BEFORE

THE UTTAR PRADESH ELECTRICITY REGULATORY COMMISSION,

LUCKNOW

IN THE MATTER OF:

Approval of Smart Meter roll out plan presented by UPPCL before the Commission.

AND

IN THE MATTER OF:

1. U. P. Power Corporation Ltd., 7th Floor, Shakti Bhawan, 14, Ashok Marg, Lucknow – 226001.
2. Madhyanchal Vidyut Vitran Nigam Ltd., 4-A, Gokhale Marg, Lucknow - 226001.
3. Dakshinanchal Vidyut Vitran Nigam Ltd., Urja Bhawan, 220KV Sub-Station Mathura bypass Road, Agra - 282007.
4. Paschimanchal Vidyut Vitran Nigam Ltd., Victoria Park, Meerut - 250001.
5. Poorvanchal Vidyut Vitran Nigam Ltd., Bhikharipur, 132KV Sub-Station, Poorvanchal Vidyut Bhawan, P.O. Diesel Locomotive Works, Varanasi - 221004.
6. Kanpur Electricity Supply Company Ltd., KESA House, 14/71, Civil Lines, Kanpur - 208001.

ORDER

(Date of Presentation 11.09. 2018)

1. Ministry of Power Govt. of India vide their letter dated 08.09.2016 wrote to the Secretary, Forum of Regulators (FOR) about the strategy for roll out of advance metering infrastructure in the States. Sighting clause 8.4 of the revised National Tariff Policy issued on January 28, 2016 regarding installation and provision of smart meters. Central Electricity Authority also reiterated the said clause of revised National Tariff Policy and intimated the Power Secretary's out the technical specification of smart meters. The CEA asked the Principal Secretary of power department of the State to prepare a detailed plan for installation of smart meters and submit the same to respective State Regulatory Commissions for approval.
2. One of the public representative Shri A.K. Verma, Chairman U.P Rajya Upbhokta Parishad also wrote to this Commission that UPPCL is embarking on installation of smart meters without the approval of the State Commissions. The Commission vide its letter dated 16-05-2018 asked UPPCL to submit the detailed roll out plan of installation of smart meters for the approval of the Commission.
3. In follow up of the directions of the Commission, UPPCL vide their letter dated 06-08-2018 submitted the smart meter roll out plan for the State owned distribution companies. The Commission examined the roll out plan of different distribution companies and raised the following queries and also invited UPPCL to make a presentation on the salient features of the roll out plan. Accordingly, UPPCL made the presentation on 11-09-2018.

4. Queries raised by the Commission

A. Queries with the respect to Commercial Aspects:

I. As per the Business Proposal Clause 4 (Financial Model) Annexed to the MOU signed with EESL, Rs. 86/- (exclusive of Tax) is the monthly OPEX cost. How Rs. 86/- has been derived and under which heads this amount will go i.e. cost of meters, O & M and PMC or any other charge.

II. There are three types of smart meters i.e. Single Phase, Three Phase Whole-Current Meter & Three Phase LT CT Meter. The per meter monthly charges of Rs. 86/- is same for the all type of meters, please explain the reason for keeping the same cost for all the three categories.

III. As per the clause 4.2.4 Implementation Roadmap (Indicative), The book value of the assets at the time of handover will be decided after EESL provides age/life cycle of each of the assets; how the book value will be dealt as the average life cycle of the meter is 10 years and it has been mentioned that O & M phase can be extended up to another 5 years so it means that the total life cycle of the meter will go up to 15 years; will EESL change the meter after the average life without any cost implication?

IV. For MVVNL, the collection efficiency is assumed to increase by 2% in first, second and third year and reach to 96% in third year and remain constant third year onwards. For KESCO, the collection efficiency is assumed to increase by 3% in first, second and reach to 95% and remain constant third year onwards. For DVVNL, the collection efficiency is assumed to increase by 1% in first,

second and by 2% in third year and remain constant third year onwards. For PuVVNL, the collection efficiency is assumed to increase by 1% in first, second and by 2% in third year and remain constant third year onwards. For PVVNL, the collection efficiency is assumed to increase by 1% in first, second year and by 2% in third year and remain constant third year onwards. It is not reflected that how the collection efficiency will increase when many of the consumers on whom the smart meters installed, are already paying the bills on time.

V. In KESCO roll out plan it has been mentioned that being the OPEX model the assets procured/installed under the program will not appear into the DISCOM Balance Sheet. How the payments will be dealt into the accounts and whether the meters procured will form part of the DISCOMs' Fixed Assets or not?

VI. That the areas having AT&C losses greater than or equal to 15% have been considered for installation of smart meters but the roll out plan states that towns having AT&C losses as high as 44% would be taken up in Phase II or III, explain the reasons and basis of selection of towns.

VII. It has not been mentioned that till what time the centralised data centre shall be functional and if the meters are not disconnected remotely on the command from the data centre, then how the full benefit will accrue to the Discom.

VIII. Consumer's data is proposed to be stored at third party cloud Server ; what precautions are being taken to safeguard consumer's data privacy.

B. Queries with respect to Technical aspects

I. What will be the communication methodology (**variant-1 and variant-2**) opt i.e., **NAN with PLC/RF or WAN with cellular technologies/OFC**.

II. Hardware compatibility of communication network in meter for 2G/3G/4G network

III. If 2G/3G network obsolete/discontinue and any new communication technology is introduced, than the meter will be replaced with new network technology or the same meter will be upgraded. Also who will be responsible for this task?

IV. Communication hardware in meter is built in type or plug-in type?

V. All type of network bands are supported in meter or any one will be used (2G/3G/4G)?

VI. Prepaid functionality considered or not, if yes than prepayment will be currency based or KWH based?

VII. Net metering (Import/Export) considered or not?

VIII. Remote Load limit/control (connect & disconnect mechanism) functionality considered or not?

IX. What will happen if load switch is damaged/defective in meter; how such scenario will be tackled?

X. Remote Meter reading & billing is to be done then how the consumer will know his reading or bill?

XI. Can we disconnect the meter remotely due to non-payment of bill, if yes then how the consumer will be intimated about the same before actual disconnection?

XII. Does consumer have option to switch from post-paid to prepayment mode or vice versa without meter change? If yes, then how can we implement the same through smart meter?

XIII. Any backup for meter reading/billing in case smart meter communication failure occurs with HES.

XIV. Whether the smart meters are compliant to the Standards set by CEA.

5. UPPCL made presentation of the key aspects of the roll out plan before the Commission on 11.09.2018. The Commission raised the following issues:

I. What is the need of Smart Metering?

UPPCL submitted that it is a signatory to Ujjawal Discom Assurance Yojna (UDAY), the flagship scheme of Government of India. The installation of smart meters was a key aspect under UDAY and supports in achieving its objectives. As per UDAY scheme the installation of smart meters will help in achieving the following:

- Reduction in AT&C losses
- Improving the billing efficiency
- Managing peak load and
- Enhancing the consumer experience

II. What is the AMI Technical Structure, Project Landscape & Consumer Awareness initiatives

UPPCL submitted that the AMI technical Structure consists of the following:

a. IT Solution

b. Services

c. Field Services

d. Field Devices

The AMI Project Landscape consists of the following:

a. Smart Meter

b. IT Solutions

- Head end Systems (HES)
- Meter Data Management System
- Consumer Portal/ Mobile App

c. Field Services

III. What are the challenges of UPPCL in installation of smart meters and how UPPCL plan to mitigate this challenge:

UPPCL submitted that there is a big challenge in achieving the improvement in Billing Efficiency and achieving loss levels targets of UDAY for FY 2019-20 (i.e. reduction in the AT&C losses levels at nearly half of the levels of FY 2017-18).

In order to mitigate this challenge, the UPPCL is going for installation of smart meters for urban consumers who consume more than 500 units and 200 units by 2019. And for rest of the consumers such meters will be installed in a phased manner. The CEA Roll out Strategy, provides for deployment of smart meters area wise or feeder wise.

IV. Why EESL has been selected to provide smart meters and what are the benefits to the Consumers:

UPPCL submitted that the EESL (Energy Efficiency Service Limited) is selected due to their expertise in low cost bulk procurement and working as demand aggregators thereby bringing Economy of Scale. The EESL will make the upfront capital investment and will recover its investment in long term out of gains of the project on OPEX basis.

UPPCL further submitted that the selection of meter supplier and system integrator has been done through International Competitive Bidding process. The following agencies have been selected for different activities:

- System Integrator: L&T
- Supply of Smart Meters: Genus, ITI, Zen and Keoncis Meter
- Billing System Implementing Agency (SIA): M/s HCL (R-APDRP) and M/s Fluent grid (Non-RAPDRP)
- Targeted Consumers: 40 Lakh across 5 Discoms (PuVVNL, PVVNL, MVVNL, DVVNL, and KESCO) including 47 towns (as per Roll-out Plan)

The Benefits to consumers after deployment of smart meters are as follows:

- The Existing Consumers will not have to pay any additional charge for existing Meter replacements with Smart Meters.
- The new Consumers will have to pay the Meter Charges only as per the existing rates in cost data-book and not the actual cost of the Smart Meter.
- Any concerns & misapprehensions of consumers about mal-functioning of Smart meter shall be addressed as per existing clauses of Supply code like installation of check meters etc.

- Provisioning of the Helpdesk for the Consumers i.e access via Email, Telephone, Mobile, Web with request tracking Mechanism.

V. How UPPCL plan to execute the Smart Meters Roll out Plan and what are the Project Benefits:

UPPCL submitted that the typical criteria for selection of areas for roll out are as follows:

- Urban areas
- High Energy Input
- High AT&C loss areas

The Approach of UPPCL is as follows:

- In Phase 1, towns with high energy input > 500 MU and high AT & C losses
- In subsequent phases, towns with high energy input and High losses
- Phase 2 >= 250 MU
- Phase 3 >= 150 MU and <250 MU)
- Complete coverage of a division

The UPPCL has submitted a deployment Plan which consists of the Year-wise allocation of smart meters for different Discoms as under:

DISCOMs	Year-1	Year-2	Year-3	Grand Total
	Nos (in Lakh)	Nos (in Lakh)	Nos (in Lakh)	Nos (in Lakh)
PuVNNL	5.11	4.95	1.41	11.47
MVVNL	2.32	2.37	4.35	9.04

DISCOMs	Year-1	Year-2	Year-3	Grand Total
PVVNL	4.01	4.18	3.44	11.63
DVVNL	2.12	2.64	1.53	6.29
KESCO	1.32	0.25	0.00	1.57
GRAND TOTAL	14.88	14.39	10.73	40.00

Project Benefit Assumptions:

The Energy Input and number of consumers are assumed to be constant throughout the period of the project to be undertaken in the Rollout plan. There will be overall increase in Billing Efficiency (BE) by 5%-7% after deployment of smart meters which could also facilitate an enhanced Billing. Further, additional improvement in billing efficiency can be brought in by a pin pointed action based on data analytics and audit along with administrative support in sensitive areas.

UPPCL submitted Project Benefit Plan, table of Comparison between pre and post smart metering of Lucknow town and KESCO, which are reproduced below:.

Project Benefit Derivation Sample (Lucknow)

Project Benefit Plan		
Description	**Pre-Smart Metering**	**Post Smart Metering**
Total Consumers Nos	365089	365089
Energy Input (MU)	2614.28	2614.28
Energy Billed (MU)	2027.91	2222.14
Billing Efficiency	77.57%	85%
Revenue Assessed (Cr.)	1226.42	1343.89
Revenue Realised (Cr.)	1207.62	1343.89
Min. ABR	6.05	6.05
Thru Rate	4.62	5.14 (11.2% increase)

Project Benefit Derivation Sample (KESCO)

Project Benefit Plan		
Description	**Pre-Smart Metering**	**Post Smart Metering**
Total Consumers Nos	156532	156531
Energy Input (MU)	916.20	916.20
Energy Billed (MU)	689.49	760.45
Billing Efficiency	75.26%	83%
Revenue Assessed (Cr.)	421.42	464.78
Revenue Realised (Cr.)	375.51	441.54
Min. ABR	6.11	6.11
Thru Rate	4.10	4.82 (17.5% increase)

UPPCL has submitted the Project Benefits to 5 DISCOMs as reproduced below:

Discoms	Towns	Division	No. of Consumers	Energy Input	BE FY 17-18	Projected BE	Overall Opex Cost	Overall Assessed Gain	Net Gain in 8 years
	Nos	Nos	In Lakhs	MU	%	%	In Cr.	In Cr.	In Cr.
PuVVNL	10	24	11.47	8612	79%	84%	955	1491	536
MVVNL	12	21	9.04	7547	77%	84%	693	1809	1116
PVVNL	15	21	11.63	9876	77%	84%	929	2513	1584
DVVNL	9	17	6.29	3929	74%	81%	494	1123	629
KESCO	2	5	1.57	40.0916	75%	83%	139	330	191
TOTAL	47	88	40.00	301879	77%	83%	3211	7266	4056

UPPCL has submitted the project benefits to Discoms as Tangible and Intangible Benefits as under:

Tangible Benefits

- Bill quality improvement
- Savings on reduction in AT &C losses via increase in billing efficiency and reduction of theft

Intangible Benefits

- Consumer satisfaction
- Change of perception of UPPCL

- Data Analytics, MIS and monitoring of exceptions in the metering infra to provide Value Added Services.
- Savings on faster detection of dead/defective meters leading to reduction in assessed bill duration.

What is the Smart Metering Business Model?

UPPCL submitted that the CAPEX and OPEX details of the rollout plan are as under:

CAPEX details:

Description	Cost	GST	Total Cost incl.GST	Cost incurred by EESL	Cost incurred by UPPCL
	(In Cr.)	(In Cr.)	(In Cr.)	(In Cr.)	(In Cr.)
Smart Meter and Meter Box Cost	1112	200.16	1312.16	1312.16	NIL
AMI Software Cost	112	20.16	132.16	132.16	NIL
Consumer Indexing	25	4.5	29.5	29.5	NIL
Training	3	0.54	3.54	3.54	NIL
Installation, Integration and Commissioning of AMI Solution	160	28.8	188.8	188.8	NIL

Note:

(i). All the pries of the Item are derived from International Competitive Bidding (ICB)

(ii). GST @ 18%

OPEX details:

Description	Cost	GST	Total Cost inc.GST	Cost incurred by EESL	Cost incurred by UPPCL
	(In Cr.)	(In Cr.)	(In Cr.)	(In Cr.)	(In Cr.)
FMS of deployed AMI solution including additional warranty cost of meters beyond 5.5 Warranty	120	21.6	141.6	141.6	NIL
ATS Charges on Software	50	9	59	59	NIL
Recurring Operating Cost on GPRS	294	52.9	346.92	346.92	NIL
Cloud Hosting Charges	31	5.58	36.58	36.58	NIL
Interest	454	NIL	454	NIL	453
PMC	114	20.52	134.52	NIL	134.52

Note:

(iii). All the pries of the Item are derived from International Competitive Bidding (ICB)

(iv). GST @ 18%

In the OPEX based Cost methodology, the EESL is to incur CAPEX during the Built-up phase and OPEX during Built up and O & M Phase. In this process the DISCOM will pay to EESL on per Meter per Month basis, on number of Meters Integrated and communicating Billing Data with Billing System, after the project goes Live. The per

Meter per month cost is calculated as total Project Cost spread over the actual recovery period, post integration of Meters on per Meter basis.

The Debt Equity ratio of Project Investment cost in 80:20. The interest and RoE component is built on actual CAPEX component, which is incurred to spread over the built-up phase as per the rollout plan and the balance CAPEX portion is done post recovery.

Total Project Cost consists of Actual Cost of the following:

(i). AMI Components

(ii). O&M Charges

(iii). GPRS Charges

(iv). Cloud & ATS Charges

(v). Interest on Debt Capital

(vi). PMC and Return of Equity.

Managing Director of UPPCL vide letter no.352 dated 25/9/2018 submitted the reply to the in house comments raised by the Commission.

Reply of UPPCL for the Queries raised by the Commission

Response for the Commercial aspects:

1. EESL will pass on the total cost to DISCOMs which include 14 % ROE.
2. DISCOMs will not charge any cost from consumers upfront. Therefore, the evaluation of per meter per month cost is based on certain preposition of single

phase, three phase and LT-CT meters. Per meter cost of project is Rs 86 per month and will change as the preposition changes. Cost of single phase, three phase whole current and LT-CT meter is as given below:

Sr. No.	Type of Meter	Meter Cost (in Rs.)	Meter Box Cost (in Rs.)	Total Cost (in Rs.)
1.	Single Phase	2503	203	2706
2.	Three Phase whole current	3634	292	3926
3.	LT-CT	3425	2230	5655

3. EESL will transfer the assets at zero cost after completion of life of meter as prescribed in rollout plan. There after DISCOMs will bear replacement cost of defective meters on actual basis and O&M cost of AMI (advanced metering interface) system.
4. In smart metering, reading and billing work is free from human intervention therefore this will provide error free billing to consumers and will increase accuracy in assessment. Smart metering is having the feature of remote disconnection; this feature of disconnection in consumer mind set will lead to improved consumer turn-up and increased collection efficiency as well. Smart meter is also having feature of prepaid mode with remote disconnection.

5. DISCOM will pay to EESL on OPEX basis as O&M expenditure. The assets will be in the books of EESL till the transfer of assets at the end of project at zero value.
6. The parameter for selection of towns is based on input energy and then on AT&C loss basis to optimize the gain. In view of above, KESCO and LESA area are partially selected.
7. The data centre for above work is available on cloud. Field implementation of smart metering is based on the deployment of at post-paid GPRS system and has disconnection feature. All smart metering services provided by EESL are on SLA basis.

Comments on Technical aspects.

1. The smart meters are Variant 2 - WAN with Cellular Technologies for this project.

2. The smart meters are 2G & 3 G both supported. This project is OPEX based for 8 year. Either EESL shall provide services on continuous basis with same technology or if technology does not support during project duration, it shall be upgraded by EESL.

   a. The smart meter has Pluggable Communication hardware

   b. The smart meter support Data Communication Band of 2G & 3 G.

3. Smart meter support Prepaid functionality, prepayment will be currency based but the tariff will be part of billing system instead of part of meter.

4. The smart meter supports net metering.

5. Smart meter has remote connect / disconnect functionality and.

Disconnection and reconnection procedures are mentioned below:

Disconnection procedure - Electricity supply will be disconnected under following conditions:

a. Over current (105% of maximum current in any phase)
b. Load control limit (programmable)
c. Disconnection signal from utility control centre.

Reconnection procedure –

a. Meter can be reconnected remotely from HES or from optical port locally.
b. Meter will locally connect automatically (in case of over current and load control limit). In these cases, meter will try to reconnect the load (after 30 seconds of disconnection) and if current is within permissible limits, reconnection will take place. If current is still more than permissible limits, it will lock out and wait for 30 minutes. Post this it will check if current is within permissible limits and try to reconnect. If still current is not within permissible limits, it will try to reconnect again after 30 seconds. If current is still above permissible limits, a status update will be made to HES.

6. In case of defective meter / damage of load switch, Meter will be replaced within 15 Days SLA time.

7. The consumer will get to know the reading via mobile app and consumer portal on regular intervals. In addition, consumer will be able to view its bill as well on mobile app and customer portal.
8. Smart meter can be disconnected remotely,

   In Post Paid mode: After Due date with proper Notice.

   In Pre-Paid: During Working Hours after 100% exhaust of Payment amount. Except for Happy Hours which is Configurable.

9. With installation of smart meter, consumer will be able to switch from post-paid to prepaid mode (and vice versa) without replacing the meter. The meters are certified as per IS 16444 which have both post-paid and prepaid functionality. To switch from one mode to the other, consumer can send a notification to utility via mobile App or SMS to utility, can also register its request via consumer portal or can give a call to the customer care centre or contact in the concerned office.
10. The meter has 35 days data stored in its memory and HES will extract that data at a later stage if communication is not present briefly. Hence there will be no loss of data in HES. Furthermore, communications will be closely monitored, if meter does not communicate, action against the telecom service provider shall be taken.

Commission's Analysis:

The Commission has analysed the presentation of Roll out plan of smart meters along with the responses by UPPCL to the queries raised by the Commission.

The Smart meter provides a real time metering facility which enables the consumer as well as the Discoms to monitor the real time electricity consumption of a consumer and also ensures accurate meter reading and load. It creates a path for load analysis and managing the peak load when integrated with the load analysis. The accuracy of billing also enhances the consumer experience. The huge target of reduction in the AT&C losses is possible through the AMI (Automated Metering Infrastructure, where smart meter is a component of AMI). The tangible benefits include savings on reduction on AT&C losses by increase in billing and collection efficiency along with reduction in theft. Intangible benefits include consumer satisfaction, improved data analytics and better management of activities for the Discoms.

Acknowledging the advantages of smart metering the Commission has noted that UPPCL has proposed the improvement in billing efficiency by 5%-7% and in the data submitted for 40 Lakh meters the maximum billing efficiency has been projected at 85%. In smart metering the meter data has to flow on line in the billing system and if the system works efficiently, why not 100% billing can be ensured. It appears that this important aspect has not been looked into with enough seriousness while giving the projections to the Commission. The smart metering system is a costly solution and unless the value addition is commensurate with the investment the initiation of programme cannot be justified. The Commission feels that at least 98% billing efficiency should be ensured in cases where the smart meters have been put up.

The Commission has also noted that the cost benefit data which have been furnished before the Commission are not based on any detailed exercise. The Commission is of

the view that stringent monitoring of billing and collection efficiency is required after the roll out of this plan to ensure financial sustainability of this programme.

Since installation of Smart Meters is a national programme and has produced very encouraging financial returns in private Discoms, the Commission approves the proposed roll out plan of UPPCL and Discoms submitted before the Commission. Besides the terms of the roll out stated by UPPCL/Discoms in their proposal, following conditions shall also be ensured by UPPCL/ Discoms.

I. Smart meters conform to the standards set out by Ministry of Power/ CEA i.e. IS 16444 & IS 15959.

II. Personal data privacy of the consumer's data stored on 3rd party cloud server.

III. The Billing efficiency of the consumers having smart meters is not less than 98%.

IV. Since the smart meters have remote disconnection features, the collection efficiency of target consumers shall not be less than 95%.

The UPPCL shall submit the progress of installation of smart meters to the Commission every quarter and after the complete roll out the plan, UPPCL shall submit the data of actual billing efficiency and collection efficiency of consumers which are covered by the smart meters.

(K.K Sharma)	(S. K. Agarwal)	(R.P Singh)
Member	**Member**	**Chairman**

Place: Lucknow

Date: November 15, 2018

ANNEXURE-A

S.No	Division	Till 30th September	Single Phase (Nos)		Three Phase (Nos)		CTPT		Reading Recorded		Payout to EESL	% Increase in Billing Efficiency		% Increase in Collection Efficiency	
		Prior to - Smart Metering	Q3 of 2018-19	Post-Smart Metering	Q3 of 2018-19	Post-Smart Metering	Q3 of 2018-19	Post-Smart Metering	Q3 of 2018-19	Post-Smart Metering		Prior to-Smart Metering	Post-Smart Metering	Prior to - Smart Metering	Post-Smart Metering
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															

Note: Q3 of 2018-19 includes October, November, December.