"Implementation of 5-Minute Scheduling, Metering, Accounting and Settlement"

ERLDC, Kolkata

13 February 2018

CONTEXT AND BACKGROUND

- **GoI Renewable Energy (RE) target of 175 GW capacity by 2022.**

- FOR constituted a "Technical Committee for Implementation of Framework on Renewables at State Level" to facilitate large scale grid integration of renewables.

- *In 11th Meeting of FOR Tech Committee on 28.03.2017 "Introduction of 5 Minute Time Block – Rationale, Preparedness and Costs (towards metering and related infrastructure) and Benefits, and Way Forward".*

- 5-minute scheduling and settlement at the Inter State level due to variability of load and renewables with increasing RE penetration in future.

CONSTITUTION OF SUB-GROUP

- 11th Meeting of the "FOR Technical Committee for Implementation of Framework on Renewables at the State Level" - Chennai - 28th March 2017

- Members
  - Shri S.K. Soonee, Advisor, POSOCO
  - Representative of all RPCs and NPC
  - Representative of CEA
  - Representative of POSOCO
  - Representative of CTU
  - Representative from one RE rich state each in NR, WR and SR

IMPERATIVES TO MOVING 5 MIN SCHEDULING & SETTLEMENT

- Increasing Renewable Energy Penetration
- Harnessing and Incentivising Flexibility
- Ramp Management
- Reduced Requirement of Reserves
- Economy in System Operation
- Implementation of Primary, Secondary & tertiary Control

VARIABILITY & INTERMITTENCY

- Load varying every moment
- Renewables – Increased level of variability and uncertainty
- Faster markets allow manoeuvring capability of the conventional generation to respond
- Better alignment with the timescale of variability of RE resources.
  - 16 revisions allowed in CERC RE Framework
- Lowering of Overall System Operating Costs
  - Short dispatch intervals allow more frequent re-dispatch of the whole systems, enabling deviations to be dealt with by adjustment of every market participant in the system as appropriate.

POLICY / REGULATORY MANDATE

- Report of the Expert Group on 175 GW by 2022, NITI Aayog (December, 2015)

Interventions to reduce overall system costs [Section 3.23(ii)]

"…..Scheduling and Dispatch: Through both practice and theory, it has become evident that grids that are operated in a manner where scheduling and dispatch are implemented over short time durations (e.g., as low as five minutes) have significantly lower overall costs to consumers as the need for ancillary resources decreases….."

- CERC order in Petition No. SM/127/2011 (24 May 2011)

"…..Thereafter matter was discussed in the Central Advisory Committee (CAC) meeting held on 29th September, 2010 with the agenda "How to make power markets more efficient". The CAC recommended for modification in the bidding time block from one hour to fifteen minutes….."

- SAMAST Report, Technical Committee of the Forum of Regulators, 2016

"5.6……The States who are about to implement the intrastate accounting and settlement system could leapfrog and go for scheduling and settlement at 5-min interval. The scheduling software and the energy meters specifications could in line with the above. All the other States and the Regional Pools shall also endeavor to have systems and logistics for 5-min scheduling and settlement system…."

DEVELOPMENTS IN OTHER SECTORS…

Airlines

Banking

भारतीय रिज़र्व बैंक
RESERVE BANK OF INDIA
www.rbi.org.in

May 08, 2017

National Electronic Funds Transfer (NEFT) system – Settlement at half-hourly intervals

Petroleum

Railways

12392*	Shramjeevi SF Expres...*	SF	ECR	6	S M T W T F S	NDLS	13:10
19023	Mumbai Firozpur Jant...	Exp	WR	1	S M T W T F S	NDLS	13:15
12716	Sachkhand Express	SF	SCR	4	S M T W T F S	NDLS	13:20
12483	Kochuveli - Amritsar...	SF	NR	2	F	NDLS	13:25
19566	Uttranchal Express	Exp	WR	--	S	NDLS	13:25
12217	Kerala Sampark Krant...	SKr	NR	3	M W	NDLS	13:25
09566	Haridwar Okha Uttran...	Exp	WR	--	S	NDLS	13:25
19024	Firozpur - Mumbai Ce...	Exp	WR	7	S M T W T F S	NDLS	13:30
12485	Hazur Sahib Nanded -...	SF	NWR	3	M T F	NDLS	13:30

Stock Exchanges

Data Time-Interval	Annual Cost*
1 Minute	Rs. 13,20,000
2 Minutes	Rs. 7,50,000
5 minutes	Rs. 2,75,000
15 Minutes	Rs. 60,000

*NSE Annual Data Charges, Capital Market Segment

LOOKING BACK TO LOOK FORWARD

Pre - ABT era
- Daily energy booking
- Joint Meter Reading (JMR) based Monthly accounting
- Overlay accounts, frequency taken from SCADA

1994: GoI ECC Report

Inadequacies
- No incentives for utilities to respond for frequency control
- Absence of merit order operation, Grid indiscipline
- No signal for power trading
- Perpetual operational & commercial disputes
- Poor supply quality , Overall economy lost

1995-98: NTF and RTF

2000: CERC ABT Order

ABT Reforms
- 15-minute scheduling, despatch, metering (SEMs), accounting and settlement
- 15-minute deviation (UI) accounts

2002-03: ABT Implementation

Bilateral transactions
- 15-minute trading in power and settlement

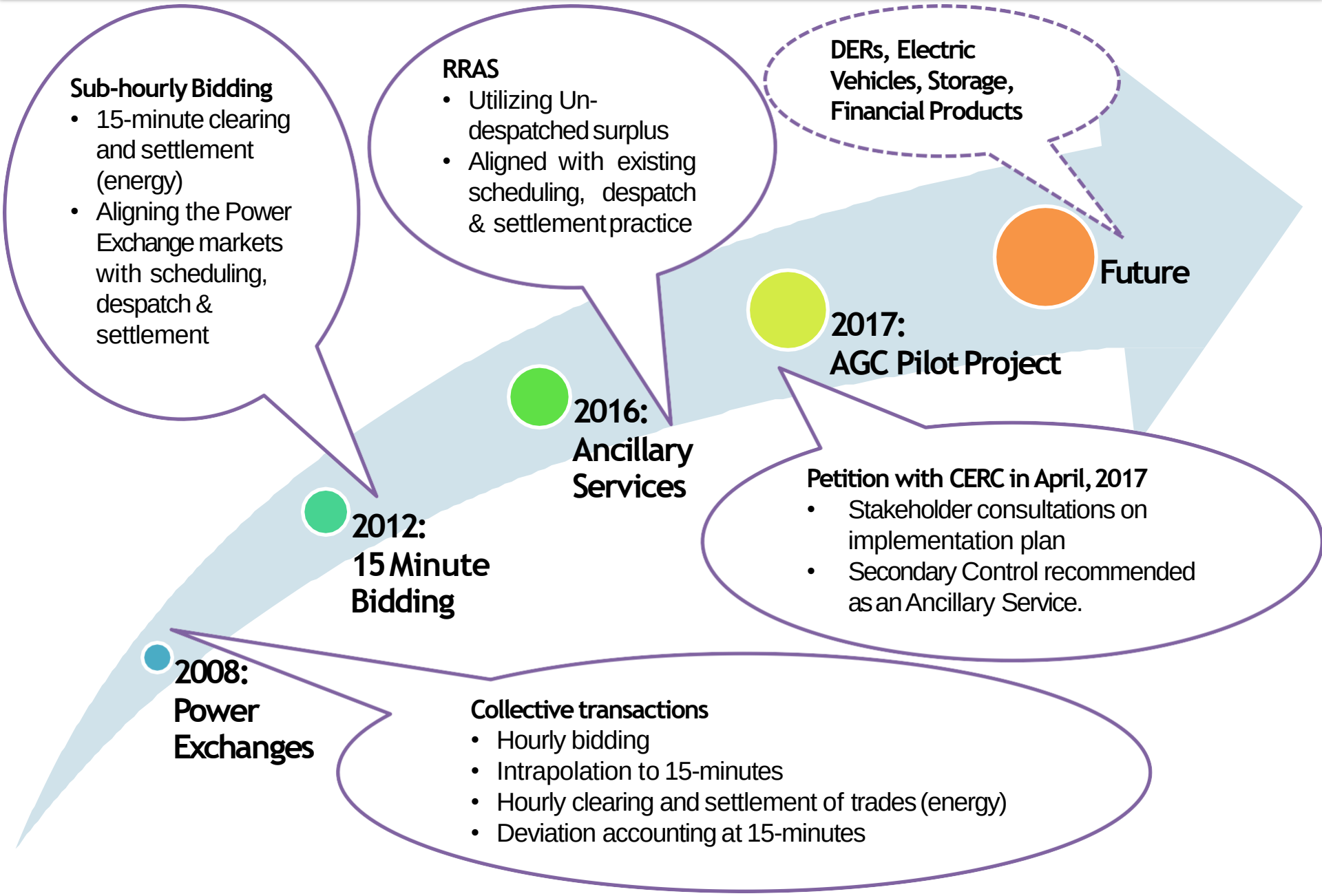
2004: Open Access

Systemic Transformation
- Multi-Part Performance based Tariff
- Day Ahead Scheduling
- System of incentives and penalties

CERC ABT ORDER DATED 04TH JAN2000

5.9.12 We have also considered the views of some of the beneficiaries to change the time block of 15 minutes. We are convinced that a short time block of 15 minutes can be expected to ensure alertness on the part of the dispatcher to take quick corrective action for maintaining desirable system parameters. If the interval is larger, there may be a tendency to defer the action with possibilities of steep frequency excursions thereby inviting damages to the system.

LOOKING FORWARD TO LEAPAHEAD



LEARNING FROM ANCILLARY SERVICES

- Requirements under Ancillary Despatch are
  - Quick / Fast response & turnaround time
  - Despatch for short durations
  - Example: hour boundary changeover

- A costly resource, to be used in limited manner for system reliability
  - Increasing granularity would optimize cost of despatch

- Earliest possible implementation of RRAS despatch instruction is 16 minutes
  - Fast Tertiary control at best

INTERNATIONAL EXPERIENCE (1)

- Australia Energy Market Operator (AEMO)
  - "Scheduling and Despatch" decoupled with "Settlement" from 1998, prior to large scale RE integration
    - Scheduling and despatch at 5-minute interval
    - Settlement at 30 minute interval using average of 5-minute prices in that interval
  - 2016: Debate/Stake holder consultations being held to align "scheduling & despatch" interval and the "settlement" interval
- USA

RTO / ISO	Despatch Interval	Settlement Interval
CAISO	5-minute	5-minute
ISO - NE	5-minute	Hourly average
MISO	5-minute	Hourly average
NYISO	5-minute	5-minute
PJM	5-minute	Hourly average
SPP	5-minute	5-minute

FERC Final Rule on "Settlement Intervals and Shortage Pricing in Markets Operated by Regional Transmission Organizations and Independent System Operators", 16th June 2016

".....We require that each regional transmission organization and independent system operator align settlement and dispatch intervals by:

(1) settling energy transactions in its real-time markets at the same time interval it dispatches energy;

(2) settling operating reserves transactions in its real-time markets at the same time interval it prices operating reserves; and

(3) settling intertie transactions in the same time interval it schedules intertie transactions....."

DISCUSSION IN SUB GROUP MEETING

- Forecasting
- Scheduling & Despatch
- Markets : 5-minute bilateral markets; Power Exchanges – 5 minute price discovery
- Deviation Settlement 5-minute prices in DSM
- Commercial interface metering
- Settlement system – energy accounting, financial settlement
- Changes in various CERC/SERC Regulations
- Changes in CEA Metering Standards
- Replacement of meters
- AMR Infrastructures
- Software upgrade at the RLDCs/SLDCs – scheduling, meter data processing, accounting, settlement
- Software upgrade at the RPCs
- Holding workshops, dissemination, stakeholder capacity building

DECISION OF SUB GROUP

- All RPCs may discuss the 5-minute scheduling and settlement
- NPC to follow up the status of amendment of metering standards with CEA and also place the required amendments as agenda item in the next NPC meeting.
- CTU to facilitate collection of the region-wise data on type, vintage and location of existing meters along with proposed procurement process.
- Need for capacity building for better forecasting and scheduling - SLDCs to coordinate with RLDCs/NLDC. Interactive sessions may be organized at different RPCs for generation of ideas and solutions.
- In view of SAMAST implementation, the states who are about to implement the intrastate accounting and settlement system could leapfrog and go for scheduling and settlement at 5- min interval.

REQUIRED REGULATORY INTERVENTIONS

- **Amendments in CEA metering standards/regulations**
- Meter specifications
- Changes in Standards referred in the Regulations
- **Regulatory Framework by CERC for 5-minute scheduling, metering, accounting and settlement**
  - Indian Electricity Grid Code
  - Deviation Settlement Mechanism
  - Open Access in inter-State Transmission
  - Ancillary Services Operations
- Identification of Interface Energy Meters and locations by CTU/STU
  - Number of meters to be replaced and number of meters to be upgraded
- Formulation of Technical specifications
  - for new meters and configuration change in the existing meters

BALL STARTED ROLLING… WRPC COMMUNICATION TO CEA

To,
Chief Engineer (DP & D),
Central Electricity Authority,
Sewa Bhavan,
R.K.Puram, New Delhi

Date: 27.04.2017

Sub: Proposed amendment in the CEA (Installation & Operation of Meters) Regulations 2006-reg.

Sir,

This is to inform that in the 33rd WRPC meeting held on 01.02.2017, it was decided to replace all the existing interface SEMs (Special Energy Meters) installed in Western Region, since most of the SEMs have crossed their useful life cycle(copy enclosed).

In anticipation of the Regulatory and technological changes, it was further decided to procure the SEMs capable of recording/storing of 5 mins as well as 15 mins block data of Frequency, Wh & VArh(low & high) along with suitability for transmitting the data to remote locations using appropriate communication medium (AMR). This will enable accommodation of any future regulatory requirement/change, such as change in "energy scheduling / recording block timings", in the SEMs being procured in WR.

It is therefore proposed to kindly amend clause (1) (b) (i), (ii), (iii) & (iv) of "Part II Standards for Interface meters" of the CEA (Installation and Operation of meters) Regulations 2006 notified on 17.03.2006, to accommodate the above provisions regarding integration/storage of data (i.e. interface meters capable of recording 5mins as well as 15mins block data of frequency, Wh & VArh (low & high)).

Yours faithfully,

Activities for Metering Infrastructure

- Procurement of meters
  - By CTU at inter-state level and STU at intra-state level
- Upgrade of metering infrastructure at the cross border interconnections
- Metering Software changes including any hardware upgrade required
  - At RLDCs, SLDCs
  - Data communication from sites to RLDCs
  - Data Validation, Processing, Reporting, Archival and Website uploading.
- Accounting software upgrade at the RPCs
  - Including any hardware upgrade needed
- Handling Transition to 5-Minute Scheduling, Metering and Accounting systems by RPC/RLDC/SLDC/STU in the transition period upto the cut-off date
- Capacity building of stakeholders

METER DEMONSTRATION & TESTING RESULTS - SUMMARY

Title	Elster	Secure	L & T
Reconfiguration of existing 15-min meter to 5-min	Possible in Existing meters, Simple, on-site	Not possible in existing meters, possible in new models only, on-site	Not possible in existing meters, new models only, off-site
Reconfiguration Time	Fast	Fast	At factory
Retention of old data	Old data erased	Block wise data erased cumulative data retained	Data yet to be made available
Conversion software for NPC File	The software for conversion to .npc file is available	Software for converting to NPC format needs upgrade	Software for converting to NPC format needs upgrade
Wh recording	Acceptable	Acceptable	Data N.A.
VARh recording	Variations observed due to integration time difference		Data yet to be made available
Storage	Could not be ascertained		Storage upgraded in factory

PROPOSAL FOR PILOT PROJECT

Installation of 5-minute capable meters at 2 locations in each Region

Objectives

- Gain practical experience in 5-minute metering
- Gain experience in interfacing requirements / file interchange formats
- Develop Data Analytics / tools for 5-minute metering, data validation, reporting, etc.

Advantages / Benefits

- Helps in formulation/refinements of Technical specifications for 5-minute metering
- Helps in writing the Software Requirement Specifications (SRS) for Metering Software at RLDCs and Accounting Software at RPCs

Suggested Locations

- Generating stations – Conventional / RE
- Substations – 765 kV / 400 kV
- Inter-Regional inter-change points

Action Plan as per Sub Group report

ACTION PLAN

Required Action	Action By	Timeline
Pilot Projects implementation (Freezing technical specs for ISTS meters to enable pilot project implementation. After specs is in place, time for NIT, LOA, type test, delivery, installation etc.)	CTU / RPCs / POSOCO	June 2018
Changes in CEA standards & regulation	CEA	June 2018
CERC Staff Paper on Regulatory Framework for 5-minute Scheduling, Metering & Settlement arrangements	CERC	June 2018
Final Regulatory Framework	CERC	September 2018
Formulation of Technical specifications for new meters and configuration change at RPC/State level	CTU/RPCs/ POSOCO	July 2018
Software upgradation at RPC/NLDC/RLDCs/SLDCs	CTU/RPCs/ POSOCO	July 2018
Procurement process from tendering to commissioning led by CTU at inter-state level and STU at intra-state level	CTU/RPCs/ POSOCO	September 2018
Power Exchanges to migrate to 5-minute bidding framework	CERC/PX/POSOCO	April, 2019
Trial Run (Transition)	All	April 2019 – March 2020
Go Live	All	**01st April, 2020**

Thank U