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REPORT ON OPTIMAL AND MARKET BASED UTILIZATION OF ELECTRICITY SUPPLY RESOURCES OF ASSAM

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This report is an output of a comprehensive study carried out by PACE-D 2.0 RE team comprising of experts from Tetra Tech and En-genuity.

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About the PACE-D 2.0 RE

In 2018, MNRE and USAID concluded the six-year Partnership to Advance Clean Energy Deployment (PACE-D) Program. PACE-D focused on accelerating the deployment of RE technologies through technical assistance to create a strong enabling environment with constructive policies and regulations, process design and standardization, institutional strengthening, awareness and knowledge creation, business models, tools, and innovative financing mechanisms. The program's activities were aligned to support the Government of India's core renewable energy priorities, such as the national solar mission and Power for All.

As a follow-on to PACE-D program, MNRE and USAID launched a two-year RE program, PACE-D 2.0 RE, was launched to focus on strategic energy planning, scaling grid-connected DPV, smart incentives, competitive procurement, and the deployment of emerging RE-based technologies, to bring reliable clean energy to scale in India.

Assam has been selected as one of the partner states in the program. The program aims to enhance the deployment of renewable energy technologies to reduce power purchase cost, increase power supply reliability, address the energy security needs of India and support the government of India to achieve its target of 175 GW by the year 2022.

One of the components of the program focuses on **Innovative Procurement of RE.** This component supports the deployment of emerging, utility-scale RE options prioritized by MNRE, such as solar-wind hybrid, repowering, and waste-to-energy. The program aims to achieve these objectives through encouraging support for the development of competitive procurement frameworks and transaction support, new business models to serve C&I consumers, and the development of enabling regulations and guidelines. This component helps the DISCOMs realize the benefits of distributed RE resources.

More details about the program are available at www.pace-d.com

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ABBREVIATION

APDCL	Assam Power Distribution Company Ltd
APGCL	Assam Power Generation Company Ltd
FY	Financial Year (April 01 to March 31)
DISCOM	Distribution Company
GDP	Gross Domestic Product
GW	Giga Watt
HT	High Tension
IEX	India Energy Exchange ltd
INR	Indian Rupee
kWh	Kilo Watt Hour
LT	Low Tension
MU	Million Unit (Unit – kWh)
MW	Mega Watt
NEEPCO	North Eastern Electric Power Corporation Ltd
OTPC	ONGC Tripura Power Company Ltd
RE	Renewable Energy
ToD	Time of Day

EXECUTIVE SUMMARY

The objective of this study is to examine the scope for optimization in the operation of the existing supply side resources of Assam Power Distribution Company Limited (APDCL). The Second objective is to suggest gainful utilization of the present surplus generation during the day and upcoming solar generation, in the state of Assam.

USAID PACE-D 2.0 RE investigated and analyzed the existing supply side resources, their operation, capacity, tariff, supply and demand pattern, import and export from power exchange (IEX). The supply and the demand data for the FY 2019-20 was collected and analysed in an interval of 15 minutes. The team conducted several discussions with the team from APDCL and officers from the State Load Dispatch Centre of Assam. The team also examined the per capita consumption of electricity in the state, price elasticity of electricity and correlation of electricity with economic activities.

At present, APDCL has tied up with 1949 MW capacity from three major sources Hydro, Gas and Coal almost in equal capacity which contribute to 86% of the total electricity procured in FY 2019-20. Despite equality in capacity, hydro contributed to only 19% (2,086 MUs) while gas and coal contributed to 33% (3,600 MUs) and 34% (3,711 MUs) respectively, of total generation. The plants operate based on the cost-based merit order system. The average variable tariff of hydro, gas and coal is INR 1.75/kWh, INR 2.13/kWh and INR 2.93/kWh, respectively.

APDCL frequently exports to and imports from IEX. Majority of exports to IEX is between 12 midnight to 5 PM. Out of 1,477 MUs exported to IEX in FY 2019-20, 1,303 MUs is exported between 12 midnight to 5 PM. APDCL realized INR 2.49/kWh for the exports to IEX during this period. The export becomes necessary as APDCL procures surplus energy to meet purchase obligations due to must-run status of hydro and renewables; technical limits of thermal plants; and merit order. The exported electricity was generated by mainly from thermal plants at an average variable tariff of INR 2.55/kWh. Thus, in FY 2019-20 APDCL has exported to IEX 1303 MU at a loss of INR 0.06/kWh.

Due to their must run status and dependence on rains, operations of hydro plants cannot be changed significantly to optimize the procurement. Moreover, the storage capacity based hydro plants in Assam are small to make any meaningful impact. Due to the nature of the technology and plant size, operations of coal-based plants are less flexible.

Gas based plants provide flexibility of operation due to their fast ramp up and ramp down rate and low time to start and shut down. As a result, they are in great demand to provide stability to the grid from variations in demand and supply of the targeted 175 GW RE generation by 2022. However, APDCL is neither exploiting this flexibility for their own use nor using the market to earn a premium. In the current cost-based merit order system, gas-based plants are operated before coal plants, limiting the capacity of APDCL to exploit the flexibility provided by gas-based power plants.

Thus, our recommendations regarding optimization of supply sources are developed around utilizing the flexibility provided by gas-based plants and facilitating reduction of surplus or gainful utilization of surplus. Here are our specific recommendations for APDCL:

A. Exclude gas-based plants from cost- based merit order.

B. APDCL should discontinue selling surplus power to IEX at a loss by quick ramping up and down of the load on gas-based plant or by taking reserve shut down after change in the cost-based merit order.
C. As the ancillary market develops, explore possibility of selling flexibility of gas-based plant at a premium.
D. Explore possibility of selling surplus power on long term basis to DISCOMs from other States with a complementary demand supply curve and at a price higher than IEX.
E. Improve Resource Planning by using REPOSE tool developed under PACE-D 2.0 RE program.

At present, Assam is selling surplus generation of 1303 MU between 12 midnight to 5 PM at an average loss of INR 0.06/kWh to IEX. We recommend APDCL to sell surplus energy to their own consumers (all categories) in place of IEX, by offering a rebate of INR 1.0/kWh for the additional consumption (from the consumption of the same month in the previous year) between 12 midnight to 5 PM. Experience suggests, that this rebate would encourage demand generation and demand shift.

Assam has second lowest per capita electricity consumption in India. To increase per capita electricity consumption, the State Government is putting lot of efforts, focusing on electrification drive and promotion of industrial activity. The proposed rebate will provide additional support to the State in achieving its initiatives for demand generation. Demand generation has several economic and social benefits to Assam. The proposed rebate includes a Time of day tariff used popularly to shift demand. However, the scope for demand shift is limited in Assam due to low industrial consumption. The best way to test is by implementing it as there is hardly any implementation cost.

Our analysis shows that a small 6.6% increase in consumption between 12 midnight to 5 PM either due to demand generation or demand shift, would reduce export to IEX by 30%. After considering proposed rebate of INR1.0/kWh and 25% T&D losses, this 6.6% extra sale in the day will provide annually minimum benefit to APDCL INR 29.71 crore and to consumers by INR 29.32 crore. As increased consumption do not have any overheads, profits from increased consumption will lead to increase in net profit. The gain of INR 29.71 crore is 141% of the gain APDCL made in FY 2018-19.

Therefore, we recommend reduction in tariff for all categories by INR 1.0/kWh for any additional consumption during the period from 12:00 mid night and 5:00 PM in the FY 2021-22.

1. INTRODUCTION

With the expected addition of 100 GW of solar power in the country by 2022 and the must run status of RE power, most states will have to grapple with the following problems soon:

- Higher supply than demand during the day leading to surplus energy during the day.
- Unutilized thermal generation capacity during the day resulting into payment of fixed charges.
- Lower prices on energy exchange for surplus energy during the day and higher prices during peak time.

Unfortunately, the problem has already started in Assam. The PACE-D 2.0 RE team (herein after team) has proposed the solution of green tariff in the steering committee meeting of June 2020. Power (Electricity) Department, Government of Assam in the meeting has suggested to examine various supply sources available to Assam and suggest measures to improve their utilization to meet the demand of the state while proposing green tariff. This study examines following interventions for APDCL

1. Optimal and market-based utilization of existing supply resources of Assam.
2. Increasing demand during non-peak period

The study has conducted with the hypothesis that above interventions are likely to provide following benefits to the state of Assam:

1. Flatten load curve
2. Reduced import/export of electricity to/from exchange
3. Higher utilization of RE power
4. Financially gainful utilization of supply side resources in the day
5. Increased per capita consumption of electricity in the State

2. EXISTING ELECTRICITY DEMAND SUPPLY STATUS IN APDCL

2.1 ELECTRICITY DEMAND

In the FY 2019-20 the average monthly demand varied between 875 MW to 1,468 MW (Refer Figure 1), and average hourly demand varied from 878 MW and 1,497 MW (Refer Figure 2). Electricity demand is higher between June and September and lower between December and March. Higher demand is witnessed during the evening between 5:00 PM and 12:00 midnight, with a peak between 7:00 PM and 8:00 PM. Demand is lowest between 3:00 AM and 7:00 AM. Demand during rest of the hours is found to be flat.

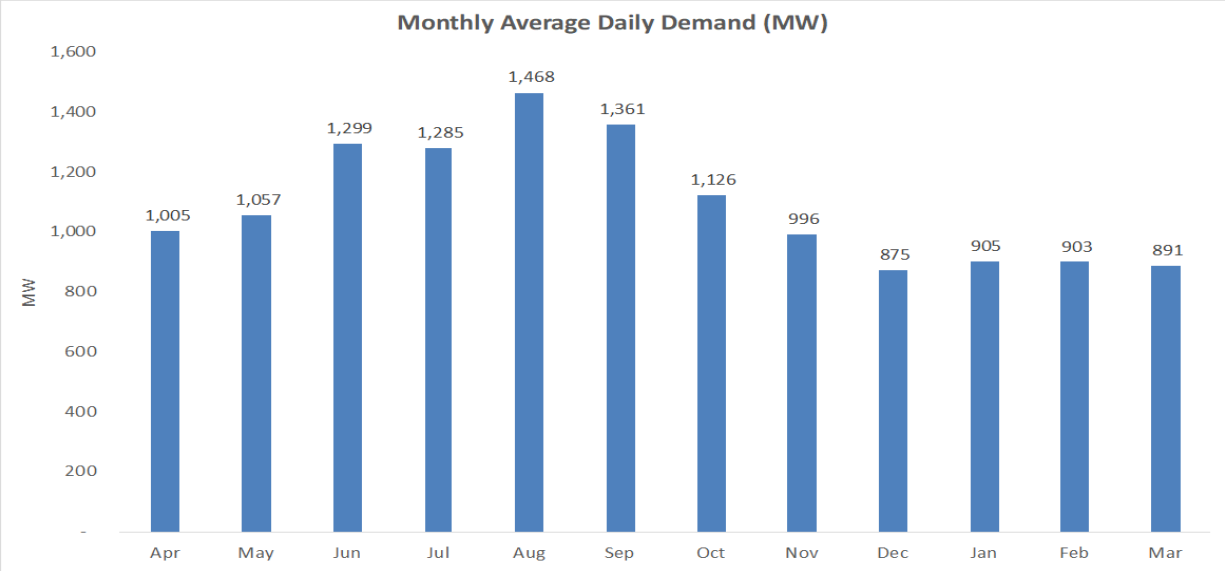

Figure 1: Monthly Average Daily Demand

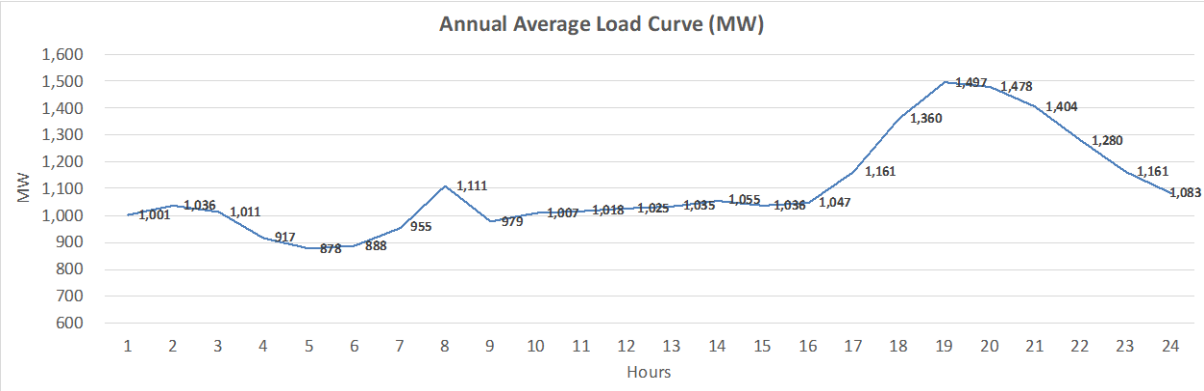

Figure 2: Annual Average Hourly Load Curve for 2019-20

2.2 SOURCES OF SUPPLY

APDCL has tied up with 1,949 MW of generation capacity. APDCL procures from a wide range of technologies, projects and suppliers. Assam Power Generation Corporation Ltd (APGCL), North Eastern Electric Power Corporation Ltd (NEEPCO) and NTPC being the

major suppliers of the electricity to APDCL. Hydro, Gas and Coal are the major sources contributing almost equally to the capacity in MW. However, supply in kWh from hydro capacities is only 19%. Electricity supply from Hydro has been low due to seasonal nature of generation. Present contribution from renewables i.e., solar and wind is about 2%.

Other important sources of electricity are short term purchases and drawl from power exchange (IEX). Large portion of these purchases can be attributed to shortage in supply due to temporary non availability of tied-up capacities and high demand during evenings. Table 2.1 and Figure 3 summarizes the sources of electricity used by APDCL in FY 2019-20, along with the average variable cost.

Table 2.1: Sources of electricity for APDCL

Source	Capacity (MW)	Supply (in million units)	Share in total Supply (%)	Variable Tariff in INR/kWh
Hydro				
State Sector	114	425		1.28
Central (NER) Sector	435	1,453		1.48
Others	114	207		4.67
Sub-total	*663*	*2,086*	*19%*	*1.75*
Gas				
State Sector	211	1,073		2.55
Central (NER) Sector	455	2,528		1.94
Sub-total	*666*	*3,600*	*33%*	*2.13*
Coal				
Central (NER) Sector	430	2,692		3.20
Central Sector	190	1,019		2.23
Sub-total	*620*	*3,711*	*34%*	*2.93*
Renewables				
Solar		52		7.41
Wind		163		3.15
Sub-total		*215*	2%	4.19
Short term		627	6%	4.24
IEX		505	5%	4.10
Others		197	2%	4.71
Total	**1,949**	**10,941**		**2.63**

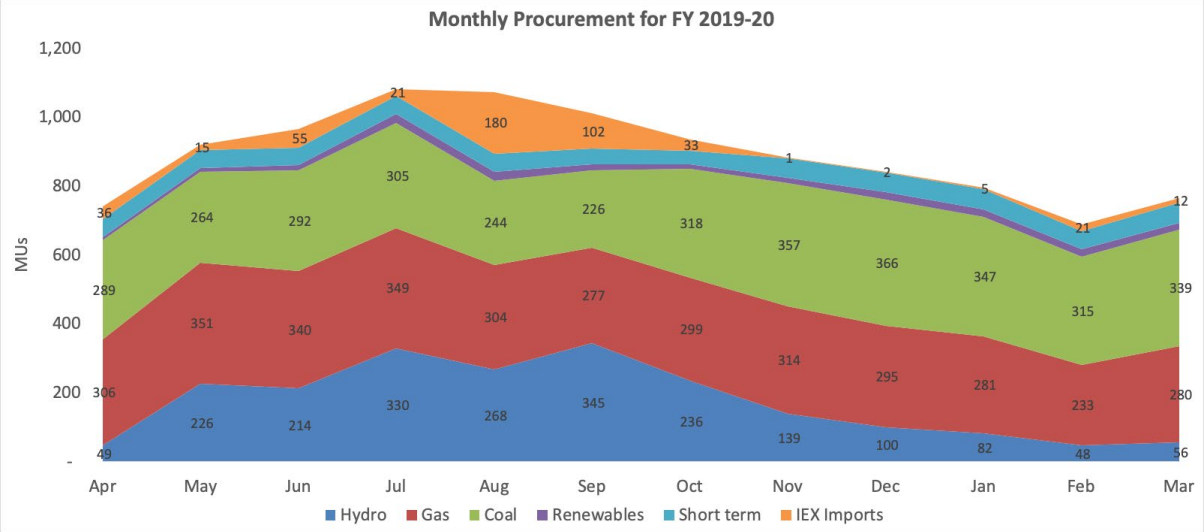

Figure 3: Monthly Procurement of electricity from various sources

- **Hydro**
  Hydro is the cheapest source of supply to APDCL. Due to must-run status of hydro projects, entire available electricity needs to be procured by APDCL. Few of these projects have storage capacity. Hydro contributes to about 19% of total supply and varies between 7% to 34% across the months. Generation from hydro is high between May and October (Refer Figure 3). During this period, hydro projects supply electricity throughout the day. Storage capacity is not used for scheduling the generation during this period to avoid flooding of surrounding and downstream areas. During rest of the year, stored water is used to schedule generation to meeting daily peak demand i.e., during evenings.

- **Gas**
  Gas is the second cheapest source of supply for APDCL[1]. Gas based capacities have higher flexibility compared to thermal. However, gas being cheaper source of electricity is high on the merit order compared to coal. Monthly supply from gas- based capacities vary within a relatively narrow band of 233 to 351 MUs. APDCL pays for entire capacity charges for available capacity irrespective of quantum of energy offtake. Electricity from gas-based plants are drawn based on merit order without consideration of the flexibility it offers due to fast start and shut down time.

- **Coal**
  Coal along with gas is among the major sources of electricity. APDCL relies heavily on coal for meeting demand despite being costlier compared to other two major sources (Hydro and Gas) and pressure to use renewable energy (RE) in place of coal. This is due to the infirm nature of hydro and RE. However, APDCL is trying hard to drop the share of coal with higher hydro and renewables but tied up capacity for thermal would remain to be high till energy storage solutions gets affordable or demand increases in Assam. APDCL pays for entire capacity charges for available capacity irrespective of quantum of electricity offtake.

[1] Average variable expense for gas-based capacities is lower than average variable expense for thermal based capacities. However, variable expenses for individual gas capacities are higher than few of the individual thermal capacities. (Refer Table-1)

- **Renewables**
  Currently, share of renewables in total supply is 2%. Share of renewables will increase with the ongoing commissioning and planned solar projects. Solar generates only during the daytime and the generation can be low during the rainy months. Solar need to be backed up with thermal power (gas and coal) to supply during the non-daytime.

- **Imports from IEX**
  APDCL is a net exporter of electricity to IEX. However, APDCL imports electricity from IEX on a regular basis to meet the peak demand and exports electricity to IEX during the day. A large portion of these imports occur during the evenings to supply the peak demand when the prices of IEX are higher. Imports from IEX are the most expensive sources for APDCL. In the FY 2019-20 the average import price was INR4.10/kWh. (Refer Figure 4)

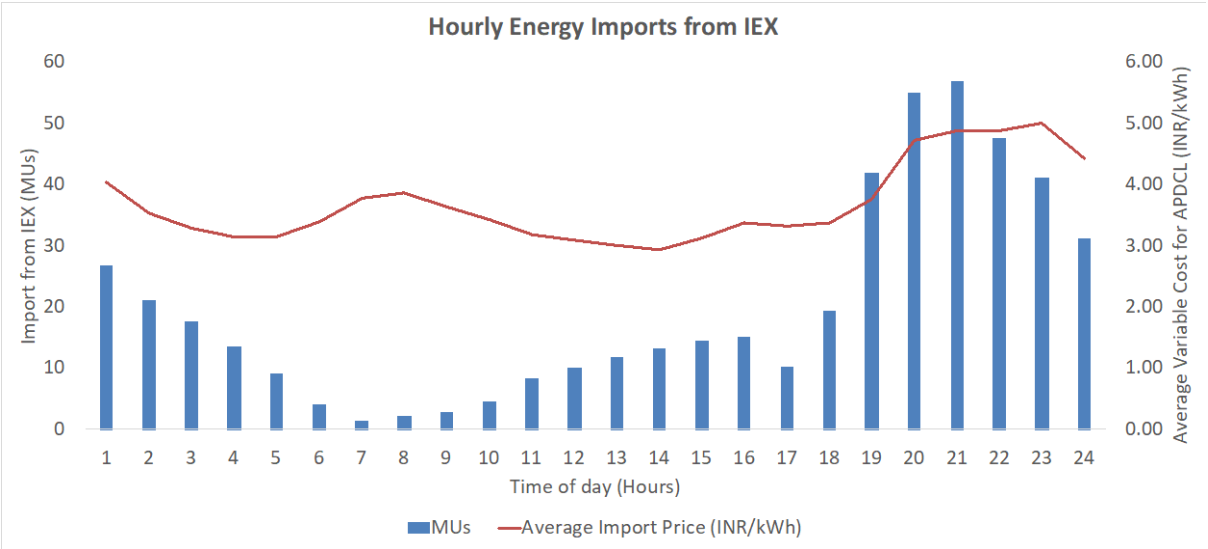

Figure 4: Hourly Energy Imports from IEX

2.3 KEY OBSERVATIONS IN DEMAND SUPPLY STATUS OF APDCL

1. **Export of Surplus to Exchange is at Loss and Highly Risk:** In FY 2019-20, APDCL sold 1,477 MUs on IEX which is about 13.8% of total energy procured from all sources. Surplus energy varies across the months and day (Refer Figures 5 and 6). Out of 1,477 MUs, 88% i.e., 1,303 MUs was exported between 12:00 midnight and 5:00 PM to IEX at an average realized price of about INR 2.49/kWh. Considering the must run status of Hydro and RE, the surplus can be reduced only by reducing the procurement from gas and coal-based power plants. Average variable cost of electricity from gas and thermal is about INR 2.55/kWh.

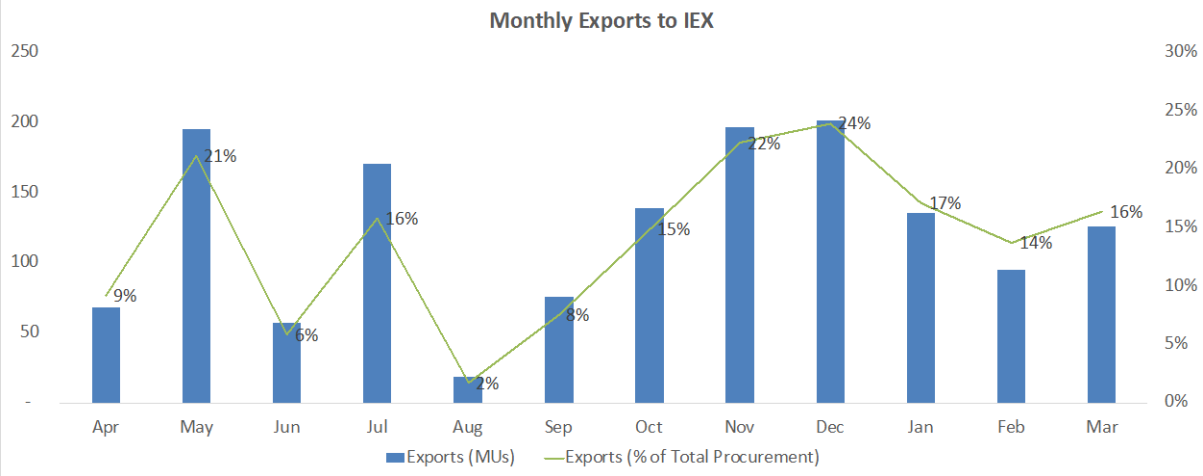

Figure 5: Monthly Exports to IEX

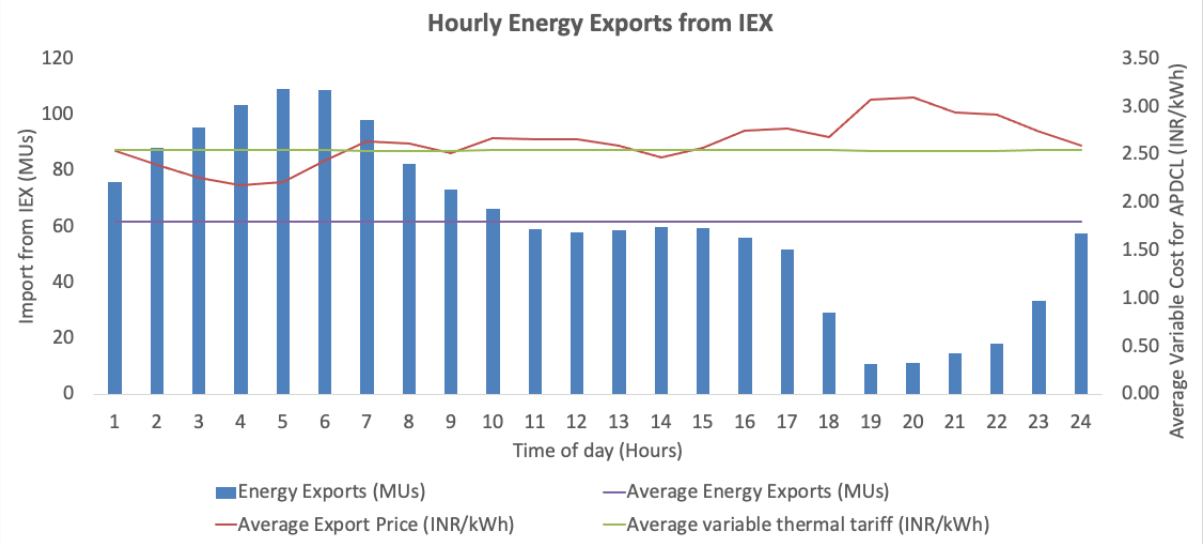

Figure 6: Hourly Exports to IEX

2. **Low Demand** – APDCL has low demand in the day during the most part of the year. The efforts made by Assam Government and APDCL such as promise for reliable, and 24 x 7 supply to industries have resulted into limited increase of demand. Assam has second lowest per capita electricity consumption in the country, the high cost of electricity may be one of the reasons for low demand.

3. **Merit Order Restricts Gainful use of Gas Based Sources** – After must run sources, merit order based on the variable cost is the sole criterion for operation of balance supply side resources. The flexibility APDCL has by way of gas-based power plants is not exploited.

3. OPTIMAL AND MARKET-BASED UTILIZATION OF EXISTING SUPPLY RESOURCES OF ASSAM

APDCL has tied up with new hydro and solar capacities. With the commencement of supply from these capacities, the surplus will increase. For gainful utilisation of the surplus generation, APDCL need to work on demand generation and explore market-based utilization. PACE-D 2.0 RE program has developed following recommendations for APDCL in this context.

Recommendation 1 - Exploit the flexibility offered by gas-based plants and avoid loss due to export to IEX

Due to high ramp up and ramp down rate and quick start up and shut down time, gas-based plants provide higher flexibility in operation than coal-based plants. APDCL has tied up with six gas-based plants. Out of which, three are owned by Assam Power Generation Company Ltd (APGCL) and their supply being entirely tied up with APDCL. Rest three plants are owned by North Eastern Electric Power Corporation Ltd (NEEPCO) and ONGC Tripura Power Company Ltd (OTPC) which are higher capacity and supply electricity to other states also in addition to Assam. (Refer Table 1: Sources of electricity for APDCL).

At present gas-based power plant are part of cost-based merit order. Their variable cost is low in comparison of coal-based plant (Refer Table 1) as Assam is near to source and due to vintage of the plant. During the day, coal-based plants are taken into operation after gas-based power plant. Coal-based plant need to be run at technical minimum (even if demand is low) and do not provide flexibility through neither high ramp up and ramp down rate of load nor of quick start and shut down. This results into excess generation to full fill the requirement of minimum generation and surplus generation is sold to IEX at loss. If cost-based merit order is disregarded and coal-based plants are taken into operation first and there after gas-based plant, the problem of surplus generation will be taken care by the flexibility of gas-based plants. Simple illustration is used to illustrate the same in Figure 7.

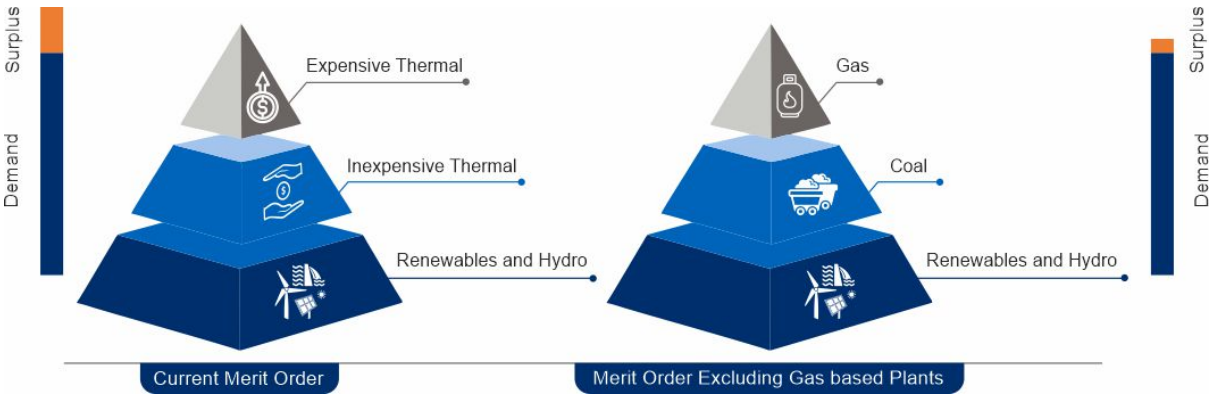

Figure 7: Illustration of Procurement by Excluding Gas Plants from Cost based Merit Order

Therefore, we make following recommendations.

1. Excluding gas-based plants from cost- based merit order.
2. Reducing surplus procurement by quick ramping up and down of the load on gas-based plant or by taking reserve shut down disregarding the cost-based merit order.

Recommendation 2 - Sell flexibility of gas-based plants at a premium via Ancillary Market

CERC has floated the regulations for ancillary market. As 2022 comes closer, share of RE in the grid increases. This will require flexible generation from gas-based plants to balance the variation of RE power in the grid. The ancillary market will become one such option for supplying flexibility.

As the ancillary market developed explore possibility of selling flexibility of gas based plant at a premium.

Recommendation 3 - Tie up with states and consumers outside of the state who can absorb surplus energy with APDCL

APDCL has surplus for large part of year and large part of day. Finding new demand from within the state or outside the state which has a profile complementary to APDCL would flatten the demand and supply curve while reducing supply cost and improving revenue. For example, states with high industrialization has high daytime demand compared to the evening demand. APDCL can have a long-term agreement to supply to these states.

Sale surplus power on long term basis to DISCOMs with complementary demand supply curve and at a price higher than IEX.

Recommendation 4 – Improve Resource Planning by better demand forecasting and profile based RE procurement

By improving the quality of forecasting demand, APDCL can plan procurement in a better way. The procurement of RE should be based on profile in place of current practice of MW based procurement. Under Component A of PACE-D 2.0 Program, a team is working with APDCL to improve forecasting and procurement of power by use of REPOSE software tool developed in the program.

Improve Resource Planning by using REPOSE tool developed in PACE-D 2.0 RE program.

Recommendation 5 – Increase Demand by Reducing Tariff

Tariff is most potent tool to increase or shift demand. APDCL procured surplus thermal energy with an average variable tariff of INR 2.55/kWh and sold on IEX at a loss of INR 0.06/kWh. With an assumption of average 25% transmission and distribution (T&D) losses any power sold by APDCL to its own customer at a rate higher than INR 3.40/kWh will allow APDCL to make profit. Tariff is INR 5.10/kWh for LT Domestic A consumer category is considered lowest tariff among consumer categories expected to increase or shift demand[2]. Thus, a rebate of say INR 1.0/kWh is passed to customers, APDCL will make a minimum profit of INR 0.70/kWh against the present loss of INR0.06/kWh. Tariff incentive will encourage consumers to increase demand by energy substitution or otherwise. The details are provided in next section.

Tariff Incentive for increasing demand when APDCL has surplus

[2] Tariff for LT Domestic A consumers is the fifth cheapest followed by Jeevan Dhara (INR 4.10/kWh), Electric Crematorium (INR 4.30/kWh), LT Agriculture (INR 4.45/kWh) and Small Industrial (INR 4.90). However, these four consumer categories consume 6% cumulatively of the total electricity sale. The LT Domestic A consumers contribute 41% to the total sales.

4. DEMAND GENERATION WHEN APDCL HAS SURPLUS POWER

In India the correlation of electricity consumption and gross domestic product (GDP growth is 0.9843. Another study[4] on the subject concludes, "electricity consumption statistically significantly stimulates economic growth in India both in long term and short term. However, the elasticity of economic growth with respect to electricity use is found to be higher in the long term than that of the short term.". For 2018-19, Assam had second lowest per capita consumption of electricity in India[5]. Thus increasing per capita electricity consumption in Assam is key for increasing economic activities in the state. It is also observed that the average daytime demand increases with increase in per capita consumption. One of the ways to increase per capita consumption is by reducing the electricity tariff. Several initiatives have been taken by Government of India and Assam Government to increase electricity demand in the state. Tariff incentive is historically tested most sensitive tool for demand enhancement,

Leaving the exceptions APDCL has surplus power between 12:00 mid night and 5:00 PM (Refer Figure 6). APDCL exported surplus to IEX at a loss of INR 0.06/kWh. APDCL should consider promoting demand during this period. A rebate on tariff can encourage consumers to consume more. However, rebates can reduce the revenue for APDCL. A targeted approach is required to design rebate to suit the needs of APDCL and at the same time large enough to encourage consumers to increase consumption. To protect the revenue of the APDCL, we suggest rebate should be applicable to those consumers only who increases their consumption during the day over the previous year consumption in the same month. The rebate will be applicable for the increased consumption only between 12:00 mid night and 5:00 PM.

APDCL should promote consumers to increase their consumption between 12:00 mid night and 5:00 PM through a rebate of say INR 1.0/kWh for increased consumption. We call this rebate as green tariff as its help in higher consumption of green power. Such rebate/green tariff has been introduced by Madhya Pradesh, Maharashtra and Rajasthan. The details of which are provided in Annexure 1.

4.1 ANALYSIS

In the FY 2019-20, APDCL had procured about 7,223 MUs between 12:00 mid night and 5:00 PM, out of which 5,920 MUs is used to meet the consumer demand and rest i.e., 1,303 MUs are exported to IEX. Average variable cost of thermal energy is about INR 2.55/kWh during this period while the average price realized (net of statutory expenses) is about INR 2.49/kWh. Thus, making a loss of about INR 7.82 crore @ INR0.06/kWh.

With an assumption of average 25% T&D losses any energy sold by APDCL to its own customer at a rate higher than INR 3.40/kWh[6] will allow APDCL to make profit. The tariff

[3] Project Report on "Relationship between Electricity Consumption and Economic Growth in India" by Dr. E. Mohamad Shereef. May 2017.

[4] OPEC Review Volume 42, Issue 4, December 2018. "The relationship between electricity consumption, trade openness and economic growth in India" by Ramphul Ohlan

[5] Ministry of Power

[6] The figure is calculated by taking average generation price as INR2.55/kWh and 25% T&D losses (2.55/0.75)

for LT A consumer is INR 5.10/kWh, the lowest tariff considered for this analysis. Thus, if a rebate of say INR 1.0 kWh is passed to customers, APDCL will make a minimum profit of INR 0.70/kWh against the present loss. The customer will get tariff incentive which will encourage them to increase demand by energy substitution or otherwise. The gains of APDCL and consumers at various level of demand generation are presented in Table 4.1.

Table 4.1: Gains to APDCL and Consumers at Various Level of Demand Generation between 12:00 midnight and 5:00 PM

Increase in consumption Generated (MUs)	% of Export to IEX	% of Consumption between 12 midnight to 5 PM	Reduced losses from reduced exports (INR crore)	Min. Gains to APDCL from Increased Consumption (INR crore)	Min. Total Profit to APDCL (INR crore)	Benefit to Consumers (INR crore)
130.3	10	2.2	0.78	9.12	9.90	9.77
260.6	20	4.4	1.56	18.24	19.81	19.55
390.9	30	6.6	2.35	27.37	29.71	29.32
521.2	40	8.8	3.13	36.49	39.61	39.09
651.5	50	11.0	3.91	45.61	49.52	48.87
977.25	75	16.5	5.86	68.41	74.28	73.30
1303	100	22.0	7.82	91.22	99.04	97.73

Consumption of APDCL between 12:00 midnight and 5:00 PM	5,920 MUs
Export to IEX between 12:00 midnight and 5:00 PM	1,303 MUs
Loss to APDCL from export to IEX (INR/kWh)	INR 0.06/kWh
Gain to APDCL from increased consumption of LT1 consumers @ INR 3.55/kWh	INR 0.70/kWh

Practically, the rebate shall encourage all consumer categories to increase consumption between 12:00 midnight and 5:00 PM, thus gains of APDCL will be higher than those estimated in Table 2. Depending upon the success of the rebate after first year, APDCL may consider passing higher benefits to the consumer categories from which APDCL has higher gains.

At this point it is difficult to ascertain expected increase in demand from the rebate of INR 1.0/kWh as no such studies are available for Indian context. The test of pudding lies in eating. Proposed rebate scheme has limited downside while the upside is large. APDCL would lose nothing in case of the rebate scheme not being successful. But APDCL and Assam as an state would benefit significantly if it is successful. APDCL from financial gains and Assam from economic and social gains.

Therefore, we strongly recommend reduction in tariff for all categories by INR1/kWh for any additional consumption during the period from 12:00 mid night and 5:00 PM in the FY 2021-22.

4.2 IMPLEMENTATION

The biggest challenge for implementing rebates for increased consumption is ascertaining the day consumption of the consumers of the previous year in same month (Base line). Based on

the methodologies adopted by other states (Annexure-1) we suggest following methodology to determine the base line. Several examples are provided in Annexure-2 to further clarify the methodology for determination of the consumption in the previous year of the same month. However, to announce rebate for FY 2021-22, using monthly consumption of FY 2020-21 will be misleading due to COVID-19 pandemic. Thus, we suggest selecting the monthly consumption of FY 2019-20 for baseline.

A. **Consumers have TOD meters and their consumption during 12:00 mid night and 5:00 PM. is available for base line**

   Rebate of INR 1/kWh shall be applicable for any increase in consumption between 12:00 midnight and 5:00 PM from the baseline year for same month.

B. **Consumers do not have TOD meters and their consumption during 12:00 mid night and 5:00 PM. is not available for base line.**

   The consumption for baseline year between 12:00 mid night and 5:00 PM will be determined by a multiplying the monthly consumption of baseline year by a factor of 0.708 (17/24). Increased consumption will be determined from the difference of current year ToD consumption and estimated ToD consumption for baseline year. Rebate of INR 1/kWh shall be applicable on increased consumption.

APDCL can roll out this rebate immediately for the current ToD consumers. Non-ToD consumers should first get ToD meter installed.

Several examples are provided in Annexure 2 to further clarify the methodology for determination of the consumption in the baseline year of the same month.

ANNEXURE-1 - REBATE SCHEMES IMPLEMENTED BY OTHER STATES

Currently, three states i.e., Madhya Pradesh, Maharashtra and Rajasthan have announced rebates for incremental consumption so as to promote the increased consumption. Following table highlights the targeted consumers of these rebate schemes:

Targeted Consumers for Rebate Schemes			
Incentive	Madhya Pradesh	Rajasthan	Maharashtra
Rebate for existing HT connections	Applicable	Applicable	Applicable
Rebate for new HT connections	Applicable	Applicable	NA
Rebate for Captive power plant consumers	Applicable	NA	Applicable
Rebate for Open Access Consumers	Applicable	NA	Applicable
Reference	ARR and Retail Supply Tariff Order for FY 2019-20	ARR and Tariff Petition of JVVNL, AVVNL and JdVVNL for FY 2019-20.	Truing-up of ARR of FY 2017-18 and FY 2018-19, Provisional Truing-up of ARR of FY 2019-20 and Projections of ARR and determination for the 4th Multi Year Tariff Control Period FY 2020-21 to FY 2024-25

Following tables summarize the rebate schemes for each targeted consumer category

Existing Consumers			
	Madhya Pradesh	**Rajasthan**	**Maharashtra**
Incentives	INR 1/kWh rebate on tariff	• INR 0.55/kWh for Medium Industrial (HT) consumers • INR 0.85/kWh for Large Industrial consumers	INR 0.75/kVAh
Eligible Consumers	• Industrial (HT) • Non-industrial (HT) • Shopping Malls (HT)	• Medium Industrial (HT) consumers • Large Industrial consumers	• HT industries • HT commercial • HT public services • HT-PWW • HT - Railways/Metro/Mono • HT - Group Housing Society

Existing Consumers			
	Madhya Pradesh	**Rajasthan**	**Maharashtra**
Applicable Consumption	Incremental consumption over baseline only	Incremental consumption over baseline only	Incremental consumption over baseline only
Baseline	FY 2015-16 consumption	FY 2018-19 consumption	3-year average monthly consumption by consumer from FY 2017-18 to FY 2019-20
Others	For new connections after FY 2015-16, baseline would be consumption during first 12 months of operations	For new connections sanctioned in between FY 2018-19, baseline would be consumption during first 12 months of operations	• For consumers connected between FY 2017-18 and FY 2019-20, rebate shall be applicable after completion of 3 years • Rebate shall be applicable for 3 years and to be reviewed during mid term review

New Consumers			
	Madhya Pradesh	**Rajasthan**	**Maharashtra**
Incentives	INR 1/kWh rebate on tariff or 20% of applicable tariff whichever is lower	• INR 0.55/kWh for Medium Industrial (HT) consumers • INR 0.85/kWh for Large Industrial consumers	NA
Eligible Consumers	• Industrial (HT) • Non-industrial (HT) • Shopping Malls (HT)	• Medium Industrial (HT) consumers • Large Industrial consumers	NA
Applicable Consumption	Entire consumption	Entire consumption	NA
Baseline	NA	NA	NA
Others	• Rebate on entire consumption is applicable upto FY 2021-22 • Rebate on incremental consumption is not applicable	• Rebate on entire consumption is applicable until further notice • Rebate on incremental consumption is not applicable	NA

Captive Consumers			
	Madhya Pradesh	**Rajasthan**	**Maharashtra**
Incentives	INR 2/kWh rebate on tariff	NA	NA
Eligible Consumers	• Industrial (HT) • Non-industrial (HT) • Shopping Malls (HT) • Meeting energy demand fully or partially through CPPs between FY 2016-17 to FY 2018-19	NA	NA
Applicable Consumption	Incremental purchases from DISCOM subject to reduction in captive generation	NA	NA
Baseline	Consumption of Preceding financial year	NA	NA
Others	Rebate shall be applicable upto FY 2021-22	NA	NA

Open Access Consumers			
	Madhya Pradesh	**Rajasthan**	**Maharashtra**
Incentives	INR 2/kWh rebate on tariff	NA	INR 0.75/kVAh
Eligible Consumers	• Industrial (HT) • Non-industrial (HT) • Shopping Malls (HT) • Meeting energy demand fully or partially through open access during FY 2018-19	NA	• HT industries • HT commercial • HT public services • HT-PWW • HT Railways/Metro/Mono • HT- Group Housing Society
Applicable Consumption	Incremental purchases from DISCOM subject to reduction in captive generation	NA	Incremental consumption from DISCOM over baseline only
Baseline	Consumption of FY 2018-19	NA	3-year average monthly consumption by consumer from DISCOM from FY 2017-18 to FY 2019-20
Others	NA	NA	• For consumers connected between FY 2017-18 and FY 2019-20, rebate shall be applicable after completion of 3 years • Rebate shall be applicable for 3 years

Open Access Consumers			
	Madhya Pradesh	**Rajasthan**	**Maharashtra**
			and to be reviewed during mid term review

ANNEXURE-2 EXAMPLES TO EXPLAIN THE PROPOSED METHODOLOGY

A. For Existing ToD consumers whose ToD consumption for the baseline year is known

Example 1: A consumer consumed 800 kWh is between 12:00 mid night and 5:00 PM in May 2021 against total consumption of 1600kWh. In May 19, the consumption was 600kWh 12:00 mid night and 5:00 PM and the total consumption was 1600kWh.
Incentive = (800 - 600) x 1=INR 200

Example 2: A consumer consumed 800 kWh is between 12:00 mid night and 5:00 PM in May 2021 against total consumption of 1600kWh. In May 19, the consumption was 900kWh 12:00 mid night and 5:00 PM and the total consumption was 1600kWh.
Incentive = (800 - 900) x 1=INR 0

Example 3: A consumer consumed 800 kWh is between 12:00 mid night and 5:00 PM in May 2021 against total consumption of 2000kWh. In May 19, the consumption was 800kWh 12:00 mid night and 5:00 PM and total consumption was 1600kWh.
Incentive = (800 - 800) x 1=INR 0

B. For Non-ToD consumers whose consumption in the baseline year is not known

Example 4: A consumer consumed 800 kWh is between 12:00 mid night and 5:00 PM in May 2021 against total consumption of 1600kWh. In May 19, the total consumption was 1600kWh.
Incentive = (800 - 1600 x 0.708) x 1 =INR 0

Example 5: A consumer consumed 1200 kWh is between 12:00 mid night and 5:00 PM in May 2021 against total consumption of 1600kWh. In May 19, the total consumption was 1600kWh.
Incentive = (1200 - 1600 x 0.708) x 1 =INR 66.67

Example 6: A consumer consumed 800 kWh is between 12:00 mid night and 5:00 PM in May 2021 against total consumption of 2000kWh. In May 19, the total consumption was 1600kWh.
Incentive = (800 - 1600 x 0.708) x 1 =INR 0

Example 7: A consumer consumed 1200 kWh is between 12:00 mid night and 5:00 PM in May 2021 against total consumption of 2400kWh. In May 19, the total consumption was 1600kWh.
Incentive = (1200 - 1600 x 0.708) x 1 =INR 66.67

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