Council on Energy, Environment & Water

Retail Tariffs for Electricity Consumers in Delhi

A Forward Looking Assessment

KAPARDHI BHARADWAJ, KARTHIK GANESAN, AND NEERAJ KULDEEP

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A report on 'Retail Tariffs for Electricity Consumers in Delhi: A Forward Looking Assessment'

Editor: Karthik Ganesan

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About the Authors

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Prior to his association with CEEW he has worked on an array of projects in collaboration with various international institutions, with a focus on low-carbon development and energy security. His published (and under review) works include Rethink India's Energy Strategy (Nature, Comment) the Co-location opportunities for renewable energy and agriculture in North-western India: Trade-offs and Synergies (American Geophysical Union), Valuation of health impact of air pollution from thermal power plants (ADB), Technical feasibility of metropolitan siting of nuclear power plants (NUS), Prospects for Carbon Capture and Storage in SE Asia (ADB). His role as a research assistant at a graduate level focused on the linkages between electricity consumption and sectoral economic growth using a time-series approach.

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He has been actively involved in renewable energy and sustainability activities. He was the founding member of Team Shunya, first ever team from India to qualify to participate in prestigious Solar Decathlon Europe 2014, an international competition to build and demonstrate a 700 Sq. ft. net zero energy solar powered house. He also initiated the Energy Club at IIT Bombay where he organised various events to raise awareness about sustainability and RE technologies.

Neeraj holds an M. Tech in Energy Systems and a B. Tech in Energy Science and Engineering from Indian Institute of Technology (IIT), Bombay.

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Executive Summary

Estimating the future cost of electricity requires an understanding of the different components that make up an electricity bill, the regulatory procedures and influences that impact the tariff for each of these components, and the market and political forces that affect these tariffs. Each component of an electricity bill is determined by a variety of factors. In order to provide clarity on the build-up of power supply costs, the overall cost is broken down into four parts - power procurement costs, transmission charges, distribution charges and cross-subsidy charges. Should there be more clarity (in due course), on specific trends of each, the forward-looking trends can be fine-tuned accordingly.

The four components that make up an electricity bill and their influences is as follows:

- Power procurement costs – the cost to generate the power which is driven by the overall mix of generation, the cost of fuel for each generation source, the efficiency of those generators, and the capital and operational cost of each generator. In addition, this component also accounts for (technical) losses incurred in transmission and distribution.
- Transmission charges – the cost of moving high-voltage power from the generators over the inter-state and intra-state lines to the distribution companies' (DISCOMs) infrastructure, is driven by the cost of building and maintaining these lines as India's need for electricity grows.
- Distribution charges – the cost to distribute and transform to lower voltages, the power from the transmission lines to individual customers which is driven by the cost to build and maintain the infrastructure to deliver power and to comply with Renewable Procurement Obligations from each state
- Cross-subsidy charges – cost for commercial and industrial customers to offset the total delivered cost of electricity to domestic customers which is driven by political matters in each state.

This report examines each of these factors in detail. In order to showcase the relative influence of different factors, this report has considered two scenarios, with varying energy mix based on renewable energy (RE) capacity additions and some expectations on changes in cross-subsidy that is inherent in the power sector. The two scenarios - high RE penetration and low RE penetration, are (both) conservative estimates of future RE capacity additions, going by the ambitions expressed by the current government. The variable components of each of these sources (energy charges) are assumed to vary as shown in the table below:

Table 1 – Assumptions in power procurement costs

Source	Assumptions
Coal	Energy charges assumed to increase by 9.1% year-on-year
Natural Gas	Energy charges assumed to increase by 6.2% year-on-year
Hydro	Energy charges assumed to increase by 1.3% year-on-year
Solar	Energy charges assumed to decrease by 5% year-on-year

Source: CEEW analysis

Transmission charges will rise as per the investments made in the overall network (inter-state as well as intra-state). To the extent possible, the investment plans of the utilities have been captured and converted to equivalent impact on every unit of electricity transmitted.

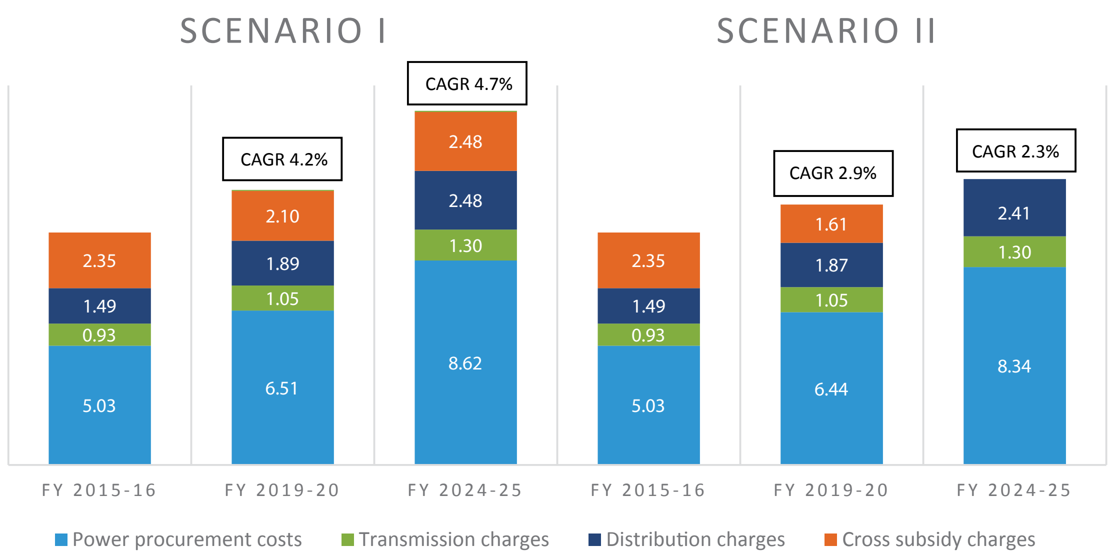
Distribution charges, based on the operating expenses of a DISCOM, are a complex mix of administrative and O&M expenses, capital expenditure and employee expenses. For the purposes of this study, operating expenses of DISCOMs (distribution charges) have been assumed to constitute 20% of the overall cost of supply. This represents the upper bound of the range of values seen in the DISCOMs that operate in Delhi.

The cross-subsidy component can have a telling impact on future tariffs. Extensive review of tariff orders provides no insight to the science of the cross-subsidy determination. However, policy makers acknowledge that reduction of cross subsidies (across consumer categories) is one of the major drivers for regulatory reforms. This constitutes a significant assumption in this assessment and is considered in parallel with the scenarios that depict two different energy mixes. The ratio of the average billing rate for a consumer category (ABR) to the overall average cost of supply (ACoS) is an indicator of tariff rationalisation for that category of consumers. Going forward, in both the scenarios, some rationalisation is expected. This ratio is assumed to be decreasing to +/- 20% in high RE scenario and 0% in the low RE scenario.

Observations

Power procurement costs continue to constitute the largest share of the cost of supply. The illustration below indicates the share of components in future tariffs for commercial consumers of BRPL – one of the three utilities, that was analysed as part of the study.

Figure 1 – ABR for commercial consumers of BRPL



Source: CEEW estimates

Power procurement cost is dictate by the rate of growth of the energy charges associated with the various sources of electricity. The large penetration of RE in both scenarios, brings down overall procurement costs. A fundamental expectation is that cost of generation from fossil fuel based sources will continue to increase (in real terms)[1].

Alternative Supply Options for Industrial and Commercial Consumers

Open Access (OA) is competition to DISCOMs supplying electricity to bulk consumers (consumption of 1 MW and above). Analysis of open access market trends indicates that long and medium-term transactions have declined, primarily due to regulatory uncertainty across states. OA charges for 2015-16, as per tariff orders of Delhi, Gurgaon and Noida are given below.

1 All the estimations in this report are expressed in **nominal terms.** Growth rates assumed in the analysis cover inflation adjustment.

Table 2 – Open Access charges as per tariff orders 2015-16

Landed Price through Open Access (INR/kWh) /Voltage Level	11 kV	33/66 kV	>66 Kv
TPDDL Industrial	7.34	7.18	7.12
TPDDL Commercial	8.78	8.66	8.34
BRPL Industrial	7.18	7.42	6.45
BRPL Commercial	9.23	8.37	7.48
Gurgaon Industrial	8.17	8.17	8.17
Gurgaon Commercial	8.64	8.64	8.64
Noida Industrial	9.22	8.51	8.51
Noida Commercial	10.92	10.09	10.09

Source: As per tariff orders of respective DISCOMs for 2015-16

OA charges and losses for open access consumers of solar and wind energy are considerably lower. Inter-state charges and losses are exempted up to 31st March 2019 (as per a recent MNRE announcement). Other charges vary from state-to-state. Components of open access are ascertained on a year-on-year basis, by the respective SERCs. Regulatory risks are high for Industrial and Commercial consumers, who are looking for medium and long-term deals with generators.

Summary of Results

Based on the assumptions for each of the components that make up an electricity bill, CEEW estimates that electricity costs for Commercial customers will rise at an expected CAGR of 4% and for Industrial customers will rise at an expected CAGR of 5%. Some general trends emerged from the study:

- Consumers in Delhi are already paying higher tariffs, as compared to other parts of India
- Despite the limitations posed by the lack of land, it is anticipated that solar energy will make significant inroads in future energy mix of Delhi, as it will for most DISCOMs across the country.
- Consumers in Delhi will benefit from the decreasing trend in tariffs associated with RE generation. In our analysis, the decrease is accentuated by the economies of scale and the expectations of technological breakthroughs that will drive down costs.

Other factors that this study did not consider could also influence electricity prices:

- While the government has indicated a goal of reducing cross-subsidy charges, it may prove politically difficult to accomplish for the foreseeable future
- Higher penetration of renewables, which are intermittent sources of power, requires a smarter transmission and distribution network to enable balancing of power sources and reliability. These costs are not fully known but could be substantially aid or hinder the penetration of renewables.
- A hike in overall tariffs may be considered in order to make good, the historic losses to DISCOMs. The current provisions under the UDAY scheme do not indicate this option but only a transfer of debt to the host state.
- Environmental commitments arising from the Paris Agreement would reduce the utilisation of coal plants and when coupled with the potential need to set higher RE targets, an overall increase might be seen for natural gas based generation. As a result, overall cost of procurement could rise. This could be alternatively considered equivalent to a scenario where a carbon price is in place.
- The rates estimated in this report are **exclusive** of electricity duty and other taxes levied, as decided from time to time by the Government. These charges are payable over and above ABR estimations.

1. Introduction

Electricity charges form a significant portion of the operational costs of Industries and Commercial establishments in India. A good understanding of these costs is linked to knowledge of the regulatory process, involved in estimation of cost of supply of electricity. The electricity tariffs are ascertained by the state electricity regulatory commissions (SERCs), either at the start of the financial year or for multiple years (with Multi Year Tariff – MYT orders). Aggregate Revenue Requirement (ARR) of the distribution companies is the basis for recovery of charges from consumers.

This report attempts to estimate electricity tariff for consumers in the National Capital Territory (NCT) of Delhi, it details the methodology, assumptions in the estimates and the limitations in these estimates. The estimates also incorporate two scenarios of RE growth and the impact on cost of procurement. Further, open access is also discussed as an alternative to distribution companies (DISCOMs), to access grid electricity. A comparison of landed cost of electricity accessed through DISCOMs and Open Access, for industrial and commercial consumers is presented.

For the purpose of estimation and analysis, this report has sourced majority of the data from previous ARR orders of the Delhi Electricity Regulatory Commission (DERC). The data for estimations of transmission and power procurement costs is sourced from the Power Grid Corporation of India Limited (PGCIL) and Central Electricity Authority (CEA) reports.

It is important to note that there is fair amount of uncertainty associated with the estimates, owing to the fact that power procurement cost, transmission charges and the administrative expenses can vary significantly given their dependence on multiple factors, which are susceptive to real market conditions. Further, domestic consumers are charged a subsidized tariff (lower than average cost of supply), as decided on a year-on-year basis by the regulators. The Industrial and Commercial consumers are charged a higher tariff, above the average cost of supply of electricity, to cross subsidize the domestic consumers. All this adds to the complexity of tariff estimation.

2. Cost of Supply Model

Delhi state has five DISCOMs supplying power, of which the first three are joint ventures between the Government and private companies, the other two are wholly Government owned entities. DISCOMs follow the cost of supply model to arrive at different tariff rates for consumers. The cost of supply model has various key components involved in the computation of the retail tariff, like – power purchase costs, inter and intra-State transmission charges, operating expenses of DISCOMs, etc. Of these components, power purchase costs constitute nearly 70-75% of the annual expenses of DISCOMs, which forms the basis for further discussions on the cost of power from different energy mixes, in the following chapters.

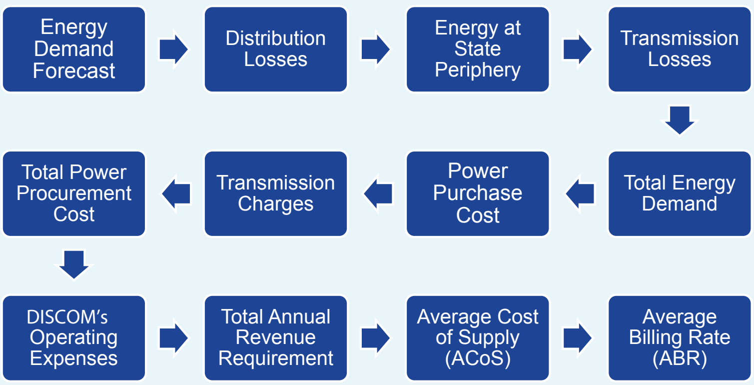
2.1 Delhi DISCOMs

Delhi state has been one of the success stories when it comes to unbundling and privatizing power distribution in the country and achieving 100% power connectivity. It has a high per capita electricity consumption of 1561 units per capita, which is well above the national average of 1010 units per capita. Supplying electricity through such extensive distribution networks requires a comprehensive structure to determine ARR and the retail supply tariffs. DISCOMs use the cost of supply model to determine tariff rates in order to recover the incurred expenses from the consumers.

The expenses that are incurred by DISCOMs are either towards operations and maintenance, administrative purposes or for power procurement from generators. Power procurement cost also incorporates inter-state and intra-state transmission line losses, distribution losses and transmission charges. DISCOMs are required to estimate their aggregate revenue requirement based on expenses they will incur in the following financial year, which is then reviewed by DERC. The regulatory process involved in estimating ARR for DISCOMs is shown in the Figure 2.

The methodology followed in this study estimates the future trajectory of the key components out of all ARR components (Fig. 2), while assuming the rest to be following the historical trend observed so far. The detailed estimation process and assumptions are discussed in the following chapters.

Figure 2 – Regulatory process in estimating ARR and retail supply tariffs



Source: CEEW compilation from ARR documents

2.2 Observations in the Cost of Supply

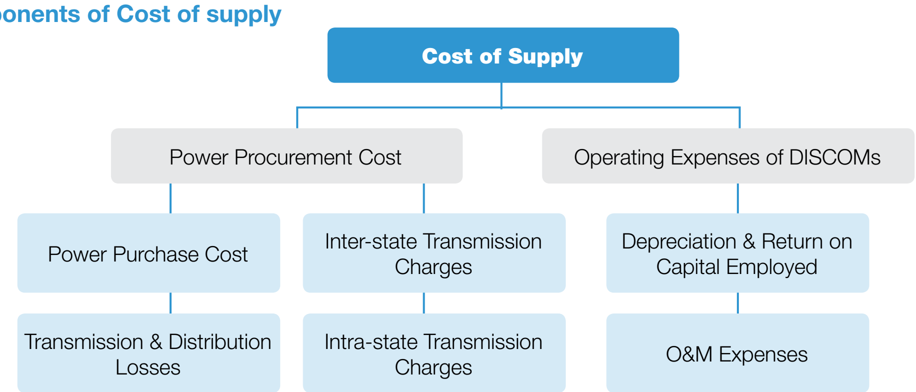
Delhi has 5 DISCOMs which cater to different parts of Delhi as detailed below:

- BSES Rajdhani Power Limited (BRPL) - South and West Delhi.
- BSES Yamuna Power Limited (BYPL) – East and Central Delhi
- Tata Power Delhi Distribution Limited (TPDDL) – North and North West Delhi
- New Delhi Municipal Corporation (NDMC)
- Military Engineering Services – Delhi cantonment area

Of these, TPDDL, BRPL and BYPL are the three largest DISCOMs which cater to about 85% of the total energy demand in Delhi. In 2015-16, TPDDL sold about 8000 MUs, BRPL sold about 10,700 MUs and BYPL sold 5629 MUs to different consumer categories.

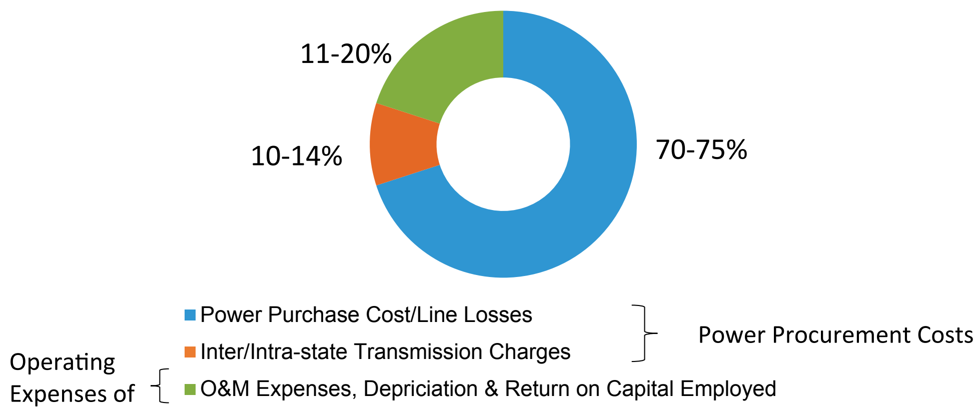
An assessment of data from the three large DISCOMs shows the key components of the cost of supply (Fig. 3). It is observed that the cost of power purchase forms the major portion of the ARR, aggregated across all three DISCOMSs. The distribution and transmission components contribute a relatively smaller in the overall cost of supply. Distribution comprises expenses towards loan repayment, depreciation, operations and maintenance, employee remunerations, pensions etc. (Fig. 3). These distribution related cost trends indicate that their share has remained relatively unchanged in the overall cost of supply. Also, observing a growing trend in transmission costs and budgetary outlays for the transmission sector (both at state and central levels), an estimation of transmission costs has been undertaken in the analysis. Thus, the approach for overall cost of supply is driven primarily by the power purchase quantum, the energy generation mix and the cost of supply from each source. Transmission related investments are the single most important driver of increase in transmission costs.

Figure 3 – Components of Cost of supply



Source: CEEW analysis

Figure 4 – Share of cost of supply components



Source: CEEW compilation from ARR documents

3. Estimations of Cost of Supply

As mentioned in the previous section, the key components in the estimation of the cost of supply for DISCOMs are – power procurement cost, which includes energy demand, power purchase costs, transmission and distribution losses, transmission charges of DISCOMs, and DISCOM expenses like O&M costs, salaries of employees, etc.

The overall energy demand has been increasing at a steady rate, whereas the share of energy demand by industrial and commercial consumers shows a decreasing trend in the three DISCOMs that have been studied. The power purchase cost (generation tariffs of power plants along with T&D losses) constitutes fixed costs and variable costs, where fixed costs comprise 30-40% of the generation tariffs. The variable component of the tariff, which includes the fuel costs and the operating performance of the generating plant, is the key driver of future costs and is used to project power purchase costs in the future. Since this study uses the energy balance system and follows the electricity from the demand side to arrive at the costs, T&D losses are integral to the power procurement costs. Transmission and distribution losses in Delhi have been steadily declining over the last 5 years; however, technical limitations are likely to stem this decline in the losses. The above-mentioned parameters affect the power procurement costs, but in order to compute the total cost of supply, the transmission charges of DISCOMs also need to be considered. Transmission charges include intra-state transmission charges, inter-state transmission charges and SLDC charges (which are not very significant).

These parameters are used to estimate the total cost of supply (Table 4). Some factors like fuel prices, changes in the energy mix of generation plants, generation tariffs tend to affect the cost of supply more significantly than others.

3.1 Power Procurement Cost to DISCOMs

Power procurement cost has the largest share in total ARR for DISCOMs. Power procurement cost, inclusive of power purchase costs, transmission losses and transmission charges, represents about 80% of total revenue requirement. Estimation of power procurement cost is based on the quantum of power sourced from different generating stations. In order to budget the power procurement costs based on the quantum of power to be procured, it is necessary for DISCOMs to determine current energy demand and project future energy demand. Energy demand values also help DISCOMs plan their energy mix along with the procurement costs associated with it. Delhi, in 2015-16 sourced most of it power from coal based power plants (about 78%), 11% from gas based generating stations, share of hydro power is about 9%, remaining 2% is procured largely from nuclear power plants and renewable constitutes a very minimal share in overall energy mix. In addition to that, DISCOMs buy RECs (Renewable Energy Certificates) from the market to meet their Renewable Purchase Obligation targets, which further adds to the power procurement cost of the DISCOMs.

3.1.1 Estimating Energy Sales

The first step in estimating power procurement costs is to estimate the electricity demand of the DISCOM. DISCOMs have multiple energy users, and assessing the total energy demand in the future becomes more accurate when the energy demand of each individual consumer category is projected based on its current and historical growth trend.

A wide range of factors could affect electricity demand and consumer share in a region. Whilst estimating energy sales for each consumer category, it is important to note the historical trends. DERC uses time series trends for multiple years (up to 8 years) to estimate future energy sales and has done so with a high level of accuracy. Building on this approach, this study estimates energy sales based on the growth trends of the respective categories. However, for some of the categories, like –railway traction sales, industrial sales, etc., there are observable anomalies in historical trends. Some assumptions have been made to project the future sales of these categories, which are given below:

TPDDL - Railway Traction sales estimations – The trend indicates negative growth, the estimated growth percentage for 2015-16 was used to project the future sales.

- DMRC sales estimates – The CAGR for **one** year (FY 2013-14 to FY 2014-15) was assumed as growth rate for future sales.
- Advertisement & Hoardings – CAGR of **two** years (FY 2012-12 to FY 2014-15) was assumed as growth rate for future sales.

BRPL - Industrial sales estimations – This category has seen 6% decrease in consumption (4-year trend from FY 2012 to FY 2016), however, conservative negative growth rate of **1.6%** is assumed for future sales.

BYPL - Industrial sales estimations – This category has seen 16% decrease in consumption (3-year trend from FY 2013 to FY 2016), however, conservative negative growth rate of **6.6%** is assumed for future sales.

Electricity demand estimates for all three DISCOMs for their key consumer categories show how the share of commercial and industrial consumers in the energy usage mix has changed over time and how it is expected to change in the future (Table 3). Electricity demand of commercial consumers (non-domestic category in the table below) is expected to increase.

Table 3 – Energy sales estimations for different categories (in MU)

In MU	Particulars	FY 2007-08	FY 2015-16	Average Sales from FY 2007-08 to 20015-16	% share of consumer category	FY 2019-20	FY 2024-25
TPDDL	Domestic	2027	3471	2790	43%	4178	5268
	Non-Domestic	933	1404	1184	18%	1676	2091
	Industrial	1744	2365	2035	31%	2748	3314
	DMRC	78	160	130	2%	174	217
	Others	66	119	62	1%	249	529
	Total	4975	7988	6527		9643	12392
BRPL	Domestic	3199	6094	4738	54%	7574	9998
	Non-Domestic	2174	2906	2616	30%	3150	3507
	Industrial	653	507	570	7%	468	431
	DMRC	69	287	189	2%	619	1413
	DIAL	82*	220	206	2%	191	168
	Others	195	148	166	2%	224	341
	Total	6440	10683	8763		13085	17827
BYPL	Domestic	1784	3045	2501	52%	3516	4257
	Non-Domestic	1077	1715	1439	30%	2056	2580
	Industrial	434	282	378	8%	200	142
	DMRC	50	165	115	2%	619	652
	Others	194	176	166.25	3%	166	157
	Total	3616	5629	4797		6538	8104
Delhi Total		15031	24299	20086		29266	38323
*DIAL consumption is shown from FY 2009-10							

Source: CEEW estimations, from ARR documents of respective DISCOMs

3.1.2 Power Purchase Cost

Power purchase cost (which is a sub-set of power procurement) refers to the rate at which the DISCOM purchases power from the various generation stations. Power purchase cost is calculated based on fixed and variable cost of each generating plant and total quantum of electricity sourced from respective plants. Since Delhi is sourcing power from about 43 plants, it becomes cumbersome to track changes in annual price rise for each of the plants. To overcome this, DISCOMs either use the generation tariff approved by the Central Electricity Regulatory Commission (CERC) in Multi Year Tariff (MYT) orders or assume a certain hike in the tariff based on historical trends for all generating plants. However, the actual generation tariff could be different from the one assumed for ARR, which is then adjusted in true-up petitions.

Determination of Generation Tariff for Power Plants

Generation tariff for power plants consists of fixed and variable components, which represents capital expenditure and fuel expenditure respectively.

Fixed cost component (capital expenditure) includes depreciation, interest on loan, return on equity, interest on working capital, operations and maintenance expenses and special allowances.

Variable cost components (fuel expenditure) is dependent on consumption of primary and secondary fuel. Consumption of primary and secondary fuel depends on operating parameters, heat rate, plant load factor, auxiliary consumption, plant availability factor, calorific value of fuel etc. of a particular plant.

Based on the fixed and variable cost components of power plants supplying power to Delhi DISCOMs, it is observed that the fixed cost component represents about **30-40%** of the total generation tariff and escalates linearly as a result of routine maintenance schedules, interest on working capital, and inflation etc. A similar share in the final tariff is assumed for the fixed cost component when forecasting for 2020 and 2025. The variable component of the generation tariff is the key driver of future costs of procurement, and is based on fuel prices and the actual operating performance of power plants.

For estimating the generation tariff, two scenarios are considered, which capture variation in the energy mix in Delhi. The scenarios are shown in the figure below:

Figure 5 – Generation mix assumed for estimation of power purchase costs

Scenario I
Low Renewables

- Renewables contribute to 10% of the total supply by 2020 and 15% by 2025.
- Share of natural gas is assumed to be the same at 10.4%.
- Share of hydro is assumed to be unchanged at 8.42%.

Scenario II
High Renewables

- Renewables contribute to 16% of the total supply by 2020 and 20% by 2025
- Share of coal capacity is decreasing in proportion with increasing capacity of renewables.
- The share of Natural gas, hydro and nuclear is assumed to be the same

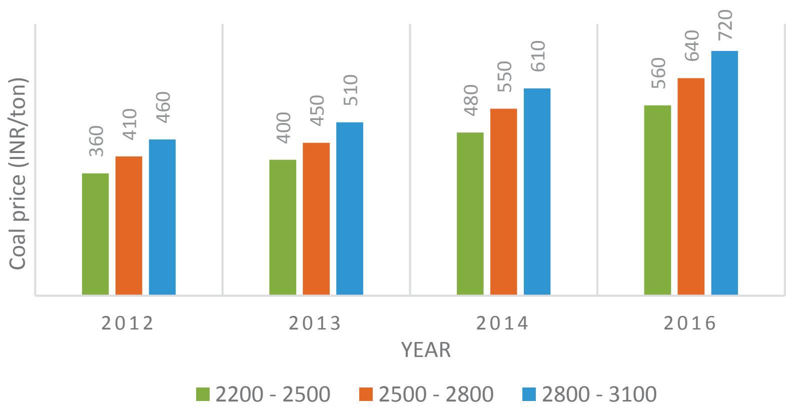
Source: CEEW analysis

The scenarios mentioned above take the varying generation mix into account. The fuel price escalations and their impact on variable charges for thermal generation is discussed below.

Fuel price escalation as per CERC orders

- The orders indicate **9.1%** hike in variable charges for coal, based on six-year data of domestic coal prices from power plants supplying to Delhi. The figure below shows the coal price escalation from 2012.
- Hike in variable costs for gas power plants is assumed at **6.2%** (Amol Phadke, December 2016). This is the 10-year CAGR for LNG prices.
- The generation tariff escalation assumed for hydro stations is **1.5%**, based on tariff approved by CERC for year 2015-16 to 2018-19.
- Renewable energy tariffs are considered as per market trends.

Figure 6 – Coal price escalation based on Gross Calorific Value for thermal power plants



Source: Based on data from Coal India Ltd

Details on the generation mix and power procurement costs in both the scenarios are discussed in detail, in Annexure – I.

3.1.3 Estimation of Transmission and Distribution Losses

Transmission and distribution losses are used to estimate the power procurement cost, over and above the power purchase cost, since the additional cost due to transmission and distribution losses is borne by the DISCOMs and needs to be computed along with the retail supply tariff for consumers. The intra-state losses have shown a slow but steady decline in the last five years. Delhi Transco Limited (DTL) has allocated Rs.**6000** crores (Delhi Transco Ltd, April 2016) for next six years to augment the system, upgrade existing lines and set up GIS substations to curtail the power outages. However, the technical limitations in the system will stem the decline in losses. The limit has been assumed at **0.65%** losses at the DTL level.

The observed trends in inter-state transmission losses are uneven, and are assumed to be unchanged at **3.10%**; reducing from **3.14%** in the year 2015-16. This is based on the renewable energy additions to the grid energy mix, notwithstanding the augmentation and automation, which balance out the additional losses and efficiency of the grid.

Energy balance estimations in this study follow the electricity from the demand side, which takes into account the inter-state and intra-state transmission losses, distribution losses incurred beyond the state transmission periphery. Energy balance can also be estimated from the supply side, which involves the estimation of various plant availabilities, the number of units injected from each plant and the transmission losses incurred thereby.

The DERC, in its analysis, in the ARR orders, estimated the distribution losses to decline by 0.5% year-on-year, in its 2nd MYT (Multi Year Tariff) order ending 2014-15, which was extended to FY 2015-16. The same has been assumed for estimations of distribution losses, limiting the loss at 7% for all three DISCOMs (Table 4).

Table 4 – Transmission & distribution losses, energy at state transmission periphery

	Category	2015-16	2019-20	2024-25
Transmission & Distribution Losses (%)	TPDDL	10.56%	7.56%	7%
	BRPL	11.23%	8.23%	7%
	BYPL	12.90%	9.90%	8.40%
	Delhi Intra-state loss %	0.70%	0.65%	0.65%
	Inter-state loss %	3.14%	3.10%	3.10%
Total Units at State Transmission Periphery in MU	TPDDL	9245	10908	13785
	BRPL	12457	14914	19854
	BYPL	6689	7591	9150

Source: CEEW analysis

3.2 Transmission Charges for DISCOMs

Transmission charges form a significant portion (10-14%) of the cost of supply for DISCOMs (Figure 4). The transmission charges for DISCOMs consist of three components as given below –

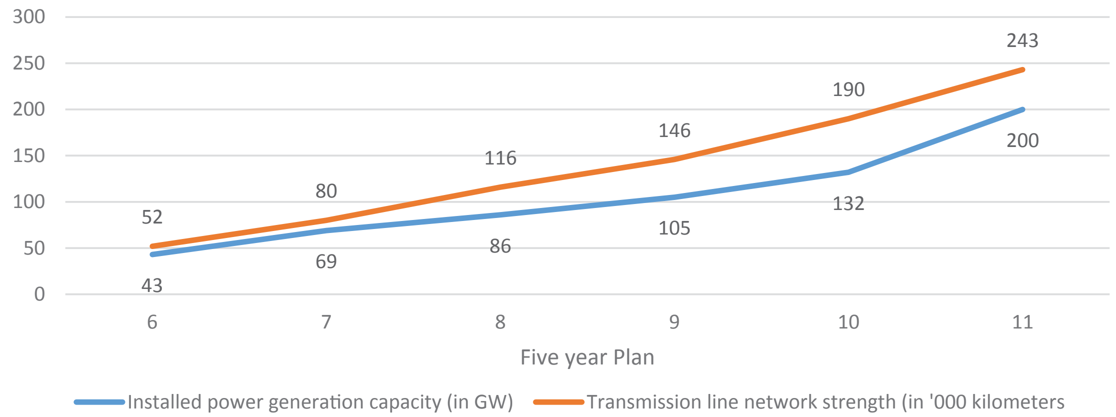
i. Inter-state Transmission charges

ii. Intra-state Transmission charges

iii. SLDC charges

The trends observed in inter-state transmission charges show inconsistent growth, making it cumbersome for future estimations. Literature review of transmission investments suggests that the next decade will witness heavy investments to augment, renovate and automate the transmission networks, substations at state and national levels. The current national level transformation capacity in India stands at 2.3 MVA per MW of generation capacity (as per the analysis for 220kV and above), well below the 7MVA per MW necessary to ensure free and uninterrupted flow of power (Sharma, Ankur and Amit Shah, December 2015). In the five-year period of 2008-13, the transmission capacity has increased by 30%, compared to the generation capacity increase of 50% for the same time period. The graph below shows the comparative growth of generation capacity addition vis-a-vis additions in transmission line network, in different five-year plans. This shows that the Indian transmission sector is playing catch-up with the generation sector, which will call for deliberate investments this sector. However, the translation of new capital assets to overall transmission charges is unclear.

Figure 7 – Comparison of generation capacity addition and transmission network additions



Source: (FICCI, 2013)

Table 5 – Trends in Inter-state transmission charges

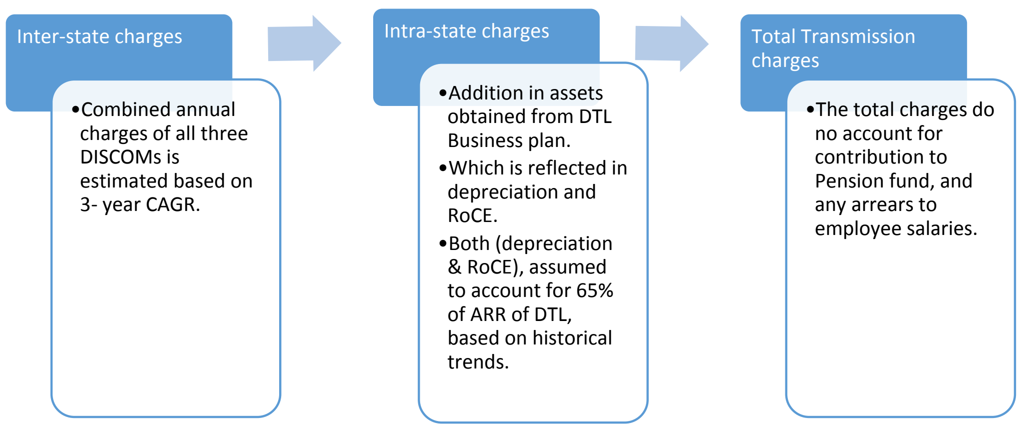
Escalation in inter-state charges Y-o-Y	2013-14	2014-15	2015-16
TPDDL	5% escalation on average transmission cost for Apr 2012-Sept 2012	4% escalation on average transmission cost for Jul 2013-Sept 2013	5% escalation on average transmission cost for Apr 2014-Aug 2014
BRPL	5% escalation on the actual transmission charges of 2012-13	As per actual charges paid during 2012-13, in proportion to the current allocated capacity	Same as charges for 2014-15
BYPL	5% escalation on the actual transmission charges of 2012-13	As per actual charges paid during 2012-13, in proportion to the current allocated capacity	Same as charges for 2014-15

Source: ARR orders of respective DISCOMs

There is inconsistent variation in inter-state transmission charges (Table 6). It is cumbersome to translate investments in transmission capacities to yearly transmission charges. This translation will depend on factors including line voltage, material, circuit type, conductor configuration, and type of terrain. Estimations for Intra-state transmission charges, on the other hand were relatively less complex, owing to the definite trends in the ARRs filed by DTL. DTL, in its business plan for FY 2017-18 to FY 2021-22 (Delhi Transco Ltd, April 2016) has indicated the investment outlay.

SLDC charges have minimal effect on the overall transmission charges levied (**0.37%** in 2015-16), hence they are not included in the estimations of transmission costs. In ARR filings, Inter-state transmission charges are calculated based on submissions of TPDDL, BRPL and BYPL.

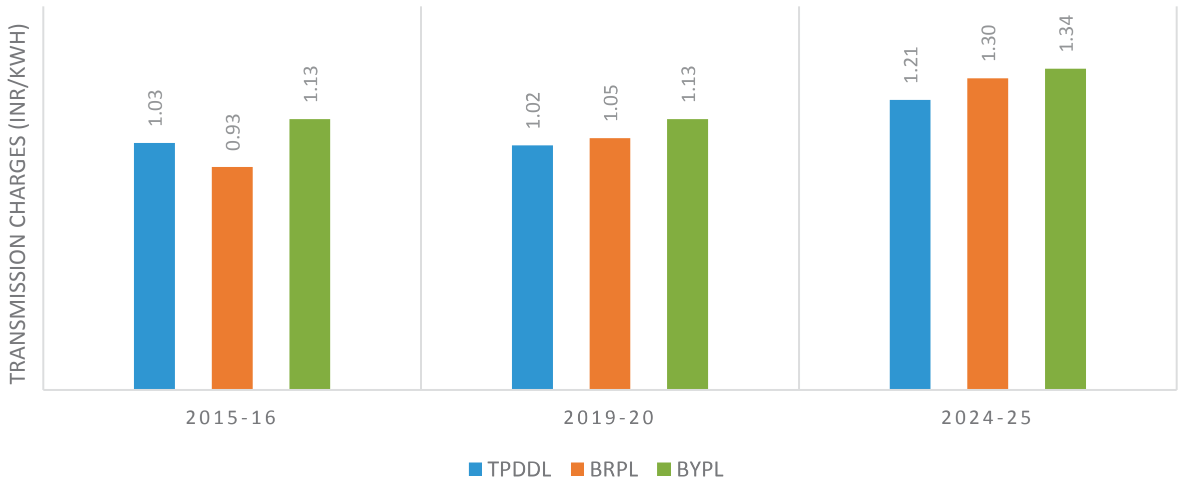
Figure 8 – Procedure for estimation of transmission charges



Source: CEEW analysis

The forecasts of transmission charges for all three DISCOMs show a lower growth for BRPL owing to the high consumption as compared the other two (Fig. 9).

Figure 9 – Total transmission charges



Source: CEEW analysis

It is important to note that, the estimated transmission rates do not account for the arrears to employees' salaries, due to revision of salaries by the pay commission. The impact of these arrears on the total transmission charges for FY 2014-15, FY 2015-16, can be seen in Annexure - II.

3.3 Charges of DISCOMs

As mentioned earlier in this report, DISCOM expenses in Delhi constitute between 11-20% of the total cost of supply. This study does not attempt the estimation of charges of DISCOMs which involve the following components:

- O&M Expenses
- Depreciation of Distribution assets
- Return on Capital Expenditure
- Working capital requirements

However, to arrive at Cost of Supply, it is necessary to account the above charges into the calculations. For the estimations, charges of DISCOMs are conservatively assumed to contribute to **20%** of the total Cost of Supply. Further, given that the service levels of Delhi DISCOMs are fairly good, with little recourse to load shedding and maintenance related outages, we do not expect any significant increase in outlay towards O&M and capacity enhancement, over and above what has been seen historically.

3.4 Cost of Supply Projections

Based on the assumptions laid out so far, the average cost of supply for the three DISCOMs is estimated with two energy mix scenarios – low RE (10% capacity addition) and high RE (16% capacity addition) for the years 2019-20 and 2024-25 (Table 6).

Table 6 – Average cost of supply (INR/kWh)

	TPDDL		BRPL		BYPL	
	2019-20	2024-25	2019-20	2024-25	2019-20	2024-25
Scenario – I	9.21	12.20	9.45	12.40	9.55	12.51
Scenario – II	9.12	11.85	9.37	12.05	9.46	12.15

Source: CEEW analysis

3.4.1 Uncertainties in the Forecast

The assumptions made are based on the data available for all three DISCOMs, the actual ACoS for the DISCOMs could vary beyond the lower and higher estimates shown above. The parameters which could affect the cost (ACoS) further are fuels prices, change in generation mix, increased generation tariff due higher/unexpected expenditures (impact of salary hike by pay-commission) and increased capital inflow for repair and maintenance etc.

4. Average Billing Rate (ABR)

The Average Cost of Supply is not the tariff that is payable by the consumers. Some categories of consumers cross-subsidise the cost of supply for the other consumer categories. The impact of subsidies on the tariff for each consumer category can be seen from the ABR to ACoS ratio. **ABR is the actual billing rate applicable for each category of consumers.**

The DERC in its tariff order for FY 2015-16 has stated that direct subsidies be provided to consumers in line with the National Tariff Policy, and in keeping with this, the DISCOMs have continued with a policy of subsidizing the domestic consumers below the cost of supply and shifted part of the burden to all other consumers except agriculture, public lighting and DMRC. The subsidy component in this study has been incorporated based on the ratio of ABR to ACoS.

The ABR values are derived from the category-wise revenues available to the DISCOMs. The ABR comprises fixed and energy charges, which are reflected in the electricity bills of the consumers, as per their contracted demand. Formula for ABR calculation is shown in the formula below:

ABR (for a particular consumer category) = **Revenue** expected from the respective category in INR (given in the tariff order)/**Approved sales** in MU (given in the tariff order)

For e.g. if Rs.100 crores in revenues are expected from the Industrial category consumer of a DISCOM, the approved sales are 100 MU for the same year, the ABR is
=100*10/100
= Rs10/kWh

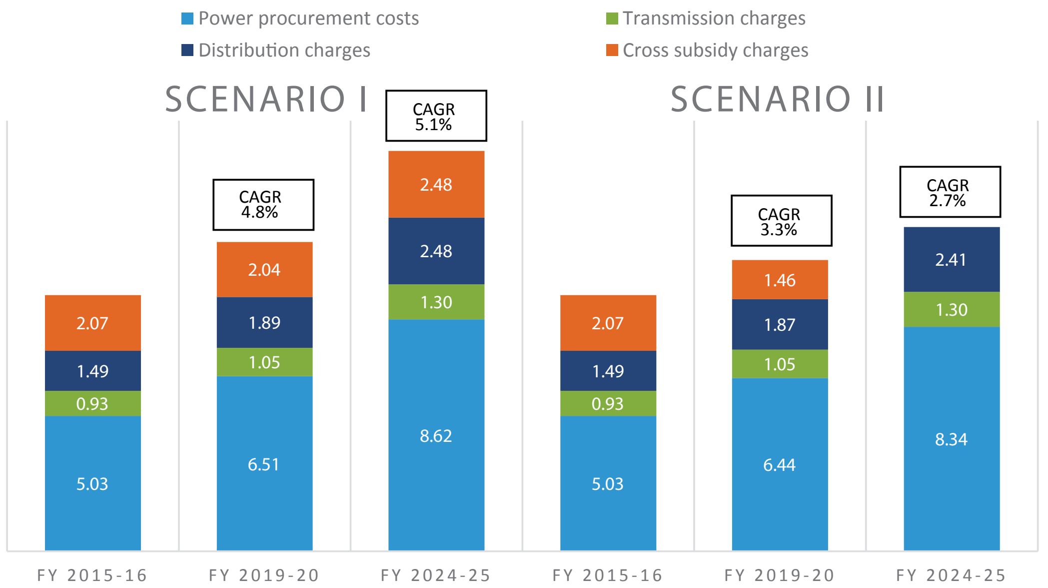
The forward-looking estimation of ABR rests on how the cross-subsidy changes over time. In each of the scenarios (described in section 3.1.2), there is an added assumption on the nature of variation of the cross-subsidy. The assumptions for each scenario are as below:

i. High RE scenario – The ABR to ACoS ratio is assumed to adhere to the National Tariff Policy by FY 2020-21, where the ratio is within +/- 20% of the cost of supply. This ratio is assumed to remain constant up to 2024-25.

ii. Low RE scenario – The ABR to ACoS ratio is assumed to converge to 100% for all categories by 2024-25

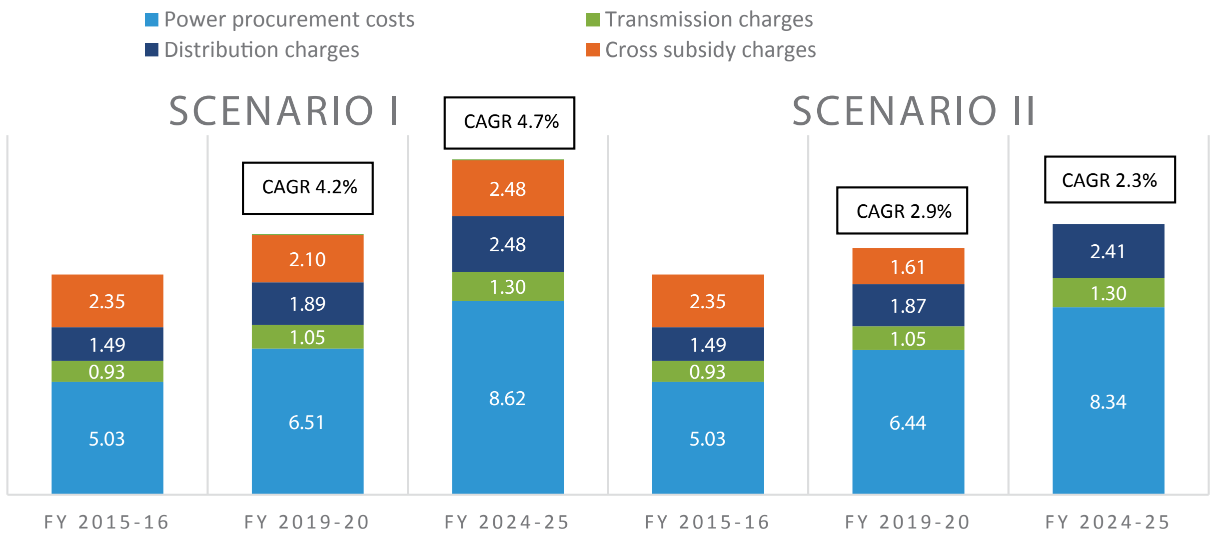
In the both the above cases, the expectation is for some rationalisation of the cross-subsidy and an implicit reform of tariff across consumer categories. However, the political economy of such bold reforms would dictate the pace of such changes. Based on the above scenarios and assumptions, ABR for C&I consumer categories is estimated. The estimates show that increasing tariffs are evened out by the decreasing ABR to ACoS ratio. Despite increased penetration of low cost RE sources, the ACoS is seen to be increasing. However, this increase does not translate to an increase in tariff for the C&I category on account of the rationalisation of cross-subsidy (a tapering or lower ABR to ACoS ratio), as shown in Figure 10 and 11.

Figure 10 – ABR for industrial consumers of BRPL – Scenario I & II TPDDL



Source: CEEW analysis

Figure 11 – ABR for commercial consumers of BRPL – Scenario I & II



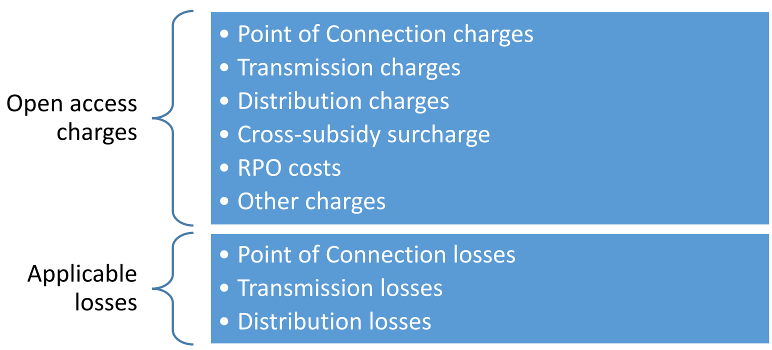
Source: CEEW analysis

5. Open Access

Other than power procurement from DISCOMs, consumers (especially bulk consumers) have the option of purchasing power from the Open market via Open Access under the Section 2 (47) of the Electricity Act, 2003. This section of the Act allows non-discriminatory use of transmission and distribution systems for any consumer, entity or DISCOMs, in accordance with CERC regulations. Pertaining to this study, the research was limited to Industrial and Commercial consumers of Delhi, Noida and Gurgaon.

The approach to understanding open access charges and its market, involved a mix of desk based research and interaction with power exchanges, traders, etc. Open access comprises two main components – charges and losses (Fig. 11).

Figure 12 – Applicable Open Access charges and losses



Source: CERC regulations on Open Access charges and losses

Analysis of past trends in the open access market concluded that the medium-term transactions across India have slumped recently. All the Open Access charges are determined annually by the State regulator and are thus sensitive to regulatory decisions. The instability in SERC's approach to open access has prompted most consumers to tap the low-risk short term markets. Some states (most recently Punjab, Maharashtra, Andhra) have raised the electricity duty charges and cross subsidy surcharge components which render open access unviable. Primarily due to the regulatory uncertainty across the states, which have levied heavy charges pushing open access unviable as compared to grid tariffs. The other factor impeding open access consumers is the grid congestion in NR-WR and WR-SR networks.

Open access charges in comparison to the grid tariff show limited incentives for Industrial consumers of TPDDL & BRPL, owing to unviable Open Access charges (Table 7&8).

Table 7 – Landed cost of power (procured from open access) for industrial consumers of TPDDL

Particulars/Voltage Level	11 kV	33/66 kV	>66 kV
Energy Cost (INR/kWh)	4.1	4.1	4.1
Applicable losses (INR/kWh)	0.34	0.23	0.18
Open Access Charges (INR/kWh)	2.98	2.95	2.94
Landed Price through Open Access (INR/kWh)	7.34	7.18	7.12
TPDDL tariff for Industrial Consumer (INR/kWh)	7.61	7.61	7.61
Approximate Saving (INR/kWh)	0.29	0.43	0.49

Source: CEEW estimations of OA charges for Industrial consumers of TPDDL

Table 8 – Landed cost of power (procured from open access) for industrial consumers of BRPL

Particulars/Voltage Level	11 kV	33/66 kV	>66 kV
Energy Cost (INR/kWh)	4.1	4.1	4.1
Applicable losses (INR/kWh)	0.27	0.23	0.18
Open Access Charges (INR/kWh)	2.90	2.88	2.27
Landed Price through Open Access (INR/kWh)	7.18	7.12	6.45
BRPL tariff for Industrial Consumer (INR/kWh)	7.61	7.61	7.61
Approximate Saving (INR/kWh)	0.43	0.49	1.16

Source: CEEW estimations of OA charges for Industrial consumers of BRPL

Table 9 – Landed cost of power (procured from open access) for industrial and commercial consumers of Gurgaon and Noida

Landed Price through Open Access (INR/kWh) /Voltage Level	11 kV	33/66 kV	>66 kV
Gurgaon Industrial	8.17	8.17	8.17
Gurgaon Commercial	8.64	8.64	8.64
Noida Industrial	9.22	8.51	8.51
Noida Commercial	10.92	10.09	10.09

Source: CEEW estimations of OA charges

Open access calculations for Delhi, Noida and Gurgaon are based on the assumption that the power is sourced from thermal power plants (Components of Open Access charges for Industrial and Commercial consumers of Gurgaon & Noida are detailed in Annexure – V, VI). Power sourced from thermal power plants is levied with all the open access charges. On the other hand, power sourced from solar and wind power plants is exempted from inter-state transmission charges and losses (POC charges and losses), (Ministry of Power, 2016) , however, rest of the Open Access charges and losses vary from state to state. (Components of Open Access charges for solar are detailed in Annexure – VII).

6. Conclusion

6.1 Cost of Supply

The cost of supply has been increasing significantly (6.4% increase annually for TPDDL and 6.2% annually for BRPL) and is expected to do so in the future. However, this increasing Cost of Supply does not manifest as a commensurate increase in retail tariff (for C&I consumers) owing to a decrease (expected) in the cross-subsidy charge.

6.2 Cross-Subsidisation - A Key Factor

Though the cost of supply represents the average cost of supplying each unit of electricity, the actual tariff levied on the consumers is different for different categories. Cross subsidizing the domestic consumers is a common practice in many states. In Delhi, historically, ABR to ACoS ratio has been uneven across all consumer categories (based on data from FY 2011-12 to FY 2015-16). Still, the Commercial (Non-domestic) consumers have been paying for the majority of the subsidies to domestic and agricultural consumers. In FY 2015-16 the cross subsidy for all three DISCOMs of Delhi amounted to Rs.2288 crores.[2]

A report by the Forum of Regulators also suggests multiple methods of estimating cost of supply and doing away with cross subsidies in all states. It is important to note that the National Tariff Policy has mandated states to bring down cross subsidies within +/-20% of ACoS. Although, some states have managed to bring down cross subsidies within +/-20% of ACoS, it is unlikely that this trend will be picked up across the country. However, in one of the scenarios for estimation of ABR, zero cross subsidy across all categories was assumed to be achieved by 2025-26.

6.3 Role of Renewable Energy in Forecasting

It is envisaged that renewable sources, primarily solar, wind and biomass, could play a key role in confirming or differing with the forecasts in this study. Multiple factors could drive this shift but it is difficult to drive RE penetration on the basis of these underlying factors. However, it is a common understanding that the targets for renewables (175 GW capacity addition target by 2022) are ambitious, and there is uncertainty in reaching these targets. The cost of renewable, on the other hand also plays a major role in future energy choices, and shows a decreasing trend, which could result in grid-parity (with conventional sources) over the course of the next decade. Hence, all these factors could play a major role in the future energy markets.

6.4 Regulatory Uncertainties in Tariff Design

The forecasting exercise undertaken does not take into account all the elements, as considered by any Regulatory Commission. Some of these elements are dependent on extraneous factors like hike in salaries of Government employees, failure to disburse timely payments by DISCOMs, rate of depreciation, cyclical variations in fuel prices, or hikes in green cess for thermal power plants. These complications are inherent in tariff estimations. Further, they are subject to human decision-making, which could be based on factors extraneous to data based rationale. It is important to take cognizance of these uncertainties, before using the results of this exercise.

2 Analysis for Delhi State, Roadmap for Reduction in Cross Subsidy, by Forum of Regulators and PwC, April 2015

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Annexures

Annexure – I

The fixed and variable components of generation tariff from different fuels are escalated as follows:

Generation costs (INR/kWh) for different fuels												
Coal	Fixed	1.17	1.27	1.38	1.51	1.65	1.80	1.96	2.14	2.33	2.54	2.77
	Variable	2.71	2.96	3.23	3.52	3.84	4.19	4.57	4.99	5.44	5.93	6.47
	Total	3.88	4.22	4.61	5.03	5.48	5.98	6.53	7.12	7.77	8.48	9.25
Gas	Fixed	2.96	3.39	3.60	3.82	4.06	4.31	4.58	4.86	5.16	5.48	5.82
	Variable	3.90	4.14	4.40	4.67	4.96	5.27	5.60	5.94	6.31	6.70	7.12
	Total	6.86	7.53	8.00	8.49	9.02	9.58	10.17	10.80	11.47	12.18	12.94
Hydro	Fixed	1.42	1.44	1.46	1.48	1.50	1.51	1.53	1.55	1.57	1.60	1.62
	Variable	1.53	1.55	1.57	1.59	1.62	1.64	1.66	1.68	1.70	1.72	1.75
	Total	2.95	2.99	3.03	3.07	3.11	3.15	3.19	3.23	3.28	3.32	3.36
Nuclear	Fixed	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Variable	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93
	Total	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93
Solar	Fixed	0.00	0	0	0	0	0	0	0	0	0	0.00
	Variable	5.50	5.23	4.96	4.72	4.48	4.26	4.04	3.84	3.65	3.47	3.29
	Total	5.50	5.23	4.96	4.72	4.48	4.26	4.04	3.84	3.65	3.47	3.29

Thermal Generation (Coal and Gas)

Fixed component for a coal power plant represents about 30% of total generation tariff. Variable component which consists fuel charges is about 70% of total generation tariff. Similarly, for gas based generation fixed and variable component is respectively about 45% and 65% of total generation tariff.

CERC has specified the "energy charge rate" formula to translate fuel cost into per unit cost of electricity generation (variable component). The variable component is directly proportional to fuel charges, any increase in fuel cost will increase variable charges with same percentage. Hence, to estimate future generation tariff for coal and gas based plants, variable components is forecasted based on expected growth in coal and gas prices.

- For coal plants, 9.1% annual increase in coal price is assumed based on previous coal tariff orders released by Coal India Limited. Going forward, India is likely to less dependent on imported coal, so it is safe to consider fuel prices increase from Coal India Limited.
- For gas plants, 6.2% annual increased is considered based on gas prices in the international market since India largely rely on imported gas.

GCV Bands (Kcal/Kg)	Rs/Ton				CAGR
	2012	2013	2014	2016	
Exceeding 7000	*			*	
Exceeding 6700 and not exceeding 7000	4870	4870	4870	3450	-6.7%
Exceeding 6400 and not exceeding 6700	4420	3890	3890	3210	-6.2%
Exceeding 6100 and not exceeding 6400	3970	3490	3490	3000	-5.4%
Exceeding 5800 and not exceeding 6100	2800	2800	2800	2750	-0.4%
Exceeding 5500 and not exceeding 5800	1450	1600	1920	2280	9.5%
Exceeding 5200 and not exceeding 5500	1270	1400	1680	1920	8.6%
Exceeding 4900 and not exceeding 5200	1140	1250	1510	1700	8.3%
Exceeding 4600 and not exceeding 4900	880	970	1170	1320	8.4%
Exceeding 4300 and not exceeding 4600	780	860	1030	1180	8.6%
Exceeding 4000 and not exceeding 4300	640	700	840	970	8.7%
Exceeding 3700 and not exceeding 4000	600	660	800	910	8.7%
Exceeding 3400 and not exceeding 3700	550	610	730	860	9.4%
Exceeding 3100 and not exceeding 3400	500	550	670	780	9.3%
Exceeding 2800 and not exceeding 3100	460	510	610	720	9.4%
Exceeding 2500 and not exceeding 2800	410	450	550	640	9.3%
Exceeding 2200 and not exceeding 2500	360	400	480	560	9.2%

* For GCV exceeding 7000 Kcal/Kg, the price shall be increase by Rs 150/- per tonne over and above the price applicable for GCV band exceeding 6700 but not exceeding 7000 Kcal/Kg, for increase in GCV by every 100 Kcal/Kg or part thereof.

Hydro Generation: for hydro stations, even though there are no fuel expenditure, tariff is still divided into fixed and variable component in about 50:50 ratio. For the generation tariff escalation for hydro station, tariff approved by CERC for year 2015-16 to 2018-19 is used for calculations. For remaining years, from 2019-20 to 2024-25, similar annual increase is considered as per following table.

Plants	2015-16	2016-17	2017-18	2018-19	CAGR
Chamera I	1.31	1.33	1.35	1.37	1.17%
Chamera II	2.25	2.3	2.34	2.39	1.47%
Chamera III	4.15	4.26	4.37	4.48	1.94%
Dhauliganga	2.16	2.2	2.24	2.27	1.24%
Dulhasti	4.90	5	5.1	5.2	1.47%
Parbathi III	3.89	3.93	3.97	4.01	0.75%
Salal	0.76	0.77	0.79	0.81	1.70%
Sewa II	3.60	3.66	3.73	3.8	1.37%
Tanakpur	1.94	1.99	2.04	2.09	1.82%
Uri-I	0.96	0.96	0.97	0.98	0.62%
Uri-II	2.08	2.1	2.13	2.16	0.98%

Nuclear Generation: nuclear power plants has single part tariff, there is no variable component. The escalation in generation tariff is assumed to remain same, as per the tariff approved by CERC for nuclear power plants serving to Delhi DISCOMs.

Plants	2015-16	2016-17	2017-18	2018-19
NAPS	2.37	2.37	2.37	2.37
RAPS - 3 & 4	2.74	2.74	2.74	2.74
RAPS - 5 & 6	3.41	3.41	3.41	3.41

Solar Generation: solar prices are expected to decrease by 5-6% annually given the efficiency gains and reduction in costs. These rates are in line with long term tariff decline of solar power generation. Same is assumed while estimating future procurement cost from solar plants.

Year	Weighted Average Tariff
2010	12.16
2011	8.79
2012	8.23
2013	7.38
2014	6.49
2015	5.61
2016	4.43

Annexure – II

The table indicates share of – contribution to pension fund as % of total annual transmission charges.

Contribution to pension fund due to revision in pay commission.		
Contribution as % of total transmission charges	2014-15	2015-16
TPDDL	18%	22%
BRPL	24%	25%
BYPL	21%	22%

Annexure – III

The impact of subsidies on tariff for each consumer category can be seen from the ABR to ACoS ratio. Historical ABR trends are shown in the table below. The trends indicated uneven growth, for all sectors.

ABR/ACoS (In %)	Particulars	FY 2013-14	FY 2014-15	FY 2015-16
TPDDL	Domestic	81.93%	71.68%	75.48%
	Non-Domestic HT	147.70%	130.80%	140.09%
	Non-Domestic (>100kW)	173.06%	155.67%	163.25%
	Large Industrial	117.91%	105.54%	112.43%
	Small Industrial (>100kW)	159.75%	143.50%	153.10%
	DMRC	94.93%	85.84%	92.59%
	Railway Traction	120.60%	108.72%	114.92%
BRPL	Domestic	100.48%	77.28%	82%
	Non-Domestic HT	142.42%	161.15%	131%
	Non-Domestic (>100kW)	174.84%	131.88%	164%
	Large Industrial	120.81%	112.84%	112%
	Small Industrial (>100kW)	163.39%	152.19%	177%
	DMRC	95%	86.94%	85%
	DIAL	120.16%	113.12%	111%
	Railway Traction	116.61%	108.22%	111%

ABR/ACoS (In %)	Particulars	FY 2013-14	FY 2014-15	FY 2015-16
BYPL	Domestic	79.05%	73.09%	76.03%
	Non-Domestic HT	137.31%	132.37%	139.78%
	Non-Domestic (>100kW)	163.76%	160.56%	171.78%
	Large Industrial	116.21%	116.34%	122.52%
	Small Industrial (>100kW)	146.48%	149.50%	170.38%
	DMRC	86.54%	84.15%	88.11%

The National Tariff Policy, has directed the DISCOMs to limit the ABR to ACoS ratio to +/- 20% of ACoS. Further, *Report on Roadmap for Reduction in Cross-subsidy*, prepared by PwC for the Forum of Regulators, has suggested alternative approaches for estimation of retail supply tariffs.

Annexure – IV

The breakdown of ABR components for commercial consumers is given in the table below:

Commercial (Rs/kWh)		FY 2015-16	FY2019-20	FY 2024-25
TPDDL - Scenario I	Power procurement costs	4.85	6.35	8.55
	Transmission charges	1.03	1.02	1.21
	Distribution charges	1.47	1.84	2.44
	Cross subsidy charges	2.95	2.21	2.44
	Total	**10.30**	**11.42**	**14.63**
TPDDL - Scenario II	Power procurement costs	4.85	6.28	8.27
	Transmission charges	1.03	1.02	1.21
	Distribution charges	1.47	1.82	2.37
	Cross subsidy charges	2.95	2.03	0.00
	Total	**10.30**	**11.15**	**11.84**
BRPL - Scenario I	Power procurement costs	5.03	6.51	8.62
	Transmission charges	0.93	1.05	1.30
	Distribution charges	1.49	1.89	2.48
	Cross subsidy charges	2.35	2.10	2.48
	Total	**9.80**	**11.55**	**14.88**
BRPL - Scenario II	Power procurement costs	5.03	6.44	8.34
	Transmission charges	0.93	1.05	1.30
	Distribution charges	1.49	1.87	2.41
	Cross subsidy charges	2.35	1.61	0.00
	Total	**9.80**	**10.98**	**12.05**
BYPL - Scenario I	Power procurement costs	4.58	6.51	8.67
	Transmission charges	1.13	1.13	1.34
	Distribution charges	1.43	1.91	2.50
	Cross subsidy charges	2.84	2.29	2.50
	Total	**9.98**	**11.83**	**15.00**
BYPL - Scenario II	Power procurement costs	4.58	6.44	8.38
	Transmission charges	1.13	1.13	1.34
	Distribution charges	1.43	1.89	2.43
	Cross subsidy charges	2.84	2.09	0.00
	Total	**9.98**	**11.55**	**12.15**

The breakdown of ABR components for Industrial consumers is given in the table below:

Industrial (Rs/kWh)		FY 2015-16	FY2019-20	FY 2024-25
TPDDL - Scenario I	Power procurement costs	4.85	6.35	8.55
	Transmission charges	1.03	1.02	1.21
	Distribution charges	1.47	1.84	2.44
	Cross subsidy charges	2.13	2.01	2.44
	Total	**9.48**	**11.21**	**14.63**
TPDDL - Scenario II	Power procurement costs	4.85	6.23	8.27
	Transmission charges	1.03	1.02	1.21
	Distribution charges	1.47	1.87	2.37
	Cross subsidy charges	2.13	1.47	0.00
	Total	**9.48**	**10.59**	**11.84**
BRPL - Scenario I	Power procurement costs	5.03	6.51	8.62
	Transmission charges	0.93	1.05	1.30
	Distribution charges	1.49	1.89	2.48
	Cross subsidy charges	2.07	2.04	2.48
	Total	**9.52**	**11.49**	**14.88**
BRPL - Scenario II	Power procurement costs	5.03	6.44	8.34
	Transmission charges	0.93	1.05	1.30
	Distribution charges	1.49	1.87	2.41
	Cross subsidy charges	2.07	1.46	0.00
	Total	**9.52**	**10.82**	**12.05**
BYPL - Scenario I	Power procurement costs	4.58	7.05	9.85
	Transmission charges	1.13	1.00	1.10
	Distribution charges	1.43	1.50	1.55
	Cross subsidy charges	2.32	2.15	2.50
	Total	**9.46**	**11.69**	**15.00**
BYPL - Scenario II	Power procurement costs	4.58	6.94	9.49
	Transmission charges	1.13	1.00	1.10
	Distribution charges	1.43	1.52	1.56
	Cross subsidy charges	2.32	1.70	0.00
	Total	**9.46**	**11.16**	**12.15**

Annexure – V

The table below shows landed cost of power for open access consumers of Gurgaon.

Calculation of Delivered Cost for Consumers in Gurgaon	Industrial consumers			Commercial consumers		
Voltage Level	11 KV	33/66 KV	Above 66 KV	11 KV	33/66 KV	Above 66 KV
Volume (MW)	1	1	1	1	1	1
Total Hours Traded	24	24	24	24	24	24
Total Volume in MWH	24	24	24	24	24	24
Total Volume in KWh	24000	24000	24000	24000	24000	24000
Total unit cost	48000	48000	48000	48000	48000	48000
Gurgaon Periphery Pricr Rs./Unit	2	2	2	2	2	2
Applicable Losses						
POC Loss	1.28%	1.28%	1.28%	1.28%	1.28%	1.28%
State Losses	3.82%	3.82%	3.82%	2.46%	2.46%	2.46%
Distribution Losses	6.00%	6.00%	6.00%	6.00%	6.00%	6.00%
Cost After Losses (in Rs per unit)	2.23	2.23	2.23	2.20	2.20	2.20
Applicable Charges						
POC Charge	0.22	0.22	0.22	0.22	0.22	0.22
State Charges (Rs./KWh)	0.33	0.33	0.33	0.33	0.33	0.33
Distribution Charges	0.85	0.85	0.85	0.85	0.85	0.85
Cross Subsidy Surcharge (Rs./KWh)	0.93	0.93	0.93	1.46	1.46	1.46
Additional Surcharge	1.17	1.17	1.17	1.17	1.17	1.17
SLDC+ Application Charges	0.10	0.10	0.10	0.10	0.10	0.10
Total Charges	3.5972	3.5972	3.5972	4.1272	4.1272	4.1272
Landed Cost (Rs./KWh)	5.83	5.83	5.83	6.33	6.33	6.33

Annexure VI

The table below shows landed cost of power for open access consumers of Noida.

Calculation of Delivered Cost for Consumers in Noida	Industrial consumers			Commercial consumers		
Voltage Level	11 KV	33/66 KV	Above 66 KV	11 KV	33/66 KV	Above 66 KV
Volume (MW)	1	1	1	1	1	1
Total Hours Traded	24	24	24	24	24	24
Total Volume in MWH	24	24	24	24	24	24
Total Volume in KWh	24000	24000	24000	24000	24000	24000
Total unit cost	48000	48000	48000	48000	48000	48000
Gurgaon Periphery Pricr Rs./Unit	2	2	2	2	2	2
Applicable Losses						
POC Loss	3.09%	3.09%	3.09%	3.09%	3.09%	3.09%
State Losses	3.59%	3.59%	3.59%	3.59%	3.59%	3.59%
Distribution Losses	2.48%	1.05%	1.05%	2.48%	1.05%	1.05%
Cost After Losses (in Rs per unit)	2.19	2.16	2.16	2.19	2.16	2.16
Applicable Charges						
POC Charge	0.171	0.171	0.171	0.171	0.171	0.171
State Charges (Rs./KWh)	0.17	0.17	0.17	0.17	0.17	0.17
Distribution Charges	1.326	0.829	0.829	1.326	0.829	0.829
Cross Subsidy Surcharge (Rs./KWh)	2.97	2.82	2.82	4.84	4.4	4.4
Additional Surcharge	0	0	0	0	0	0
SLDC+ Application Charges	0.10	0.10	0.10	0.10	0.10	0.10
Total Charges	4.7362	4.0892	4.0892	6.4352	5.6692	5.6692
Landed Cost (Rs./KWh)	6.93	6.25	6.25	8.62	7.83	7.83

Annexure VII

Open access components, applicable for solar and wind are given below

Particulars	Applicable/NA for solar & Wind
Point of Connection charges	NA
Point of Connection losses	NA
Transmission charges	Vary from state to state
Transmission losses	Vary from state to state
Distribution charges	Vary from state to state
Distribution losses	Vary from state to state
Cross-subsidy charges	Vary from state to state
RPO charges	NA
Other charges	Vary from state to state

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