80	1980-90	1990-2000
Bangladesh - GDP growth	2.8%	3.7%	4.8%
Bangladesh income growth		1.2	2.5
	1976-86		1987-97
Thailand – GDP Growth		6.0	8.7
Thailand - Income growth		3.7	7.2

Source: Bangladesh Bureau of Statistics & Thailand Economic Monitor, World Bank (1999).

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 due to subsidy to residential customers as PBSs have high proportion of residential consumer resulting in low revenues [Khan, 2003]. In Bangladesh, 57% 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 adequate resource base for subsidizating its residential customers. Smaller non-residential resource base was a factor that seems to have inhibited the electrification rate in Bangladesh.

Table 15. Power Market Share of Domestic and Commercial/Industrial Consumers

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

Source: ADB (1997).

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 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 power sector are aimed at moving towards commercial operation in power sector. The reforms are expected to increase the tariff [Karekezi and Kamani, 2002]. Albouy and Nadifi (1999) stated that the tariff increases in countries that have undertaken reforms are observed for customers paying less than the cost of supply prior to reforms [Albouy and Nadifi, 1999]. 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 enables delivery mechanisms that increase access [Albouy and Nadifi, 1999], whereas, [Karekezi and Kamani, 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 early 1990s with the aim to privatize the power sector. Two major reforms were undertaken, viz., tariff reforms to reflect cost of supply in the tariffs and opening of 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[12]; 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[13]. 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.

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 (SPP and IPP) 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[14] retain monopoly in distribution and retail in their franchise areas.
Regulation	Since the three utilities are state enterprises, the government through the Prime Minister 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 was small.

Source: Author's compilation…

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 the rural electrification. 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 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 for 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 customers 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.

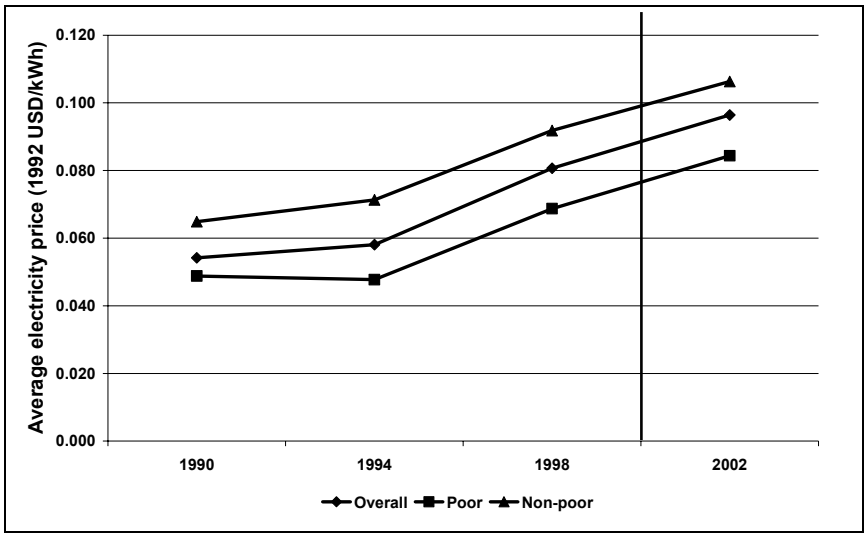

Figure 3. Electricity Tariffs During 1990-2002 in Thailand

Source: PEA Annual Report (various issues).

The figure shows that for the period from 1990 to 1994 when 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 have 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 comparison of average tariff at which EGAT sold power to PEA and MEA highlighting the subsidy received by PEA from MEA.

Table 17. EGAT Bulk Supply Tariff to the Distribution Utilities (Cents/kWh) (Please indicate the currency) 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

1US$ = Baht 42 as of December 2002.

Source: NEPO (2000*)*.

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 consumption pattern on 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[15] 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 slightly higher rate as compared to the consumption of the non-poor. The trend in growth also indicates that 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 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 the poor. The dip in per capita consumption after 1998 could be because of the economic crisis in Thailand.

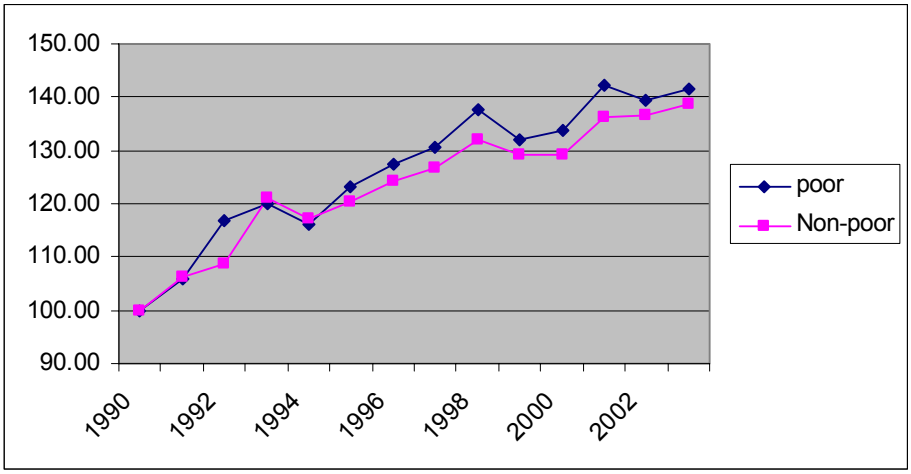

Figure 4. Index number of Electricity Consumption per Household during 1990-2003 in Thailand (1990=100).

Source: Various annual reports of PEA.

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 categorised 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 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 as 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.

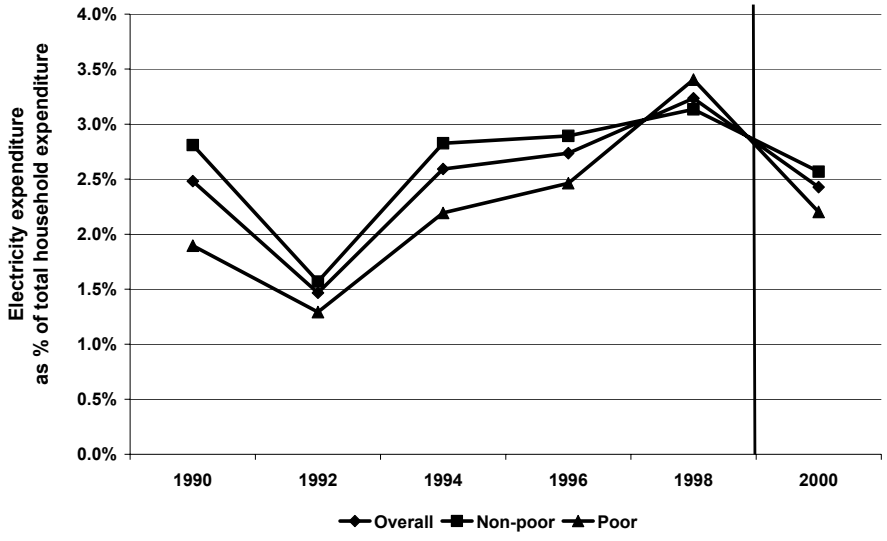

Figure 5. Electricity Expenditure as % of Total Household Expenditure

Source: NSO Household Socio-economic Survey (various editions).

Table 18. Compounded Annual Growth Rate of Average Income, Average Total Expenditure, and Average Electricity Expenditure per Household Between 1990 and 2000

	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).

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, growth rate of expenditure on other goods and services was higher than that for electricity, and hence the percentage of electricity expenditure has declined.

The income for the poor during 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 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 increase in the 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 approaches, the achievements of the RE programs were more significant in Thailand where the RE programs increased electrification from 7% in early 1970s to 97% of rural households by 2000, whereas, in Bangladesh only 19% of households were electrified by 2000. REB/PBS has covered 90% of 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: (i) adequate electricity generation capacity – In Thailand generation capacity to meet the growing demand from expansion in distribution network was not a barrier, whereas, inadequate generation capacity appears to have affected rural electrification in Bangladesh; (ii) 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; and, (iii) higher economic growth - Higher economic growth in Thailand seems to have affected rural electrification by increasing the purchasing power of customers as well as increased resources base in terms of commercial and industrial customers. On the contrary economic growth

in Bangladesh was lower 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 factors include necessary skills and competencies to build a power network, adequate transmission network, and financial/investment climate. These factors may be included in the 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.

Acknowledgement:

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Notes

1. Author for correspondence: ram@ait.ac.th
2. http://www.gnesd.org/rationale.htm (30th June 2004)
3. In the early 1960s, the government established other various 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 the Thailand; 2) the Northeastern Electricity Authority (NEEA) was established in 1962 to provide electricity in the northeast where the hydro-electric plant was situated; 3) Private franchises which were managed as electric utilities by private concessionaires in their concerned areas.
4. http://www.orierc.org/docs/BANGLADESH.pdf (21 July 2004)
5. http://www.bbsgov.org/ - 30th June 2004
6. Source: http://www.bangladeshgov.org/reb/about_reb.htm on 13th June 2004.
7. Dhakal, Sanajaya, 2003. Rural Electrification – Setting example
8. (http://www.environmentnepal.com.np/articles_d.asp?id=195)
9. http://www.sdnbd.org/sdi/metadata/fifth5-yesr-plan/252.htm (21st July 2004)
10. At 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; the poor bill collection; inadequate tariff structures leading to financial losses; and lack of enough funds available for expanding the distribution system and new connections.
11. Fourth Five year plan. http://www.bbsgov.org/
12. Population earning less than 1US$ a day. (Human Development Report 2003)
13. 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 based on usage in each time zone classification and a service charge. In Time of Use (TOU) system, consumption was charged based on consumption during peak and off-peak hours. The concept of partial peak applicable in TOD was dropped. The customers pay energy charge based on time of use and a fixed service charge.
14. Most SPPs generate for own use and sell excess electricity to EGAT.
15. 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).
16. 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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