Minutes of the
63rd Meeting of the Forum of Regulators

Venue	**:**	**Central Electricity Regulatory Commission** **Conference Room** **Upper Ground Floor** **Chanderlok Building** **Janpath** **New Delhi-110001**
Day / Date	**:**	**Monday, the 9th April, 2018**
List of Participants	**:**	**Enclosed as Annexure-I**

Opening Session

Shri Anand Kumar, Chairperson, Gujarat Electricity Regulatory Commission (GERC) and the seniormost State Regulator welcomed Shri P.K. Pujari on his taking over as Chairperson of CERC and FOR.

Chairperson, Central Electricity Regulatory Commission (CERC) and Forum of Regulators (FOR) Shri P.K.Pujari welcomed the Members of the Forum to the 63rd Meeting of Forum of Regulators. He also extended a warm welcome to Shri Subhash Chandra Das, Chairperson, Assam Electricity Regulatory Commission who was attending the meeting of the Forum for the first time after assuming charge.

Thereafter, the Forum took up the agenda items for consideration.

Business Session

Agenda Item No. 1 — **Confirmation of Minutes of the 62nd Meeting of FoR held on 15.12.2017.**

The Forum considered the minutes of the 62nd Meeting of Forum of Regulators held on 15.12.2017 at New Delhi and endorsed the minutes.

Agenda Item No. 2

I. Approval & Adoption of the Audited Accounts of the Forum of Regulators for FY 2016-17.
II. Budget of the Forum of Regulators for FY 2018-19.
III. Proposed Studies and Training Programmes for FY 2018-19.
IV. Resolution for Applying for Net Banking for the Forum of Regulators Plan Fund Account.
V. Appointment of Auditor for the FY 2017-18 and FY 2018-19.
VI. Appointment of Tax Consultant for the FY 2017-18 to 2019-20.

I. Approval & Adoption of the Audited Accounts of the Forum of Regulators for FY 2016-17.

The Audited Accounts for the year 2016-17 as circulated were discussed in detail. Salient features of the Audited Accounts were explained. The Forum approved the Audited Accounts for FY 2016-17 (as placed at Annexure-I of the Agenda Note).

The Forum suggested the Secretariat to explore the options for maintaining the fixed deposits (by splitting the total deposit) in more than one bank. It was also suggested to take a relook at the auto-sweep deposits in order to keep them at the minimum requisite level.

The Forum advised the Secretariat to bring more clarity to the disclosure statement (as part of the Audited Accounts) about the corpus given by the Government of India.

II. Budget of the Forum of Regulators for FY 2018-19.

The budget for the year 2018-19 as circulated was discussed in detail. Salient features of the proposed budget as reflected in the income and expenditure statement (contained in Annexure-II of the Agenda Note) were explained. The Forum approved the Annual Budget for FY 2018-19.

III. Proposed Studies and Training Programmes for FY 2018-19.

The Forum was informed that the proposal for commissioning the studies and conducting the training programmes during the financial year 2018-19 was evolved keeping in view the need for detailed analysis of the emerging issues facing the sector and also with due regard to the need for capacity building for the Regulators and staff of the regulatory Commissions. The Forum decided that the following studies and capacity building programmes would be undertaken during the financial year 2018-19: -

Studies:

1. Study on "Consumer Protection in Electricity Sector"

2. Study on "Price Cap Regulation for Distribution and Supply Margin"

3. Review of "State Level Regulation on Roof-top Solar PV System"

4. Study on Development of E-Court Software for SERCs

The Forum also decided that *inter se* prioritization of studies/ programmes would be left to the Chairperson, FOR.

Training Programmes:

1. Training Programme on Consumer Protection and Consumer Interest
2. Training Program on tariff setting principles, fixation of tariff, principles of prudence check
3. Capacity Building of SERCs/ JERC of North Eastern States
4. Capacity Building/ Training Programme for Chairpersons/ Members of SERCs at IIT Kanpur (including international component)
5. Workshop for Secretaries of SERCs/ JERCs

The Forum welcomed the proposal of Chairperson, GERC (who is also the Chairperson of the FOR Task Force of the North East) to facilitate the next module of Capacity Building Programme for SERCs/ JERC of North Eastern States. It was noted that while GERC would bear the expenditure related to training and expenses towards local stay/ local travel, the respective SERCs/ JERC would be required to bear the expenses towards air/ train fare to reach the venue.

With respect to the Training/ Capacity Building Programme at Sl. No. 4 above, it was decided that Forum may meet the expenditure towards economy class airfare of participants. However, the difference of air fare arising out of travel by the participants for their entitled class would be borne by the respective SERCs.

IV. Resolution for Applying for Net Banking for the Forum of Regulators Plan Fund Account.

The Forum considered the proposal related to applying for internet banking (only viewing facility of the bank statements) for the Plan Funds account of FOR, being maintained with Corporation Bank, K.G. Marg, New Delhi and approved the "Resolution" in this regard (placed at Annexure-III of the Agenda Note).

V. Appointment of Auditor for the FY 2017-18 and FY 2018-19.

The Forum approved the appointment of M/s MBR & Company LLP, Chartered Accountants, New Delhi (who have audited the Accounts of FOR for the F.Y. 2014-15 to 2016-17), to conduct the Audit of FOR for the next two years also, viz. F.Y. 2017-18 & 2018-19.

VI. Appointment of Tax Consultant for the FY 2017-18 to 2019-20

The Forum noted the efforts being made to engage a tax consultant and advised the Forum to complete the task at the earliest.

VII. References received from Tripura ERC

a. TERC sought to know that in the context of non-applicability of Service Tax in its earlier form on FoR Membership fee, whether GST would be applicable? It also enquired whether GST is applicable on license fee and petition fee collected by the ERCs and whether registration of ERCs under GST was mandatory?

It was informed that a communication had been sent by CERC to GST Council seeking clarification in this regard. The response on the same is still awaited. However, GST is applicable on FOR. Therefore, a provision in the Budget has been made for payment of GST on Membership fee collected by FOR.

b. TERC requested for reduction in FOR membership fee.

The Forum felt that no such distinction has ever been made in regard to membership fee. Further, in view of the increasing activities of FOR and corresponding requirement of funds, it may not be feasible to offer any reduction in Membership fee to any ERC.

Agenda Item No. 3 **UPLOADING OF CASES OF SERC ON THE WEBSITE OF FORUM OF REGULATORS - DISCUSSION**

The Forum was informed that Ministry of Power through various communications has been requesting Secretariat of the Forum to provide status and details of cases/ petitions filed before CERC and SERCs and their disposal on a regular basis.

In this regard, Chairperson, CERC/ FOR advised the Members to place the statement of pendency status (i.e. petition filed, petition disposed and petition pending, in the same format of CERC) on monthly basis on their websites, as a move towards greater transparency and disclosures.

Agenda Item No. 4 **DRAFTING GUIDELINES ON PRINCIPLES OF TARIFF DETERMINATION FOR DISTRIBUTION ASSETS INCLUDING DEPRECIATION PARAMETER IN COMPLIANCE TO TARIFF POLICY, 2016**

The Forum was informed that clause 5.11(c) of Tariff Policy, 2016 provides for Central Commission to notify the rates of depreciation in respect of generation and transmission which will be applicable for distribution assets with appropriate modification as may be evolved by the Forum of Regulators. It was informed that CERC has already notified the principles of depreciation for generation and transmission assets through the Central Electricity Regulatory Commission (Terms & Conditions of Tariff) Regulations, 2014 (as amended from time to time). The depreciation rates notified vide above Regulation shall remain effective for the period 2014-19 and now, CERC is in the process of framing its Tariff Regulations for 2019-24.

The Forum noted that in its earlier meeting, Chairperson, CERC/ FOR has been authorised to constitute a Working Group. The Forum deliberated upon the matter and decided that issues related to "Return on Investment" and "Operating Norms in Distribution Sector" may also be included in the scope of the Working Group. The Forum suggested that one Member each from Assam ERC, Bihar ERC, Gujarat ERC, Kerala State ERC and West Bengal ERC may be included in the Working Group.

Agenda Item No. 5 **FOR Standing Technical Committee – An Update**

Dr. Sushanta K. Chatterjee, Joint Chief (Regulatory Affairs) briefed the Forum with an update about the progress made by the "FOR Standing Technical Committee", since the last FOR Meeting. The Forum was informed that 18th Meeting of the "FOR Standing Technical Committee" was held on 23.2.2018 and a special meeting was held with Hydro Generators on 13.3.2018. During these two meetings, several critical issues were discussed, which include "Load/Generation Management – Intra Day context – Regional cooperation for RE integration", "Implementation of 5-Minute Scheduling, Metering, Accounting and Settlement", "Introduction of Fast Response Ancillary Services (FRAS) from Hydro Generating Stations" etc. Presentations on each of these issues were made before the Forum.

a. Load/Generation Management – Intra Day (Options for Handling Variation Including RE) Context - Regional Co-Operation For RE Integration

A presentation was made by Dr. Sushanta K. Chatterjee, Joint Chief (Regulatory Affairs) on the options for intra-day load/ generation management in the context of RE integration. (Copy enclosed as **Annexure-II**). The Forum was informed that the Standing Technical Committee discussed the seven options, which include, Option 1: "Banking"; Option 2: "Power Exchange (DAM price as reference)"; Option 3: "Pool based on Variable Cost (VC) as approved by the Regulator and on payment of variable cost"; Option 4: "Pool based on VC as approved by the Regulator and on payment of Marginal Cost"; Option 5: "Pool based on auction for intra-day for the rest of the day"; Option 6: "Pool based on auction for intra-day on hourly basis"; and Option 7: "Pool based on auction for intra-day on intra-hour basis i.e for 15 min. block-wise".

The basic objective was to explore the optimal means of meeting the energy requirement closer to real time, especially in the wake of the large scale penetration of renewable energy. Generally, after the day ahead scheduling, the utilities depend primarily on Deviation Settlement Mechanism (DSM)/ Unscheduled Interchange (UI) to meet their last mile energy requirement. DSM/ UI is not a trading platform and as such there is a need for a market product between day ahead time horizon and real time, say one hour before the actual schedule - to balance energy requirements which could not be envisaged on day ahead basis. After detailed discussion, the Technical Committee had unanimously recommended, to go ahead with the Option 6: "Pool based on auction for intra-day on hourly basis". This requires introduction of the concept of "Gate Closure".

The Forum had discussion on this concept. It transpired that the current framework – *of the right to recall the un-scheduled power one hour before the actual schedule* - gives comfort to Discoms but at the same time leaves a lot of uncertainty in terms of utilization of un-requisitioned surplus on a firm basis closer to the real time. The concept of "Gate Closure" implies that the right to revision of schedule for any specific one hour will close at some pre-defined time before the start of the said hour. It was felt that there could be a concern on the part of the Discoms if their flexibility (provided by the right to recall) is curbed. However, it was argued that there are a number of advantages which could outweigh the apparent disadvantages. The Discoms will have a revolving reserve available in the form of hourly trading opportunity. In fact, the real time energy market will give the Discom a multi-lateral platform to meet their real time energy needs vis-à-vis the one to one bi-lateral contract based price under the existing system of right to recall.

After discussion, the Forum endorsed the recommendation of the Technical Committee for introduction of real time energy market with hourly gate closure, and requested CERC to take suitable action, to take the idea forward. It was also reiterated that automation of the process, preparedness of the stakeholders, especially, Discom and the Power Exchanges were essential requisites to the success of the framework. It is equally important that this idea be explained in detail to the stakeholders.

b. Sub-Group for Implementation of 5-Minute Scheduling, Metering, Accounting And Settlement

A presentation on "Implementation of 5-Minute Scheduling, Metering, Accounting and Settlement" was made by the representative of POSOCO before the Forum. (Copy enclosed as **Annexure-III**). It was informed that the FOR Technical Committee members appreciated the need to move to 5-minute scheduling and settlement in view of the increasing RE penetration. The international experience evinces that shorter dispatch and settlement period such as 5-minutes offers a lot of advantages, particularly in terms of reduction in the requirement of reserve, robust price discovery and bringing out the value of flexibility. In advanced markets like in Australia and USA, the framework of 5-minute scheduling, dispatch and settlement has already been introduced. The cost benefit analysis of implementation of the 5-minute metering/ scheduling framework at the inter-State level was also presented by POSOCO.

A sub-Group constituted by the Committee has also examined the proposal and suggested that, on a pilot basis, 5-minute capable meters may be installed at say, 4-5 locations in each Region to gain practical experience in 5-minute metering, interfacing requirements/ file interchange formats and develop data analytics/ tools for 5-minute metering, data validation, reporting, etc. It was recognized that pilot project 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.

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.

c. Introduction of Fast Response Ancillary Services (FRAS) From Hydro Generating Stations

A presentation on "Introduction of Fast Response Ancillary Services (FRAS) From Hydro Generating Stations" was made by the representative of POSOCO before the Forum. (Copy enclosed as **Annexure-IV**).

The marginal cost for hydro generation is almost zero and the segregation of fixed and variable charges in case of hydro is only notional. Thus, the present model of ancillary services, which relies on payment of fixed charges, variable charges and incentive is incompatible for hydro stations. Therefore, in order to harness the flexibility and fast response provided by storage and pondge hydro, a framework of Fast Response Ancillary Services for providing frequency regulation services was proposed.

The Forum endorsed the recommendation of the Technical Committee for pilot studies on FRAS for Hydro (along with pilot studies on 5-Minute Scheduling, Metering, Accounting and Settlement) in the States of Andhra Pradesh, Rajasthan, Telangana, Uttar Pradesh and West Bengal.

Agenda Item No. 6 **CERC DRAFT REGULATIONS ON GENERAL NETWORK ACCESS**

The Forum was informed that CERC, in September, 2014 published the "Staff paper on the Transmission Planning, Connectivity, Long Term Access, Medium Term Open Access and other related issues " highlighting issues raised by the transmission planners, system operators, generators, etc., and the probable solutions to these issues and sought views of Stakeholders. Subsequently, CERC formed a Committee to "Review Transmission Planning, Connectivity, Long Term Access, Medium Term Open Access and other related issues".

The said Committee, along with other recommendations, suggested for change in transmission planning from the existing Long Term Access (LTA) based transmission planning to General Network Access (GNA) based transmission planning. The Commission considered the recommendations of the said Committee and published the Draft CERC (Grant of Connectivity, General Network Access and other related matters) Regulations, 2017 on 14.11.2017.

The Forum noted the matter.

Agenda Item No. 7 **REFERENCE RECEIVED FROM ASSAM ERC: (I) RENEWABLE PURCHASE OBLIGATION SETTING OF TARGETS (II) MODEL REGULATIONS ON SAFETY OF PUBLIC AND COMPENSATION TO THE VICTIMS.**

I. ***Renewable Purchase Obligation- Setting of Target.***

AERC informed the Forum that in light of the provisions contained in the Tariff Policy, 2016 for determination of RPO trajectory so as to reach 8% Solar and overall trajectory of 17% (including Solar & Non-Solar) by 2022, AERC has amended their RPO Regulations. Subsequently, MNRE on 22.07.2016 issued another set of guidelines proposing that 17% overall RPO may be achieved by FY 2018-19 itself.

The Forum noted the same and observed that power to determine RPO trajectories lies with the respective SERCs/ JERCs and therefore, appropriate decision may be taken by them.

II. ***Model Regulations on Safety of Public and Compensation to the Victims***

In the light of the reference received from AERC requesting the Forum to come up with a uniform and standard model Regulations on "Safety of Public and Compensation to the Victims", the Forum noted that APERC, TSERC and BERC have already come up with their state specific Regulations on safety of public and compensation to the victims.

Forum observed that other SERCs / JERCs may come up with their own Regulations.

Agenda Item No. 8 **REFERENCE RECEIVED FROM HARYANA ERC : (I) ISSUANCE OF COMPETITIVE BIDDING GUIDELINES FOR POWER PROCUREMENT (II) OPEN ACCESS CHARGES PAYBLE FOR RAILWAYS AS DEEMED LICENSEE (III) APPLICABILITY OF GST ON STATE ELECTRICITY REGULATORY COMMISSIONS (IV) POWER OF STATE GOVERENMENT UNDER SECTION 108 OF THE ELECTRICITY ACT, 2003 FOR WAIVING THE OPEN ACCESS CHARGES.**

I. **Issuance of competitive bidding guidelines for power procurement**

The Forum considered the reference received from Haryana Electricity Regulatory Commission seeking intervention of the Forum for issuance of competitive bidding guidelines for hydro power procurement by MoP. The Forum observed that the Tariff Policy, 2016 provide for cost plus tariff determination for hydro projects. Therefore, no further action is suggested.

II. **Open Access charges payable for Railways as deemed licensee**

The Forum considered the reference received from Haryana ERC seeking intervention of FOR to decide the applicability of various charges along with other terms and condition payable by Indian Railways as the Deemed Licensee for availing Open Access, so that uniformity across the States in respect of levy of charges could be achieved.

The Forum noted that the Electricity Act, 2003 and Tariff Policy, 2016 provide for determination of Tariff and applicable charges by the Appropriate SERCs/ JERCs. Therefore, the matter may be considered and decided appropriately by the respective SERCs / JERCs.

III. **Applicability of GST on State Electricity Regulatory Commissions**

The Forum considered the reference received from HERC seeking intervention of FOR to take up the matter related to applicability of GST on Electricity with Central Government and exemption of SERCs from the ambit of GST.

The Forum noted that the matter related to CERC has already been referred to GST Council and reply from the Council was awaited.

IV. **Power of State Government under Section 108 of the Electricity Act, 2003 for waiving the open access charges**

The Forum considered the reference received from HERC seeking discussion on waiver of Open Access charges in the light of directions received from the State Government under Section 108 of the Electricity Act, 2003.

The Forum noted that the Electricity Act, 2003 and Tariff Policy, 2016 provide for determination of Tariff and applicable charges by the Appropriate SERCs/ JERCs. Therefore, the matter may be considered and decided appropriately by the respective SERCs/ JERCs.

Agenda Item No. 9 **IMPLEMENTATION OF REVISED ENVIRONMENTAL NORMS ISSUED BY MINISTRY OF ENVIRONMENT AND FORESTS, GOI VIS-À-VIS STAGGERING SIMULTANEOUS INSTALLATION OF FGDS ON IPPS IN PUNJAB - REFERENCE FROM PUNJAB ERC.**

The Forum considered the reference received from PSERC, seeking the intervention of FOR to stagger the simultaneous installation of FGDs in IPPs located in Punjab. PSERC stated that in the light of the notification issued by Ministry of Environment and Forest (MoEF) on 7th December 2015 revising the Environmental Emission norms for Thermal Power Stations and advancement to achieve the specified norms therein, some of the generating stations located in Punjab are required to shut down causing severe power shortage during the critical paddy harvesting season. Hence, PSERC requested FOR to intervene and facilitate staggering the simultaneous installation of FGDs in IPPs located in Punjab.

The Forum discussed the matter and observed that PSERC may consider taking up the matter through the State Government of Punjab with MoEF and CEA directly.

Agenda Item No. 10 RPO WEB TOOL – PRESENTATION BY TERI.

In the context of centralized monitoring of compliance of Renewable Power Purchase Obligation by the obligated entities, MNRE in association with TERI developed a web-tool to facilitate providing a centralized platform to monitor RPO compliance status for all the States. A detailed presentation (**Annexure-V**) was made by the representatives of TERI on the proposed RPO web-tool. During the discussion, the Forum was informed that the web-tool developed by TERI facilitates dovetailing of RPO web-tool as facilitated by the FOR Standing Technical Committee. Such interoperability facilitates usage of existing mechanism to its full potential. Representative of MNRE also informed the Forum that the web-tool developed by MNRE would be made available to all the States free of cost. SERCs/ JERCs could approach MNRE (contact person Dr. P.C. Maithani, Advisor) directly for this purpose.

Agenda (Any Other Item) Proposal for establishment of Centre for Energy Regulation at IIT, Kanpur

Dr. Anoop Singh, Assoc. Professor, IIT-Kanpur, made a presentation (**Annexure-VI**) before the Forum regarding proposed Centre for Energy Regulation (CER) at IIT-Kanpur. It was informed that CER is aimed at enhancing regulatory research, knowledge building and networking in the Indian power sector. The Centre and its activities are supported through tapered funding through a project on "**Strengthening Regulatory Research & Network in the Power Sector**" by the Government of United Kingdom under the **Power Sector Reform (PSR)** program. CER has two-part cost structure, including a fixed cost to sustain its operations and is actively looking forward to "Social Corpus" and cooperation of all Regulators to actively participate in the programs of CER.

The Forum noted the proposal.

The Chairperson, CERC/ FOR thanked the Members of Forum. Secretary, CERC thanked the staff of "FOR" Secretariat for their arduous efforts in organizing the meeting.

The meeting ended with a vote of thanks to the Chair.

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/ ANNEXURE – I /

LIST OF PARTICIPANTS ATTENDED THE 63RD MEETING

OF

FORUM OF REGULATORS (FOR)

HELD ON MONDAY, THE 09TH APRIL, 2018 AT NEW DELHI.

S. No.	NAME	ERC
01.	Shri P.K. Pujari Chairperson	CERC / FOR – in Chair.
02.	Justice (Shri) G. Bhavani Prasad Chairperson	APERC
03.	Shri R.P. Singh Chairperson	APSERC
04.	Shri Subhash Chandra Das Chairperson	AERC
05.	Shri S.K. Negi Chairperson	BERC
06.	Shri Narayan Singh Chairperson	CSERC
07.	Shri Anand Kumar Chairperson	GERC
08.	Shri Jageet Singh Chairperson	HERC
09.	Shri S.K.B.S. Negi Chairperson	HPERC
10.	Dr. Arbind Prasad Chairperson	JSERC
11.	Shri M.K. Goel Chairperson	JERC for State of Goa & UTs
12.	Shri Ngangom Sarat Singh Chairperson	JERC for Mizoram & Manipur
13.	Shri M.K. Shankaralinge Gowda Chairperson	KERC
14.	Shri Preman Dinaraj Chairperson	KSERC
15.	Dr. Dev Raj Birdi Chairperson	MPERC
16.	Shri W.M.S. Pariat Chairperson	MSERC

17.	Shri U.N. Behera Chairperson	OERC
18.	Ms. Kusumjit Sidhu Chairperson	PSERC
19.	Shri Vishwanath Hiremath Chairperson	RERC
20.	Shri S. Akshayakumar Chairperson	TNERC
21.	Shri Ismail Ali Khan Chairperson	TSERC
22.	Shri Suresh Kumar Agarwal Chairperson	UPERC
23.	Shri Subhash Kumar Chairperson	UERC
24.	Shri Rabindra Nath Sen Chairperson	WBERC
25.	Shri Deepak Lad Member	MERC
26.	Shri Sanoj Kumar Jha Secretary	CERC/FOR
27.	Dr. Sushanta K. Chatterjee Joint Chief (RA)	CERC
MNRE		
28.	Shri P.C. Maithani Advisor	MNRE
SPECIAL INVITEES		
29.	Shri A.K. Singhal Member	CERC
30.	Shri A.S. Bakshi Member	CERC
31.	Dr. M.K. Iyer Member	CERC
32.	Shri M.K. Anand Chief (Fin.)	CERC
33.	Shri T. Rout Chief (Legal)	CERC
34.	Smt. Geetu Joshi Chief (Eco.)	CERC
35.	Shri S.C. Shrivastava Chief (Engg.)	CERC

CEA / POSOCO		
36.	Shri Chandra Shekhar Chief Engr. (UMPP)	CEA
37.	Shri Narendra Singh Chief Engr. (Thermal)	CEA
38.	Shri Ramesh Kumar Director	CEA
39.	Shri S.K. Soonee Advisor	POSOCO
40.	Shri S.S. Barpanda General Manager	POSOCO

Annexure-II

Intra-Day Load/Generation Management

(Options for Handling Variation including in RE)

9.4.2018

Dr. Sushanta K. Chatterjee
Joint Chief (Regulatory Affairs)
Central Electricity Regulatory Commission

This Presentation contains …..

1. Background
2. Constitution of RPC Sub-Committees
3. Views of RPC Sub-Committees
4. Options for “Intra-Day / Hour-Ahead” transactions
5. Proposed Framework

1. Background

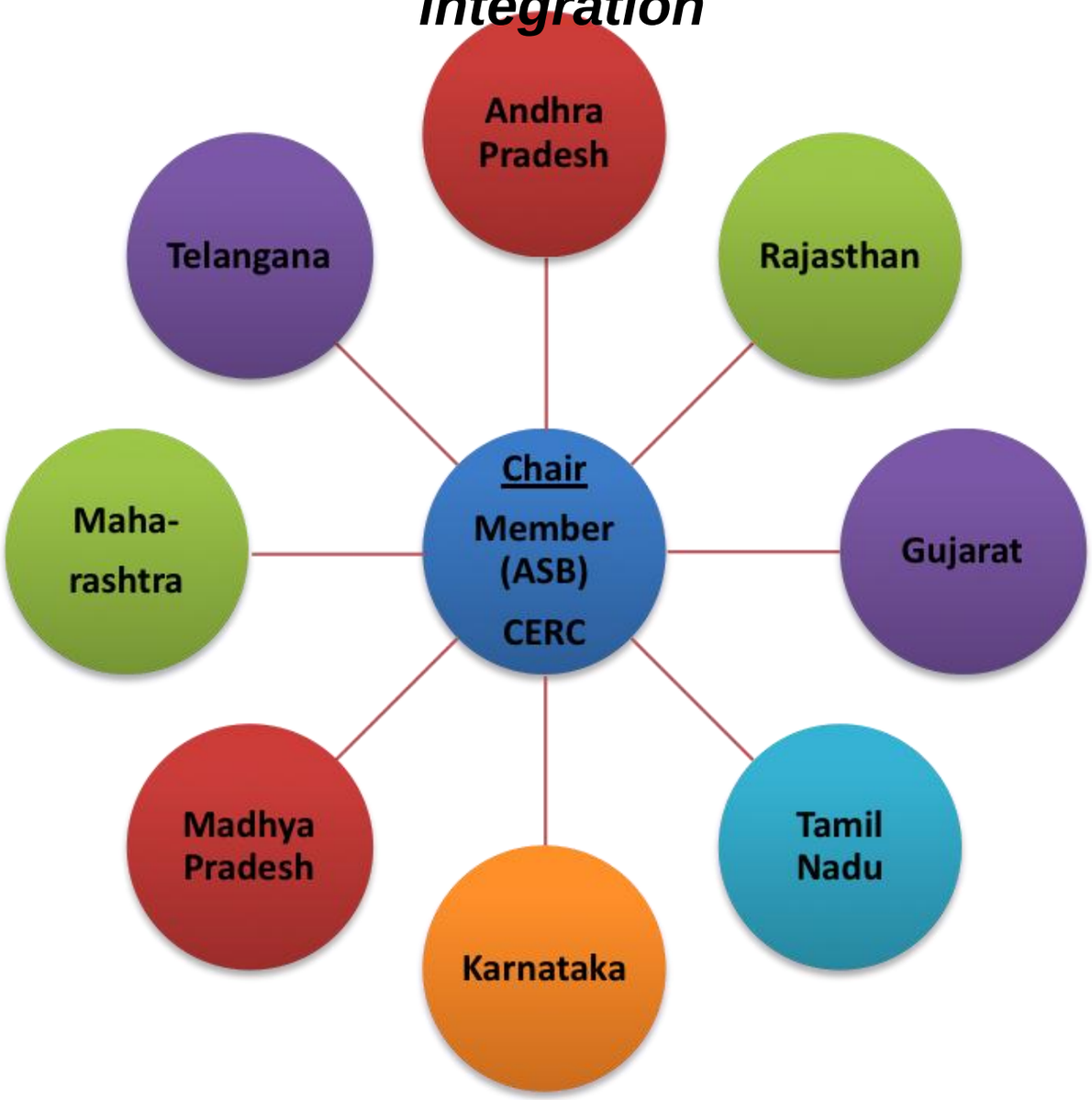
FoR Standing Technical Committee

for Handholding States for roll out of framework at State level for effective Re integration

1. Background

FoR Standing Technical Committee

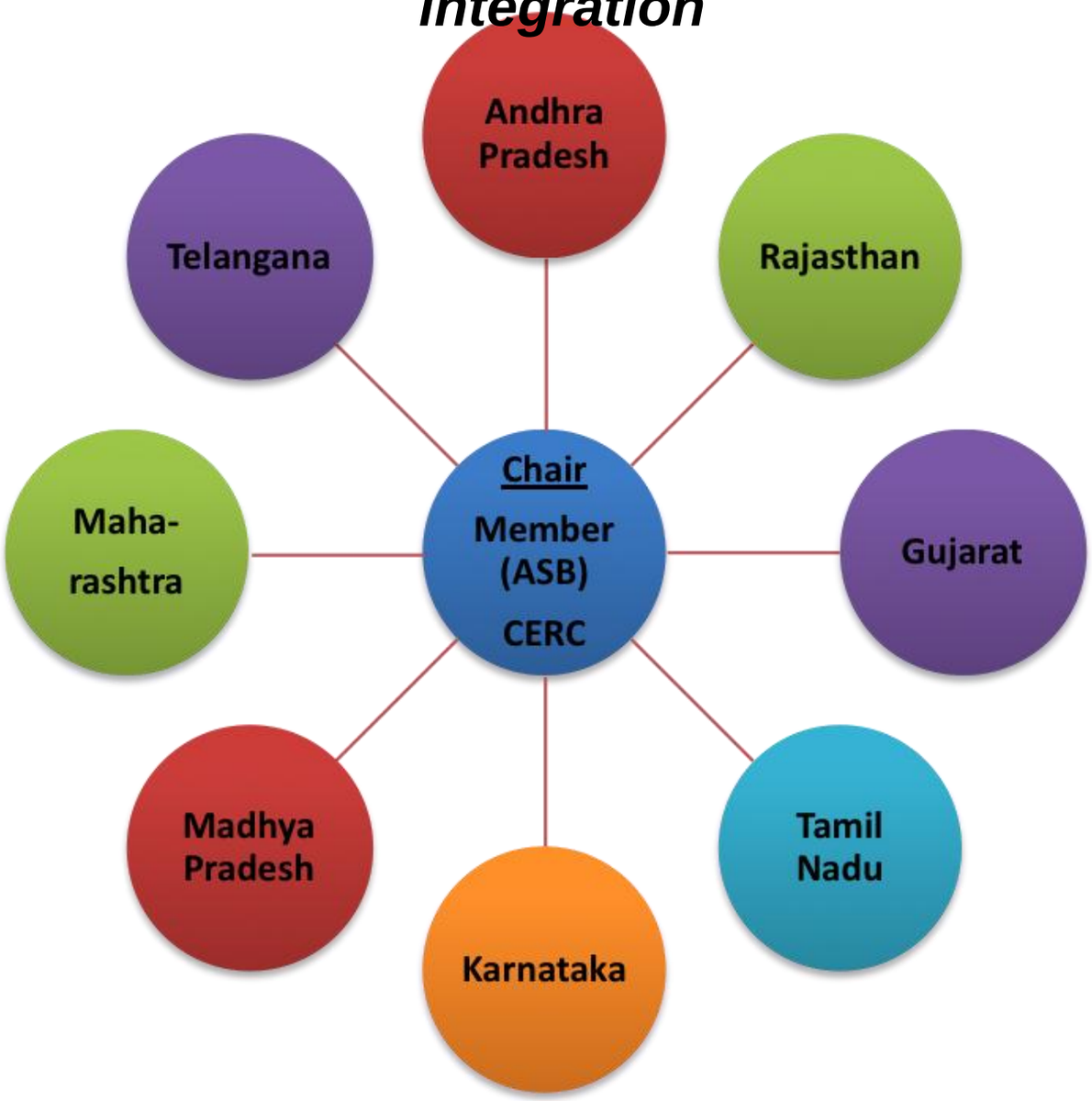
for Handholding States for roll out of framework at State level for effective Re integration



1. Background

FoR Standing Technical Committee

for Handholding States for roll out of framework at State level for effective Re integration



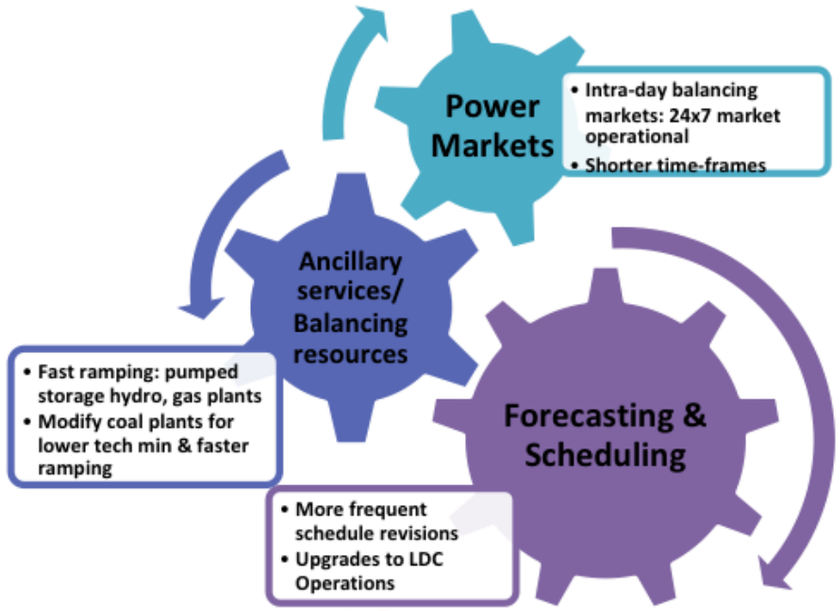
Mandate (expanded from time to time)

- **Deployment of Framework on Forecasting, Scheduling and Deviation Settlement of wind & solar generators;**
- **Implementation of Availability Based Tariff (ABT) framework;**
- **Introduction of Ancillary Services and Reserves;**
- **Implementation of Automatic Generation Control (AGC) and primary control**

So far held 18 Meetings

(apart from 2 additional Special Meetings)

1. Background



Renewable Energy Integration

Handholding States through FoR Technical Committee – for roll out of similar framework at State level

- **Report on Scheduling, Accounting, Metering and Settlement of Transactions in Electricity (SAMAST)** **[5 States have submitted final DPRs, and 6 States are in the process of finalizing the DPR]**
- **Model Framework for Forecasting, Scheduling and Deviation Settlement for RE sources at the State level** **[7 States issued final Regulations, and 5 States issued draft Regulations]**
- **Model Deviation Settlement Mechanism (DSM) Regulations** **[2 States have issued final Regulations, and 2 States issued draft Regulations]**
- **Sub-group on Regional Co-operation for optimum utilization of Generation Resources**
- **Sub-group on Introduction of 5-minute Time Block**
- **Model Regulations on intra State Hydro Generation**
- **RPO Web-Tool**

2. Constitution of RPC Sub-Committees

FoR Standing Technical Committee, during its 12th Meeting,

- **Discussed the need for cooperation among States for Optimum Utilization of Generation Resources amongst other issues**
- **Sub-Groups of RE rich regions (NR, WR & SR) headed by Member Secretaries of RPCs**
- **Sub-Groups mandates to examine the feasibility and modality of cooperation for optimum utilization of generation resources with least cost options**

3. View of RPC Sub-Committees

FoR Standing Technical Committee, during its 12th Meeting,

- **Discussed the need for cooperation among States for Optimum Utilization of Generation Resources amongst other issues**
- **Sub-Groups of RE rich regions (NR, WR & SR) headed by Member Secretaries of RPCs**
- **Sub-Groups mandates to examine the feasibility and modality of cooperation for optimum utilization of generation resources with least cost options**

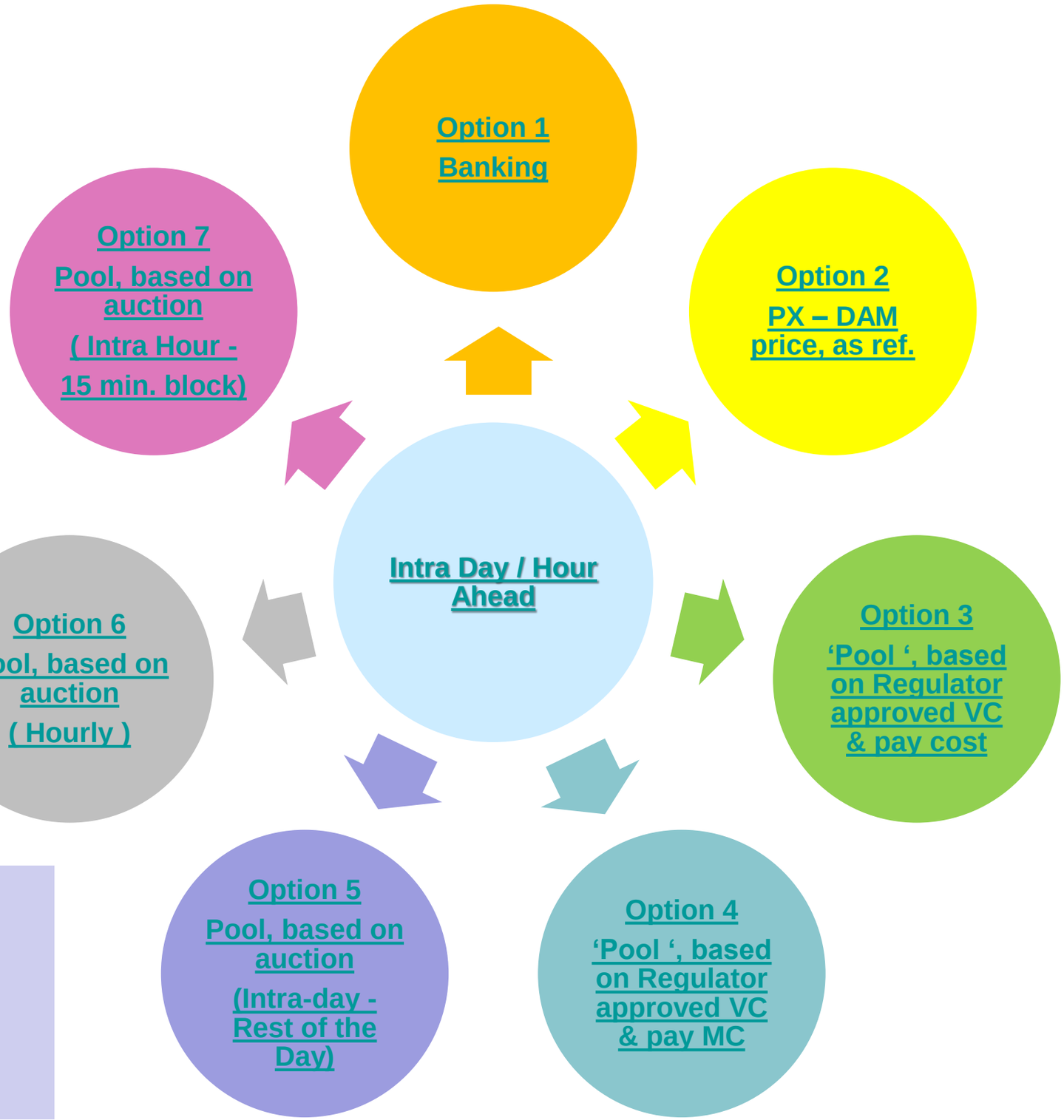
Sub-Committees

- **Held region-wise meetings for initial brainstorming**
- **During their meeting with FoR Standing Technical Committee, it emerged that,**
  - ***The States have recognized the value of electricity vis-à-vis the cost of generation.***
  - ***Some of the States are not willing to cooperate with other States in the Region on "cost" basis, for example, valuing pumped hydro resources.***
  - ***Some of the Regions are predominantly "surplus" in power, leaving little scope for co-operation within the region. This necessitates a national level framework / product for optimum resource utilization.***
  - ***Inter-state transactions need to be enabled closer to real-time, which will necessitate new intra-day market products at the national level.***

4. Options for “Intra Day / Hour Ahead” Transactions

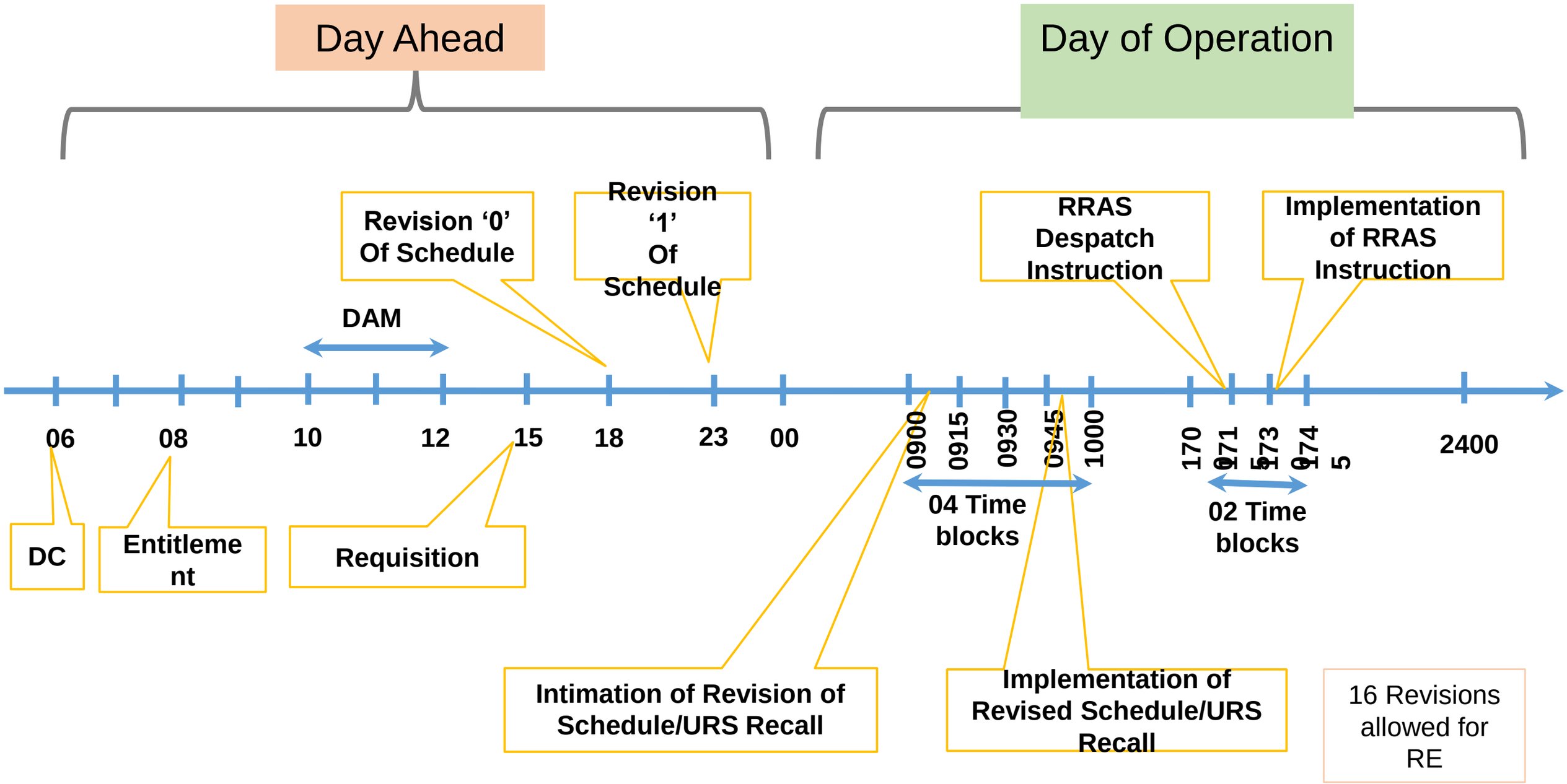
During the Meeting of FoR Standing Technical Committee with all Sub-Committees,

Joint Chief (RA) presented his personal views on options for enabling inter-State Trade of Power

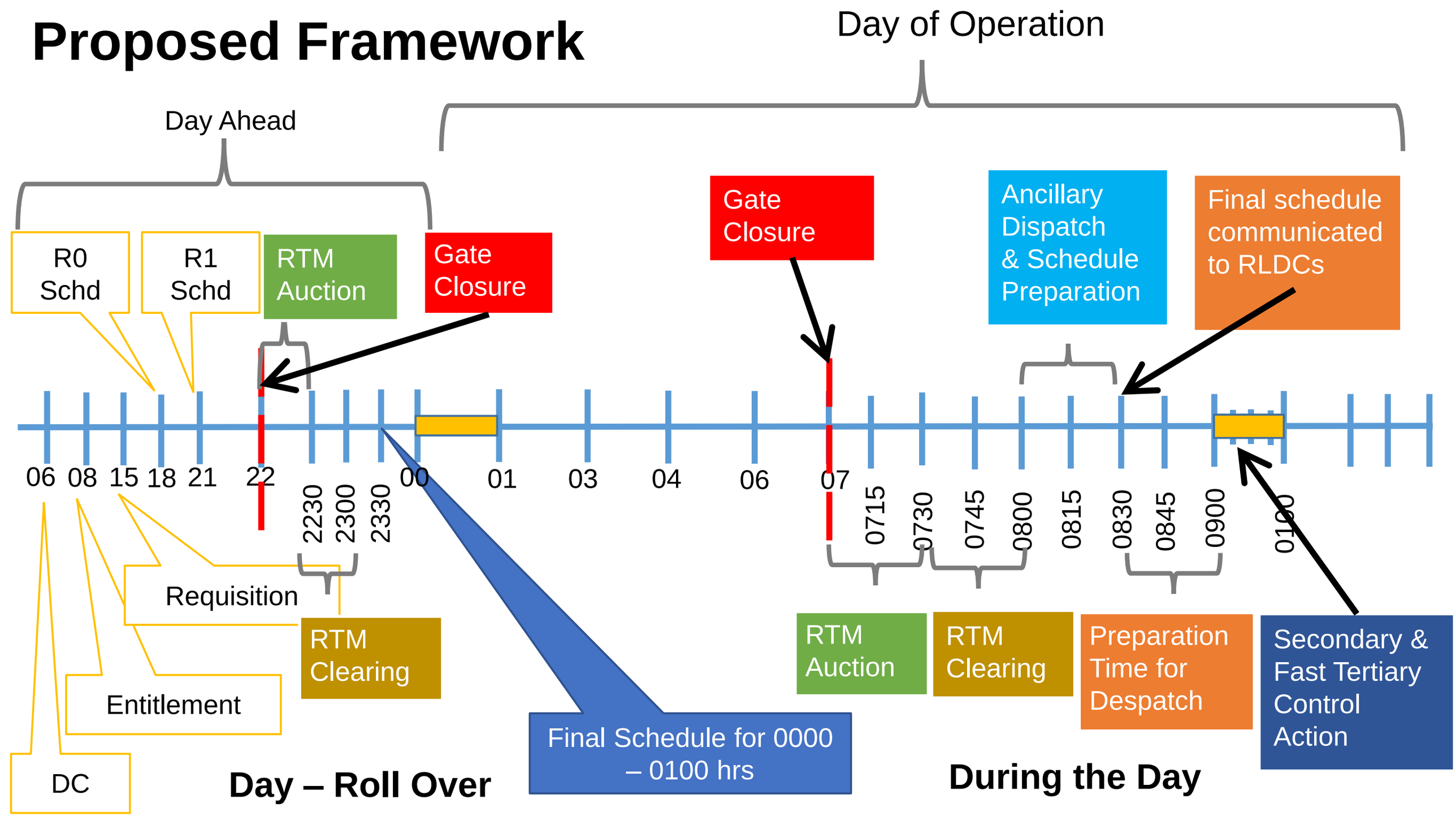


PX – Power Exchange
DAM – Day Ahead Market
VC – Variable Cost
MC – Marginal Cost
OA – Open Access
ISGS – Inter-State Generating Station
IPP – Independent Power Producer
MPP – Merchant Power Producer

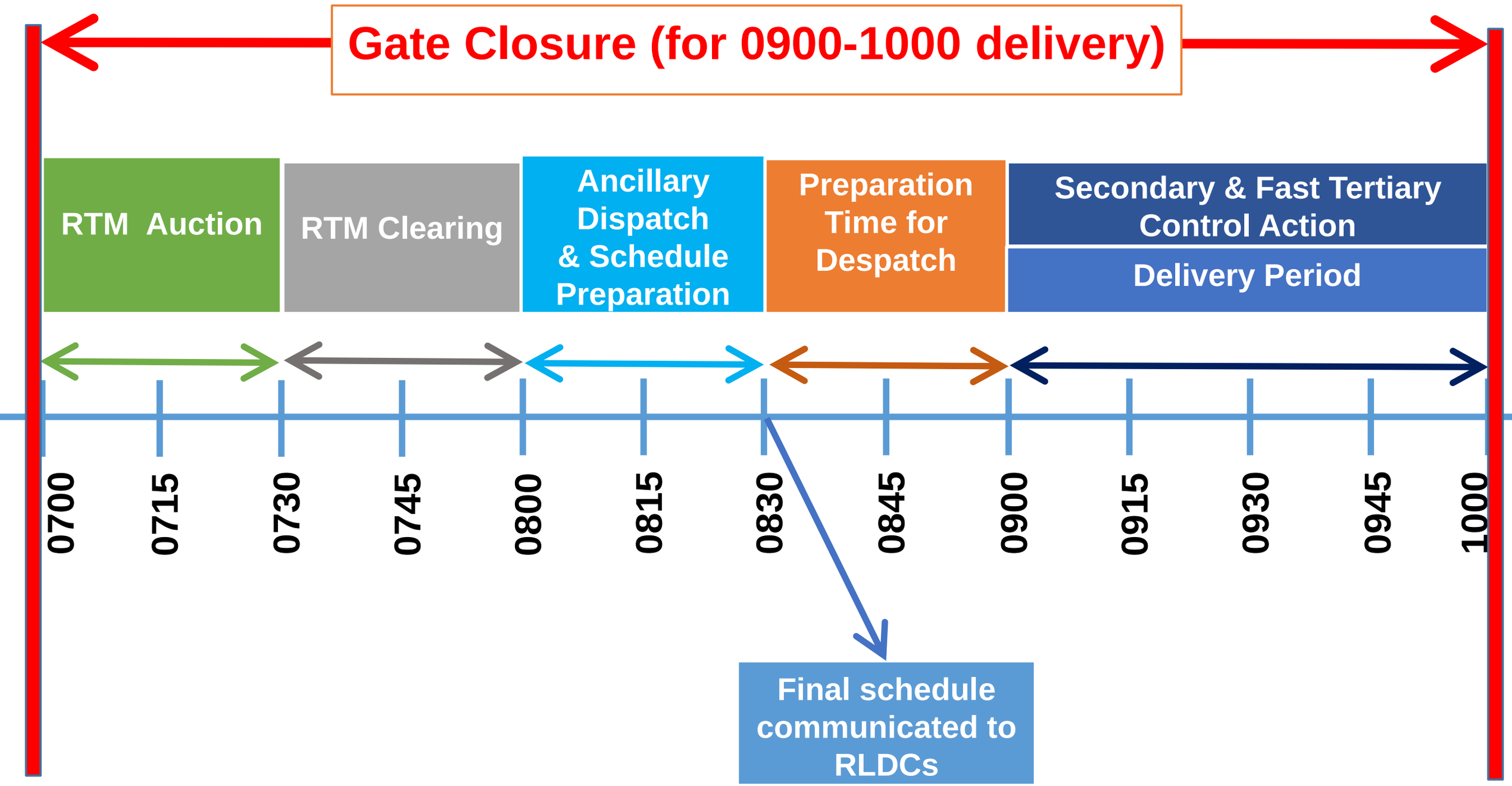
5. a. Present Framework



5. b. Proposed Framework



5. c. Gate Closure



5. d. Imperatives of Real Time Market with Gate Closure

- **Recognizes intermittency of RE as also variability of load / generation**
  - Facilitates RE integration and better load / generation balance
- **Reduced Dependence on Ancillary Services & DSM / UI**
  - Default Pool of Reserves
- **Planning for reserves and dispatch with certainty by the states and RLDCs**
  - Firmness of contracts leading to certainty in despatch
- **RTM to provide opportunities and advantages of an 'organized market'**
  - Standalone schedule revisions
  - Reduced transaction costs
  - Procurement from cheaper power sources
  - Re-balancing the system / portfolio close to real time with more certainty
  - Reduced deviations
  - Reduced balancing costs

5. e. Concerns & Way Forward

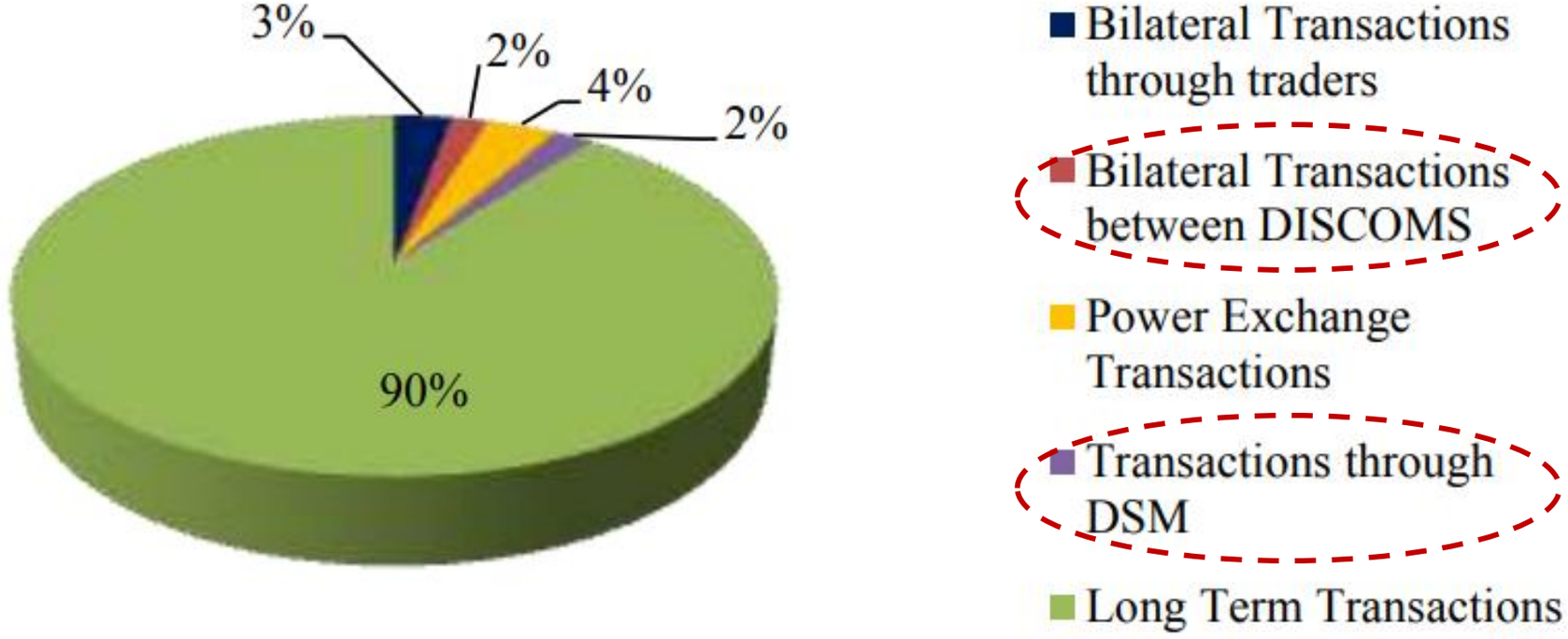
1. Issue of Liquidity
2. Right to Recall Vs. Fixed Cost Payment Liability
3. Sharing of Net Revenues
4. Flexibility to Discoms to sell their power at Bus Bar

Issue of Liquidity

1. Liquidity is an issue ….., but

- **with progress of time, the market share under "Direct Bilateral" and a significant part of "UI / DSM" might move towards "RTM"**

Share of Market Segments in Total Electricity Generation, 2016-17



Right to Recall Vs. Fixed Cost Payment Liability

1. Currently, Discom can recall one hour before the actual schedule
2. Proposed framework shifts the one hour margin backwards

3. Right to Recall takes the shape of bilateral – “One to One”, which does not offer other pricing options
4. But the new framework facilitates multilateral market.
5. Provides for multiple price points, efficiency in pricing
6. Facilitate better pricing choices for Discom

Sharing of Net Revenues & Flexibility to sell power at Bus Bar

1. Currently, the net gains from URS are shared in the ratio of 50:50 between the generator and Discom
2. Discoms argue that 50% of the gains provided to the Discom are insufficient to meet the cost towards procure power from short term market
3. Flexibility to Discoms to sell their power at Bus Bar
4. Draft GNA Regulations provide for such flexibility to the Discoms

5. f. Action Points

1. **CERC to facilitate introduction of Real Time Market with Gate Closure**
   - **Amendments to relevant Regulations**

2. **Capacity Building of stakeholders, especially Discoms to disseminate the concept**

Thank you

4 (a) Option-1 for “Intra Day / Hour Ahead” Electricity Transactions

Option-1

Banking

Details

Pros

Voluntary;

No price transaction;

Easy to implement

Cons

Still bilateral;

Opaque to cheaper options;

True marginal cost of meeting demand not known;

Elements of Cost and Value missing;

No knowledge of gain or loss

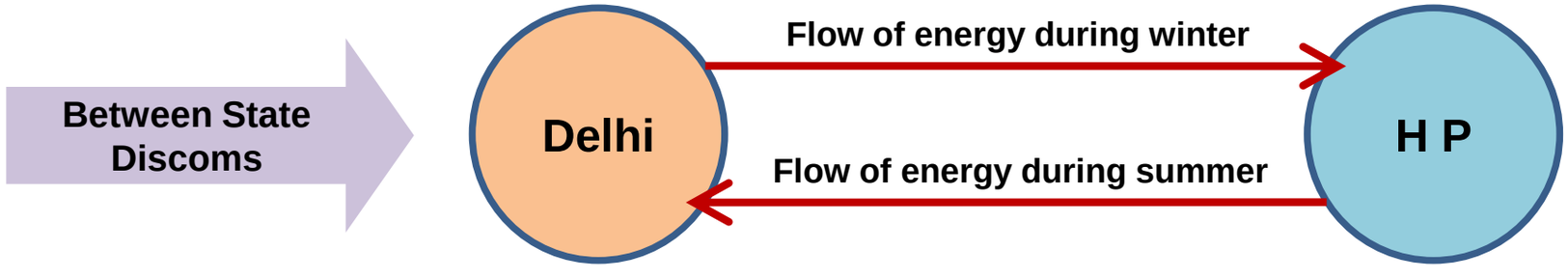
Main

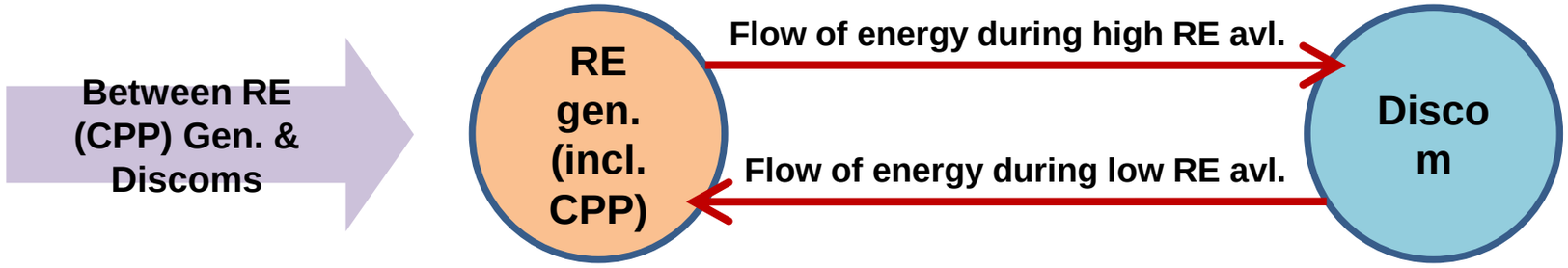
PX – Power Exchange; DAM – Day Ahead Market; VC – Variable Cost; MC – Marginal Cost; OA – Open Access; ISGS – Inter-State Generating Station; IPP – Independent Power Producer; MPP – Merchant Power Producer

4 (a) Option-1 “Banking”

1.Arrangement between two parties to share generation resources without price considerations (reciprocal supply of equivalent quantum of energy without price consideration)

2.Banking is used by the contracting parties to hedge against the uncertainty of power availability and the vagaries of price fluctuations in situations of shortage. This may help manage the energy imbalances closer to real time for both the parties.





3.Participation is voluntary; Easy to implement; No formal contracts and no need for regulatory approval.

4.The contracting parties are unaware of the availability of cheaper options for meeting the same demand. Elements of cost as well as value of resources are missing completely; The parties have no knowledge of whether they are losing or gaining and to what extent.

Section Main

4 (b) Option-2 for "Intra Day / Hour Ahead" Electricity Transactions

Option-2

PX, DAM price as reference for settlement

Details

Pros

Well accepted reference price;

Dispute free

Cons

Very remote chance of availability of generation sources with marginal cost equal to or less than DAM price;

Liquidity will always be an issue

Main

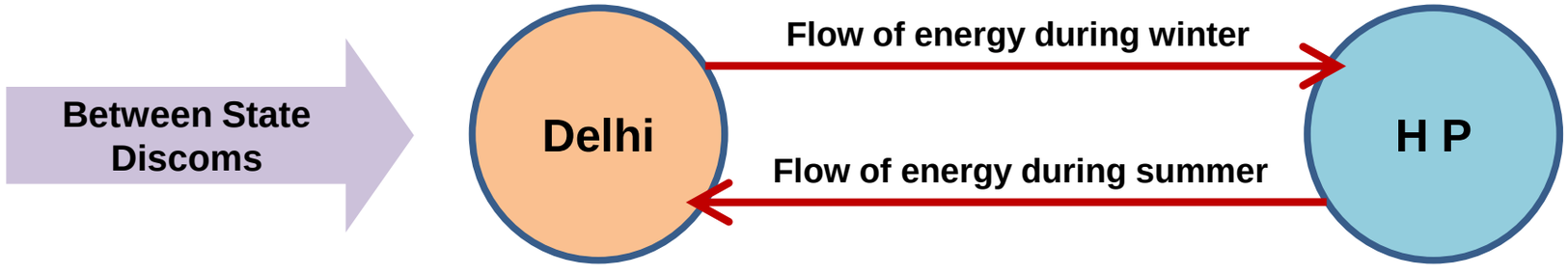
PX – Power Exchange; DAM – Day Ahead Market; VC – Variable Cost; MC – Marginal Cost; OA – Open Access; ISGS – Inter-State Generating Station; IPP – Independent Power Producer; MPP – Merchant Power Producer

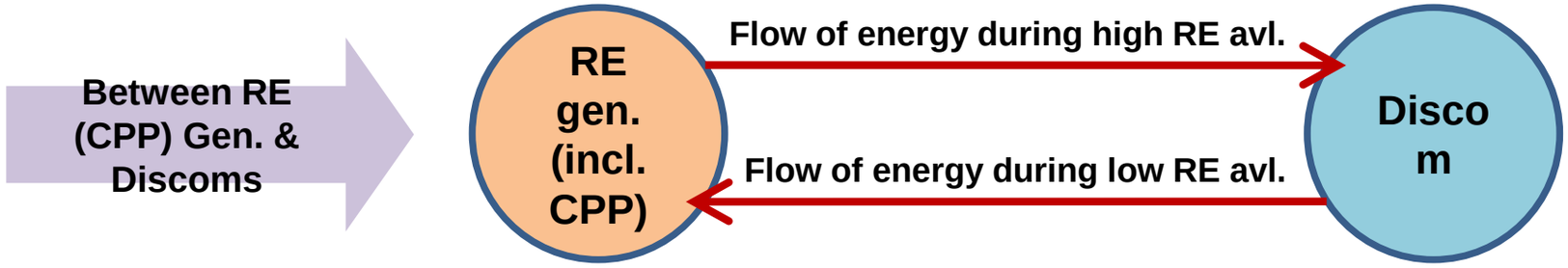
4 (b) Option-2 “PX, DAM price as reference for settlement”

1.Improved “Banking” arrangement with “Price Element” added to it

2.MCP of DAM in PXs stands as reference for settlement of transaction

3.MCP of DAM in PXs gained wider acceptability





4.Participation is voluntary; Easy to implement

5.There could be a problem of Liquidity, as available sources could be costlier than DAM Price.

6.URS could be used for Ancillary Services, rather than for Banking – as Ancillary Service may fetch more price (full cost + mark up of Rs. 0.50 p.u.)

7.May not be long term sustainable option for real-time energy market

Section Main

4 (c) Option-3 for "Intra Day / Hour Ahead" Electricity Transactions

Option-3

Pool based on regulator approved VC / and pay as per cost

Details

Pros

Visibility of all options for purchase decision;

Dispute free as regulator approved VC;

All resources get paid as per their cost or MC;

Improvement over option 2;

Liquidity

Cons

Still based on cost and not on value;

VC difficult to ascertain;

Merchant plants cannot participate as their tariffs are not determined by Regulator

Main

PX – Power Exchange; DAM – Day Ahead Market; VC – Variable Cost; MC – Marginal Cost; OA – Open Access; ISGS – Inter-State Generating Station; IPP – Independent Power Producer; MPP – Merchant Power Producer

4 (c) Option-3 “Pool based on regulator approved VC / and pay as per cost”

1. **Transactions move from bilateral to multilateral**
2. **Pool of Generation sources (not cleared in DAM and available for real-time dispatch) stacked in VC based merit order**
3. **This is a viable option at regional level to be pooled by RLDC or RPC**
4. **Options for value of transaction include pay-as-you-bid-action / VC alone / VC + mark up / Total Cost**

5. **Limitations of bilateral transactions addressed**

6. **VC of state level gencos not available, hence difficult to draw merit order**
7. **MPPs / CPPs with surplus power remain excluded as their VC is not determined by Regulator**
8. **Pay-as-you-bid mechanism is inferior to uniform price auction mechanism**

Section Main

4 (d) Option-4 for “Intra Day / Hour Ahead” Electricity Transactions

Option-4

Pool based on regulator approved VC / and pay as per marginal cost

Details

Pros

Same as Option 3;

Improvement over Option 3;

Element of ‘value’ introduced because of marginal cost based payment

Cons

VC difficult to ascertain;

Merchant plants cannot participate as their tariffs are not determined by Regulator;

Payment based on marginal cost may lead to heart burn;

Still administered

Main

PX – Power Exchange; DAM – Day Ahead Market; VC – Variable Cost; MC – Marginal Cost; OA – Open Access; ISGS – Inter-State Generating Station; IPP – Independent Power Producer; MPP – Merchant Power Producer

4 (d) Option-4 “Pool based on regulator approved VC / and pay as per MC”

1. Inclusion of uniform price auction mechanism
2. Payment based on “Regional Level System MC (@ highest VC of generation scheduled)”
3. Uniform payment is made
4. Real time excess RE generation could also be accommodated

5. VC of state level Gencos not available, hence difficult to draw merit order
6. MPPs / CPPs with surplus power remain excluded as their VC is not determined by Regulator

Section Main

4 (e) Option-5 for “Intra Day / Hour Ahead” Electricity Transactions

Option-5

Pool based on Auction (collective transaction)

Auction based

Double sided closed bidding

Bidding platform at RPC level/PX

Monitoring Committee at RPC level.

Details

Illustration & Participants

Pros

Market Discovered Price;

Dispute free;

Not administered;

Akin to DAM but closer to real time;

Cons

Preparedness of PX;

Discoms decision making process;

OA registry, a pre-requisite

Main

PX – Power Exchange; DAM – Day Ahead Market; VC – Variable Cost; MC – Marginal Cost; OA – Open Access; ISGS – Inter-State Generating Station; IPP – Independent Power Producer; MPP – Merchant Power Producer

4 (e) Option-5 “Pool based on Auction (collective transaction)”

1. **Introduction of Uniform Price Auction for real time price discovery**
2. **Facilitates participation of regulated as well as non-regulated generators**
3. **Price discovery based on demand and supply – truly reflects value**
4. **DAM framework on PXs can be adopted for the intra-day segments**
5. **Double sided closed auction recommended as facility to adjust the quotes till the point of inflection may attract adversarial audit scrutiny**
6. **Facilitates resource optimization across regions subject to transmission constraints**
7. **Collective transaction in “Intra-Day” segment might not work due to low liquidity. However, increasing awareness may lead to growth in liquidity**
8. **Delegation of decision making authority in Discoms**
9. **Automation of the Process is pre-requisite**
10. **Absence of “Gate Closure” option**

Section Main

4 (e) Option-5 for “Intra Day / Hour Ahead” Electricity Transactions

Option-5

Pool based on Auction (collective transaction)

Auction based

Double sided closed bidding

Bidding platform at RPC level/PX

Monitoring Committee at RPC level.

Illustration

- **7.30 – 8.00 – for ---rest of the day, and so on**
- **Until 7.30 am discoms can self – schedule for rest of the day, if they so desire.**
- **7.30 am onwards, no right for self scheduling for rest of the day**

(This will need change in existing re-call facility of one hour)

This is not going to adversely affect discoms’ right to recall as they will have several reference price points every hour to take a call on self scheduling.

Participants

- **State Gencos inclining RE, on their own , or**
- **Discoms on their behalf**
- **Discoms as buyers and sellers**
- **ISGS / IPPs / MPP**

Section Main

PX – Power Exchange; DAM – Day Ahead Market; VC – Variable Cost; MC – Marginal Cost; OA – Open Access; ISGS – Inter-State Generating Station; IPP – Independent Power Producer; MPP – Merchant Power Producer

4 (f) Option-6 for “Intra Day / Hour Ahead” Electricity Transactions

Option-6

Pool based on Auction (collective transaction)

Auction based

Double sided closed bidding

Bidding platform at RPC level/PX

Monitoring Committee at RPC level.

Details

Illustration & Participants

Pros

Market Discovered Price;

Dispute free;

Not administered;

Akin to DAM but closer to real time;

Cons

Preparedness of PX;

Discoms decision making process;

OA registry, a pre-requisite

Main

PX – Power Exchange; DAM – Day Ahead Market; VC – Variable Cost; MC – Marginal Cost; OA – Open Access; ISGS – Inter-State Generating Station; IPP – Independent Power Producer; MPP – Merchant Power Producer

4 (f) Option-6 “Pool based on Auction (collective transaction)”

1.Introduction of National Uniform Price Auction based on Hourly Bids

2.Introduction of “Gate Closure”,

- **Window of “7.30 – 8.00” will be open for transactions of “9.00 – 10.00”**
- **Window of “8.30 – 9.00” will be open for transactions of “10.00 – 11.00”**
- **And so on.**

3.Facilitates desired firmness and seriousness in real-time trade and effective integration of RE

4.Delegation of decision making authority in Discoms

5.Automation of the Process is pre-requisite

Section Main

4 (f) Option-6 for “Intra Day / Hour Ahead” Electricity Transactions

Option-6

Pool based on Auction (collective transaction)

Auction based

Double sided closed bidding

Bidding platform at RPC level/PX

Monitoring Committee at RPC level.

Illustration

- **7.30 – 8.00 – for ---9.00 to 10.00 and so on**
- **Until 7.30 am discoms can self – schedule for, 9.00 to 10.00 if they so desire.**
- **7.30 am onwards, no right for self scheduling for 9.00 to 10.00**

  (This will need change in existing re-call facility of one hour)

This is not going to adversely affect discoms’ right to recall as they will have several reference price points every hour to take a call on self scheduling, say for 9.00 to 10.00 and so on

Participants

- **State Gencos inclining RE, on their own , or**
- **Discoms on their behalf**
- **Discoms as buyers and sellers**
- **ISGS / IPPs / MPP**

Section Main

PX – Power Exchange; DAM – Day Ahead Market; VC – Variable Cost; MC – Marginal Cost; OA – Open Access; ISGS – Inter-State Generating Station; IPP – Independent Power Producer; MPP – Merchant Power Producer

4 (g) Option-7 for “Intra Day / Hour Ahead” Electricity Transactions

Option-7

Pool based on Auction (collective transaction)

Auction based

Double sided closed bidding

Bidding platform at RPC level/PX

Monitoring Committee at RPC level.

Details

Illustration & Participants

Pros

Market Discovered Price;

Dispute free;

Not administered;

Akin to DAM but closer to real time;

Cons

Preparedness of PX;

Discoms decision making process;

OA registry, a pre-requisite

Main

PX – Power Exchange; DAM – Day Ahead Market; VC – Variable Cost; MC – Marginal Cost; OA – Open Access; ISGS – Inter-State Generating Station; IPP – Independent Power Producer; MPP – Merchant Power Producer

4 (g) Option-7 “Pool based on Auction (collective transaction)”

1. **Introduction of National Uniform Price Auction based on Intra-Hour Bids**
2. **Availability of “Gate Closure”,**

3. **Addresses variations due to change in RE output at a very short time interval**
4. **Real time market design facilitating effective integration of large scale RE**

Section Main

4 (g) Option-7 for "Intra Day / Hour Ahead" Electricity Transactions

Option-7

Pool based on Auction (collective transaction)

Auction based

Double sided closed bidding

Bidding platform at RPC level/PX

Monitoring Committee at RPC level.

Illustration

- **7.30 – 8.00 – for ---9.00 to 9.15 and so on**
- **Until 7.30 am discoms can self – schedule for 9.00 to 9.15 time block, if they so desire.**
- **7.30 am onwards, no light for self scheduling for 9.00 – 9.15 block**

(This will need change in existing re-call facility of one hour)

This is not going to adversely affect discoms' right to recall as they will have several reference price points every hour to take a call on self scheduling, say for 9.00 – 9.15 and so on

Participants

- **State Gencos inclining RE, on their own , or**
- **Discoms on their behalf**
- **Discoms as buyers and sellers**
- **ISGS / IPPs / MPP**

Section Main

PX – Power Exchange; DAM – Day Ahead Market; VC – Variable Cost; MC – Marginal Cost; OA – Open Access; ISGS – Inter-State Generating Station; IPP – Independent Power Producer; MPP – Merchant Power Producer

4. Process Flow of Options for “Intra Day / Hour Ahead” Transactions

Illustration

- **Auction: 7.30 Hrs. – 8.00 Hrs. window, transaction for**

4. Process Flow of Options for “Intra Day / Hour Ahead” Transactions

Illustration

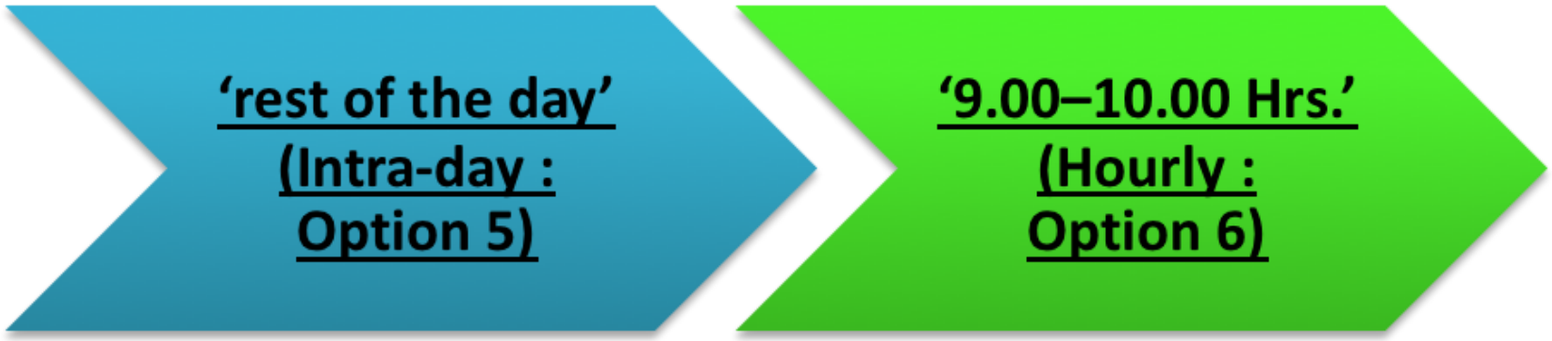
- **Auction: 7.30 Hrs. – 8.00 Hrs. window, transaction for**

‘rest of the day’ (Intra-day : Option 5)

4. Process Flow of Options for "Intra Day / Hour Ahead" Transactions

Illustration

- **Auction: 7.30 Hrs. – 8.00 Hrs. window, transaction for**



4. Process Flow of Options for “Intra Day / Hour Ahead” Transactions

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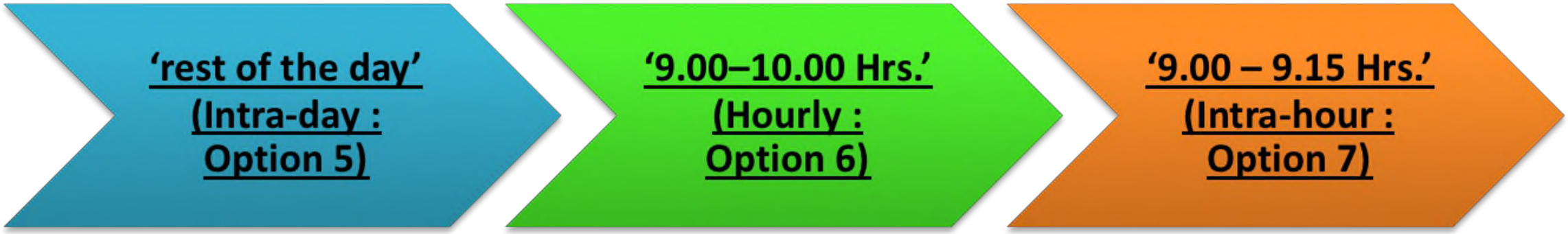
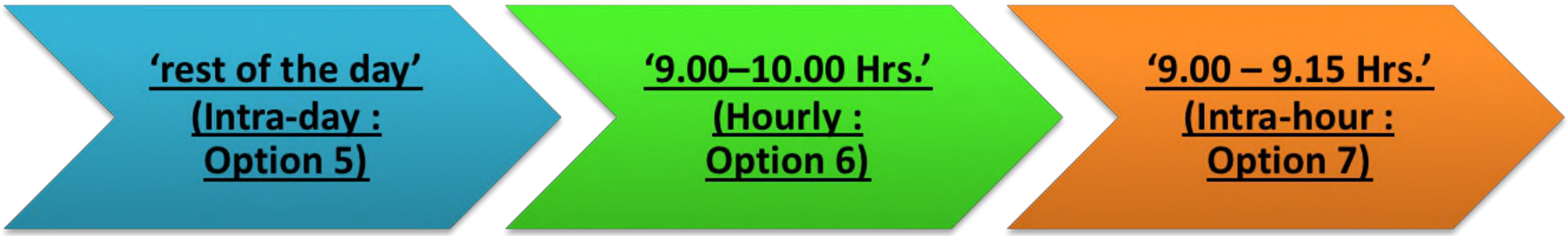
- **Auction: 7.30 Hrs. – 8.00 Hrs. window, transaction for**



4. Process Flow of Options for "Intra Day / Hour Ahead" Transactions

Illustration

- **Auction: 7.30 Hrs. – 8.00 Hrs. window, transaction for**



- **Generators can participate for sale of surplus power (over and above already scheduled on day-ahead basis)**
- **Sellers (other than generators) and buyers can participate for surplus / deficit vis-à-vis their schedule on day-ahead basis**
- **After the trade materializes under Option 5, 6 or 7 as the case may be, net schedule for the buyers and sellers shall be prepared, which will serve as reference point for Deviation Settlement Mechanism (DSM) / Unscheduled Interchange (UI)**
- **However, payment for 'Day-ahead' transaction and 'Intra-day' (Option 5) / 'Hourly' (Option 6) / 'Intra-hour' (Option 7) transactions shall be settled separately based on the schedules for the respective segments**
- **Open Access Registry and delegation of decision making authority to operating level at Discom are pre-conditions to success of this framework**

Main

Forum of Regulators
62nd Meeting, New Delhi

Annexure-III

Sub-Group Report

on

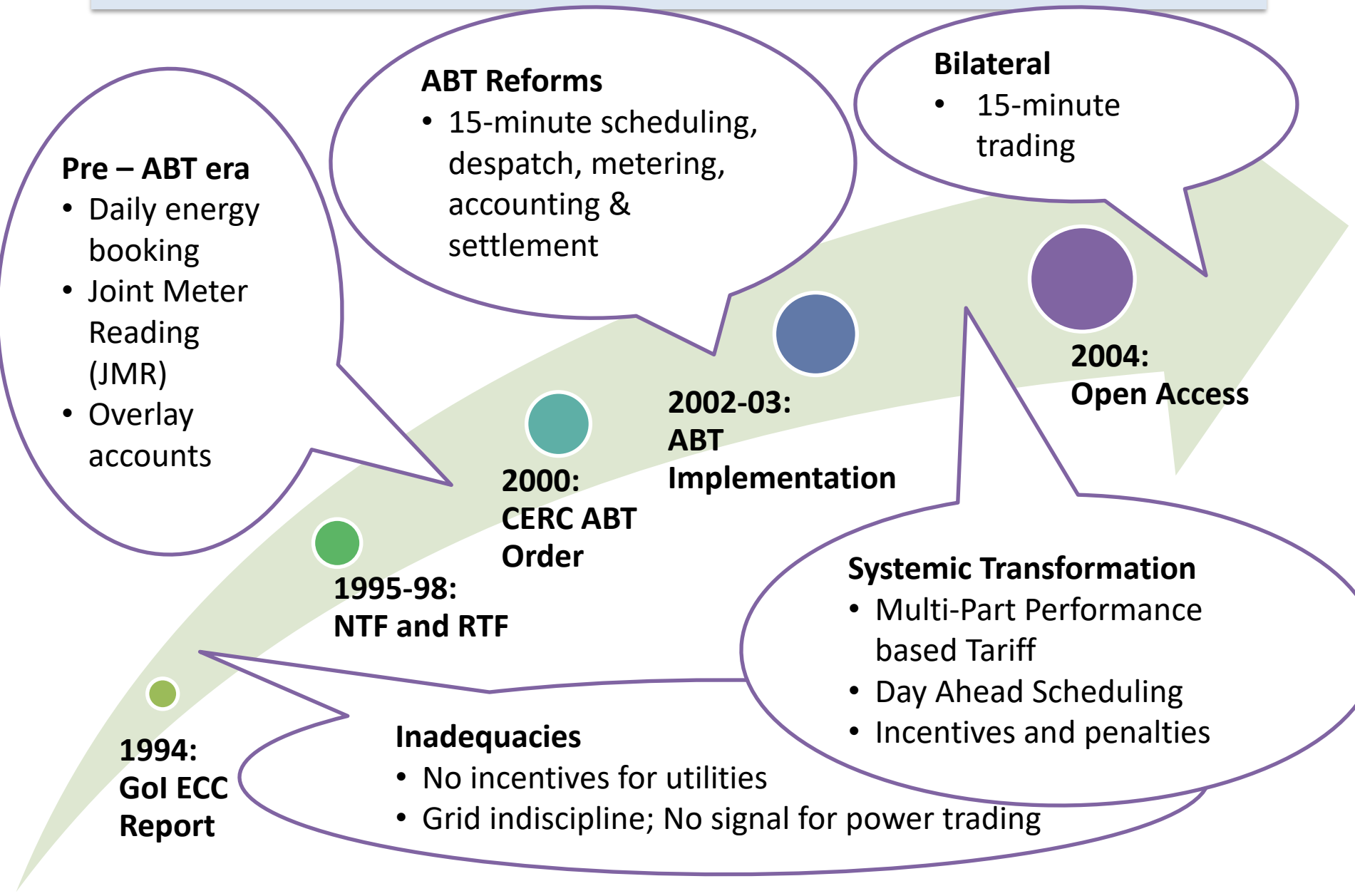
"Implementation of 5-Minute Scheduling, Metering, Accounting and Settlement"

9th April 2018

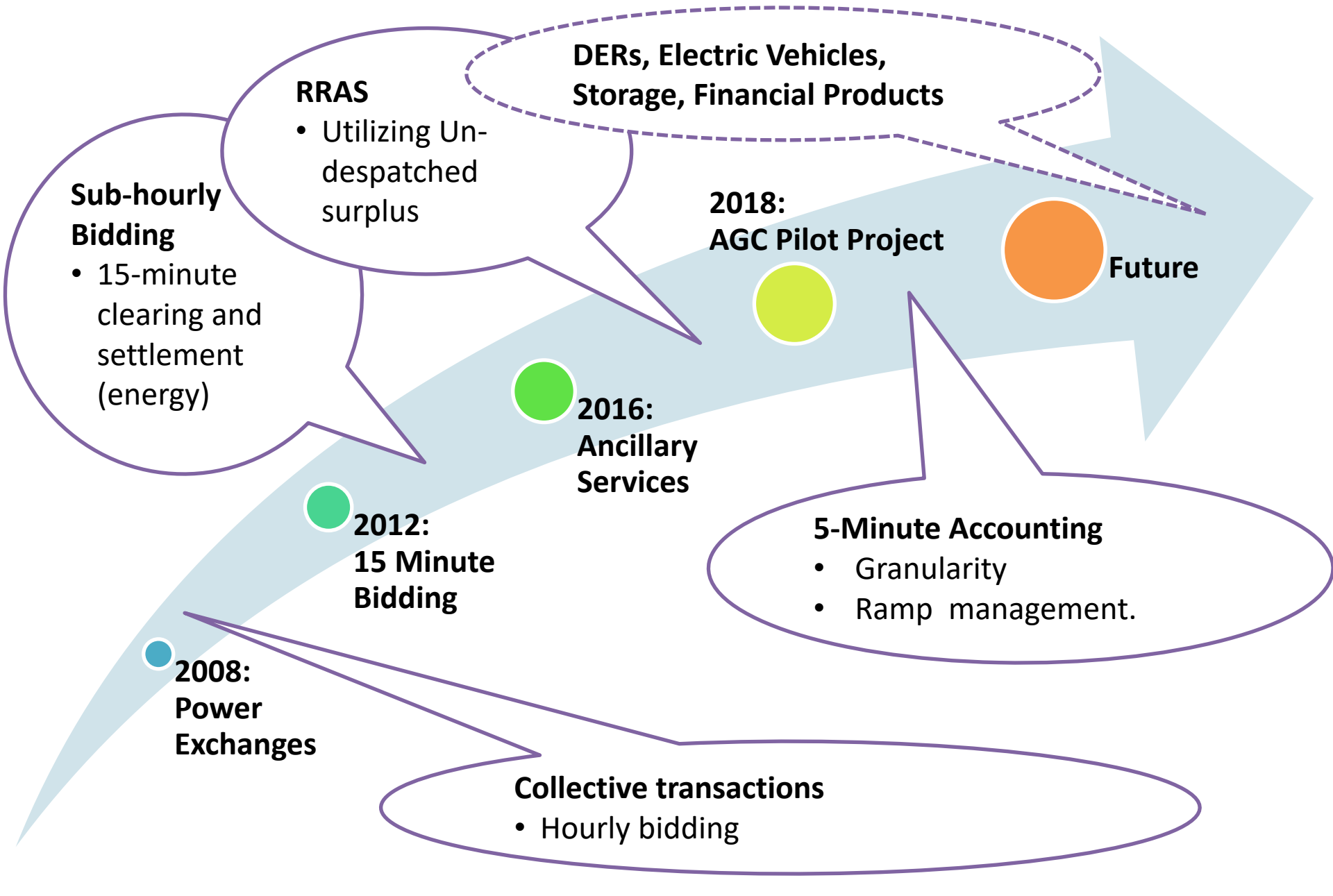
Structure of the Report

- Chapter 1 - Introduction
- Chapter 2 - Imperatives for Fast Markets
- Chapter 3 - Policy and Regulatory Mandate
- Chapter 4 - International Experience
- Chapter 5 - Deliberations and Stakeholder consultations
- Chapter 6 - Meter Capability Demonstration and Testing
- Chapter 7 - Regulatory Provisions to Handle Transition
- Chapter 8 - Action Plan
- Chapter 9 - Metering Infrastructure and Cost Estimates
- Chapter 10 - Handling Transition and Timelines
- Chapter 11 - Recommendations and Way Forward
- Chapter 12 - References

Looking Back to Look Forward



Looking Forward to Leap Ahead



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

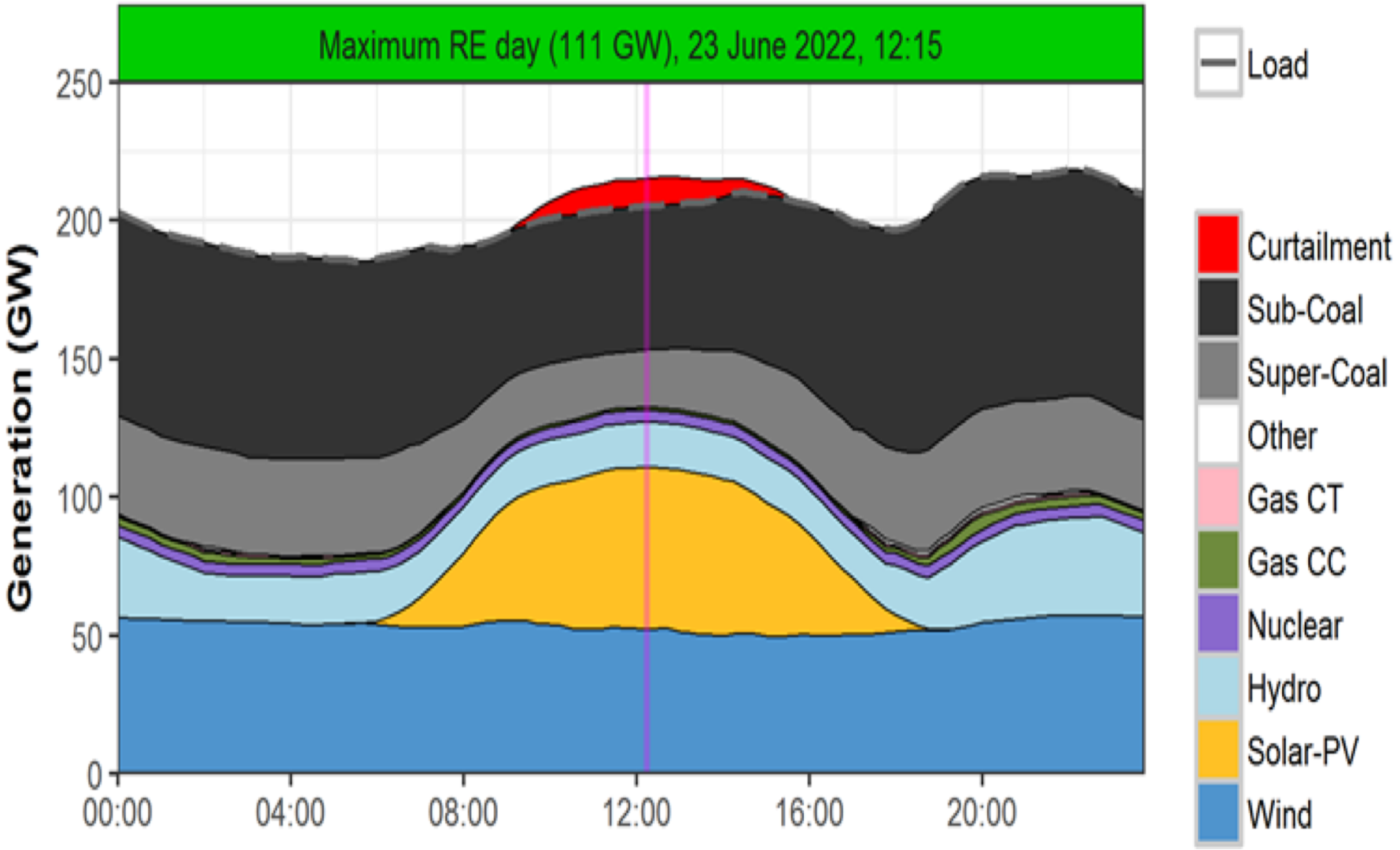
12392*	Shramjeevi SF Expres...*	SF	ECR	6	S M T W T F S	NDLS	13:10
19023	Mumbai Firozpur Jant...	Exp	WR	1	S M T W T F S	NDLS	13:15
12716	Sachkhand Express	SF	SCR	4	S M T W T F S	NDLS	13:20
12483	Kochuveli - Amritsar...	SF	NR	2	F	NDLS	13:25
19566	Uttranchal Express	Exp	WR	--	S	NDLS	13:25
12217	Kerala Sampark 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

Increasing Renewable Energy Penetration



Sample Day in 2022 (Source: GtG Study Report)

Harnessing and Incentivizing Flexibility

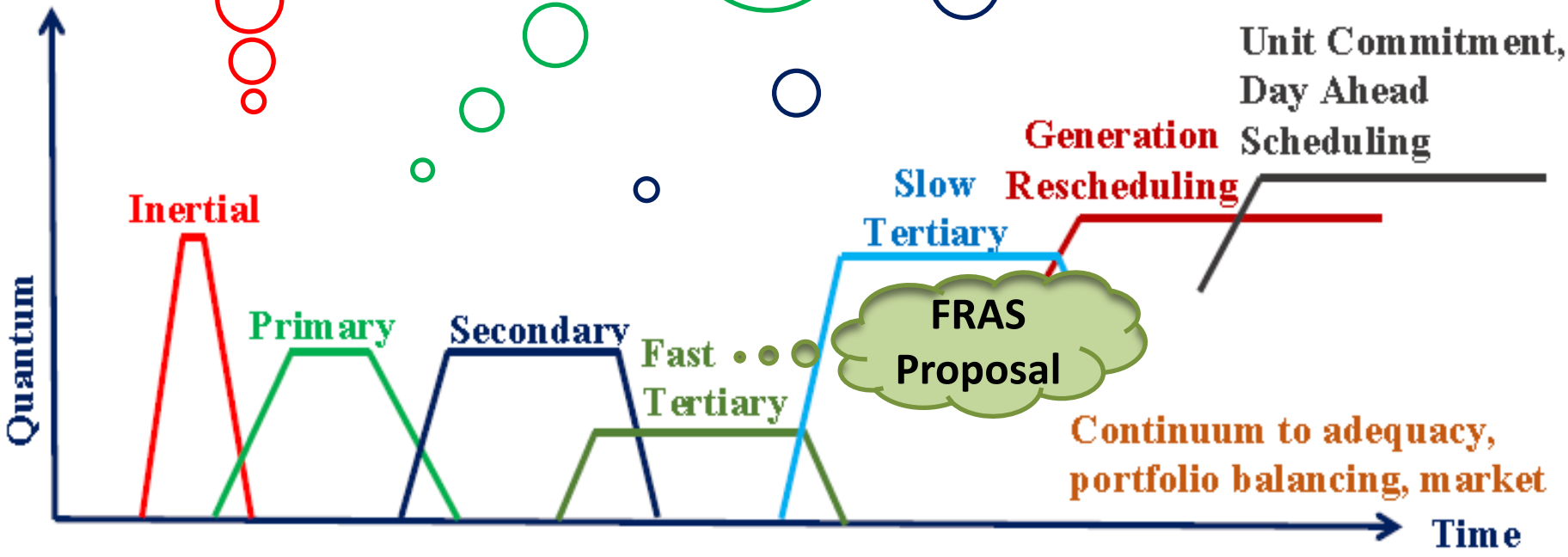
Especially Hydro in Five Minute Timeframe

Fast Response Ancillary Services

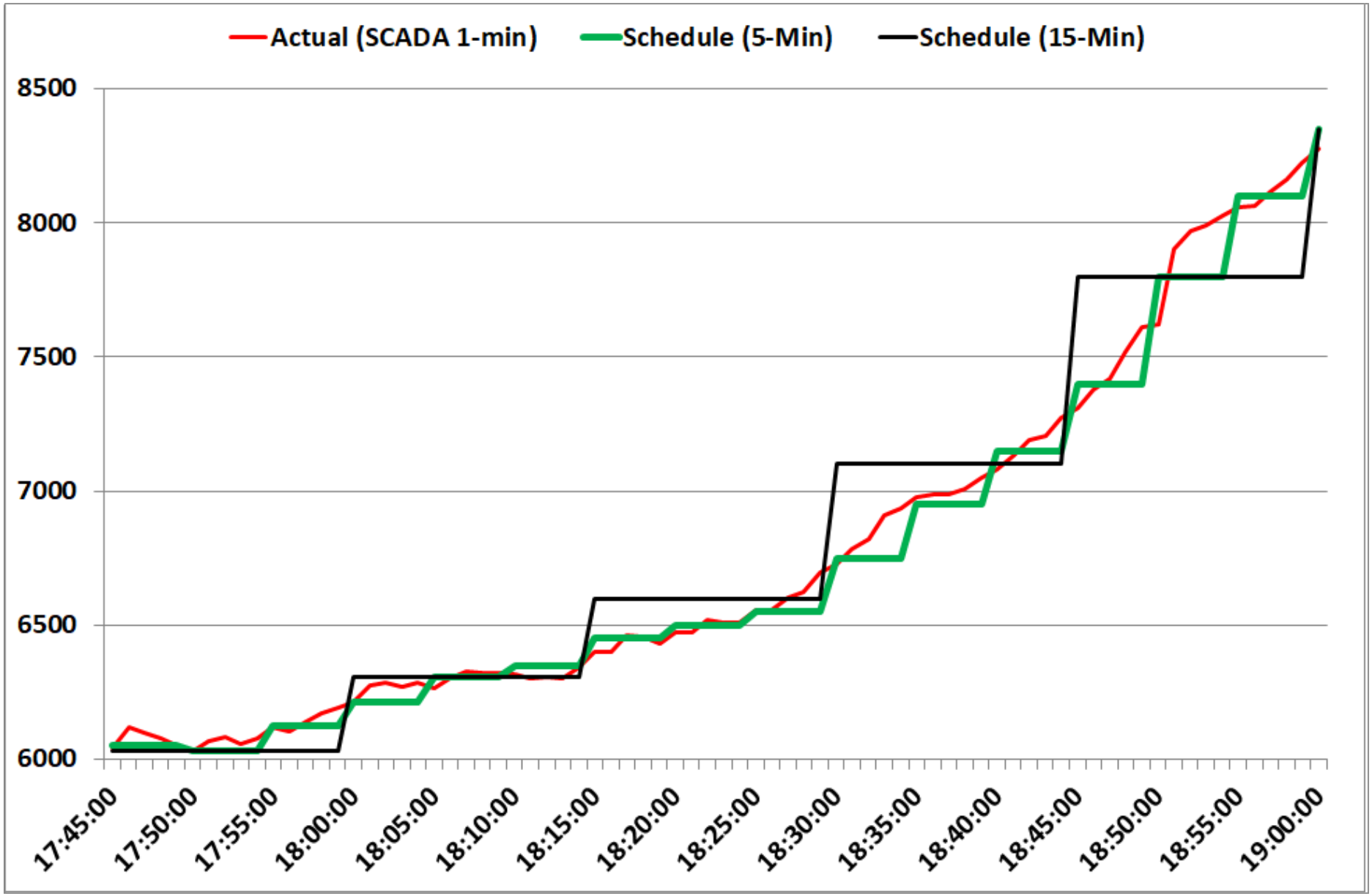
Inertia Decreasing, 175 GW RE, Need to have more hydro machines

Mandated as per Grid Code for all; Need for faster response from Hydro

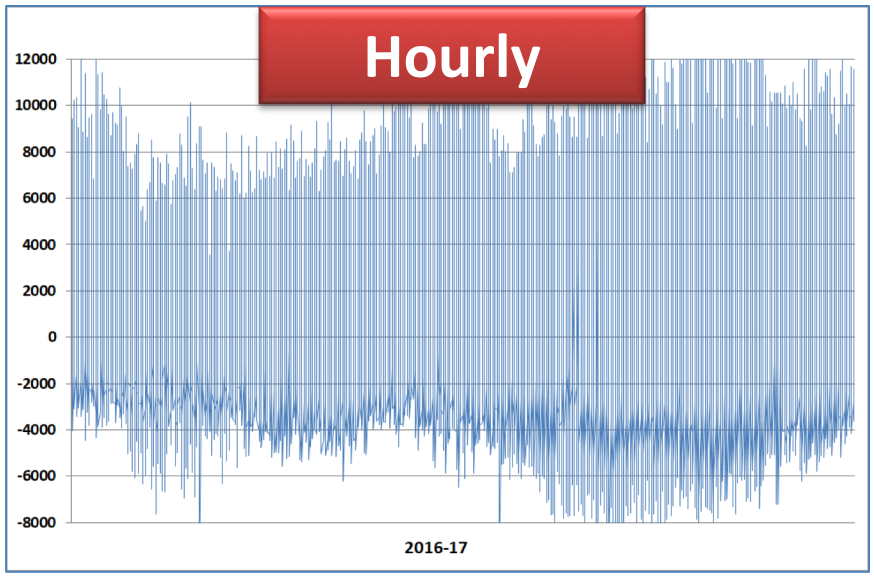
AGC Pilot Project Operational; Hydro stations may be put on AGC on pilot basis

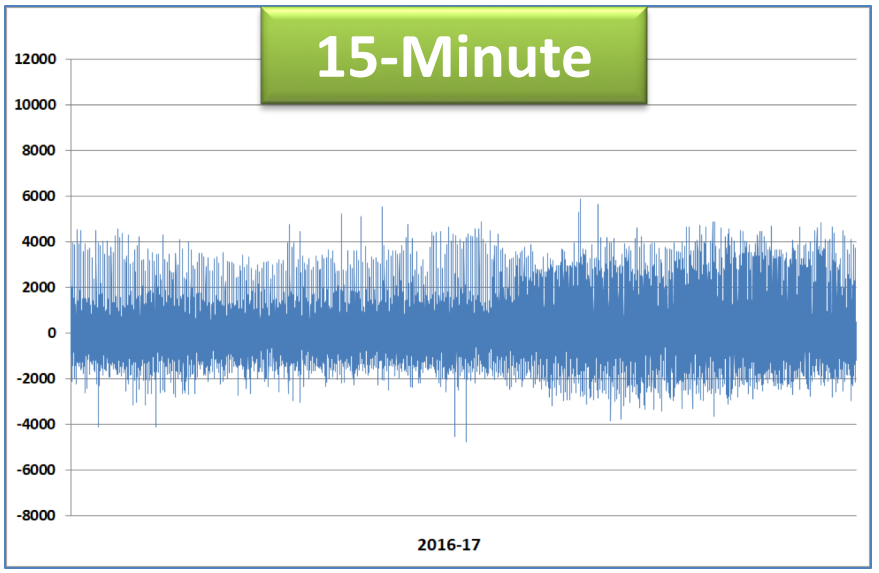


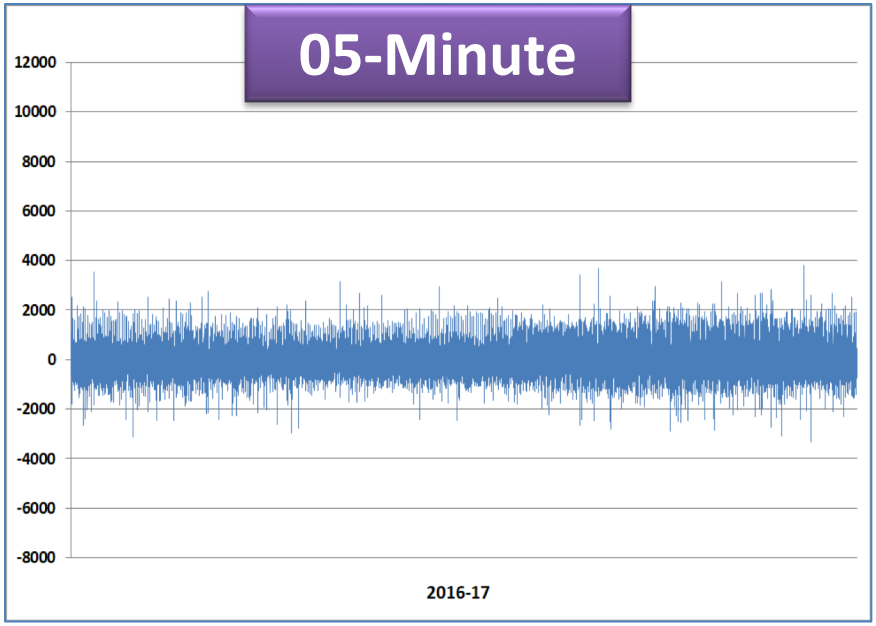
Ramp Management



Reduced Variability and Reserve Requirement







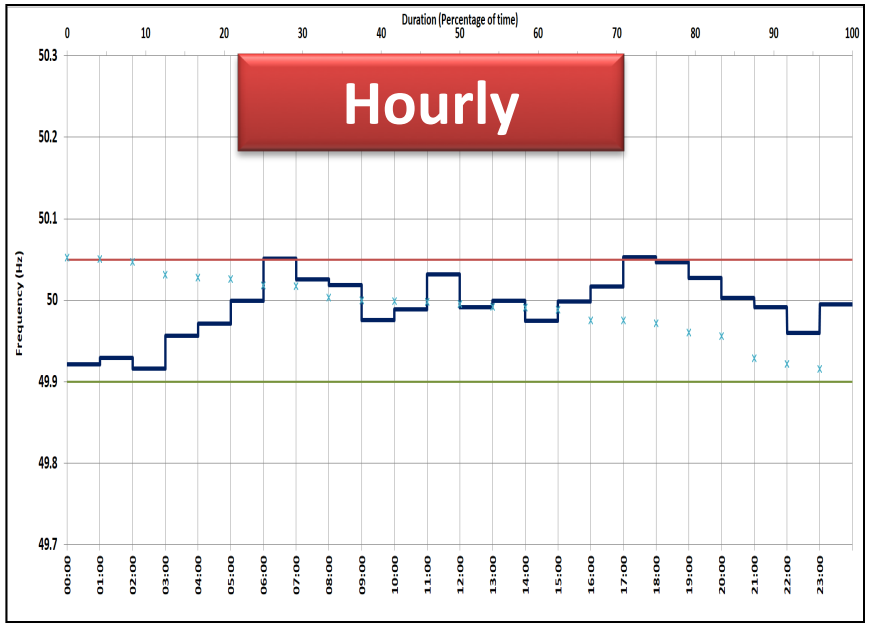
Reserve Requirement
Three Sigma

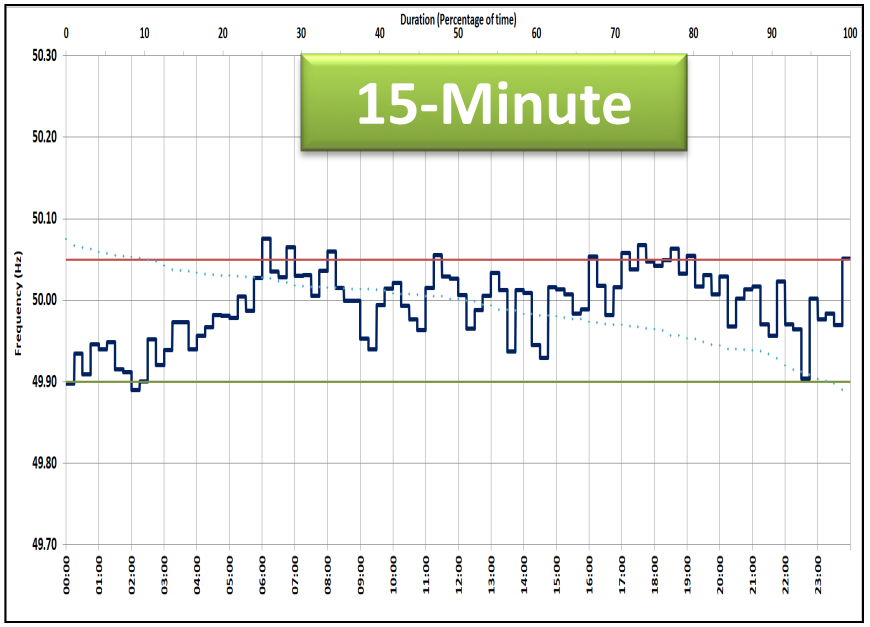
Hourly Despatch ~ 11,000 MW

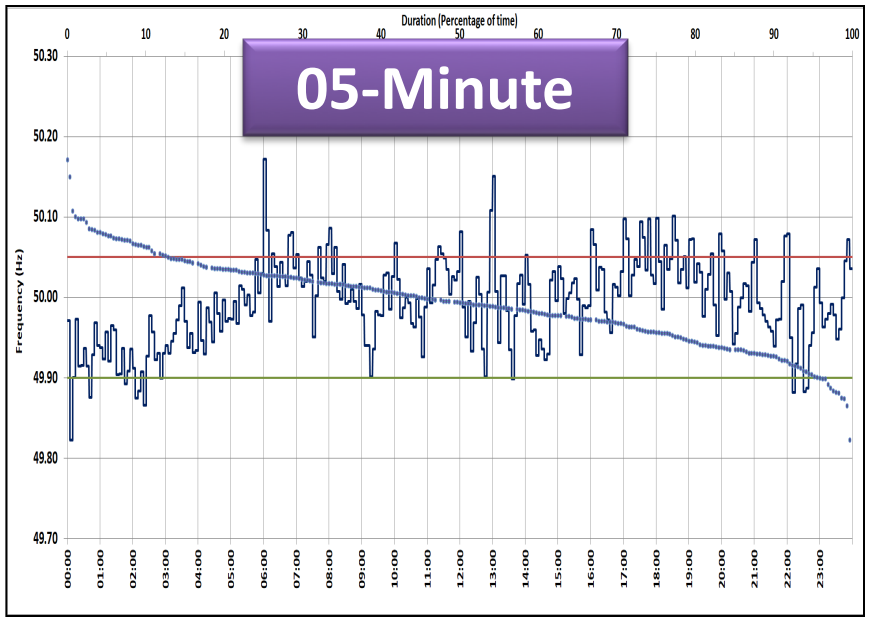
15-Minute Despatch ~ 3300 MW

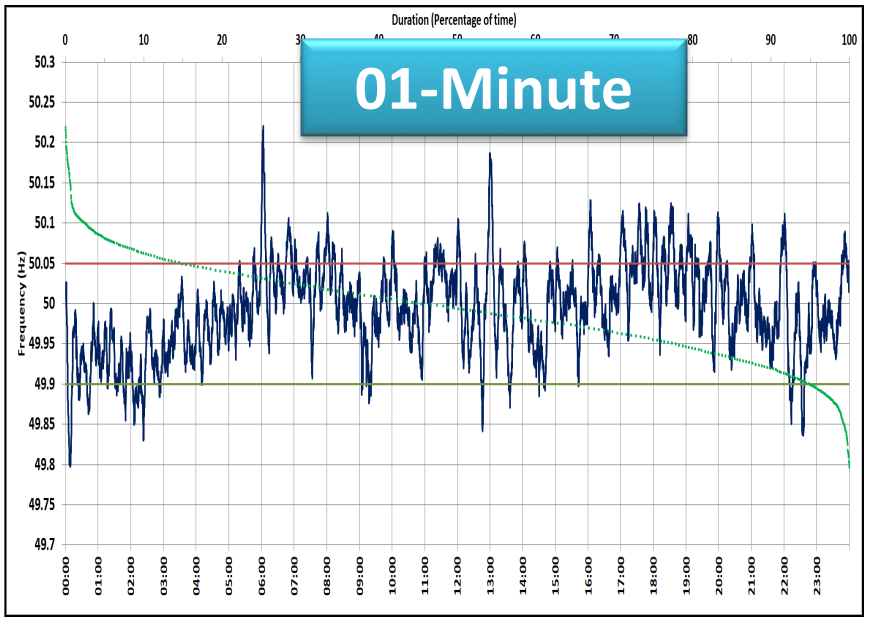
05-Minute Despatch ~ 1400 MW

Frequency Profile – Different Timescales

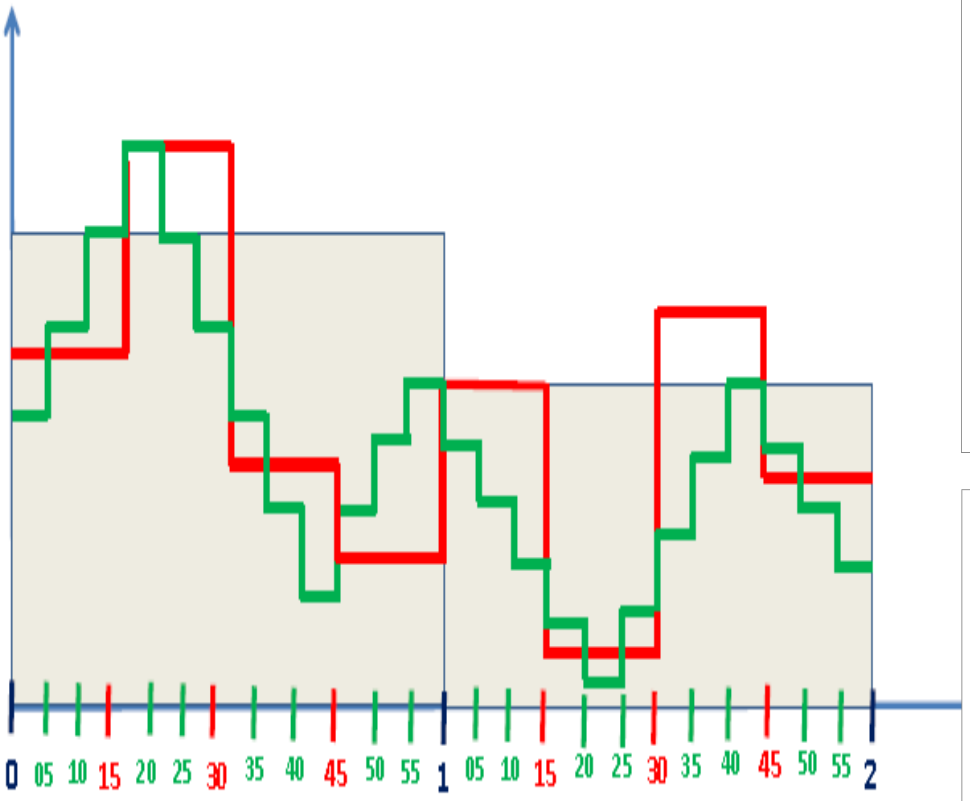




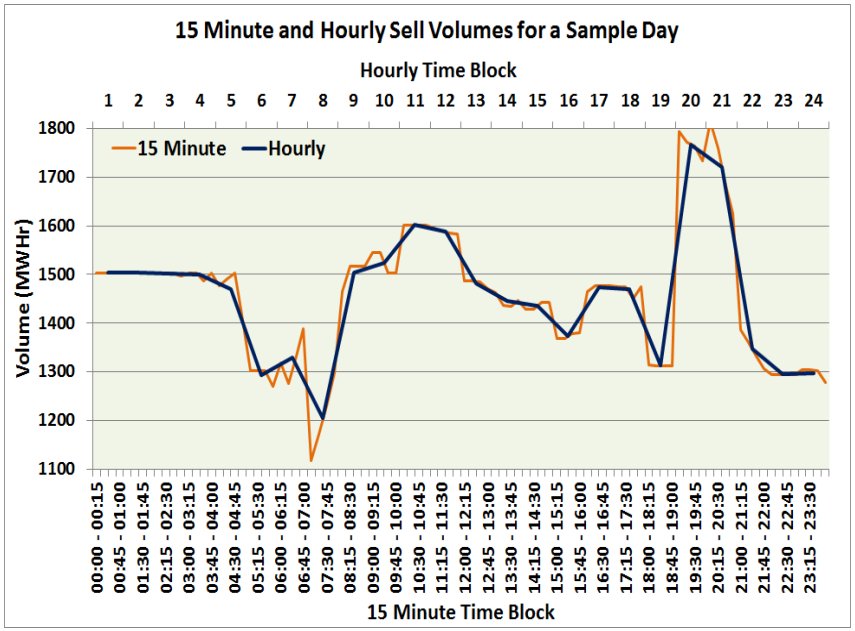


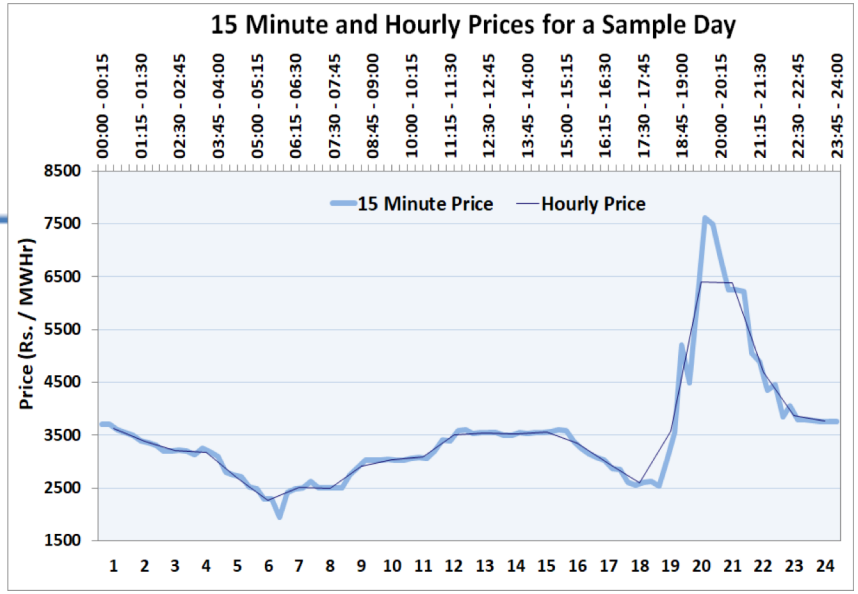


Economic (Price) Signals at Shorter Intervals



5 Minute, 15 Minute and Hourly Schedules





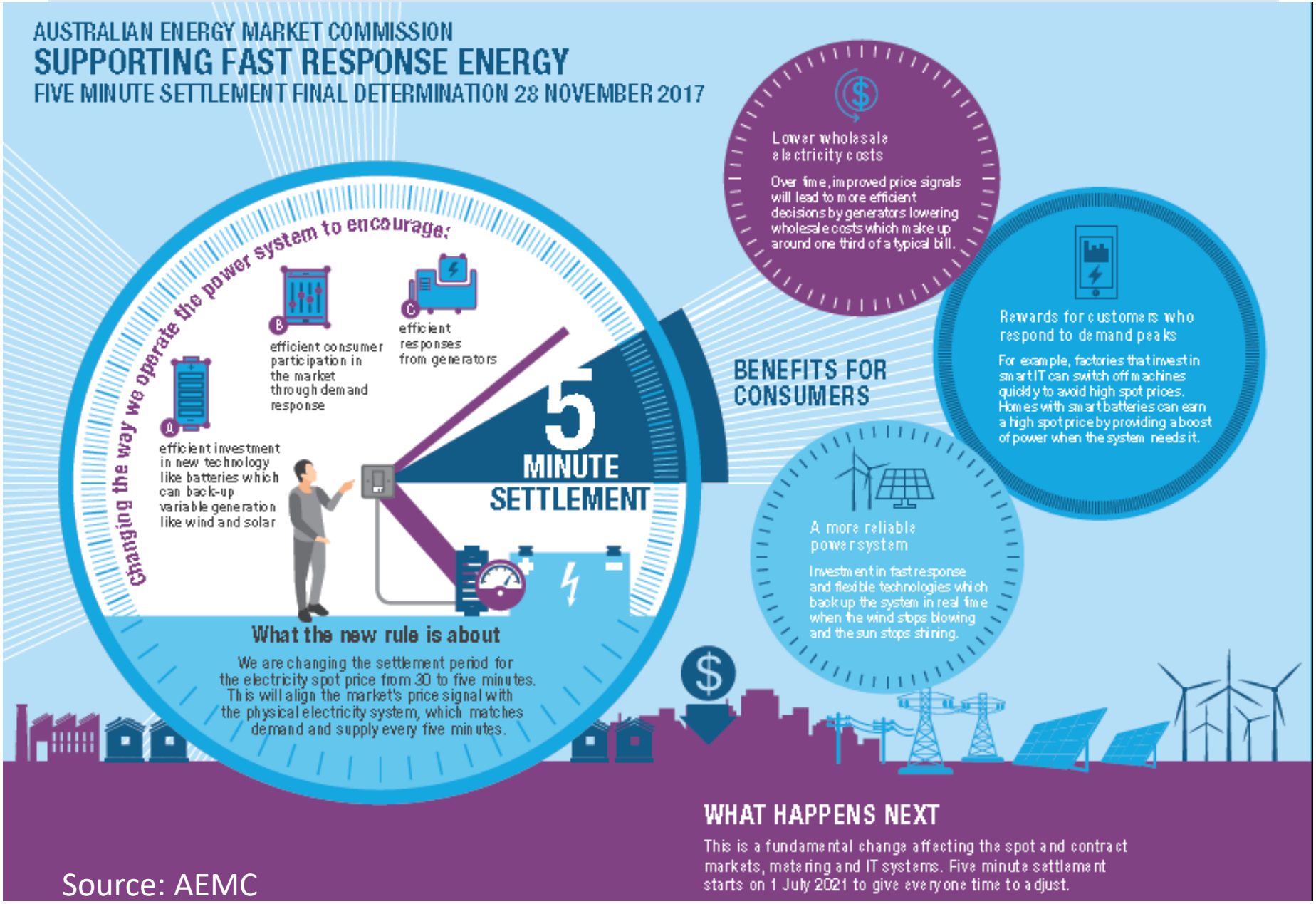
Imperatives & Benefits of Moving to Fast Markets

- Target 175 GW by 2022 – Increasing RE Penetration
- Valuing and harnessing flexibility
- Maintaining reserves for system balancing
- Ramp management
- Need for enabling economic / price signals at shorter intervals
- Need for new products – Fast response Ancillary Services
- Facilitating better portfolio management
- Handling deviations
- New technologies – Storage, Electric Vehicles
- Fast markets (5-minutes) – A catalyst for causing economy
  - A low handing fruit

Policy / Regulatory Mandate

- CERC Consultations/Orders/Regulations
  - Consultation Paper on Modifications in Power Market Design: Evening Market, 15 minute Bidding time block and Ancillary market on PX (2010)
  - Order on Automatic Generation Control (AGC) Pilot Project (2017)
  - Communication System for Inter-State Transmission of Electricity Regulations (2017)
- NITI Ayog Report - India's Renewable Electricity Roadmap 2030 (2015)
- Ministry of Power Technical Committee Report (2016)
- Forum of Regulators (FOR) - SAMAST Report (2016)
- FOR Model Deviation settlement Regulations (2017)
- NITI Aayog - Draft National Energy Policy (2017)

International Experience – Australia (1)



Source: AEMC

International Experience – Australia (2)

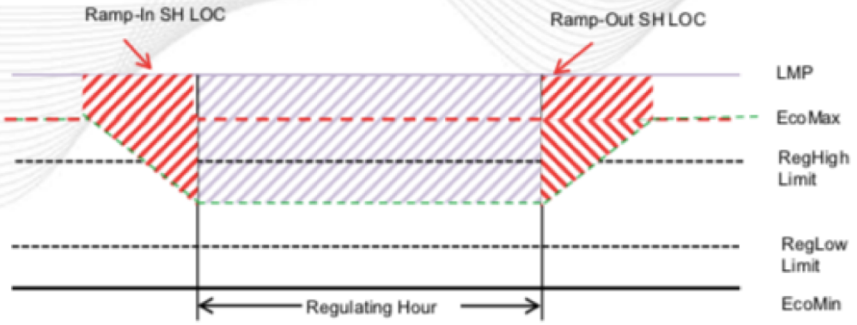
- According to AEMC, the cost of implementing the 5 minute settlement represents mainly one -off costs
  - Relatively small compared with the ongoing annual NEM transactions (AUS$ 16.6 billion in 2016/17) and with an expected medium term generation investment of up to AUS$ 90 billion.
  - benefits of this implementation would outweigh the costs.
  - According to them a reduction of AUS$ 0.50/MWh in average wholesale price would represent savings of around AUS$100 million per year in energy costs which is translated in lower retail prices to consumers (AEMC 2017, p. vi).

Shoulder Hour Lost Opportunity Cost

Shoulder Hour Lost Opportunity Cost

Existing

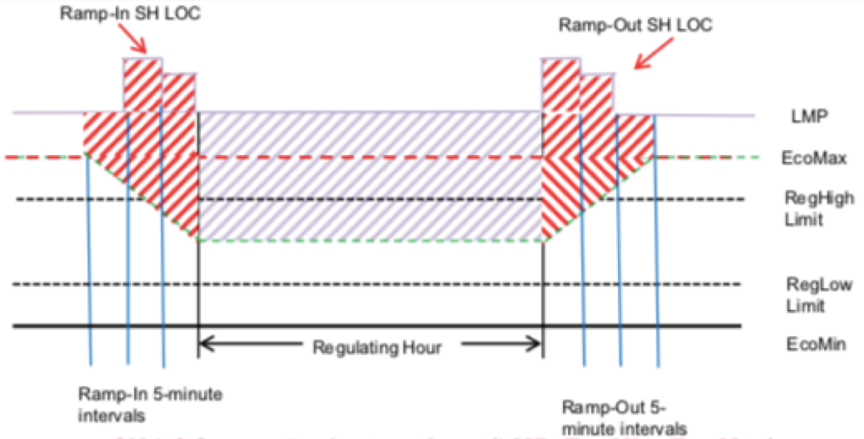
- SH LOC is cost incurred or revenues lost in ramp-in and ramp-out hour to move uneconomically to regulation assignment
- Determined using hourly LMP and MW values then adjusted by percentage of hour that unit is increased or decreased from its economically desired output using offer ramp rates



SH LOC uses hourly integrated values then adjusts using % of hour

5-Minute Settlement

- SH LOC is cost incurred or revenues lost in the 3 ramp-in and ramp-out 5-minute intervals to move uneconomically to regulation assignment
- Determined using 5-minute LMP and 5-minute MW
- Regulation high and low limits and Regulation assigned MW from first or last 5-minute interval of regulating hour
- Ramp-in Shoulder Hour: LOC calculated for last three 5-minute intervals
- Ramp-out Shoulder Hour: LOC calculated for first three 5-minute intervals



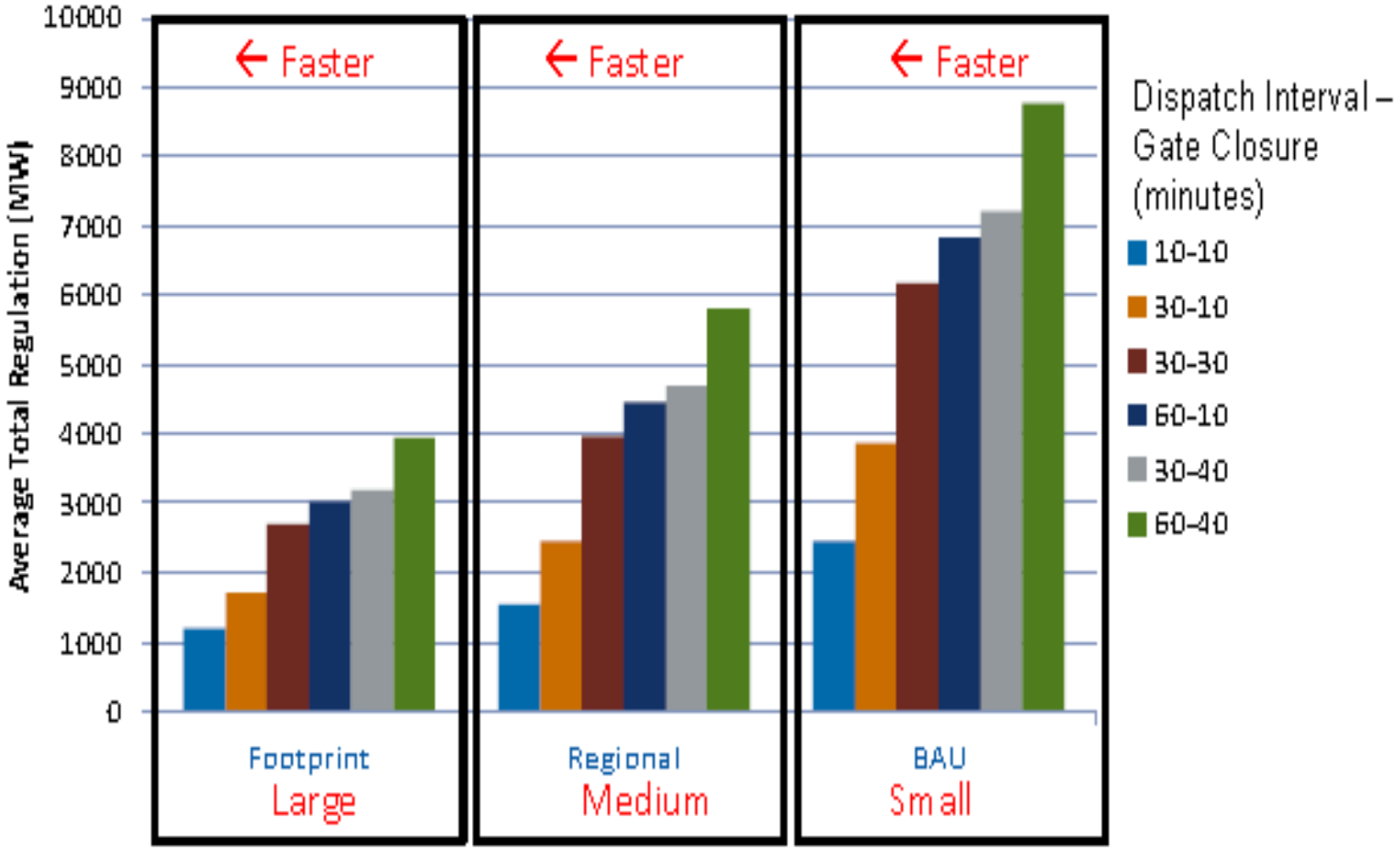
SH LOC uses 5-minute values (LMP, EcoMin, EcoMax)

Source PJM: http://www.pjm.com/-/media/committees-groups/forums/tech-change/20180108/20180108-5-minute-settlements-education.ashx

Benefits – US ISOs/RTOs

- Five-minute dispatch - Over 2/3 of the national load
- Five minute scheduling adopted
  - it reduces power system operating costs
  - Enables renewable generation integration.
- Five minute scheduling has helped reduce regulation requirements to below 1% of peak daily load in many ISO/RTOs.
- Studies have shown that integration costs are lower in areas with faster despatch.
  - Eg., integration costs have ranged from $0 to $4.40/MWh with 05-minute dispatch, compared to $7 to 8/MWh with hourly dispatch (WGA 2012)
  - Eg. Western Wind and Solar Integration Study 1 - Sub-hourly scheduling cut in half the amount of fast maneuvering required by combined-cycle plants.
  - Hourly scheduling had greater impact on regulation requirements than the variability introduced by wind and solar power in the scenarios studied.

Despatch Interval and Regulation



Milligan, Kirby, King, Beuning (2011), The Impact of Alternative Dispatch Intervals on Operating Reserve Requirements for Variable Generation. Presented at 10th International Workshop on Large-Scale Integration of Wind (and Solar) Power into Power Systems, Aarhus, Denmark. October

International Experience - USA

Table i. ISO's intraday timeline summary[4]

ISO	Procedure	Frequency	Look-ahead	Commitment	Dispatc	Prices[5]
CAISO	Residual unit commitment (RUC)	Daily	24-168 h	Long start units		Availability[6]
	Short-term unit commitment (STUC)	1 h	4 h	Medium/short		
	Real-time unit commitment and FMM	15 min	60-105 min	Fast start units	✓	✓
	Real-time economic dispatch	5 min	Up to 60 min		✓	✓
ISO-NE	Resource Adequacy Analysis (RAA)	Daily	Oper. day	Non-fast start		
	Additional RAAs	As needed	Oper. day	✓		
	Unit dispatch software	5 min	60 min		✓	Ex-post
MISO	Reliability Assessment Commitment	Daily	Oper. day	✓		
	Intraday RAC	As needed	Oper. day	✓		
	Look-ahead commitment (LAC)	15 min	3 h	✓		
	Real-time SCED	5 min	N/A		✓	Ex-post
NYISO	Supplemental resource evaluation	As needed	Oper. day	✓		
	Real-time commitment (RTC)	15 min	150 min	✓		
	Real-time dispatch (RTD)	5 min	60 min		✓	✓
PJM	Reliability Assessment Commitment	Daily	Oper. day	✓		
	Combustion Turbine Optimizer (CTO)	As needed	Oper. day	✓		
	Ancillary Service Optimizer (ASO)	1 h	60 min	✓		
	Intermediate-term SCED	15 min	60-120 min	✓		
	Real-time SCED	5 min	15 min		✓	✓
ERCOT	Day-ahead Reliability Unit	Daily	Oper. day	✓		
	Hourly RUC	1 h	Oper. day	✓		
	SCED	5 min	N/A		✓	✓

USA ISOs Intraday Timeline Summary (Source: MIT Energy Initiative)

Deliberations in Meetings (1)

- Need to move to “fast” markets
- 5-minute scheduling & settlement and earmarking of the reserves are interwoven processes.
- 5-minute bidding in OTC/PX markets will lead to more granular price discovery.

- 5-minute DSM prices would be a vital indicator for imbalance handling caused especially by renewable generation.
- Provisions for 5-minute may be made mandatory for future procurement of meters.
- Requirement of amendments in the CEA Metering Standards
- 5-minute scheduling & settlement entail regulatory interventions

Deliberations in Meetings (2)

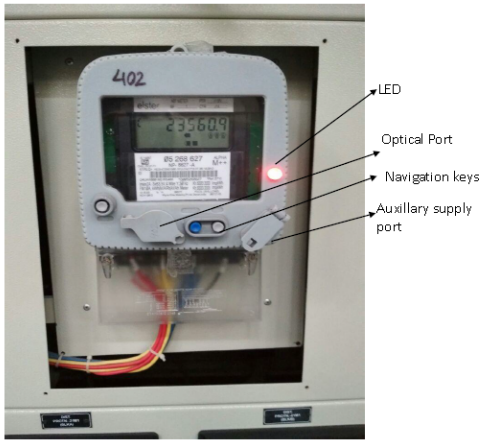
- Handling Transition
  - To begin with, 5-minute metering will be in parallel with 15 minute metering. A changeover date would be applicable
  - “Scheduling and Despatch” has to be aligned with “Settlement” process in 5-min too.
  - To begin with, accounts for both 5-minute and 15-minute accounting may be kept in parallel.
- Capacity building for 5-Minute granular forecasting at state level
- SAMAST implementation would enable states to leapfrog
- Stakeholder Consultations
  - RPC Forum
  - Discoms – Gujarat, Delhi, Tamil Nadu and West Bengal

Meter Demonstration

Main meter: NP-8607 A (Elster)
Model- Alpha M++

Check meter: Y0356046 (Secure)
Model- Apex 150

Main meter: NP-8627 A
Model- Alpha A1640



Check meter: NR-3102 A
Model- Alpha M++

Main Meter – NP 2985A (Secure)
Model E2M021

Check Meter - H 170903 (L&T)
Model ER300P

Meter Testing Witnessed Jointly by Representatives of NLDC, WRLDC, POWERGRID, Gujarat SLDC and Meter Manufacturers

Demonstration of 5-Minute Metering at POWERGRID 400/220 kV GIS Magarwada Station, Daman, 13th Sep 2017

1. List of participants attached
2. Objective:
   a. Demon… ing at 15-minute interval) for record…
   b. Validate… g 15-minute meters
3. Participating M…
   a. M/s Se…
   b. M/s Ho…
   c. M/s L&… the 25th September as the re-configu…
4. Site Description … wing elements:
   a. 400 kV …
   b. 400 kV …
   c. 400 kV …
   d. 400 kV Magarwada Boisar s/c
   e. 315 MVA 40…
   f. 315 MVA 40…
5. Existing Meter Placem…
   a. In 400 kV lines, the main meters are placed at both ends
   b. On the ICTs, main meter on HV side and standby meter on LV side
   c. Drawl of Daman & Diu computed from the HV side meters of the ICTs
   d. All the meters at Magarwada end are of Elster make Model 'Alpha M++'

Magarwada S/s

Meter No.	CT Ratio	PT Ratio	Element Detail
NP-8627-A	1000/1	400/100	400KV Navsari Magarwada - I
NP-8589-A	1000/1	400/110	400KV Navsari Magarwada - II
NP-8598-A	1000/1	400/110	400kv Boisar Magarwada(PG)
NP-8607-A	1000/1	400/110	400KV Kala Magarwada GIS(PG)
NP-8626-A (HV)	600/1	420/110	315 MVA 400/220 kV ICT I
NP-8597-A (LV)	1000/1	245/110	315 MVA 400/220 kV ICT I
NP-8604-A (HV)	600/1	420/110	315 MVA 400/220 kV ICT II
NP-8624-A (LV)	1000/1	245/110	315 MVA 400/220 kV ICT II

WRLDC NLDC SLDC-GJ POWERGRID ELSTER SECURE

Demonstration of 5-Minute Metering at POWERGRID 765/400/220kV GIS Vadodara Station, Gujarat, 10th Oct 2017

1. List of participants attached in annexure-1
2. Objective:
   a. Dem… ling at 15 minu…
   b. Vali… isting 15-minu…
3. Site descrip… following elements
   a. 400…
   b. 400…
   c. 400…
   d. 400…
   e. 765…
   f. 765…
   g. 765…
   h. 400…
4. Existing Me…
   a. Spec… ICTs are stand… main meters.
   b. SEMs at Vadod… scription of meters is as below.

Vadodara S/s

S. No	Meter ID	Make	Model No.	Description
1	NP-2979-A	SML	E2M021	765KV Indore(PG) line at Vadodara(PG)
2	NP-2977-A	SML	E2M021	765KV Dhule(BDTCL) line at Vadodara(PG)
3	NP-2981-A	SML	E2M021	400KV Pirana(PG) line-1 at Vadodara(PG)
4	NP-2983-A	SML	E2M021	400KV Pirana(PG) line-2 at Vadodara(PG)
5	NP-2985-A	SML	E2M021	400KV Asoj line-1 at Vadodara(PG)
6	NP-2986-A	SML	E2M021	400KV Asoj line-2 at Vadodara(PG)
7	NP-2978-A	SML	E2M021	765KV side ICT-1 at Vadodara(PG)
8	NP-2982-A	SML	E2M021	400KV side ICT-1 at Vadodara(PG)
9	NP-2980-A	SML	E2M021	765KV side ICT-2 at Vadodara(PG)
10	NP-2984-A	SML	E2M021	400KV side ICT-2 at Vadodara(PG)
11	NP-5446-A	ELSTER	Alpha M++	400KV side of ICT-1 at Vadodara(PG)
12	NP-5448-A	ELSTER	Alpha M++	220KV side of ICT-1 at Vadodara(PG)
13	NP-5447-A	ELSTER	Alpha M++	400KV side of ICT-2 at Vadodara(PG)
14	NP-5449-A	ELSTER	Alpha M++	220KV side of ICT-2 at Vadodara(PG)

SLDC Gujarat WRLDC NLDC POWERGRID LBT-Baroda LBT

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	No retention
Conversion software for NPC File	The software for conversion to .npc file is available	Software for converting to NPC format needs upgrade	The software for conversion to .npc file is not available
Wh recording	Acceptable	Acceptable	Acceptable
VARh recording	Variations observed due to integration time difference		Data not available
Storage	Could not be ascertained		Storage upgraded in factory

Required Regulatory Interventions

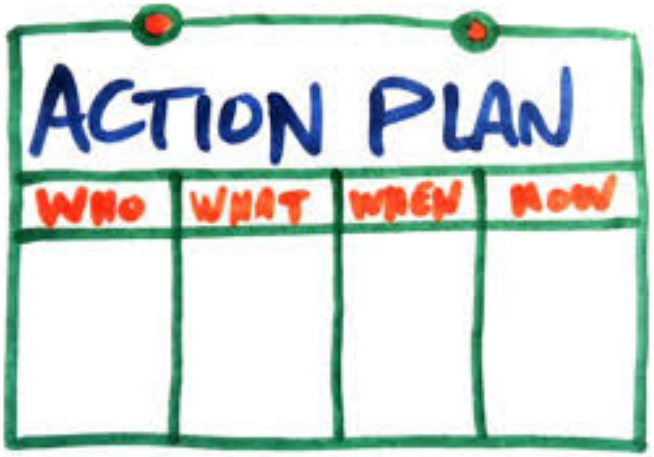
- **CERC Regulations**
  - Terms and Conditions of Tariff
  - Indian Electricity Grid Code
  - Deviation Settlement Mechanism
  - Open Access in inter-State Transmission
  - Ancillary Services Operations
  - Measures to relieve congestion in real time
- **Need for Expert Group:**
  - Technical Specifications for Interface Energy Meters
  - File Interchange Formats
  - Automated Meter Reading System
  - Communication Infrastructure
  - Application software at Central Location
  - Metering System Administration
  - Recovery of CAPEX and O & M charges

Modifications in CEA Metering Standards

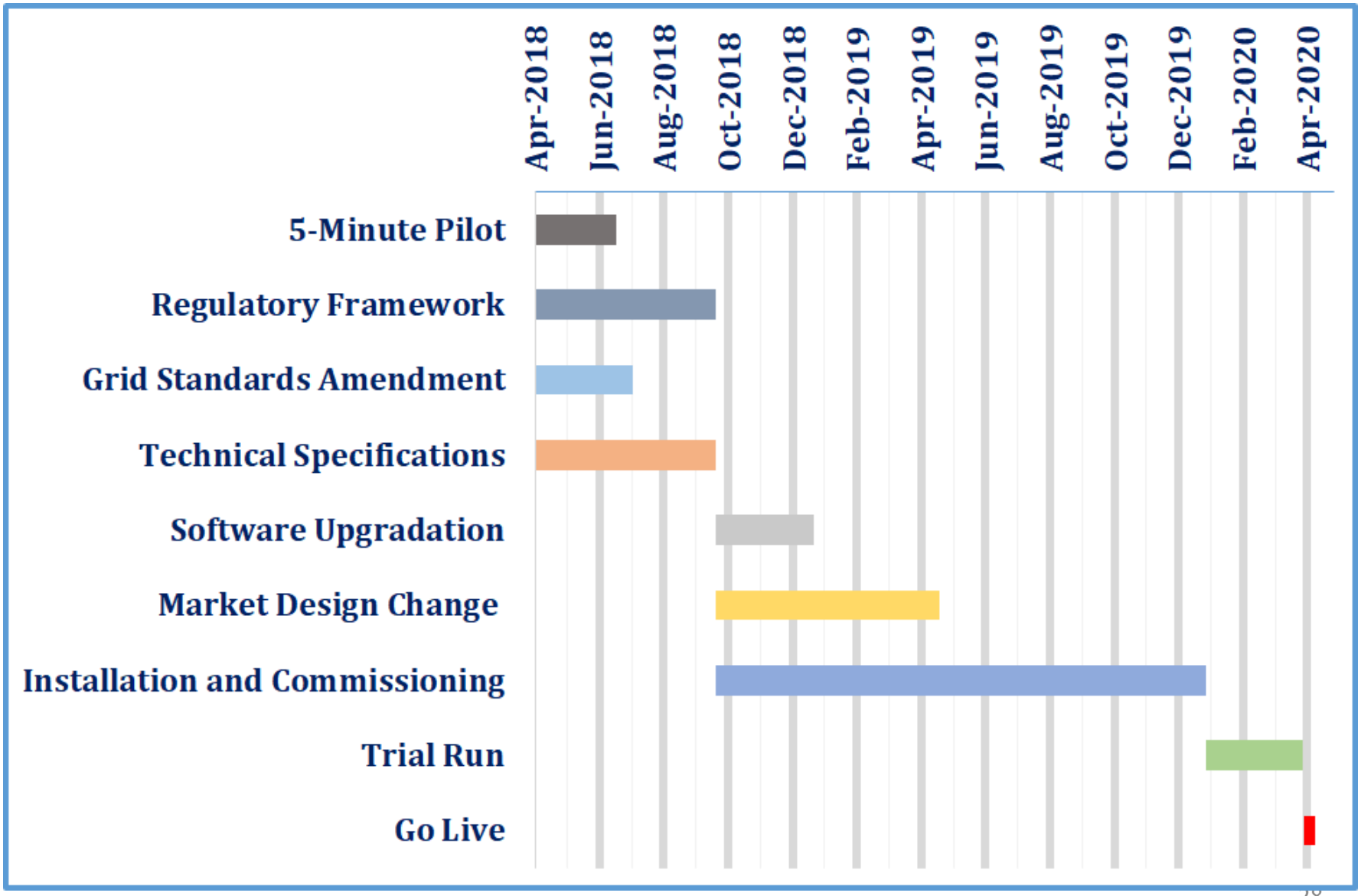
- Record frequency data at 0.01 Hz resolution
- Net VARh and voltage to be recorded for each time block.
- Auxiliary Supply - SEM may normally be capable of operating with power drawn from the VT secondary circuits.
- Provision to operate on control power supply to the SEM from 110V DC / 220V DC.
- Built-in calendar and clock
- Secured software based solution for meter time correction and synchronization with GPS
- DLMS compliant for SEM communication protocol – Indian COSEM standard
- Data security ensured as per IEC-62056-51 standard
- Automated Meter Reading (AMR)
- Uniform protocol for communication for meters of different vendors.
- Optical coupling cable should be compatible with all types of meters.
- Replacement of defective meters within a stipulated time frame

Action Plan

- Forecasting
- Scheduling & Despatch
- Power Exchanges – 5 minute price discovery
- Administration and Treatment of DSM
- Metering and Settlement
- Regulatory Amendments
- Gate closure provisions
- CEA Metering Standards Amendments
- Upgradation/Replacement of meters
- Cost Recovery
- Software upgrade at the RPC/RLDC/SLDC
- Implementation of SAMAST Recommendations
- Stakeholder Capacity Building
- Centre for Power Sector Information Technology Services



PERT Chart of Activities



Cost Benefit Analysis

(~ 6000 meters @ ₹ 30,000/Meter) at inter-state level with 5 minutes integration

S.No.	Item	Estimated cost
1.	Tentative Cost of replacement of all Pan-India Interface Energy Meters	**₹ 20 Crore**
2.	Additional costs for hardware/software upgradation (@ 50 %)	**₹ 10 Crore**
3.	**Total**	**₹ 30 Crore**

- **Method 1**
  - PoC Yearly Transmission Charges (YTC) ~ ₹ 32,000 Crore.
  - **Cost of replacement ~ 0.009 % of YTC.**
- **Method 2**
  - 15-minute despatch - Reserve requirement is of the order of 3300 MW.
  - Daily Average RRAS despatch ~ 8 – 10 MUs
  - 5-minute despatch - Reserve requirement is of the order of 1400 MW
  - Assuming RRAS despatch decreases by say, at least 30 %, on an daily average basis
  - Assuming fairly accurate load forecasting & portfolio management
  - Daily Average RRAS despatch reduces to ~ 5 – 7 MUs -> **Saving of ~ 3 MUs/day**

Recommendations

- Development of Forecasting as a Core Area in System Operation
- Implementation of Five minute Scheduling and Despatch
- Implementation of 5-minute bidding in OTC/PX
- Five-minute Energy Accounting and Settlement System
- Administration and Treatment of the Five-minute Deviation Price
- Pan-India Pilot Project on 5-minute metering
- Change in data exchange file structures and other technical issues
- Regulatory Interventions
- Amendments in CEA Metering Standards
- Upgradation/Replacement of Meter Infra
- Stakeholder Capacity Building
- Implementation of SAMAST Recommendations

Thank You !

Annexure-IV

62nd FOR Meeting
Delhi
09 April 2018

Introduction of Fast Response Ancillary Services (FRAS) from Hydro Generating Stations

Reserve Regulation Ancillary Services – At a Glance

(April, 2016 – February, 2018)

RRAS Providers:
55 Nos.

Capacity under RRAS:
56 GW

Highest Variable Charge
~ Rs. 10.24 / Unit
(Auraiya LF– NR)

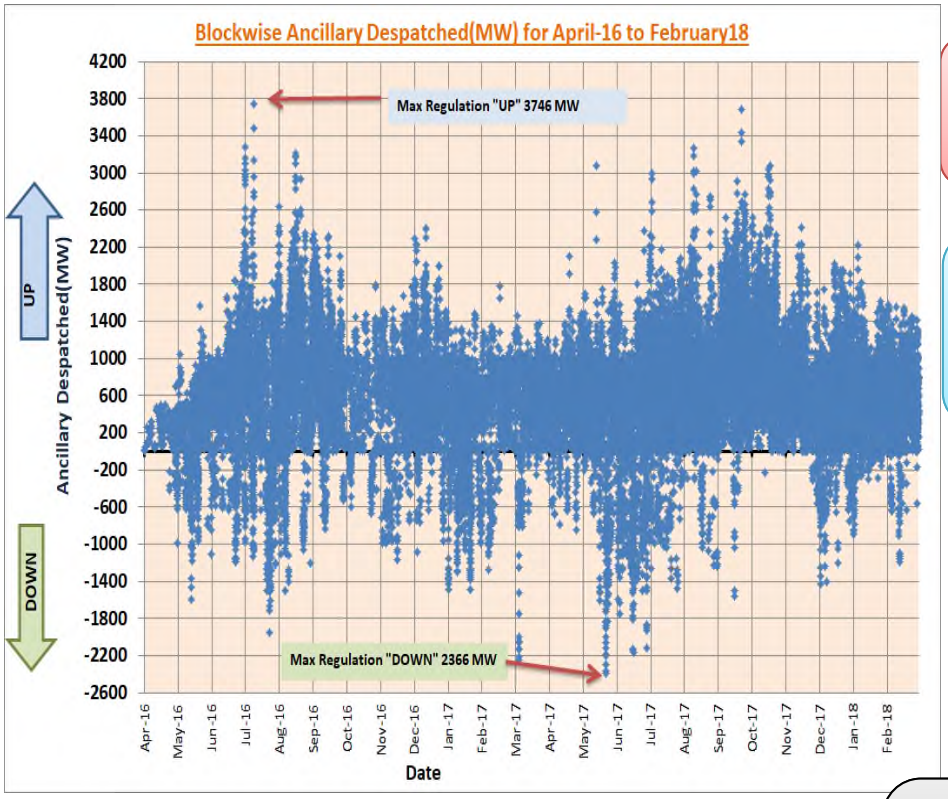
Lowest Variable Charge
~ Rs. 1.18 / Unit
(Singrauli – NR)

Maximum 'Up' Regulation :
3746 MW

Maximum 'Down' Regulation :
2366 MW

Energy Despatched:
Down – 1 MU / day
(0.03 % Energy met)

Energy Despatched:
Up – 7 MU / day
(0.2 % of Energy met)



Avg. Daily Number of RRAS Instructions :
07 to 08 Nos.

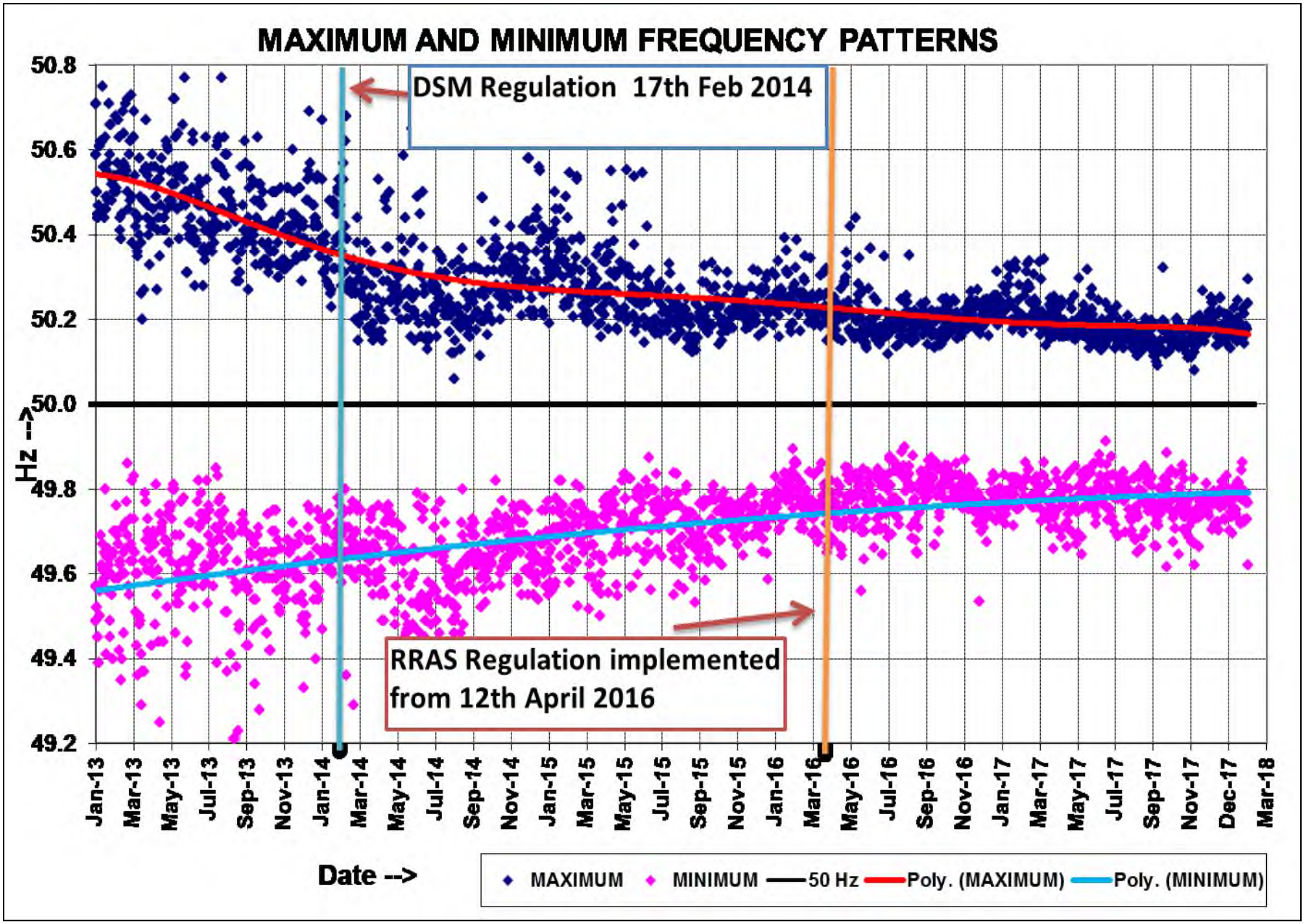
Average Cost for Regulation Up Despatch:
₹ 4.86/ Unit

Mark Up paid to RRAS provider- 50 Paise/Unit

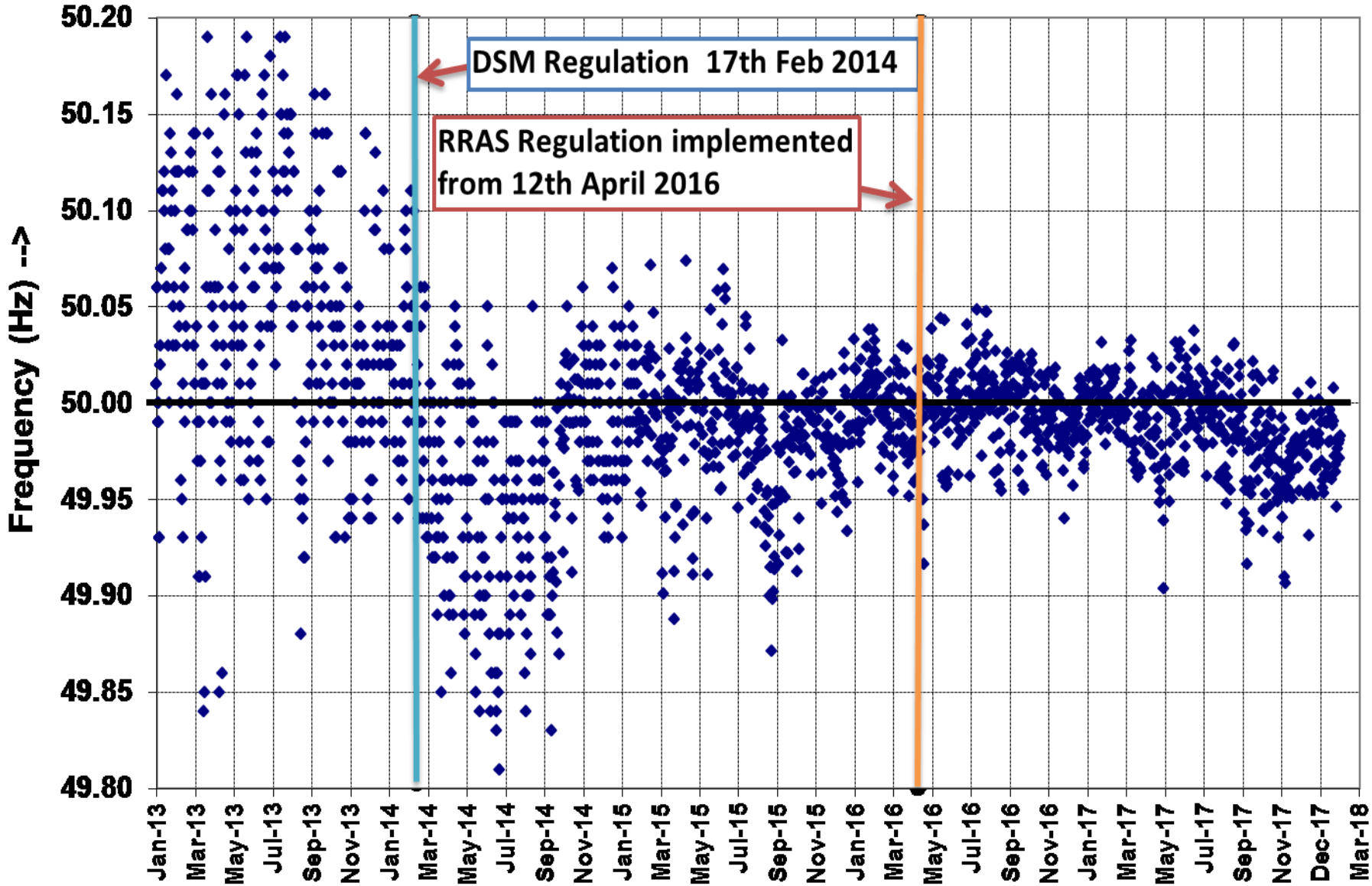
Average variable Charge refunded to DSM Pool for Regulation Down : ₹ 1.78/ Unit

Average Variable charges retained by RRAS providers
59 Paise/Unit

Improvement in Frequency Profile



Pattern of Average Frequency



Key Learnings

- Optimization Layer over Coordinated Multilateral Scheduling
- Improved Frequency Profile
- Ramp Management
- Real Time Congestion Management
- Grid Resilience
- Reliability Support
- Fixed & Variable Costs in Public Domain
- Freedom and Choice Retained

Challenges Ahead

- Revision in DSM vector
- Enlarging the Ambit
- Hydro Scheduling under Ancillary Services
- Gate Closure
- Automation, IT and Manpower
- Performance Monitoring

Hydro Power – A Flexible Solution

- **Hydro Power - a source of Flexibility & Reliability**
  - Overload capability
  - Peaking support
  - Fast ramping
  - Primary Response
  - Voltage Regulation
  - Black Start Capability
- **Need to Increase the Ambit of Ancillary Services**

Recommendations and Mandate

- Ministry of Power, GOI
  - Tariff Policy, 2016
  - Technical Committee on Renewable Integration, 2016
  - Sub-Committee on shifting Hydro power stations from Base Station to Peak Station, 2017
- CEA National Electricity Plan, 2016
- NITI Aayog - India's Renewable Electricity Roadmap, 2015

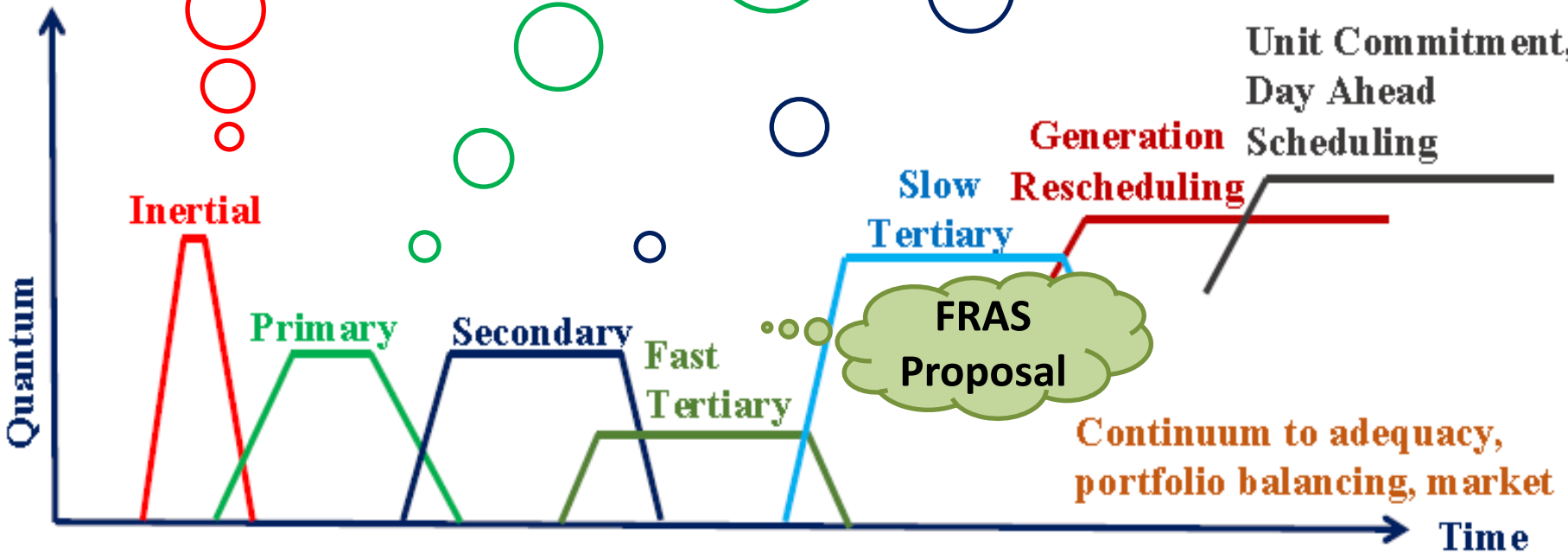
- FOLD-POSOCO Report on Operational Analysis for Optimization of Hydro Resources & facilitating Renewable Integration in India, 2017
  - **Scope for Optimization & Flexible operation along with Economic Gains**
  - **SAMAST - Need for Multi-part Hydro Tariff, Incentive for Flexibility**
  - **Bringing Hydropower Stations under Ancillary Services**

Role of Hydro in System Balancing in India

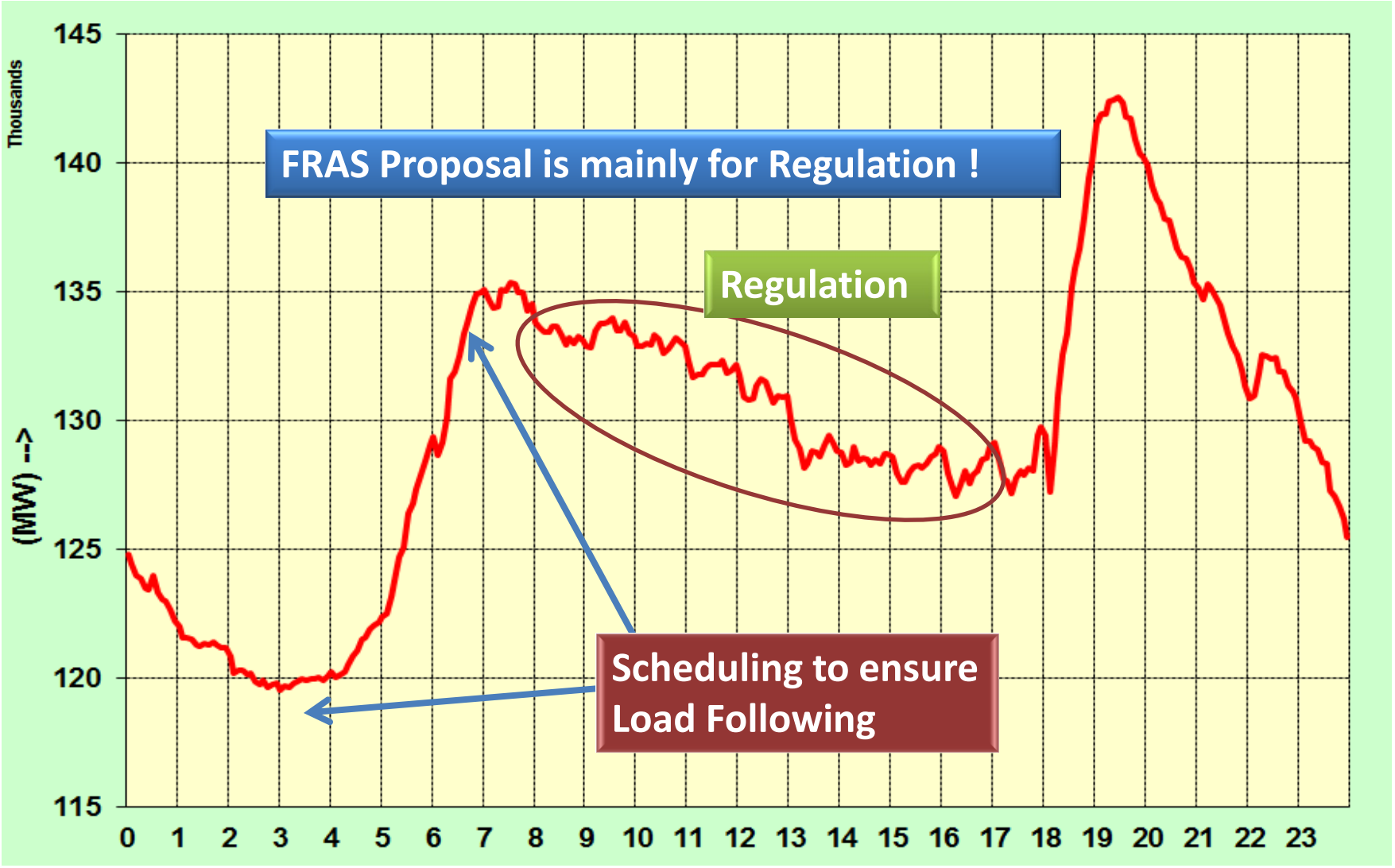
Inertia Decreasing, 175 GW RE, Need to have more hydro machines

Mandated as per Grid Code for all; Need for faster response from Hydro

AGC Pilot Project Operational; Hydro stations may be put on AGC on pilot basis



Load Following and Regulation



Present Regulatory Provisions

- **CERC (Ancillary Services Operations) Regulations, 2015**

5. Eligibility for participation for Reserves Regulation Ancillary Services (RRAS)

5.1. All Generating Stations that are regional entities and whose tariff is determined or adopted by the Commission for their full capacity shall provide RRAS.

- NR and ER Hydro generators provide RRAS data on monthly basis

- **CERC Approved Detailed Procedure for Ancillary Services Operations**

4.9. Hydro generation, within the total energy dispatch constraints, is providing the peaking support including ramping and normally, there is no un-despatched power. However, in case of exigencies or otherwise, the hydro stations would also be considered for despatch under Ancillary Services by the Nodal Agency.

Present Issues in Hydro Scheduling under RRAS

Need for fast regulation service and ramping support

Hydro : Energy limited Resource

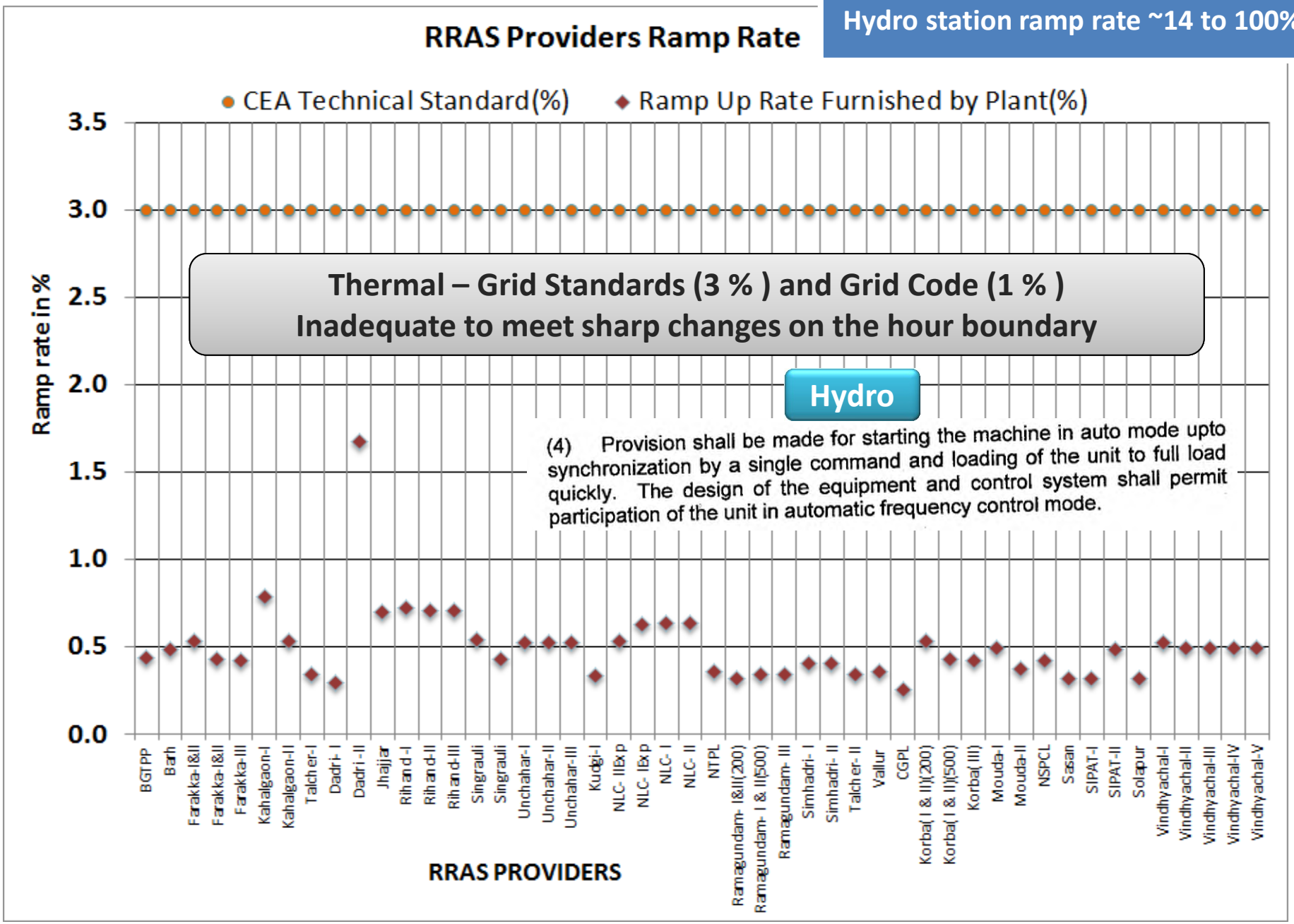
Thermal: Ramp limited Resource

Other than power generation commitments

Marginal Cost is zero

And hence, FRAS Proposal…

Hydro station ramp rate ~14 to 100%



Sl No	Name	Utility	Region	Type (S/R/P)	I/C (MW)
1	Teesta-V	NHPC	ER	R	510
2	Rangit			R	60
3	Bairasiul		NR	P	180
4	Chamera-II			P	300
5	Chamera-I			P	540
6	Uri Stage – I			R	480
7	Salal			R	690
8	Dhauliganga			P	280
9	Tanakpur			R	94.2
10	Chamera-III			P	231
11	Parbati III			P	520
12	Sewa-II			P	120
13	Dulhasti			P	390
14	Uri Stage – II			R	240
15	Naptha Jhakri	SJVN		P	1500
16	Rampur			P	412
17	Tehri	THDC		S	1000
18	Koteshwar			S	400
19	Koldam	NTPC		P	800
20	Kopili	NEEPCO	NER	S	200
21	Kopili-II			S	25
22	Khandong			S	50
23	Ranganadi			P	405
24	Loktak	NHPC		S	105
25	Pong	BBMB	NR	S	396
26	Dehar			R	990
27	Bhakra complex			S	1379
			Total		**12297**

Type	MW
Storage (S)	3555
RoR with Pondage (P)	5678
RoR (R)	3064
Total	12297

Proposal - Fast Response Ancillary Service (1)

- Stack of hydropower stations
  - Based on MW regulation possible by plant, balance energy etc.
  - Factoring congestion

- Despatch Instructions from Nodal Agency
  - FRAS Regulation Up (maximum available balance energy/reserve/MW)
  - FRAS Regulation Down (minimum available balance energy/reserve/MW)

- Net energy squared off for each hydro station same day
  - Combination of FRAS Regulation Up and Down despatch instructions

- Only for short durations

- Reservoir based stations priority over pondage based stations

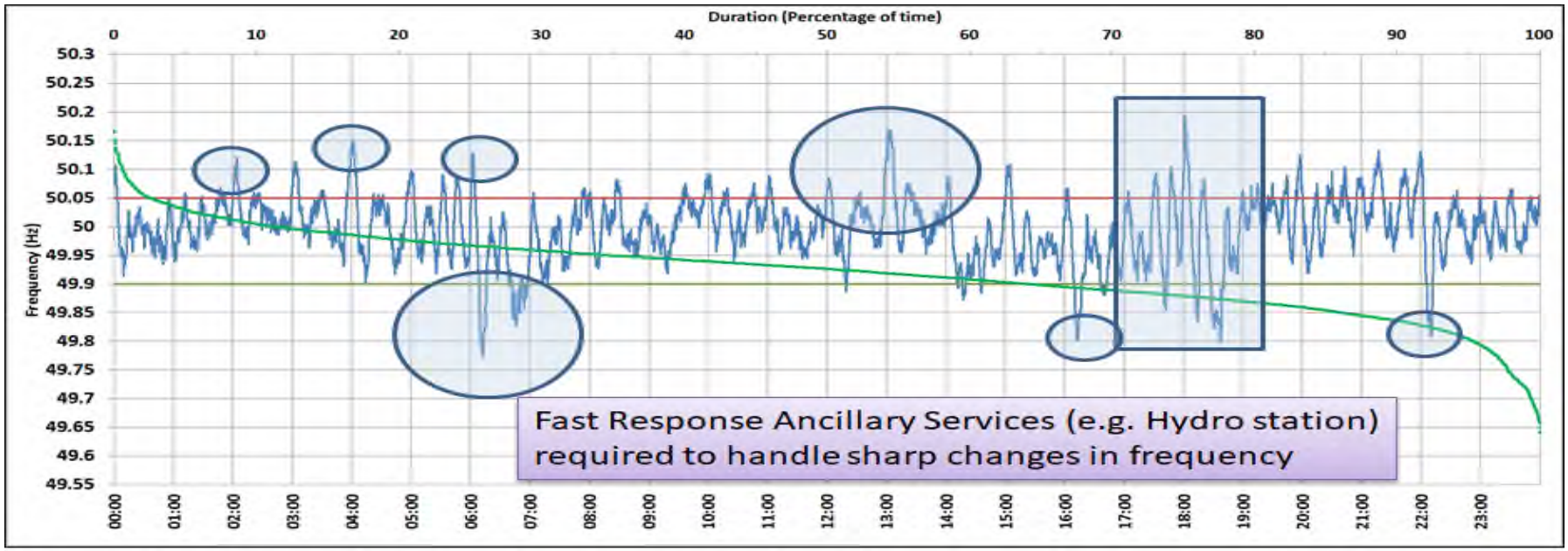
Proposal - Fast Response Ancillary Service (2)

- Scheduling
  - 5 - minute FRAS despatch schedules by Nodal Agency
    - Aggregated (3 five minute blocks)
    - Compatibility with the existing scheduling philosophy
    - Settlement and deviation accounting purposes
  - Regional Virtual Ancillary Entity – Hydro or VAE-H
    - Counterparty to FRAS despatch instructions

- Accounting and Settlement
  - No fixed charge or variable charges to be paid
  - Incentive on mileage basis
    - $E_m = \Sigma \mid E_{up} \mid + \Sigma \mid E_{down} \mid$
    - To be decided by the Commission

Triggering Criteria

- Hour boundary frequency changes
- Sudden changes in demand
- Ramp management
- Grid contingency
- RE Variation



<49.7	<49.90	<49.97	49.7-49.8	49.8-49.9	49.9-50.0	50.0-50.1	50.1-50.2	49.90-50.05	49.7-50.2	49.97-50.03	50.05-50.1	>50	>50.03	>50.05	>50.2
0.00	4.61	29.05	0.21	4.40	44.47	48.37	2.56	79.22	100.00	43.31	13.65	50.86	27.64	16.17	0.00

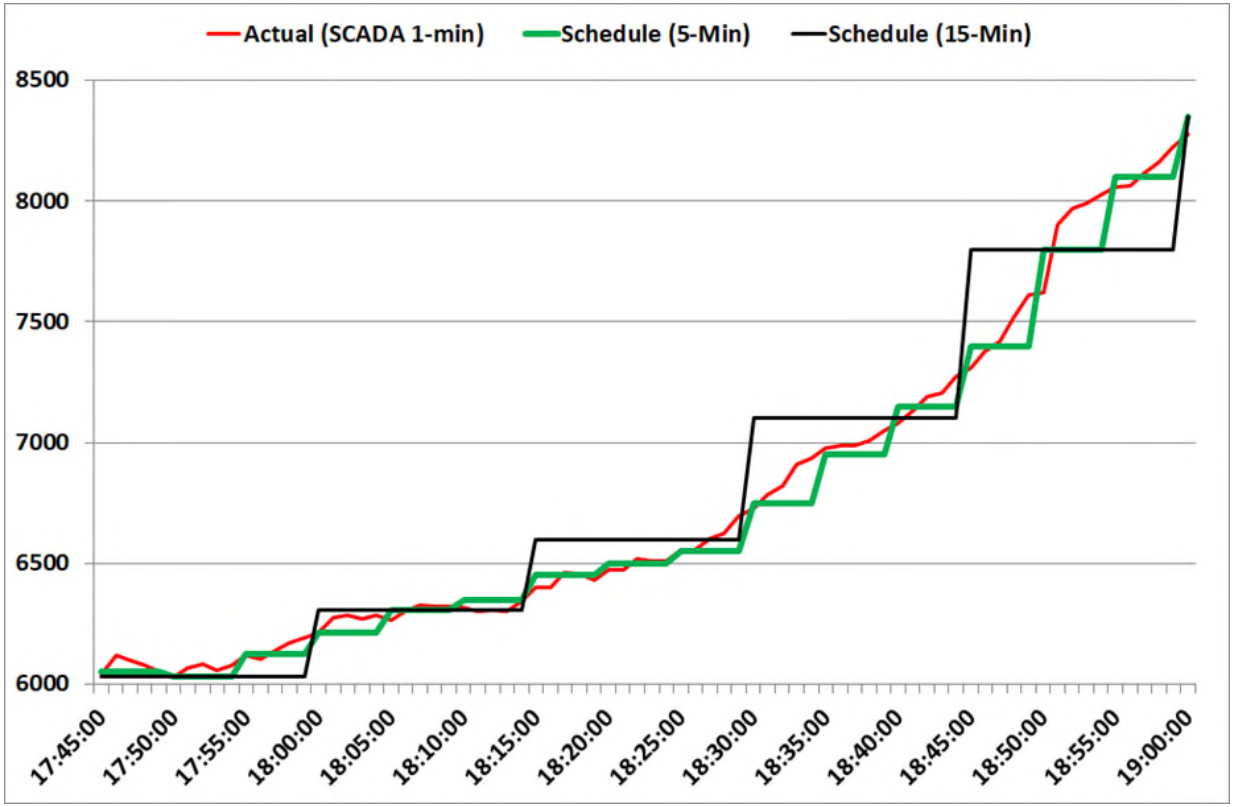
Average Frequency :	49.997	Frequency Variation Index :	0.032	Standard Deviation :	0.056	Mileage	45.61

Honouring Constraints

- Drinking Water
- Irrigation
- Contractual Obligations with State Government
- Weather Phenomena, Monsoon etc.
- Legacy Control System
- Wildlife
- Water level and Head
- High Silt, flash floods, Cloud burst, Land slides
- Shortage of Skilled and Unskilled Manpower
- Acidic Corrosion and Erosion
- Special Occasions like Water Sport activities, Snan, Mela etc.
- Any other…

Scheduling and Settlement

- FOR Technical Committee Sub-Group
  - Introduction of Five Minute Scheduling, Metering, Accounting and Settlement in Indian Electricity Market
  - Pilot Project Envisaged - in Parallel with 15-Minute Framework
- Three Regions (NR, ER and NER) – Central Sector Hydro Stations
  - 05 Minute Scheduling, 05 Minute Metering, 05 Minute Deviation Settlement

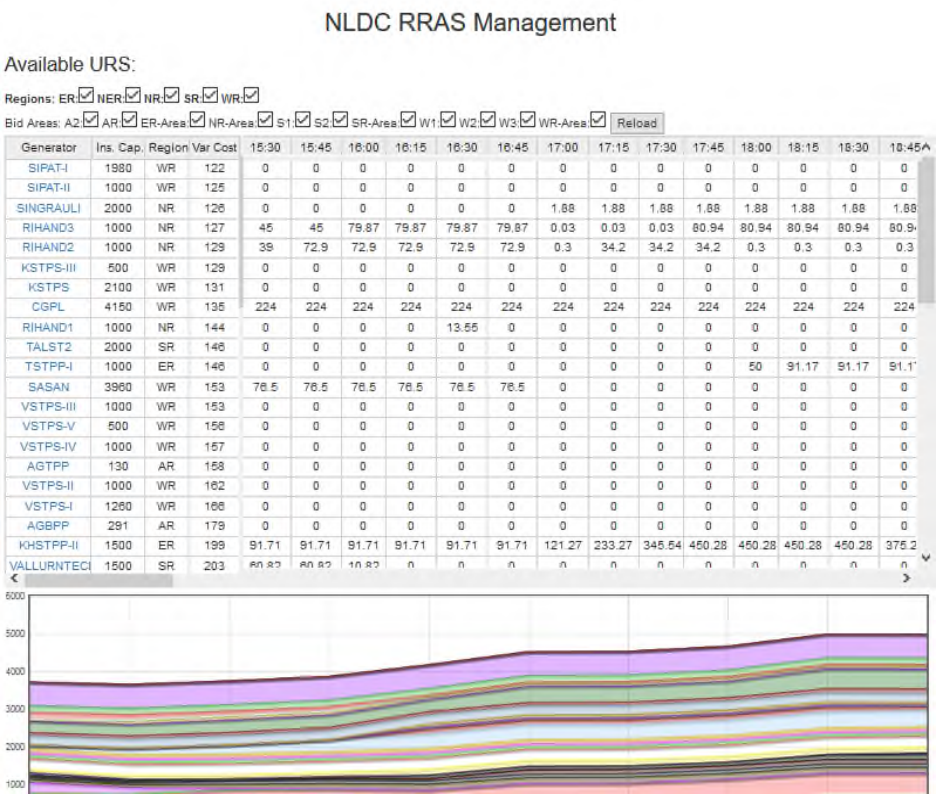


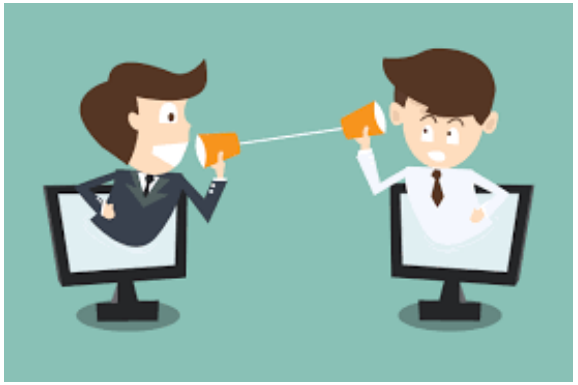
Data Exchanges

- **NLDC/RLDCs with FRAS Providers**
  - Web based Automated Solution
  - Technical Details for FRAS Despatch
  - Telephonic/SMS/E-mail

- **FRAS Providers and RPCs**
  - Ancillary Services information
  - Accounting & Settlement

- **Information on NLDC Website**
  - FRAS Instruction Summary
  - Monthly report
  - FRAS Providers details





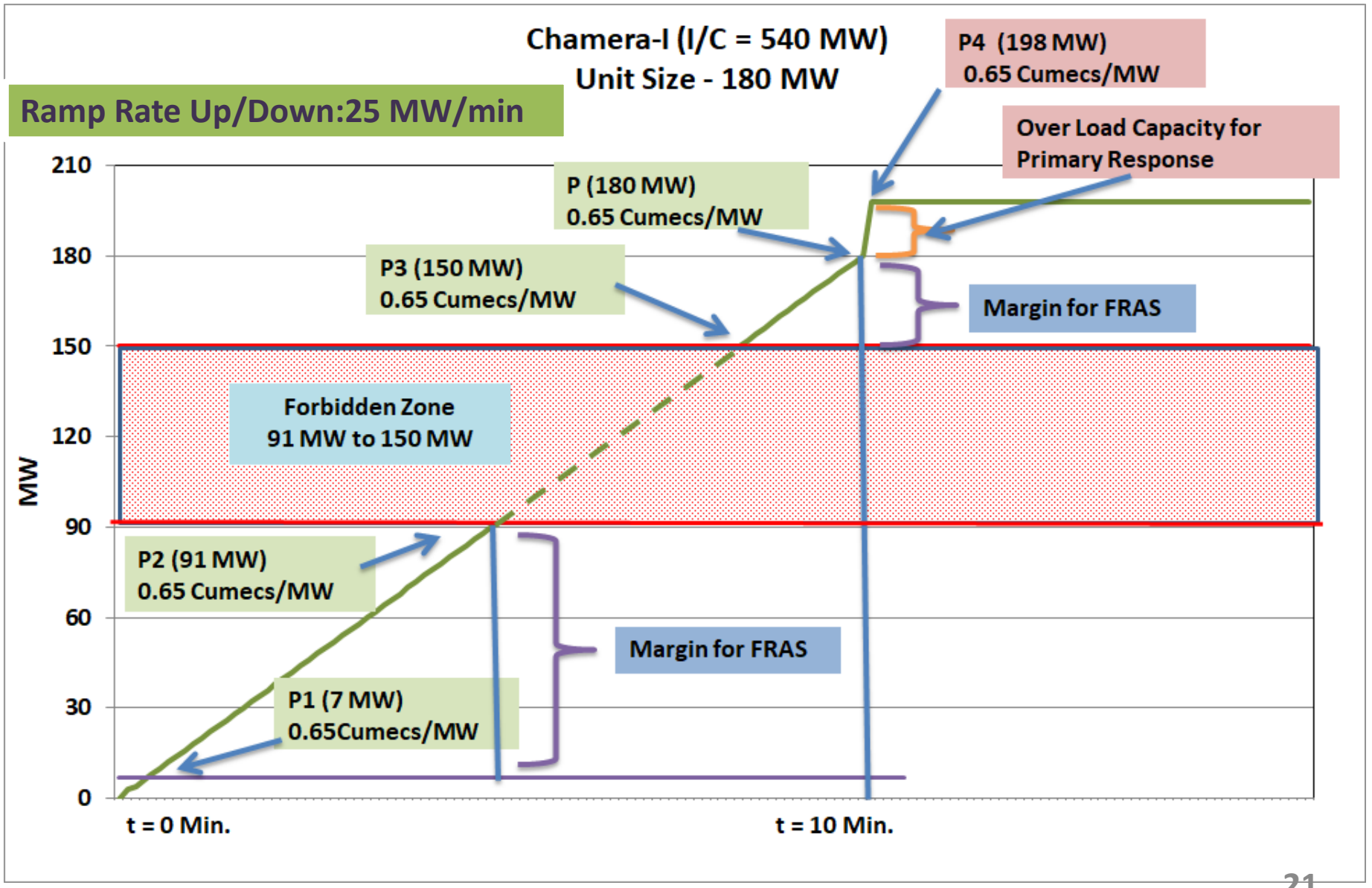
Discussion with Central Sector Hydro Generators

- Meetings
  - 13th March, 2018 at CERC, Delhi
  - 09th March, 2018 at NLDC, Delhi
  - 23rd February, 2018 at CERC, Delhi
- Participants
  - CERC, CEA, NHPC, SJVN, BBMB, THDC, NEEPCO, NTPC & POSOCO
- Deliberations held & broad consensus achieved
  - FRAS Implementation
  - Primary Response improvement through droop settings
  - 5-Minute scheduling, despatch and settlement on pilot basis
  - Other ancillary services – reactive power, black start
  - Need for fast communication of instructions
- Mark up for regulation– to be decided by CERC
- Data template circulated
  - Received data from NHPC, NTPC, BBMB, NEEPCO, THDC & SJVN

Information Requirement of Hydro Units

- Installed capacity of unit =P
- Start time; standstill to synchronization of unit to grid (in minutes)
- Minimum load at which unit stably run after synchronization (MW) - P1
- Forbidden zone or high cavitation zone (From MW to MW) - P2 to P3
- Maximum loading possible on unit (continuous) P4 (Note; range from P to P4 should be normally available for primary response unless it is a case of overflowing hydro)
- Cumecs/MW for P1, P3, P and P4 generation level as well as cumecs from standstill to synchronization. Which value is used for declaring MWh capability?
- How many units can be started simultaneously or is it sequential operation? The constraints in this regard.

Sample Hydro Station Data



Further Steps…

- Regulatory Interventions
  - Order by Central Commission for Pilot Project
  - CERC (Ancillary Services Operations) Regulations, 2015
  - Detailed Procedure
- Software Upgradation
- Communication Infrastructure Augmentation
- Capacity Building
  - LDC and Hydro Generators Personnel

A Small Step for Hydro

A Giant Leap for Indian Power System

Thank You !

Annexure-V

Introduction to National RPO Portal

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9th April 2018,

63rd FoR meeting,
CERC,
New Delhi

Outline

- Mission statement
- Key features
- Challenges addressed
- Unique features
- Reports
- Users roles & responsibilities
- Tools and technologies
- Way forward

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Scope of Work for RPO Portal

Mission Statement:

Develop a configurable portal to address current challenges and meet changing future requirements for RPO monitoring

Features looked into

- Development of a **dynamic** RPO Portal
- Ensure data **uniformity with flexibility**
- Provide State level **customization** to meet state specific requirements
- Registration of stakeholders i.e. Obligated Entities, Implementing Agencies, SERCs, MNRE, MoP, CERC, SNA, CNA etc.
- Online Submission of data at defined periods
- Online Verification of Data by single/ multiple agencies
- Online monitoring of RPO Compliance at State level and National level
- System generated email notifications, alerts and reminders
- Generation of routine and analytical MIS reports

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Unique features

- Easy quickly implementable
  - No need to reconfigure basic software
- Integration framework
  - Can access on line data from other portals developed at state levels
  - Data can be entered through software using simple Excel based forms in areas where connectivity can be issue

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Challenges addressed by dynamic portal

Data consolidation at national level

Reporting of Non-Solar REs in different states

- Maharashtra: Non-Solar (Mini /Micro hydro), Non Solar (excluding Mini /Micro hydro)
- Chattisgarh: Non-Solar (Biomass), Non-solar (Wind, hydel, waste heat recovery)

Reporting period may differ in states

- Quarterly/ Monthly reporting for unaudited data
- Half Yearly/ Yearly for audited data

RPO Targets may vary for different types of Obligated Entities

- Example(Non-Solar): 6% for OA, 7% for CPP, 8% for Discoms

RPO targets may be based on Installed Capacity range

- 6% up to 10MW, 8% above 10MW
- `OE status for above 1 MW CPP

Verification authority may be different for GEC & REs

- Agency-A for Solar Energy
- Agency-B for Non-Solar (Mini /Micro hydro)
- Agency-C for Non Solar (excluding Mini /Micro hydro)

Add new RE source anytime in future or make an existing one inactive

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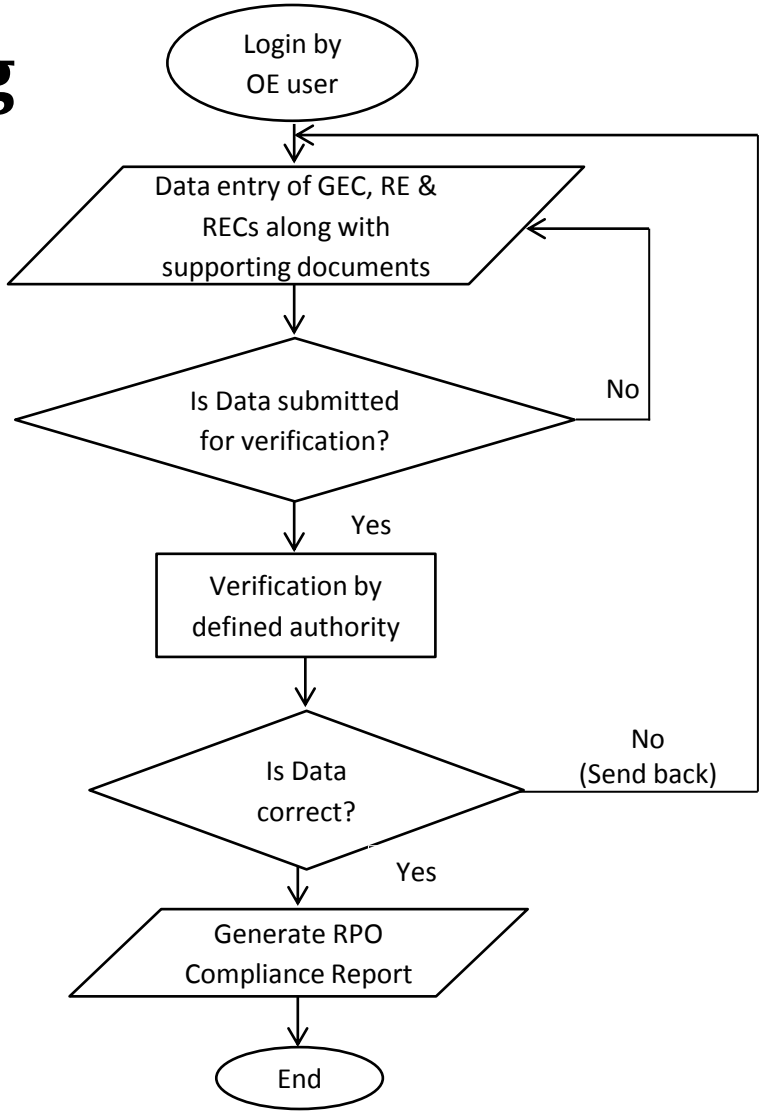
RPO Data Reporting Process Flow



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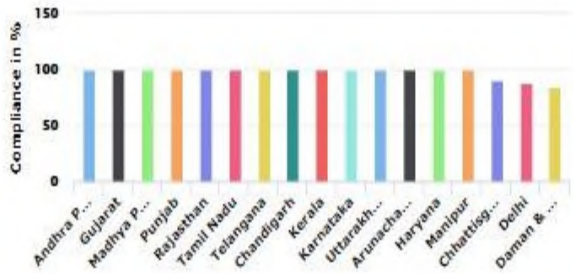
REPORTS

Home Page

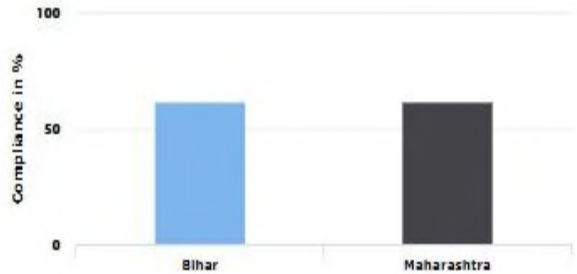
National Level Portal for Renewable Purchase Obligation Compliance

RPO Compliance Status of(2016-2017) as per Individual State Target

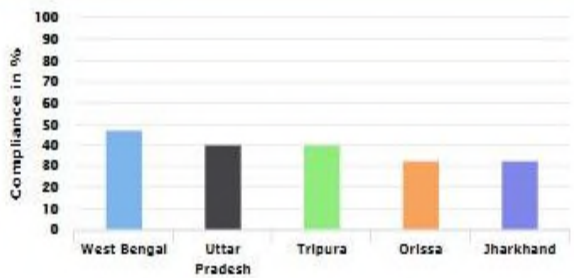
75% and above Compliance



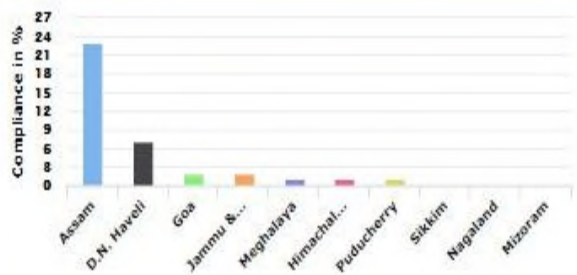
50 - 74% Compliance



25 - 49% Compliance



0 - 25% Compliance



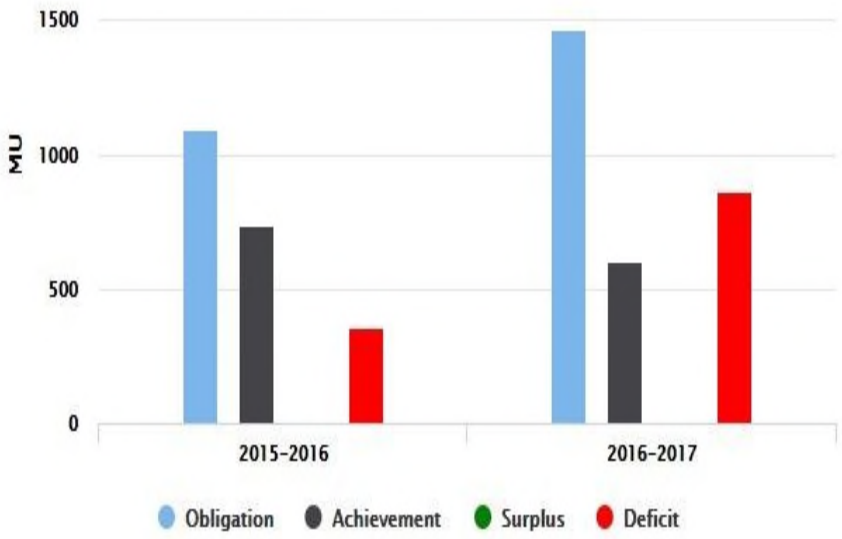
CNA Dashboard

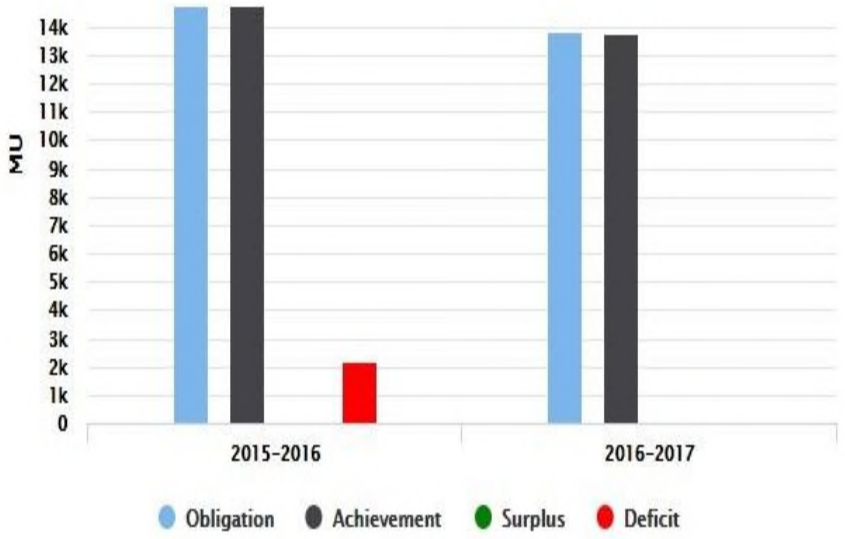
Home | Data entry | Data verification | Reports | Documents | State | Control Info | User | Help | Hello, Priyranjan

Reports / National level

RPO Compliance Status

State Agencies





Solar RPO Compliance

Financial Year	Obligation (MU)	Achievement(MU)	Achievement(%)
2015-2016	1093.82	736.58	67
2016-2017	1464.85	603.69	41

Non-Solar RPO Compliance

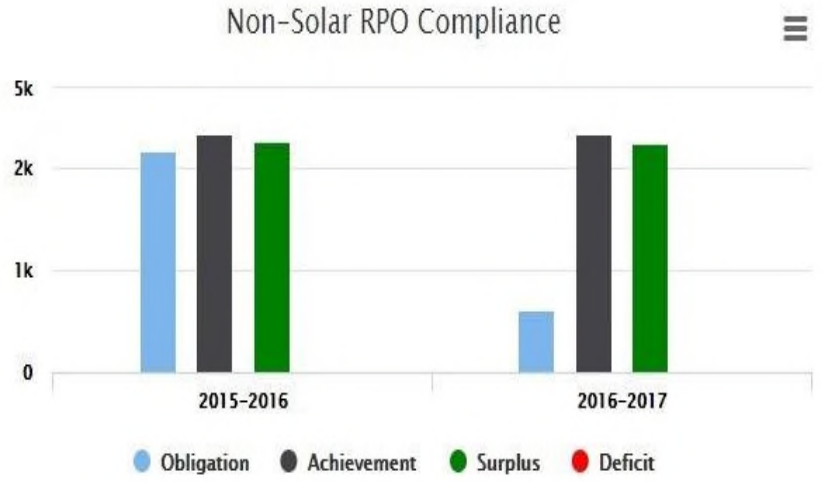
Financial Year	Obligation (MU)	Achievement(MU)	Achievement(%)
2015-2016	17977.65	15796.09	88
2016-2017	13849.73	13774.39	99

SNA/SERC Dashboard

Home | Data entry | Data verification | Reports | Documents | State | User | Help | Hello, Administrator

Reports / Agency level

Chhattisgarh RPO Compliance Status

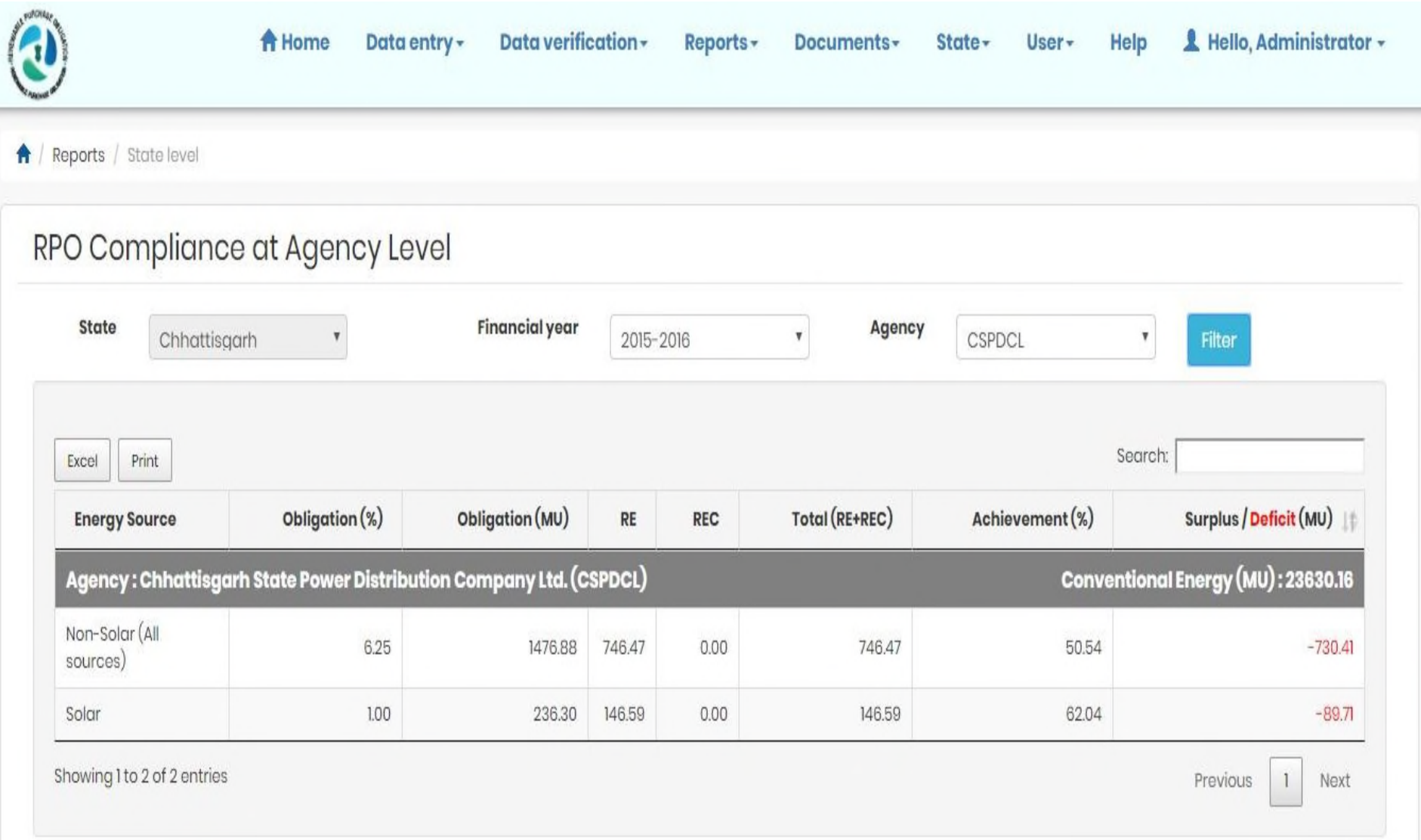


Solar RPO Compliance			
Financial Year	Obligation (MU)	Achievement(MU)	Achievement(%)
2015-2016	348.07	156.34	45
2016-2017	140.96	12.84	9

Non-Solar RPO Compliance			
Financial Year	Obligation (MU)	Achievement(MU)	Achievement(%)
2015-2016	2175.44	4449.55	205
2016-2017	610.83	2854.45	467

Reporting Status

Agency wise Report



Entity Type wise Report

Home | Data entry | Data verification | Reports | Documents | State | User | Help | Hello, Administrator

Reports / State level

Excel | Print

Search:

Energy Source	Obligation (%)	Obligation (MU)	RE	REC	Total (RE+REC)	Achievement (%)	Surplus / Deficit (MU)
Agency : Chhattisgarh State Power Distribution Company Ltd. (CSPDCL)							**Conventional Energy (MU) : 23630.16**
Non-Solar (All sources)	6.25	1476.88	746.47	0.00	746.47	50.54	-730.41
Solar	1.00	236.30	146.59	0.00	146.59	62.04	-89.71
Agency : Jindal Steel & Power Ltd. (JSPL), Raigarh							**Conventional Energy (MU) : 737.59**
Non-Solar (All sources)	6.25	46.10	0.00	0.00	0.00	0.00	-46.10
Solar	1.00	7.38	0.00	0.00	0.00	0.00	-7.38
Agency : Town Electrical Engineering Deptt.,BSP (TEED)							**Conventional Energy (MU) : 202.0532**
Non-Solar (All sources)	6.25	12.63	14.69	0.00	14.69	116.31	2.06
Solar	1.00	2.02	0.05	0.00	0.05	2.29	-1.97

Showing 1 to 6 of 6 entries

Previous | 1 | Next

National level report

RPO Compliance at National Level

Financial year: 2015-2016 | Filter

Excel | Print | Search:

State	Gross Energy Cousumption	Solar: RPO Target (%)	Solar: RPO Target (MU) (1)	Solar: Achievement (MU) (2)	Solar: Achievement (%)	Solar: Surplus / Deficit (MU) (3=2-1)	Non-Solar: RPO Target (%)	Non-Solar: RPO Target (MU) (4)	Non-Solar: Achievement (MU) (5)	Non-Solar: Achievement (%)	Non-Solar: Surplus/ Deficit (MU) (6=5-4)
Chhattisgarh	35427.63	1.00	354.28	160.92	45.42	-193.35	6.25	2214.23	4247.94	191.85	2033.71
Maharashtra	13702.79	0.50	68.51	604.52	882.38	536.00	8.50	1164.74	10957.96	940.81	9793.23
Uttarakhand	49595.67	0.10	49.60	7.36	14.84	-42.24	8.00	3967.65	812.93	20.49	-3154.72

Showing 1 to 3 of 3 entries

Previous | 1 | Next

Actions during implementation

- Hosting on a Public Server (on cloud)
- Facilitating data updates
  - Development of templates for Data Export & Data Import
- Configuring email for Notifications, Alerts and Reminders
- Develop demand based reports
- Incorporating users feedback





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Way Forward

- Updated data on Open Access and Captive power producers
- Uniformity of RPOs
- Uniformity on Obligated Entity criteria
- Verification through cross checking with other agencies. (At present CA audited reports are submitted to SNA)
- National level RPO portal integration to state portals through API

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Thank You

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User Roles & Responsibilities

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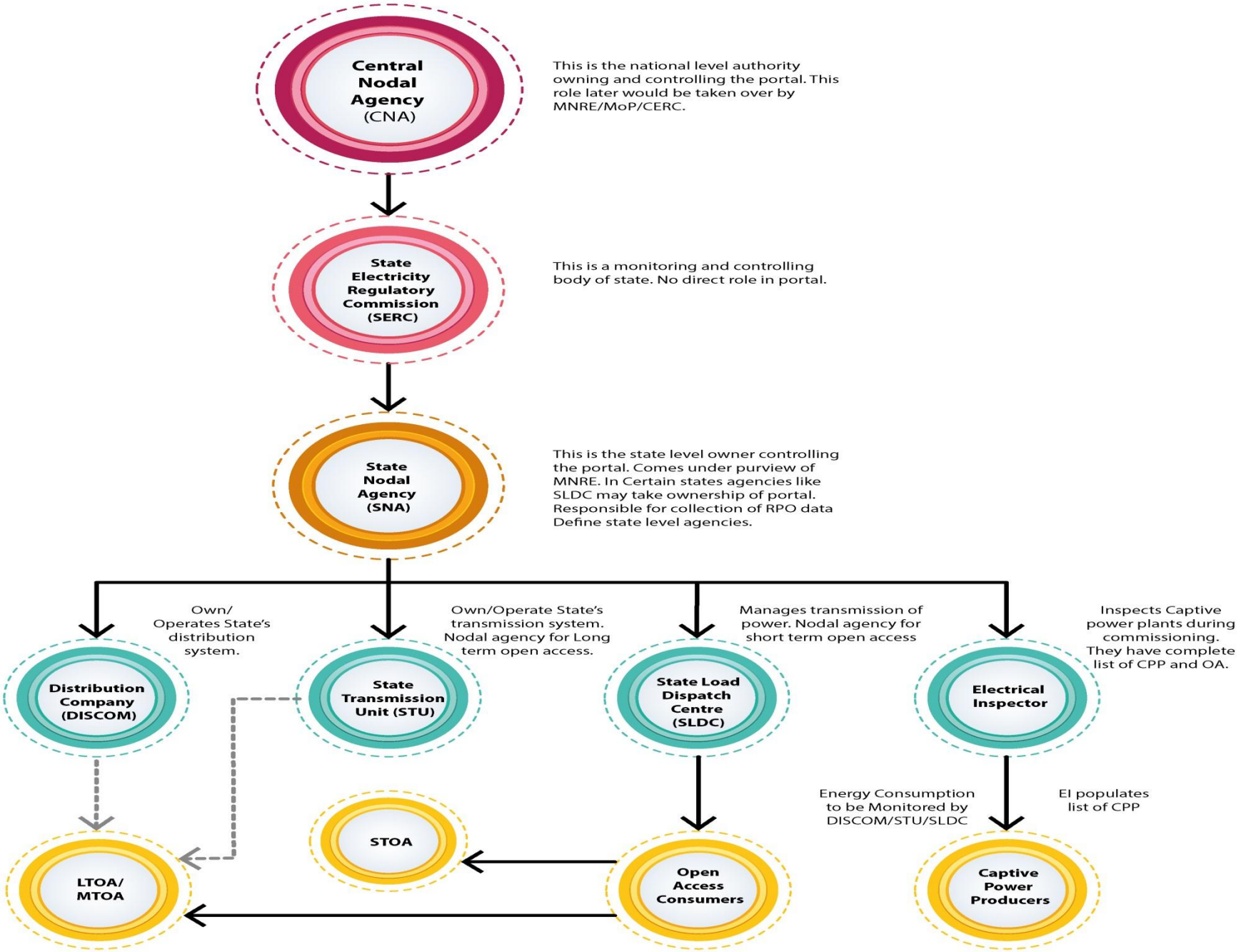
Central Nodal Agency (CNA)
This is the national level authority owning and controlling the portal. This role later would be taken over by MNRE/MoP/CERC.
State Electricity Regulatory Commission (SERC)
This is a monitoring and controlling body of state. No direct role in portal.
State Nodal Agency (SNA)
This is the state level owner controlling the portal. Comes under purview of MNRE. In Certain states agencies like SLDC may take ownership of portal. Responsible for collection of RPO data Define state level agencies.
Own/ Operates State's distribution system.
Own/Operate State's transmission system. Nodal agency for Long term open access.
Manages transmission of power. Nodal agency for short term open access
Inspects Captive power plants during commissioning. They have complete list of CPP and OA.
Distribution Company (DISCOM)
State Transmission Unit (STU)
State Load Dispatch Centre (SLDC)
Electrical Inspector
Energy Consumption to be Monitored by DISCOM/STU/SLDC
EI populates list of CPP
LTOA/ MTOA
STOA
Open Access Consumers
Captive Power Producers

National level configurations/ controls

- **Energy sources:** all energy sources to be entered with following details:
  - **Energy Source Type:** Renewable/ Conventional
  - **Energy Source:** name of energy source e.g. Solar, Non-Solar (Biomass), Non-solar (Wind)
  - **Group Source Type:** Yes/ No – Is it a group of other sources e.g. Non-solar (All sources)
  - **Action:** - Break-up of group source/ Edit details
- **Entity types:** e.g. CPP, OA, DISCOMs, CNA, SNA, CERC etc.
- **State Lists**
- **User Roles:** Entity type-wise Administrators/ Users

State level configurations

RE to be reported separately: financial year-wise to meet state specific data reporting structure

RPO Targets: define state RPO targets with following details:

- Financial Year
- Obligated Entity Type (Discom/ OA/ CPP)
- Installed Capacity range
  - From (in MW)
  - To (in MW)
- Energy Source
- Obligation expressed as % of gross energy consumption (GEC)

Provisional reporting period: financial year-wise reporting period

- Monthly/ Quarterly/ Half –Yearly/ Yearly

Audited reporting period: financial year-wise reporting period

- Monthly/ Quarterly/ Half –Yearly/ Yearly

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State level configurations…contd.

Implementing Agency: Type of Entity, Organization Name, user role, email-id and Reporting Authority

Obligated Entities: Type of Entity, Organization Name, user role, email-id, verifying authority

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RPO data entry details

- **Unaudited data & Audited data**
  - Conventional Power
  - Renewable Power
- **Data details**
  - *RE Type*
  - Transaction Type: Generation/ Purchase/ Sale/ *REC*
  - Agency (Purchased from/ Sold to)
  - Quantum (in MUs)
  - Supporting document
  - Remarks (If any)





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RPO data Verification process

- Verification authorities may be different
- Verification of all data submitted by OEs
- On line verification of supporting documents
- Each entry level action : Correct/ Send back
- Observation remarks
  - Mandatory in case of “Send back”
- Form level action
  - Submit to complete verification
  - Hold to verify later





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Key Reports

- Agency level
  - Agency performance in past 2 years
- State level
  - RPO compliance of all agencies of a state in selected year
- National level
  - State-wise RPO compliance in selected year

* More reports can be designed & developed during implementation





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Tools & Technology (Microsoft)

Development platform	ASP.Net MVC 6 Entity Framework 6.0
Database	MS SQL 2012
Software	Operating System: Windows Web server: IIS
Framework	Framework 4.6
IDE	Visual Studio 2015

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Annexure-VI

Centre for Energy Regulation (CER)

Anoop Singh
Centre for Energy Regulation (CER)
Department of Industrial and Management Engg.
Indian Institute of Technology Kanpur
Kanpur – 208 016

Objectives of CER

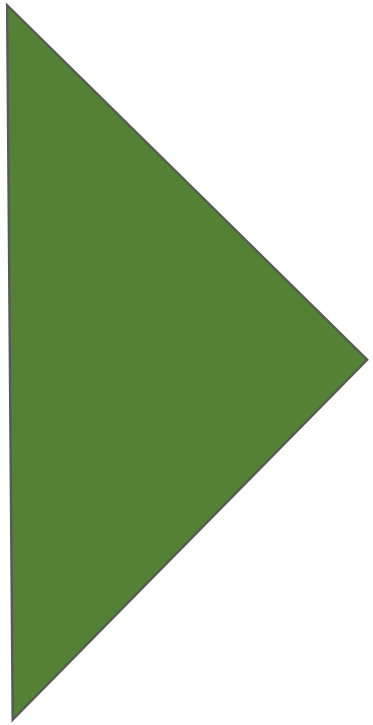
Key institutional gaps in power sector

1. **Institutional gaps in regulatory agencies**
   - Inadequate staff strength and skills
   - Lack of knowledge management
   - Inadequate capacity building across hierarchy
   - High reliance on external experts to carry out research and analysis
   - Lack of knowledge sharing platform

1. **Lack of Sustained interventions** for institutional strengthening

2. **Research and Implementation exist in different silos**

3. **Discrete regulatory information**



Objectives of establishing CER

1. **Enhanced regulatory-academia-utility interaction**

2. To **support research based studies, opinions impacting the power sector** and its regulation

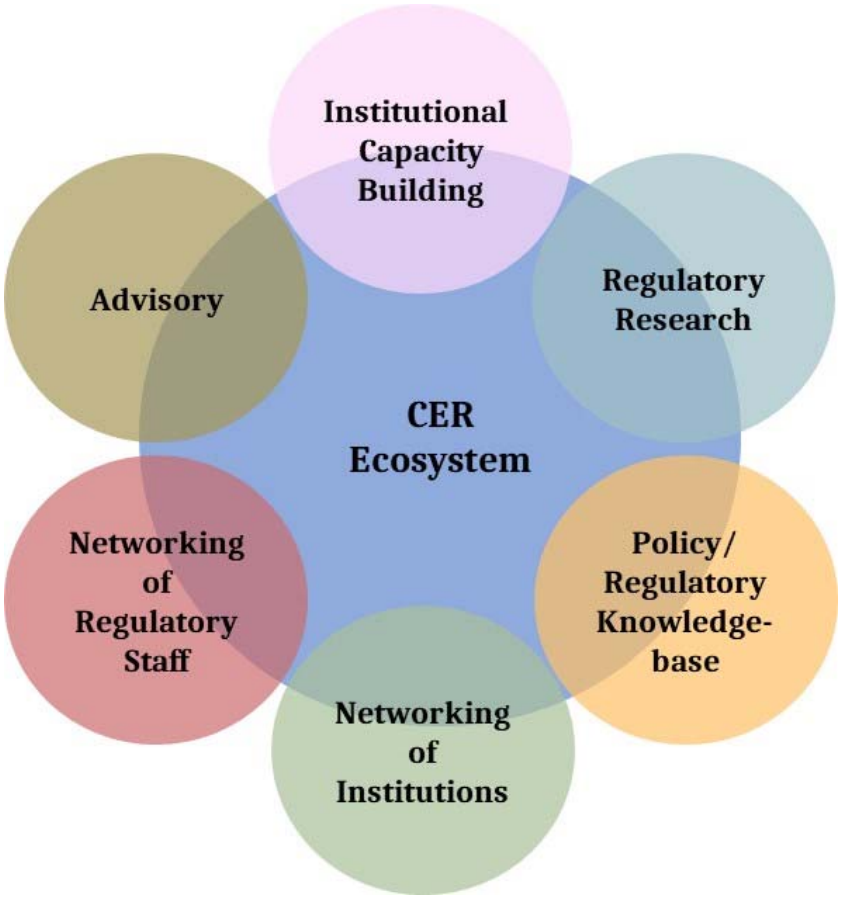
3. To **develop knowledge base** and database repository related to power sector for informed and **well-evidenced policy and regulatory decisions**

4. **Promote active platforms** for peer to peer learning amongst ERCs

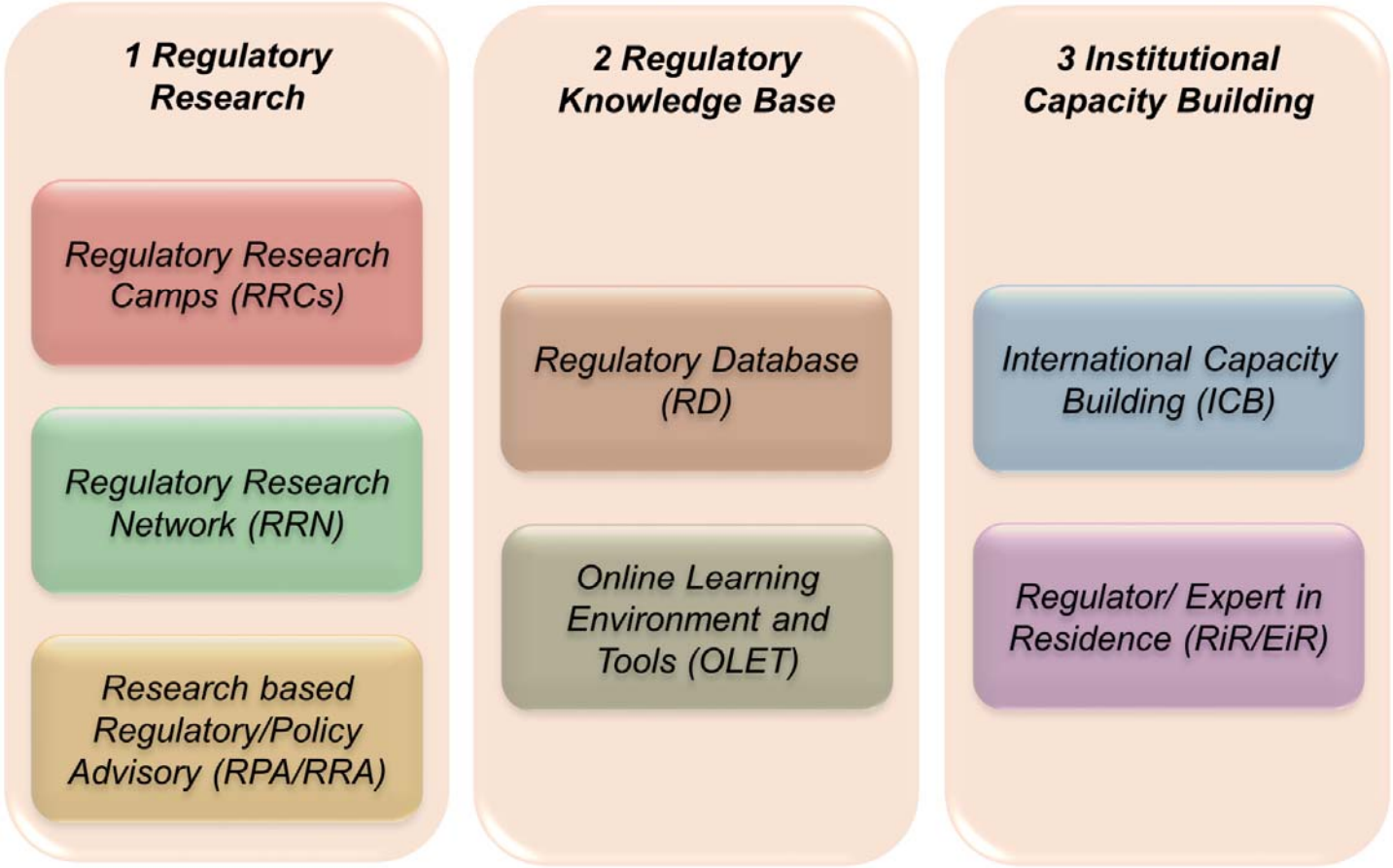
CER - Strengthening Regulatory Research & Network in The Power Sector

- Department of Industrial and Management Engineering, at IIT Kanpur has been engaged in teaching, research, capacity building, policy advocacy and consulting activities in various aspects of power sector reform and regulation.
- In continuance with these endeavours, the department is setting up the **Centre for Energy Regulation (CER),** to enhance regulatory research, knowledge building and networking in the Indian power sector.
- The Centre and its activities are supported through tapered funding through a project on "**Strengthening Regulatory Research & Network in the Power Sector**" by the Government of United Kingdom under the **Power Sector Reform (PSR)** program.
- Concurrence of Ministry of Power
- Support of FOR

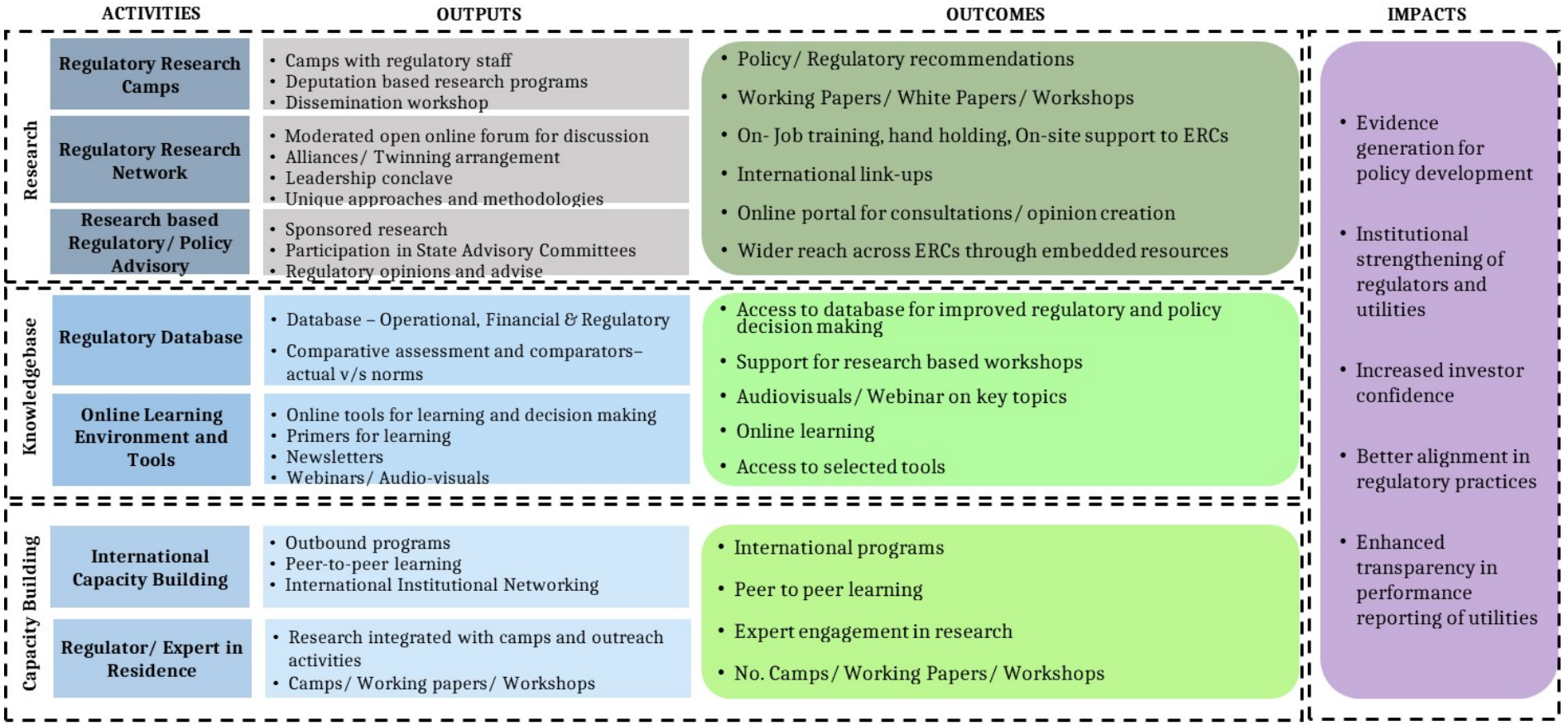
CER Ecosystem



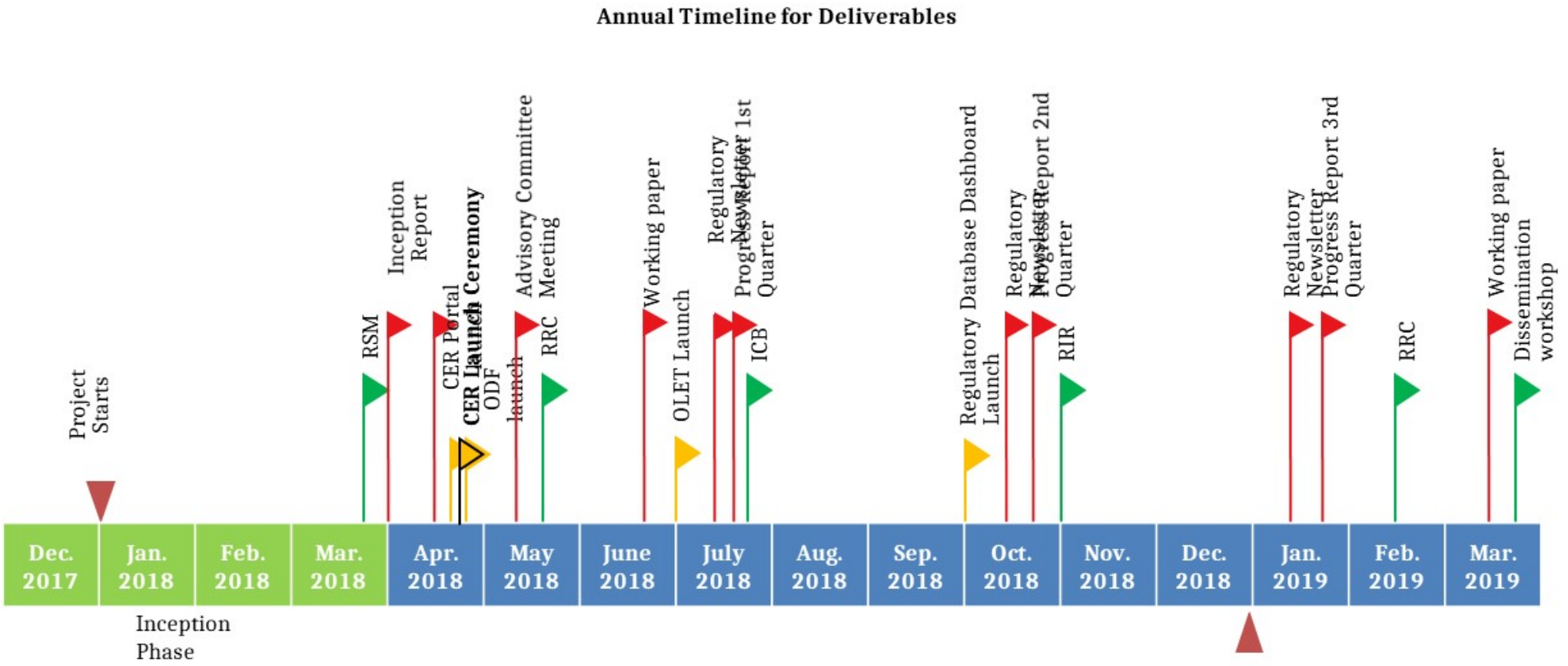
Three Pillars of CER Activities



CER – Activities & Outcomes



Activity Timeline



Stakeholders of CER

Role of Regulatory Commissions & Forum of Regulators

Activity	Role of ERCs and FOR
Regulatory Skill Mapping	▪ Registration at CER portal ▪ Input to Design of Activities and Identification of Participants
Regulatory Research Camps	▪ Suggestions for Research Topics ▪ Resource Commitment (Participation) ▪ Feedback on Outcomes
International Capacity Building	▪ Resource Commitment (Participation) ▪ Institutional Alliances
Dissemination Workshops cum Leadership Conclave	▪ Resource Commitment (Participation) ▪ Discussion by Sector Leaders

Role of Regulatory Commissions & Forum of Regulators

Activity	Role of ERCs and FOR
Regulatory Database	▪ Scope of Database - Prioritisation ▪ Data Accessibility ▪ Database Review ▪ Utilisation and Assimilation ▪ Feedback
Online Learning Tools	▪ Topics for Learning modules ▪ Prioritisation for Visualisation Tools ▪ Utilisation and Assimilation ▪ Feedback
Regulatory Database	▪ Scope of Database - Prioritisation ▪ Data Accessibility ▪ Database Review ▪ Utilisation and Assimilation

Role of Regulatory Commissions & Forum of Regulators

Activity	Role of ERCs and FOR
Online Learning Tools	▪ Topics for Learning modules ▪ Prioritisation for Visualisation Tools ▪ Utilisation and Assimilation ▪ Feedback
Online Discussion Forum	▪ Inputs for developing the online Discussion Forum ▪ Participation in Discussion Forum ▪ Feedback
Working Papers	▪ Expert Review ▪ Dissemination and Utilisation
Regulatory Newsletter	▪ Inputs for coverage of newsletter ▪ Content Contribution ▪ Dissemination and Utilisation ▪ Feedback

CER – Collaborate, Engage and (provide) Resources

Collaborate

- Collaborate on regulatory research
- Network with Regulatory Peers
- Contribute to Discussion Forum

Engage

- Input to Regulatory Processes
- Identifying areas of regulatory research – RRC & OLET
- Scope of Database
- Learning Tools

Resources

- Time
- Intellectual
- Financial

CER – Institutional Sustainability

- Institutional Building is time and resource consuming exercise.
- It needs engagement and commitment of stakeholders.
- Stakeholders, particularly, the ERCs need to engage with the Centre and each other.
- Key Activities like **Regulatory Database, Learning Tools, Regulatory Research, Newsletter** need to be continuously updated and improved upon.
- CER has two-part cost structure.
  - Fixed cost incurred to supports the above
- Models of support
  - MoU with FOR
  - 'Social' Corpus

Thank you

CER - cer.iitk.ac.in/RSM

Energy Analytics Lab - eal.iitk.ac.in