MINUTES OF SIXTEENTH MEETING OF "TECHNICAL COMMITTEE FOR IMPLEMENTATION OF FRAMEWORK ON RENEWABLES AT THE STATE LEVEL"

Venue	:	The Fern Gir Forest Resort, Sasan Gir,Gujarat
Date	:	24-11-2017
List of Participants	:	At **Annexure – I(Enclosed)**

1. The Sixteenth meeting of Technical Committee on Implementation of Framework for Renewables at the State level was held under the Chairmanship of Shri A. S Bakshi, Member, CERC on 24thNovember 2017. Shri Bakshi welcomed all the participants and the special invitees. He thanked the Chairperson of host state Gujarat as well as the Members of GERC for the arrangements. Shri Anand Kumar, Chairperson GERC, welcomed everyone to the venue and the meeting. He expressed his continued support to the activities of the Committee and those being undertaken in his State.

2. Ms. Shruti Deorah, Advisor- RE, CERC, welcomed all participants on behalf of the FOR Secretariat. She apprised the Committee of the actions taken since the 15th Meeting. Specifically, she updated the participants that- (i) Report on Smart Meters along with a letter on behalf of Chairperson, FOR was sent to Secretary MoP, highlighting the recommendations of the Committee; (ii) Letter was sent to all Chairpersons of SERCs to expedite the preparation of SAMAST DPR and implementation; and (iii) Letter was sent to CEO POSOCO to include cost for interface metering in SAMAST DPR and prioritize SAMAST funding.

3. Ms. Shruti also highlighted the States of Assam, Odisha, UP and Uttarakhand which are not members of the Committee but have taken concrete steps towards SAMAST implementation in their respective States.

Discussions on the Agenda

1. Agenda Item No. 1: Status of implementation of SAMAST Report- presentation by Gujarat SLDC

Discussion

1) Shri B.B.Mehta, Chief Engineer, Gujarat, SLDC, shared the status of implementation of SAMAST, sharing point-wise status of every activity. Most recommendations of the report have been implemented in the State. His presentation is attached as ***Annexure-II***.

2) Shri Mehta said that the organization structure suggested in the report will be the backbone of SLDC, and must be deployed.

3) He said that 75% of meters have AMR feature, for which existing meters were upgraded instead of purchasing new ones. He stated that in future, all new meters shall be procured based on new specifications. Some members highlighted that CEA should be requested to come out with the technical standards as soon as possible. Shri Bakshi supported and said a meeting will be organized with CEA to take this forward.

4) Infosys is the technical partner for Gujarat SLDC for metering automation and various software upgrades.

5) Shri Mehta requested that till LTA capacity exists for a State, the State should be given freedom on using it for short-term transactions as well. Shri Bakshi responded that the new GNA Regulations will address this issue. He also requested all members to provide comments on the draft regulations.

6) Shri Mehta shared that intra-State ABT has been in place since 2011, and that the State had implemented a zero-pool system at the time-block level. He shared a set of other initiatives undertaken by Gujarat, and invited other States to visit the State SLDC.

7) It was mentioned that once corridor availability is checked, issuance of OA clearance happens online in a transparent automated fashion. He said that number of STOA transactions have dropped.

8) He said that 100% of RE generators above 5 MW capacities are connected to SCADA system of the SLDC. Real-time data is available at the three sub-SLDCs, and sent to the SLDC post processing.

9) Shri Mehta stated that creation of SPC is still pending, though the matters are addressed at the state operations meeting. Shri Bakshi reiterated that SPC should have government approval or mandate. Shri Vishwanath Hiremath, Chairperson RERC, stated that creation of SPC in Rajasthan has been mandated in the State Grid Code, and hence it has statutory standing.

10) He said that Gujarat SLDC has a lot of certified professionals. Shri K.V.S. Baba, CEO POSOCO acknowledged the participation of the State in various specialist courses that are offered by NPTI and recognized by POSOCO. He also requested all regulators to encourage their SLDC for more participation.

Decisions

i) A meeting to discuss revisions to technical standards of meters shall be organized by FOR Secretariat under chairmanship of Shri Bakshi.

ii) Members of the Technical Committee to peruse the Central Electricity Regulatory Commission (Grant of Connectivity and General Network Access to the inter-State transmission system and other related matters) Regulations, 2017 and send their comments to the Commission.

iii) A letter to be sent to all SERCs requesting support for higher participation in specialist courses for SLDC officials.

iv) A note to be prepared by Gujarat SLDC detailing additional initiatives undertaken beyond the recommendations of SAMAST report, which shall be shared for reference of other members of the Committee.

v) Other State representatives to coordinate with Shri Mehta for further exchange of information and best practices, including visits by SLDC officials.

vi) The format used by Mr Mehta for presenting the status of implementation of Samast report was appreciated by everyone. It was agreed that this format shall be used in future by each state making presentation on the status of Samast implementation.

2. Agenda Item No. 2:

a. Status of implementation of F&S Regulations- presentation by GERC

Discussion

1) ShriS.R. Pandey, Legal Advisor, GERC, shared the status of implementation of Forecasting & Scheduling Framework for Renewables in the State (presentation attached as ***Annexure – IV***).

2) He updated the Committee that the Regulations have been finalized, and the Statement of Reasons (SOR) document is under preparation. The same is expected to be completesoon.

3) It was stated that a tri-partite agreement among the generator, QCA and SLDC shall be prescribed. A sample agreement will form an annexure to the Regulations.

4) Shri Preman Dinaraj, Chairperson KSERC cautioned the Committee that such a contract needs to be worded very meticulously as otherwise it could become a source of litigation. He offered his expertise to examine the sample contract.

5) While Shri P. Rama Mohan, Member, APERC stated that the Regulations as notified by APERC provided a generic structure but left the precise agreement to SLDC, it was also brought up that the QCA cannot be termed as a ‘state entity’.

Decisions

i) It was decided that the sample agreement as endorsed by Shri Dinaraj may be shared as a Model Agreement with the Committee, and the same may be annexed to the Model Regulations.

b. Update in respect of other States

Discussion

1) **West Bengal –**ShriR.N. Sen, Chairperson, WBERC informed the Committee that DPR for SAMAST has been completed and has obtained the Board approval. The same is in the process of being sent to POSOCO. He also stated that the State is running a pilot for smart meters (~1000 nos.) in a couple of districts, in which several communication protocols are being evaluated. He suggested that outcomes of NTPC's study regarding cycling of thermal plants be shared with the Committee.

2) **Rajasthan** – Shri R.P.Barwar, Member RERC, apprised the Committee that 85% of SAMAST work has been done. The Forecasting & Scheduling framework has been notified in the State for which the implementation shall commence from Jan 1st, 2018. He also stated that corresponding procedures are under preparation.

3) **Andhra Pradesh** – The State has already applied for funds to the tune of Rs. 12.81 crores under SAMAST. F&S Framework shall be implemented starting 1/1/18, while the commercial implication will begin on 1/7/18.

4) **Karnataka** – Shri Manival Raju, Member KERC, stated that the State SLDC is not responding on next steps on the RE framework. KERC is planning to hold a meeting with the Head of SLDC as well as DISCOMs.

5) **Madhya Pradesh –** Shri Dev Raj Birdi, Chairperson MPERC, informed the Committee that Forecasting & Scheduling Regulations shall be notified within a month as soon as final approval from the State Govt. is obtained. SAMAST is under implementation.

6) **Kerala** – Shri PremanDinaraj, Chairperson KSERC, submitted that work on RE Framework shall be taken up starting January 2018.

7) **Maharashtra –** Shri Deepak Lad, Member, MERCinformed the Committee that the Forecasting & Scheduling Regulations are ready and the SOR preparation is in progress.

3. Agenda Item No. 3: Status of implementation of SAMAST Report/Forecasting & Scheduling and Deviation Settlement for Tamil Nadu, Haryana and Punjab

1) The Consultant (Idam Infra) made a presentation (attached as ***Annexure- IV***) on the status of implementation of SAMAST inTamil Nadu, Haryana and Punjab.

2) **Tamil Nadu:** The Consultant had detailed discussions withthe State Commission regarding draft Forecasting &Scheduling Regulations as well asDraft DSM Regulations.

3) The Consultant updated the Committee on the final decisions made w.r.t outstanding issues on the RE Framework. For example, for inter-state transactions by state entities, deviation charges will now be linked to the PPA rate (instead of a flat rate), while the interface point for metering shall be on L.V. side of the pooling station. DSM Regulations are in line with the Model Regulations. The regulatory process for finalization of both Regulations will be taken up simultaneously. Implementation time of six months shall be provided.

4) Further amendments to bring the Open Access Regulations and State Grid Code in alignment with the DSM Regulations shall be carried out subsequently.

5) **Haryana:** Scheduling and Despatch Code is under preparation. Draft F&S and DSM Regulations are both in final stages.

6) **Rajasthan:**The consultant updated that the RPO web-tool for the State of Rajasthan is complete and the launch of the same is scheduled for 27th Nov. The RPO tool for Gujarat is in final stage of security audit.

7) Shri Bakshi along with Shri AnandKumar ,Shri Hiremath and Shri M.K.Iyer unveiled a brochure on the Generic RPO Tool as prepared by the Consultant. Copies of the same were handed over to all participants.

Decisions

i) Work for Tamil Nadu and Haryana will continue at a fast pace and the Consultant shall keep the Committee updated on the same.

4. Agenda Item No. 4: Presentation by POSOCO on:Update on Sub-Group for 5-Minute Scheduling, Metering, Accounting and Settlement

Discussion

1) Shri K.V.S. Baba, CEO POSOCO, updated the Committee regarding proceedings of the sub-group on 5-minute metering (presentation attached as ***Annexure- V)***. He stated that three meetings have been held so far.

2) At the first meeting, the participants discussed whether the shift to 5-minute metering is really required, and what the advantages shall be. Shri Baba underscored the

importance of this vision, that moving to 5-minute grid management will be beneficial for improving reliability and security of the grid. He said that along with variable RE power, the variability in load is increasing too as on-demand power becomes increasingly available.

3) He appreciated the efforts of Gujarat SLDC for coordinating the testing exercise at the 2nd Meeting of the sub-group.

4) He stated that all future procurements of meters should be compatible with 5-minute resolution. He also informed the Committee that most meters procured post 2014 can be upgraded to 5-minute format through change of firmware only.

5) ShriB.B. Mehta submitted that the 4-block time-interval for revision of schedule can be shrunk now that the whole process is online. Ms Shilpa Agarwal, JC(Engg) CERC, agreed and further said that this would be crucial to get any benefit from moving to 5-minute metering and settlement.

6) Shri Lad mentioned that a mandate has to be made so that all future procurements of meters are done accordingly.

Decisions

The Committee members reiterated the need for firming up of technical standards by CEAand making it mandatory to purchase only the meters with 5 minute recording capabilityin future.

5. Agenda Item No. 5: Presentation by POSOCO on

a. Analysis of Hydro Resources in Gujarat

b. Demand Pattern Analysis/Load Forecasting for Gujarat

Discussion

1) Shri Baba also presented analysis on hydro resources and demand patterns of the State (***Annexure- VI*** and ***Annexure- VII*** respectively). He highlighted that the State has about 7.5GW of installed capacity of Hydro power but the maximum that is generated is about 5GW only.

2) He impressed on the need to use hydro resources for ramping needs, given that the State is RE rich and well-equipped to plan all available resources. He specifically underscored the importance of better management of Sardar Sarovar project, and operationalizing pumping mode at the plant.

3) He also stated that hydro plants are good resources to provide Reactive Support Ancillary Services.

4) Shri Baba demonstrated with charts that the peak is growing faster than the lean for the State, and that there is a 4000 MW gap between the maximum and minimum load. This needs to be accounted for during capacity planning for future.

6. Agenda Item No. 6: View of RPCs on Options for Intra-Day / Hour Ahead Market Transactions

1) Ms. Shruti updated the Committee regarding the deliberations on Intra-Day Market Framework. She summarized that with increasing penetration of renewables, the increased requirement of balancing resources closer to real-time has necessitated that new intra-day market products are made available to the States.

2) Shri Bakshi added that states like Kerala with good hydro resources would like to value their resources while making them available to other states for balancing of infirm RE power. While inter-State banking has been used so far, moving forward, that will not suffice as number of transactions between States increase.

3) Ms. Shruti apprised the Committee of the feedback received from Regional Power Committees on the various options presented by Dr. S.K. Chatterjee, JCRA CERC, at the 14thTechnical Committee Meeting. Feedback has been received from NRPC, WRPC and SRPC. All three of them have recommended Option #5 as a starting point. Option 5 refers to 'Pool based on auction for intra-day for the rest of the day'.

4) It was noted that further discussions are needed to evolve the details of operationalizing this option.

With this, the Meeting was concluded, and Shri Bakshi thanked all the Committee members and the special invitees for fruitful discussions.

Annexure-1

LIST OF PARTICIPANTS AT THE SIXTEENTH MEETING OF THE TECHNICAL COMMITTEE FOR "IMPLEMENTATION OF FRAMEWORK ON RENEWABLES AT THE STATE LEVEL" HELD ON 24.11.2017 AT SASAN GIR, GUJARAT

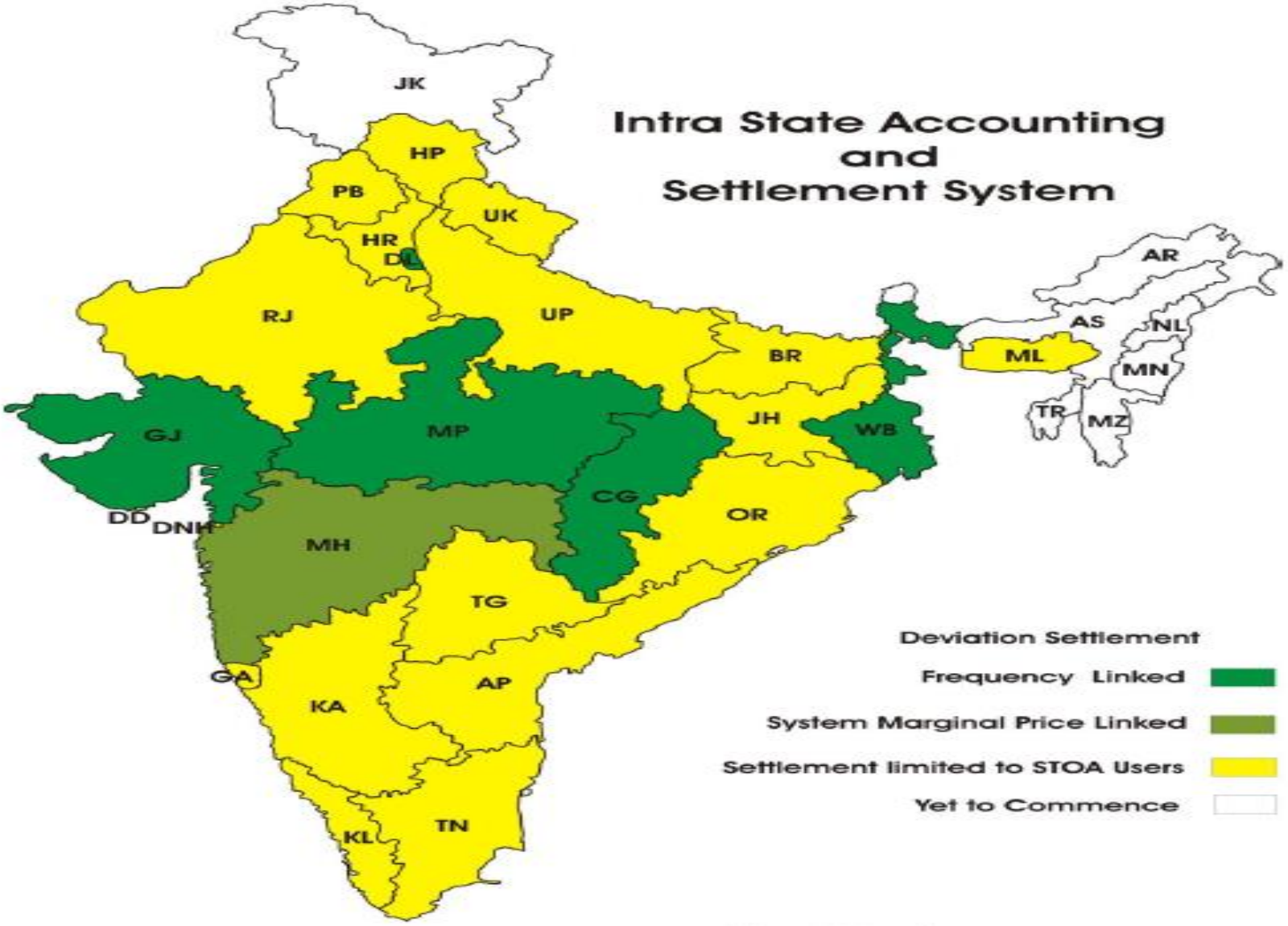
1	Shri. A. S. Bakshi, Member	CERC
2	Dr. M.K Iyer, Member	CERC
3	Shri Ismail Ali Khan, Chairperson	TSERC
4	Shri Anand Kumar, Chairperson	GERC
5	Shri Dev Raj Birdi, Chairperson	MPERC
6	Shri RabindraNath Sen, Chairperson	WBERC
7	ShriVishwanath Hiremath, Chairperson	RERC
8	Shri PremanDinaraj, Chairperson	KSERC
9	Shri P. Rama Mohan, Member	APSERC
10	ShriP.J. Thakkar, Member	GERC
11	Shri Deepak Lad, Member	MERC
12	Shri K.M. Shringarpure, Member	GERC
13	Shri R.P. Barwar, Member	RERC
14	Shri D.B. Manival Raju, Member	KERC
15	Shri K.V.S Baba, CEO	POSOCO
16	Ms. Shilpa Agarwal, JC (Engg.)	CERC
17	Ms. Shruti Deorah, Advisor – RE	CERC

18	Shri Vivek Pandey	WRLDC
19	ShriAditya Das	WRLDC
20	Shri. B.B Mehta, Chief(Engg)	Gujarat SLDC
21	ShriS.R.Pandey, Legal Advisor	GERC
22	Shri Sanjay Anada, Joint Director (Engg)	GERC
23	ShriAjitPandit, Director, Idam	Consultant

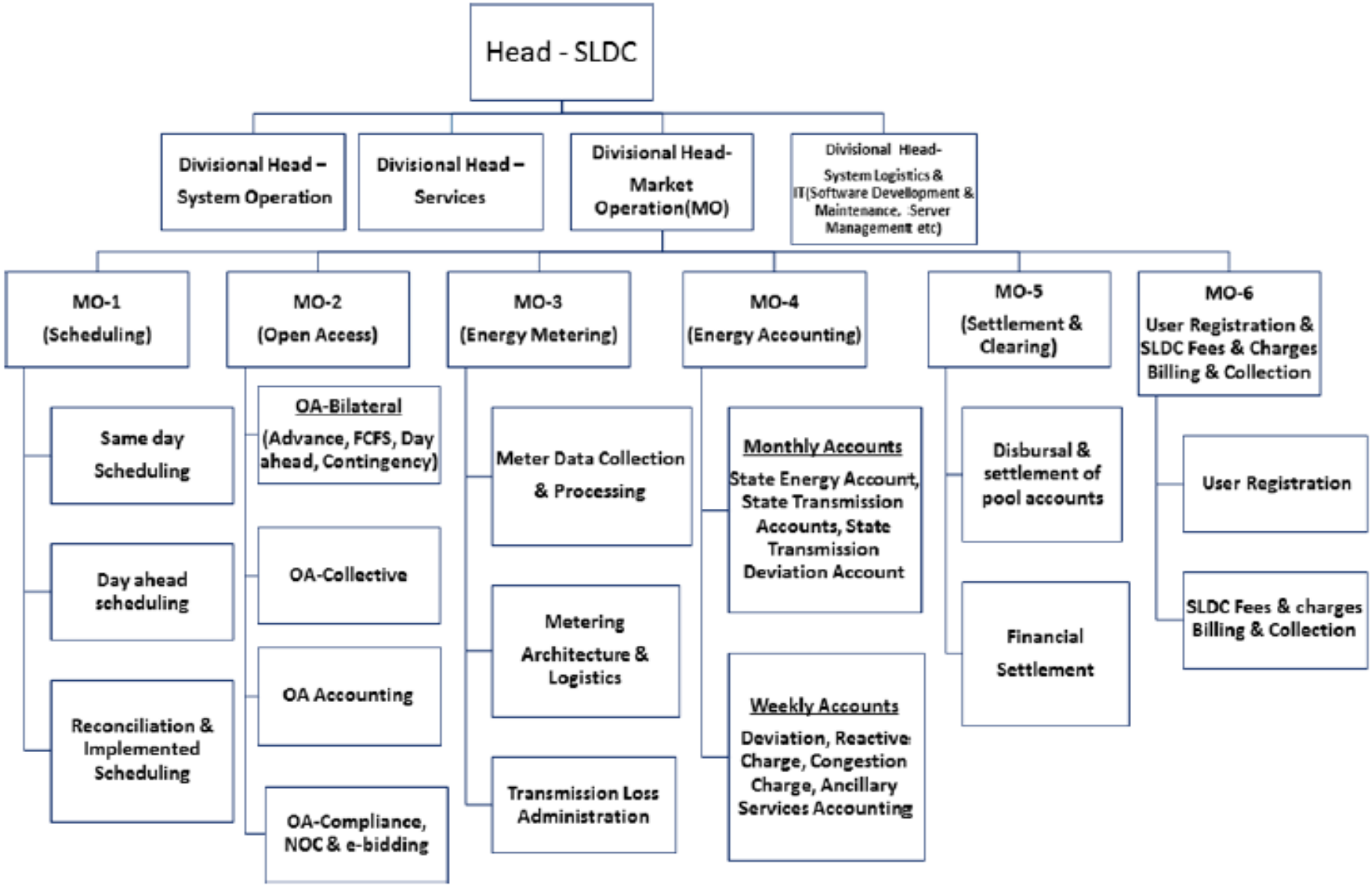
Scheduling, Accounting, Metering and Settlement of Transaction in Electricity

"SAMAST"

Status of Intra-State DSM in India



Typical Organization Chart for SAMAST

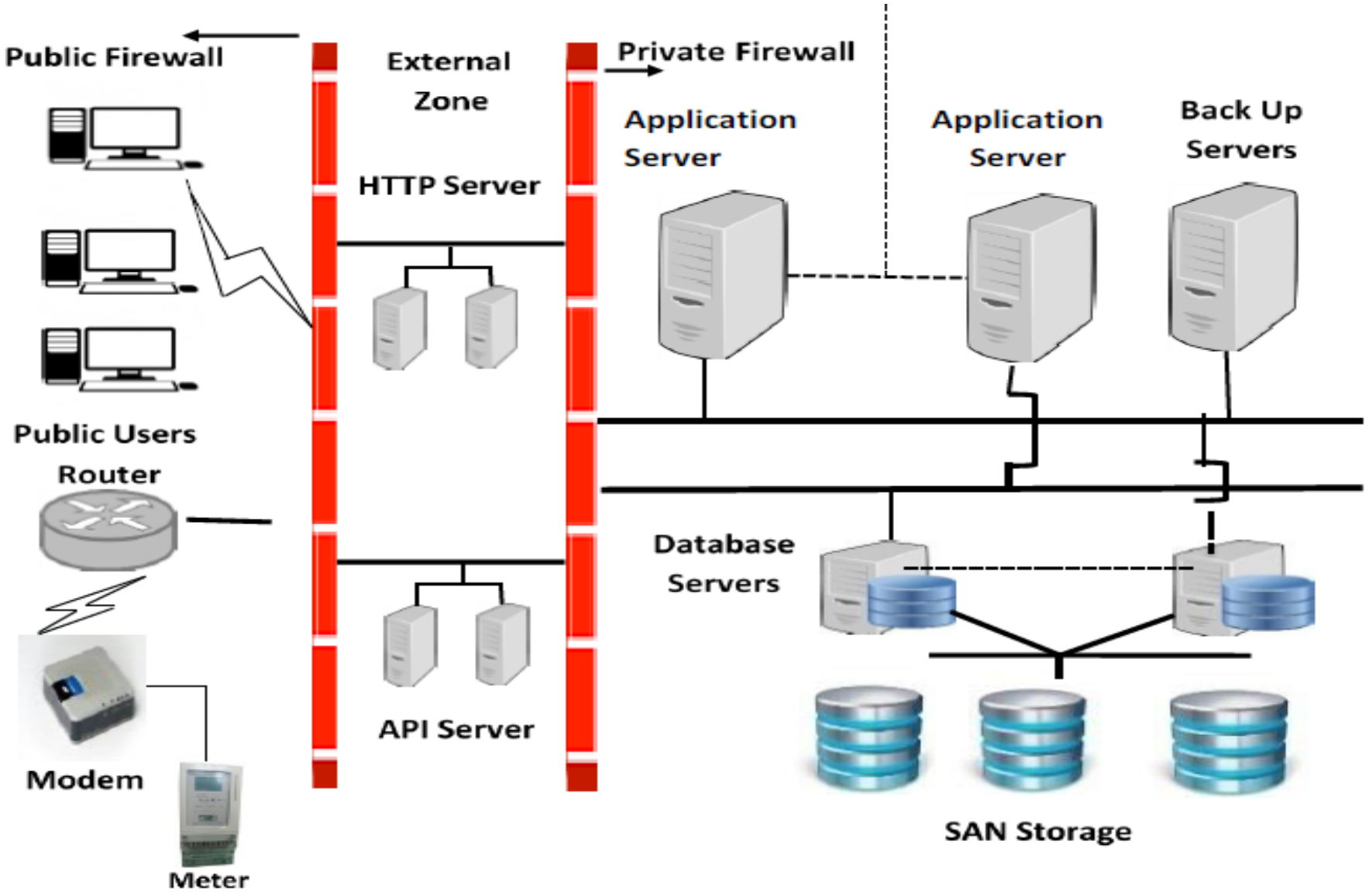


Typical Application Software for SAMAST

Application Software

- Registration
- Open Access
- Scheduling
- Energy Accounting
- Management Information System
- Fees & Charge
- Forecasting
- Meter Data Management
- Settlement & Clearing
- Big Data Analysis

Typical IT Infrastructure for SAMAST



Demarcation of Interface boundary & identification of Pool Members

All the **entities connected at the transmission level** of the intra State System to be identified and **made pool members**.	**Implemented**
Interface locations and tie lines to be notified. small feeders at 33 kV level and below should be out of the intra state energy accounts and must be settled bilaterally between the utilities. Delay in getting meter data from these small feeders should not scuttle the entire weekly system.	**Implemented**
Jurisdiction, roles and responsibilities of SLDC, STU, Users, Market players to be outlined **in** the respective **State Grid Code.**	**Implemented**
All pool entities, transmission licensees, distribution licensees and market players to be registered as **Users of appropriate LDC.**	**Implemented**

Adequate Interface Energy Meters with AMR infrastructure

Assessment of **locations** in the intra system **for placement of energy meter** for demarcation of interface boundary.	**Implemented**
Installation of IEM- Main, Check and Standby as mandated by the CEA Metering Standards. The CEA Metering Standards stipulate the bare minimum requirement. Faster detection of meter failure is also desirable as the present one week for meter data collection could become a constraint. **Alternatively, more meters could be installed to ensure N-2 or N-1-1 security of the metering system.** Robustness of the metering system to be enhanced by ensuring N-1-1 or N-2 security of the metering system.	**Implemented** **More meters could be installed to ensure N-2 or N-1-1 security of the metering system**

Adequate Interface Energy Meters with AMR infrastructure

Meter placement and submission of dummy reading to be a necessary condition **before granting pool membership** to an entity and connectivity at any location.	**Implemented**
PT/CVT in all three phases to be provided for implementing electrical energy measurements based on **3-phase 4-wire metering principle.**	**Implemented**
SLDC to be responsible for designating placement of meters.	**Implemented GETCO, CO done the job**
STU to be responsible for Interface Energy Meter procurement, installation, maintenance, testing and calibration.	**Implemented**

Adequate Interface Energy Meters with AMR infrastructure

Interface Energy Meters to be tamper proof and compliant with CEA "Functional Requirements for Advanced Metering Infrastructure"	**Implemented**
All future procurements of Interface Energy Meters to have recording at 5-min interval and frequency resolution of 0.01 Hz. They must be capable of recording Voltage and Reactive Energy at every 5-min and have feature of auto-time synchronization through GPS.	**Meter procurement done by GETCO, CO. Requirement is being conveyed.**
The energy interchange of all the State Entities with the State Grid should be meticulously **recorded with the help of energy meters** of appropriate accuracy class installed at the interface points **as per the CEA Regulations.**	**Implemented**

Adequate Interface Energy Meters with AMR infrastructure

Meter records of all Interface Energy Meters (Main, Check and Standby) **to be collected at respective SLDCs** for energy accounting at the State level.	**Implemented**
Infrastructure for Automatic Meter Reading and Data collection System to be in place. The Interface Energy Meters shall satisfy the functional requirements for Advanced Metering Infrastructure notified by CEA.	**Implemented**
Meter Management System with a provision for **automatic data validation, estimation of reading in case of bad data as well as provision for Data security and Big Data Analysis to be in place.**	**Implemented**
Database of Interface Energy meter configuration and database (including CT/PT ratio) for the entire system to be maintained by the SLDC and submitted to the appropriate Commission by SLDC on an yearly basis	**Implemented Details are ready for submission.**

Ex-Ante Scheduling

Implementation of scheduling mechanism based on Coordinated Multilateral model where the market players would take commercial decisions while security related decisions would be taken by the System Operator.	**Implemented**
5-min scheduling for addressing ramping challenges imposed by RES to be implemented.	**Yet to be done**
Scheduling to be based on **security constrained merit order with a well-defined timeline.**	**Implemented**
Freedom and choice with market players for portfolio management.	**Implemented**
All information related to the interchange schedules **(Declared Capacity, Entitlement, Requisition, Schedule, Scheduled Losses, scheduled STOA etc.) to be transparently uploaded on website** in a comprehensible format.	**Implemented**

Ex-Ante Scheduling

All before the fact changes in schedule to be sacrosanct. **No post facto changes in schedule to be allowed.**	**Implemented**
Seasonal / Diurnal Energy Banking Contracts between two entities to be converted into separate reciprocal contracts with distinct buyer and seller in each direction specific.	**Not exist**
Energy rate (regulator approved or Market discovered) declared ex-ante shall be used for Merit Order **dispatch in real-time. No post-facto modification in Energy rate.**	**Implemented**
Assessment and declaration of Transfer Capability (based on anticipated network, load, generation availability) by the SLDCs. **Quarterly feedback by SLDCs** to the STU, CTU (through STU), RLDC, RPC and SERC.	**Implemented**

Ex-Ante Scheduling

Transmission Losses recovery in kind; Transmission losses applicable to various category of transactions to be a common knowledge.	**Implemented**
Schedules at various seams/ boundaries to be compiled and published. Care to be taken during curtailment of schedules due to transmission constraints.	**Implemented**

Uniform Energy Accounting System

Implemented Schedule (that incorporates all before-the-fact changes in schedule) to be used as a reference **for energy accounting.**	**Implemented**
Energy Accounting System to be compliant with the Basic principles of Accounting such as the Double Entry System, Full Disclosure principle, Going concern principle etc.	**Implemented**
Deviations to be computed with reference to the Implemented schedule.	**Implemented**
Energy Accounts to inter alia comprise of Declared Capability, Entitlement, Requisition, Scheduled loss, Scheduled transactions through LTA/MTOA/STOA bilateral/ STOA-collective, Actual Interchange and Deviation from Schedule.	**Implemented**

Uniform Energy Accounting System

Metered Transmission Losses (Energy credit to pool minus Energy Debit from pool) **to be computed** for every time block on the lines of Profit and Loss Account in Financial System**.**	**Implemented**
No post facto administration of transmission losses to be done.	**Implemented**
Formats for Energy Statements issued by SPC / SLDC / RLDC / RPC / NLDC / NPC to be standardized.	**Implemented**
Periodic reconciliations and process audit of accounts to be made mandatory.	**Implemented**

Simple, robust, scalable but dispute-free settlement system

Settlement system design should be such that it is scalable and functional **with multi buyer, multi-seller, prosumers.**	**Implemented**
Each intra State entity (Conventional Generator, Pooled RE Generator, Captive Power Plant, OA customer connected at Transmission level) **connected to the Intra State Transmission System to be a member of the pool and separately accountable for deviations.**	**Implemented**
Settlement to be multi-layered. **Charges for Capacity and Energy to be settled mutually between buyers and sellers** while the System Operator to carry out net settlement (Accounting and Billing of Deviation from Schedule).	**Implemented**
Deviation Settlement Mechanism based on "causer pays" principle, **similar to the mechanism at the Inter State level**.	**Implemented**

Simple, robust, scalable but dispute-free settlement system

The pool to be surplus by design so that there is a **provision of reserve funds.**	**Zero pool system implemented**
State pool to be delinked from super and sub-pool to avoid circular reference, recursive revisions and collection / disbursement. There may be reconciliation on an annual basis.	**Implemented**
Gross Settlement for Ancillary Services.	**Yet to be Implemented**
Non zero sum pool by design to maintain reserves.	**Zero pool system implemented**
The settlement period to be 15-minute to start with and **moved to 5-minutes in next five years.**	**It is implemented for 15 -minute time block.**

Administration of transmission losses

Transmission Losses for the Intra State Transmission System to be computed for every settlement period and each settlement cycle.	**Implemented**
Trajectory of Losses over a period (Diurnal and Seasonal) **to be monitored and benchmarked**. Large variations to be analyzed to identify leakages or corrective measures.	**Implemented**
Difference between the Scheduled Losses and Metered Losses to be monitored but there shall be no post-facto truing up/adjustment of energy accounts or losses**.**	**Implemented**
Transmission Loss to be considered as a measure of **transmission adequacy as recommended in the ECC report.**	**Implemented**

Transmission Charges

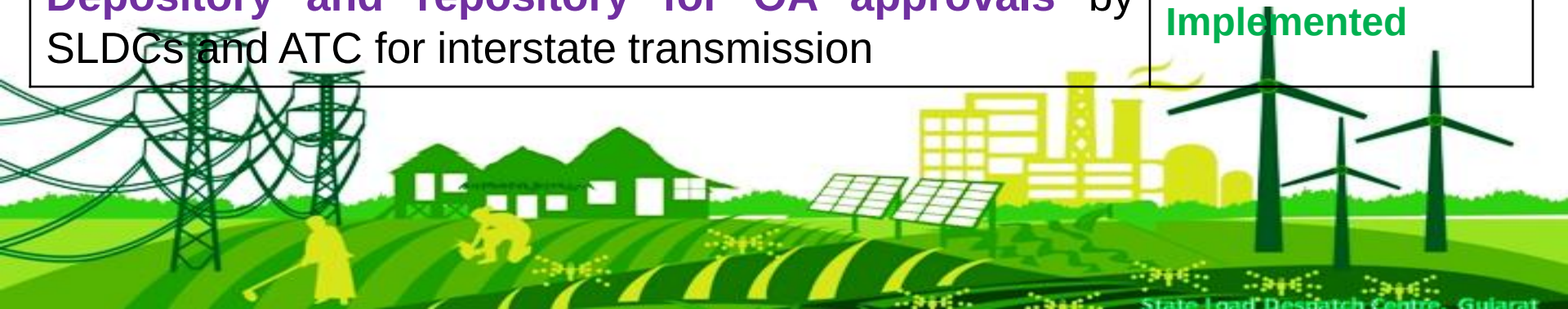
Transmission Charges to be in line with the Tariff Policy.	**Implemented**

Reactive Energy Pricing

Reactive Energy Pricing at inter utility level to be linked to voltage instead of power factor.	**Implemented**
In view of the envisaged challenges due to uneven loading of transmission system with high penetration of RE, **the metering of voltage and reactive energy shall be for each time block.**	**Reactive energy computed on daily basis as per SEM meter provision.**

STOA Registry and Clearing Agency

STOA Registry and Central Clearing house to be established similar to depositories in capital market.	**OA section is established for registration and clearing OA applications.**
Compliance to KYC norms for all market players to be mandated.	**Will be implemented**
Submission of dummy reading to be a necessary condition **before granting pool membership to an entity**	**Not envisaged**
Depository and repository for OA approvals by SLDCs and ATC for interstate transmission	**Implemented**



STOA Registry and Clearing Agency

Integrated **IT based system to facilitate automatic issuance of OA clearance.**	**Implemented**
Mitigation of systemic risk and credit risk for all Regulatory Pool Accounts.	**Necessary BG is to be obtained**
Guarantee of settlement of trades to all members **maintaining adequate margins**.	**Implemented**
Exposure limits for each player derived from past record of credit worthiness.	

Transparency

Rules and Charges for Deviation from schedule **to be known ex-ante.**	**Implemented**
Transmission charges, System Operators **charges applicable to various category of transactions to be declared upfront.**	**Implemented**
Detailed Statements related to Declared Capacity, Long-term/Medium-term/Short term Schedule, Scheduled Transmission Losses, Interface points (tie lines), Interchange Computation formulae, CT/PT ratio, Interface Energy Meter data, Discrepancy statements, Deviation Account, Energy Account, Reactive Energy Account, STOA charges, SLDC charges, Metered Transmission losses, Pool Account liabilities/Assets/defaults/reserves, etc**. to be put in public domain for reference and verification by the respective Entities.**	**Implemented**

Transparency

Formula and Energy Meter reading to be used for computation of interchange with the grid **to be made available to the respective Entities through website.**	**Implemented**
All Energy Statements and Accounts to be kept open for pre-defined duration for reconciliation at periodic intervals and correction of any errors/omissions.	**Implemented**
Data to be shared for research and academic.	**Implemented**

Integrity and Probity of Accounts

Interface Energy Meter Testing, Maintenance and Calibration to be coordinated by the STU who may deploy Certified Metering Service Providers. **Defective Meters to be immediately notified and replaced within a SERC specified time-frame by the STU with information to the SLDC.**	**Implemented**
Repository of IEM Test Certificates to be maintained at the Load Despatch Centre	**No**
In order to **keep check on the accounting system**, the Interchange of the Intra State Entity with the Intra State Transmission System as **recorded in Energy Meters to be compared with the Interchange recorded through real-time SCADA by SLDC.**	**Will be implemented in future**

Integrity and Probity of Accounts

Algorithm for 'Meter Data Estimation' (Similar to State Estimation in SCADA/EMS) to be evolved to detect bad data, changes in network configuration. Meter Data Estimation algorithm to be run at SLDC.	**Implemented** **Validation processing is carried out for detecting bad data and network configuration.**
Implemented Schedule and Energy Account to remain open for 15 days for cross checking and verification.	**Implemented**
Mandatory Process Audit (Internal as well as external) at periodic intervals to be conducted for stakeholder confidence and risk mitigation. A system of peer review of the account by SLDCs could be done say SLDC-A audits SLDC-B and so on.	**Implemented**

Disbursal and Clearing

Electronic clearing through NEFT / RTGS to be mandated.	**Implemented**

Statutory Compliances

Taxation and other statutory compliance aspects associated with pool accounts to be suitably taken care in the Regulations.	**Implemented**

Payment Security Mechanism and Risk Mitigation

Periodic reconciliation of payment and receipt in Regulatory Pool Accounts with the stakeholders to be mandated through regulations.	**Implemented**
Highest priority to payment of Deviation Charges to the pool to be mandated through regulations as well as penal interest for each day of delay as is applicable at inter-state level.	**Implemented**
Payment Security through Suitable Financial Instruments.	**Implemented**
Pool reserves (Non-zero sum pool by design) **to be used to clear the receivable dues.**	**Zero sum pool account is at present adopted.**
Suitable regulatory provision for habitual / chronic defaulters (such as Sec 25A of the CERC-STOA regulations).	**Implemented**

Archival and Utilization of Energy Meter Data

The data related with Implemented schedule, Interface Energy Meter and Deviation **to be archived by the SLDC and State Power Committee**	**Implemented**
Energy Meter data to be used for Load forecasting	**Implemented**
Energy Meter data to be utilized for Big Data Analysis	**Implemented**
Archived data to be shared for research and academic purpose	**Implemented**

Logistics for SAMAST

Adequate and scalable **IT infrastructure** to be in place **with a provision for maintenance and periodic up-gradation**	**Implemented**
Work processes to be automated to the extent possible	**Implemented**
Development of software applications to be through **collaboration of in house team and a long term IT partner** so as to be adapt the systems to the regulatory directions and amendments	**Implemented**
Web-based interface to be deployed wherever feasible (e.g. scheduling Open Access request processing, User Registration etc.)	**Implemented**
Systems for data archival and retrieval to facilitate 'Big Data Analytics' to be in place	**Implemented**
Systems to ensure Data security, Cyber Security and Disaster recovery to be in place	**Implemented**

Logistics for SAMAST

Energy Accounting and settlement system to be made paperless **with the help of IT tools**	**Implemented**
Repetitive and tedious activities to be automated	**Implemented**
Automatic Meter Reading System to be in place with adequate communication system. **Telemetry of Meter data is desirable for faster accounting.**	**AMR Implemented & Telemetry of meter data is yet to be done.**
Separate organization to be established for development of IT applications for Load Despatch Centres / Power Sector utilities on the lines of Centre for Railways Information System. **In house IT team at a Load Despatch Centre to perform the role of project management, system/database/network administration, help-desk support and data centre operations** with necessary support from software vendors	**In house IT team working at SLDC level.**

Logistics for SAMAST

The maintenance of IT hardware could be outsourced. LDCs also need to take up vendor development programme to encourage and attract IT solution providers in Load Dispatching.	**Implemented**
Vendor development activities to be taken up for **creating pool of IT service providers in the power sector.**	**Under Implementation**

Adequacy of Human Resource

Adequate human resources to be deployed **for energy accounting and settlement system.**	**Implemented**
Training on regulatory provisions, IT provisions and accounting principles to be imparted to keep the HR update and motivated.	**Implemented**
Periodic job-rotation and job-enrichment to be mandated.	**Implemented**
Experts Groups to be formed for knowledge sharing and peer review.	**Implemented**

Governance Structure

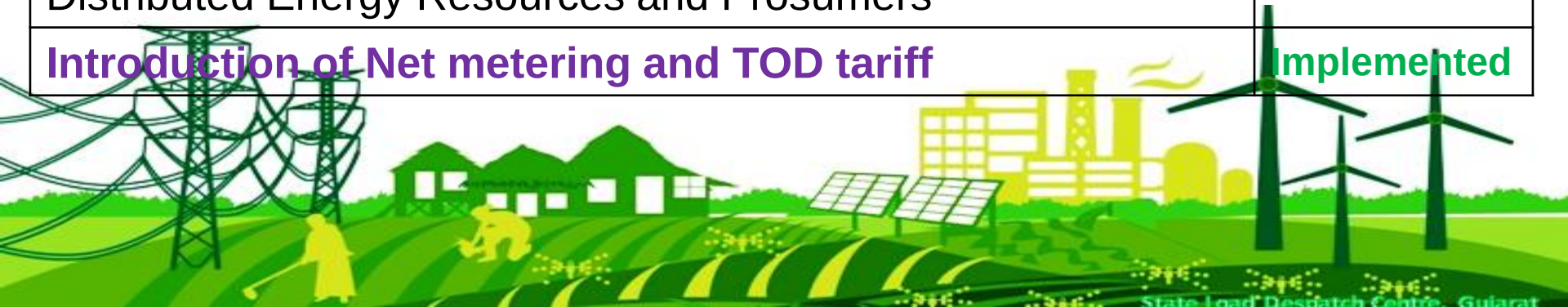
Creation of the State Power Committee with representatives from State Pool members. SPC to prepare the State Energy Account based on the Implemented Schedule and Meter data submitted by the SLDC. **One who prepares the energy account to be different from the one who verifies and approves.** A System of "Maker-Checker" in energy accounting to be in place similar to the maker checker for financial accounting.	**Yet to be Implemented**
The recommended governance structure with roles and responsibilities of various entities in the State for energy accounting and settlement system to be notified by the SERC.	**Implemented**

Facilitating enhanced Grid Security and Economic Despatch

Identifying marginal cost of generation - commonly the variable cost for **cost plus based Thermal Power Stations** – separate from fixed cost	**Implemented**
Separate tariff for peak and off peak generation	**Yet to be Implemented**
Two-part tariff for reservoir/pondage based Hydro Power Stations, so long as they are based on cost plus tariff design principles on the lines of Central Hydro Stations (viz. separate capacity charge) to enable utilization of hydro power as flexible resource for peaking, ramping etc. Appropriate tariff for operation of hydro stations in synchronous in condenser mode for voltage regulation.	**Yet to be Implemented**
Allocation of existing Power Purchase Agreements (PPAs) between distribution licensees	**Implemented**

Facilitating enhanced Grid Security and Economic Despatch

Valuation of flexibility of conventional generating stations for handling inherent variability of demand and RES.	**Implemented**
Multi-part tariff for conventional stations to be introduced to enable hydro flexing, pumped storage operation, synchronous condenser operation, ramping, load following, peaking, two cycle operation	**Non Implemented**
Two-part tariff for RES to be explored	**Yet to be Implemented**
Creation of Distribution System Operators to ensure security of the transmission and distribution system with Distributed Energy Resources and Prosumers	**Yet to be Implemented**
Introduction of Net metering and TOD tariff	**Implemented**



Implementation of Dispatch with Ancillary Services

Freedom and Choice to Entities for revision of schedules for contracts having multipart tariff.	**Implemented**
Despatch based on merit order with Ancillary Services for real time imbalance management.	**Yet to be Implemented**
Transmission charges to be ignored while issuing despatch directions	**Yet to be Implemented**
Pre-defined rules for congestion management (Priority, Market Split)	**Yet to be Implemented**
Suitable mechanism for alleviation of congestion in real-time (Curtailment priority of transactions)	**Yet to be Implemented**

Advance Technology deployment at SLDC - Gujarat

- ***WAMS Technology using PMU***
- ***Real-time RE Generation Data***
- ***WGF Application***
- ***ADMS Scheme***
- ***Development of Back up SLDC***
- ***Latest IT Infrastructure***
- ***Other technology development & Upgradation***

Implementation of WAMS technology using PMU

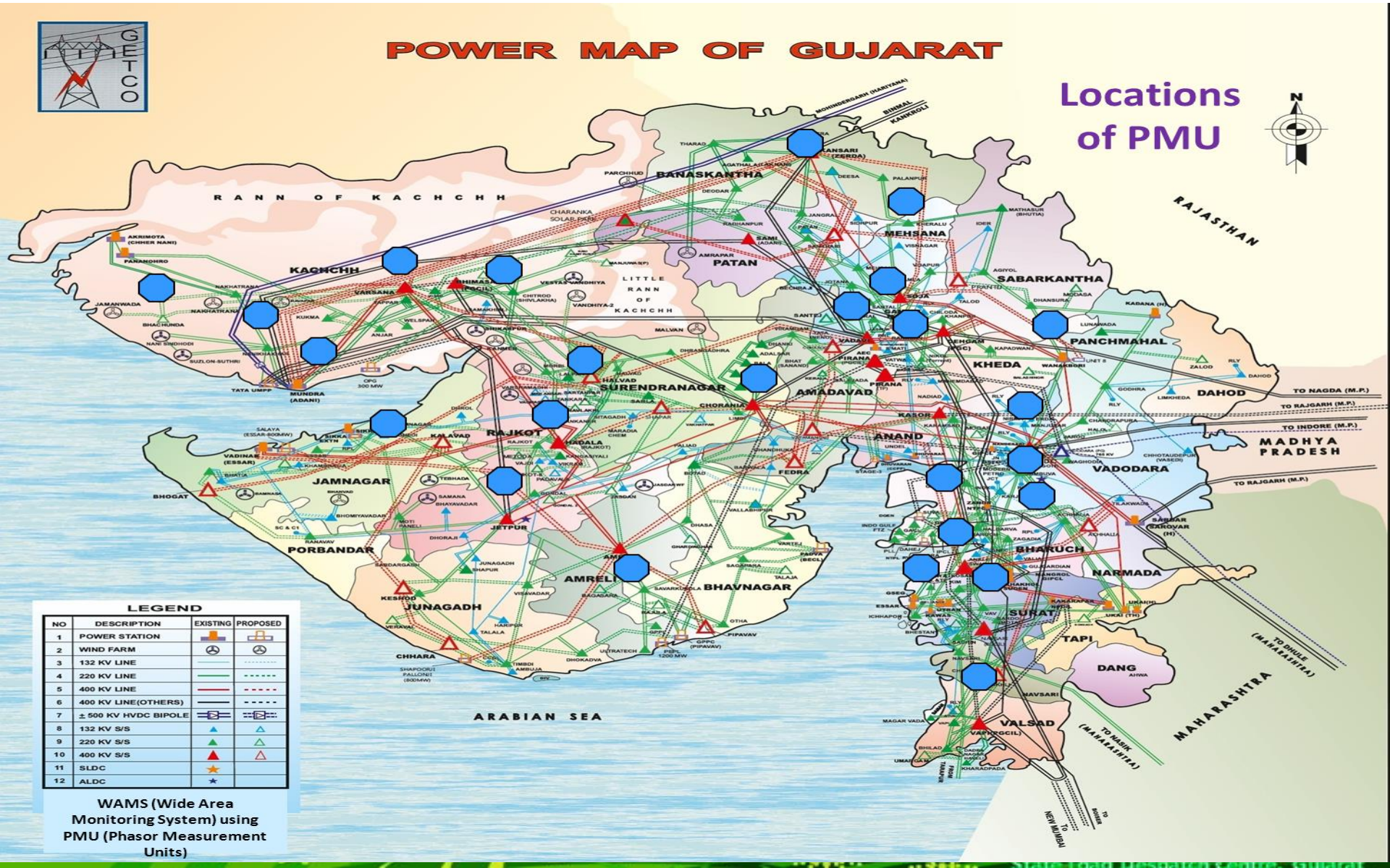
PMU & WAMs technology

- WAMS technology using Synchro phasor.
- Over hundred PMUs are commissioned at 25 locations.
- The Phasor Data Concentrator (PDC) is commissioned at SLDC which is capable of handling 1500 phasors.
- This facility is very much helpful for early detection of any forthcoming harmful event to the grid so as to respond quickly.

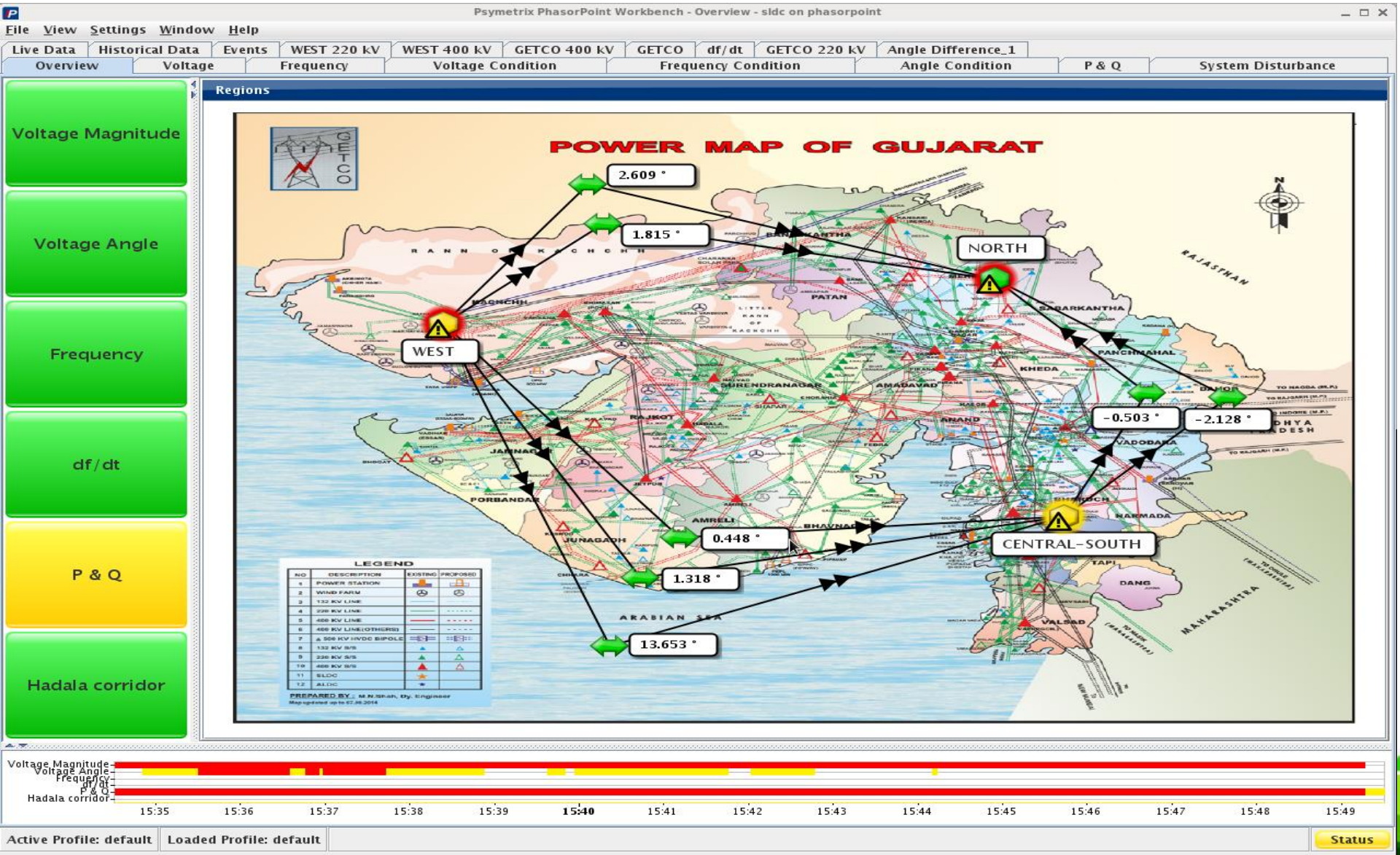
Analytics

- Online Power System oscillation Mode Identification
- Hybrid State estimator
- Dynamic security assessment with voltage stability

System Architecture For WAMS



System Architecture For WAMS



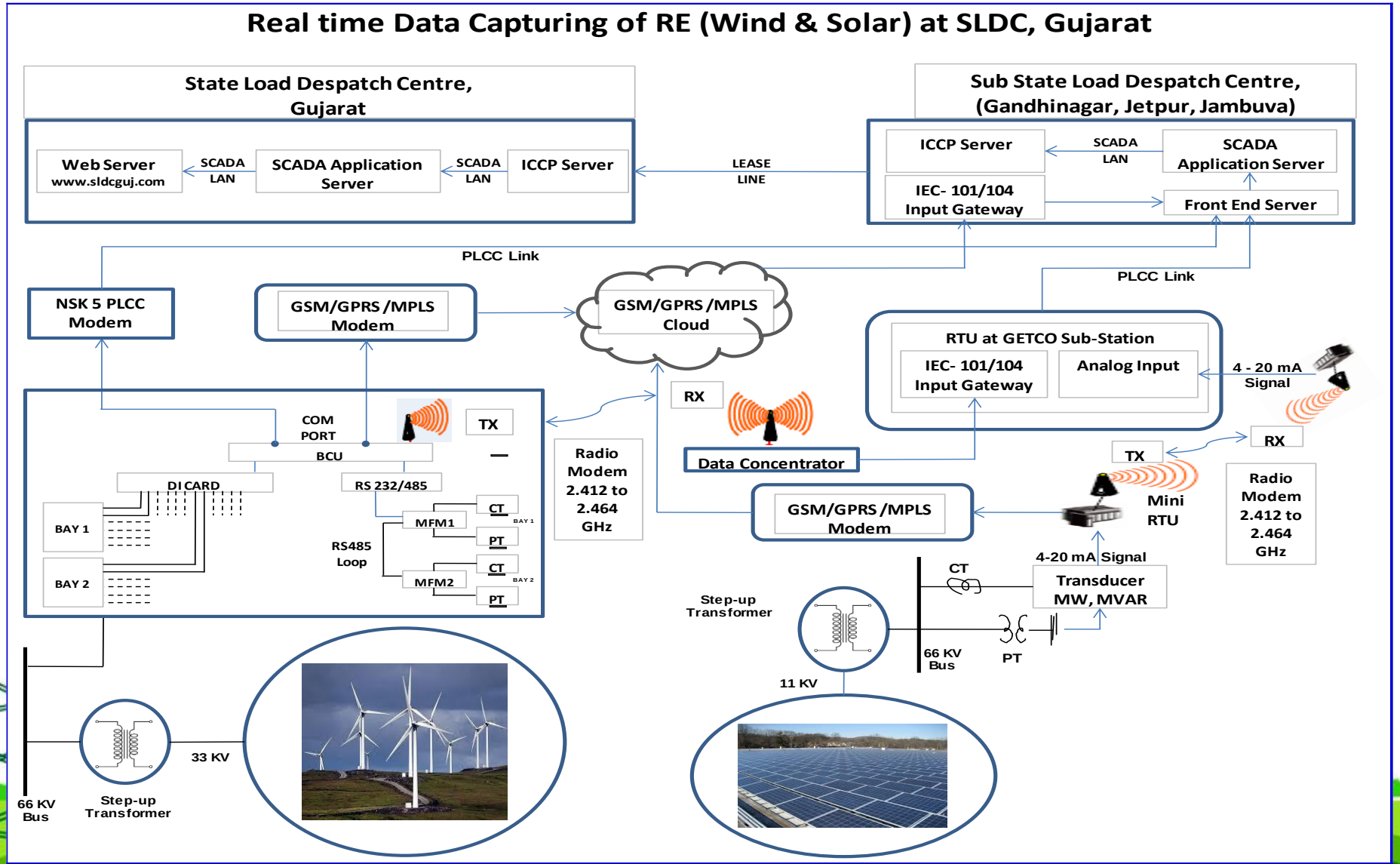
Integration of Real-time RE Generation Data

Data connectivity with mix of available Technologies

- Radio Modem,
- GSM/GPRS,
- Lease Line,
- PLCC

- RTUs providing real-time analog and status data to Sub Control Centre (i.e. Sub SLDC) over IEC 101 protocol through PLCC Communication link / lease line / MPLS / GPRS. Data from Sub Control Centre (i.e. Sub SLDC) shall be transferred to Main Control Centre (i.e. SLDC) through ICCP Servers.

System Architecture For Real-time RE Data



Deployment of WGF Application

FSP: REConnect Energy Solution Pvt. Ltd. (JV- GNERA ENERGIA, Spain)
Web portal: Online web based application
Forecasting of Wind Generation: Gujarat State as a whole.
Input by SLDC:
Static Data (one time) &
Variable Data (weekly ABT meter data & real time SCADA data)

Deliverables from FSP:

Week Ahead Forecasting

Day Ahead Forecasting

Real time Forecasting

– 16 Revision allowed

– each fixed one and half hour time slot starting from 00.00 hrs

– effect of revision from 4th time block

Deployment of WGF Application

Expected Accuracy:

% Error/Deviation = [(Actual data – Forecast data (Schedule data))/Forecast data (Schedule data)]*100

1) ± 15%, during high wind scenario - above 10 MUs per Day

2) ± 30 %,during low wind scenario - 10 MUs per Day and below

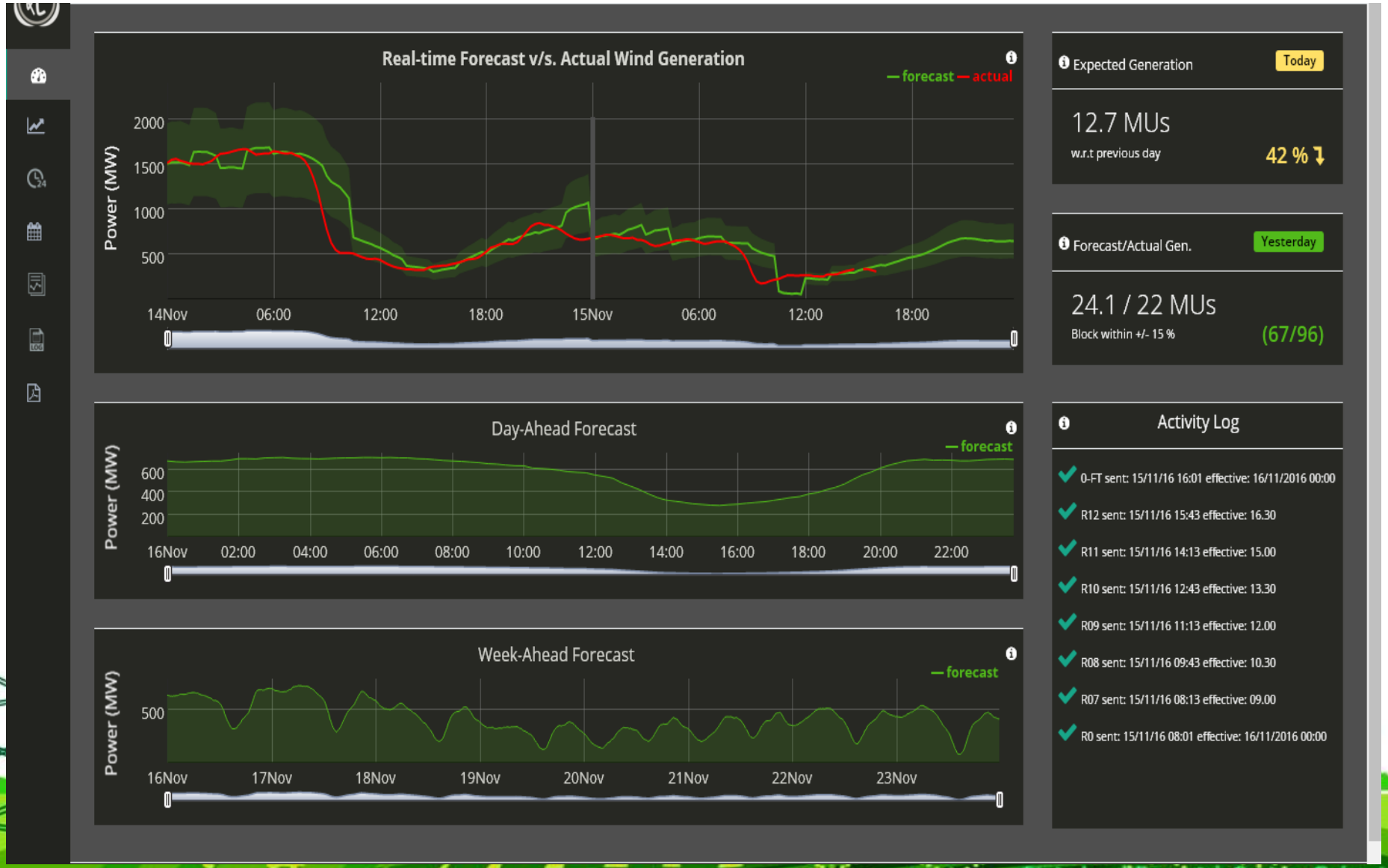
Payment Terms:

Fixed Amount: 10 % of contract value.

Variable Amount: balance 90 % based on accuracy

- % charge payment based on accuracy in Nos. of blocks per day.

Wind Generation forecasting (WGF) Application



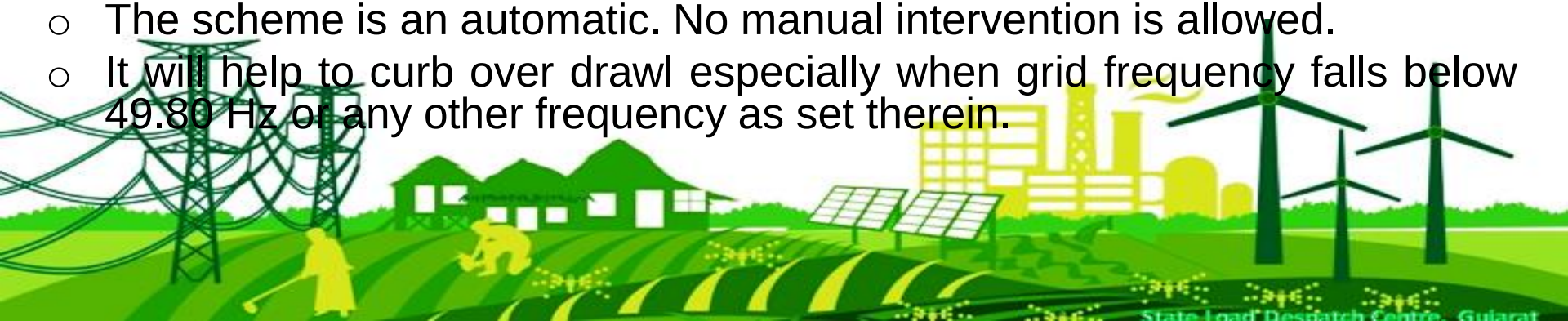
Implementation of ADMS

ADMS technology

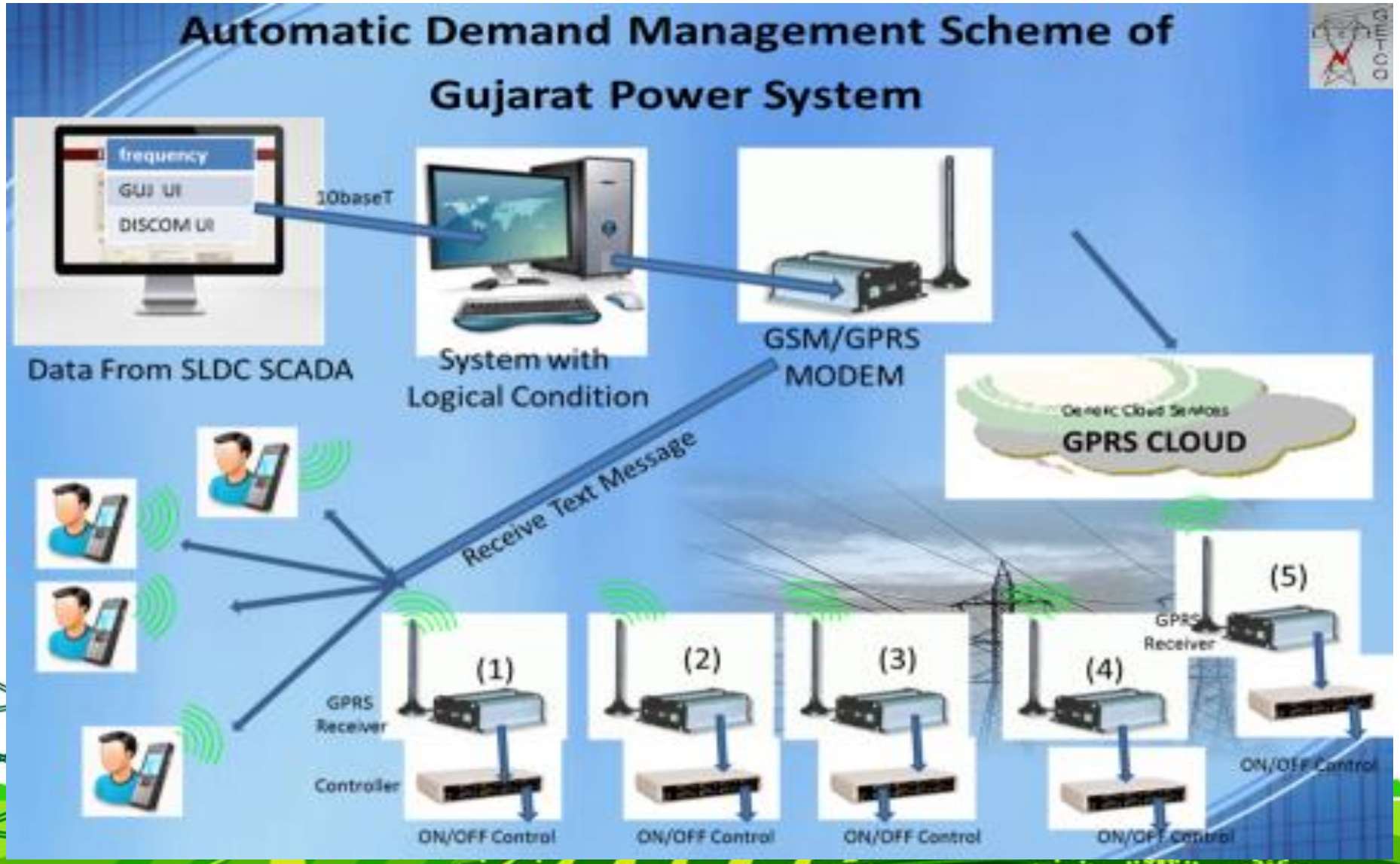
- Feeders identifications
- Evolving logics for ADMS.
- Software / Hardware requirements at Control Centre level / Field level
- Finalization of communication scheme
- Execution and implementation

Key Identification

- Total five groups in each State Discoms.
- Each group is having five 66 KV substation.
- Load relief about 35 MW from each group
- The scheme is an automatic. No manual intervention is allowed.
- It will help to curb over drawl especially when grid frequency falls below 49.80 Hz or any other frequency as set therein.



System Architecture For ADMS



IT Infrastructure

- IPv6 compliance network
- SSL Certification
- Firewall Cyber Security
- Secure redundant LAN with OFC network
- SAS Gateway
- Video Conference facility for meeting / workshop
- Integration between WAMS and SCADA and URTDSM

Technology developed and upgraded

- The web based scheduling software for quick response to acknowledge the acceptance of declared capability of generators
- Fully Automated software for Scheduling & Energy Accounting along with AMR
- The line outage management module in ERP software
- Black start Mock drill twice in a year
- Back-up SLDC at Gandhinagar with advanced IT and hardware infrastructures.
- Back-up SLDC - Tested and successfully operated time to time.

Technology developed and upgraded

- The web based scheduling software for quick response to acknowledge the acceptance of declared capability of generators
- Fully Automated software for Scheduling & Energy Accounting along with AMR
- The line outage management module in ERP software
- Black start Mock drill twice in a year

Technology developed and upgraded

- Back-up SLDC at Gandhinagar with advanced IT and hardware infrastructures.
- Back-up SLDC - Tested and successfully operated time to time.
- For creation of translucent environment, SLDC website is made user friendly and very much informative.
- 4 X 10 KW Roof Top Solar system have been installed at SLDC & 3 Nos. of Sub SLDCs.

Recent Achievement

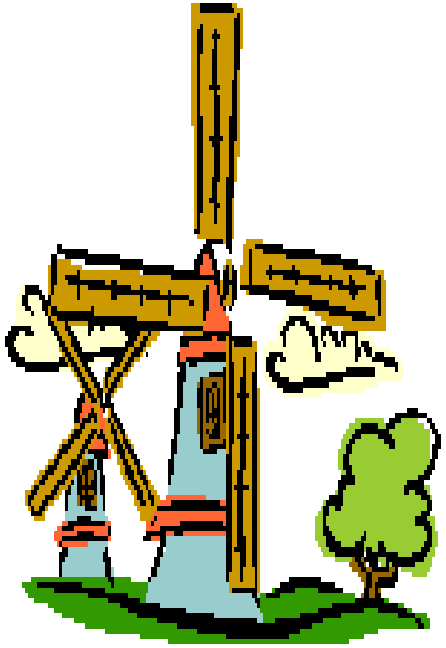
- Prestigious award of **“Utility Best Practice Award-2015"** by India Utility Knowledge and Networking Forum (**IUKAN**), New Delhi.

- Runner up award under the category of **Technology Excellence RISE-2016** with by **Mission Energy** Foundation, Mumbai.

- Prestigious award **of “Innovation in improving the efficiency of Load Despatch Centre”** in Power Awards 2017 by Independent Power Producer Association of India (**IPPAI**), New Delhi.

- **Word of appreciation:** Bob Staton and Mark Edstrom, USEA, during their visit at SLDC under GTG program, have express “Gujarat SLDC well appointed and maintained load despatch facility with inspiration and uplifting office culture.”

- Gujarat SLDC / Sub SLDC is having **53 certified Power System Operators. (PSO)**



Thanking you !!!

System Statistics

Total Installed Capacity (MW)	27133
Thermal	13855
Gas	4934
Hydro	779
Nuclear	559
Wind	5480
Solar	1476
Biomass	41
Other	9

Operational Statistic

Operational Statistic	MW	Date
Max Catered in Mus	372.657	06.10.17
Max Catered in MW	17097	09.10.17
Max Wind Gen in Mus	75.87	05.07.17
Max Wind Generation in MW	3763	05.07.17
Max Solar Gen in Mus	6.99	01.10.17
Max Solar Generation in MW	991	17.10.17

IT & SCADA Statistic

Nos of RTU	181
Nos. of Modem	370
Nos. of Server	50
Analog & Digital Data handling I Nos.	35000

OA & Energy Accounting

Nos. of OA Consumer	501	Registered with system (Both seller & Buyer)
Nos. of pool member (UI)	76	As on week 15 (17-18)
Nos. of ABT Meter	1573	As on 21.11.17
Nos. of AMR	1404	As on 21.11.17 (Oct 17)
Transmission losses	4.07% / 3.88%	Average of 17-18 / 16-17
Pool losses	1.43%	As on week 15 (17-18)

GERC(FORECASTING, SCHEDULING, DEVIATION SETTLEMENT AND RELATED MATTERS OF SOLAR AND WIND GENERATION SOURCES) REGULATIONS, 2017

Background:

- GERC has recently come up with draft regulation for forecasting and scheduling and deviation settlement mechanism. The primary objective is :
  - *a) facilitate large-scale grid integration of solar and wind generating stations*
  - *b) maintaining grid stability and security.*
- Gujarat Electricity Regulatory Commission (GERC) has published draft regulations for forecasting and scheduling for wind and solar projects on 13.1.2017.
- The last date for giving comments and suggestions is 16th February 2017. The Commission has received large participation from the stakeholders and received 22 nos. of comments/suggestions. The Commission has heard the stakeholders on 7.7.2017 and now the regulation is under finalisation.
- The various draft clauses of Regulations under the different heads namely, Scope, Objective, Forecasting & Scheduling code, Qualifying criteria for Qualified Co-ordinating Agency (QCA), Commercial & Deviation Settlement, Implementation Procedure, Means of Communication between QCA & SLDC, Access to Meters, Deviation Accounting, Settlement of Deviation charge, Payment Mechanism and Security, Information about Curtailment, Energy Accounting De-pooling of Deviation Charges, etc. are incorporated in the said draft Regulations.

Applicability:

- Regulations applicable to the Wind Energy Generators and Solar Energy Generators connected with Intra-state network and injecting the energy into the grid.
- Regulations applied to all Wind & Solar Pooling sub-stations, irrespective of their capacity, commissioning date and connectivity voltage level, have to provide **a day-ahead** and **a three day ahead schedule.**
- Day ahead Scheduling of wind and solar energy generation need to carry out by generator or QCA appointed by it.
- Intra-day revisions to a maximum of **16/day** for wind and **8/day** for solar energy permitted. However, the same may be allowed after 6 blocks, i.e. after one and half hour, but effective after 4 blocks.

Executive Summary:

- Forecasting and scheduling will be mandatory for **all** the wind and solar generators connected to the State grid, including those connected via pooling stations.

Error (%) = 100 X [Actual Generation– Scheduled Generation] / Available Capacity;

- Error will be calculated on the basis of **Available Capacity (AvC),**
- The permissible deviation error for wind energy generators are (i) **±12%** for old wind projects commissioned prior to 30.01.2010 and **±8%** for new wind projects (ie, projects commissioned after Jan 2010).
- Permissible deviation for **solar project** will be **±7%.**
- Penalty rates are different than those in the model FOR regulations.
- For wind, the initial penalty is Rs 0.35/unit, increasing to Rs 0.70 and Rs 1.05 per unit in higher penalty bands.
- For solar, the initial penalty is Rs 0.60/unit, increasing to Rs 1.2 and Rs 1.8 per unit in higher penalty bands.

Continue…

- **16** and **8 intraday revisions** will be allowed for wind and solar energy respectively (one revision every 1.5 hours). Revisions will be effective starting from 4th time block onwards.
- Forecasting may be done either by generator or QCA appointed on behalf of it.
- In case of wind/solar generators the scheduling/forecasting may be carry out at the generating station or pooling station.
- Settlement will be done through the “Qualified Coordinating Agency” or **QCA**. QCA will be treated as a state entity, registered with SLDC.
- **SCADA & Telemetry data** is to be mandatorily provided to SLDC by the generators. SLDC shall formulate Data/information exchange requirements and protocols for the same.

Error calculation and penalty bands:

- Payment for generation shall be as per **actual generation** (this is different from the inter-state regulation, where payment is on the basis of scheduled generation).
- Unlike all other DSM regulations, the absolute error for wind energy generators will be **reduced by 1% every year** in the specified deviation band from start of fourth year till subsequent **5 years.**
- At the end of 5th year the absolute error shall become **<=7% for old projects** and **<=3% for new projects** in case of wind projects.
- Similarly in case of **solar projects** the absolute error shall be reduced by 1% every year from start of the fourth year till subsequent **5 years**, reaching the **minimum of <=2%.**

Continue....

- Penalty is calculated at fixed amounts per unit (whereas, for Inter-state it is calculated as a percentage to PPA rate).
- **A tripartite agreement** will be formed amongst the **Generator, QCA and SLDC**, in case the generator fails to pay the deviation charges within specified timeline, the QCA shall require to pay such charge. Such agreement need to submit to SLDC and get approved from the Commission.
- Energy accounts shall be prepared by SLDC on 10 day basis.
- De-pooling shall be done in proportion to available capacity, energy generated in each time block, absolute error of individual generator or any other methodology between QCA & Generators.

In case of Intra-State transmission, Penalty Mechanism for **wind** generating station or pooling station **commissioned prior to 30.01.2010**

Deviation within +/- 12%	No penalty	Full payment
Deviation from 12% to 20%	Penalty of 0.35 on	Per Unit Deviation
Deviation from 20% to 28%	Penalty of 0.70 on	Per Unit Deviation
Deviation greater than 28%	Penalty of 1.05 on	Per Unit Deviation

In case of Intra-State transmission, Penalty Mechanism for **wind** generating station or pooling station **commissioned after to 30.01.2010**

Deviation within +/- 8%	No penalty	Full payment
Deviation from 8% to 16%	Penalty of 0.35 on	Per Unit Deviation
Deviation from 16% to 24%	Penalty of 0.70 on	Per Unit Deviation
Deviation greater than 24%	Penalty of 1.05 on	Per Unit Deviation

In case of Intra-State transmission, penalty mechanism for **solar** generating station or pooling station

Deviation within +/- 7%	No penalty	Full payment
Deviation from 7% to 15%	Penalty of 0.60 on	Per Unit Deviation
Deviation from 15% to 23%	Penalty of 1.20 on	Per Unit Deviation
Deviation greater than 23%	Penalty of 1.80 on	Per Unit Deviation

QCA:

The qualified coordinating agency (QCA) will be required to meet certain eligibility criterion. Briefly, these are:

- Providing F&S services for more than 2 years
- Having a net-worth of more than Rs 2.5 crore
- Have experience of working in different “terrains and regions”
- QCA should have a well qualified team in-house, including skills of data science, statistics and software development
- QCA should be using software of a “at least CMMI Level 3 certified” company
- QCA shall required to open LC on behalf of the Members for payment security.

Metering and Communication

- QCA/generator shall required to set up special energy meter/ABT compliant meter capable of recording energy in 15 minutes time blocks.
- QCA/generator forward weekly meter reading to SLDC of a previous week in addition to data acquisition provided to SCADA for energy accounting purpose.
- QCA and SLDC should communicate using software developed by QCA duly approved by SLDC. The various information like Real Time generation at pooling station/individual generator, grid constraints or curtailment from SLDC for generation, outage ad its reason, basic information of the site and turbines/invertors provided to such communication.
- QCA may have access of data from existing modem on ABT meter and also access to API link for getting data from meter.

Deviation Accounting

- DSM for conventional generator prepare in line with CERC Regulations.
- Deviation charge(D) payable/receivable for the State as a whole at the State periphery shall be first computed.
- Deviation Charges payable by the Distribution Licensee/Open Access customers/conventional generators shall be calculated by SLDC as per CERC DSM Regulations.
- Absolute Error in the schedule energy and actual energy at each pooling station and each generator which fed energy directly to sub-station and deviation if any observed and its reflection in State Account shall be calculated by SLDC.
- Energy Account specified deviation charges are for Renewable Energy (R) prepared by SLDC based on the present regulations.
- SLDC prepare energy account specifying deviation made by the pooling station or the individual generator and amount payable on that basis as per these regulations.
- SLDC evaluate the D-R and these amount shall be allocated in proportion to deviation made by the Wind/Solar generators which is reflected at State periphery.
- SLDC calculate deviation of RE generator who actually deviate from given schedule and its impact at State level deviation charge and proportionate deviation charge receivable from RE generator.

Payment Mechanism and Security

- Payment settlement shall be prime responsibility of wind generator or solar generator as case may be.
- QCA shall collect the applicable deviation charge from such generators
- Wind/Solar generator/QCA provide payment security to SLDC by way of BG or Revolving LC.
- Any delay in paying deviation charge beyond permissible limit, an interest of 0.04% per day for each day of delay shall be levied.

Curtailment

- In case of failure of SLDC to communicate about the curtailment to QCA/generator deviation penalty shall not be levied for those given time blocks.
- In case of planned curtailment QCA/generators have required to amend their schedule failing which the SLDC shall revised the schedule.

THANK YOU

Idam Infrastructure Advisory Pvt. Ltd.

Agenda Item - 3

Status of Implementation of SAMAST Report/Forecasting And Scheduling & DSM Regulations (Tamil Nadu, West Bengal and Haryana)

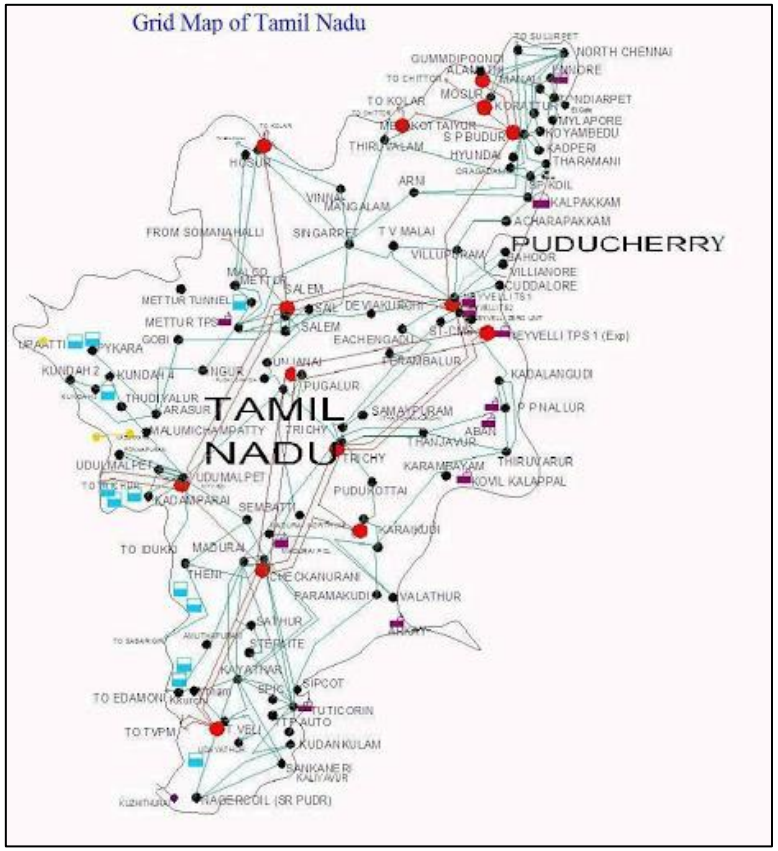
For Discussions during 16th Meeting of FOR Technical Committee

November 24, 2017

The engagement of Consultant for support to FOR and its Technical Committee is supported under USAID/GTG-RISE initiative through Deloitte.

Status Update on F&S and DSM Regulations for Tamil Nadu:

Profile of Tamil Nadu



Peak Demand: 14823 MW
Supply: 14823 MW
No. of Sub-stations: 842 no. of Substations
(Ref.: LGBR 2017-18 Report & TANTRANSCO website)

Profile of State

Generation sources	Installed Capacity in MW	No. of Units
Thermal	4844	58
Hydro	2203	70
Wind	7895	11906
Solar	1687	176
Other RE	922.4	161

Total Gen Cap. : 29324 MW
IPPs: 746.5 MW
CPPs: 3084 MW

(Ref.: CEA Executive Summary Oct 2017; TANGEDCO Website & SIGMA Insights)

No. of Distribution Licensees /SEZ: 1 no. (TANGEDCO)
No. of Transmission Licensees: 1 no. (TANTRANSCO)
No. of OA Consumers : 440 no. (LTOA/MTOA/STOA)
(Ref.: FOR - SAMAST Report, 2016)

Regulatory Developments:

- Tamil Nadu falls under **Category 'C'** of SAMAST report
- Generators payment on actual basis
- MYT Tariff Regulations, 2005 and its amendments, TNERC MYT Regulation specifies provision determination of Capacity Charge and Energy Charge of generators
- State Electricity Grid Code, 2005 and its amendments
- Grid Connectivity and Intra-State Open Access Regulations, 2014, specifies treatment to the Deviation of OA generators/consumers

Chronology and Scope of Activities in Tamil Nadu

- During the 11th Meeting of the Technical Committee, TNERC presented the issues and challenges being faced while drafting the F&S Regulations for Tamil Nadu due to highest penetration of RE and sought support of the consultant (Idam) for revamping the F&S and DSM Framework for Tamil Nadu.
- Consultant studied and revised the draft F&S Regulations of TNERC and also prepared the Draft DSM Regulations for TNERC in line with Model DSM Regulations for States and submitted the to TNERC on 3rd November,2017.
- **The Consultant also discussed the Draft DSM and F&S Regulations with TNERC during meeting dated 8 and 9th November,2017.**
- As instructed by the TNERC, the Consultant also visited and interacted with officials of the TNSLDC for in depth understanding of the existing RE generator metering arrangement, interconnection points, No. of pooling stations etc.
- Based on the interactions with TNSLDC, Consultant revised the draft F&S Regulations and Draft DSM Regulations for the State and submitted to TNERC for further Regulatory process on 9th November,2017.

TNERC draft F&S Regulations – 1/2

Sr.	Particulars	FOR Model F&S	Revised TNERC Draft F&S Regulations (9 Nov2017)
1	**Applicability**	Wind and solar generators selling power within or outside the state	• All Wind and Solar generators (excluding Rooftop PV solar power projects) connected to the InSTS or Distribution System, including those connected through Pooling S/s, and using the power generated for Self-consumption or sale within or outside the State.
2	**Forecasting and Scheduling Responsibility**	Wind and solar generator or by QCA Or forecast by SLDC to be accepted	• Wind and solar generator or by QCA • Forecast by SLDC accepted
3	**Computation of Error Formula**	Available Capacity in denominator	• Absolute Error = 100x {(Actual generation- Scheduled Generation)/ Available Capacity(AvC)}
4	**Tolerance Band for DSM**	10% new wind and solar generator. < = 15% existing wind and solar generator	• Uniform tolerance band for Wind and Solar (+/-10%, +/-20%, +/-30%) • No distinction between Existing or New
5	**Scheduling Requirement**	Weekly and day-ahead with maximum 16 revisions during a day	• Weekly and day-ahead with maximum 16 revisions during a day
6	**Generator Payouts linked to**	• On Schedule basis (inter-state) • On Actual basis (intra-state)	• On Schedule basis (inter-state) • On Actual basis (intra-state)
7	**Deviation Pricing**	• Linked to Fixed Rate/PPA (inter-state) • PU INR 0.50, 1.0, 1.50 (intra-state)	• Linked to Fixed Rate/PPA (inter-state) • PU INR 0.50, 1.0, 1.50 (intra-state)

Simulation exercise was undertaken to evaluate the impact of the different options for deviations pricing for inter-state RE.

TNERC draft F&S Regulations – 2/2

Sr.	Particulars	FOR Model F&S	TNERC (draft)
8	**Reference point for DSM**	Pooling station	• Pooling Station (incl. Discom S/S) • Existing RE Gen. need to be mapped. • Definitions of Interconnection Point and Metering Point modified considering existing practices
9	**Apportion of Energy Deviations & DSM Charges among RE generators at a pooling S/S**	In proportion to actual generated units or available capacity	In proportion to actual generated units or available capacity as may be mutually agreed between QCA and the Generators.
10	**Telemetry and Communication Requirement & Responsibility for providing telemetry and Communication**	Data relating to power system output and weather By Generator	Data relating to power system output and weather By Generator/QCA
11	**Procedure for Data Telemetry and Communication**	Detailed procedure to be evolved by SLDC	Contours of Detailed procedure by SLDC have been outlined in Regulations
12	**DSM For Sale Outside State Specified**	Yes	Yes, subject to conditions
13	**Meeting Shortfall of DSM Pool**	PSDF and NCEF	RE generators treated as a virtual pool within the State Pool. Deviations for and within this virtual pool could be settled first at the rates proposed under Deviation charge and then any Excess/shortfall shall be treated under state Deviation Pool Account.

Draft TNERC DSM Regulations,2017 – Salient features(1/3)

Sr. No.	Ref of Draft Regulations	FOR Model DSM Regulations	Proposed Draft TNERC DSM Regulations (ver 9 Nov 2017)
1	Objective	To maintain grid discipline and grid security as envisaged under the Grid Code through the commercial mechanism for Deviation Settlement through drawal and injection of electricity by the users of the grid	To maintain grid discipline and grid security as envisaged under the Grid Code through the commercial mechanism for Deviation Settlement through drawal and injection of electricity by the users of the grid.
2	Applicability	Seller(s) and Buyer(s) involved in the transactions facilitated through short-term open access or medium-term open access or long-term access in intra-state transmission or distribution of electricity (including inter-state wheeling of power), as the case may be.	• All Seller(s) including OA Generating Station(s) but excluding Wind and Solar Generating Station(s) connected to InSTS or Distribution system in accordance provisions of TNERC(Grid Connectivity and Intra-State Open Access Regulations), 2014. • Applicable to All Distribution Licensees and Full OA consumers in the State. • Full OA consumer defined as connected to transmission or distribution system but not having any contract demand with the distribution licensee. • Deviations of the Buyers other than Distribution Licensee and Full OA shall be subsumed within Discom deviations and shall be governed as per OA Regulations.

- TNERC Tariff Regulations, 2005 and amendments thereof (for ABT applicability to Generating Stations)
- MYT Tariff Order for TANGEDO
- TNERC Grid Code 2005
- TNERC Open Access Regulations, 2014 and amendments thereof

Draft TNERC DSM Regulations,2017 – Salient features(2/3)

Sr. No.	Ref of Draft Regulations	FOR Model DSM Regulations	Proposed Draft TNERC DSM Regulations (9 Nov 2017)

3	Limits for Deviation	• No over-drawal/under-injection when Frequency below 49.8 Hz.
		• No under-drawal / over-injection when frequency is above 50.05 Hz
		• Volume Cap for Intra-state Entities proposed as under:
		  • For Generators /Sellers : 10 MW or 12% of Schedule, whichever lower
		  • For DISCOMs/Buyers: X Limit or 12% of Schedule, whichever lower
		  • In case of schedule is less than 40 MW, Volume cap of 5 MW or 12% of schedule, whichever higher.
		• Additional Charges at rate of 20%, 40%, 100% of Applicable Deviation Charges in steps of deviation 12%-15%, 15%-20%, > 20% or X+10 MW, X+ 20 MW, > X+ 20 MW
			• No over-drawal/under-injection when Frequency below 49.7 Hz
			• No under-drawal / over-injection when frequency is above 50.05 Hz
			• Volume Cap for Intra-state Entities proposed as under:
			  • For Generators /Sellers : 10 MW or 12% of Schedule, whichever lower
			  • For DISCOMs/Buyers: X Limit or 12% of Schedule, whichever lower
			  • In case of schedule is less than 40 MW, Volume cap of 5 MW or 12% of schedule, whichever higher.
			• Additional Charges at rate of 20%, 40%, 100% of Applicable Deviation Charges in steps of deviation 12%-15%, 15%-20%, > 20% or X+10 MW, X+ 20 MW, > X+ 20 MW

Draft TNERC DSM Regulations,2017 – Salient features(3/3)

Sr. No	Ref of Draft Regulations	FOR Model DSM Regulations	Proposed Draft TNERC DSM Regulations (9 Nov 2017)
4	Charges for Deviation	• Charges payable (over-drawal/under-injection) and receivable (under-drawal/over-injection) for each time-block with slope of 50 paise/unit per 0.01 Hz • Linked to avg. freq (15 min duration) in steps of 0.01 Hz over range from 49.9 Hz to 50.05 Hz • Change in sign of deviation once every 6 time blocks- violation attracts additional charges @10% of deviation charges applicable for the continuance of violation • Cap Rate of Paise 303.04/ unit (indicated- to be linked through imported coal power plant) • Charges for over injection / under drawal in excess of 12% of the schedule or 10 MW shall be zero.	Charges shall be accordance to CERC (DSM Regulations), 2014 • Charges payable (over-drawal/under-injection) and receivable (under-drawal/over-injection) for each time-block with slope of 35 paise/unit per 0.01 Hz • Linked to avg freq (15 min duration) in steps of 0.01 Hz over range from 49.7 Hz to 50.05 Hz • Change in sign of deviation once every 6 time blocks- violation attracts additional charges @10% of deviation charges applicable for the continuance of violation • Cap Rate of Paise 303.04/ unit (indicated- to be linked through imported coal power plant) • Charges for over injection/ under drawal in excess of 12% of the schedule or 10 MW shall be zero.
5	Institutional Arrangement	• State Power Committee to prepare Statement for Deviation Charges on Weekly basis • State Load Despatch Centres to operate & maintain 'State Deviation Pool Account Fund'	• TNSLDC to prepare and maintain State Deviation Pool Account • State Power Committee to co-ordinate and facilitate intra-state energy exchange • SPC to monitor compliance of DSM Regulations by State Entities.

Status Update on DPR preparation on SAMAST implementation in West Bengal:

Scheduling, **A**ccounting, **M**etering **a**nd **S**ettlement of **T**ransactions in Electricity

SAMAST DPR for West Bengal:

- West Bengal comes under Group-A category state as per SAMAST Report. Intra-state ABT, Energy accounting and Deviation settlement for all intra-state entities since 1.4. 2008 through WBERC BSC Code Regulations, 2008.

➢ Frequency linked DSM similar to CERC, DSM liability is transferred to DISCOMs.

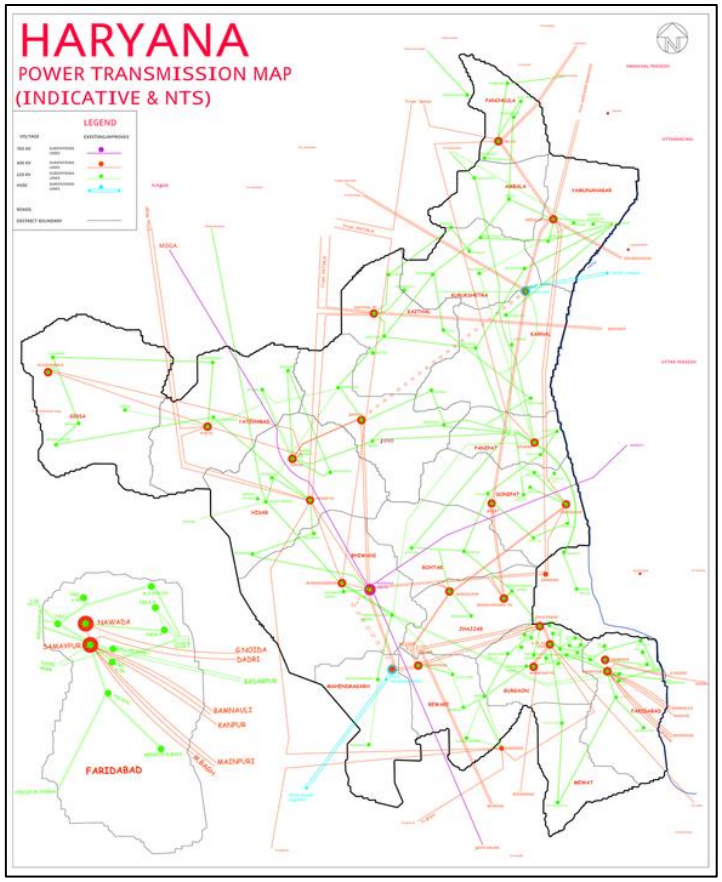
Status for Implementation of Intrastate ABT Mechanism

- Working draft of DPR for SAMAST implementation and Template for Cost Estimation sheet was submitted to WBSLDC for review.
- WBSLDC reviewed the Draft DPR with its IT team and suggested some revisions in the Draft DPR.
- Considering comments of WBSLDC Darft DPR is revised and submitted to WBSLDC on 25 October,2017.
- WBSLDC has processed the revised DPR for internal approval of Management before submitting the DPR before the PSDF appraisal committee.

Status of Implementation of SAMAST Report/Forecasting and Scheduling & DSM Regulations in Haryana

Scheduling, **A**ccounting, **M**etering **a**nd **S**ettlement of **T**ransactions in Electricity

Profile of Haryana



Peak Demand: 9262 MW
Supply: 9262 MW
No. of Transmission S/s: 412 no. of Substations
(Ref.: LGBR 2017-18 Report & HVPNL website)

Profile of State

Generation sources	Installed Capacity in MW	No. of Units
Thermal	6951	20
Hydro	1284	11
Wind	-	-
Solar	12.8	9
Other RE	353.2	-

Total Gen Cap. : 11180 MW
IPPs: 3106 MW
CPPs: 352 MW

(Ref.: HERC Annual Report 2014-15 & CEA Executive Summary Oct 2017)

No. of Distribution Licensees /SEZ: 2 no. (UHBVN & DHBVN)
No. of Transmission Licensees: 1 no. (HVPNL)
No. of OA Consumers : 349 no. (LTOA/MTOA/STOA)
(Ref.: FOR - SAMAST Report, 2016)

Regulatory Developments:

- Haryana falls under **Category 'B'** of SAMAST report (Deviation Settlement only for Open Access Consumers)
- Generators payment on actual basis
- MYT Tariff Regulations, 2012 specifies determination of Capacity Charge and Energy Charge of generators
- State Electricity Grid Code,2009 and its amendments
- HERC Open Access Regulations 2012, specifies treatment to the Deviation of OA generators/consumers
- HERC is yet to notify Scheduling and Despatch Code for Haryana

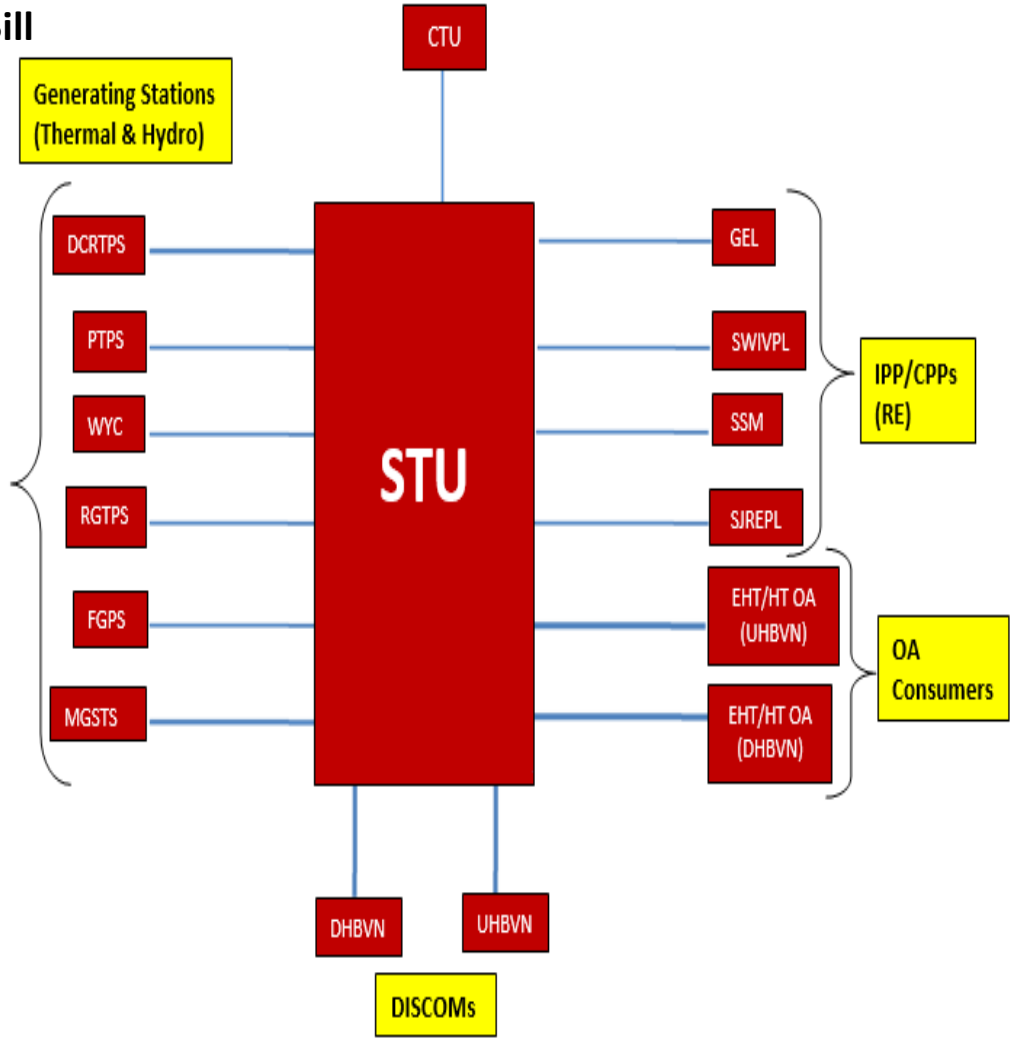
Chronology and Scope of Activities in Haryana

- Consultant held Meetings/Presentations with HVPN & SLDC, Haryana under aegis of HERC **on 13th November 2017** for SAMAST implementation at state level and to brief about Model F&S/DSM Regulations at state level.
- Consultant also visited SLDC Haryana Energy Centre to discuss and guide on various issues for preparing working draft DPR for SAMAST implementation in Haryana and shared the formats of DPR and templates for estimation with HVPN/ SLDC, Haryana.
- Based on the **preliminary information of Interface points and existing metering points** shared by HVPN/ SLDC, Haryana, consultant has prepared and shared the preliminary estimation for AMR and Hardware and software infrastructure to be developed under SAMAST.
- Further, the Consultant also discussed the **steps for formulation of separate Regulations for Forecasting & Scheduling framework and Deviation Settlement Mechanism for Haryana** on the lines of model F&S and model DSM Regulations.
- The State specific consideration and need for appropriate modifications was identified along with **need for Scheduling and Despatch code** for the State.
- Based on discussions with HERC, consultant has prepared the **Draft HERC F&S Regulations** and submitted to HERC for review.
- Detailed discussions on **Draft DSM Regulations** are proposed to be scheduled in 1st week of Dec.,2017

Exiting ABT system under operation in Haryana

Boundary meters considered for preparation of Deviation Bill

Entities	Constituent	No. of feeders	Installed Main meters	Installed Check Meters
HPGCL Generating Stations (G<>T) (34 No.)	DCRTPS	8	8	8
	PTPS	11	4	4
	RGTPS	4	4	4
	FGPS	4	4	4
	MGSTPS	4	4	4
	WYC (Hydro)	3	3	3
IPP/CPPs (G<>T) (4 No.)	GEL (RE)	1	1	1
	SWIVPL (RE)	1	1	1
	SSM (RE)	1	1	1
	SJREPL (RE)	1	1	1
EHT/HT OA Consumers (T<>C) (40 No.)	OA (UHBVN)	15	15	2
	OA (DHBVN)	25	25	17
Distribution Licensees (T<>D) (1045 No.)	UHBVN	538	538	298
	DHBVN	547	547	338
		1163	**1156**	**686**



Existing ABT Metering arrangement

Premise for cost estimation for SAMAST implementation in Haryana

- Estimation of quantities for Metering and Communication infrastructure is based on no. of Interface points, no. of intra-state entities as identified by HVPN.
- At present, 40 OA Entity has been identified as connected to transmission interface. However, the same could increase in future.
- While ABT meters are in place at interface points, the cost of Metering infrastructure has been considered taking into account requirements to be compatible with future standards and communication.
- Cost Estimate of Hardware Component-II (Servers, storage, laptops etc), Software Component and Training and Capacity building is based on assumptions on similar lines for other States (AP, TN).
- Preparation of DPR by HVPN is in process. After preparation of DPR, approval of Management will be sought and then DPR will be submitted to PSDF appraisal committee for approval.

Summary of Budgetary Cost Estimation for Haryana DPR:

S. No.	Item Description	Cost Estimate (INR Lakh)	Cost Estimate incl. Contingency (INR Lakh)
6	**Summary of Key Cost Components**		
6.1	Hardware component-I	1,412	1,454
6.2	Hardware component-II	193	203
6.3	Software component	536	563
6.4	Communication component	603	633
6.5	Infrastructure component	236	248
6.6	Training, Capacity Building & Annual Operating Cost	118	124
6.7	Contingency (est @ 3% on Metering and @5% on other cost)	127	
6.8	**GRAND TOTAL**	**3,225**	**3,225**

Item Description	Cost Estimate (INR Lakh)
Cost-Estimate - Hardware-Metering infrastructure	1,454
Cost-Estimate - Communication Component	633
Cost-Estimate - Software, Hardware-II, Infrastructure, Training & Capacity Building - SAMAST	1,138
COST ESTIMATE GRAND TOTAL	**3,225**

INR 1771 Lakh

Note : Budgetory cost estimates based on preliminary information. HVPN/SLDC is in the process of verification/site specific validation of interface points/metering arrangement.

Idam Infrastructure Advisory Pvt. Ltd.

Thank You

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16th FOR Technical Committee Meeting
Sasan-Gir, Gujarat
24 November 2017

Progress of the

FOR Sub-Group

for

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

Status Update

- **Three Meetings of the Sub-Group**
  - First Meeting – 03rd August, 2017
  - Second Meeting – 28th August, 2017
  - Third Meeting – 25th October, 2017

- **5-Minute Meter Demonstration and Testing**
  - **M/s Secure Meters and M/s Elster-Honeywell**
    - 13th September, 2017
    - 400/220 kV Magarwada PGCIL S/s, Daman-Diu UT
  - **M/s L&T**
    - 10th October, 2017
    - 765/400 kV Vadodara (Wagodia) PGCIL S/s, Gujarat
  - **M/s Genus Power Infrastructure Ltd**. – Communication to Tamil Nadu SLDC

Deliberations in Meetings so far (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 efficient 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.

Deliberations in Meetings so far (2)

- Requirement of amendments in the CEA Metering Standards
- 5-minute scheduling & settlement entail regulatory interventions
- 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

Meter Demonstration & Testing Results - Summary

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

Proposal for Pilot Project

- **Installation of 5-minute capable meters at 4-5 locations in each Region**

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

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

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

Suggested Action plan

Required Action	Action By	Timeline
Submission of Sub-Group Report	FOR Sub-Group	Nov 2017
Pilot Projects implementation	CTU / RPCs / POSOCO	March 2018
CERC Staff Paper on Regulatory Framework for 5-minute Scheduling, Metering & Settlement	CERC	March 2018
Changes in CEA standards & regulation	CEA	March 2018
Final Regulatory Framework	CERC	Sep 2018
Formulation of Technical specifications for new meters and configuration change at RPC/State level	CTU/RPCs/ POSOCO	July 2018
Procurement process from tendering to commissioning led by CTU at inter-state level and STU at intra-state level	CTU/RPCs/ POSOCO	Sep 2018
Trial Run (Transition)	All	Apr'19 – Mar'20
Go Live	**All**	**01st April, 2020**

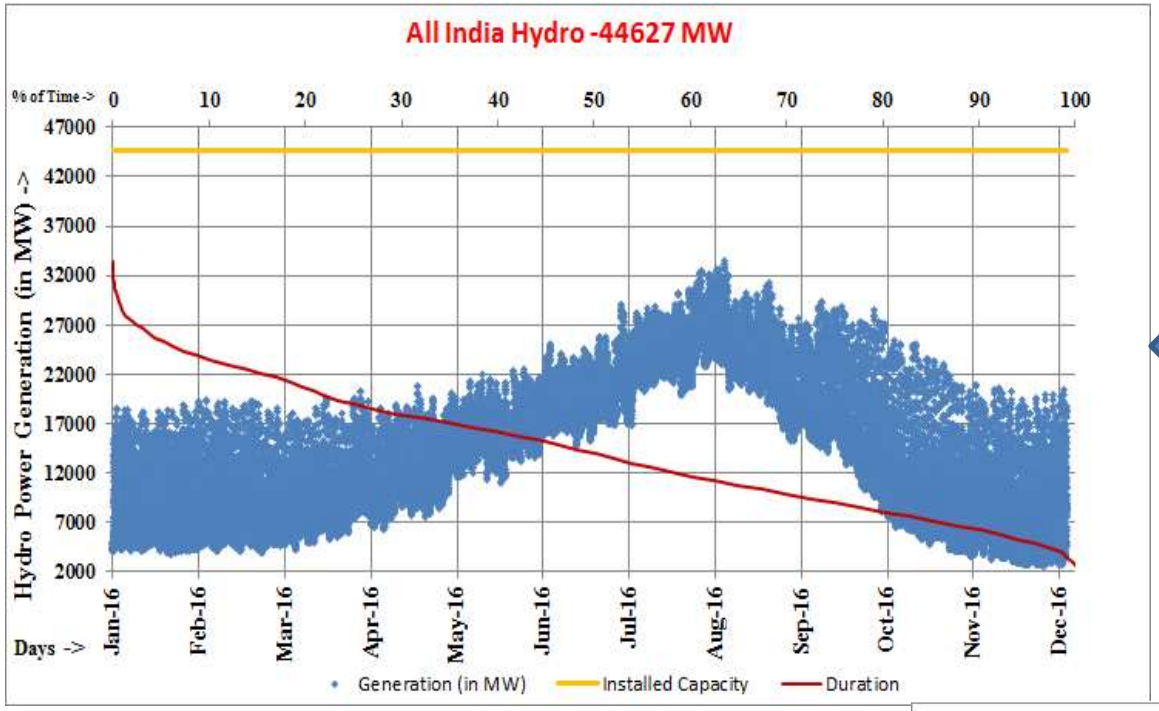
16th Meeting of the Technical Committee
Forum Of Regulators (FOR)

Agenda No. 5(i)

Analysis of Hydro Resources in Gujarat

Sasan Gir, Gujarat
24.11.2017

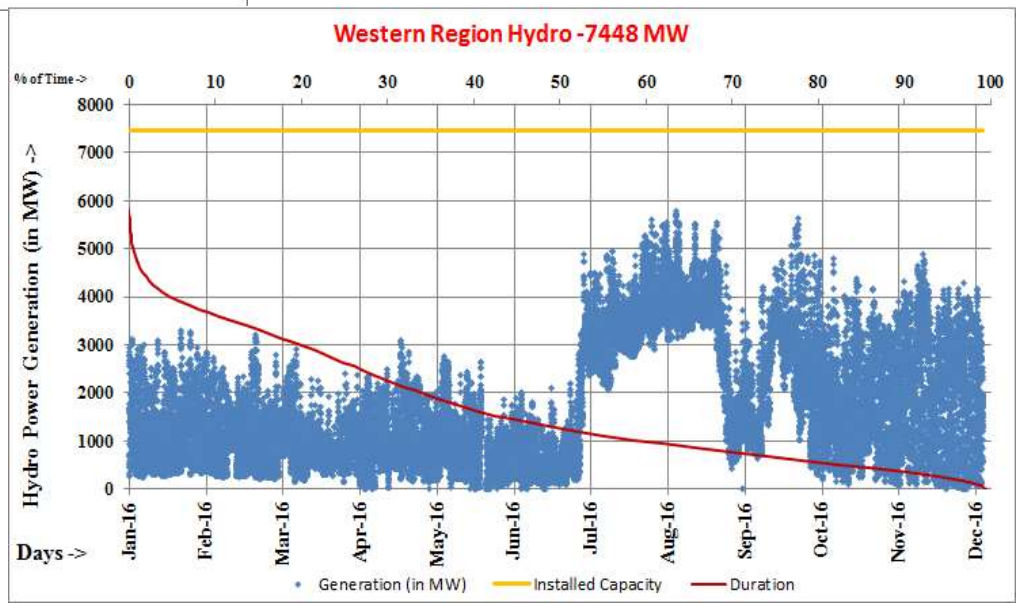
Hydro Generation – All India and Western Region



2016

All India
Peak achieved = 32 GW
(out of 45 GW)

WR Peak achieved = 5 GW
(out of 7.5 GW)



Hydropower Resources in Gujarat

S.No.	Hydropower Plant	Installed Capacity (MW)	Type	River
1.	Ukai	4x75 = 300	Storage	Tapi
2.	Kadana	4x60 = 240	Pumped Storage & RoR	Mahi
3.	SSP-RBPH*	6x200 = 1200*	Storage	Narmada
4.	SSP-CHPH*	5x50 = 250*	Run-of-the-River	Narmada
5.	Madhuvan Dam	2x1.5+2.6=5.6	Small Hydro	-
6	Karjan	3	Small Hydro	-
7	Panam Canal	2x1	Small Hydro	-
8	Ukai LBCH	2x2.5	Small Hydro	
	Total	**779**		

Major Reservoirs	Full Reservoir Level (m)	Min. Draw Down Level (m)	Effective Storage Capacity at FRL (MCM)	Energy Content at FRL (MUs)
Ukai	105.16	82.3	6619	813
Kadana	127.7	114	1203	131.33
Sardar Sarovar	138.68	110.84	5760	1818

Source: CEA, CBIP, FOLD Survey Report; * Gujarat share in Sardar Sarovar (SSP) = 16% = 232 MW

Key Flexibility Metrics (2016)

Station Name	Installed Capacity (IC) (MW)	Max/IC (%)	5 min Ramp-Up rate/IC (%)	5-min Ramp-Down rate/IC (%)	Avg/IC (%)
Ukai	300	102	75	75	15
Kadana	240	99	50	64	17
SSP-R	1200	89	30	29	23

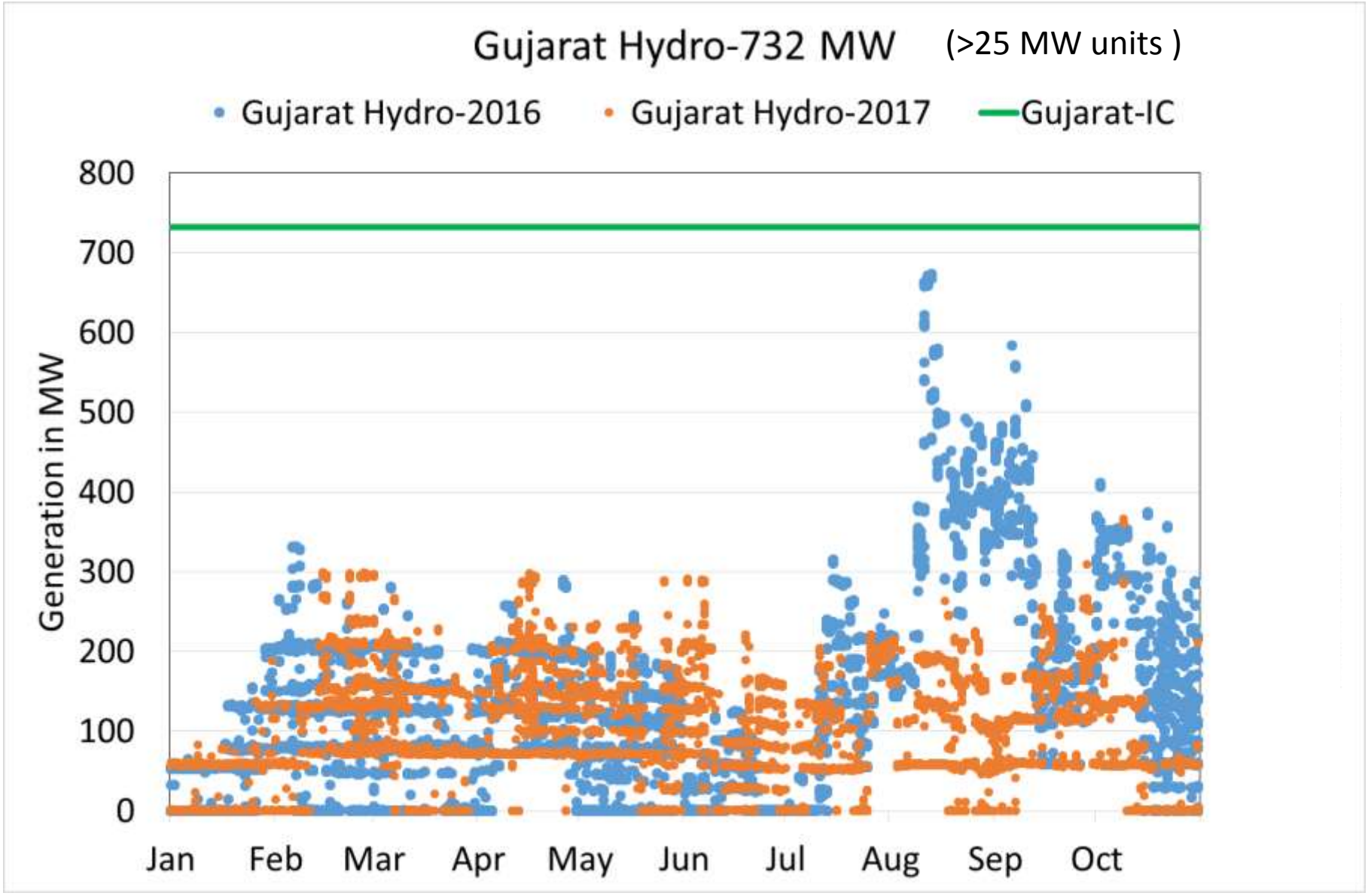
Source: FOLD Survey 2016

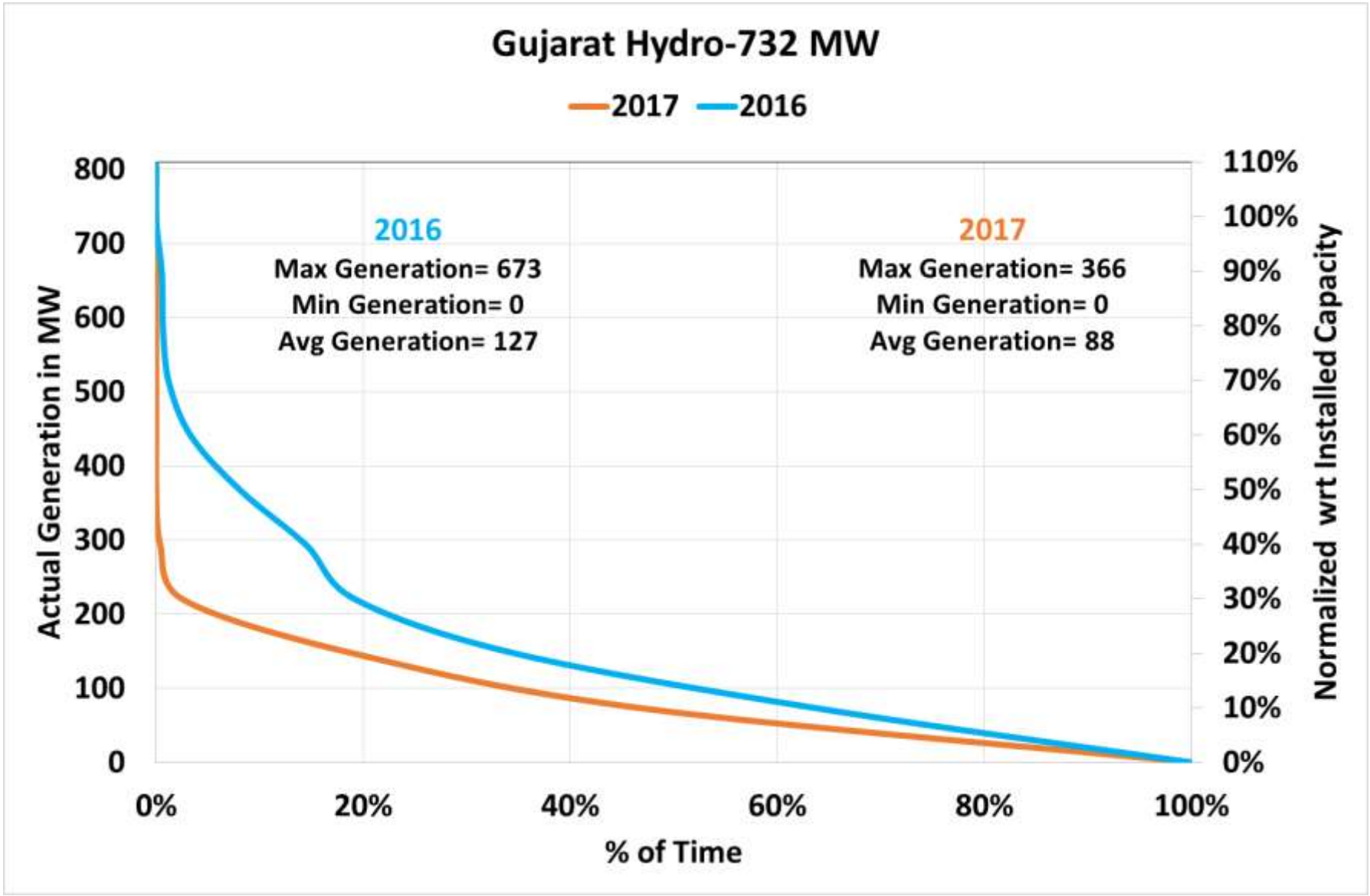
Flexibility Metrics (2016)

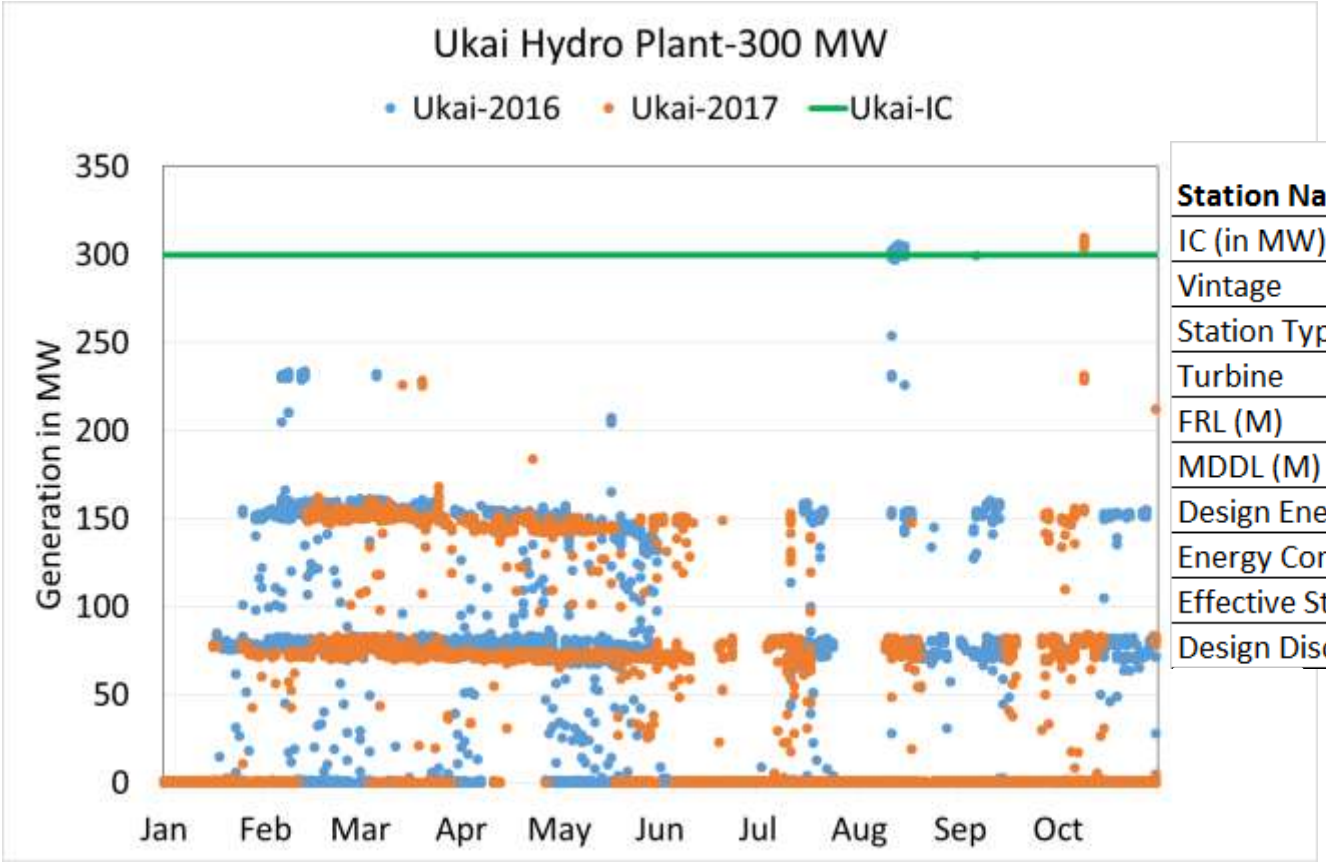
Station Name	No. of Black start drills in since 2011	Syn. Condenser Operation	PSP Capability
Ukai	3	N	N
Kadana	3	N	Y
SSP-R	5	Y	Y

Source: FOLD Survey 2016

Review of Hydro Generation in Gujarat (2017 Vs 2016)



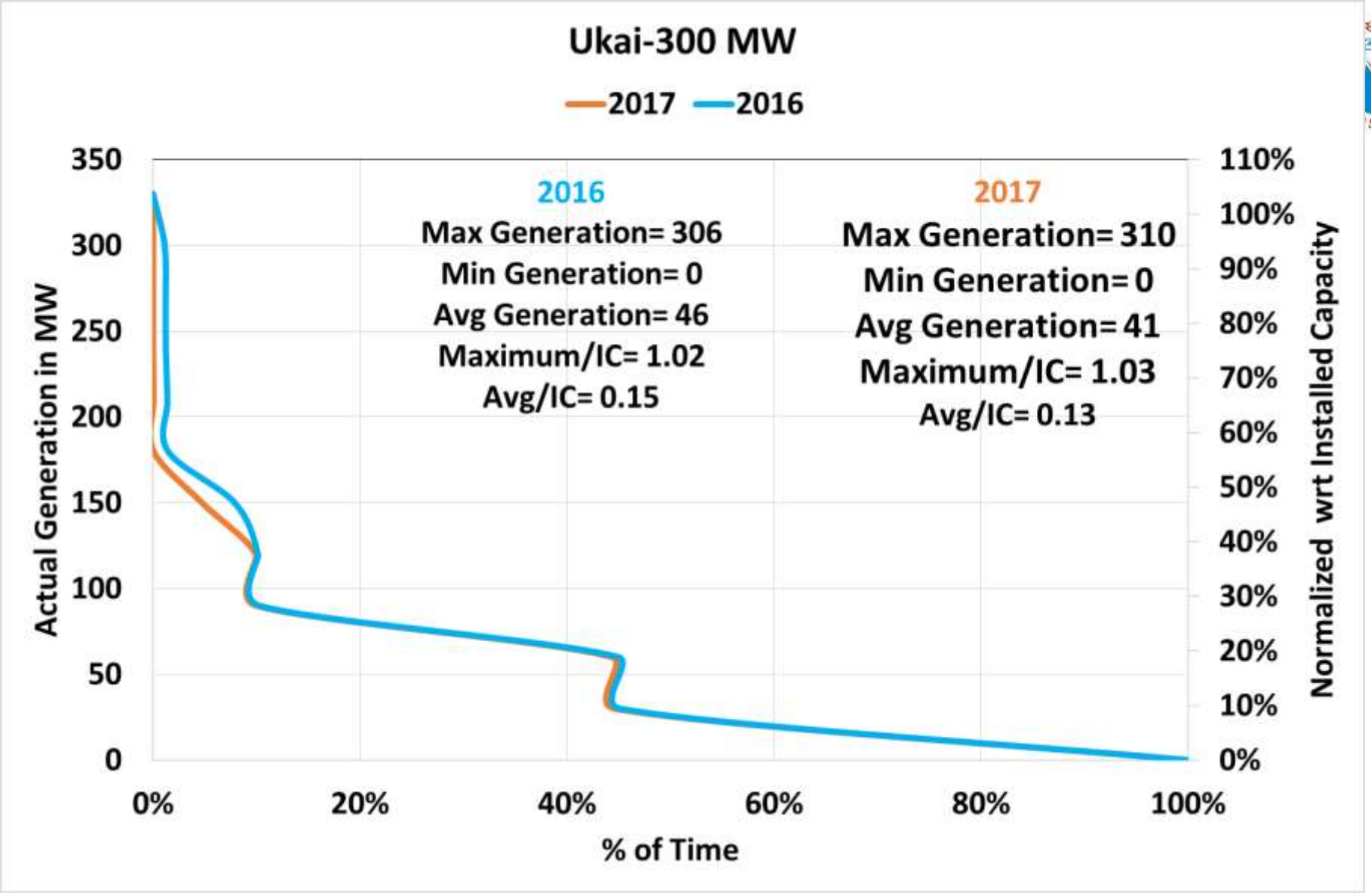

Gujarat Hydro-732 MW
2017
2016
2016
Max Generation= 673
Min Generation= 0
Avg Generation= 127
2017
Max Generation= 366
Min Generation= 0
Avg Generation= 88
Actual Generation in MW
Normalized wrt Installed Capacity
% of Time
800
700
600
500
400
300
200
100
0
110%
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0%
20%
40%
60%
80%
100%



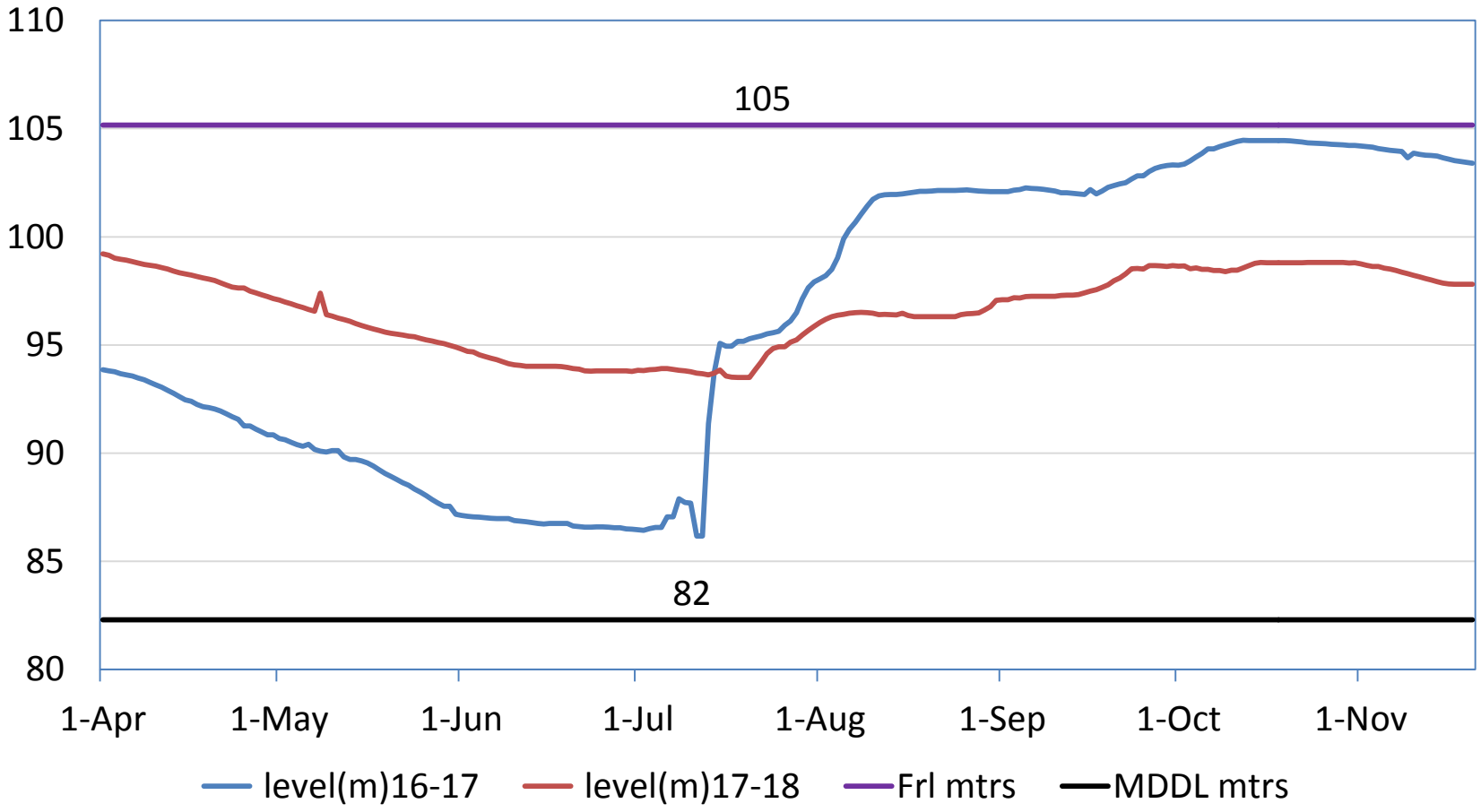
Station Name	Ukai HPS
IC (in MW)	4x75=300 MW
Vintage	1976
Station Type	Storage
Turbine	Kaplan
FRL (M)	105.2
MDDL (M)	82.3
Design Energy(MU)	770.67
Energy Content At FRL(MU	813
Effective Storage at FRL(MCM)	6619
Design Discharge (Cumec/u)	169

Constraints:

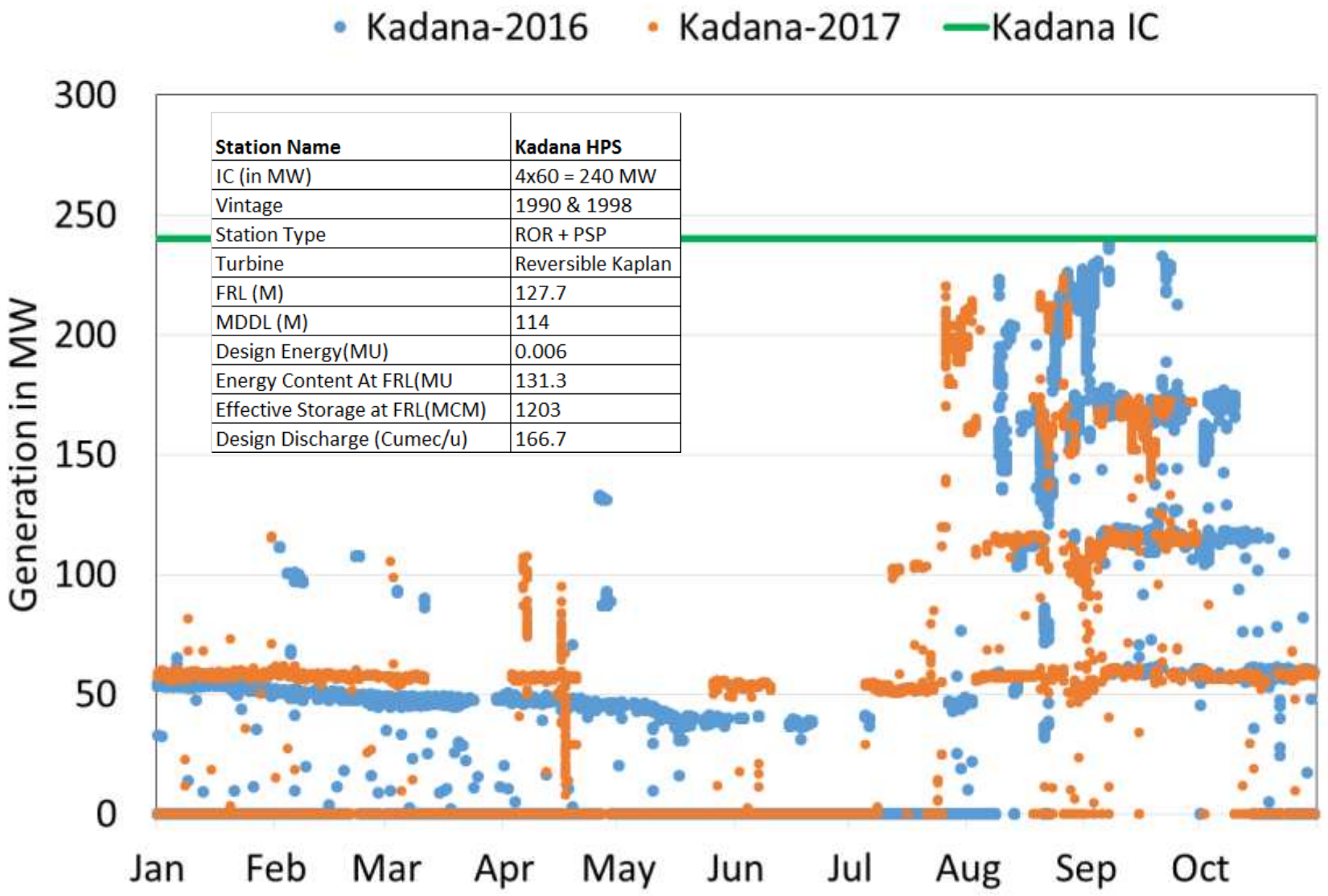
- Irrigation
- Maintaining level at Kakrapar barrage to avoid spillage into sea
- Weak lining of Ukai left bank main canal


Ukai-300 MW
2017
2016
2016
Max Generation= 306
Min Generation= 0
Avg Generation= 46
Maximum/IC= 1.02
Avg/IC= 0.15
2017
Max Generation= 310
Min Generation= 0
Avg Generation= 41
Maximum/IC= 1.03
Avg/IC= 0.13
Actual Generation in MW
Normalized wrt Installed Capacity
350
300
250
200
150
100
50
0
110%
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0%
20%
40%
60%
80%
100%
% of Time

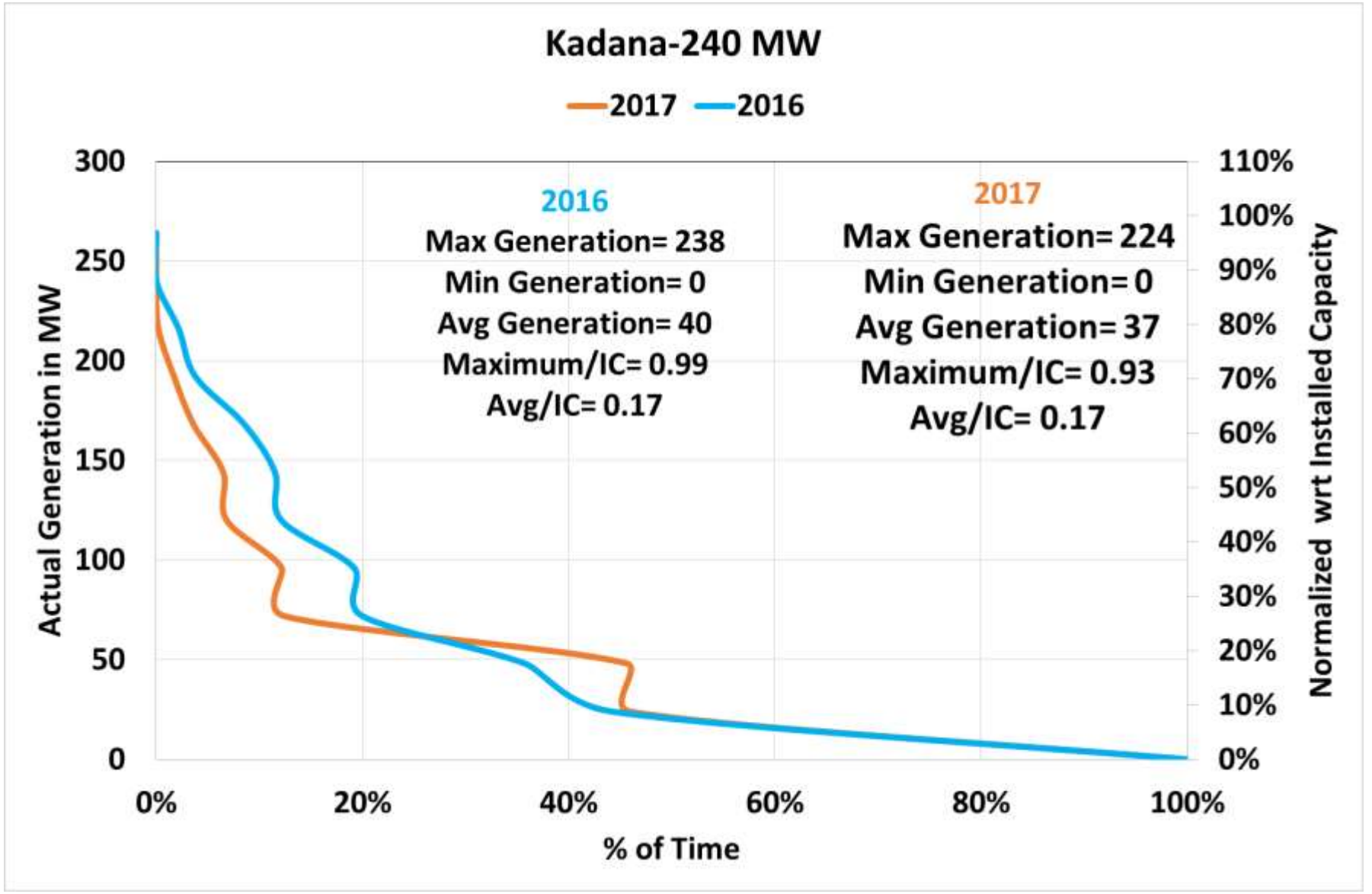
4x 75 MW Ukai Hydro - Reservoir Level Plot



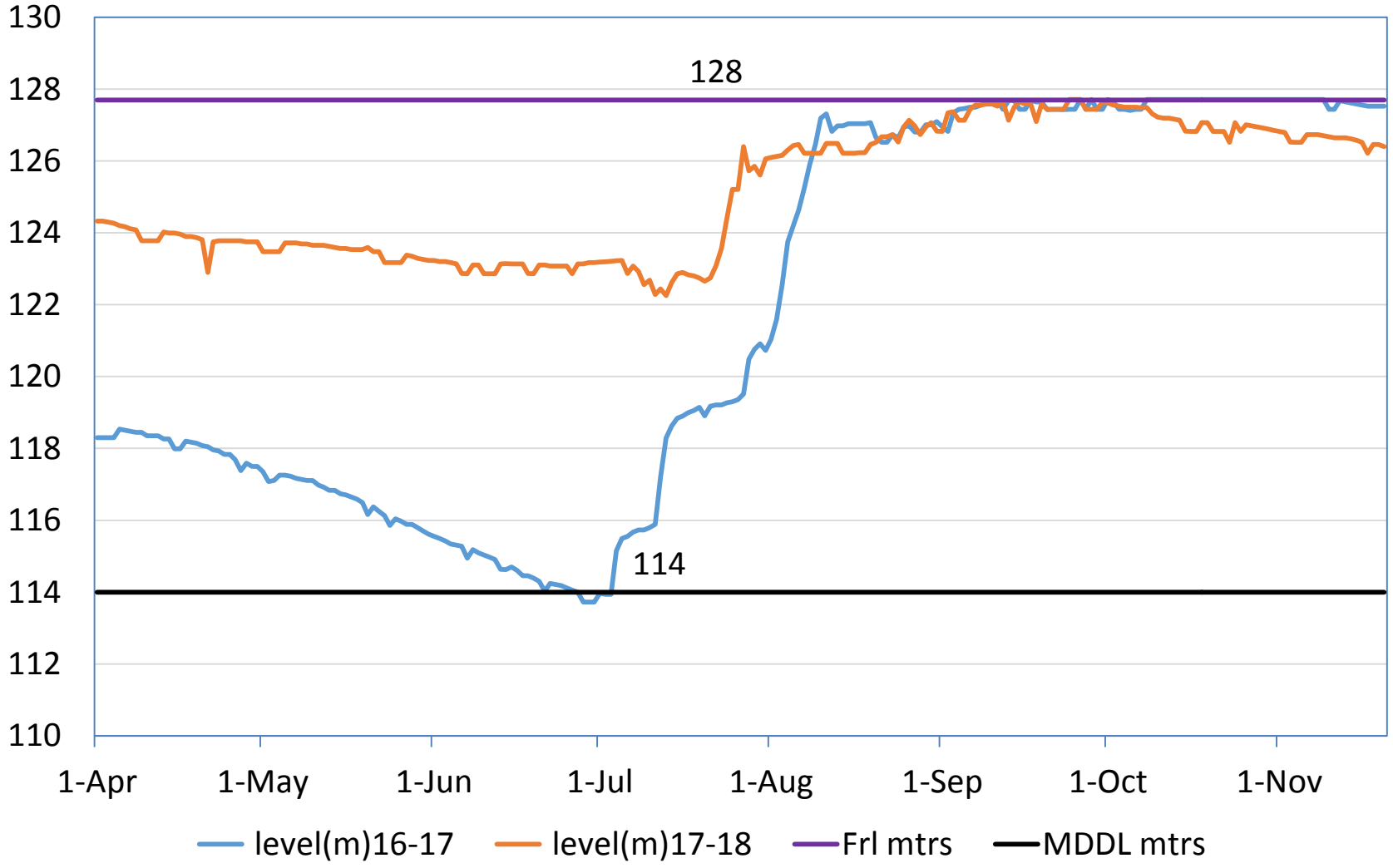
Kadana Hydro Plant-240 MW



Station Name	Kadana HPS
IC (in MW)	4x60 = 240 MW
Vintage	1990 & 1998
Station Type	ROR + PSP
Turbine	Reversible Kaplan
FRL (M)	127.7
MDDL (M)	114
Design Energy(MU)	0.006
Energy Content At FRL(MU	131.3
Effective Storage at FRL(MCM)	1203
Design Discharge (Cumec/u)	166.7


Kadana-240 MW
2017
2016
2016
Max Generation= 238
Min Generation= 0
Avg Generation= 40
Maximum/IC= 0.99
Avg/IC= 0.17
2017
Max Generation= 224
Min Generation= 0
Avg Generation= 37
Maximum/IC= 0.93
Avg/IC= 0.17
Actual Generation in MW
300
250
200
150
100
50
0
110%
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Normalized wrt Installed Capacity
0%
20%
40%
60%
80%
100%
% of Time

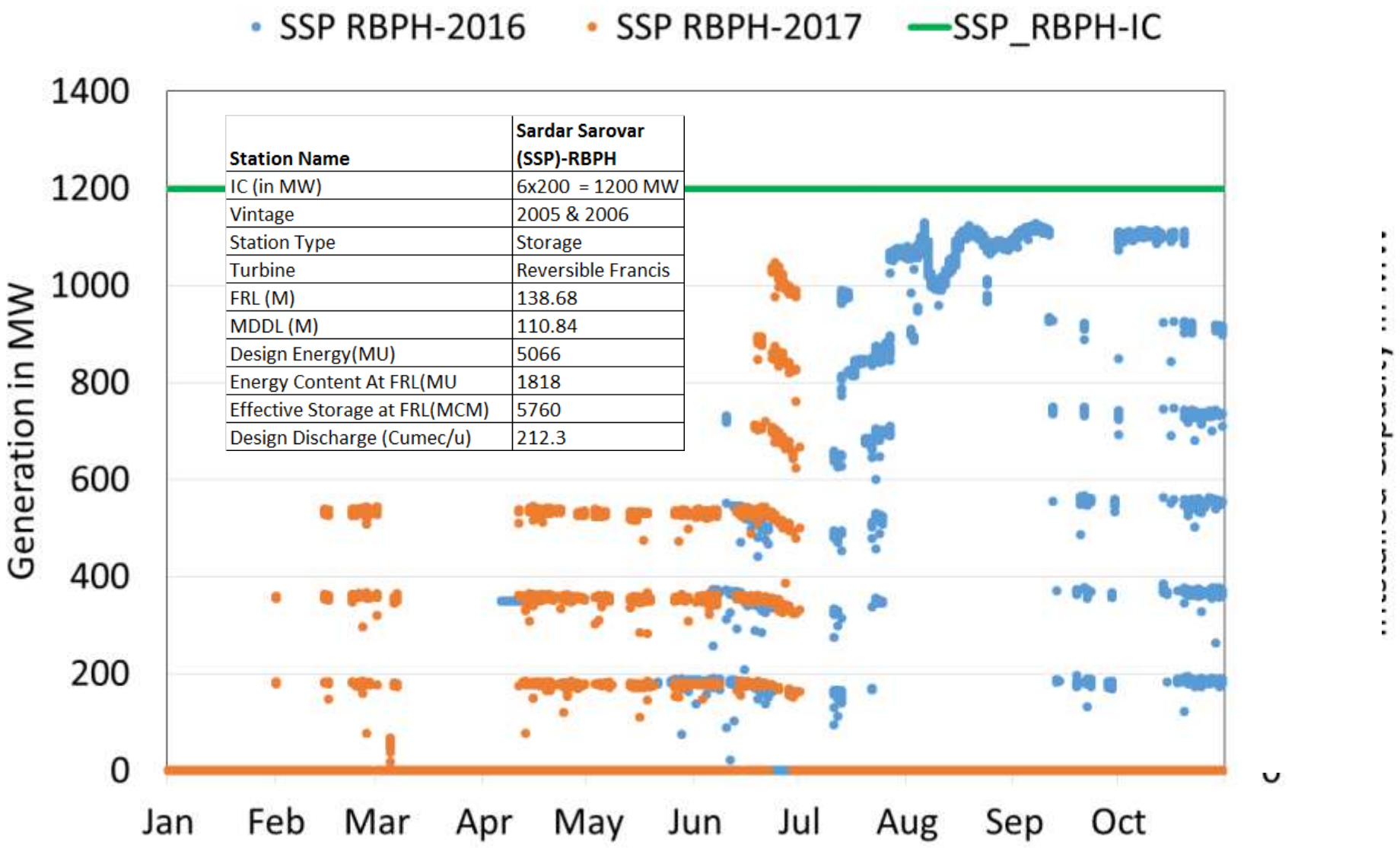
4x60 MW Kadana Reservoir Plot



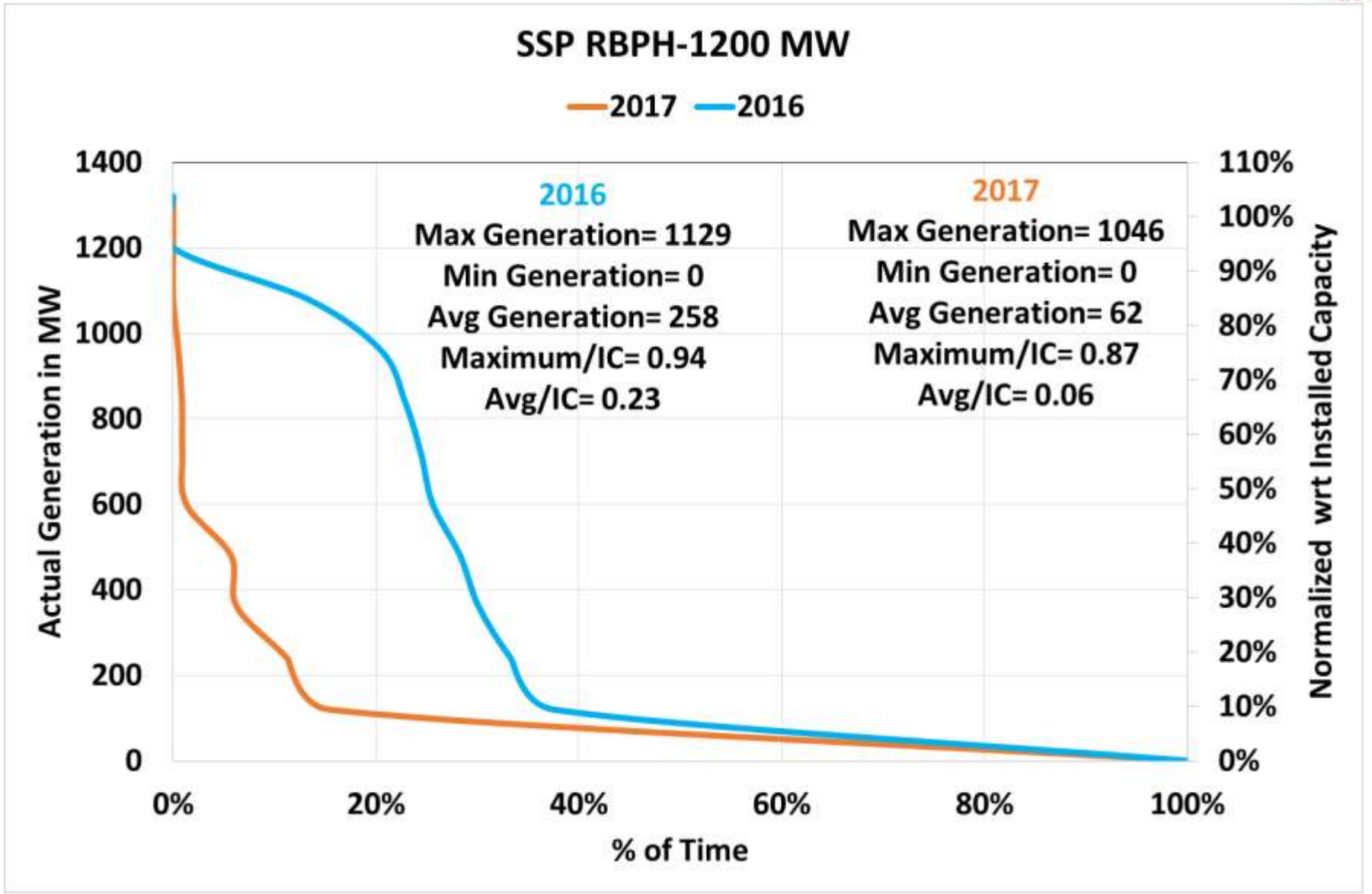
Kadana: Scope for Improvement

- Overload capability indicated : 115%
  - Achieved peaking 99% in 2016 & 93% till date in 2017
  - Scope for additional peaking of 40 MW (10 MW per unit).
- Rejuvenation of Pumping Operation
  - R & M necessary to address technical constraints
  - Regulatory Incentives

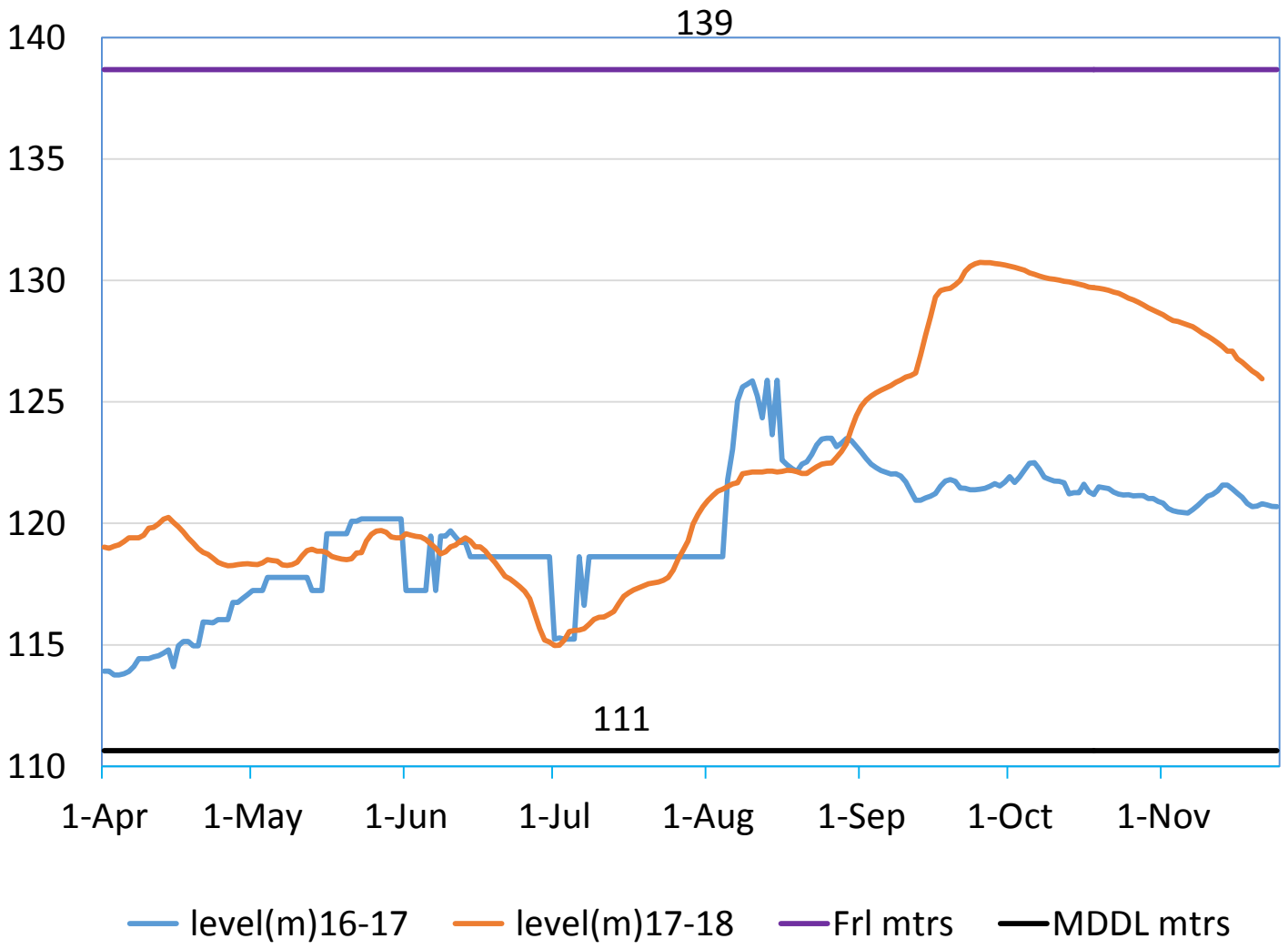
SSP-RBPH Hydro Plant-1200 MW



Station Name	Sardar Sarovar (SSP)-RBPH
IC (in MW)	6x200 = 1200 MW
Vintage	2005 & 2006
Station Type	Storage
Turbine	Reversible Francis
FRL (M)	138.68
MDDL (M)	110.84
Design Energy(MU)	5066
Energy Content At FRL(MU	1818
Effective Storage at FRL(MCM)	5760
Design Discharge (Cumec/u)	212.3


SSP RBPH-1200 MW
2017
2016
2016
Max Generation= 1129
Min Generation= 0
Avg Generation= 258
Maximum/IC= 0.94
Avg/IC= 0.23
2017
Max Generation= 1046
Min Generation= 0
Avg Generation= 62
Maximum/IC= 0.87
Avg/IC= 0.06
Actual Generation in MW
1400
1200
1000
800
600
400
200
0
Normalized wrt Installed Capacity
110%
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0%
20%
40%
60%
80%
100%
% of Time

6x200+5x50 MW Sardar Sarovar (SSP) - Reservoir Plot



Issues : Sardar-Sarovar HPS

- Limited water availability for power in RBPH
  - NIL generation for 60% time in 2016,
  - NIL generation for > 80% time in 2017
  - Water availability for Power Generation from RBPH (1200 MW) would reduce with development of upstream canal system in command aread
- Operationalisation of Pumping Mode Essential
  - For flexibility
  - For capacity utilisation

Model Regulation for Tariff Determination & other related matters for Intra-State Hydro Generating stations 2017

Tariff Recovery (AFC) – 2 Part

(i) Capacity Charge (50%) – Linked to 85-90% annual availability(NAPAF) & 3 hrs Peaking in a day (PAFM)

(ii) Energy charge (50%) – ECR linked to Design Energy(DE)

(iii) ECR capping (beyond DE)

ABT & DSM for Hydro: Ex-ante schedule to be sacrosanct

PSP Hydro – Capacity charge & Energy charge; Prorated reduction in AFC for m/c outage by > 15%; Plant DC to include Gen/Pumping hours & MWh in each mode

RoE linked to Flexibility features:

- Peaking/FGMO/PSS/AVR/Communication/Black-start/Synchronous Condenser facility wherever applicable
- Higher RoE for Storage/Pondage type to promote flexibility
- Incentive for timely completion

Incentivising Black Start Service based on capability demonstration & certification

Incentivising Synchronous Condenser operation

Trial Operation Norms : Compliance to CEA Standards viz. peaking(110%) ,12 hrs at MCR, FGMO, PSS/AVR, Fast ramp, part load operation , islanded operation etc.

Model Regulation endorsed - 61st FOR Meeting (22 Sep 2017)

Need for expeditious implementation at intra-state level

Discussion

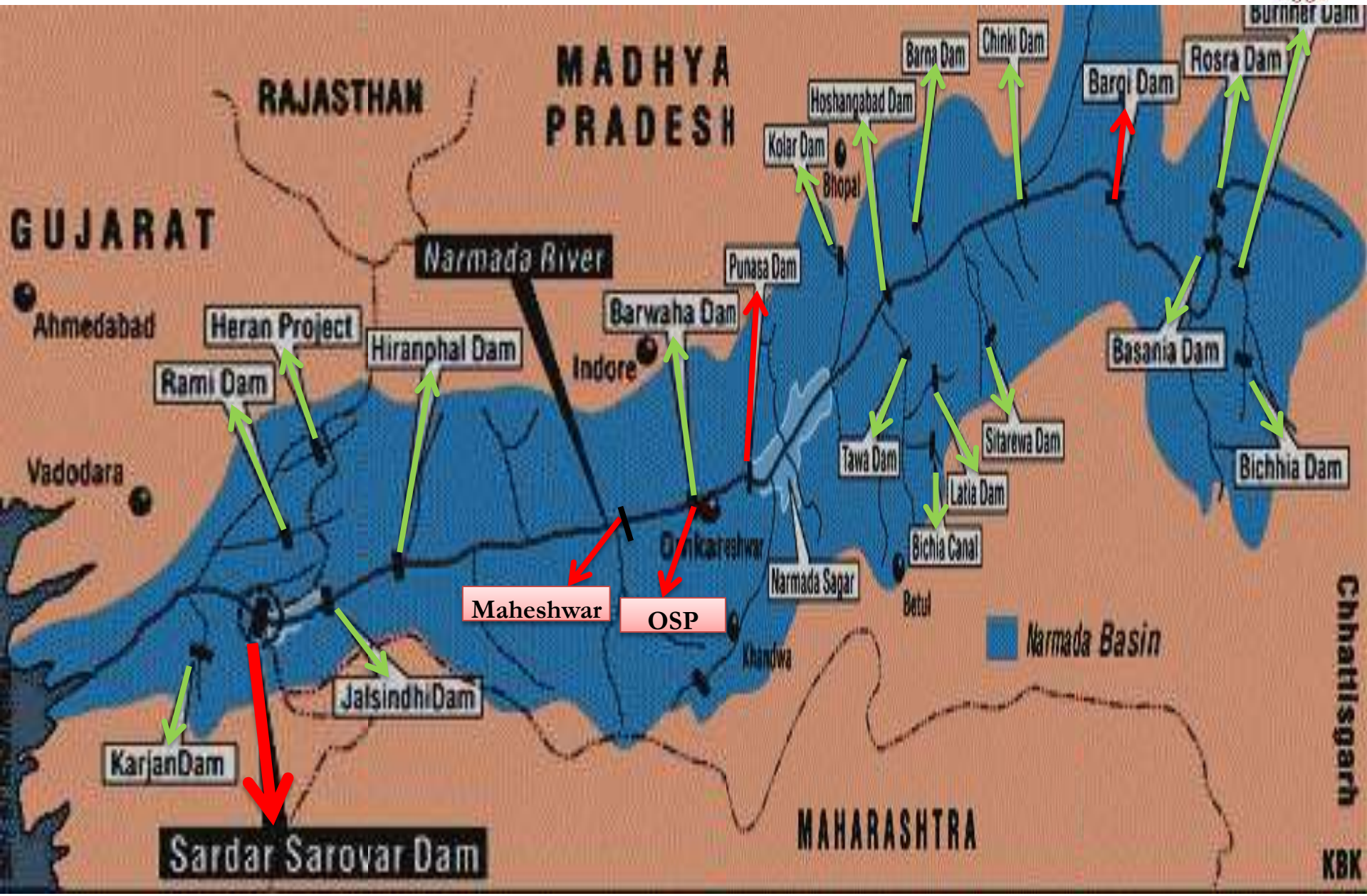
Thank You !!

Key Flexibility Metrics (2016)

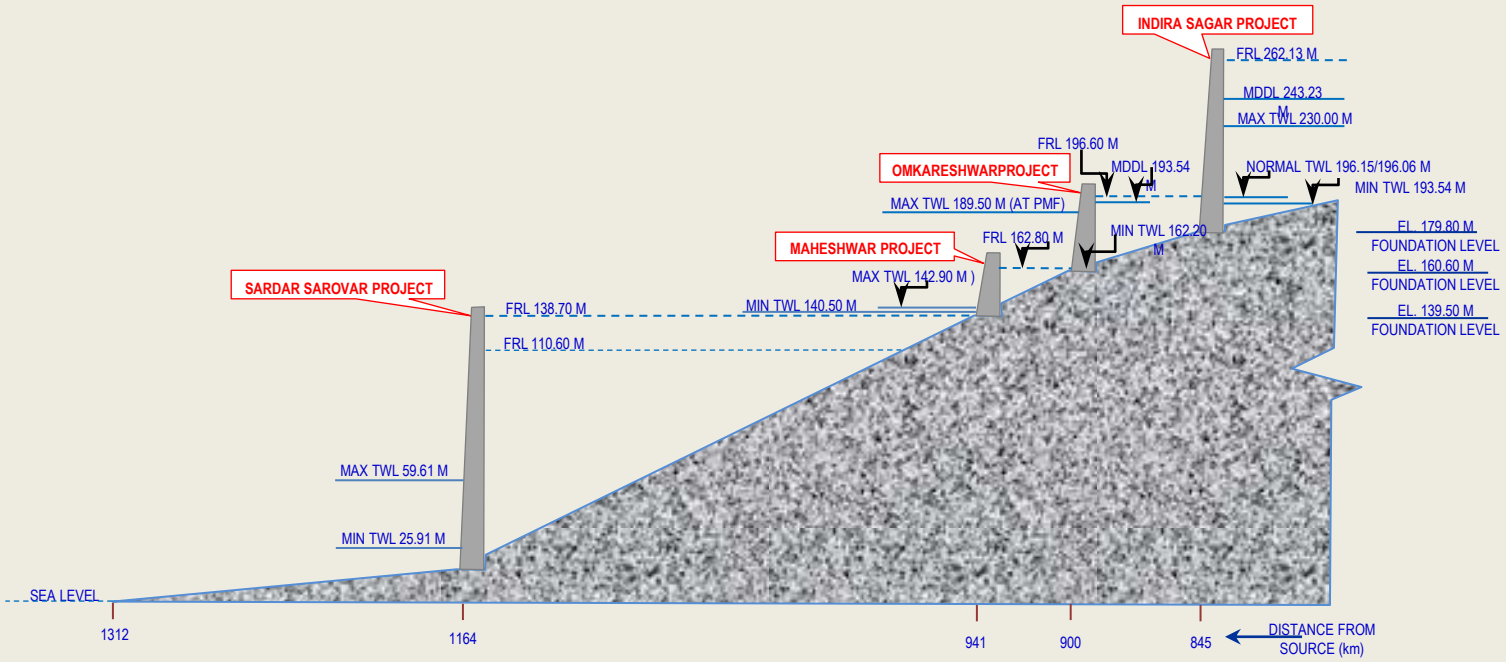
Station Name	Inst. Cap. (IC) (MW)	Max /IC (%)	5 min Ramp-Up rate /IC (%)	5-min Ramp-Down rate/IC (%)	Avg/IC (%)	No. of Black start drills in since 2011	Syn. Condenser	PSP Capability
Ukai	300	102	75	75	15	3	N	N
Kadana	240	99	50	64	17	3	N	Y
SSP-R	1200	89	30	29	23	5	Y	Y

- Flexibility of hydro plants: Overload, peaking, fast ramping, load following capability etc.
- Immense value for reliable, secure and economic grid operation.
- **Tariff design needs to Value - Water & Flexibility**
  - Multi-part tariff to incentivize flexibility – Peaking, Mechanical Availability
  - Regulatory Framework for Incentivizing -
    - Pumped Storage facility (PSP)
    - Black Start service
    - Voltage Control service (Synchronous Condenser Operation)

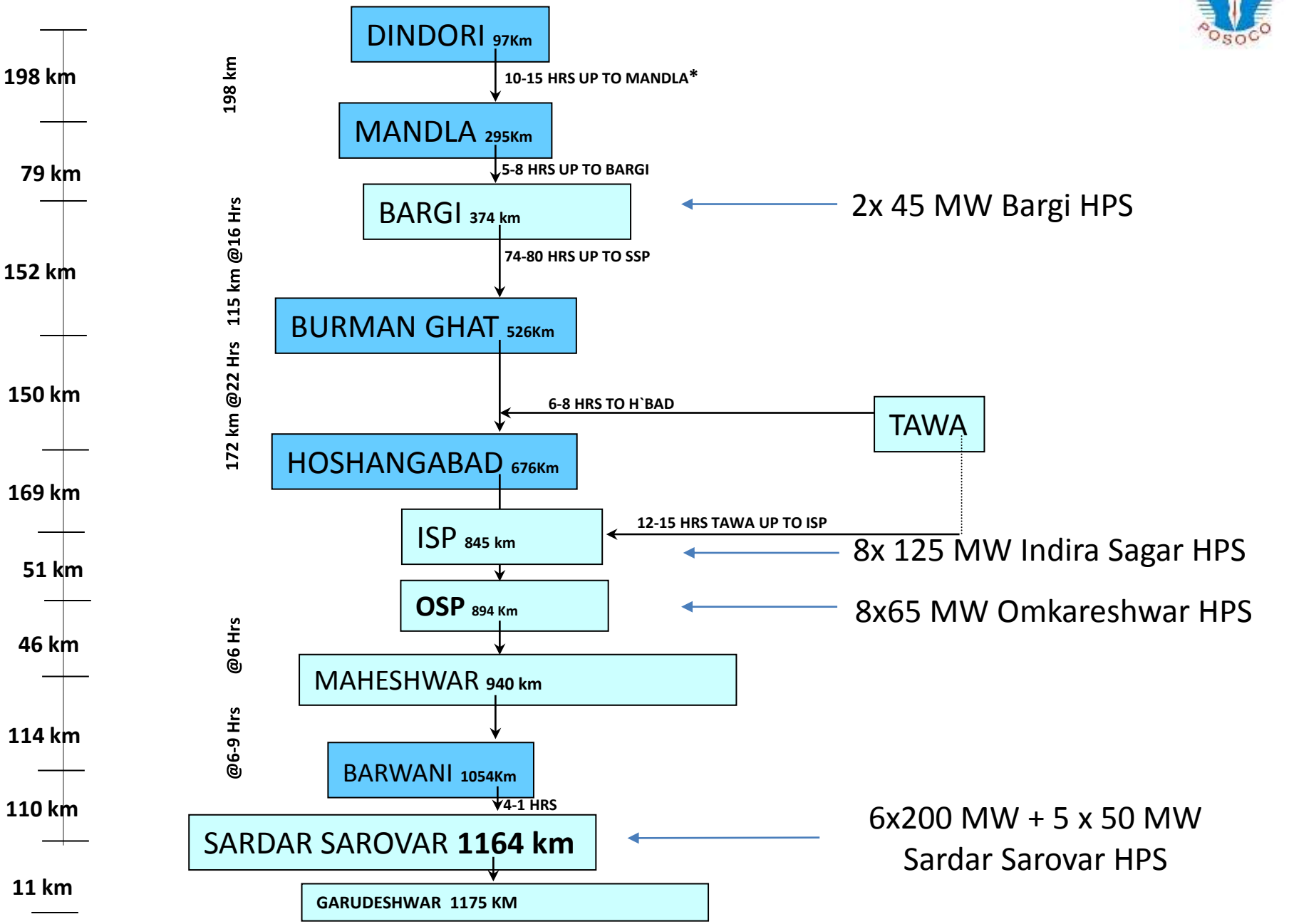
MAIN PROJECTS IN NARMADA BASIN

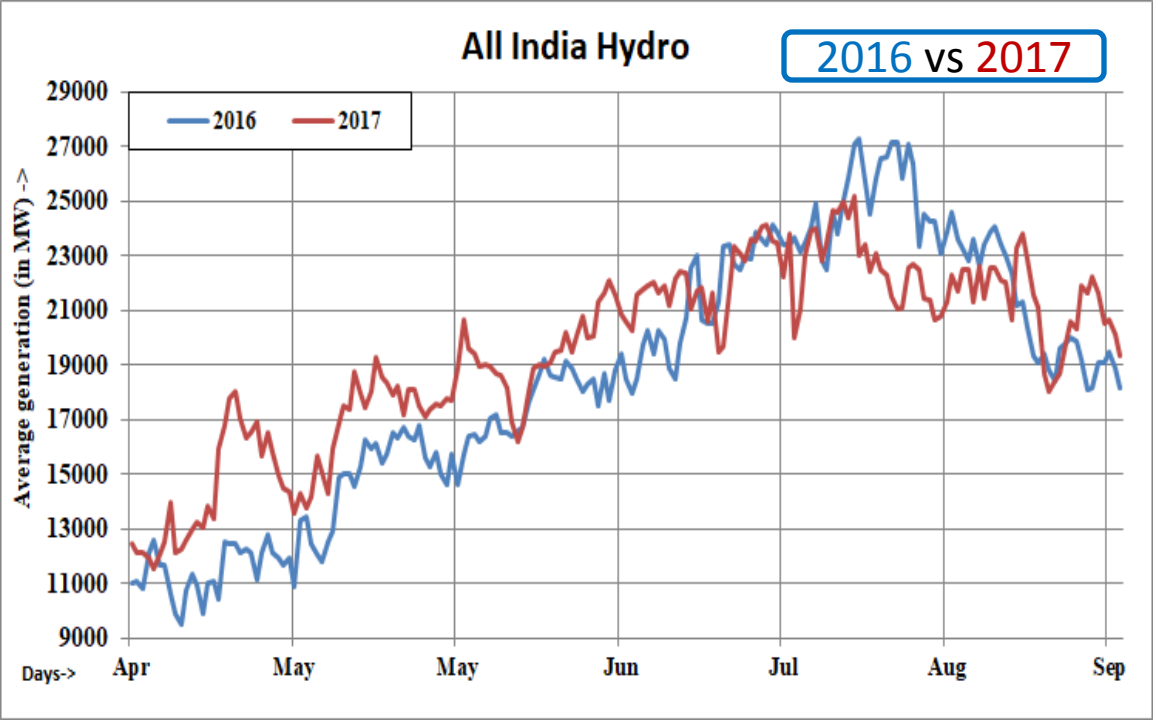


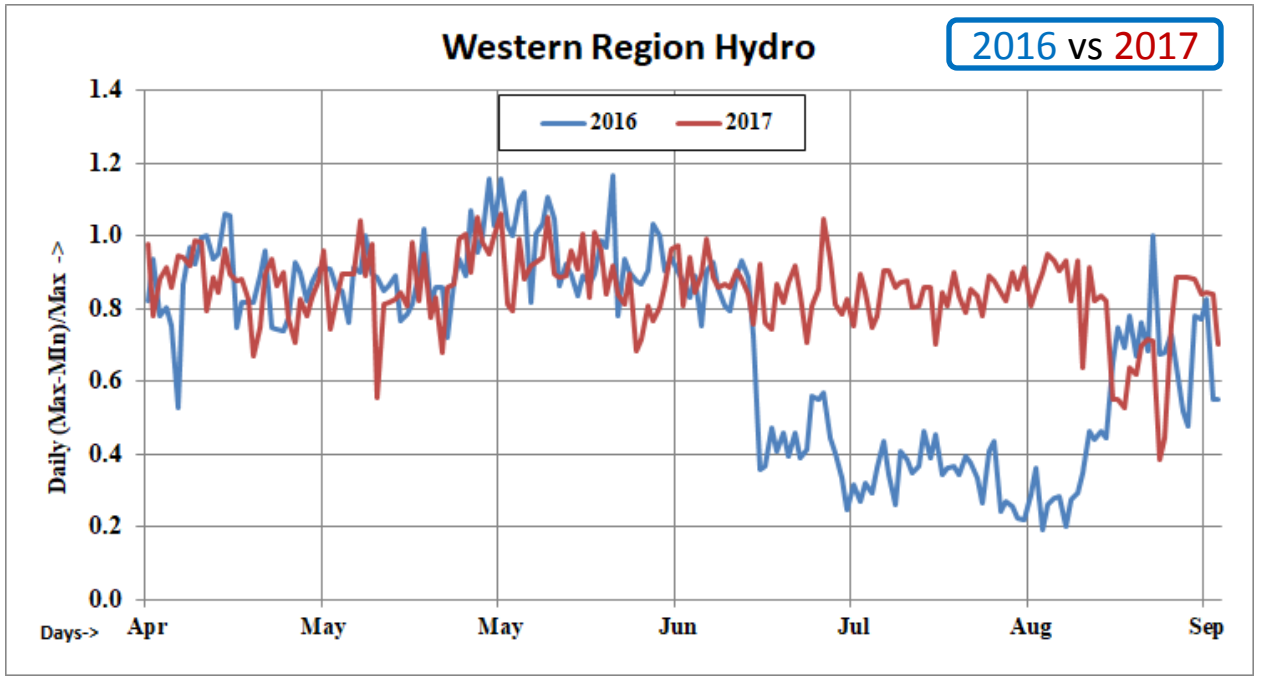
CASCADE DEVELOPMENT IN LOWER NARMADA ZONE



Travel Time in Different Reaches of Narmada River Basin




All India Hydro
2016 vs 2017
2016
2017
Average generation (in MW) ->
29000
27000
25000
23000
21000
19000
17000
15000
13000
11000
9000
Days->
Apr
May
May
Jun
Jul
Aug
Sep

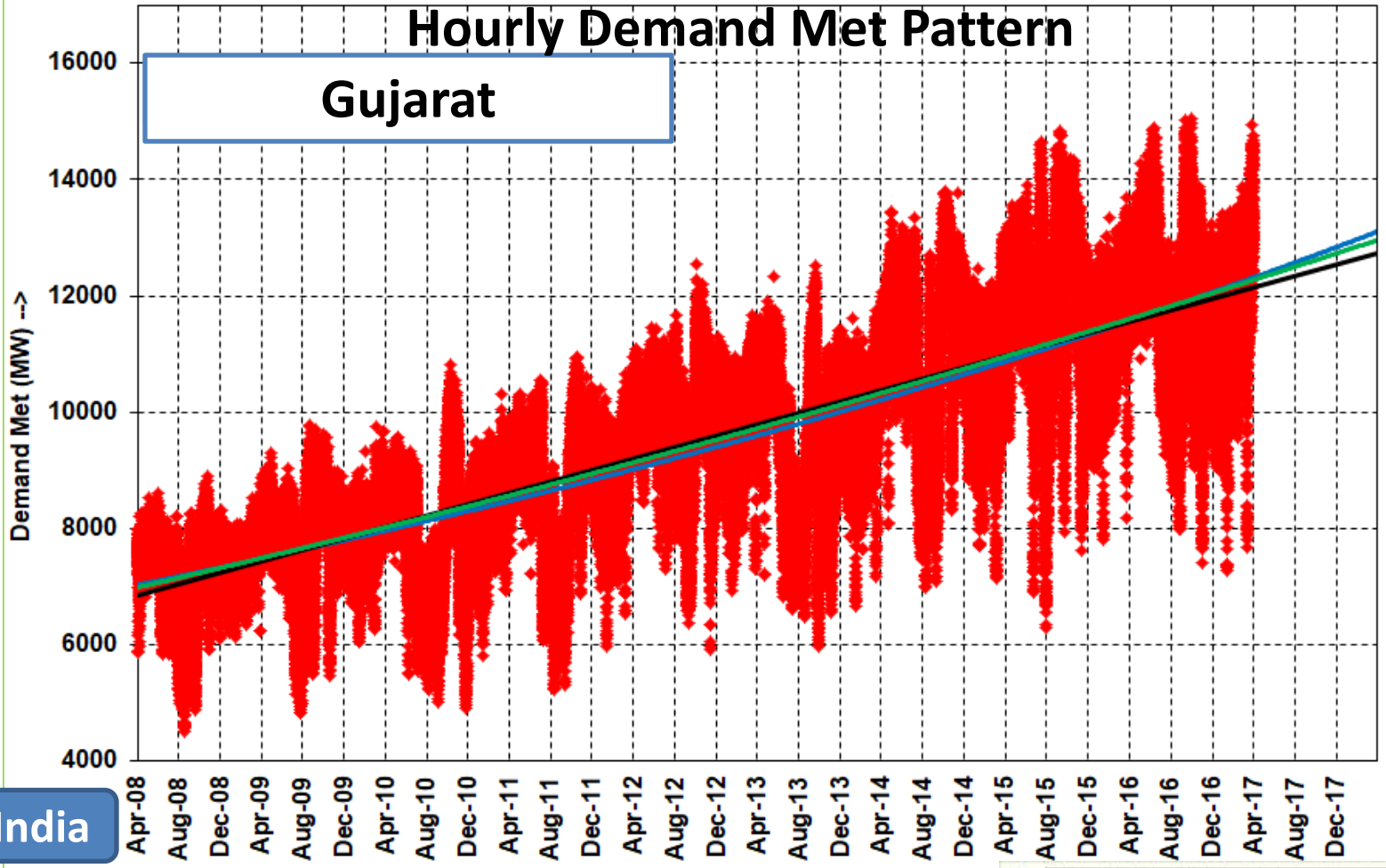

Western Region Hydro
2016 vs 2017
2016
2017
Daily (Max-Min)/Max ->
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Days->
Apr
May
May
Jun
Jul
Aug
Sep

Agenda No. 5(ii)

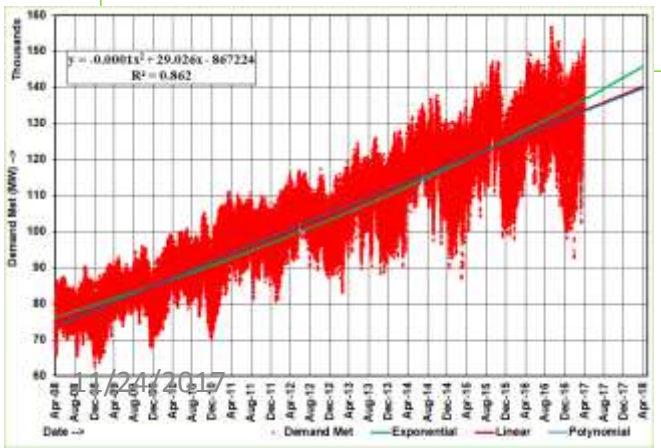
Demand Pattern Analysis of Gujarat

Hourly Demand Met Pattern

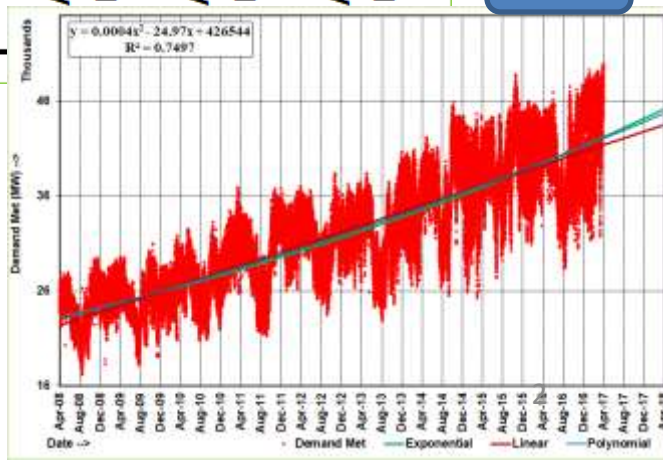
Gujarat



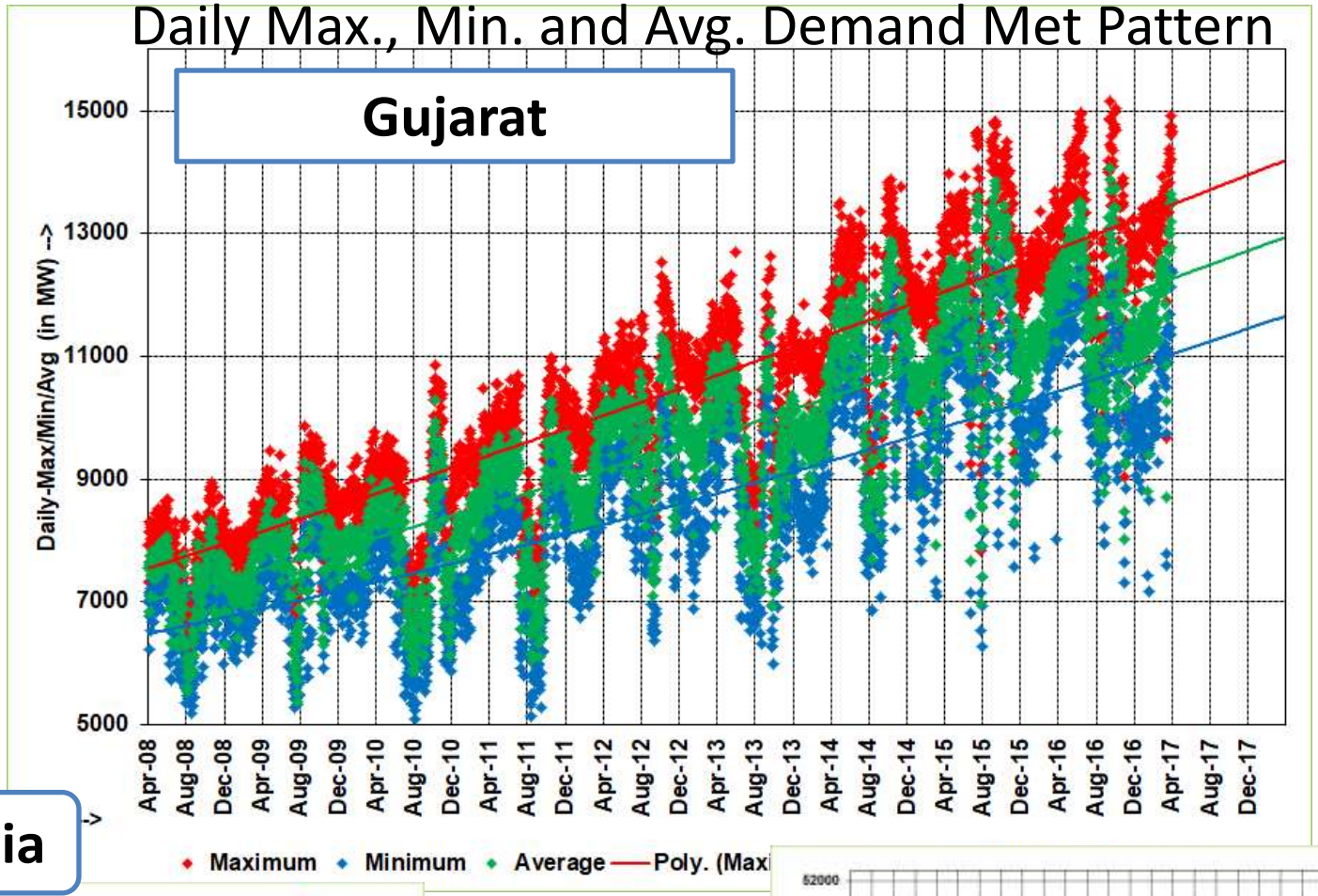
All India



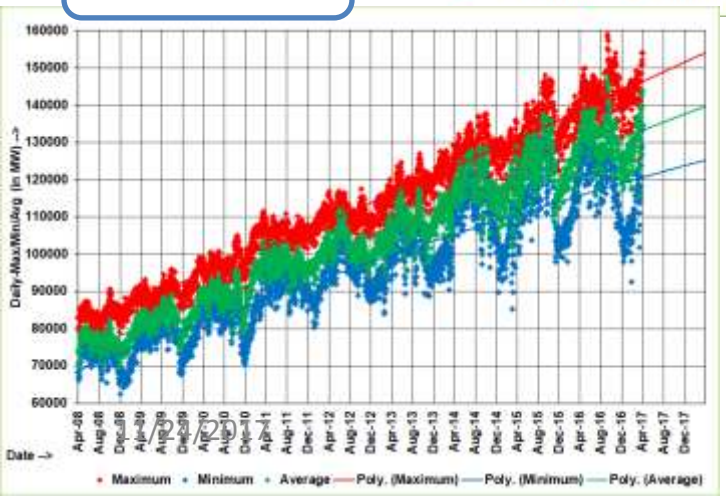
WR



Daily Max., Min. and Avg. Demand Met Pattern



All India



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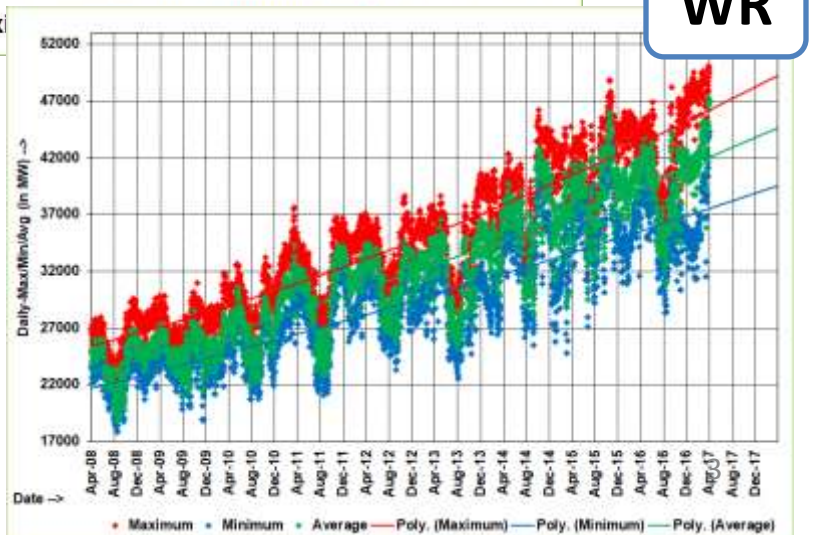

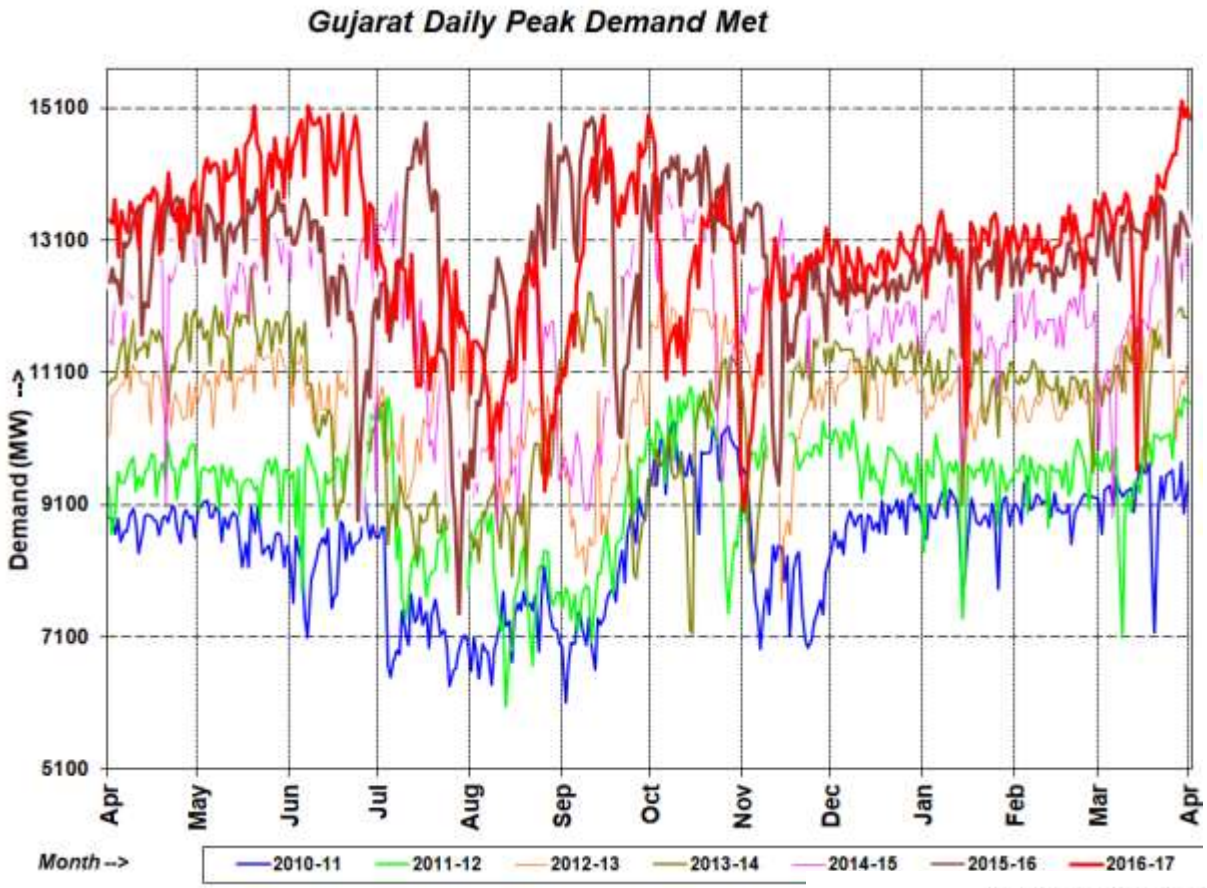

All India

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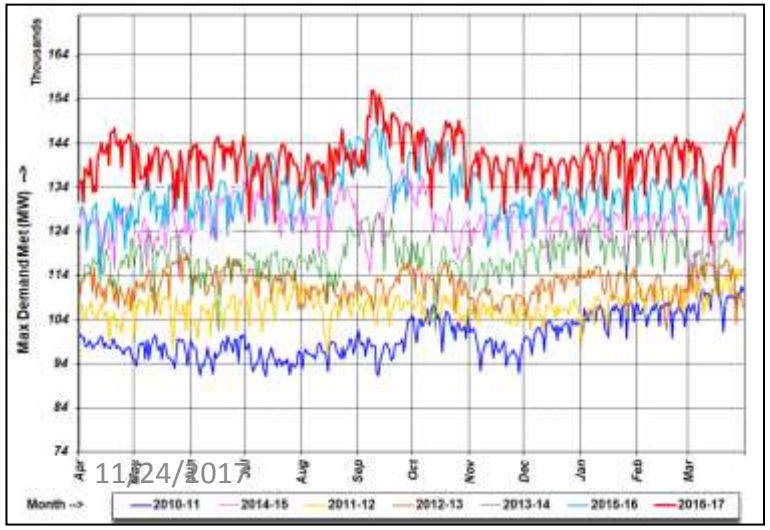
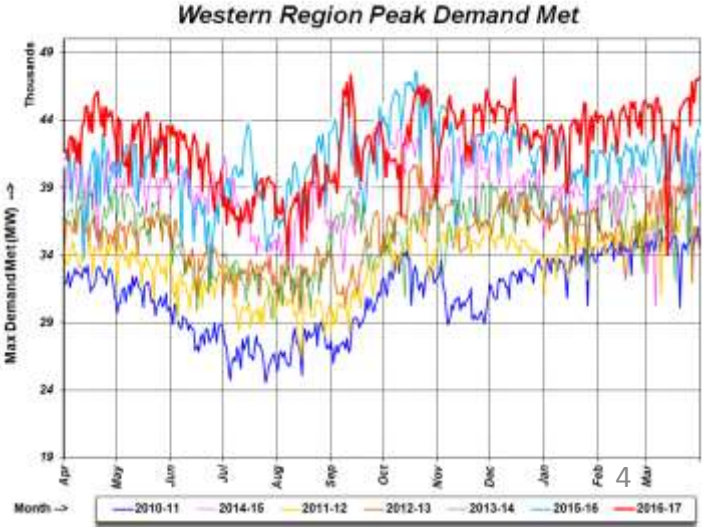
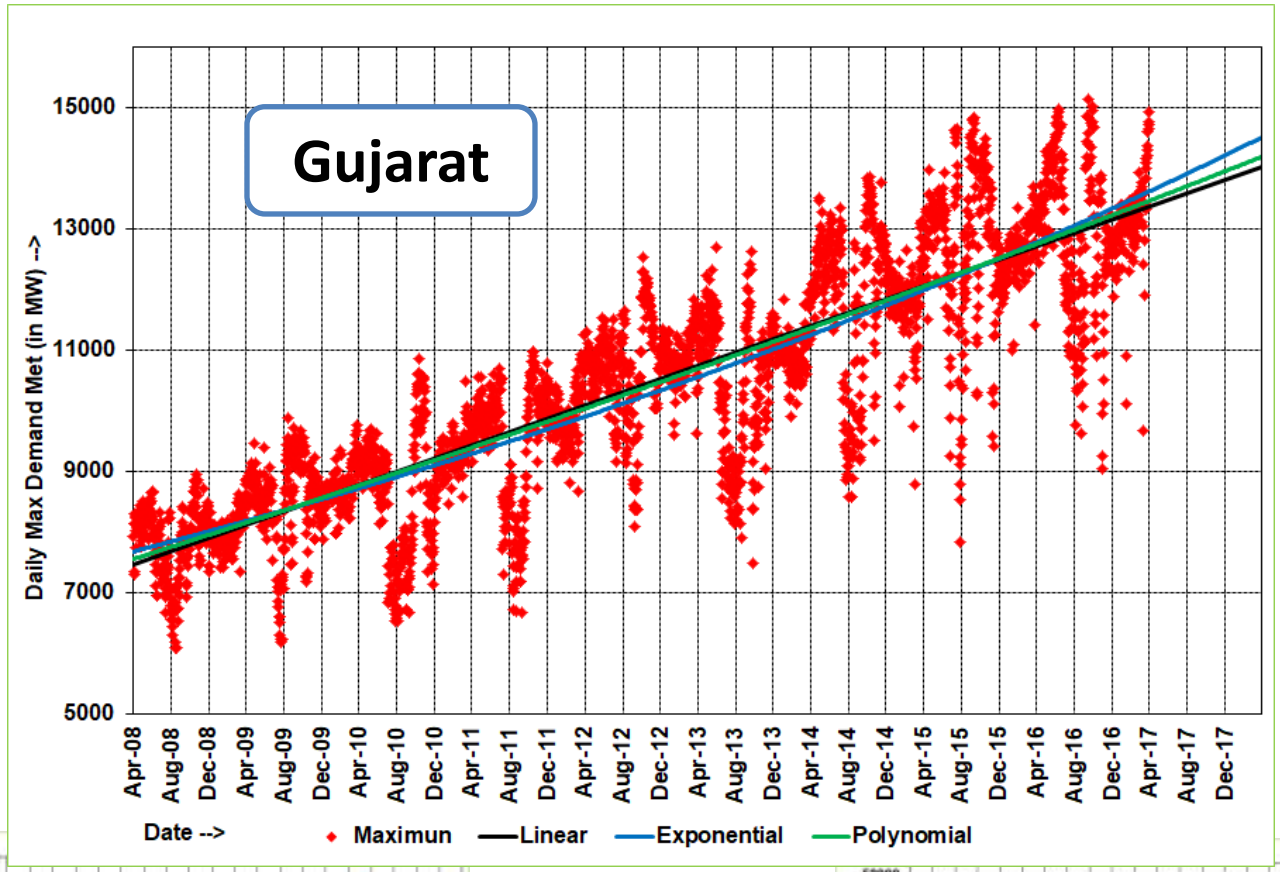
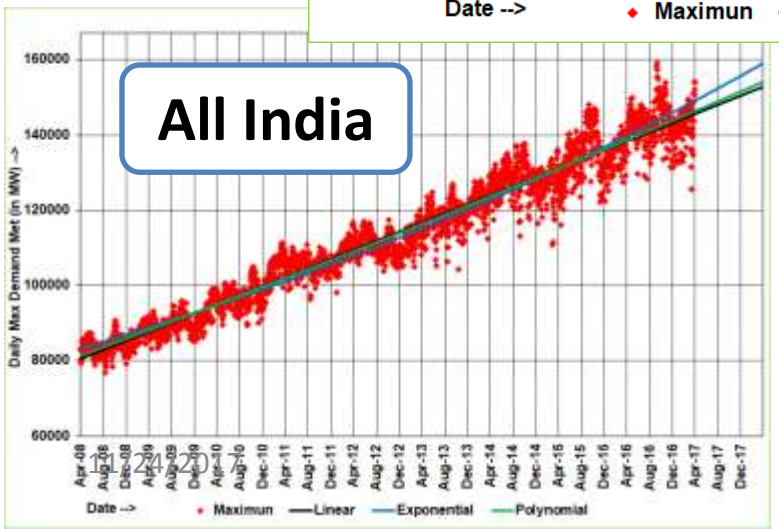
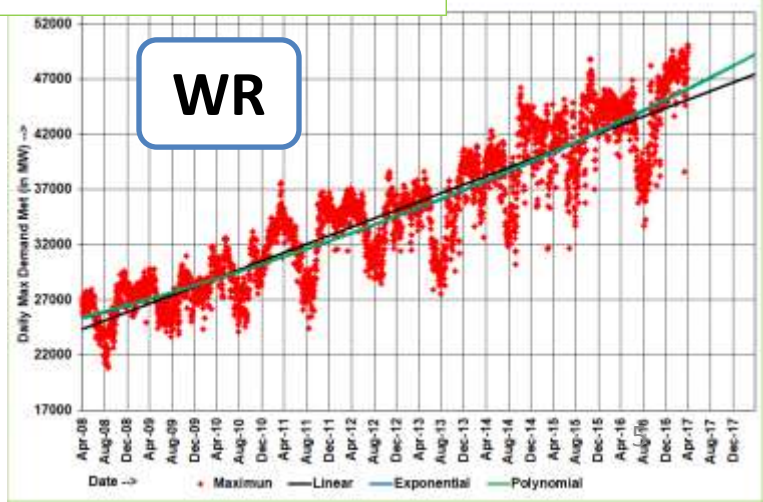




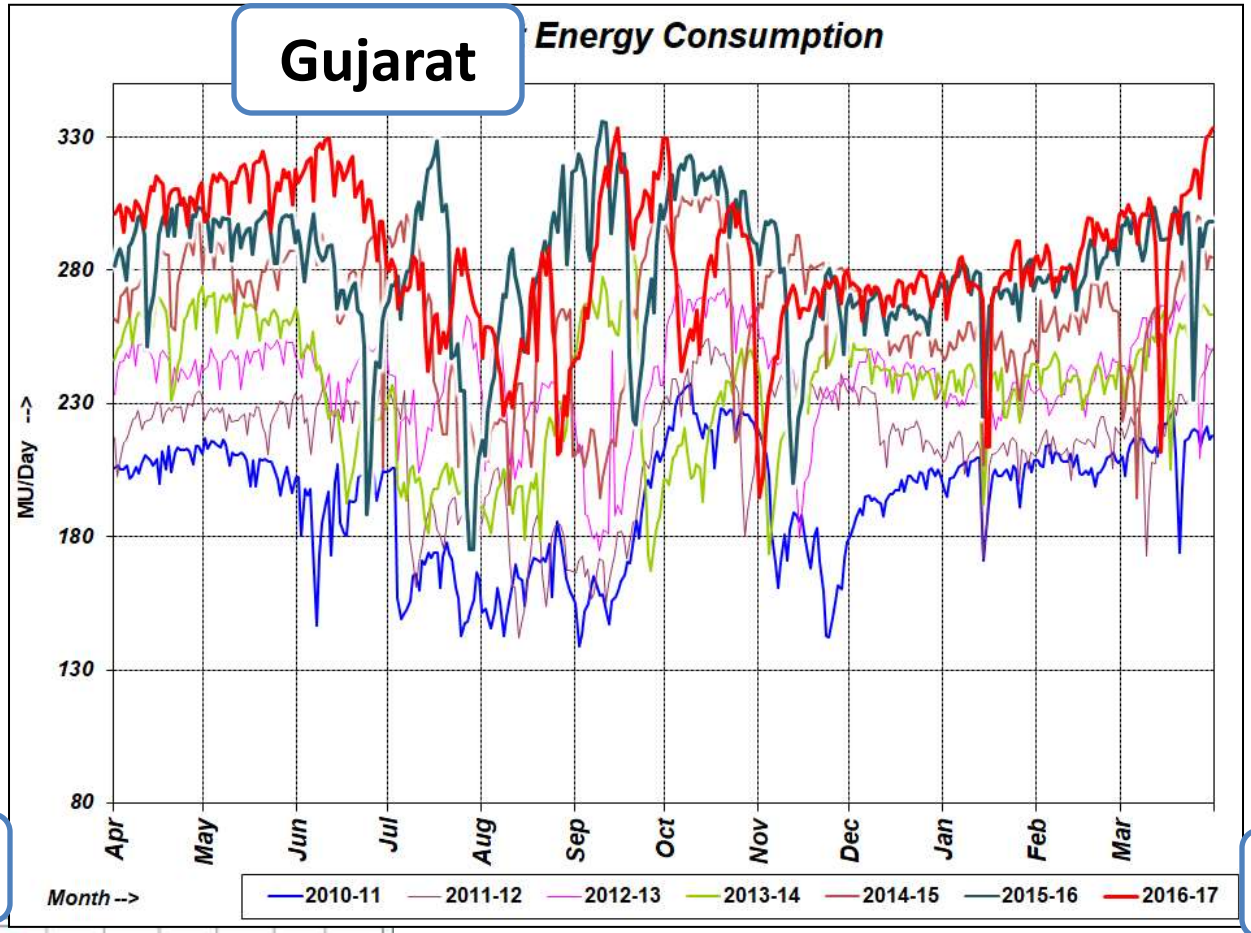
Daily Max. Demand Met Pattern



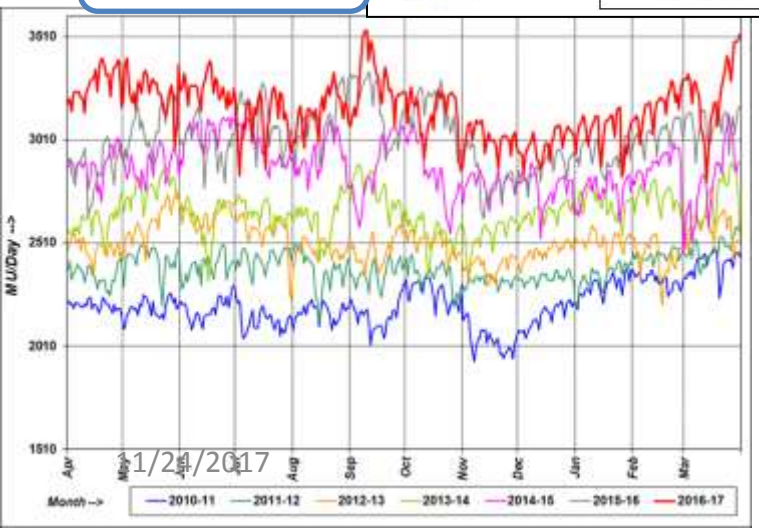




Gujarat



All India



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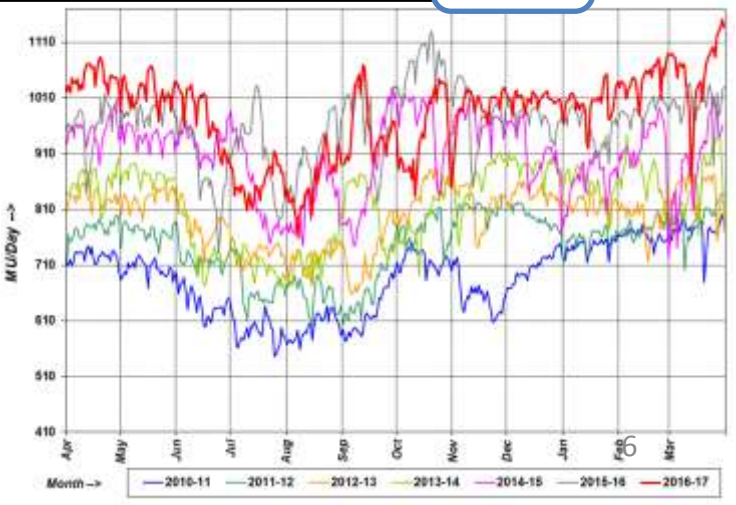
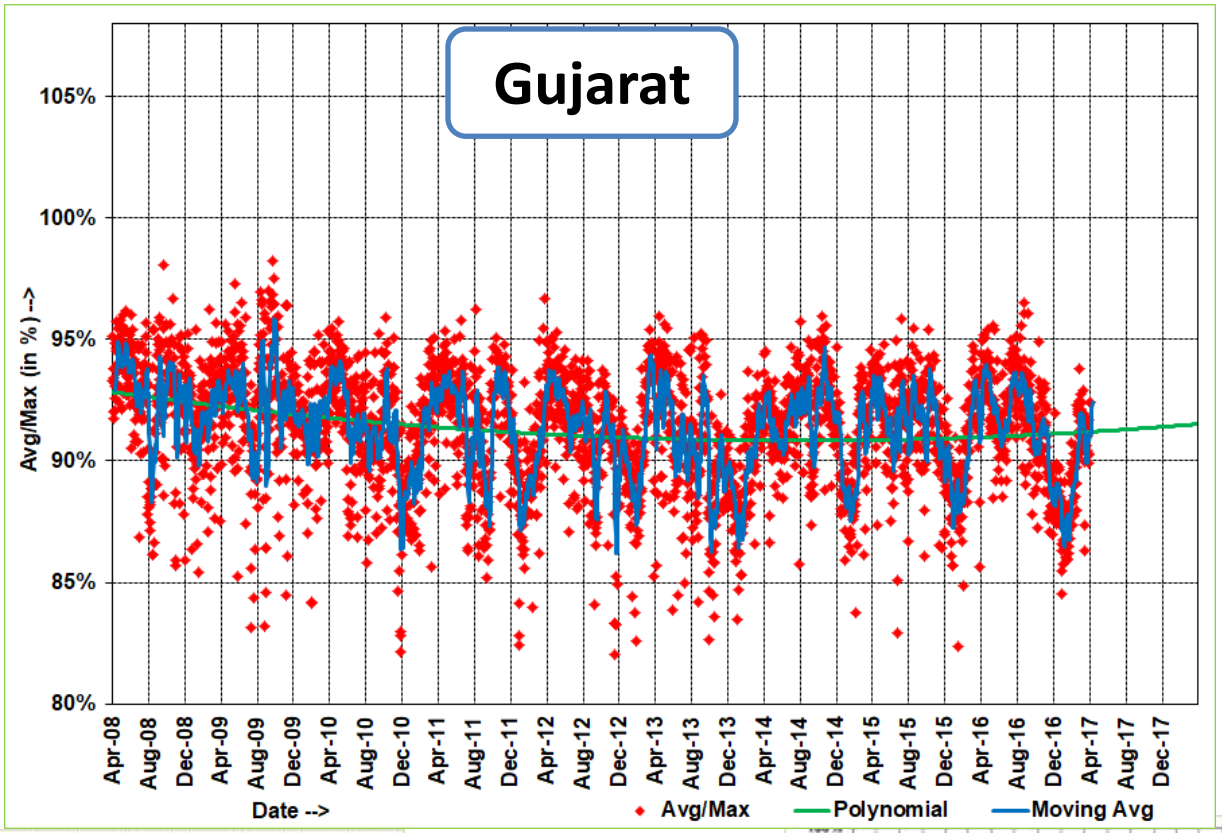
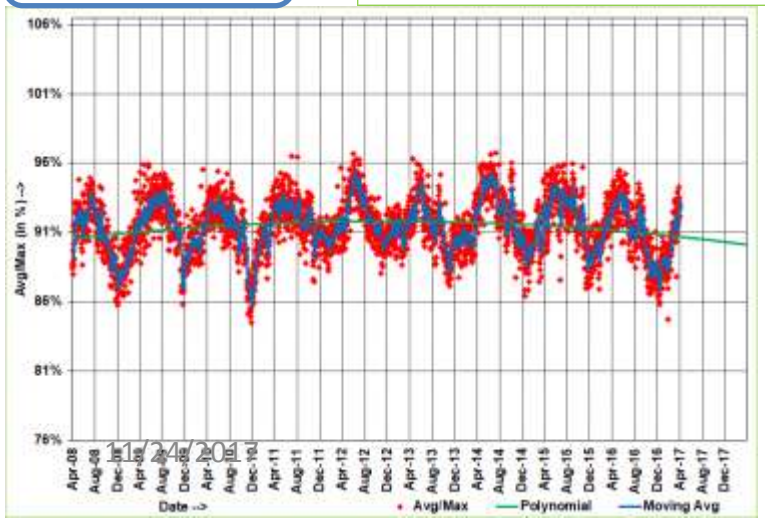


Daily Average demand as a % of Peak demand met (Load Factor):

Gujarat



All India



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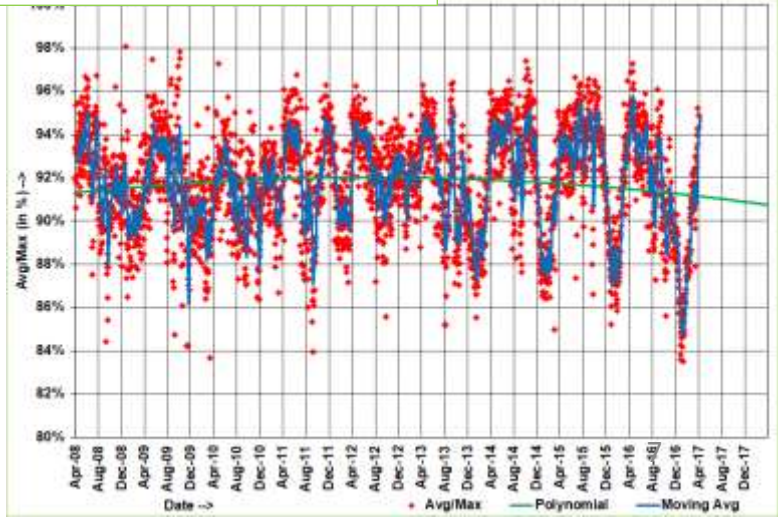
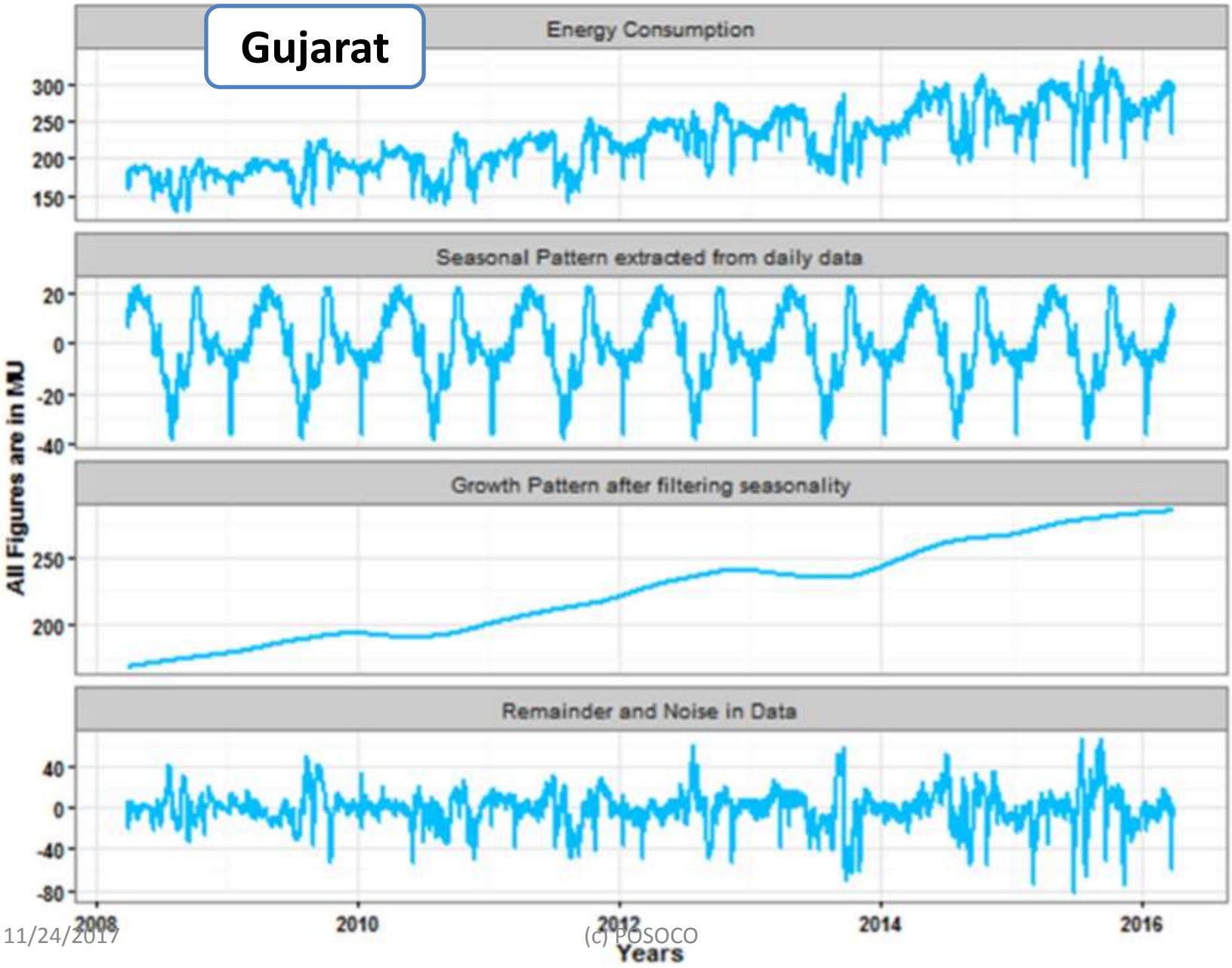
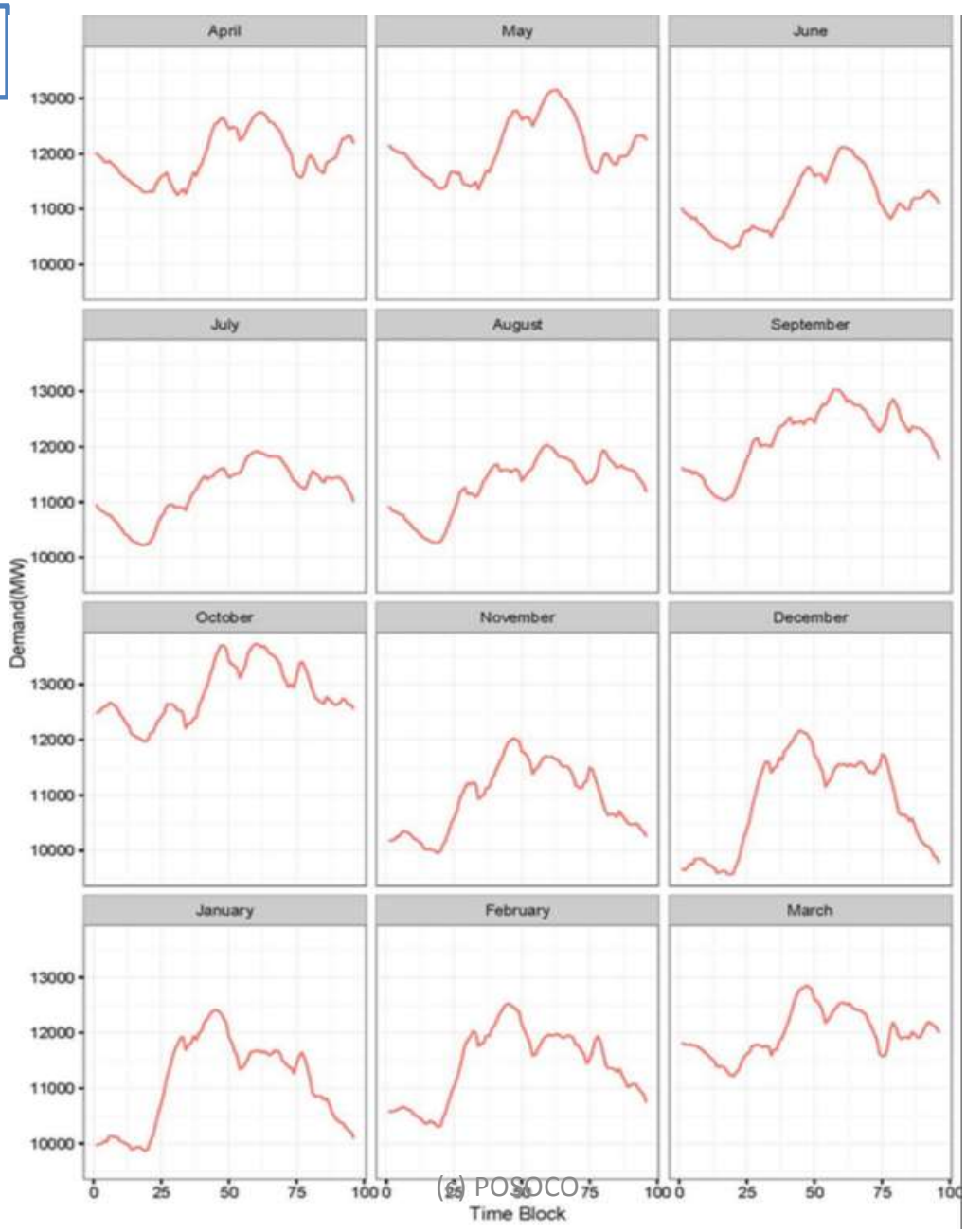


Decomposition of Daily Energy Met(MUs)

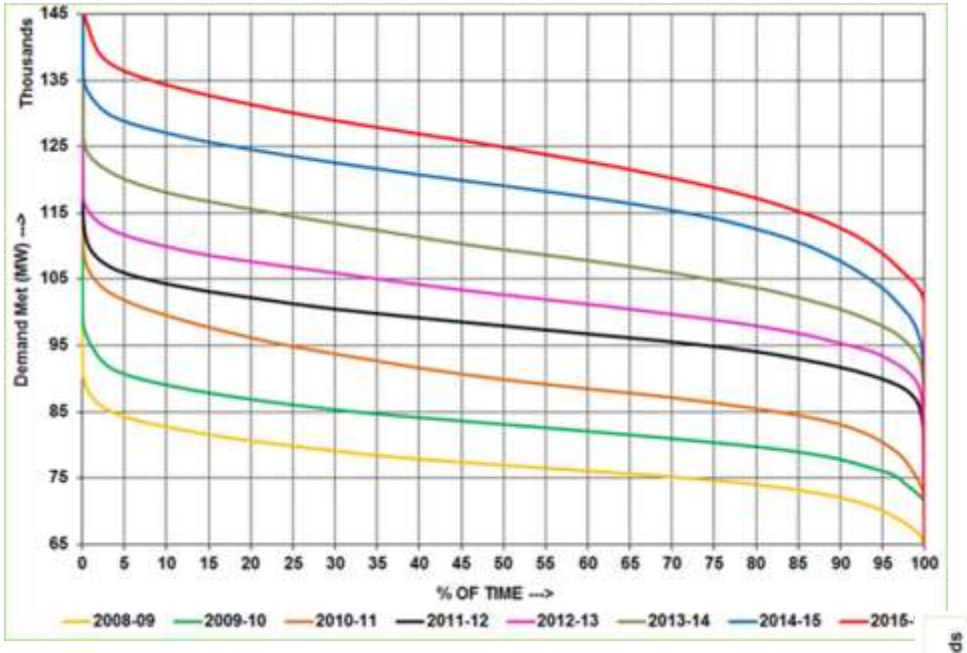


Monthly Demand Met Pattern

Gujarat

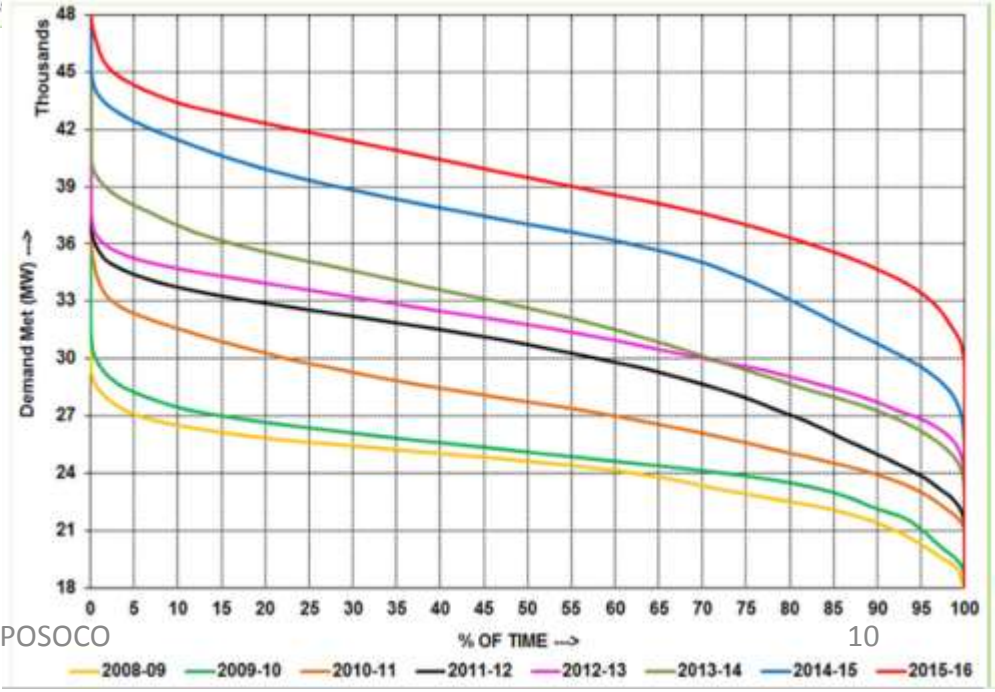


Annual Demand Duration Curve

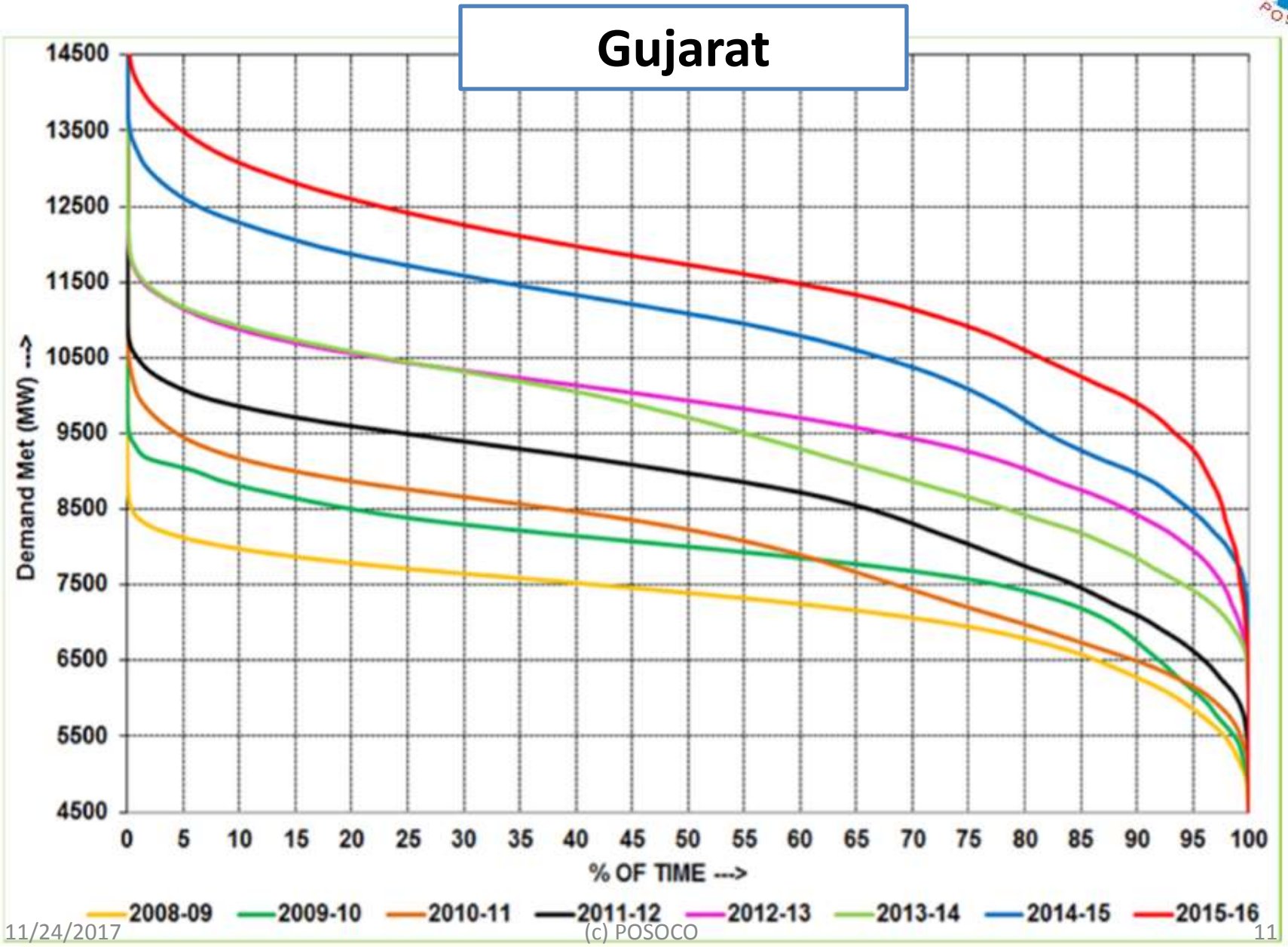


All India

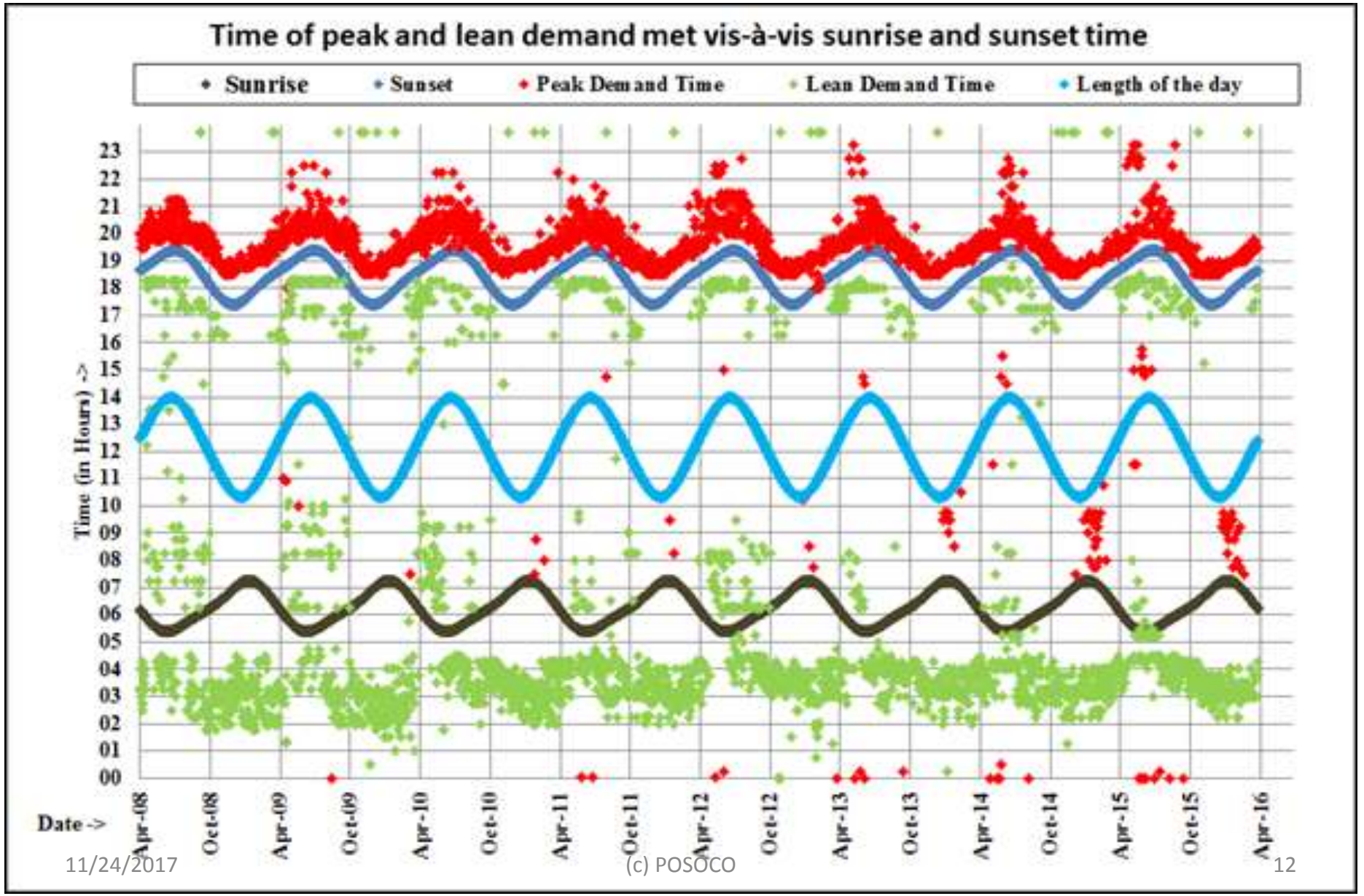
Western Region



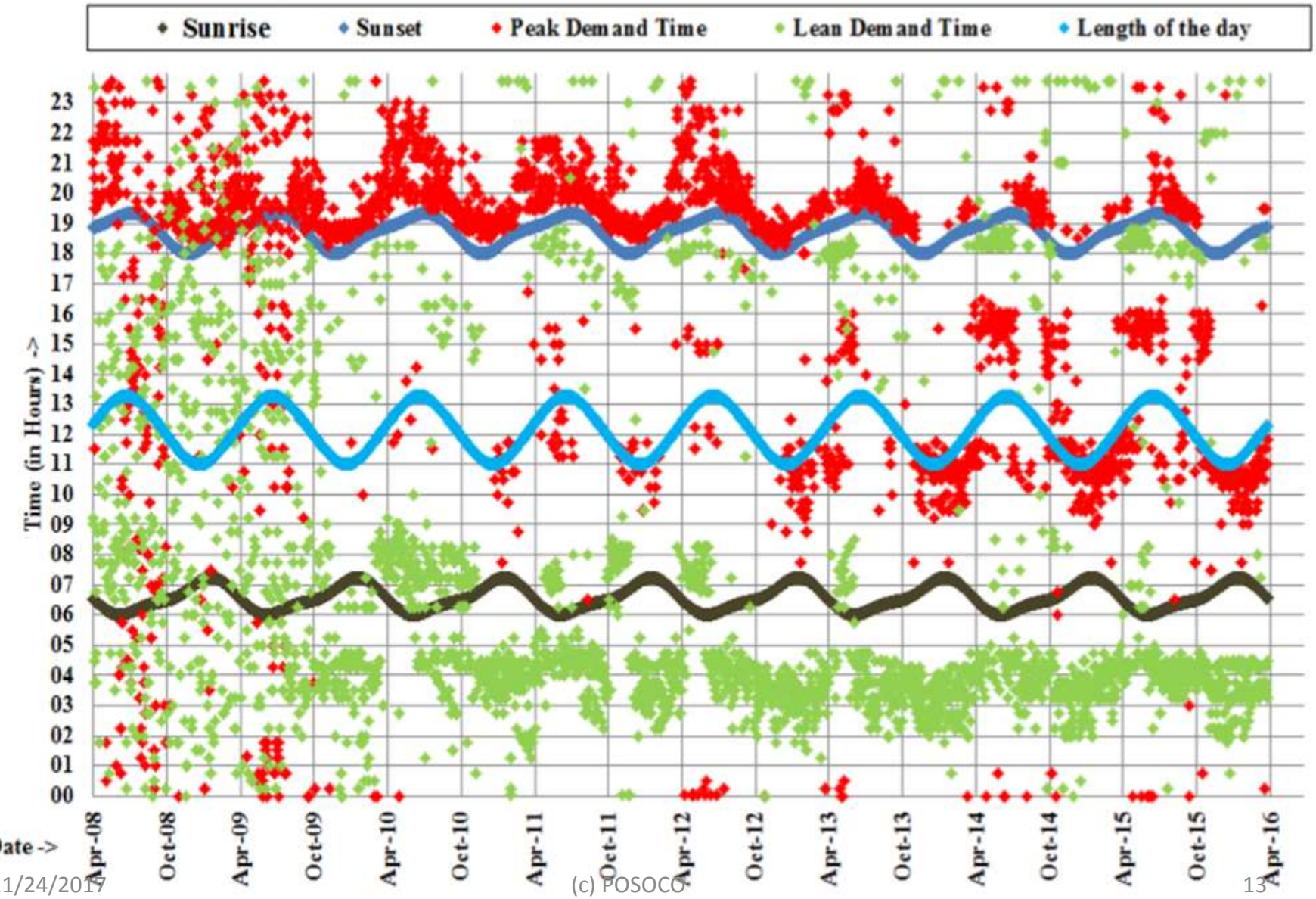
Annual Demand Duration Curve



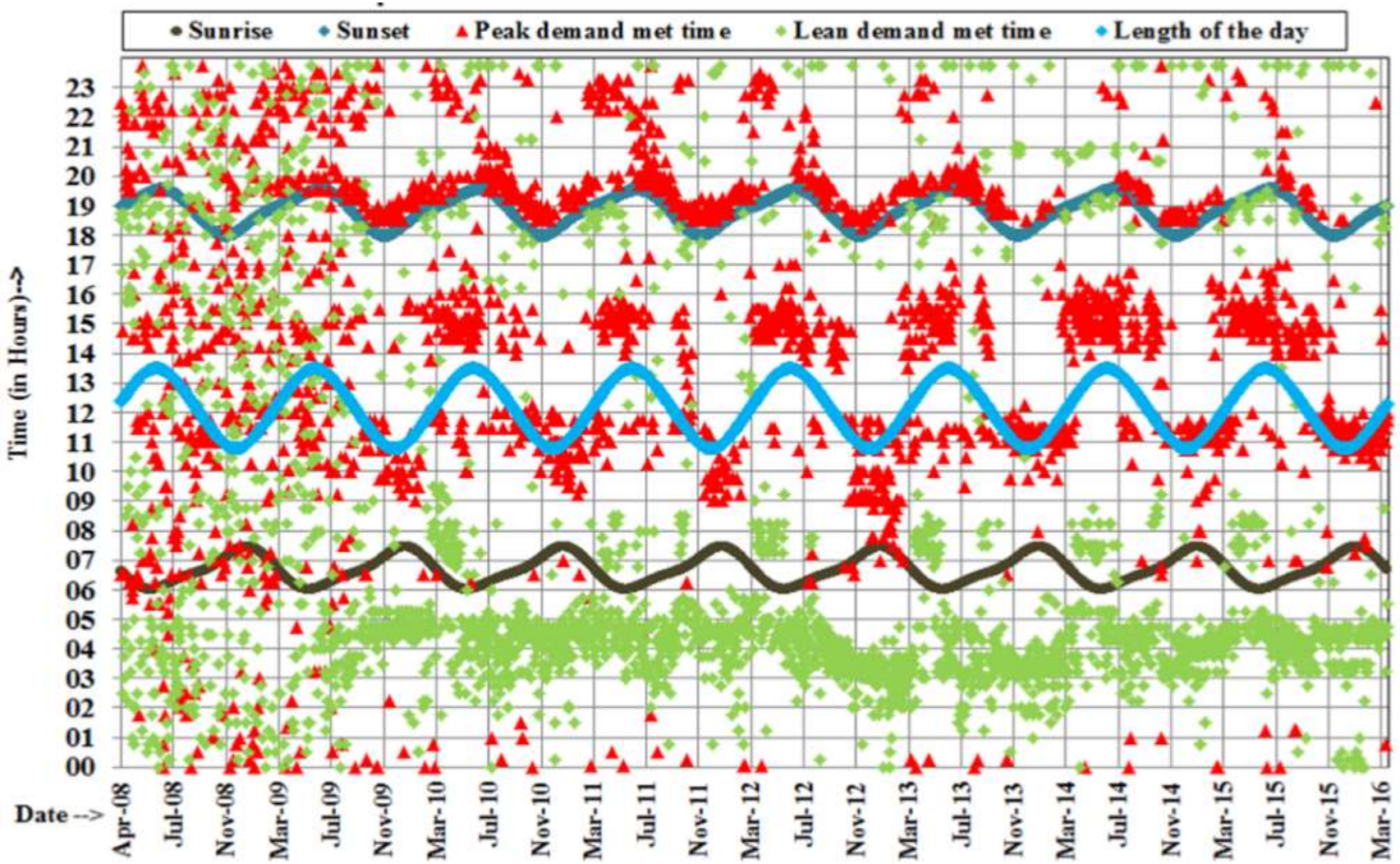
Time of daily sunset, sunrise with occurrences of peak and lean demand met – **All India**



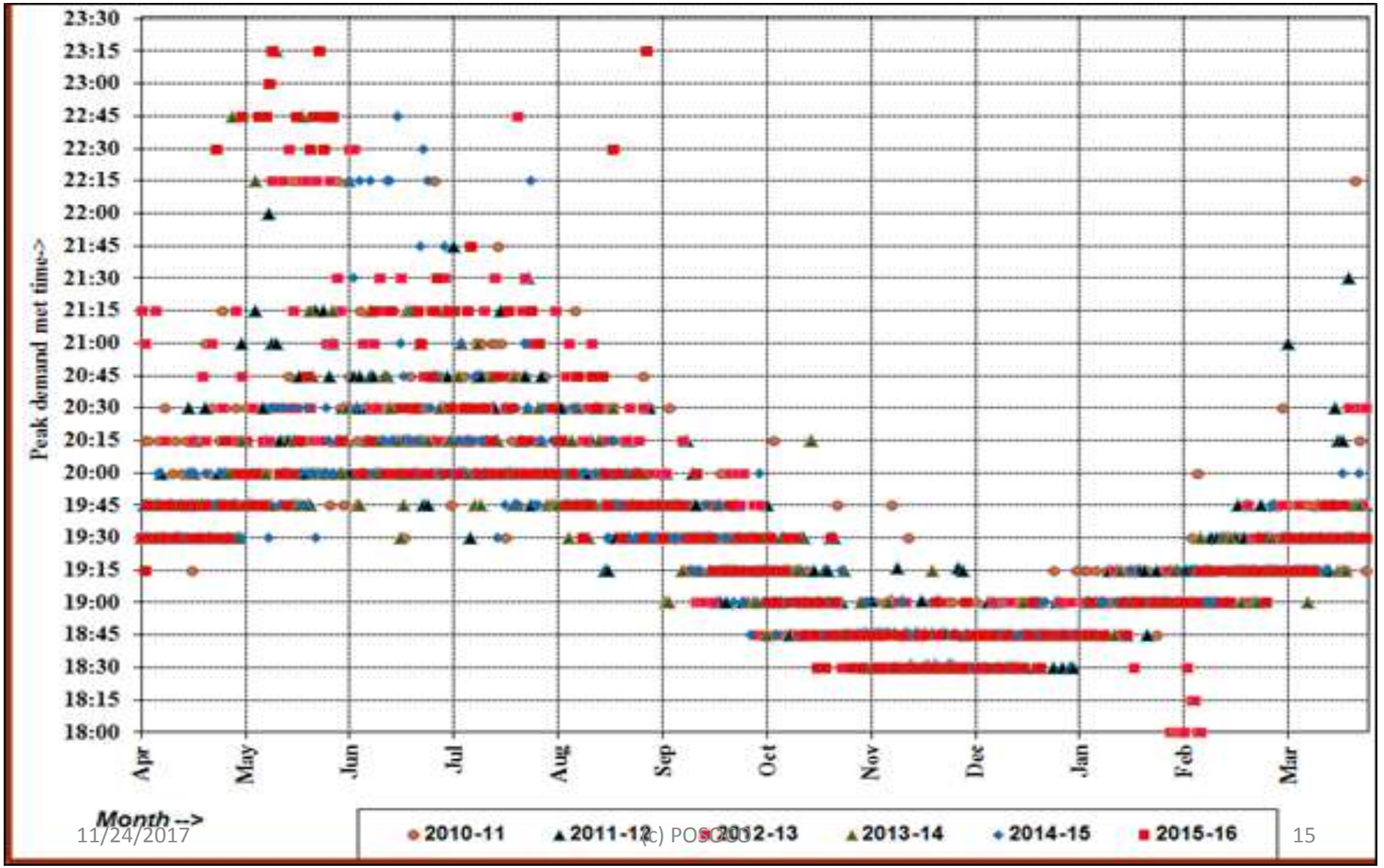
Time of daily sunset, sunrise with occurrences of peak and lean demand met – **Western Region**



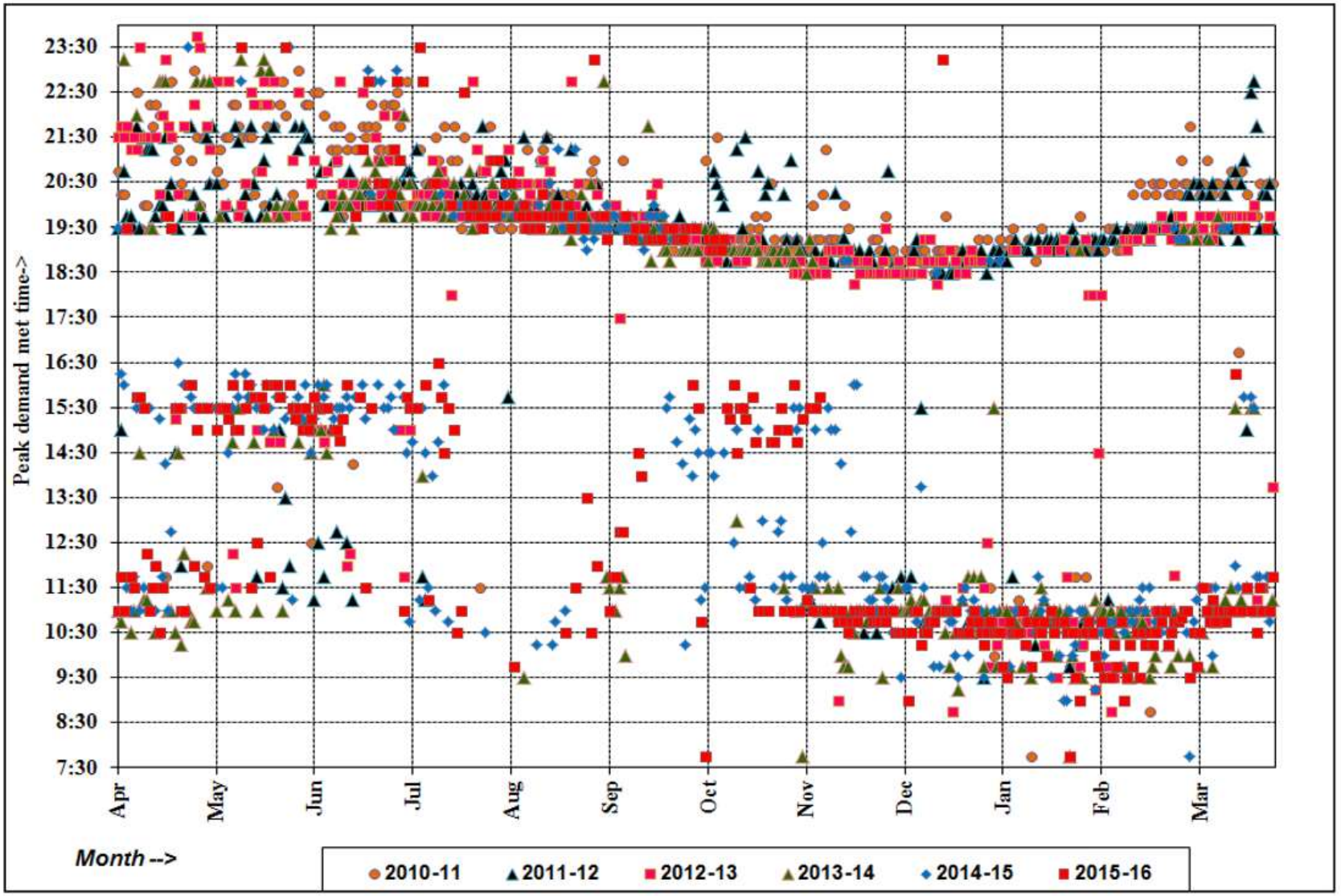
Time of daily sunset, sunrise with occurrences of peak and lean demand met – **Gujarat**



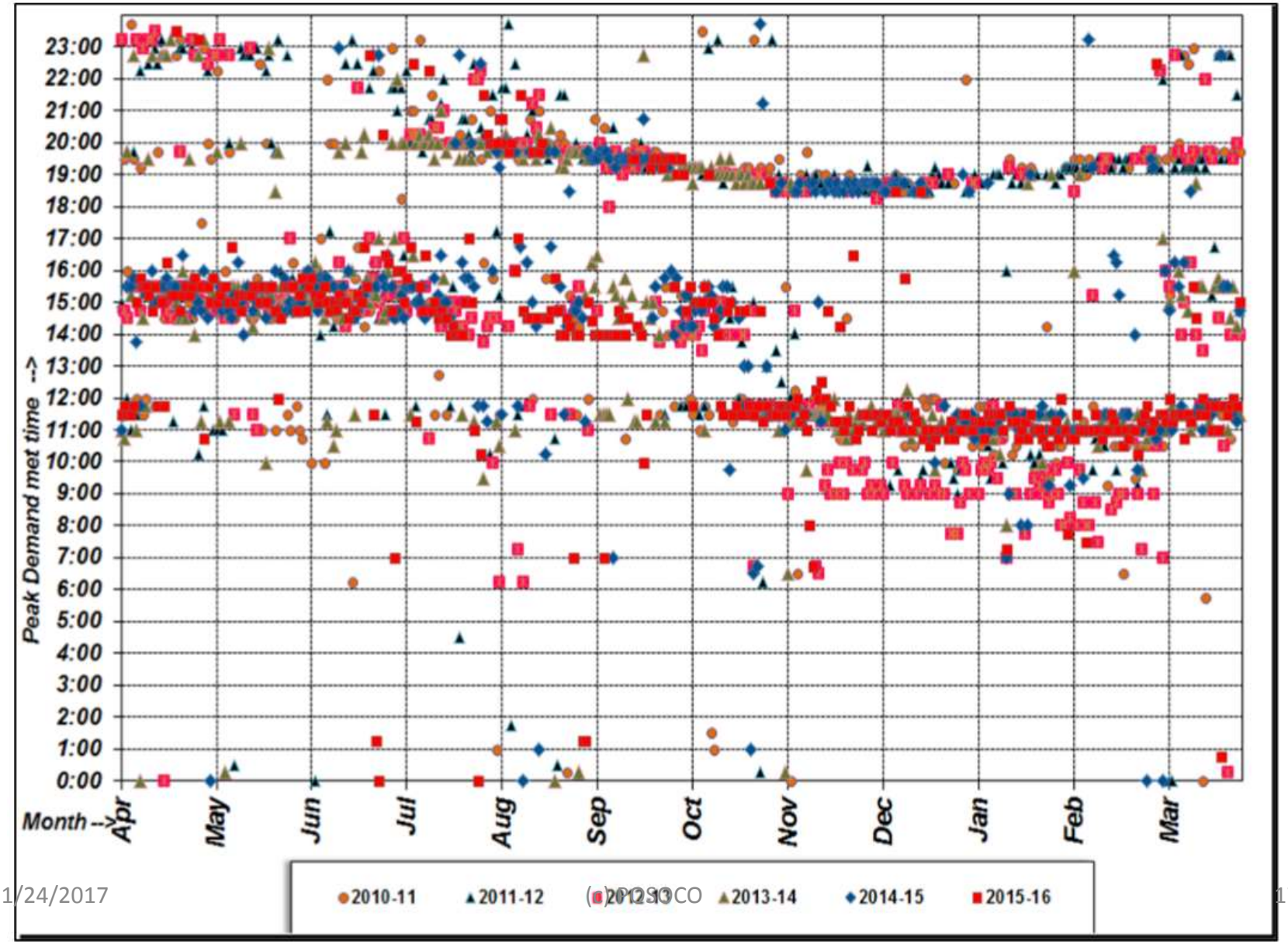
Maximum Daily Demand Met occurrences: Year-On-Year pattern – **All India**



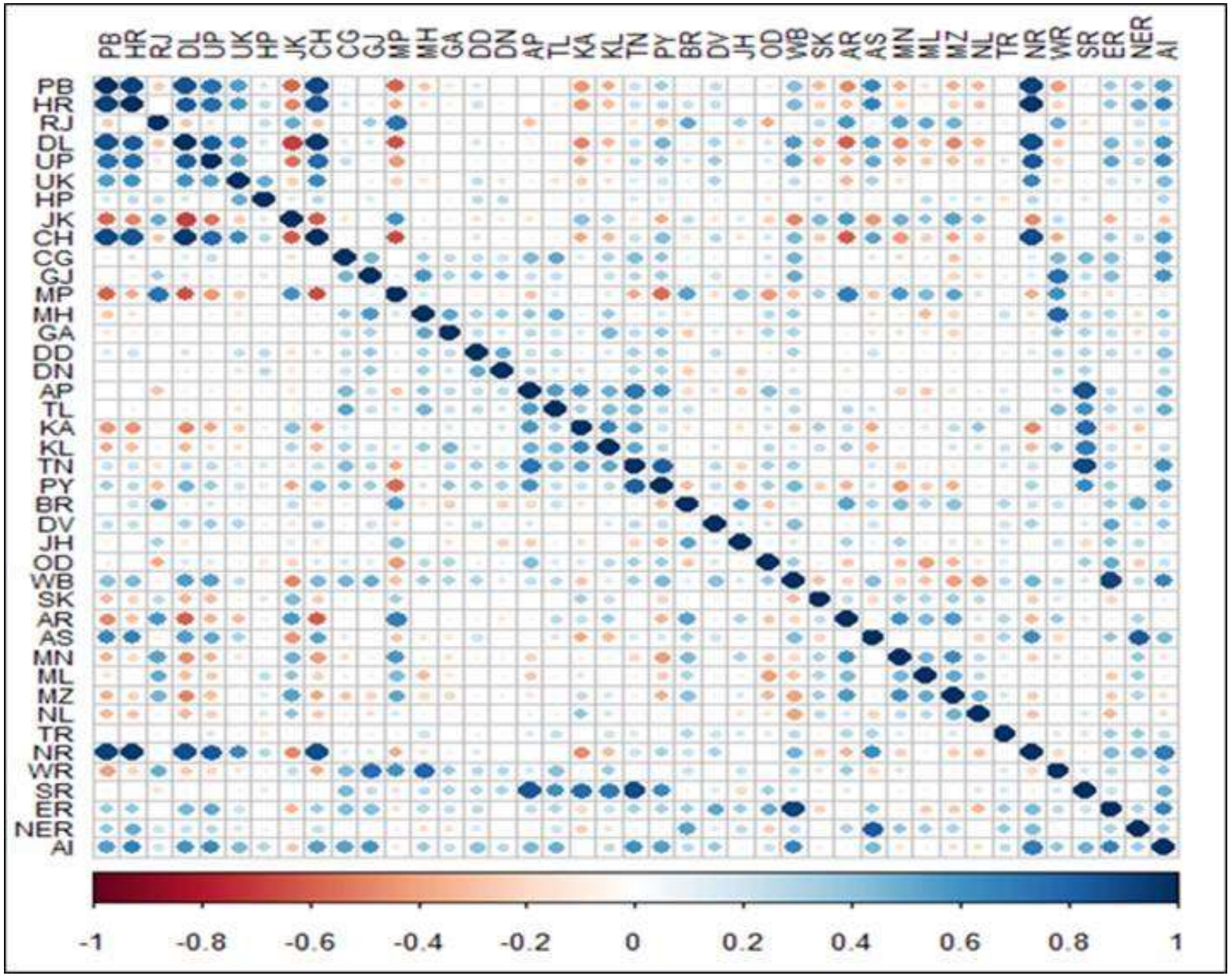
Maximum Daily Demand Met occurrences: Year-On-Year pattern – **Western Region**



Maximum Daily Demand Met occurrences: Year-On-Year pattern – **Gujarat**



DEMAND CORRELOGRAM



Source: Electricity Demand Pattern Analysis Report-2016, POSOCO

Discussion

Thank You !!