TARIFF APPRAISAL STUDY

BALANCING SUSTAINABILITY AND EFFICIENCY WITH INCLUSIVE ACCESS

Tilak Siyambalapitiya

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ABBREVIATIONS

ADB	–	Asian Development Bank
ARR	–	annual revenue requirement
BEA	–	Bhutan Electricity Authority
BERC	–	Bangladesh Energy Regulatory Commission
BPC	–	Bhutan Power Corporation Limited
BPL	–	below poverty line
BTI	–	beneficiary target index
CEB	–	Ceylon Electricity Board
ETFC	–	Electricity Tariff Fixation Commission
IBT	–	increasing block tariff
MEA	–	Maldives Energy Authority
MYT	–	multiyear tariff
O&M	–	operation and maintenance
PUCSL	–	Public Utilities Commission of Sri Lanka
PV	–	photovoltaic
SERC	–	State Electricity Regulatory Commission
TOU	–	time of use
US	–	United States
VDT	–	volume differentiated tariff

CURRENCY UNITS

Bangladesh	-	taka (Tk)
Bhutan	-	ngultrum (Nu)
India	-	Indian rupee (₹)
Maldives	-	rufiyaa (Rf)
Nepal	-	Nepalese rupee (NR)
Sri Lanka	-	Sri Lankan rupee (SLR)

In this publication, currency equivalents are specified as required in data presented.

WEIGHTS AND MEASURES

GWh	–	gigawatt-hour
kV	–	kilovolt
kVA	–	kilovolt-ampere
kW	–	kilowatt
kWh	–	kilowatt-hour
MW	–	megawatt

GLOSSARY

beneficiary targeting	–	a special consideration or a subsidy targeted toward a beneficiary
bulk supply service tariff	–	the costs allowed to be charged for the provision of bulk supply services, typically buying from generation and selling to distribution entities or large customers
bulk supply tariff	–	the price (or price structure) at which electricity is sold from transmission to distribution; includes generation costs, transmission costs, and bulk supply service costs
connection rate	–	the share of customers within reach of a distribution line (definitions vary across countries, typically 100 meters), who have an active electricity connection
connection subsidy	–	subsidy toward receiving a connection to the distribution utility
consumption subsidy	–	subsidy toward the use of electricity
cost-reflective tariff	–	price of electricity that reflects the costs of supply to the class/category of customer
cross-subsidy	–	subsidy awarded to one category of customer to enable the price to be below the cost of supply, earned by charging another category (or categories) of customer above the cost of supply to that category
digital metering	–	measurement of electrical energy; rate of use of electrical energy, voltage, current, or other parameters using digital technology
distribution tariff	–	the allowed costs (either in total or on a per kilowatt-hour [kWh] basis) for the provision of distribution (wire) services
dynamic pricing	–	pricing electricity, even on real time, to reflect the varying costs of supply
electrification ratio	–	share of households that have an active electricity connection. In certain South Asian countries, this may be defined as the percentage of villages that have received an electricity supply, which does not imply that all households in an electrified village have an active connection.
gross subsidy	–	subsidy to the electricity industry as a whole, to pay for all or some of the customers charged below their cost of supply
increasing block tariff	–	the system of pricing electricity in which the price of a unit of electricity increases as the consumption moves from one block to another. Blocks are defined for a billing period of 1 month; consumption within the block would be priced at the block price, irrespective of the customer's total consumption.
lifeline block	–	units of electricity allowed for a defined period, typically for 1 month, at the lifeline tariff. Lifeline blocks are usually between 10–100 kWh per month per household.
lifeline rate	–	the price of electricity charged for a specified number of units of electricity used over a defined period that is presumed to be adequate to meet the basic need of a household. The defined period is usually 1 month; the tariff is substantially subsidized; basic needs include lighting.
lifeline tariff	–	same as lifeline rate

multiyear tariff	–	a tariff determination that covers typically 3–5 years ; applied to determination of annual allowed revenue for transmission and distribution activities; considers investment plans, sales forecasts, and existing assets and liabilities to derive yearly allowed charges for the business
retail supply tariff	–	the allowed costs (either on per customer or per kWh basis) for the provision of service connection, metering, meter reading, accounting, allowed profits, bad debts
revenue separation	–	separation of income and expenditure of each business line of a utility into generation, transmission, bulk supply, distribution, and retail supply
sanctioned load	–	approved demand for electricity, typically stated in kilovolt-ampere (kVA) or ampere. If the rate of consumption increases beyond the sanctioned load, a penalty may apply or electricity supply may be automatically cut off by protection devices.
single buyer	–	the entity designated as the sole buyer of electricity in countries where the bulk supply business is not liberalized. Any party wishing to sell electricity should sell only to the single buyer; any reseller (e.g., distribution utility) should buy only from the single buyer.
transmission tariff	–	the allowed costs (either in total or on a per kWh basis) for the provision of transmission (wire) services
unit of electricity	–	commonly used term to refer to a kWh of electricity
vertically integrated utilities	–	electricity supply organizations (corporations, boards, companies) that are engaged in all the five operations within the electricity utility industry: generation, transmission, bulk supply, distribution, and supply
volume-differentiated tariff	–	the system of pricing electricity wherein the price of a unit of electricity increases as the consumption moves from one block to another. Blocks are defined for a billing period of 1 month. The entire monthly consumption will be charged on the rate of the block where the customer's total monthly consumption lies.
wheeling	–	carrying electricity over a transmission or distribution network from one point to another
wheeling charge	–	charge for transporting a unit of electricity across a transmission or distribution network

EXECUTIVE SUMMARY

This study examines socially inclusive electricity tariffs in six countries of South Asia: Bangladesh, Bhutan, India, Maldives, Nepal, and Sri Lanka. Tariff diversity was analyzed across Indian states: Assam, Gujarat, Kerala, Madhya Pradesh, Maharashtra, and Tamil Nadu.

The results indicate that regulatory reforms have been implemented in all countries, with varying degrees of analysis, depth, and success. All countries have a regulatory commission or an equivalent arrangement. Tariff filings and determinations are regular in some countries, but occasional in others. Electricity utilities are increasingly required to be technically and financially independent; most countries have unbundled the vertically integrated utilities to separate corporate entities.

Country subsidies varied from (i) 100% free electricity to rural households in Bhutan; (ii) free electricity to households with handlooms and power looms in Tamil Nadu, India; and (iii) up to 5% subsidy for small industries in Tamil Nadu. All free or significantly subsidized electricity is limited.

The lifeline block of an increasing block tariff in most countries appears to be the only instrument to implement socially inclusive tariffs. The lifeline block (or blocks) is arbitrarily defined, with no significant analysis of its relevance in meeting the basic needs or the channel to reach its intended target beneficiaries. Improved analysis of impacts, such as providing more information on who pays for the subsidies, analyzing and presenting subsidies (and surcharges) in regulatory documents, and indicating the subsidy amount in the bills issued to customers, would assist the overall process of delivering relief to socially disadvantaged customers.

The performance of lifeline tariffs in reaching their implied or defined objectives is weak due to (i) limitations in defining what the lifeline quantity of electricity is, (ii) poor targeting of the subsidies received, and (iii) shortcomings of the governments in meeting the subsidy payments to utilities. Cross-subsidies within the electricity sector (i.e., charging other customers higher than what it costs to supply electricity to them) is the most common way of meeting the social objectives of tariffs. Some governments pledged a direct, well-calculated subsidy to customers through utilities, and honored and paid the subsidies so pledged.

Studies in many countries, especially those with very low connection rates (e.g., in Africa) as well as those with high (almost 100%) connection rate (e.g., Sri Lanka), have shown that customers cannot benefit from lifeline tariffs because some simply cannot afford the cost of house wiring and connecting to the grid. In countries with lower connection rates, the reason is widespread poverty. The economic cost of extending the grid would not yield its intended benefits, unless such projects are accompanied by a mechanism to support house wiring and to pay the electricity connection cost.

Countries in the study have not implemented any subsidies based on gender, which would be unrealistic to expect from modern, regulated utilities unless clear policies and mechanisms are established by regulators. Some subsidies have been proposed in India for women entrepreneurs, and there are discussions on a similar approach in Maldives. It is too early to make any conclusions on the possible benefits of such tariffs, but socially disadvantaged families are more in need of connection support and capital to commence a business undertaking.

However, special tariffs and subsidies that support cottage and small industries, and businesses—which in some countries are driven by women entrepreneurs and have women as majority employees—would directly benefit women and assist in empowering women.

All over South Asia, there is societal expectation that electricity should be subsidized, judging from various statements of political and administrative authorities; and objections from customer groups often appear in the press when subsidies are proposed to be withdrawn or reduced. Pricing electricity by purpose rather than by voltage is widespread throughout South Asia. However, pricing of other commodities including other forms of energy (e.g., gasoline, diesel, gas) and utility services (e.g., water, telecommunication services) is largely accepted by society in terms of place of delivery and quantity delivered, with no reference to the purpose for which the service is used or to the income level of the buyer.

I. INTRODUCTION

Electricity utilities are increasingly required to be accountable for their income and expenditure through enhanced regulatory reforms across the region. Utilities are frequently faced with the question of who pays for the subsidies. This study examines the prevailing policies and tariffs in six countries in South Asia to identify lifeline tariffs, subsidies, and cross-subsidies, and the overall regulatory treatment of the subject of making tariffs socially inclusive. Through a desk study using published information from the Asian Development Bank (ADB), country regulatory agencies, and public utilities, the study examines the consumption subsidies provided to households and small businesses, and compares the tariff levels against each other. The study further examines the issue of beneficiary targeting to identify who receives what amount of subsidy and who pays for those subsidies.

This study is specifically limited to the use of electricity from public grids, although it is recognized that mini-grids, micro-grids, or individual household electricity generation units (such as solar home systems, solar lanterns) provide a valuable entry point to households in remote locations where the grid may not have reached. While research and development continue, which may in the longer term enable mini-grids and micro-grids to also provide electricity at a comparable quality, reliability, predictability, cost, and price as in main grids, this study assumes that the present perceptions of any household in Asia will prevail: (i) the grid has to be extended to reach their households, commercial, and industrial premises; (ii) the price of electricity should be "affordable;" (iii) electricity should be available on demand; and (iv) the customer would not be called upon to maintain electricity generation and supply facilities through personal effort.

The study reviews literature on the status of electricity use in household and small commercial activities. Renewable energy for electricity generation at the household level, especially through solar photovoltaic systems, has opened up new avenues for on-grid electricity customers to produce electricity and offset all or a portion of their expenses, or to be net electricity producers. Countries have different rules and regulations for such participation, as this report describes.

II. REVIEW OF ELECTRICITY REGULATORY STATUS, LAW, AND PRACTICE

This study covers six countries: Bangladesh, Bhutan, India, Maldives, Nepal, and Sri Lanka. All these countries have moved away from the traditional government-administered electricity tariffs that prevailed over several decades to a process that offers at least a limited degree of transparency in tariff determination. None of these countries have achieved complete independence in tariff determination or economic regulation, with a free hand given to the regulator to determine tariffs, and none have implemented truly cost-reflective tariffs for the sale of electricity to end use customers. Many countries have retained some of their traditional principles and practices such as (i) providing gross subsidies to the electricity industry,[1] (ii) setting tariffs to facilitate cross-subsidies across customer groups, (iii) using the electricity industry to provide relief to low-income customers, and (iv) pricing electricity based on the purpose of use as against the voltage of supply.

The desire to move to cost-reflective customer tariffs, to remove subsidies from the electricity sector, and to move direct or indirect gross subsidies[2] from governments to the electricity industry generally

[1] A gross subsidy is a sum of money pledged by the government to an electricity utility to assist either a group of identified customers or the utility as a whole, so that electricity prices would be kept below their costs.

[2] A direct gross subsidy means cash support to a utility. Indirect gross subsidies may include preferential pricing of fuel used for electricity generation, concessions in sales taxes, import duty, and tax on profits.

come into conflict with the desire of the governments of developing member countries to use electricity to create an enabling environment for economic growth. Customer tariffs have finally settled for two objectives: (i) achieving cost-reflectivity, and (ii) using electricity pricing as a tool to provide subsidies.

A. Tariff Regulation in Bangladesh

The Bangladesh Energy Regulatory Commission (BERC), formed in 2003, is a five-member independent commission that regulates the energy sector (electricity, gas, and petroleum products) in Bangladesh. BERC is fully operational, except for a few types of decisions that require consultation with the government. BERC states its mission to be (i) enforcement of fiscal discipline in the energy sector, (ii) introduction of performance targets and incentive-based regulation, (iii) introduction of uniform operational standards and quality of supply, (iv) transparency in tariff determination and economic efficiency, (v) increased opportunities for development of competitive markets, (vi) increased opportunities for efficiency and economic growth, and (vii) public involvement in the energy sector.

The electricity industry in Bangladesh is unbundled, with private sector participation in generation (fully privately owned generation and state-owned corporate entities), while some previously state-owned distribution entities are corporatized but largely remaining as state-owned companies. Distribution activities of the Bangladesh Power Development Board, the previously vertically integrated national utility, continue to remain under the board, which also has generating plants and performs the role of the single buyer. Rural cooperatives function as distribution utilities, supervised by the Rural Electrification Board.

In 2014, BERC issued the regulation on a uniform system of accounts for tariff regulation work. In addition, BERC issued tariff regulations for distribution tariffs and transmission wheeling charges in 2015, which have existed as draft documents for a few years. The tariff methodology is not widely known among the utilities nor practiced by the regulated entities. As such, the regulatory environment and implementation of tariffs and related regulatory initiatives are still underway. On the technical front, the grid code has been finalized and published, while other crucial documents such as the distribution code, performance standards, etc. are evolving. All distribution utilities have published a "citizen's charter," covering largely the explanatory notes on tariffs and service connections. Some utilities have published key performance indicators, including targets and achievements. These indicators include indexes to monitor technical quality of services to customers in terms of outage frequency and duration.

In 2015, BERC made determinations on (i) customer tariffs for all distribution utilities, (ii) distribution tariffs for each distributor, (iii) wheeling charges for Power Grid Company of Bangladesh. BERC holds open meetings, with subjects listed in advance for discussion. There are no reports of ex post reviews of tariff determinations, or true-up,[3] to adjust for any estimates and forecasts used in the tariff, after such information becomes available at the end of the tariff period.

B. Reforms and Tariff Regulation in Bhutan

The Bhutan Electricity Authority (BEA) was initially established as a functional autonomous agency in accordance with the Electricity Act of Bhutan, 2001 to regulate Bhutan's electricity supply industry, and was subsequently granted full autonomy by the Government of Bhutan in January 2010. It consists of

[3] "True-up" is an exercise in which assumptions used in tariff calculations are reviewed at the end of a tariff period, and electricity utilities are compensated or surcharged for the difference between the tariffs calculated at the beginning and at the end of the tariff period.

four commission members and a chairman, all appointed by the minister, with a full-time secretariat in Thimphu. It is headed by a chief executive officer, who is also the BEA's member secretary. The BEA's functions are to regulate the electricity supply industry and to (i) set technical, safety, and performance standards for the electricity sector; (ii) develop electricity tariff regulations and approve tariffs; (iii) issue licenses; (iv) monitor compliance of licensees; (v) settle disputes that may arise between licensees or between a customer and a licensee; and (vi) determine royalties, fines, penalties, to be paid by licensees.

Tariff determinations are done in accordance with the tariff determination regulations (first issued in 2007, updated in August 2013). Tariff regulations allow the BEA to consider (i) operation and maintenance (O&M) costs; (ii) depreciation; (iii) a return on fixed assets, including an allowance for company taxation; (iv) power purchases and fuel costs for electricity generation, should either of these be applicable; (v) the cost of losses and nonpayment of electricity bills; (vi) the cost of working capital; and (vii) any regulatory fees, duties, or levies that the licensee is liable to pay under the laws of Bhutan.

Tariff regulations explicitly allow the BEA to implement policies on subsidies, as determined by the minister. Regulations specifically state that the BEA may (i) authorize a generation licensee to sell the royalty on energy to customers to give them subsidies; (ii) determine which customer group should receive subsidies; (iii) facilitate subsidies to the poor; and (iv) allow cross-subsidies only as a special measure and only as a transition arrangement.

The BEA receives tariff applications and conducts tariff determinations. Submissions on customer tariffs are made by Bhutan Power Corporation Limited (BPC) and Druk Green Power Corporation. The last submission and tariff determination was in 2013, and it was decided that the tariff period will be 3 years. In the case of BPC, after the tariff determination process, the BEA determined the tariffs for wheeling (transmission charges), and the cost of supply for power delivered at high voltage, medium voltage, and low voltage. As expected, the determined cost of supply as power flows from high voltage to medium voltage to low voltage progressively increases, reflecting the additional investments and maintenance costs to deliver power at lower voltage. In transferring the costs to tariffs, subsidies are built in, as allowed in the regulations (Chapter 3).

Therefore, Bhutan's tariff determinations (tariff regulation, tariff filing, determination of the costs of supply, definition of subsidies and subsidy beneficiaries, and the end use tariff structure) are conducted in accordance with acceptable methodology starting in 2013, following a well-defined procedure. There are no reports of any ex post adjustments to tariffs to address errors in forecasts made up front or changes in policies during the implementation period (currently 3 years) of tariffs.

C. Tariff Regulation in India

India initiated its power sector reform program in 1991. Although several state governments initiated steps to reform the power sector, Odisha became the first Indian state to enact the reform legislation and privatize the distribution system in the state. All the other states and union territories of India also enacted the reform legislations to create the State Electricity Regulatory Commissions (SERCs) and to reform their power sector. Unbundling of state electricity boards has taken place in several states such as Andhra Pradesh, Assam, Delhi, Gujarat, Madhya Pradesh, and Odisha. Delhi was the second state that privatized its distribution system after Odisha. Not many states privatized the electricity utilities; corporate entities were created, and they remain as state-owned companies such as in Maharashtra and Tamil Nadu.

The Central Electricity Regulatory Commission prepares regulations and guidelines on tariff methodology and defines implementation parameters. The SERC in each state follows the methodologies, regulations, and guidelines prepared by the Central Electricity Regulatory Commission, and conducts tariff-filing activities and tariff hearings. Tariff determinations are conducted after public hearings. Tariff orders are issued typically every year, although some states covered in the study such as Assam, Madhya Pradesh, and Tamil Nadu follow a policy of conducting tariff filings and determinations once in 3 years, following multiyear tariff (MYT) principles. Considering the forecast cost of energy (as determined by the respective generation tariff orders) and wheeling charges to be paid to transmission (both the national grid and the state grid, as determined by the respective tariff orders), the distribution annual revenue requirement is calculated. This, along with the allowed losses (which are determined based on the loss targets issued by each SERC), yields the annual revenue requirement (ARR) and the average tariff. Thereafter, retail tariffs for each customer category are determined based on a mix of historic structure of tariffs, government policies, state policies, and the public hearing results.

At the end of each tariff period, an evaluation is conducted (a true-up exercise) to consider changes in the costs of each transmission and distribution utility as well as the market structure and the sales during the tariff period, and certain revisions to costs are allowed and included in the subsequent determination of ARR. Accordingly, the transmission and distribution utilities are allowed to claim additional costs and subsequent customer tariffs. These utilities and regulators get an opportunity to claw back any unspent allowances in the previous ARR, and return such credits to customers through the subsequent determination of the ARR.

However, revenue separation of distribution utilities is still in progress, and the corporate entities established as successors to the state electricity boards are not yet fully independent in their financial and revenue management. Complete independence (even privatization) has been implemented, while the distribution entities in states covered in the study operate independently with limited autonomy.

It may be concluded that tariff determination in Indian states covered in the study follows a methodology that enables the costs of supply to be evaluated transparently based on regulations and methodologies. Estimation of the cost of supply and the average cost of supply are critical elements for the assessment of true levels of subsidies enjoyed and surcharges imposed on certain categories of customers. Subsidies in the states covered can be assessed only in comparison with the average costs of supply to all customers.

D. Procedure on Tariffs at Maldives Energy Authority

Maldives Energy Authority (MEA) is responsible for regulating generation, distribution, and tariff setting.[4] MEA was reestablished in 2006 and is now under the Ministry of Environment and Energy. The mandate of MEA covers all activities required to regulate the sector, but has no clear powers to enforce standards, ensure compliance, or promote the critical objectives of the government. Since its initial formation, the regulatory body has been part of the ministerial structure, governed by civil service rules. It has a governing board, an executive managing director, and several staff members.

MEA receives tariff applications from generation and distribution utilities in a prescribed format. It then conducts a review and approves or revises the proposal. To support private sector and customer participation in power generation, MEA has published some draft documents. These include a draft power purchase agreement and net metering guidelines. No ex post adjustments to approved tariffs are calculated or announced.

[4] Maldives has no transmission requirement, owing to the short distances covered by each island network.

E. Tariff Regulation in Nepal

The Electricity Act of 1992 streamlined some of the sector's activities, facilitated licensing, and caused the establishment of the Electricity Tariff Fixation Commission (ETFC). The hydropower policy of 2001 sought to introduce a competitive environment for electricity development. This was inclusive of designating the already existing ETFC as the future regulatory authority for the electricity industry, to be developed later. The policy assigned the Department of Electricity Development the tasks of promoting investments and licensing. Some key power sector planning functions, including the preparation of the national demand forecast and system planning studies, were assigned to the Water and Energy Commission Secretariat. However, the propositions have remained dormant and have not been incorporated into new legislation to empower ETFC (or an enhanced version of ETFC) as the industry regulator. Presently, regulating the retail electricity tariff of Nepal Electricity Authority is the sole function of the ETFC.

In 2014, ETFC conducted a tariff application and a public consultation process. This resulted in customer tariffs being increased after almost 10 years of maintaining fixed customer tariffs in Nepal. No ex post adjustments are calculated or announced.

F. Methodology and Regulation of Tariffs in Sri Lanka

The Public Utilities Commission of Sri Lanka (PUCSL) has issued one generation license to the Ceylon Electricity Board (CEB), the previously vertically integrated utility, and generation licenses to over 150 independent power producers in the large and small categories. The transmission and bulk supply business license is held by CEB, which acts as the single buyer. Five distribution licenses have been issued, four of which are held by CEB's successor entities and the fifth license is held by Lanka Electricity Company Private Limited.

The tariff methodology was issued by the PUCSL under Section 30 of the Sri Lanka Electricity Act, No. 29 of 2009. The tariff has three components: (i) bulk supply tariff, (ii) distribution tariff, and (iii) retail supply tariff.[5] Generation and transmission costs are included in bulk supply tariffs. All generation is priced based on power purchase agreements between the transmission licensee (single buyer) and each generation licensee. The single buyer determines the generation costs that are used to calculate the bulk supply tariffs. Generation costs are passed through by the purchaser (transmission) to distribution. Distribution licensees pass them through to end users.

The transmission allowed revenue is calculated based on a 5-year MYT system. The bulk supply tariff for sales from transmission to distribution is the sum of generation tariff, transmission tariff, and bulk supply and operations business tariff. It consists of two parts: a capacity charge and an energy charge. The forecast bulk supply tariffs are passed through to the end use customer tariffs, and calculated and filed once every 6 months by the transmission licensee. It includes (i) the forecast for the corresponding (upcoming) 6-month period, and (ii) an adjustment factor to compensate the differences between forecast and actual bulk supply tariffs for the completed 6-month period. The actual bulk supply tariffs are not passed through to the end user tariffs each month. However, it is used to compensate at the end of each 6-month period for deviations between forecast and actual bulk supply tariffs.

[5] Bulk supply tariff is for the transfer of capacity and energy from transmission to distribution. Distribution tariff is the cost of "wires" business of each distribution utility. Retail supply tariff is the cost of supply—the service drop, metering, billing, and associated commercial costs.

Distribution allowed revenue is calculated based on a 5-year MYT system, in which a cap on overall revenues is imposed during the tariff period. This cap is adjusted for changes in the number of distribution users and energy distributed as prescribed by the revenue control formula, and changes in the indexes contained in the revenue control formula. For the distribution and supply tariff, each distribution and supply licensee makes a tariff filing to PUCSL once in 5 years.

The end use customer tariffs are expected to be determined based on the costs of supply to each customer category. When aggregated across all distribution licensees, costs of supply are expected to be equal to the revenue requirements at the transmission–distribution boundary. Sri Lanka follows a policy of uniform national tariffs to end use customers, although no specific clauses are included in any laws or regulations. Therefore, the bulk supply tariff (i.e., tariff at which electricity is sold from transmission to distribution) is adjusted to ensure that each distribution licensee would retain the allowed revenue for its distribution and retail service expenses.

For transmission and distribution business, the first 5-year period of the MYT system ended in December 2015. The implementation of tariff methodology was limited during the first 5-year period. The bulk supply tariffs are now calculated and published for each 6-month period, but publication is delayed by a few months. Summary costs of supply are published along with the 6-monthly bulk supply tariffs. End use customer tariffs, which should have been calculated and published once in 6 months, are neither calculated nor published. Revision of customer tariffs is conducted as and when required, but not in accordance with the 6-monthly recalculations specified in the tariff methodology. Over the first 5-year tariff period (2011–2015), the following revisions were announced in (i) January 2011 (initiated by PUCSL), (ii) May 2013 (initiated by the government and announced by PUCSL), and (iii) September 2014 (announced by the government). As such, the end use customer tariffs are not following the laid down procedures and methodologies, but only respond generally to government directives.

Absence of clear revenue separation among CEB's licensed entities has made tariff methodology implementation effectively incomplete and meaningless. The CEB generation licensee serves about 65% of total generation. The CEB transmission licensee conducts the transmission wire business, system operations, and bulk supply business. The four CEB distribution licensees serve about 90% of total energy to customers. Although separation of administration and staff among CEB's licensed entities has been completed, and metering and invoicing for transfers between licensed entities have been established, the absence of revenue separation limits the benefits of the tariff methodology.

End use customer tariffs remain almost on the same structure that prevailed before the first MYT period, except that time-of-use (TOU) tariffs have been made mandatory to medium and large industrial and commercial customers. End use tariffs have been made further complicated by the introduction of more blocks into household tariffs and the introduction of a new category for government institutions, whereas the methodology specifies the need to remove anomalies and move to cost-reflective tariffs for each customer category.

Ex post adjustments are calculated and announced to enable the transmission and distribution licensees to recover the allowed revenue. In this process, the transmission licensee and each distribution licensee is (i) compensated for changes in actual customer mix against the forecast customer mix, (ii) compensated for investments not previously approved in the MYT but subsequently made owing to justifiable service requirements, (iii) penalized for investments approved but not implemented, and (iv) compensated for any extraordinary investments required owing to reasons beyond their control. No compensation or surcharge is implemented for increases or reductions in allowed losses. This means that if the licensee

meets the target allowed loss set by PUCSL, the licensee will buy only the stipulated amount of energy from the transmission licensee. If losses increase, the additional energy to be purchased from transmission will not be compensated. If the licensee's loss is lower than the target, the value of saved losses can be retained by the licensee. Such allowed loss targets are fixed for each year in the MYT.

III. REVIEW OF CUSTOMER CLASSIFICATION AND TARIFFS

Existing electricity tariffs of the six South Asian countries covered in this study are reviewed in this analysis. Customer categories such as households, agriculture, industry, commercial, and public services such as street lighting and water pumps were given additional consideration.

A. Bangladesh

There are five distribution companies in Bangladesh: Bangladesh Power Development Board, Dhaka Electric Supply Company Limited, Dhaka Power Distribution Company Ltd., Rural Electrification Board, and West Zone Power Distribution Company Ltd.

Electricity customers are primarily divided into 10 categories in Bangladesh (from A to J). Household customers are charged under Category A. Household customers whose monthly electricity consumption is less than 50 kilowatt-hour (kWh) are given a special lifeline rate. Electricity for agricultural purposes where the sanctioned load is less than 50 kilowatt (kW) are charged under Category B, whereas small industries with a sanctioned load of up to 50 kW are charged under Category C. Category D for nonresidential customers is applicable to hospitals, educational institutions, religious and charitable establishments, etc., having a sanctioned load up to 50 kW. Low-tension commercial customers are categorized under E. Medium voltage, high voltage, and extra high voltage general purpose customers are categorized under F, G, and H, respectively. Electricity consumption of street lighting and drinking water pumping stations are categorized under J. For all the 10 customer categories, electricity tariff comprises the energy charge, service charge, and demand charge. Table 1 summarizes the electricity tariffs of Dhaka Power Distribution Company in 2015.

B. Bhutan

Electricity distribution throughout Bhutan is carried out by BPC. Electricity customer categorization in Bhutan is different from that of other countries in this study, as the customers are categorized according to the voltage level. There are three customer categories: low voltage customers, medium voltage customers (connected at 6.6 kV or 11 kV or 33 kV), and high voltage customers (connected at 66 kV and above). A 100% subsidy (free electricity) is given to rural low voltage customers whose monthly electricity consumption is less than 100 kWh. Low voltage customers are charged only for their energy consumption, whereas medium voltage and high voltage customers have to pay the demand charge as well. Table 2 summarizes the BPC electricity tariff approved from July 2015 to June 2016.

C. India

In this tariff review, six states in India were considered: Assam, Gujarat, Kerala, Madhya Pradesh, Maharashtra, and Tamil Nadu. Current approved electricity tariffs summarized in the following subsections do not include the electricity duty applied by each state.

Table 1: Electricity Tariff of Dhaka Power Distribution Company, as of September 2015

Category	Energy per Month (kWh)	Energy Charge (Tk/kWh)	Service Charge (Tk/Month)	Demand Charge (Tk/kW per month)
A: Residential	Lifeline 1–50	3.33	1-phase: 10.00 3-phase: 30.00	15.00
	0–75	3.80		
	76–200	5.14		
	201–300	5.36		
	301–400	5.63		
	401–600	8.70		
	>601	9.98		
B: Agricultural pumping		3.82	30.00	40.00
C: Small industries	Flat rate	7.66	70.00	40.00
	Off-peak time	6.90		
	Peak time	9.24		
D: Nonresidential (light and power)		5.22	1-phase: 10.00 3-phase: 30.00	20.00
E: Commercial and office	Flat rate	9.80	1-phase: 10.00 3-phase: 30.00	25.00
	Off-peak time	8.45		
	Peak time	11.98		
F: MV, general purpose (11 kV)	Flat rate	7.57	400.00	45.00
	Off-peak time	6.88		
	Peak time	9.57		
G: EHV, general purpose (132 kV)	Flat rate	7.35	500.00	40.00
	Off-peak time	6.74		
	Peak time	9.47		
H: HV, general purpose (33 kV)	Flat rate	7.49	450.00	40.00
	Off-peak time	6.82		
	Peak time	9.52		
J: Street light and water pumps		7.17	210.00	40.00

EHV = extra high voltage, HV = high voltage, kV = kilovolt, kW = kilowatt, kWh = kilowatt-hour, MV = medium voltage, Tk = Bangladesh taka.

$1.00 = Tk77.78 (as of 30 Sep 2015).

Source: Dhaka Power Distribution Company. Tariff Rates. https://www.dpdc.org.bd/article/view/52/Tariff%20Rates (accessed 8 September 2015).

Table 2: Electricity Tariff in Bhutan, as of July 2015

Category	Monthly Use (kWh)	Energy Charge (Nu/kWh)	Demand Charge (Nu/kW)
Low voltage	Rural: 0–100	0.00	–
	Others: 0–100	1.28	–
	101–300	2.45	–
	>301	3.23	–
	LV bulk	3.68	–
Medium voltage (6.6 kV/ 11 kV/ 33 kV)		2.43	235.00
High voltage (66 kV and above)		1.96	180.00

– = not available, kV = kilovolt, kWh = kilowatt-hour.

$1.00 = Nu64.14 (as of 31 Jul 2015).

Source: Bhutan Electricity Authority. Approved Tariff. http://www.bea.gov.bt/approved-tariff/ (accessed 8 September 2015).

D. India: Assam

Electricity distribution in Assam is carried out by the government-owned Assam Power Distribution Company Limited, and the electricity tariff is regulated by the Assam Electricity Regulatory Commission. Table 3 summarizes the electricity tariffs effective from 1 August 2015. Household customers with a load below 0.5 kW and monthly consumption less than 30 kWh are categorized under "Jeevan Dhara" customer category. They are given a subsidy by the government. Low-tension households, commercial customers, and small industrial customers are also given a subsidy if their monthly consumption is low. In addition, rural small industry customers are given electricity at a reduced price compared with urban industry customers.

Table 3: Electricity Tariff in Assam, as of August 2015

Category			Monthly Use (kWh)	Energy Charge (₹/kWh) Without Government Subsidy	Energy Charge (₹/kWh) With Government Subsidy	Fixed Charge (₹/kW)	Demand Charge (₹/kVA)
LT	Jeevan Dhara	Load <0.5 kW and units <30 kWh per month	0–30	4.10	2.79	15.00	–
	Domestic A	Load <5 kW	0–120	4.95	3.94	30.00	–
			121–240	6.25	–	30.00	
			>241	7.25	–	30.00	
	Domestic B	>5 kW and <20 kW		6.85	–	30.00	–
	Commercial	<20 kW	0–120	7.55	6.95	110.00	–
			>120		–	–	
	General purpose			6.35	–	125.00	–
	Public lighting			6.40	–	120.00	–
	Agriculture	Up to 7.5 hp		4.30	–	30.00	–
	Small industries (contract load < 20 kW)	Rural	0–120	4.85	4.55	30.00	–
			>120		–		
		Urban	0–120	5.10	4.80	40.00	–
			>120		–		
HT	Commercial	Demand >25 kVA		7.55	–	–	115.00
	Public water works			6.05	–	–	125.00
	Small industries	Demand >25 kVA up to 50 kVA		5.60	–	–	40.00
	Industries	Demand >50 kVA up to 150 kVA	Normal	6.25	–	–	100.00
			Peak	8.50	–		
			Night	5.60	–		
		Demand >150 kVA	Normal	6.85	–	–	140.00
			Peak	8.30	–		
			Night	6.35	–		

– = not available, hp = horsepower, HT = high-tension, kVA = kilovolt-ampere, kW = kilowatt, kWh = kilowatt-hour, LT = low-tension.
$1.00 = ₹66.15 (as of 31 Aug 2015).

Source: Assam Electricity Regulatory Commission. *Tariff Order Truing Up of FY 2013–24: APR of FY 2014–15, ARR and Tariff for FY 2015–16*. Guwahati. http://aerc.nic.in/APDCL%20Tariff%20Order%20dated%2024.07.2015.pdf (accessed 8 September 2015).

E. India: Gujarat

In Gujarat, there are 11 distribution licensees, among which 4 licensees are government-owned entities. The government-owned distribution licensees carry out their operations mainly in North, South, Central, and Western Gujarat. Electricity distribution in other areas of Gujarat is carried out by privately owned distribution licensees. Gujarat Electricity Regulatory Commission regulates the tariffs for these distribution entities every year. Table 4 details the tariff in Gujarat with effect from 1 April 2015. Household customers are divided into two categories: rural and other. Rural household customers are given a subsidy; at the same time, a subsidy is given to "below poverty line" (BPL) household users.

Table 4: Electricity Tariff in Gujarat, as of April 2015

Category		Monthly Use (kWh)	Energy Charge (₹/kWh)	Fixed Charge (₹/Month)	Charge (₹/kW)	Demand Charge (₹/kVA)
Domestic	BPL	0–30	1.50	5.00	–	–
	Others	0–50	3.15	0–2 kW: 15.00 2–4 kW: 25.00 4–6 kW: 45.00 >6 kW: 70.00	–	–
		51–100	3.60			
		101–200	4.25			
		201–250	4.35			
		>250	5.30			
Domestic (rural)	BPL	0–30	1.50	5.00	–	–
	Others	0–50	2.75	0–2 kW: 15.00 2–4 kW: 25.00 4–6 kW: 45.00 >6 kW: 70.00	–	–
		51–100	3.20			
		101–200	3.85			
		201–250	3.95			
		>250	5.00			
Educational institutes			3.90	70.00	–	–
Non-domestic (load <40 kW)	Load up to 10 kW		4.35	–	50.00	–
	Load >10 kW		4.65		85.00	
LTMD (load >40 kW up to 100 kW)	0–40 kW		4.70	–	90.00	–
	40–60 kW				130.00	
	>60 kW				195.00	
Public water works			4.10	–	27.00	–
Agriculture			0.60	–	27.00	–
Street lights			4.05	–	–	–
HT	Demand <500 kVA		4.35	–	–	130.00
	Demand >500 kVA up to 2,500 kVA		4.55			240.00
	Demand >2,500 kVA		4.65			425.00

– = not available, BPL = below poverty line, HT = high-tension, kVA = kilovolt-ampere, kW = kilowatt, kWh = kilowatt-hour, LTMD = low-tension maximum demand.

$1.00 = ₹63.46 (as of 30 Apr 2015).

Source: Gujarat Electricity Regulatory Commission. Tariff Order. http://www.gercin.org (accessed 8 September 2015).

F. India: Kerala

The Kerala State Electricity Regulatory Commission has issued 10 distribution licenses, among which the Kerala State Electricity Board is the largest distributor. Household customers are charged based on their consumption, and a special subsidy is given to the BPL customers similar to those in Gujarat. Table 5 summarizes the electricity tariffs in Kerala for major customer categories.

Table 5: Electricity Tariff in Kerala, as of August 2015

Category		Monthly Use (kWh)	Energy Charge (₹/kWh)	Fixed Charge (₹/month)	Charge (₹/kW per month)	Demand Charge (₹/kVA per month)
Domestic	BPL (<1 kW)	0–40	1.50	–	–	–
	Others	0–50	2.80	1–phase: 20.00	–	–
		51–100	3.20		–	–
		101–150	4.20	3–phase: 60.00	–	–
		151–200	5.80		–	–
		201–250	7.00		–	–
		0–300	5.00		–	–
		0–350	5.70		–	–
		0–400	6.10		–	–
		0–500	6.70		–	–
		>500	7.50		–	–
Industry	<10 kW		5.20	100.00	–	–
	10–20 kW			–	60.00	–
	>20 kW			–	–	125.00
Agriculture			2.00	–	8.00	–
LT general (educational institutes and hospitals)		0–500	5.50	–	50.00	–
		>500	6.30	–	–	–
LT commercial	Load <1 kW	0–100	4.70	–	40.00	–
		0–200	5.70			
		0–300	6.30			
	Load >1 kW	0–100	6.00	–	1–phase: 60.00	–
		0–200	6.70			
		0–300	7.40		3–phase: 120.00	
		0–500	8.00			
		>500	9.30			
Public lighting			3.60	30.00	–	–
HT industry		Normal	5.20	–	–	300.00
		Peak	7.80			
		Off-peak	3.90			
HT commercial		0–30,000	6.30	–	–	400.00
		>30,000	7.30			

– = not available, BPL = below poverty line, HT = high-tension, kVA = kilovolt-ampere, kW = kilowatt, kWh = kilowatt-hour, LT = low-tension.

$1.00 = ₹66.15 (as of 31 Aug 2015).

Source: Kerala State Electricity Board Limited. Tariff at a Glance. http://www.kseb.in/index.php?option=com_content&view=article&id=22&Itemid=89&lang=en (accessed 8 September 2015).

G. India: Madhya Pradesh

There are three distribution licensees in Madhya Pradesh: Madhya Pradesh Madhya Kshetra Vidyut Vitaran Company Ltd., Madhya Pradesh Poorv Kshetra Vidyut Vitaran Company Ltd., and Madhya Pradesh Paschim Kshetra Vidyut Vitaran Company Ltd. Madhya Pradesh Electricity Regulatory Commission regulates the electricity tariffs in the state. Table 6 provides the retail electricity tariff in the state applicable for 2015–2016. Customers are divided into several categories such as domestic, non-domestic, industrial, agriculture, and street lights. A special lifeline tariff is offered to domestic customers if the sanctioned load is less than 0.1 kW and the monthly consumption does not exceed 30 kWh. For several customer categories, fixed charge differs according the geographical area.

Table 6: Electricity Tariff in Madhya Pradesh, 2015–2016

Category			Monthly Use (kWh)	Energy Charge (₹/kWh)	Fixed Charge (₹/kW per month)		Demand Charge (₹/kVA per month)
					Urban	Rural	
Domestic	LV 1.1	Sanctioned load <100 W and units <30 per month	0–30	2.90	0.00		–
	LV 1.2		0–50	3.40	40.00*	25.00*	–
			51–100	4.05	70.00*	45.00*	–
			101–300	5.20	160.00	120.00	–
			>300	5.70	170.00	160.00	–
Non-domestic	LV 2.1: Educational institutes and hostels	Sanctioned load <20 kW		5.40	100.00	70.00	–
		Sanctioned load >20 kW		5.40	200.00	140.00	–
	LV 2.2: Commercial/ entertainment	Units <50	0–50	5.75	55.00	35.00	–
		Units >50		6.50	95.00	70.00	–
		Contract demand >20 kW		5.55	210.00	140.00	–
Public water works	LV 3.1			4.05	190.00	75.00	–
Street light	LV 3.2			4.15	290.00	65.00	–
LT industrial	LV 4			5.70	260.00	145.00	–
Agriculture	LV 5		0–300	3.55	25.00		–
			301–750	4.20			
			>750	4.50			
Industrial	HV 3.1	11 kV supply		5.75	–	–	280.00
		33 kV supply		5.65	–	–	435.00
		132 kV supply		5.25	–	–	525.00
		220/400 kV supply		5.05	–	–	560.00
Nonindustrial	HV 3.2	11 kV supply		6.05	–	–	250.00
		33 kV supply		5.90	–	–	370.00
		132 kV supply		5.40	–	–	475.00

– = not available, HV = high voltage, kVA = kilovolt-ampere, kW = kilowatt, kWh = kilowatt-hour, LT = low tension, LV = low voltage.

$1.00 = ₹66.48 (as of 31 Dec 2015), $1.00 = ₹67.97 (as of 31 Dec 2016).

* Fixed charge (₹/month), not based on measured maximum demand.

Source: Madhya Pradesh Madhya Kshetra Vidyut Vitaran Company Ltd. Tariff Details. http://www.mpcz.co.in/portal/Bhopal_home.portal?_nfpb=true&_pageLabel=regulations_tariff_bpl (accessed 8 September 2015).

H. India: Maharashtra

The regulation of power generation, transmission, and distribution tariffs in Maharashtra is conducted by the Maharashtra Electricity Regulatory Commission. There are several distribution licensees in the state, such as Maharashtra State Electricity Distribution Co. Ltd. and the Tata Power.

A subsidy is given to BPL household customers who use less than 30 kWh a month, similar to those in Madhya Pradesh. Other household customers are charged under an increasing block tariff (IBT). Tariffs for the power loom industry are slightly less compared with the low-tension industry tariff. Electricity for agricultural purposes and public water services are charged at a reduced price compared with other categories. Table 7 summarizes tariffs in Maharashtra with effect from June 2015.

Table 7: Electricity Tariff of Maharashtra, as of June 2015

Category			Monthly Use (kWh)	Energy Charge (₹/kWh)				Fixed Charge (₹/month)	Demand Charge (₹/kVA per month)
				Off-Peak	Other	Day	Peak		
LT	Residential (BPL)	Sanctioned load <0.1 kW and units <30 per month	0–30		0.87			10.00	–
	Residential		0–100		3.76			1-phase: 50.00 3-phase: 150.00	–
			101–300		7.21				
			301–500		9.95				
			501–1,000		11.31				
			>1,000		12.50				
	Non-residential	0–20 kW	0–200		6.60			220.00	–
			>200		9.62			220.00	
		>20 kW and <50 kW		8.70	10.20	11.00	11.30	–	220.00
		> 50 kW		11.51	13.01	13.81	14.11		220.00
	Public water and sewage treatment plants	0–20 kW		1.20	2.70	3.50	3.80	–	60.00
		>20 kW and <40 kW		2.30	3.80	4.60	4.90		70.00
		>40 kW		3.50	5.00	5.80	6.10		105.00
	Agriculture				3.60			–	40.00
	Industry – power looms	0–20 kW			5.43			220.00	
		>20 kW		5.38	6.88	7.68	7.98	–	150.00
	Industry: general	0–20 kW			5.51			220.00	
		>20 kW		5.48	6.98	7.78	8.08	–	150.00
	Street light	Gram Panchayat			4.78			–	40.00
		Municipal corporation areas			5.80				40.00

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Table 7 *continued*

Category			Monthly Use (kWh)	Energy Charge (₹/kWh)				Fixed Charge (₹/month)	Demand Charge (₹/kVA per month)
				Off-Peak	Other	Day	Peak		
	Public services	0–20 kW	0–200		4.54			220.00	–
			>200		5.84			220.00	–
		>20 kW and <50 kW		5.00	6.50	7.30	7.60	–	220.00
		>50 kW		5.70	7.20	8.00	8.30		220.00
HT	Industry			5.71	7.21	8.01	8.31	–	220.00
	Commercial			9.65	11.15	11.95	12.25	–	220.00
	Agriculture				3.32			–	30.00
	Public services			5.70	7.20	8.00	8.30		220.00

– = not available, BPL = below poverty line, HT = high tension, kVA = kilovolt-ampere, kW = kilowatt, kWh = kilowatt-hour, LT = low tension, ₹ = Indian rupee.

$1.00 = ₹63.70 (as of 30 Jun 2015).

Source: Maharashtra State Electricity Distribution Co. Ltd. Latest Announcements. http://www.mahadiscom.com/download.php?docname=tariff/Order-121of2014-26062015.pdf (accessed 8 September 2015).

I. India: Tamil Nadu

Tamil Nadu Generation and Distribution Corporation Limited is a government-owned distribution licensee in Tamil Nadu. Electricity tariffs are highly subsidized in the state compared with other Indian states in the study. Subsidized tariffs are shown in Table 8.

Table 8: Subsidized Electricity Tariff in Tamil Nadu, as of December 2014

Category		Monthly Use (kWh)	Energy Charge (₹/kWh)	Fixed Charge (₹/Month)	Charge (₹/kW per month)	Demand Charge (₹/kVA per month)
Domestic	Up to 50 units	0–50	1.00	10.00	–	–
	Up to 100 units	0–100	1.50	10.00		
	Up to 250 units	0–100	2.00	15.00		
		101–250	3.00			
	>250 units	0–100	3.50	25.00		
		101–250	4.60			
		>250	6.60			
Handloom weavers		0–50	0.00	0.00	–	–
Government educational institutes and hospitals			5.75	–	120.00	–
Cottage and tiny industries	up to 10 hp	0–500	4.00	–	40.00	–
		>500	4.60			

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Table 8 *continued*

Category		Monthly Use (kWh)	Energy Charge (₹/kWh)	Fixed Charge (₹/Month)	Charge (₹/kW per month)	Demand Charge (₹/kVA per month)
Power looms	up to 10 hp	0–500	0.00	–	0.00	–
		501–1,000	2.30	–	70.00	–
		1,001–1,500	3.45			
		>1,500	4.60			
Industries			6.35	–	70.00	–
Agriculture			0.00	–	0.00	–
Commercial and others		0–50	5.00	–	140.00	–
		>50	8.05			
HT Industries			6.35	–	–	350.00
HT Commercial			8.00	–	–	350.00

– = not available, hp = horsepower, HT = high tension, kVA = kilovolt-ampere, kW = kilowatt, kWh = kilowatt-hour, ₹ = Indian rupee.
$1.00 = ₹63.33 (as of 31 Dec 2014).
Source: Tamil Nadu Generation and Distribution Corporation Limited. Schedules of Tariff. http://www.tangedco.gov.in/linkpdf/Tariff%20payable%20by%20consumer(12.12.2014).pdf (accessed 8 September 2015).

J. Maldives

Having more than 1,000 islands, electricity distribution in Maldives is carried out under seven electricity utilities: State Electric Company Limited, Upper North Utilities Limited, North Utilities Company, Central Utilities Company, South Central Utilities Limited, Upper South Utilities Limited, and South Utilities Company. State Electric Company operates in two provinces of Maldives: Malé and North Central. Table 9 summarizes electricity tariffs in Malé. There are only two customer categories in the country: (i) domestic; and (ii) commercial, government, and institutes. All electricity customers are charged under a block tariff, and the tariff consists only of energy charges.

Table 9: Electricity Tariffs in Malé, as of September 2015

	Energy Charge (Rf/kWh)	
Monthly Use (kWh)	Domestic	Commercial, Government, and Institutes
0–100	3.15	4.20
101–300	3.40	4.25
301–500	3.85	4.55
501–600	4.45	4.90
>600	4.75	5.25

kWh = kilowatt-hour, Rf = rufiyaa.
$1.00 = Rf15.370000 (as of 30 Sep 2015).
Source: State Electric Company Limited. Tariff rates. http://www.stelco.com.mv/tarrifs (accessed 8 September 2015).

K. Nepal

Electricity distribution in Nepal is carried out by the Nepal Electricity Authority. Nepal's electricity customers are primarily divided into two categories: domestic customers and other customers. Domestic customers are again categorized according to their supply voltage: low voltage (400 V or 230 V) customers and medium voltage (33 kV or 11 kV) customers. Other customers are also categorized according to voltage levels (low voltage and high voltage). Industrial, commercial, irrigation, street lighting, etc. are charged at different tariffs under "other customers" category. A time of day tariff has been made compulsory for customers supplied at high voltage (66 kV and above) and medium voltage (33 kV and 11 kV), who fall under "other customers" category. Table 10 details the electricity tariffs in Nepal, with effect from August 2012.

Table 10: Electricity Tariffs in Nepal, as of August 2012

Category			Monthly Use (kWh)	Energy Charge (NRs/kWh) Peak	Off-Peak	Normal	Demand Charge (NRs/kVA per month)
Domestic customers	LV (400 V/230 V)	Single phase	0–20		4.00		–
			21–30		7.30		–
			0–50		7.30		–
			51–150		8.60		–
			0–150		8.60		–
			151–250		9.50		–
			>250		11.00		–
		Three phases	Up to 10 kVA		12.00		–
			>10 kVA up to 25 kVA		12.50		–
	MV (33 kV/11 kV)		>25 kVA		12.90		–
Other customers	LV (400 V/230 V)	Industrial	Rural and domestic		6.50		55.00
			Small industry		8.00		100.00
		Commercial			9.35		295.00
		Noncommercial			10.00		195.00
		Irrigation			3.60		–
		Street light			6.10		–
	MV (11 kV)	Industrial		8.75	4.30	7.10	230.00
		Commercial		10.50	5.50	9.25	285.00
		Noncommercial		11.25	5.70	10.20	220.00
		Irrigation		5.30	2.80	3.95	50.00
		Street light		7.35	3.00	3.65	70.00

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Table 10 *continued*

Category			Monthly Use (kWh)	Energy Charge (NRs/kWh) Peak	Off-Peak	Normal	Demand Charge (NRs/kVA per month)
	MV (33 kV)	Industrial		8.50	4.20	7.00	230.00
		Commercial		10.25	5.40	9.00	285.00
		Noncommercial		11.00	5.60	10.00	220.00
		Irrigation		5.25	2.50	3.90	50.00
		Street light		7.00	2.80	3.50	70.00
	HV (66 kV or above)	Industrial		7.75	3.30	6.25	220.00

– = not available, HV = high voltage, kVA = kilovolt-ampere, kWh = kilowatt-hour, LV = low voltage, MV = medium voltage, NRs = Nepalese rupees.

$1.00 = NR 88.39 (as of 31 Aug 2012).

Source: Nepal Electricity Authority. 2014. *A Year in Review: Fiscal Year 2013/2014*. Kathmandu.

L. Sri Lanka

The Public Utilities Commission of Sri Lanka (PUCSL) is the regulator that determines electricity tariffs for customers. Among the five distribution licensees, the Ceylon Electricity Board (CEB) owns four licensees and is the largest distributor. Lanka Electricity Company Private Limited distributes electricity, especially in the western coastal areas. Table 11 details the electricity tariffs in Sri Lanka with effect from November 2015. Household customers whose consumption is less than 60 kWh are charged at a reduced price. Commercial customers fall under the category "General Purpose." A mandatory TOU tariff has been introduced since 2011 for industrial, hotel, and general purpose customers who are supplied at medium voltage or high voltage. An optional TOU tariff was introduced in 2015 for larger household customers.

Table 11: Electricity Tariffs in Sri Lanka, as of November 2014

Category		Monthly Use (kWh)	Energy Charge (SLRs/kWh) Day	Peak	Off-Peak	Fixed Charge (SLRs/month)	Demand Charge (SLRs/kVA per month)
Household	<60 kWh	0–30		2.50		30.00	–
		31–60		4.85		60.00	–
	>60 kWh	0–60		7.85		–	–
		61–90		10.00		90.00	–
		91–120		27.75		480.00	–
		121–180		32.00		480.00	–
		>180		45.00		540.00	–
Religious		0–30		1.90		30.00	–
		31–90		2.80		60.00	–
		91–120		6.75		180.00	–
		121–180		7.50		180.00	–
		>180		9.40		240.00	–

continued on next page

Table 11 *continued*

Category		Monthly Use (kWh)	Energy Charge (SLRs/kWh)			Fixed Charge (SLRs/month)	Demand Charge (SLRs/kVA per month)
			Day	Peak	Off-Peak		
Industry	I-1	<301		10.80		600.00	–
		>300		12.20			–
	I-2		11.00	20.50	6.85	3,000.00	1,100.00
	I-3		10.25	23.50	5.90	3,000.00	1,000.00
Hotel	H-1			21.50		600.00	–
	H-2		14.65	23.50	9.80	3,000.00	1,100.00
	H-3		13.70	22.50	8.80	3,000.00	1,000.00
General purpose	GP-1	<301		18.30		240.00	–
		>300		22.85		240.00	–
	GP-2		21.80	26.60	15.40	3,000.00	1,100.00
	GP-3		20.70	25.50	14.35	3,000.00	1,000.00
Government	GV-1			14.65		600.00	–
	GV-2			14.55		3,000.00	1,100.00
	GV-3			14.35		3,000.00	1,000.00

– = not available, kWh = kilowatt-hour, kVA = kilovolt-ampere, SLRs = Sri Lanka rupee.
$1.00 = SLR131.15 (as of 30 Nov 2014).
Source: Authors' summary of information in Public Utilities Commission of Sri Lanka. www.pucsl.gov.lk (accessed 8 September 2015).

M. Summary and Cross-Country Comparison

Electricity tariffs to three customer categories (household, commercial, and industrial) were selected for comparison in this study. Household customers were divided into four classes depending on their monthly electricity consumption. Commercial customers were divided into three classes considering their contract demand. Industrial customers were categorized based on their maximum demand. Unity power factor was assumed both for commercial customers and industrial customers. When calculating the average unit price for the six states of India, an electricity duty was included. Table 12 shows the average unit prices in United States cents of the six countries for three major customer categories.

Electricity tariffs in Maldives are very high compared with other countries in the study. The lowest unit price for household customers can be observed in Bhutan. Tamil Nadu, India has the second lowest unit price for household customers; this is mainly due to the government subsidy. Sri Lanka has the highest unit price for household customers whose monthly consumption is 600 kWh. Figure 1 shows the comparison of average unit prices of household customers of different classes.

Bhutan reports the lowest price for commercial customers of all three classes, similar to the household customer tariff, while Maldives has the highest price in the region. Gujarat has the lowest price for commercial customers compared with other Indian states included in the study, whereas Maharashtra has the highest price for commercial users. Figure 2 shows the comparison of average unit prices for commercial customers.

Table 12: Comparative Average Electricity Price Across Countries, as of October 2015

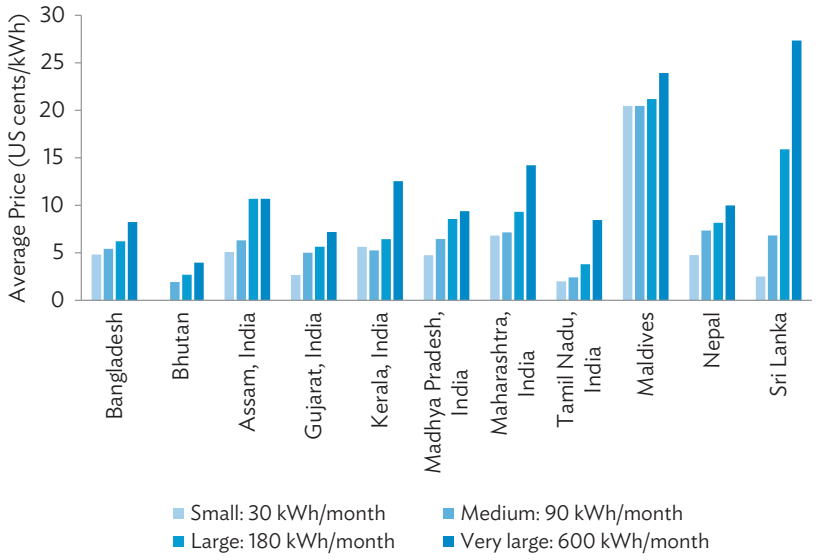
Customer Category	Class	Electricity Use (kWh/ month)	Maximum Demand (kW)	Average Price (US cents/kWh) at Unity Power Factor										
				Bangladesh	Bhutan	Assam, India	Gujarat, India	Kerala, India	Madhya Pradesh, India	Maharashtra, India	Tamil Nadu, India	Maldives	Nepal	Sri Lanka
Household	Small	30	–	4.82	0.00	5.09	2.67	5.63	4.75	6.82	2.00	20.47	4.76	2.50
	Medium	90	–	5.42	1.92	6.32	5.01	5.25	6.45	7.16	2.42	20.47	7.35	6.84
	Large	180	–	6.21	2.70	10.68	5.64	6.44	8.56	9.32	3.80	21.18	8.16	15.89
	Very large	600	–	8.24	3.97	10.68	7.19	12.54	9.39	14.22	8.45	23.93	9.99	27.35
Commercial	Small	1,000	–	12.76	5.53	12.15	8.54	12.60	11.16	16.65	12.51	30.99	9.82	15.52
	Medium	58,000	180	9.97	4.74	12.18	9.12	14.46	10.15	23.03	12.51	34.05	9.46	17.99
	Large	600,000	1,500	9.83	3.62	12.18	9.44	14.46	11.58	19.87	14.11	34.11	9.46	16.90
Industrial	Small	5,000	–	10.07	5.53	8.05	8.19	9.34	10.71	8.36	9.74	33.49	7.83	8.71
	Medium	65,000	180	9.97	4.63	10.51	7.72	10.39	11.09	12.45	11.64	34.06	7.39	11.30
	Large	270,000	600	9.84	3.54	11.48	8.32	10.39	11.21	14.04	11.64	34.10	6.65	10.86
	Very large	1,050,000	2,250	9.83	3.52	11.48	8.29	10.39	10.75	15.63	11.64	34.11	6.31	10.85

– = not available, kW = kilowatt, kWh = kilowatt-hour, US = United States.

$1.00 = Tk77.82, $1.00 = Nu65.40, $1.00 = ₹65.40, $1.00 = Rf15.29, $1.00 = NR104.55, $1.00 = SLR141.11 (as of 31 Oct 2015).

Source: Authors' calculations based on tariff determinations announced by the respective regulatory authorities and commissions, as of October 2015.

Figure 1: Comparison of Average Electricity Price for Household Customers, as of October 2015



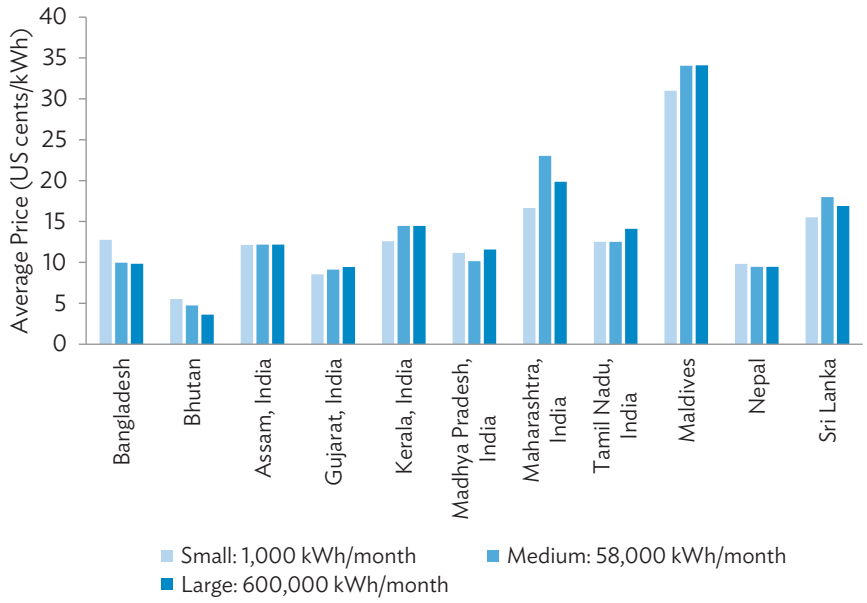
kWh = kilowatt-hour, US = United States.

Note: Bhutan provides free electricity to low-user households.

$1.00 = Tk77.82, $1.00 = Nu65.40, $1.00 = ₹65.40, $1.00 = Rf15.29, $1.00 = NR104.55, $1.00 = SLR141.11 (as of 31 Oct 2015).

Source: Published information by utilities and regulators, as of October 2015.

Figure 2: Comparison of Average Electricity Price for Commercial Customers, as of October 2015



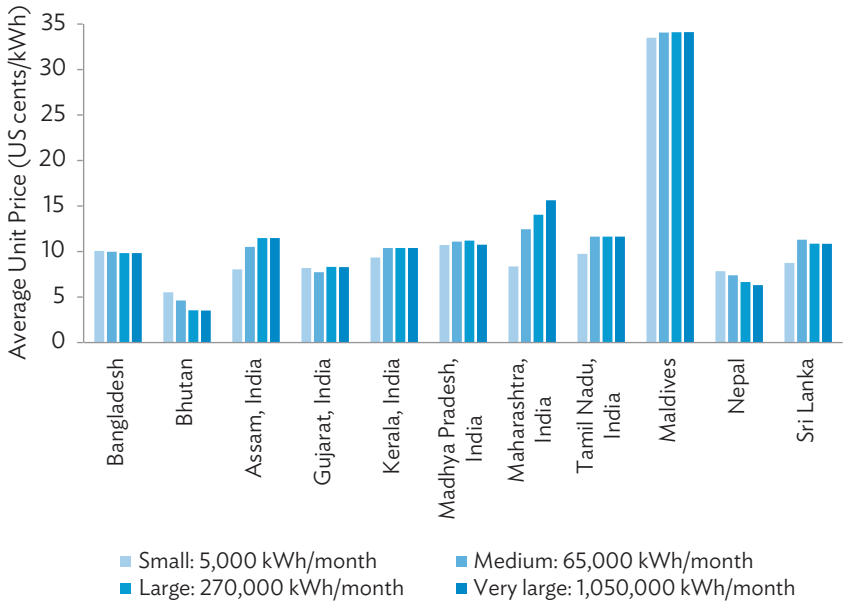
kWh = kilowatt-hour, US = United States.

$1.00 = Tk77.82, $1.00 = Nu65.40, $1.00 = ₹65.40, $1.00 = Rf15.29, $1.00 = NR104.55, $1.00 = SLR141.11 (as of 31 Oct 2015).

Source: Published information by utilities and regulators, as of October 2015.

Industrial customers are divided into four classes based on their maximum demand. There is no large difference between the average prices in industry customer classes, but there is a significant variation country-wise. Bhutan has the lowest unit price for industrial customers as well, and Nepal reports the second lowest in the region. Average unit price of Maldives is still the highest in the region. Figure 3 gives the comparison of the average price for industrial customers.

Figure 3: Comparison of Average Electricity Price for Industrial Customers, as of October 2015



kWh = kilowatt-hour, US = United States.

$1.00 = Tk77.82, $1.00 = Nu65.40, $1.00 = ₹65.40, $1.00 = Rf15.29, $1.00 = NR104.55, $1.00 = SLR141.11 (as of 31 Oct 2015).

Source: Published information by utilities and regulators, as of October 2015.

IV. BASELINE TARIFFS, SUBSIDIES, AND FEATURES OF SOCIAL INCLUSION

This chapter details lifeline tariffs for household customers, cost of electricity supply, subsidies and cross-subsidies provided to customers, and geographical and social inclusion considerations in tariff settings. In this assessment, special consideration was given to household customers, small industry and small commercial customers, and agricultural customers.

The cost of electricity supply for different customer categories of each country was calculated based on published data. Information required for the calculation of cost of electricity supply in Bangladesh and Maldives was not available in the public domain. In contrast, detailed information required for the calculation of the cost of electricity supply for each customer category, based on the burden imposed by each category on the electricity system, was available for Bhutan and Sri Lanka. Average cost of electricity supply for each Indian state was available in the *Annual Report (2013–14) on The Working of State Power Utilities & Electricity Departments* published by the Power and Energy Division of the Planning Commission of the Government of India.[6] The average cost of electricity supply in Nepal was calculated using publicly available information.

To calculate the cost of electricity supply, the basic methodology is detailed. The cost of electricity supply mainly comprises three components: (i) generation cost, (ii) transmission (wire business and system

[6] Power and Energy Division Planning Commission Government of India. 2014. http://planningcommission.nic.in/reports/genrep/rep_arpower0306.pdf.

operation) cost, and (iii) distribution (wire and supply business) cost. Electricity generation cost consists of capacity cost and energy cost. Transmission cost consists of transmission base allowed revenue, considering the asset base (to allow for depreciation), interest costs, return on investment, transmission operation and maintenance (O&M) cost, system operation costs, and taxes. Distribution cost consists of distribution allowed revenue, considering the asset base (to allow for depreciation), interest costs, return on assets, distribution O&M costs, supply costs, and taxes. The above cost components were extracted from published annual reports/regulatory reports, and are shown in Table 14 for Bhutan and Table 25 for Nepal. Electricity sales data were also available for the countries, thereby the national average cost of electricity supply or cost of electricity supply to each customer category was calculated.

A. Bangladesh

As the required details for the calculation of the cost of electricity supply of Bangladesh are not available, the magnitude of subsidies given to each customer category cannot be calculated in detail. In Bangladesh, household customers, whose consumption is less than 50 kWh, is provided with a lifeline tariff. Although the cost of supply is not available, by observing the average tariff of household customer classes, one can clearly see that household customers with lower consumption receive a subsidy while large household customers do not receive any subsidy.

Small commercial customers are also charged at a higher rate, compared with other customer categories. Average tariffs in Bangladesh are summarized in Table 13.

Table 13: Average Tariff for Different Customer Categories in Bangladesh, as of October 2015

Customer	Class	Monthly Use (kWh)	Average Tariff (Tk/kWh)
Household	Small	30	3.75
	Medium	90	4.22
	Large	180	4.83
	Very large	600	6.41
Commercial	Small	1,000	9.93
Industrial	Small	5,000	7.83

kWh = kilowatt-hour, Tk = Bangladesh taka.

$1.00 = Tk77.82 (as of 31 Oct 2015).

Source: Authors' calculation based on information in Dhaka Electricity Supply Company Limited. Tariff Rate. https://www.desco.org.bd/index.php?page=tariff-rate (accessed 8 September 2015).

B. Bhutan

Electricity customers are mainly divided into three categories. Cost of electricity supply for 2014–2015 for these three categories are given in Table 14. Low voltage electricity customer tariffs differ according to the geographical area. Rural low voltage customers, whose consumption is less than 100 kWh, are given a 100% subsidy, while urban household customers are given only a 76% subsidy. Table 15 summarizes the subsidies given to household customers.

Table 14: Cost of Electricity Supply in Bhutan, as of October 2015

Cost	HV	MV	LV
Energy cost (million Nu)	2,139	213	680
Network cost (million Nu)	900	423	1,620
Working capital (million Nu)	38	13	26
Other revenue (million Nu)	–	–	(110)
Total cost (million Nu)	3,076	650	2,216
Total sales (GWh)	1,428	145	413
Cost of supply (Nu/kWh)	2.15	4.48	5.37

– = not available, GWh = gigawatt-hour, HV = high voltage, kWh = kilowatt-hour, LV = low voltage, MV = medium voltage, Nu = ngultrum.

$1.00 = Nu65.40 (as of 31 Oct 2015).

Source: Authors' calculations based on information in Bhutan Electricity Authority. 2013. *Bhutan Power Corporation Limited: Tariff Review Report*.

Table 15: Subsidy to the Household Customers in Bhutan, as of October 2015

Class	Monthly Use (kWh)	Average Unit Price (Nu/kWh)		Cost of Supply[a] (Nu/kWh)	Subsidy (%)	
		Rural	Urban		Rural	Urban
Small	30	0.00	1.28	5.37	100	76
Medium	90	0.00	1.28	5.37	100	76
Large	180	1.09	1.80	5.37	80	66
Very large	600	2.43	2.65	5.37	55	51

kWh = kilowatt-hour, Nu = ngultrum.

$1.00 = Nu65.40 (as of 31 Oct 2015).

[a] Owing to unavailability of data, cost of supply for all the four classes was assumed to be similar to the cost of supply to the low voltage customers.

Note: Subsidy was calculated by comparing the cost of supply and price.

$$\text{Subsidy} = \frac{\text{Cost of supply} - \text{Average tariff}}{\text{Cost of supply}} \times 100\%$$

Source: Authors' calculations.

Small commercial and small industrial customers also fall under the Low-voltage customer category. Therefore, the tariff for these customers also differs with the geographical area. Table 16 shows the subsidies given to these two customer categories.

Table 16: Subsidy to Small Industry and Commercial Customers in Bhutan, as of October 2015

Class	Monthly Use (kWh)	Average Unit Price (Nu/kWh)		Cost of Supply (Nu/kWh)	Subsidy (%)	
		Rural	Urban		Rural	Urban
Commercial	1,000	2.75	2.88	5.37	49	46
Small industry	5,000	3.13	3.16	5.37	42	41

kWh = kilowatt-hour, Nu = ngultrum.

$1.00 = Nu65.40 (as of 31 Oct 2015).

Note: Subsidy was calculated by comparing the cost of supply and the price.

Source: Authors' calculations.

C. India

The *Annual Report (2013–14) on The Working of State Power Utilities & Electricity Departments* includes the unit cost of power supply of different Indian states.[7] This assessment used this published data, presented in Table 17. The published information is the average cost of supply, but the cost of supply to each customer category or at each voltage level is not published. Among the six states considered in this study, Gujarat has the lowest unit cost of supply while Tamil Nadu has the highest cost.

Table 17: Cost of Electricity Supply in Different States of India, 2013–2014

State	Average Cost of Power Supply (₹/kWh)	Average Tariff (₹/kWh)
Assam	6.29	4.78
Gujarat	4.96	4.63
Kerala	5.97	4.42
Madhya Pradesh	5.39	4.24
Maharashtra	5.84	5.82
Tamil Nadu	6.46	4.93
National Average	5.93	4.80

kWh = kilowatt-hour, ₹ = Indian rupee.

$1.00 = ₹61.92 (as of 31 Dec 2013), $1.00 = ₹63.33 (as of 31 Dec 2014).

Source: Government of India, Planning Commission, Power and Energy Division. 2014. *Annual Report (2013-14) on The Working of State Power Utilities & Electricity Departments*.

D. India: Assam

In Assam, a lifeline tariff has been given to household customers with a monthly electricity consumption of less than 30 kWh and with a connected load below 0.5 kW. A government subsidy is given to the lifeline category as well as to household users with a lower consumption. Large household customers are charged at a higher price, while the subsidy is given to small household customers. Commercial and small industrial customers also receive the government subsidy for the first 120 kWh. Among the small industrial customers, rural industries receive electricity at a lower price compared with urban industries. Details of subsidies provided to the electricity customers in Assam are given in Table 18.

E. India: Gujarat

Table 19 shows the subsidies provided to electricity customers in Gujarat, India. BPL household customers, irrespective of the geographical area, receive a subsidy for their electricity consumption. Other household customers' average unit price differs according to the geographical area. Large household customers hardly receive a subsidy. Both commercial and industrial customer electricity tariffs are high compared with the average cost of electricity supply. The agricultural sector is given a large subsidy compared with the subsidies to other customer categories.

[7] The *Annual Report (2013–14) on The Working of State Power Utilities & Electricity Departments* includes 22 State Power Utilities and 8 Electricity Departments.

Table 18: Subsidies to Electricity Customers in Assam, India, as of October 2015

Customer	Class	Monthly Use (kWh)	Average Unit Price (₹/kWh)	Average Cost of Supply (₹/kWh)	Subsidy (%)
Household	Small: Jeevan Dhara	30	3.39	6.29	46
	Medium	90	4.21	6.29	33
	Large	180	7.12	6.29	–13
	Very large	600	7.12	6.29	–13
Commercial	Small	1,000	8.09	6.29	–29
Industrial	Rural	5,000	5.06	6.29	20
	Urban	5,000	5.36	6.29	15
Agriculture			4.60	6.29	27

kWh = kilowatt-hour, ₹ = Indian rupee.

$1.00 = ₹65.40 (as of 31 Oct 2015).

Notes:

1. Agricultural customers' energy consumption was calculated assuming 10-horsepower pump operating 8 hours per day for 5 months.
2. Subsidy was calculated comparing the cost of supply and price.

Source: Authors' calculations based on electricity tariff available at Assam Electricity Regulatory Commission. *Tariff Order Truing Up of FY 2013–24: APR of FY 2014–15, ARR and Tariff for FY 2015–16*. Guwahati. http://aerc.nic.in/APDCL%20Tariff%20Order%20dated%2024.07.2015.pdf (accessed 8 September 2015).

Table 19: Subsidies to Electricity Customers in Gujarat, India, as of October 2015

Customer	Class	Monthly Use (kWh)	Average Tariff (₹/kWh)		Average Cost of Supply (₹/kWh)	Subsidy (%)	
			Rural	Urban		Rural	Urban
Household	BPL	30	1.78	1.78	4.96	64	64
	Small	30	3.46	4.12	4.96	30	17
	Medium	90	3.34	4.02	4.96	33	19
	Large	180	3.76	4.47	4.96	24	10
	Very large	600	4.79	5.51	4.96	3	–11
Commercial	Small	1,000	5.69		4.96	–15	
Industrial	Small	5,000	5.46		4.96	–10	
Agriculture			0.87		4.96	82	

BPL = below poverty line, kWh = kilowatt-hour, ₹ = Indian rupee.

$1.00 = ₹65.40 (as of 31 Oct 2015).

Note: Subsidy was calculated comparing the cost of supply and price.

Source: Authors' calculations based on electricity tariff available at Gujarat Electricity Regulatory Commission. Tariff Order. http://www.gercin.org (accessed 8 September 2015).

F. India: Kerala

In Kerala, the electricity tariff for BPL household customers and agricultural customers are highly subsidized. Similar to those in the other states in the study except for Tamil Nadu, large household customers and commercial customers are surcharged for their electricity consumption. Small industrial customer tariffs are also high compared with the average cost of electricity supply. There is no distinction between the electricity tariffs for different geographical areas in Kerala. Table 20 shows the subsidies provided to the electricity customers in Kerala, India.

Table 20: Subsidies to Electricity Customers in Kerala, India, as of October 2015

Customer	Class	Monthly Use (kWh)	Average Tariff (₹/kWh)	Average Cost of Supply (₹/kWh)	Subsidy (%)
Household	BPL	30	1.65	5.97	72
	Small	30	3.75	5.97	37
	Medium	90	3.50	5.97	41
	Large	180	4.29	5.97	28
	Very large	600	8.35	5.97	–40
Commercial	Small	1,000	8.39	5.97	–41
Industrial	Small	5,000	6.22	5.97	–4
Agriculture			2.08	5.97	65

BPL = below poverty line, kWh = kilowatt-hour, ₹ = Indian rupee.

$1.00 = ₹65.40 (as of 31 Oct 2015).

Note: Subsidy was calculated comparing the cost of supply and price.

Source: Authors' calculations based on electricity tariff available at Kerala State Electricity Board Limited. Tariff at a Glance. http://www.kseb.in/index.php?option=com_content&view=article&id=22&Itemid=89&lang=en (accessed 8 September 2015).

G. India: Madhya Pradesh

When considering electricity tariffs in Madhya Pradesh, rural electricity customers receive a higher subsidy compared with urban electricity customers. Energy charges for customer categories are similar irrespective of the geographical area, but the fixed charge changes according to the area. Hence, there is a difference between the average unit price to rural customers and that to urban customers. BPL customers receive the highest subsidy, while large household customers, commercial customers, and industrial customers are surcharged. Even agricultural customers are surcharged in Madhya Pradesh. Table 21 details the subsidy provided to different customer categories in Madhya Pradesh, India.

Table 21: Subsidies to Electricity Customers in Madhya Pradesh, India, as of October 2015

Customer	Class	Monthly Use (kWh)	Average Tariff (₹/kWh)		Average Cost of Supply (₹/kWh)	Subsidy (%)	
			Rural	Urban		Rural	Urban
Household	BPL	30	3.16	3.16	5.39	41	41
	Small	30	4.54	5.04	5.39	16	6
	Medium	90	4.30	4.80	5.39	20	11
	Large	180	5.70	5.93	5.39	–6	–10
	Very large	600	6.25	6.83	5.39	–16	–27
Commercial	Small	1,000	7.44	7.95	5.39	–38	–47
Industrial	Small	5,000	7.14	7.60	5.39	–32	–41
Agriculture			5.64		5.39	–5	

BPL = below poverty line, kWh = kilowatt-hour, ₹ = Indian rupee.

$1.00 = ₹65.40 (as of 31 Oct 2015).

Note: Subsidy was calculated comparing the cost of supply and price.

Source: Authors' calculations based on electricity tariff available at Madhya Pradesh Madhya Kshetra Vidyut Vitaran Company Ltd. Tariff Details. http://www.mpcz.co.in/portal/Bhopal_home.portal?_nfpb=true&_pageLabel=regulations_tariff_bpl (accessed 8 September 2015).

H. India: Maharashtra

BPL customers, whose monthly consumption is less than 30 kWh and sanctioned load is less than 0.1 kW, are given the highest subsidy in the state. Large household customers and commercial customers are surcharged for their electricity consumption. Agricultural customers also receive a considerable subsidy. Table 22 shows the subsidies provided to the electricity customers in Maharashtra, India.

Table 22: Subsidies to Electricity Customers in Maharashtra, India, as of October 2015

Customer	Class	Monthly Use (kWh)	Average Tariff (₹/kWh)	Average Cost of Supply (₹/kWh)	Subsidy (%)
Household	BPL	30	1.33	5.84	77
	Small	30	4.54	5.84	22
	Medium	90	4.77	5.84	18
	Large	180	6.21	5.84	–6
	Very large	600	9.47	5.84	–62
Commercial	Small	1,000	11.09	5.84	–90
Industrial	Small	5,000	5.57	5.84	5
Agriculture			2.85	5.84	51

kWh = kilowatt-hour, ₹ = Indian rupee.

$1.00 = ₹65.40 (as of 31 Oct 2015).

Notes:

1. Agriculture customers refer to metered agricultural customers.
2. Subsidy was calculated comparing the cost of supply and price.

Source: Authors' calculations based on electricity tariff available at Maharashtra State Electricity Distribution Co. Ltd. Latest Announcements. http://www.mahadiscom.com/download.php?docname=tariff/Order-121of2014-26062015.pdf (accessed 8 September 2015).

I. India: Tamil Nadu

Electricity customers in Tamil Nadu receive the highest subsidy compared with those in the other states included in this study. Lifeline tariffs are given to household customers whose consumption is less than 50 kWh. Handloom weavers receive electricity free of charge if their monthly electricity consumption is below 50 kWh. The power loom industry also receives a 100% subsidy for the first 500 kWh. Both metered and unmetered agricultural customers also receive electricity free of charge. Other than the commercial customers, all other customer categories considered in this study receive a subsidy in Tamil Nadu. Details of the subsidies provided to the electricity customers in Tamil Nadu are shown in Table 23.

J. Maldives

The cost of electricity supply in Maldives is not published, hence the subsidies and cross-subsidies cannot be quantified. Household customers in Maldives receive a considerable subsidy; they are charged at a lower rate compared with commercial and industrial customers. Table 24 shows the average tariff for different customer categories in Maldives.

Table 23: Subsidies to Electricity Customers in Tamil Nadu, India, as of October 2015

Customer	Class	Monthly Use (kWh)	Average Tariff (₹/kWh)	Cost of Supply (₹/kWh)	Subsidy (%)
Household	Small	30	1.33	6.46	79
	Medium	90	1.61	6.46	75
	Large	180	2.53	6.46	61
	Very large	600	5.63	6.46	13
Commercial	Small	1,000	8.33	6.46	–29
Industrial	Small	5,000	6.49	6.46	0
Handloom weavers		50	0.00	6.46	100
Power looms		500	0.00	6.46	100
Cottage industries		500	4.44	6.46	31
Agriculture			0.00	6.46	100

kWh = kilowatt-hour, ₹ = Indian rupee.

$1.00 = ₹65.40 (as of 31 Oct 2015).

Notes:

1. Agriculture customers refer to both metered and unmetered agricultural consumers.
2. Subsidy was calculated comparing the cost of supply and price.

Source: Authors' calculations based on electricity tariff available at Tamil Nadu Generation and Distribution Corporation Limited. Schedules of Tariff. http://www.tangedco.gov.in/linkpdf/Tariff%20payable%20by%20consumer(12.12.2014).pdf (accessed 8 September 2015).

Table 24: Average Tariff for Different Customer Categories in Maldives, as of September 2015

Customer	Class	Monthly Use (kWh)	Average Tariff (Rf/kWh)
Household	Small	30	3.15
	Medium	90	3.15
	Large	180	3.26
	Very large	600	3.68
Commercial	Small	1,000	4.77
Industrial	Small	5,000	5.15

kWh = kilowatt-hour, Rf = rufiyaa.

$1.00 = Rf15.37 (as of 30 Sep 2015).

Source: Authors' calculations based on electricity tariff available at State Electric Company Limited. Tariff Rates. http://www.stelco.com.mv/tarrifs (accessed 8 September 2015).

K. Nepal

The cost of electricity supply in Nepal for different customer categories cannot be estimated with available data. Only the average cost of supply is available in documents, hence the following assessment is based on the average cost of supply shown in Table 25.

Table 25: Cost of Electricity Supply in Nepal, 2014

Generation expenses (million NRs)	1,886.51
Power purchase expenses (million NRs)	17,041.53
Transmission expenses (million NRs)	519.45
Distribution expenses (million NRs)	4,575.15
Administrative expenses (million NRs)	1,239.19
Depreciation (million NRs)	3,296.62
Interest on loans (million NRs)	4,234.51
Other expenses (million NRs)	4,430.78
Total sales of electricity (GWh)	3,496.31
Cost of supply (NRs/kWh)	10.65

GWh = gigawatt-hour, kWh = kilowatt-hour, NRs = Nepalese rupees.

$1.00 = NR101.54 (as of 31 Dec 2014).

Source: Nepal Electricity Authority. 2014. *A Year in Review: Fiscal Year 2013/2014*. Kathmandu.

Small household customers are given the highest subsidy compared with other customers; large household customers and commercial customers are charged at a higher price. A higher subsidy is given to rural and household industrial customers, compared with other industrial customers. Table 26 details the subsidies provided to electricity customers in Nepal.

Table 26: Subsidies to Electricity Customers in Nepal, as of October 2015

Category		Monthly Use (kWh)	Average Unit Price (NRs/kWh)	Cost of Supply (NRs/kWh)	Subsidy (%)
Household	Small	30	5.10	10.65	52
	Medium	90	7.88	10.65	26
	Large	180	8.75	10.65	18
	Very large	600	10.71	10.65	–1
Commercial	Small	1,000	10.83	10.65	–2
Industry	Rural and domestic Industry	5,000	6.72	10.65	37
	Small Industry	5,000	8.40	10.65	21
Agriculture			3.60	10.65	66

kWh = kilowatt-hour, NRs = Nepalese rupees.

$1.00 = NR104.55 (as of 31 Oct 2015).

Note: Authors' calculations based on information in Nepal Electricity Authority. 2016. *A Year in Review: FY 2015/2016*. Kathmandu.

L. Sri Lanka

In Sri Lanka, a detailed analysis on the cost of electricity supply to different customer categories was carried out in 2013 by the Public Utilities Commission of Sri Lanka (PUCSL). For this study, the average cost of electricity supply for 2014 was calculated using data published by PUCSL. Based on the 2013 analysis, costs of supply to different customer categories for 2014 were calculated (Table 27).

Table 27: Cost of Electricity Supply for Different Customer Categories in Sri Lanka, 2014

Customer Category		Cost of Supply (SLRs/kWh)
LV Retail	Domestic D1	22.88
	Religious R1	21.64
	General G1	19.61
	Industrial I1	17.19
	Hotel H1	19.04
	Street lighting	19.47
LV Bulk	General G2	16.27
	Industrial I2	15.87
	Hotel H2	14.68
MV Bulk	General G3	15.17
	Industrial I3	13.17
	Hotel H3	12.39
Average Cost of Supply		17.75

LV = low voltage, kWh = kilowatt-hour, MV = medium voltage, SLR = Sri Lankan rupee.

$1.00 = SLR131.25 (as of 31 Dec 2014).

Source: Authors' calculations based on the tariff decisions of the Public Utilities Commission of Sri Lanka, and on the Sri Lanka electricity pricing model, 2011.

Small household customers, whose consumption is less than 60 kWh per month, are charged at a lifeline rate. They are given an 87% subsidy, while large household customers are highly surcharged. Both small commercial and industrial customers do not receive a subsidy for their electricity consumption. There is no special agricultural customer category in Sri Lanka. Agricultural customers are charged under the small commercial customer category, hence they too do not receive any subsidy. Details of the subsidies provided to different customer categories in Sri Lanka are given in Table 28.

Table 28: Subsidies to Different Customer Categories in Sri Lanka, as of October 2015

Customer	Class	Monthly Use (kWh)	Average Tariff (SLR/kWh)	Cost of Supply (SLRs/kWh)	Subsidy
Domestic	Small	30	3.50	27.93	87
	Medium	90	9.57	23.29	59
	Large	180	22.24	20.92	–6
	Very large	600	38.27	19.07	–101
Commercial	Small	1,000	21.73	19.61	–11
Industrial	Small	5,000	12.24	17.19	29

kWh = kilowatt-hour, SLR = Sri Lankan rupee.

$1.00 = SLR141.11 (as of 31 Oct 2015).

Source: Authors' calculations based on the tariff decisions of the Public Utilities Commission of Sri Lanka, and on the Sri Lanka electricity pricing model, 2011.

M. Gender Analysis of Tariff Structures and Subsidies

None of the Indian states or other South Asian countries in the study offered any special tariffs to customers based on gender. However, discussions on a subsidy for women entrepreneurs have been reported in 2008 in Andhra Pradesh, but such discussions have not resulted in a specific tariff determination by the regulatory commission. A discussion has been engaged in Maldives in 2015, where the possibility of gender-based subsidies was proposed, but no specific decisions have been identified.

Cottage industries, and small commercial and industrial activities generally benefit women. Governments and regulators—while awarding concessionary tariffs to rural and domestic industries in Nepal and small commercial and industrial customers (using less than 300 kWh per month) in Sri Lanka, and similar pricing in the states of Assam, Maharashtra, and Tamil Nadu in India—would expect the tariffs to directly assist women. In small industries including cottage industries, women are the dominant beneficiaries, owing to larger involvement of women either as entrepreneurs or employees. In Sri Lanka, gender balance is adequate at formal vocational training registration (within 40% at technician training levels), but women lag behind men in enterprise-based craft training.[8] The reasonable gender balance indicates that a share of subsidies granted to small industries and some commercial customers[9] reach women, directly or indirectly. In Tamil Nadu, the special tariff for handlooms (free electricity to households with handlooms and power looms)[10] and up to a 5% subsidy for small industries are expected to be serving the female-dominated industry and trade in woven fabrics. In India, 78% of handloom workers are women; in Tamil Nadu, the national handloom census shows that only 53% of handloom workers are women.[11]

N. Summary

Table 29 summarizes the electricity subsidies given in each country covered in the study (except Bangladesh and Maldives) by customer category. As this study mainly focuses on poor and disadvantaged customers in the region, only the four customer categories—household-small, commercial-small, industrial-small, and agriculture—are reviewed in the summary assessment in this section. Each country has significantly subsidized electricity for small household customers. Bhutan provides a 100% subsidy to rural households. Commercial customers are not given a subsidy by any country in the study other than Bhutan. Small industrial customers too do not receive a considerable subsidy other than in Bhutan and Nepal. Sri Lanka and Madhya Pradesh of India do not provide any subsidy to agricultural customers. Agricultural customers in Tamil Nadu receive a 100% subsidy irrespective of whether they are metered or unmetered.

Table 30 summarizes specific tariffs in the countries and states studied for (i) low users, (ii) clearly defined socially disadvantaged or lower-income groups, and (iii) clearly defined small commercial or industrial activities. Some of these tariffs are based on technical indicators such as monthly consumption (less than some kWh of electricity per month) or capacity of the electricity connection (e.g., 5-ampere connection), and specifically identify customers or the specific purpose of electricity use. Among the

[8] ADB. 2015. *Country Gender Assessment: Sri Lanka: An Update*. Manila. Recruitment of women in craft training is low; the percentages of women recruited as motor mechanic, electrician, welder, wood craftsman, cook, and construction craftsman in the Vocational Training Authority of Sri Lanka in the first half of 2013 were less than 10% in each category (Figure 4 of the report).

[9] Commercial customers in Sri Lanka are not subsidized, except when they use less than 300 kWh/month.

[10] In 2016, Tamil Nadu announced further concessions to handloom and power loom owner-households. Handloom owners receive 100 kWh/month and power looms receive 375 kWh/month, free of charge.

[11] B. Premsundar and J. Kannan. 2013. Women in Handloom Industry: Problems and Prospects. *EPRA International Journal of Economic and Business Review*. 1 (1).

countries and states studied, only the following had more specific, targeted tariffs: (i) 100% subsidy for handloom weavers in Tamil Nadu, (ii) subsidies for BPL customers in Kerala and Maharashtra, and (iii) subsidies for electricity use in agriculture in the states in India covered in the study except Madhya Pradesh. Interestingly, only the states in India covered in the study except Tamil Nadu defined customers more specifically by their poverty level assessment or purpose of use of electricity. Other countries in the study did not specifically identify customers by specific purpose of use or a poverty level assessment, but largely provided subsidies to low users.

Table 29: Summary of Electricity Subsidies of Regional Countries: by Category, as of October 2015
(%)

Category	Bhutan	Assam, India	Gujarat, India	Kerala, India	Madhya Pradesh, India	Maharashtra, India	Tamil Nadu, India	Nepal	Sri Lanka
Domestic-small	100	46	64	72	41	77	79	52	87
Commercial-small	49	–29	–15	–41	–38	–90	–29	–2	–11
Industrial-small	42	20	–10	–4	–32	5	0	37	29
Agriculture	–	27	82	65	–5	51	100	66	–11

– = not available.

$1.00 = Tk77.82, $1.00 = Nu65.40, $1.00 = ₹65.40, $1.00 = Rf15.29, $1.00 = NR104.55, $1.00 = SLR141.11 (as of 31 Oct 2015).

Notes:

1. When a specific category is not explicitly stated in the tariff announcement, the tariff was assessed based on the definition of the type of customer. For example, Sri Lanka does not specifically classify agricultural customers, but they are automatically classified as commercial customers, and thus are required to pay tariffs higher than other customers.
2. A negative figure in the table means the customer category is charged above the cost of supply.

Source: Authors' calculations based on information in the regulatory commission websites (information updated as of October 2015).

Table 30: Summary of Electricity Prices: by Specifically Identified Use or User, as of October 2015

Country		Lifeline Allowance (kWh/ month)	Energy Charge	Fixed Charge	Minimum Charge	Demand Charge	Energy Charge (US cents/ kWh)	Fixed Charge (US cents/ month)	Minimum Charge (US cents/ month)	Demand Charge (US cents/ kW)	Comments
Bangladesh		0–50	3.33 Tk/kWh	10.00 Tk/ month	100.00 Tk/month	15.00 Tk/kW	4.28	12.85	128.50	19.28	For consumption less than 50 kWh/month
Bhutan		0–100	0.00 Nu/kWh	–	–	–	0.00	–	–	–	Only for rural domestic customers
India	Assam	0–30	2.79 ₹/kWh	15.00 ₹/month	–	–	4.27	22.94	–	–	Jeevan Dhara with subsidy (load <0.5 kW and consumption <360 kWh per annum)
	Gujarat	0–30	1.50 ₹/kWh	5.00 ₹/month	–	–	2.29	7.65	–	–	BPL category
	Kerala	0–40	1.50 ₹/kWh	0.00 ₹/month	–	–	2.29	0.00	–	–	BPL category (load <1 kW)
	Madhya Pradesh	0–30	2.90 ₹/kWh	0.00 ₹/month	40.00 ₹/month	–	4.43	0.00	61.16	–	Load <0.1 kW and consumption <360 kWh per annum
	Maharashtra	0–30	0.87 ₹/kWh	10.00 ₹/month	–	–	1.33	15.29	–	–	BPL category (load <0.1 kW and consumption <360 kWh per annum)
	Tamil Nadu	0–50	1.00 ₹/kWh	20.00 ₹/month	–	–	1.53	30.58	–	–	Subsidized rates. For Handloom weavers (consumption<50 kWh/ month) 0 energy charge
Maldives	Male	0–100	2.25 Rf/kWh	–	–	–	14.72	–	–	–	
	North Central	0–100	3.75 Rf/kWh	–	–	–	24.53	–	–	–	
	Southern	0–100	2.80 Rf/kWh	–	–	–	18.31	–	–	–	
Nepal		0–20	4.00 NRs/kWh	–	80.00 NRs/month	–	3.83	–	76.52	–	For consumption less than 30 kWh/month
		21–30	7.30 NRs/kWh	–		–	6.98	–		–	
Sri Lanka		0–30	2.50 SLRs/kWh	30.00 SLRs/ month	–	–	1.77	21.26	–	–	For consumption less than 60 kWh/month
		31–60	4.85 SLRs/kWh	60.00 SLRs/ month	–	–	3.44	42.52	–	–	

Exchange rates as of 31 October 2015.

Country	National Currency/$	US Cents/Nat. Currency
Bangladesh	77.82	1.285
Bhutan	65.40	1.529
India	65.40	1.529
Maldives	15.29	6.540
Nepal	104.55	0.956
Sri Lanka	141.11	0.709

– = not available, BPL = below poverty line, kW = kilowatt, kWh = kilowatt-hour, TK = Bangladesh taka, US = United States.

Source: Authors' calculations based on information in the respective regulatory tariff determinations.

V. CHALLENGES TO IMPLEMENTATION OF PREFERENTIAL TARIFFS FOR ON-GRID SUPPLY

Preferential tariffs are desired to either catalyze growth in certain sectors or to satisfy specific social objectives. Economic growth objectives may take the form of facilitating value addition to local raw material, retaining or protecting a threatened industrial or commercial activity, or facilitating import substitution. Social objectives are generally to ensure that a particular target group receive electricity at affordable prices. Typically, this is for activities that do not have any direct visible economic benefits (e.g., household tariffs in all countries in South Asia and special tariffs for religious institutions in Sri Lanka). The key challenges in implementing such tariffs are as follows: (i) policies on subsidies versus market pricing, (ii) the mechanism employed to target subsidies at such "deserving" customers, and (iii) the question of who pays the subsidies.

A. Subsidies versus Market Pricing

Over the past 2 decades, South Asian countries have increasingly moved to structured costing and pricing of electricity, compared with government-administered pricing that prevailed across most of the state-owned utilities until the 1990s. The sector operations in all countries in the study have been unbundled into generation, transmission, distribution, and supply, and almost all utilities in the region (except Sri Lanka and Nepal) have been corporatized, but continue to remain largely under absolute or majority government ownership. Each country has established a regulatory commission (state and national regulatory commissions in India) or a similar regulatory arrangement (e.g., Electricity Tariff Fixation Commission in Nepal). These regulatory commissions have commenced receiving periodic tariff submissions from utilities, conducting analyses and public hearings, and making determinations on transfer prices between utilities and end use customer prices. The degree of success and the depth/coverage of operations in each regulatory authority vary. Most comprehensive tariff filing documents are published for utilities in India and Sri Lanka by the respective regulatory agencies. Limited documentation is available for other countries.

Most utilities aspire to be market-oriented in their operations, which include pricing electricity on market principles. Electricity acts and regulations often state that tariffs would be established on cost-reflective principles. This means that calculation of the cost of supplying electricity to customers, submission of such costs to regulators, approval after due process, and all parties to the tariff-making process abide by the laws, regulations, and contents of tariff determinations. Such approved tariffs are implemented over several years. Regulators have ex post adjustment mechanisms (true-up) to adjust the due revenue of utilities, if the assumptions made during the tariff determination process do not materialize. These adjustments may award additional revenue or claw-back surplus revenue accrued, as the case may be. All utilities in India and Sri Lanka have such established procedures to award additional revenues or claw back excess revenue earned, through such regular ex post adjustments.

None of the utilities in the countries studied price electricity at the cost of supply to any category of customer. When pricing electricity to customers to reflect costs, the basic principles are (i) customer categories to be defined in terms of the voltage of electricity supplied to them (because supply voltage determines whether the customer is a retail user or a bulk user, requiring lower assets to deliver to bulk customers); and (ii) categorization by type of user (e.g., household, commercial) to be avoided or minimized, and only used to overcome limitations in metering.[12] Widely accepted principles of tariff

[12] Electricity may be priced in different ways. The common practice is to price in two-part tariffs (capacity charge and energy charge), with energy charge defined by a TOU tariff with two or more intervals. Monthly minimum charges, power factor penalty, etc. applied in some countries are additional charges. When metering facilities are limited, utilities charge all costs with a limited number of qualifiers (such as monthly fixed charge) and measured quantities (e.g., energy use measured in kWh).

Table 31: Summary of Electricity Prices in Selected Areas in Asia

Customer	Class	Electricity Usage (kWh/ month)	Maximum Demand (kW)	Average Unit Price in US cents/kWh (unity power factor)															
				Bangladesh	People's Republic of China	Hong Kong, China	Assam, India	Kerala, India	Maharashtra, India	Tamil Nadu, India	Malaysia	Nepal	Pakistan	Philippines	Singapore	Republic of Korea	Sri Lanka	Thailand	Viet Nam
Household	Small	30	–	4.81	7.69	11.51	5.18	5.73	6.95	2.04	5.07	4.88	2.38	10.63	15.55	6.51	2.48	0.76	6.60
	Medium	90	–	5.42	7.69	11.51	6.43	5.35	7.29	2.46	5.07	7.53	5.51	16.10	15.55	5.71	6.78	9.13	6.70
	Large	180	–	6.21	7.69	12.42	10.88	6.56	9.49	3.87	5.07	8.37	6.50	19.85	15.55	8.29	15.76	10.07	7.26
	Very large	600	–	8.24	9.47	14.88	10.88	12.77	14.48	8.60	8.40	10.24	9.19	22.64	15.55	27.89	27.12	11.43	9.80
Commercial	Small	1,000	–	12.76	11.93	17.35	9.11	12.83	16.96	12.74	11.49	10.07	14.11	19.64	15.55	9.25	15.40	11.80	10.64
	Medium	58,000	180	9.97	11.93	16.53	10.36	14.72	23.45	12.74	11.31	9.70	13.25	18.40	15.55	10.37	17.85	11.37	10.36
	Large	600,000	1,500	9.83	12.01	16.49	10.38	14.72	20.24	14.37	11.31	9.70	8.31	18.36	14.17	10.88	16.76	11.01	9.59
Industrial	Small	5,000	–	10.07	10.59	16.40	10.38	9.51	8.52	9.92	10.20	8.03	11.25	17.96	11.68	8.03	8.67	12.20	7.13
	Medium	65,000	180	9.97	10.86	16.45	6.86	10.58	12.68	11.85	10.59	7.58	10.71	17.66	14.17	9.08	11.21	11.37	6.83
	Large	270,000	600	9.83	11.06	16.41	8.97	10.58	14.30	11.85	9.06	6.82	1.11	17.81	14.05	8.91	10.77	11.01	6.61
	Very large	1,050,000	2,250	9.83	10.83	16.32	9.79	10.58	15.92	11.85	8.52	6.47	10.56	15.19	13.36	10.81	10.77	10.67	6.45

Exchange rates as of 31 October 2015

Lowest for the customer category | Highest for the customer category

Country	National Currency/$	US Cents/ Nat. Currency
Bangladesh	77.82	1.285
Bhutan	65.40	1.529
PRC	6.35	15.748
Hong Kong, China	7.70	12.987
India	65.40	1.529
Malaysia	4.30	23.256
Maldives	15.29	6.540
Nepal	104.55	0.956
Pakistan	105.00	0.952
Philippines	46.89	2.133
Singapore	1.40	71.429
Republic of Korea	1,142.25	0.088
Sri Lanka	141.11	0.709
Thailand	35.76	2.797
Viet Nam	22,475.00	0.004

– = not available, kW = kilowatt, kWh = kilowatt-hour, PRC = People's Republic of China, US = United States.

Notes:

1. Electricity use and maximum demand have been defined for typical customers of each category. Thus, the average price reflects the price to each typical customer. Analysis is based on published tariffs. Whether the tariffs are cost-reflective and whether the utilities are profitable has not been considered.
2. Sales taxes, such as value added tax, are not included. Fuel surcharges, if any, are included. For Assam, Kerala, and Maharashtra, electricity duty is included. Subsidized rates are included for Tamil Nadu.
3. These are based on published tariffs. Special concessions given to identified customers or within special economic zones are not included.
4. Optional tariffs, such as time-of-use (TOU), are not included. When TOU tariffs are mandatory, a flat load profile is assumed in this calculation.
5. Unity power factor is assumed, where relevant.

Source: Published information by utilities and regulators, as of October 2015.

making do not advocate discrimination against customers in terms of the purpose and quantity of use. In a study on electricity prices across several areas in Asia (Table 31), only Singapore refrained from discriminating against customers in terms of the purpose and quantity of use. Singapore follows a policy of pricing electricity in terms of voltage of delivery: low voltage, medium voltage, high voltage, and extra high voltage. Hence, the metering infrastructure is more detailed and sophisticated as a customer moves up the ladder toward a higher voltage of supply.

As utilities and regulators move further in their analyses and tariff restructuring, and with reducing costs of digital metering, it is most likely that customer pricing would gradually move toward both cost-reflective pricing and dynamic pricing strategies. Definition of customer categories by purpose of use (e.g., household, commercial, industry, water pumping) and by quantity of use (e.g., low user) is likely to diminish when such policies and principles are gradually implemented in the countries studied. For example, in 2010, Sri Lanka announced a road map for tariff reforms and rebalancing, which, if implemented in full, would have abolished the customer classification by purpose of use. The transition has been delayed in Sri Lanka but is likely to be implemented in the second tariff period (2016–2020).

Subsidies to deserving customers, therefore, require careful definition and assignment of responsibility. As it is done at present, subsidies are poorly targeted, subsidy receivers are poorly defined, and "who pays for the subsidy" is not clearly defined. In general, customer definitions based on quantity of use provide a convenient way to provide subsidies (or to apply surcharges). Such definitions have lower transaction costs and require lower efforts by both the customer and the utility to implement the subsidy.

B. Payment Record of Subsidies Committed by Governments

In the South Asian countries covered in the study, the general approach is to allow full cost recovery for the utilities and any subsidies to be either directly provided by the government or earned as a cross-subsidy by selling electricity to other customers at rates higher than what electricity costs.

In Bhutan, the government allocates subsidies to identified customer groups by foregoing the royalty due to the government from hydropower plants. Accordingly, Bhutan has been able to provide free electricity to low-user households, and to subsidize even certain large customers. In 2013, the entire royalty dues were allocated to the subsidy.[13] Such an arrangement provides a guarantee to the utility that financing of subsidies would not be a burden because the royalty is available in-kind (i.e., energy from hydropower plants), which the utility sells to customers and generates funds to subsidize identified customer groups.

Subsidies by the state government are clearly stated in Assam, where the state government commitment is included in the revenue calculation.[14] Additionally, the cross-subsidy is limited to ±20% of the average cost of supply, based on the government's tariff policy. In contrast, the 2014–2015 tariff order for Madhya Pradesh does not expect the government to provide any subsidies, and relies solely on cross-subsidies charged on customers and wheeling customers to subsidize certain customers. Published information indicates that the government subsidy to electricity customers in India was about ₹200 billion in 2010.[15] The ex ante and ex post adjustments in all the states of India covered in the study are implemented,

[13] Bhutan Electricity Authority. 2013. *Bhutan Power Corporation Limited: Tariff Review Report*. http://www.bea.gov.bt/wp-content/uploads/2013/11/BPC-tariff-review-report-2013.pdf.

[14] For example, in 2013–2014, the State Government of Assam provided ₹1 billion to provide subsidies, which the regulatory commission allocated transparently to Jeevan Dhara (BPL consumers) and domestic category A consumers. However, such subsidies were inadequate, and the regulatory commission resorted to charge cross-subsidies from other users including wheeling customers.

[15] International Institute for Sustainable Development. 2012. *A Citizen's Guide to Energy Subsidies in India*. Geneva.

mostly by passing-on the additional revenue awarded, or excess revenue clawed-back, to customers through the regulatory process.

In Sri Lanka, ex post adjustments are only partially implemented, with no immediate passing-on of costs to customers. For example, in the tariff determination of 2011, PUCSL defined a subsidy requirement of SLRs11,767 million for 2011 to ensure that the government-determined subsidies continue to be awarded to low-user customers.[16] This is in addition to the cross-subsidy charged on high-user households and commercial customers. However, subsequent tariff decisions continue to be silent on the subsidy commitment of the government. The annual report of the Ceylon Electricity Board (CEB) did not show the subsidy commitment by the government but not received, under accounts receivable.[17] Therefore, the government subsidy not received adds to the financial loss of the CEB. Such accounting practices place unnecessary burdens on utilities, causing utilities to be reluctant in administering subsidies to customers. If year after year unpaid subsidies by the government cause utilities to report losses (whereas the tariff methodology and revenue determinations by the regulator clearly define a profit-making utility), utilities are likely to discontinue subsidies. The only reason why subsidies continue to be implemented by utilities in Sri Lanka is that they are government-owned. Such arrangements are unlikely to be welcomed by utility management, which are increasingly required to be accountable for the technical and financial performance of their businesses, despite being owned by the government.

In summary, the transparent way government policy is implemented in Bhutan, India, and Sri Lanka (whether written or implied) to subsidize identified customer categories are adequate and well documented (information on financing subsidies in Maldives [if any] and in Nepal was not available). However, the nonpayment of subsidies due from the government to Sri Lankan utilities creates a revenue gap, which adds up to the financial losses of the bulk supply licensee. Bangladesh and Nepal, where subsidies are operational, require further documentation of the costs of supply to customers, and to clearly identify how the subsidized customer costs are financed.

C. Targeting Subsidies

Socially inclusive pricing of electricity needs to be targeted toward its intended beneficiaries. While it is convenient to implement for both the utility and the customers, increasing block-tariffs to households is weak in targeting the poor.

A study in Sri Lanka (2007)[18] provides the following information. The subsidy was intended only for household customers using less than 30 kWh/month (lifeline), while CEB's historic tariff levels imply that customers using up to 90 kWh/month (lifeline+) were also eligible to receive a subsidy.[19] This is confirmed by the customer response to the tariffs analyzed in the report. Based on total cost of supply (SLRs12.31/kWh in 2005), lifeline customers and lifeline+ customers recorded a beneficiary target index (BTI)[20] of 4% and 29%, respectively, which is poor and significantly below expectations. This means that out of the total subsidy received by the electricity sector (CEB), only 29% reached the target beneficiaries. Households as a group recorded a BTI of 48%. However, since the cost of supply calculations were streamlined with the regulatory commission taking over from 2011, the BTI, calculated

[16] PUCSL. 2011. *Decision on Electricity Tariffs-2011*.

[17] Ceylon Electricity Board. 2015. *Annual Report 2015*. http://www.ceb.lk/index.php?aam_media=34836.

[18] World Bank. 2007. *Sri Lanka Public Expenditure Review: Infrastructure, Power Sector Analysis, Final Report*.

[19] Lifeline block, however, is not clearly defined. The National Energy Policy (2008) of the Ministry of Power and Energy states that 50% of cost of supply of the first 30 kWh will be paid through coupons, but this mechanism has not been implemented.

[20] A higher BTI implies that the subsidy has been more successful in reaching its intended beneficiaries.

Table 32: Subsidy Beneficiary Indexes in Sri Lanka, 2011
(%)

Household Customer Category (consumption kWh/month)	Share of Subsidy to All Households	Share of Government Subsidy to the Sector
0–30	13.2	37.2
31–60	36.8	103.1
61–90	42.4	119.0
91–120	14.2	39.7
121–180	6.3	17.6
181–600	–7.4	–20.6
>600	–5.5	–15.3
All household customers	100.0	280.7

kWh = kilowatt-hour.

Notes:
1. A negative number implies the flow of cross-subsidies from the customer category to another. For example, if only the lifeline customers are subsidized, only 37.2% of the government subsidy called for in 2011 would be required, significantly lowering the burden on the government.
2. The total subsidy beneficiary index reaching 280.7% implies that the subsidy provided by the government and surcharge on households using more than 180 kWh/month was inadequate to finance subsidies to household customers, and that the total cross-subsidy to household customers amounted to 180.6% of the government subsidy to the sector.

Source: Authors' ex ante calculations based on Public Utilities Commission of Sri Lanka. 2011. *Decision on Electricity Tariffs-2011*.

in the present study based on cost of supply to each customer category, is provided in Table 32. As the basis of calculation has changed, it is not possible to compare the progress from 2005 to 2011 in targeting lifeline customers.

A study on three countries (Cape Verde, Rwanda, and Sao Tome and Principe) concluded that in countries with lower access to electricity or lower connection rates, subsidized connections would strongly target the poor, compared with consumption subsidies given through tariffs, which have problems of targeting.[21] The authors simulated the commonly used increasing block tariff (IBT) versus volume differentiated tariff (VDT) and concluded that VDT would provide improved beneficiary targeting. In VDT, lifeline tariffs are limited to the lifeline block, whereas, if the monthly consumption increases above a specified level, all consumption has to be paid for at the nonsubsidized rate.[22] A study in Ghana concluded that "The lifeline tariff represents an imperfect mechanism of targeting the 5%–20% of consumers who show

[21] D. Angel-Urdinola and Q. Wodon. 2007. Do Utility Subsidies Reach the Poor? Framework and Evidence for Cape Verde, Sao Tome, and Rwanda. *Economics Bulletin*. 9 (4). pp. 1–7. The authors observe, "As poor households tend to live in areas without electricity service, or far from electric lines where service exists, it is difficult for them to benefit from electricity subsidies simply because they are not connected to the network."

[22] M. Vagliasindi. 2012. Implementing Energy Subsidy Reforms: An Overview of the Key Issues. *Policy Research Working Paper*. No. 6122. Washington DC: World Bank. The author states, "In countries characterized by high connection rates a move from IBT to VDT and the use of means-tested discounts substantially increases the targeting performance of subsidies." Author's note: Implementation of VDT, however, has a few difficulties compared with IBT because any delay in meter reading, which is still conducted manually on site, may unfairly move a customer to the higher consumption block. Many countries in this study practice a hybrid tariff structure, which has features of both IBT and VDT. For example, Bhutan provides free electricity to low-user households, and Sri Lanka practices a hybrid structure for households, small commercial customers, and small industrial customers.

signs of vulnerability; in fact, it was originally not designed to target the poor, but to ease the administrative burden on the utility and to provide a 'basic needs' level of service."[23]

In summary, there is a need to improve the analysis conducted by each country covered in this study. This could be done through (i) a more comprehensive calculation of the cost of supply to each customer category, (ii) analyses of the share of subsidies that reach the customers targeted by socially inclusive tariffs, and (iii) examinations of alternative tariff structures including VDTs (subject to innovative approaches to resolving implementation issues). Such analysis would enable governments, regulators, utilities, and development partners to more clearly identify and support deserving groups of customers. Present analyses conducted by utilities and regulators in all the countries studied are inadequate or too simplified to highlight the level of prevailing subsidies. In countries where connectivity is low, the focus should be more on support for connection charges rather than for consumption charges.

Poor definition of customer groups to be subsidized is also a key shortcoming. In all countries, except India, lifeline tariff entitlements are not clearly defined. Other countries do not define the entitlement of a lifeline customer in terms of energy (kWh) per month. IBTs for households are generally considered to be the remedy for the absence of clear definitions, and such block tariffs are in operation in all countries in South Asia. A clearer definition of entitlement of a lifeline customer should include (i) a policy declaration on what constitutes basic electricity requirements in the household (lighting, television, electric fan, refrigerator); (ii) a technical, commercial, and social survey to establish how much of electricity is required to satisfy the basic needs defined in the policy; (iii) a clear calculation of the cost of supply to that customer category and by how much the cost of supply should be subsidized in establishing tariffs; and (iv) a clear calculation of who pays such subsidies, e.g., 50% from cross-subsidies from other customer categories, 50% direct from the government.

However, key questions remain to be answered. Is it fair to define lifeline entitlement on a per-household basis? Is it not fair if the lifeline entitlement is defined based on monthly consumption per person in a deserving household? Convenience in administration is the principal reason to retain the IBTs to households as the key channel to deliver consumption subsidies to low-user (presumed to be low-income) households. Additionally, IBTs are widely credited to promote energy efficiency in household as one unit. It may be argued that a per capita allowance is more fair and logical than a per household allowance or subsidy, as services such as lighting, entertainment (television), and refrigeration are shared among all in a household. A per-person allowance of lifeline tariffs or subsidies for household use of electricity would indeed be favorable to larger households with shared services, but with a negative impact on energy efficiency objectives of a tariff. Per capita subsidies or lifeline tariffs were not practiced in any country covered in this study.

Once the analysis brings out the cost of supply to each customer category, prerequisites to design targeted subsidies are the following: (i) clear definition of beneficiaries, by way of purpose of use and income levels; (ii) definition of the subsidy to be granted and the way social equity is to be achieved; and (iii) identification of the source and the mechanism to finance the subsidy. The next step would be to design the subsidy delivery procedure, keeping in mind the limitations in metering electricity and the dual-purpose electricity customers (home and microenterprise in the same premises under the same electricity account).

[23] S. Keener and S.G. Banerjee. 2005. Ghana: Poverty and Social Impact Analysis of Electricity Tariffs. *ESMAP Technical Paper*. No. 088. Washington, DC: Energy Sector Management Assistance Programme.

Subsidies, as described earlier, may either be targeted or nontargeted (generalized). A subsidy to all low-user households, all low-user industries, and all low-user commercial customers is not targeted because a low user is not always a less advantaged or poor customer, or a threatened business or industry. Such subsidies are easier to administer because the electricity meter determines automatically every month which customer is entitled to receive the subsidy. A semi-targeted subsidy is where the purpose of use is defined, but the customer's financial status is not defined. Free electricity provision to handlooms in Tamil Nadu is an example of such semi-targeted subsidies. In addition to the customer definition in the application for the electricity connection, there would most likely be one additional approval (e.g., from a state handloom department) that would be required to determine beneficiaries. Targeted subsidies (fully targeted) would examine the crucial parameter: does the specific customer (household, business, or industry) deserve a subsidy? To answer that, a regular assessment of the customer's financial status would be required. Hence, such fully targeted subsidies are difficult to implement, and would require paperwork that inevitably would lead to corrupt practices in securing approvals.

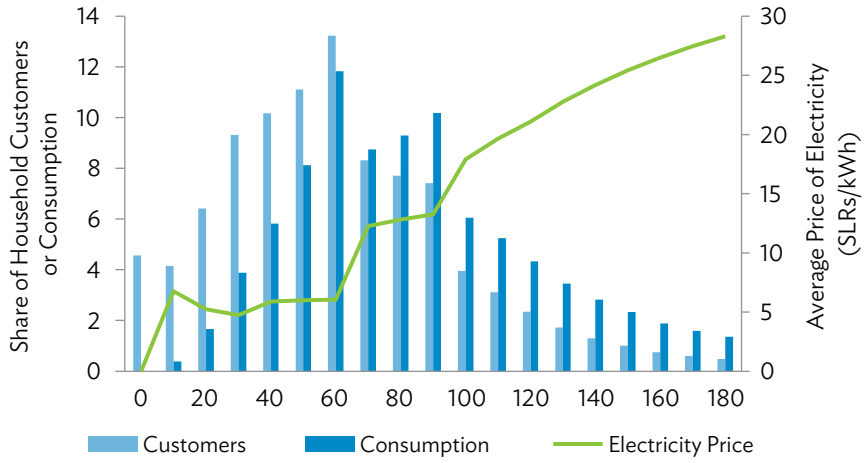
VI. EFFICIENT ELECTRICITY USE AND IMPLICATIONS FOR TARIFF SETTING

Electricity use in households upon first entry and among rural, lower-income groups is largely for lighting (followed by television and refrigeration) as the household gets accustomed to the use of electricity and as income levels increase. Where the household is also the base for income-generating activities, then lighting and other electricity use support such commercial activities. Unlike industrial and commercial customers, households pay an increasing rate per kWh as the monthly electricity use increases from one block to another. The block arrangement itself is adequate to impose energy efficiency, as seen in Figure 4. Household consumption in Sri Lanka is sensitive to the significant increase in prices beyond the lifeline+ block of consumption at 60 kWh/month. Up to 60 kWh/month, the number of customers and consumption increase in this analysis of performance for each 10 kWh block. Volume differentiation at 60 kWh/month is visible in all profiles, indicating that customers are sensitive to sharp upward price movements for consumption above 60 kWh/month. Movement from 60 kWh to 61 kWh would cause an immediate additional expense of SLRs344 for that month. In other words, customers perceive the 61st kWh to cost SLRs344.

Price-driven constraints on electricity consumption are most likely driven by inability to afford rather than by any desire to be energy efficient. With electricity prices reduced by about 30% in late 2014, Sri Lanka's average household consumption increased from 62 kWh/month (in 2014) to 70 kWh/month (in 2017). This increase may reflect the increase in household income and reducing prices, which in turn would increase consumption. Any initiative to improve energy efficiency would be covered by the ever-increasing household monthly consumption, to which customers would be required to pay increasing prices per kWh.

Energy-efficient appliances are penetrating the market, especially compact fluorescent lights and light-emitting diodes—these are lighting devices that save up to 60% of energy compared with incandescent lamps (for the same quantity of light and of comparable device life). Households using televisions and refrigerators are benefited by lower electricity use in light-emitting diode TVs and inverter-type refrigerators. Many countries have introduced regulations on minimum energy performance standards, and enforce such standards through appliance labelling to allow customers to make informed decisions when buying new appliances. Specific research on the extent by which lower-income and vulnerable households benefit from improved appliance efficiency is not available, but an assumption that such households enjoy the same benefits as the rest of the population would be reasonable.

Figure 4: Sri Lanka's Household Consumption Levels in Each Block and Prices, 2014



kWh = kilowatt-hour, SLRs = Sri Lankan rupees.

$1.00 = SLR131.25 (as of 31 Dec 2014).

Notes:

1. There are about 4.2% household customers who record zero consumption attributed to house closures, and a few net metered customers with zero import from the grid.
2. Customers using over 180 kWh/month (about 11% of electricity used in households) are 2.3% of all households.

Source: Customer data from Ceylon Electricity Board distribution entities, covering about 90% of household customers in Sri Lanka. Information relates to July 2014. Electricity tariffs have since been reduced by about 30%.

Information on tariff-setting activities of sector regulatory commissions explicitly considering energy efficiency is not available. Energy efficiency is beneficial to customers, but regulatory commissions focus more on supply-side efficiency.

VII. POLICY AND REGULATORY ENVIRONMENT FOR RENEWABLE ENERGY DEVELOPMENT

All countries in South Asia have attractive statements on renewable energy development for both on-grid and off-grid applications in country policy documents. Facilitation of renewable energy development for electricity production ranges from support for small community projects such as mini-grids, systems for individual households that lack grid access, large commercial projects to serve electrical energy to the grid, and grid connected systems such as net metered systems. Examples of on-grid renewable energy services are significant as additional sources of income, owing to their adaptability to rural and lower-income groups of customers. Hence, only such on-grid participation is enumerated in this section. Inclusive growth of household customers, with renewable energy development based on renewable energy use, can only be through electricity production schemes similar to net metered solar photovoltaic (PV) system. This is because (i) such systems require relatively smaller capital outlay; (ii) they do not have the technical complexities of major electricity generation projects such as those operating on feed-in tariffs; and (iii) participation in such schemes would not lower the quality and quantity of electricity the household would receive through a regular grid connection.

Among South Asian countries, India, Nepal, Maldives, and Sri Lanka positively encourage renewable energy development through net metering schemes that are open to any type of customers, including households. India allows customers to connect net metered renewable energy-based systems to the grid through the customer's own existing electricity connection. For example, Gujarat allows up to 50% of contract capacity to be connected as net metered facilities, while Andhra Pradesh imposes a limitation of 1 megawatt (MW) per customer. Tamil Nadu specifies that a solar PV system capacity should not be more than the approved load of the service connection. "It is also advisable to have a solar PV system size that has an annual estimated generation of not more than 90% of the estimated consumption,"[24] states the guidelines for Tamil Nadu.

Sri Lanka has allowed net metered solar PV since 2008 for renewable energy-based electricity production, and has achieved a capacity of about 40 MW by end 2016. Customers are not paid for any surplus energy banked on the grid, which will be returned to customers whenever required over the 10-year contract period (on a one-to-one basis with no banking fees). Customers with net metered renewable energy have now reached about 8,000, about 0.1% of the total customer base. In late 2016, the government announced an enhanced scheme, in which surplus energy can be sold to the grid at SLRs22 per kWh for 7 years, and at SLRs15.50 per kWh over a further 13 years. Additionally, in case the customer wants to be a micro-power producer, a stand-alone solar PV system can be installed and energy sold to the grid at the same prices as above.

A. Examples of Renewable Energy Opportunities for Livelihood Support

The Andhra Pradesh net metering announcement specifies that permission will be given to a group of persons to set up solar power projects up to 1 MW and will be treated as collective generation for supply of power to the households of each group member. Distribution companies will set off the above energy from the consumed energy of individual service connections, and the balance (either excess or deficiency) can be billed on a net metering basis. The tariff for FY2014 was ₹5.25 per kWh of excess sent-out energy for 25 years, while energy imported would be charged at the regular utility rate. Although the buy-back price may be low from a commercial point of view, the concept that generation from the facility will be set off against the collective consumption of the group members is a concession that lower-income groups can use for their advantage. Opportunities exist for several users—typically in a village setting where such groupings are common—to establish a collective solar PV-generating facility and sell the surplus to the grid while setting off against their own consumption. The financial prudence of such an initiative needs to be checked against buying electricity at the grid selling price.

In 2016, Sri Lanka announced a further concession for electricity to be sold to the grid, where a household may rent its roof space to a third party to develop solar PV facilities. The government issued guidelines for such ventures and even went to the extent of recommending the rental of SLRs500 per month to be paid by the developer to the owner for the use of roof space plus the payment of the customer's monthly electricity bill up to 60 kWh/month (Sri Lanka's lifeline+ consumption level). The guideline provides an opportunity for low-user households to earn an extra income; their electricity costs up to the lifeline+ quantity would be fully paid for 7 years. From the eighth year onward, the guideline states that 50% of the income from solar PV system should be paid to the household by the developer.[25] No limit on capacity has been stated in the guidelines, but low-user households are likely to be limited to about 30 square

[24] Tamil Nadu Energy Development Agency. *Tamil Nadu Solar Net-metering Consumer Guide*. http://www.teda.in/teda/uploads/editor/files/Solar%20net%20metering%20Consumer%20Guide.pdf.

[25] Government of Sri Lanka, Ministry of Power and Renewable Energy. 2017. *Guidelines for Joint Projects between Service Providers and Households under Net-Plus Scheme*. Colombo. (In the national language, Sinhala).

meters of roof space, allowing a 3 kilowatt-peak solar PV system. The success of the initiative is yet to be assessed, as it is in its first few months of operation.

A lesson learned from regulations in Gujarat raises a question of whether Sri Lanka and the rest of South Asia would enable customer groupings or societies to build a solar PV system centrally and allow them to collectively set off its production against the consumption of individual members of the society. Collective capacity is likely to be cost-effective and a more convenient measure for maintenance and management. Such collective initiatives have been previously implemented in Sri Lanka through small hydropower-based community mini-grids during 1995–2015. The main grid has now reached all locations of Sri Lanka, and hence such community mini-grids no longer exist.

B. Community-Owned Renewable Energy Facilities

A similar initiative was proposed in Sri Lanka in the first wind park, where a block of 25 MW out of 375 MW was proposed to be designated as a "community wind block," where the local community would be invited to invest, arranged by a semi-government investment bank.[26] The objective was to ensure that landowners and other local interest groups would not be left out of the benefits of the renewable energy source in the then remote area of the north-west, where wind resources are abundant. However, this proposal is yet to be implemented, while the first 100 MW of the 375 MW resource is now under implementation.

Community-owned renewable energy facilities are difficult to develop in an investment climate where renewable energy development is now a commercial activity that many medium and large-scale investors are enthusiastic about. The advantage of rural, relatively remote communities is that competition would be less, and the renewable energy resource (except biomass) is available subject to minimal or no regulatory limitations, costs, or fees. Therefore, rural, low-income communities should be empowered to move to commercial development of renewable energy for electricity generation, where governments may use already existing procedures (net metering, community mini-power plants). It is unlikely that community projects (or even stand-alone projects such as a grid-connected solar rooftop) will benefit communities or low-income households as an additional income source without government or utility intervention.

VIII. APPLICATION OF TARIFFS AND CHARGES BEYOND LIFELINE TARIFFS

There is no accepted yardstick to measure the efficiency or effectiveness of tariffs and charges,[27] which were established to meet socioeconomic objectives. Firstly, an efficient tariff should ensure that utility costs are fully recovered, so that any subsidies for specified customers would not be a burden on the utility. Secondly, any social or economic objectives should be adequately fulfilled. In the six countries studied, the objective of meeting the costs of utilities is fulfilled to varying degrees, which were described in the previous sections of this paper.

Some countries include the service connection to each household in the investment plan on the distribution network development, which means that either the utility or the government pays for the service drop, meter, and associated equipment. Additionally, house wiring work requires financing.

[26] ADB. 2014. *Technical Assistance to Sri Lanka for Capacity Building for Clean Power Development*. Manila (TA 8167-SRI; Part B, Final Report Part 3: Commercial Arrangements and Bidding Documents for Wind Development in Mannar District).

[27] These are fees to secure a connection to the electricity network.

In typical utility practice, house wiring costs and the costs of the service drop, meter, and associated equipment are done at customer's expense. Is there a benefit to customers of meeting the expenses of the service drop and house wiring by the state or utility? If so, how should the beneficiaries be targeted for such support? In this section, a case study application of tariffs and charges to fulfill social objectives is discussed.

A. Project Review: Gender-Inclusive Access in Sri Lanka

Sri Lanka is moving toward 100% grid electricity in the whole country, and it is widely reported that 96% of households already have an active electricity connection. Once new distribution lines are drawn to provide access, connections are taken by customers typically within a maximum of 5 years; but as the country moves toward 100% electrification, the network reaching very remote corners of the country causes the uptake of service connections to be slower than elsewhere in the country.[28] The main reason for delayed connection is the costs of house wiring and service connection. Thus, the intended benefits of providing access to grid through relatively large economic costs do not immediately reach poorer sections of society.[29] From time to time, loan schemes have been in operation in Sri Lanka through banks for customers to meet the costs of house wiring and service connection.

Improving Gender Inclusive Access to Clean and Renewable Energy in Bhutan, Nepal, and Sri Lanka was a pilot project.[30] It comprised three components: (i) component A: gender review of energy sector policies, documenting good practices in incorporating pro-poor and gender-related aspects of national energy policies, laws, and regulations in the three countries; (ii) component B: direct intervention in project communities to strengthen energy-based livelihoods for rural women through training on energy, business development, and management, and through handholding support and facilitation of financial and marketing linkages; and (iii) component C: project performance and monitoring system to systematically monitor and document the project's social and gender-related processes and results.

In Sri Lanka, component B had a strong emphasis on interventions geared toward promoting energy-based livelihood opportunities for rural women, strengthening women-led operation and maintenance (O&M) systems for small-scale energy technologies, and thereby improving local service delivery and strengthening the operational sustainability of community-managed or household energy systems in the Ampara District. This component had the following subcomponents: (i) identification of 2,500 households in Ampara District (to be provided with a new electricity connection by CEB, the distribution utility serving the area) on pre-decided criteria, based on data provided by the 20 divisional secretariats[31] serving the target area; (ii) capacity building of 750 people including 200 women on energy-based livelihoods and opportunities resulting from access to electricity; and (iii) awareness raising of 10,000 newly electrified households about safe and efficient use of electricity and energy-related livelihood opportunities. For example, under component B(ii), women owning tailoring units in Sri Lanka were trained in the proper use of machine motors, as well as in day-to-day maintenance of

[28] Sri Lanka defines all households within 100 meters of a distribution line to have access to the grid.

[29] As Sri Lanka attempts to serve remote corners of the provinces, investment on the distribution network (on grid extension by the utility or the government) has now risen to about SLRs200,000 ($1,400) per new customer. Typically, investments on grid extension are borne by the government by way of grants or additional government equity investments. Customer connection costs and house wiring costs are additional. The cost of the service drop and connection is currently (2016) SLRs20,000 ($140) per household for a household 50 meters away from the distribution line.

[30] ENERGIA. 2015. *Improving Gender Inclusive Access to Clean and Renewable Energy in Bhutan, Nepal and Sri Lanka: An ADB-Supported Project to Achieve Gender Equality Results in the Energy Sector*. https://www.energia.org/cm2/wp-content/uploads/2016/05/01-PRF4-Project-Note-WEB.pdf.

[31] A divisional secretariat is the government institution in the area that manages, among other things, all social welfare schemes, and is headed by the divisional secretary from the Sri Lanka Administrative Service.

their sewing machines. Beneficiary groups for training and livelihood-related training under component B(ii) were selected from households that already had an electricity connection. The project engaged Practical Action, a national nongovernment organization, to implement Component B.

In component B(i), the project interventions initially targeted providing electricity access to approximately 2,200 deprived and vulnerable households, as determined by project participant institutions. CEB, the project implementing agency, provided electricity connections to more than 3,000 households free of charge (approximately $130 per household, which was refinanced by ADB).

Under Component B(ii) and Component B (iii), Practical Action conducted training and awareness-raising programs for beneficary households and for select women and men with a potential to engage in new enterprises. Under Component B(i), the beneficiary households received the electricity connection for the first time through grants financed by the project, and were not specifically targeted to receive training in livelihood development activities of the project. Therefore, component B(i) targeted deserving households to receive a new connection free of charge, while component B(ii) and component B(iii) focused on training women- and men-members of households (with active electricity connection) on the productive and safe use of electricity.

For this study on tariffs in South Asia, a social impact assessment of the beneficiary households of component B(i) was conducted in December 2015 using both quantitative and qualitative approaches. This assessment involved personal interviews with members of 100 beneficiary households, of which 26% were women-headed. Around 65% of the households were engaged in seasonal and irregular work, and thus had unstable and fluctuating incomes. Higher unemployment rates were seen among women. A total of 86% of the households had a monthly income of less than SLRs25,000 ($170); the monthly incomes of 98% of the households are below the national mean. A total of 56% of the households perceived themselves as "poor" or "very poor," and 82% were the beneficiaries of government's poverty alleviation program.[32] Women in the project sites constitute the majority of the population that have no schooling or have lower education.

Lack of funds to pay for the upfront connection costs was the main reason that prevented households from getting connected to electricity earlier. Around 98% of the households used electricity exclusively for household lighting. The average number of bulbs illuminating a single household was approximately four. For cooking and boiling purposes, 96% still used fuel wood. Energy had not been used much for economic activities. Electrical appliances used in households included television sets and/or radios in 65% of the households, mobile telephones in 78%, table fans in 52%, and ceiling fans in 18%. Kitchen appliances such as rice cookers, blenders, grinders, and heaters were available in 34% of the households. Monthly expenditure for electricity consumption of more than 70% of the households was less than SLRs250 ($2).

Social benefits of electrification, as stated by the occupants, included better and brighter lighting, convenience for women to conduct their household and livelihood activities, a household environment free of harmful emissions, more entertainment for family members, increased sense of security (particularly for women at night and from the threats of wild elephants), and better lighting for children who engaged in studies. The most significant economic benefit of electrification to households was a substantial reduction of the household's costs on kerosene. Furthermore, electricity provided a better and more convenient environment for women who conducted livelihood activities, which in turn contributed to increase their work efficiency, productivity, and quality, as well as their incomes from these livelihood

[32] The program is called Samurdhi.

activities. However, not many women or their households could initiate or engage in electricity-based livelihood activities owing to lack of access to investment capital, markets, and technology; limited knowledge and capacity; and household obligations.

The selection of the beneficiary households for the project was well-targeted. Most of the beneficiary households were dependent on a singular source of livelihood that only provided them with casual and fluctuating incomes. Nearly one-fourth of the beneficiaries were women-headed households who had meager incomes or depended on others.

The study points out that a broader societal change cannot be expected to occur in these households within 2–3 years if only the electricity connection is provided. Electricity was being used mainly for a few functions such as household lighting and operation of some electrical appliances (televisions, radios, fans, kitchen appliances, and mobile phones). Households' electricity consumption for lighting was minimal, confined to three to four bulbs and restricted to a monthly consumption of less than 50 kWh. Households did not have sufficient incomes or savings to pay for the acquisition of electricity-using technologies and devices that would reduce the burden on women in their household functions and eventually improve their overall well-being.

Only 2 of the 100 beneficiary households have started up new economic activities using electricity within the first 2 years of receiving the free electricity connection. This shows that provision of access to electricity alone does not trigger its use for economic opportunities by poor and vulnerable women because they lack the minimal requirements to engage in such livelihood opportunities and to access the relevant energy-based technologies. They also lack the investment capital, knowledge, and expertise; access to credit and markets; and the entrepreneurial mindset which are prerequisites for an entrepreneurial engagement.[33] This situation is further exacerbated by social and cultural ethos and taboos that impinge on the mobility of women and confine them to conventional gender roles.

B. Lessons from Sri Lanka Project

The improved targeting, combined with the provision of connection subsidies and consumption subsidies, provided increased access to energy of poor and vulnerable households, including women-headed households.

Results of the survey on component B(i) point to the need for electrification to be followed up with an initiative to assist the beneficiaries to use electricity for productive economic activities. In contrast, the results of the end-of-project survey on Component B(ii) showed that 53% of the trained individuals started their own enterprises after the training. Similarly, a 28% increase in the average production sold and a 59% increase in the monthly average income were observed (footnote 29). These results point to the need for continued interventions and support to newly connected households such as those covered in component B(i), as demonstrated by the results of component B(ii).

While the provision of connection subsidies and consumption subsidies do provide increased access to energy of poor and vulnerable households, especially women and their households, expecting them to use electricity and electricity-using technologies for new livelihood opportunities is unrealistic. Poor and vulnerable women require a host of support services including educational and awareness-

[33] Note that this survey covered a sample of households under component B(i) of the project, in which households were selected to receive a free electricity connection for the first time. Other components of the project that provided training on livelihood development under component B(ii) and component B(iii) to households that already had an electricity connection were not covered in this survey.

raising programs until such time they get their positions consolidated. The provision of such support services should also accompany a significant change in the policy environment that triggers pro-poor interventions to increase access to, and affordability of, electricity and its associated technologies for poor and vulnerable households. As the project has anticipated, it is also necessary to facilitate an empowering process for the poor and vulnerable women to act as powerful agents of change to influence decision-making processes and to bring about gender-responsive energy infrastructure and services.

IX. LESSONS FOR DEVELOPING MEMBER COUNTRIES ON SOCIALLY INCLUSIVE TARIFFS

Improved analysis and information on lifeline tariffs. Information available to customers as well as to policy makers on how lifeline tariffs were determined in terms of the quantity allowed and the pricing of the lifeline blocks is generally absent throughout the region. Therefore, the lifeline block (or blocks) of consumption appears in most countries to be arbitrarily defined, with no significant analysis of its relevance in meeting basic needs or the channel to reach its intended target beneficiaries. Improved analysis of impacts of social and economic development on customers, more information on who pays for the subsidies, clearer analysis and presentation of subsidies (and surcharges) in regulatory documents, and indicating the subsidy amount in the bill issued to customer would assist the overall process of delivering electricity and the benefits of electricity for livelihood development activities of socially disadvantaged customers.

Improved definition and performance of lifeline tariffs. The performance of lifeline tariffs in reaching their implied or defined objectives is weak due to (i) limitations in defining what the lifeline quantity of electricity is, (ii) poor targeting of the subsidies received, and (iii) shortcomings of the governments in meeting subsidy payments to utilities. Cross-subsidies within the electricity sector is the most common way of meeting the social objectives of tariffs. Finally, as shown in this paper as well as in published analyses for other regions of the world, targeting intended customers with lifeline tariffs is weak. This means that subsidies seemingly intended for lifeline customers, explicit or implied, did not fully reach such customers; other customers received subsidies. Across the region, lifeline tariffs are not clearly defined (i.e., purpose) and quantified (i.e., kWh per month), and it is not clear how much the government will subsidize such customers (except when the electricity price is zero, e.g., to low users in Bhutan, which implies a 100% subsidy).

Options for targeting. Direct cash grants and similar instruments (e.g., energy coupons) have not been tried in South Asia, despite being indicated in certain policy documents (e.g., in Sri Lanka). When targeting is weak, customers misuse the benefits and utilities resist implementation of poorly defined lifeline tariffs that do not reflect electricity use for basic needs. Alternative approaches that may be considered include coupons issued for electric lighting (coupons may be used to pay electricity bills of electrified households or for kerosene purchases for non-electrified households) based on a nationally established poverty assessment indicator.

Improvement of targeting lower-income households and women-headed households. Targeting is weak or not calculated in all countries analyzed, and many use monthly consumption levels to target beneficiaries of subsidies. Except Tamil Nadu, all the other five states of India covered in the study use BPL classification to provide special concessions, in addition to subsidies provided under IBTs. Sri Lanka proposed a coupon system targeting lower-income households to receive energy subsidies with no clear mention of whether it will be used along with the IBTs. In any case, Sri Lanka's proposed targeting of energy subsidies was not implemented, and Sri Lanka continues to rely on increasing blocks to attempt to deliver electricity to deserving customer at lifeline tariffs.

Improved analysis of benefits of electricity to women and socially disadvantaged groups. Improved analysis on gainful use of electricity in already electrified households against those with no electricity supply is required to examine the gendered division of labor in routine household work and in productive activities. Such an analysis could develop gender-differentiated social and economic impacts of using electricity and other forms of commercial energy. It would assist in improved targeting of subsidies on gender and social inclusion considerations, such as targeting of low-income female-headed households, cottage industries, and medium and small-scale enterprises where women are the predominant producers.

Connection subsidies needed as much as consumption subsidies. Studies in many countries, especially those with very low connection rates (e.g., in Africa) as well as those with high but not 100% connection rate (e.g., Sri Lanka), have shown that households cannot benefit from lifeline tariffs offered because many simply cannot afford the cost of house wiring and the cost of connection to grid, although the grid is accessible. In countries with lower connection rates, the reason for not taking a connection even when the grid is within reach is widespread poverty; in many cases, safety regulations prevent connections to temporary buildings, which house low-income families. In other middle-income countries too, the reason for not taking a connection is poverty. The economic cost of extending the grid, usually borne by governments, would not provide its intended benefits unless such grid extension projects are accompanied with a mechanism to pay for house wiring and service connection costs.

Connections and wiring to be included as a standard cost in distribution network expansion investments. Projects including those financed by development partners presently do not essentially include the financing of house wiring and the service connection from the roadside distribution line to the house. As the region has generally passed the 60% mark in household electrification, any person with access but with no physical service connection would be left out owing to his inability to finance the connection costs and house wiring. In some countries, distribution expansion projects now include the provision of service connection as part of the standard project expenditure. As house wiring in such low-user small households would be of limited costs, such distribution projects may consider financing house wiring as well, with minimum safety standards to adhere to. It would be good and safe for the households to use a utility-funded service connection and house wiring; safety standards may otherwise be violated when the households attempt to build a low-cost wiring system in the house.

Electricity for livelihood development. The catalytic role expected to be played by electricity in developing livelihoods and new businesses is generally not seen in the first few years after providing electricity to a household. Electricity-using livelihoods require capital, and it takes time for customers to collect their savings or arrange borrowings to begin new businesses, thus causing delays in delivering benefits to the intended beneficiaries. Less capital-intensive businesses are certainly supported by electricity (by providing convenience through motorizing selected activities and improved lighting to enable longer hours of work); socially inclusive electrification programs require raising capital for start-up and associated training.

Implications for gender and social inclusion. The countries in the study have not implemented any subsidies based on customer gender. However, lifeline rates for household customers and preferential tariffs for small business and small industrial activities are applicable in many countries, directly serving to improve the status of women by easing out their household activities, and opening opportunities for cottage industries and other small-scale industries in which women are active in rural areas as entrepreneurs or employees. Some subsidies have been proposed in India for women entrepreneurs, and there are discussions about a similar approach in Maldives. It is too early to make any conclusions on the possible benefits of such tariffs, but socially disadvantaged families are more in need of connection support and capital to commence businesses if they so desire.

Conclusion. In the present context of increasing economic costs of providing grid access in the region as the power distribution networks span into remote areas with lower customer density, extending the grid further and offering consumption subsidies (to both existing and new customers) do not bring about the expected benefits. Support is required to ensure both rural and urban customers with grid access rapidly get a grid connection, and then have adequate capital and training to begin productive use of electricity beyond simple replacement of kerosene lighting with electric lighting. Such connection subsidies, along with capital and training, followed by focused consumption subsidies, would most likely maximize the economic benefits of the investment and the benefits to low-income women, socially disadvantaged individuals, and vulnerable groups. Most importantly, with utilities being required by lenders, governments, and regulators to be increasingly accountable for their expenses and income, the questions "what is the level of subsidy?" and "who pays for the subsidy?" would have to be more clearly answered and solutions provided if socially inclusive consumption tariffs are to be implemented successfully and sustainably through increasingly profit-conscious electricity utilities.

Areas for further research. The following areas are recommended for additional investigation: (i) Assessments of how much subsidies are reaching low-income, disadvantaged households should be strengthened with reliable data. Regular sample surveys and movement of customers in the consumption ladder were not available even for countries where the energy sector database is relatively strong. (ii) Assessment of how much subsidized customers value the subsidy, in relation to other expenses (including nonbasic services such as communication and entertainment). It requires evaluation through sample surveys that track household expenditure in a credible manner. Another area of related research is the trade-off between the quality of supply and the subsidy; utilities increasingly pressed to show profits or at least breakeven are likely to neglect maintenance in low-income customer regions, causing poor quality of supply. If adequately sensitized, are the subsidized customers willing to accept a reduced subsidy in return for a higher quality of supply?

Tariff Appraisal Study

Balancing Sustainability and Efficiency with Inclusive Access

This study examines electricity tariffs across South Asia to identify how well they are targeted to support inclusive economic growth. It analyzes how electricity utilities can support inclusive economic growth while remaining financially viable. The study examines socially inclusive electricity tariffs in six countries of South Asia: Bangladesh, Bhutan, India, Maldives, Nepal, and Sri Lanka. Tariff diversity was analyzed across Indian states: Assam, Gujarat, Kerala, Madhya Pradesh, Maharashtra, and Tamil Nadu.

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