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संदर्भ संख्या:पोसोको/एनएलडीसी/2021/ 82 दिनाँक:29th जनवरी,2021

सेवा मे,

सचिव,
केंद्रीय विद्युत विनियामक आयोग(सीईआरसी)
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36 जनपथ, नई दिल्ली – 110001

विषय: **Report on Pilot project - Five-Minute Metering and Accounting in India.**

संदर्भ:**1.** Central Electricity Regulatory Commission Petition No. 07/SM/2018 (Suo-Motu) order dated 16th July'2018

2. POSOCO Communication: पोसोको/एनएलडीसी/2019/55 dated 24th May'2019

3.POSOCO Communication: पोसोको/एनएलडीसी/2019/97 dated 30th July'2019

4. POSOCO Communication: पोसोको/ रा॰ भा॰ प्रे॰ कें ॰ dated 28th December'2020

महोदय,

In accordance with Honourable Commission, Petition No. 07/SM/2018 (Suo-Motu) order dated 16th July'2018, Pilot Project on Hydro as Fast Response Ancillary Services (FRAS) commenced from 26th November'2018. Based on the experience gained in the pilot project a details report was submitted on 30th July'2019.

In the said order, Commission also directed to implement 5-minute metering covering hydro stations in NR, ER and NER as well as thermal stations with AGC installations in all five regions to gain experience. The procurement and installation of 5-minute Interface Energy Meters (IEM) was delayed due to development, manufacture and supply related constraints from manufacturer side to whom initial contract was awarded. The contract was later awarded to multiple prospective manufacturers and the supply and installation of IEM was commenced. Another factor contributing to the delay was the COVID-19 restrictions.

A report covering implementation aspects, challenges and suggested way forward is hereby submitted for perusal of the Hon'ble Commission and further directions, if any.

सादर धन्यवाद,

भवदीय

देबाशिस दे 29/01/21

देबाशिस दे

कार्यपालक निदेशक, रा.भा.प्रे.के.

Enclosures: As above

पंजीकृत कार्यालय : प्रथम तल, बी-9, कुतुब इंस्टीट्यूशनल एरिया, कटवारिया सराय, नई दिल्ली - 110016
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National Load Despatch Centre

Power System Operation Corporation

Report
on
Pilot project – Five Minute Metering and Accounting in India

15-Minute 05-Minute

January, 2021

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EXECUTIVE SUMMARY

Central Commission directed the implementation of pilot project for Fast Response Ancillary Services (FRAS) covering all regional entity hydro generating stations. Additionally, a pilot on 05-minute metering was also envisaged as part of the pilot FRAS implementation.

Pilot on 05-minute metering covering hydro stations in Northern, Eastern and North-Eastern regions as well as thermal stations in all five regions pan-India has been implemented to gain experience for formulation / refinements of Technical specifications and Software Requirement Specifications for Metering Software at RLDCs and Accounting Software at RPCs for 05-minute metering.

During the implementation process, some challenges were faced such as harmonization of IEM serial numbers pan-India, technical specifications for pilot project, identification of locations, space availability at sites for installation, delay due to Covid-19 pandemic and transmission elements shutdowns for facilitation of 05-minute meters installation. The salient features of 05-minute IEM and Meter Data Processing (MDP) have been detailed in the report. The post implementation challenges include online demo of meters and MDP software due to pandemic restrictions, harmonization of output files of multiple vendors, data downloading time, availability of spare equipment and time drift related aspects.

Extensive data analysis has been carried out to compare the 05-minute IEM and 15-minute SEM data. The data upload, conversion and availability features have been in-built in the MDP software. Meter data validation is done through pair check technique. There is also provision of graphical pair check curve in MDP software for ease of user. The provision of time drift visualization is in the MDP software. Time drift can be checked & corrected only at the site where the meter clock is accessible.

The discretization of ramping up and down in 05-minute and 15-minute intervals has also been analysed in the report. The actual 05-minute and 15-minute block-wise energy have been analysed. As a mock exercise during the pilot project, 05-minute schedules were successfully communicated to Tehri hydro station by NRLDC w.e.f 27 November, 2020 for experience on 05-minute scheduling, metering and settlement. The sample accounts based on 05-minute and 15-minute settlement system were also prepared which have been presented in the report.

As per the analysis in the report, 05-minute scheduling and settlement for hydro and gas plants, which have higher ramp capability compared to thermal power plant, may help in better managing their ramp and the deviation from the schedule. It has also been felt that transition to 05-minute schedule will help thermal power plants to follow the schedule. In frequency linked Deviation Settlement Mechanism (DSM), in order to have hassle free transition to 05-minute arrangements, there is need to have harmonization to avoid any DSM price related issues.

The new 05-minute IEMs have the capability to record each 05-minute time block reactive energy exchanged and the voltage. Detailed analysis has been presented

in the report. There is also provision of visualization of 05-minute reactive power flow vis-à-vis voltage in MDP software. It would be a key step for measurement of the support provided during the requirement of reactive power supply/absorption and hence, help in introduction of Voltage Support Ancillary Services.

With the increase in memory of the IEM, the commensurate data collection facility/technology also needs to be upgraded to avoid any excessive time taken and manpower resources. With the experience from pilot project, it is felt that in case of any replacement of 15-minute SEM with new advanced 05-minute IEM, implementation of robust AMR and communication infrastructure is absolutely crucial. The time synchronization would also be important as granularity of scheduling and accounting will change. The time synchronization can be through various modes such as AMR, GPS, NaVIC, Network Time Protocol (NTP) servers etc. The available market products in 15-minute arrangements have to be migrated to 05-minute arrangements to have efficient load and generation balancing. The constraints of space availability at sites and redundancies in equipment have to be addressed.

The requirement of real time telemetry i.e. the streaming of meter data to control centre is not desirable as automation of bad data detection in IEM/SEM is yet to mature unlike SCADA. The system operator at control room would have considerable stress due to information overload and incorrect data. Further, the operators have to be protected from being vulnerable to techno-legal-commercial disputes. There is a need for a holistic view on various dimensions of the metering system such as redundant wideband communication, jurisdiction and responsibility, hosting of servers, data recovery system, metering administration norms, web-based system of complaint logging and management, norms for resolution of issues in metering infrastructure, availability norms, cost recovery through tariff (depreciation etc.) and data analytics.

The replacement of existing 15-minute SEMs with new 05-minute IEMs may be done in phase-wise manner. The scaling up of existing forecasting, scheduling, despatch, meter data processing, accounting and settlement software applications and associated communication infrastructure is needed across RPCs, NLDC, RLDCs, Utilities, Discoms and other stakeholders. All the issues faced during the pilot project need to be addressed in a suitable manner by CTU before rolling out plan for 5-minute metering system pan India basis. The CTU may plan a meter data collection centre through AMR at their premises and the data should be sent to respective RLDCs for further processing/energy accounting. The necessary capacity building measures have to be undertaken for increased awareness amongst the utilities to move towards more complex 05-minute markets format.

National Power Committee, CEA has constituted a joint committee to prepare the technical specification of the 5/15-minute IEMs with AMR and MDP system for inter-state transmission system. In view of SAMAST implementation, the states that are about to implement the intrastate accounting and settlement system could leapfrog and go for scheduling and settlement at 05-minute interval. The necessary provisions to facilitate the recovery of meter costs are also required to be incorporated in the

regulatory framework keeping in view that meter has to be maintained, periodically checked and if needed, replaced also.

In case of pan-India implementation, the number of 15-minute SEMs are of the order of 8000 nos. installed at around 1000 locations. Hence, multi-vendor procurement of 05-minute IEMs for risk diversification and mitigation may be explored.

The actions needed and proposed timeframes have been detailed in the report. Given the extent of the changes to all stakeholder systems, it is proposed that the changes are made available for pan-India transition for a period of twelve months prior to go-live on 01st April, 2023. The development of a coordinated readiness assessment process may be required which could be facilitated by POSOCO in coordination with all stakeholders.

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Annexure 1: 05-minute IEM technical specification for pilot project

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Annexure 3: Sample 05-minute IEM "*.NPC" file format

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ACRONYMS

ABT	Availability Based Tariff
AGC	Automatic Generation Control
CEA	Central Electricity Authority
CERC	Central Electricity Regulatory Commission
CTU	Central Transmission Utility
DCD	Data Collection Device
DSM	Deviation Settlement Mechanism
FOR	Forum Of Regulators
FRAS	Fast Response Ancillary Services
ISTS	Inter State Transmission System
ISO	Independent System Operator
IEM	Interface Energy Meter
IEGC	Indian Electricity Grid Code
MOP	Ministry of Power
MDP	Meter Data Processing
NLDC	National Load Despatch Centre
RLDC	Regional Load Despatch Centre
REA	Regional Energy Account
RPC	Regional Power Committees
SERC	State Electricity Regulatory Commission
SEM	Special Energy Meters
SCED	Security Constraint Economic Despatch

CHAPTER 1 - INTRODUCTION

The chapter introduces the context and background for the Pilot project on 5-Minute Metering and Accounting in India.

1.1 BACKGROUND

Hon'ble Commission directed the implementation of pilot project for Fast Response Ancillary Services (FRAS) covering all regional entity hydro generating stations which would help in gaining experience in regard to FRAS. Additionally, a pilot on 05-minute metering was also envisaged as part of the pilot implementation. POSOCO, submitted the report on FRAS Pilot Project Implementation in Indian Grid - Experience and Feedback.

Pilot on 05-minute metering covering hydro stations in Northern, Eastern and North-Eastern regions as well as thermal stations in all five regions has been implemented to gain experience for formulation / refinements of Technical specifications and Software Requirement Specifications for Metering Software at RLDCs and Accounting Software at RPCs for 05-minute metering. Monitoring performance of the plants through 05-minute metering was envisaged by the Central Commission as present interface meters give only 15-minute energy.

1.2 EXISTING PRACTICES

The 15-minute scheduling, metering, accounting and settlement system has been implemented in India in 2002-2003 with genesis in the landmark Central Electricity Regulatory Commission (CERC) order on Availability Based Tariff (ABT) mechanism in Petition No. 2/99 dated 04th January, 2000. Post-ABT, 15-minute scheduling, despatch, 15-minute metering (SEMs), accounting and settlement and 15-minute deviation (UI) accounting has been implemented. Open access was introduced in 2004 with 15-minute trading. Power Exchanges, which were implemented in 2008, began with an hourly market and migrated to sub- hourly (15-minute) market with bidding for every 15-minute time block.

1.3 INTERNATIONAL EXPERIENCE

In the various international markets, some countries have opted for a simple "low temporal resolution" market design i.e. hourly/half-hourly. This market design captures few of the underlying physical properties and flexibility

characteristics of the power system which the system operators have to handle. Other countries have opted for a complex "high temporal resolution" market design i.e. 05-minute which factors the physical reality and flexibility attributes of power systems in the process of price formation and market clearing itself. The main advantage of a low-resolution system prevalent in Europe and other parts of the world lies in its simplicity, which was sufficient in the 1990s to liberalize the electricity system to competition.

AUSTRALIA

In Australia, "Scheduling and Despatch" has been decoupled with "Settlement" from 1998. The scheduling and despatch is at 5-minute interval and settlement at 30 minute interval using average of 5-minute prices in that interval. In late 2016, AEMC initiated stakeholder consultations to align both "scheduling & despatch" and "settlement" to 05-minute interval. On 28 November 2017, AEMC made a final rule to change the settlement period for electricity spot price from 30 minutes to 05 minutes, starting in July, 2021.

As per AEMC, 05-minute settlement provides a better price signal for investment in fast response technologies, such as batteries, new generation gas plants and demand response. Price signals that align with physical operations lead to more efficient bidding, operational decisions and investment. Over time, this flows through to lower wholesale costs, which should lead to lower electricity prices than in a market with 30-minute settlement. Wholesale costs make up around one third of a typical electricity bill.

On 05-minute settlement, the AEMC has given businesses an extra three-months i.e. till October, 2021 to make up for time lost in responding to the early challenges of COVID-19. But it has ruled against a proposal to delay the start date of the reform by 12 months as proposed by the Australian Energy Market Operator (AEMO) for easing regulatory pressure and cash flow impacts during the pandemic.

UNITED STATES

The United States Federal Energy Regulatory Commission (FERC) in September 2016 ruled that all system operators under its jurisdiction must settle energy in their real-time markets at the same interval that those markets are dispatched (i.e. five-minute settlement).

CAISO already satisfied the settlement interval requirement, paying resources in the same 5 and 15-minute increments it uses to dispatch the resources. In CAISO, flexible ramping product (FRP) procured in 15- and 5-minute markets is

settled at the market clearing price for that market. Any difference between FRP procured in 15- and 5-minute markets is settled at the 5 minutes market FRP price. NYISO's existing rules are currently in compliance with FERC 05-minute settlement since March, 2014. ERCOT, outside of FERC jurisdiction, settles at a 15-minute interval. ISO-NE aligned settlement and dispatch intervals in March, 2017. The regulation market, in ISO-NE, moved from hourly to 5-minutes in December, 2017.

MISO, in-line with FERC order, made changes to align with the 05-minute settlement interval rule since July, 2018. PJM had to propose multiple changes to align its settlement and dispatch to 05-minute interval. PJM would be settling energy and ancillary services every five minutes, and intertie transactions every fifteen minutes to match both of their dispatch intervals. Real time SCED auto execution is done every 3-minute for every 10-minute look ahead interval. In July, 2020, PJM Interconnection stakeholders unanimously approved the proposal to implement short-term market rule changes to better align power price formation with generation resource dispatch.

EUROPE

In major European electricity markets like UK, product duration requirements for the Day-Ahead Market (DAM) and the Intra-Day Market (IDM) are typically set at hourly basis, with the exception of the Austrian DAM and the Austrian, German, and Swiss IDMs that facilitate trading of 15-minute products as well.

The European Union Commission has laid down regulation EU 2195/2017 (EU Commission, 2017) to establish common EU level guidelines and principles on electricity balancing. Among others, the regulation declares that all TSOs shall apply the imbalance settlement period of 15 minutes within three years of the entry into force of the regulation i.e. by 18 December, 2020. The respective national regulatory authority may grant the extension of the deadline only once and up to 01 January 2025. The regulation concerns only balance settlement, and does not regulate market design, measurement, billing or electricity data management.

1.4 JOURNEY OVER THE YEARS

The regulatory roadmap for reserves has been formulated by CERC in 2015 as also mandated by the National Electricity Policy, 2005. NITI Ayog in its Report on India's Renewable Electricity Roadmap 2030 recommended that for RE Grid Integration and More Efficient Grid Operation, 5-minute Scheduling and Dispatch may be adopted. Ancillary Services have been implemented at the

inter-state level, in 2016, as tertiary reserves at the inter-state level where actions at the power plant happen after 16-30 minutes as advised by National Load Despatch Centre (NLDC) in coordination with Regional Load Despatch Centres (RLDCs).

The FOR Technical Committee recommended the implementation of its report on **S**cheduling, **A**ccounting, **M**etering **A**nd **S**ettlement of **T**ransactions in electricity (SAMAST) at the intra-state level in 2016. The states implementing SAMAST at the intra-state level are required to factor the 5-minute periodicity in the metering as well as software being procured for scheduling and settlement.

The Forum of Regulators (FOR) constituted a "Technical Committee for Implementation of Framework on Renewables at State Level" (hereinafter referred to as FOR Technical Committee) to facilitate large scale grid integration of renewables. In the 11th Meeting of the FOR Technical Committee held at Chennai on 28th March 2017, deliberations were held on the agenda item "*Introduction of 5 Minute Time Block – Rationale, Preparedness and Costs (towards metering and related infrastructure) and Benefits, and Way Forward*".

In the 11th meeting, while deliberating the subject of shorter scheduling and settlement intervals, FOR Technical Committee members appreciated the need to move to 5-minute scheduling and settlement in view of the increasing RE penetration. For working out the modus operandi regarding migration to 5-minute scheduling, metering, accounting and settlement, it was decided that a sub-group would be constituted comprising CEA, CTU, RPCs, POSOCO and CERC Staff which would examine these issues in further detail and submit its report to the FOR Technical Committee.

FOR had brought out model DSM regulations at state level for adoption by respective SERCs in March, 2017 in which provisions for migrating to 05-minute time-block scheduling to settlement were provided. Accordingly, the Interface Metering, Energy Accounting and Deviation Settlement should be capable to undertake transactions with 5-minute duration. All future resource planning, IT and communication system requirement and infrastructure development shall be undertaken to cater to this requirement.

Central Commission, vide order no. 79/RC/2017 dtd. 06th December, 2017, approved pilot project for AGC. In January, 2018, secondary reserves through AGC system have been operationalized, on pilot basis at NTPC Dadri Stage-II

with control at NLDC. It paved the way forward for secondary regulation services through AGC to be introduced pan-India. With the experience of pilot project, Central Commission vide order in Petition No. 319/RC/2018 dated 28th August, 2019 directed for AGC implementation in India. Central Commission also observed that a settlement system based on 5-minute time block is likely to bring in better granularity in grid management and ramp monitoring. The Commission directed 5-minute accounting for AGC, as done in pilot project, should be implemented. The relevant extracts are reproduced as follows:

"…*The Commission finds that 5-minute accounting is possible for this project, and directs that the same should be implemented for improved record of AGC signal and the up/down response of the plant. This data will also be utilized for payment purposes for the mark-up...*"

In the 18th Meeting of the FOR Technical Committee held at Delhi on 23rd February 2018, Report of the Sub-Group on Implementation of 5-Minute Scheduling, Metering, Accounting and Settlement was adopted. The relevant extracts from the minutes of the meeting is reproduced below:
"…***Decisions***

i) The Committee adopted the Report on 5 Minutes Scheduling, Metering, Accounting and Settlement and the timelines proposed in the report were reviewed. POSOCO to prepare a PERT chart for the timelines of all related activities along with details of which activities are dependent on which utilities
ii) For Technical Standards of RE, a letter to be written to Secretary-Power to expedite the Regulations on Technical standards from CEA.
iii) CERC to come out with a Suo Moto Order and on its basis POSOCO to carry out at least 1 Pilot on 5 Minutes Scheduling Metering, Accounting and Settlement in each region.
iv) POSOCO to prepare estimation of cost and quantum of meters required along with the basis to quantify the benefit of moving to 5 minutes from 15 Minutes. A Scheme is also required to be prepared to seek funding for States post approval of FOR.
v) CERC should evolve Staff Paper/Draft Regulations for introduction of 5 Minutes Scheduling, Metering, Accounting and Settlement…."

In the 63rd Meeting of the FOR held on 09th April, 2018, the initiative towards 05-minute metering was appreciated. The relevant extracts from the minutes of the meeting is reproduced below:

"…The Forum appreciated the initiative and requested CERC and CEA to take the initiative forward the Forum with pilot studies as suggested at the earliest. Results may be shared with the Forum to enable the SERCs to take similar action at the State level…"

1.5 REGULATORY MANDATE FOR 05-MINUTE METERING PILOT

Central Commission directed for implementation of 05-minute metering pilot project vide order in petition no. 07/SM/2018 (Suo-Motu) dated 16th July, 2018 in the matter of Pilot Project on 05-Minute Scheduling, Metering, Accounting and Settlement for Thermal/Hydro, and on Hydro as Fast Response Ancillary Services (FRAS).

The Commission observed that there are a number of advantages of implementing 5-minute scheduling and settlement. Various studies have recognized that shorter despatch and settlement period such as 5-minute offer advantages, particularly in terms of reduction in the requirement of reserves, reduction in variability, robust price discovery closer to real time and bringing out the value of flexibility. Internationally, 5-minute scheduling has reportedly helped in reducing regulation requirements to below 1% of peak daily load in many ISO/RTOs.

The Government of India has set a target of achieving RE capacity to the tune of 175 GW by 2022 and 450 GW by 2030. The Commission recognizes that scheduling closer to real time could help manage power system operation better and facilitate smooth grid integration of RE. The Commission is of the view that the pilot would help gain experience in ancillary services along with providing valuable learning regarding 5-minutes scheduling, metering, accounting and settlement. This pilot will also provide insight for implementation of other competing resources like Battery Storage, Electric Vehicles and Demand Response as Ancillary Services.

The brief summary of the aforesaid mentioned Commission order for the 05-minute metering pilot project is as follows:

(a) 05-minute metering pilot project would cover hydro stations in NR, ER and NER as well as thermal stations with AGC installations in all five regions to gain experience which would help in formulation/refinements of Technical specifications and Software Requirement Specifications (SRS) for Metering Software at RLDCs and Accounting Software at RPCs for 5-minute metering.

(b) As a pilot, 5-minute metering can be in parallel with 15-minute metering. The Scheduling and Despatch has to be aligned with Settlement process in 5-minutes too and the accounts of both 5-minute and 15-minute shall be kept parallel.

(c) All future procurements of Interface Energy Meters should ideally have recording at 5-min interval and frequency resolution of 0.01 Hz. They should be capable of recording Voltage and Reactive Energy at every 5-min and should have feature of auto-time synchronization through GPS.

(d) The "Technical Specification for Interface Energy Meters, Automated Meter Reading System and Meter Data Processing for Inter State System in Western Region", approved in the 34thTCC/WRPC meeting held on 27-28 July 2017 in Mumbai may be used for the pilot projects.

(e) As and when CEA Metering Standards for Interface Meters to facilitate 5-minute metering are notified, the same shall be adopted for the pilot projects which have not been taken up till the date of notification of CEA standards. CEA is requested to expedite the notification of amended Metering Standards for interface metering with 05-minute capability.

(f) The Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006 mention the following:
"6(1)(a) All interface meters installed at the points of interconnection with Inter-State Transmission System (ISTS) for the purpose of electricity accounting and billing shall be owned by CTU."

Accordingly, CTU shall facilitate the pilot project with installation of 5-minute meters at the pre-identified locations. CTU is directed to complete the procurement and installation of the 05-minute meters in the pilot project by end of August, 2018 in coordination with POSOCO. The cost of such procurement shall be reimbursed to the CTU.

Central Electricity Authority (Installation and Operation of Meters) (Amendment) Regulations, 2019 were notified on 23rd December, 2019. It contains the provisions related to interface meters placement, standards, data storage, display and other features.

CHAPTER 2: IMPLEMENTATION OF PILOT PROJECT

The chapter lays down the pre- and post-implementation challenges during the pilot project

2.1 SCOPE OF PILOT PROJECT

In the pilot project, the 05-minute IEMs for eight locations in five regions pan-India were procured based on the "Technical Specification for Interface Energy Meters, Automated Meter Reading System and Meter Data Processing for Inter State System in Western Region", approved in the 34thTCC/WRPC meeting held on 27-28 July 2017. MDP software was also developed for the pilot project in order to assess the data availability, analysis, accounting and settlement process.

During the FOR technical committee sub-group deliberations in 2017, 5-minute meter capability demonstrations by meter vendors were held. One was done by M/s Secure Meters and M/s Elster-Honeywell on 13th September, 2017 at 400/220 kV Magarwada PGCIL S/s, Daman-Diu UT. Another one was done by M/s L&T on 10th October, 2017 at 765/400 kV Vadodara (Wagodia) PGCIL S/s. The need for software validation and meter data exchange format, requirement of Automated Meter Reading (AMR) along with communication infrastructure, storage enhancement, standardized data and information protocols were noted as key learnings by the sub-group.

2.1 PRE-IMPLEMENTATION

2.1.1 HARMONIZATION OF IEM SERIAL NUMBER PAN-INDIA

Each IEM has to be identified through its unique serial number. This serial number is permanently marked on the front of the IEM as well as in the memory of the meter. The meter numbering, as adopted after consultation with stakeholders, starts with two alphabets in bold followed by a 'dash' then four-digit number then 'dash' and "A" or "B". In case of CT rated secondary current is 1 Ampere, it is "A" else "B" if CT secondary rated current is 5 Ampere.

Generally, IEMs are procured by CTU on regional basis. In the extant meters, the first two bold alphabet generally start with NP but it may vary as per the order placed by the CTU to the vendor. Due to this, there is a chance of serial number duplication which causes a serial number already marked and supplied in one region to get supplied to other region(s) with similar serial number.

This anomaly can be identified only when a new meter is installed in inter-regional line and if a similar serial number IEM is already installed in the any one of the regions connected through inter-regional line.

In order to avoid such issues, new meter numbering philosophy was adopted. The serial number starts with three bold alphabet "IEM" followed by eight number then followed by "A" OR "B".

As compared to current practice, the serial number increased to eight characters from four characters to cater the future requirement. In order to identify the IEMs procured under pilot project, separate serial numbers starting from 1 and go up to 160 has been earmarked.

In order to standardize region-wise serial number of IEMs in future procurement, the serial numbers as per below mentioned table (Table – 1) would be given.

Table 1: Serial Number of IEM

Region	Number
Pilot project	IEM00000001A/B to IEM00000160A/B
NR	IEM00100000A/B to IEM00199999A/B
WR	IEM00200000A/B to IEM00299999A/B
SR	IEM00300000A/B to IEM00399999A/B
ER	IEM00400000A/B to IEM00499999A/B
NER	IEM00500000A/B to IEM00599999A/B

2.1.2 PREPARATION OF TECHNICAL SPECIFICATIONS

Central Commission directed that Technical Specification for Interface Energy Meters, Automated Meter Reading System and Meter Data Processing for Inter State System in Western Region", approved in the 34thTCC/WRPC meeting held on 27-28 July 2017 in Mumbai may be used for the pilot project.

The above-mentioned technical specifications covered the IEMs as well as data collection through AMR and processing the data for accounting of deviation settlement mechanism (DSM) through MDP software.

However, for the pilot project there was limited scope compared to that of above-mentioned technical specifications. The procurement and implementation of IEM for the pilot project was to be done on time-bound basis. The necessary infrastructure for AMR/MDP software as per the specifications would consume more time to implement pan-India. Hence, it was decided that the technical specifications would be covering only the IEM

part which would cater to the data and analysis requirement in the pilot project. It would satisfy the minimum requirements to understand the various nuances for migrating from 15-minute to 05-minute arrangements.

In this direction, a modified IEM technical specification for the pilot project (**Annexure-1**) was finalized on 07th August, 2018 for procurement and commissioning.

The 05-minute IEM under pilot project were to be installed in parallel with the existing IEMs which are used to compute the net injection of power station. In order to process and compare the data of the 05-minute IEM and 15-minute IEM through a customized MDP software, a separate procurement was initiated through NERLDC.

Since AMR was excluded in scope of the pilot project, hence, none of the 05-minute IEM data collection was integrated through AMR. The provision for data collection was kept through Hand Held Device (HHD). Since the 5-minute IEM would have to store and record greater number of parameters than existing 15-minute IEM, the feature for integration the new 05-minute IEMs with AMR has been kept for future analysis and performance check.

2.1.3 IDENTIFICATION OF LOCATIONS FOR PILOT PROJECT

In line with the CEA (Installation and Operation of Meters) Regulations, 2006, the main, check and standby meters have to be installed in the power station for calculation of the actual generation. Normally, main meter data is used for calculation of the actual injection/drawal of power station. The check meter data is used only in case of any discrepancy in main meter data is observed. Main and check meters are installed on the outgoing feeders/ICTs of generating stations.

In order to optimize the utilization of IEMs in the pilot project, the location/elements (feeder/ICT) were pre-identified for installation of new 05-minute IEMs in consultation with stakeholders. The list of locations is given in **Annexure-2**.

2.1.4 SPACE AVAILABILITY IN PILOT PROJECT SITES

The installation of 05-minute meters is to be done in parallel with the existing IEMs whose data is used for preparation of deviation statement. The IEMs are installed in control/relay panel front. Other than metering cubicle, other devices such as protection equipment's (relay) are also installed in panel and hence, there may be chances of space constraints. Therefore, pre-feasibility

check for sufficient space for placement of IEMs was carried out at all the sites for installation of IEMs in the pilot project.

2.1.5 DEVELOPMENT AND PROCUREMENT

CTU awarded the contract for supply of IEMs for pilot project, as per approved technical specifications, to M/s Honeywell Elster on 09th January, 2019 in competitive process. The completion timeframe of twelve weeks i.e. three months was mentioned from the date of Notification of Award.

During review of status of supply of IEMs in April, 2019, M/s Honeywell Elster informed that 05-minute IEM is still under development stage. It was also informed that hardware related constraints are being faced and hence, extension till 15th October, 2019 was solicited. Further, it was mentioned that the scaled down product would be delivered compared to the approved technical specification as per the contract. In view of delay and non-performance of contractual obligations, it was decided that the contract would be terminated and re-tendering process would be initiated.

In order to mitigate the risk of single vendor contract, it was decided to distribute the pilot project contract amongst prospective manufacturers (M/s L&T, M/s Secure, M/s Genus etc.). The award of contract can be considered on 60:40 ratio basis to L1 and L2 bidder respectively for better evaluation of performance of IEMs for pilot project. Accordingly, after competitive process, letter of award was issued to M/s L&T and M/s Secure for supply of 74 nos. and 48 nos. of 05-minute meters respectively for pilot project on 08 November, 2019.

2.1.6 DELAY DUE TO COVID-19 PANDEMIC

On 24 March 2020, as preventive measure against the COVID-19 pandemic in India, nationwide lockdown was implemented by Government of India. The lockdown was extended till May, 2020.

The unlock process started from June'2020 in phased manner. In order to ensure safety of the staff, the entry was restricted at the pilot project sites. In view of the COVID-19 pandemic induced constraints, the commissioning activities started from July, 2020 onwards. The first commissioning of 05-minute meters under the pilot project took place in Mouda-II plant of NTPC in western region on 15th July, 2020.

The output "*.npc" file i.e. text file of meter was under development/review stage and some issues were faced due to failure of supplied accessories and

non-availability of spares. The availability of proper validated data commenced from 01st week of December, 2020.

2.1.7 TRANSMISSION ELEMENTS SHUTDOWNS FOR METER INSTALLATION

In order to install the IEMs in pilot project, there was requirement of shutdown of the transmission elements at the respective sites/locations. The shutdowns were required for safety of the personnel during installation of the IEM and to avoid any malfunction of protection equipment due to commissioning activity in the panel where the element protection devices are also installed. Some of the elements were critical in nature for evacuation of power.

All the shutdowns were discussed and approved in the respective RPCs Operation Coordination Committee (OCC) meetings well in advance. In some cases, deferment of the approved planned shutdown for installation of IEM was done and therefore, installation was done on new dates which were approved after the discussion in the appropriate respective regional forum.

2.2 SALIENT FEATURES OF 05-MINUTE IEM

The salient features of 05-minute IEMs in the pilot project are as follows:

(i) Meter serial no. and model: IEM12345678A/IEM12345678B
(ii) Average frequency for each successive 5 min block, in Hertz up to third decimals.
(iii) Net Wh transmittal during each successive 5 min block, up to fourth decimal, with plus sign if there is net Wh export and with a minus sign if there is net Wh import.
(iv) Net VARh transmittal during each successive 5 min block, up to fourth decimal, with plus sign if there is net VARh export and with a minus sign if there is net MVARh import.
(v) Cumulative Wh transmittal at each midnight, in eight digits including one decimal.
(vi) Cumulative VARh transmittal for voltage high condition, at each midnight in eight digits including one decimal.
(vii) Cumulative VARh transmittal for voltage low condition, at each midnight, in eight digits including one decimal.
(viii) Average RMS voltage for each successive 5 minute block.
(ix) Date and time blocks of failure of VT supply on any phase, as a star (*)/ (Z) mark

The data format of the 5minute NPC file would also indicate block wise voltage and reactive power. Frequency would be stored as per actual values up to

two decimals against frequency code in earlier format. Sample data format is shown in Fig. 1.

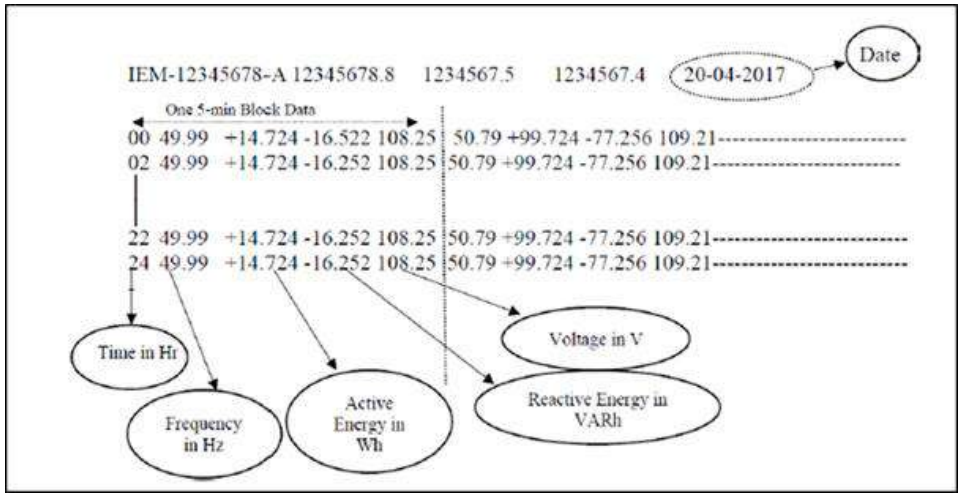

Figure 1: Sample data format of 05-minute IEM

The sample images of meters of M/s L&T make and M/s Secure make is placed is Fig. 2 and 3 respectively.

Figure 2: M/s L&T make

Figure 3: M/s SECURE make

2.3 SALIENT FEATURES OF MDP SOFTWARE APPLICATION

NERLDC, POSOCO took the initiative and carried out various activities for development of the 5-minute MDP software required to gain experience in all aspects of five-minute metering, accounting and settlement. The pilot project for MDP was awarded to M/s PWC in February, 2019. The pilot 05-minute MDP