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

Venue	**:**	West Bengal Electricity Regulatory Commission (WBERC) FD-41, Paura Bhavan, 3rd Floor Sector-III, Bidhan Nagar Kolkata - 700 106
Date	**:**	20.01.2017
List of Participants:		At **Annexure-I** (enclosed)

The Tenth Meeting of the Technical Committee on "Implementation of Framework on Renewables at State Level", was held under the Chairmanship of Shri A.S. Bakshi, Member, CERC on 20.01.2017 at WBERC, Kolkata. Shri A.S. Bakshi, Chairman, Technical Committee extended a warm welcome to all Members of the Committee. He thanked the Chairperson, WBERC for hosting the meeting at WBERC, Kolkata. The Chairperson, WBERC also welcomed all the Members of the Committee and wished fruitful deliberations over the day.

The Joint Chief (RA), CERC, briefed the Committee about the deliberations and decisions taken during the 9th Meeting of the Technical Committee held on 29.12.2016 at New Delhi.

In the context of the draft DPR for Implementation of SAMAST Report for Andhra Pradesh as discussed in the last meeting, the Member, APERC updated the

Committee about the revised estimates for the project. It was stated that a sum of Rs. 67 Cr. would be required for implementation of SAMAST in Andhra Pradesh, which includes Rs. 27 Cr. for hardware, software, communication components, infrastructure development components, training and capacity building component etc.; and Rs. 40 Cr. towards CT/PT meters.

Agenda 1: Presentation and Discussion on "RPO web tool by the Consultant, FOR" and "Regulatory changes in State level RPO Regulations; Live demo for the State of Rajasthan".

Representative of the consultants (M/s.Idam Infra) made a presentation (enclosed as **Annexure-II**) highlighting the regulatory interventions required for rolling out the web tool for monitoring compliance of RPO. The consultant also highlighted he hardware and software requirements for rolling out the web tool. Thereafter a demo of the web tool done for Rajasthan was given and functionalities of the web tool for monitoring compliance of RPO were also explained.

After deliberation, the following were agreed upon by the Committee.

Consensus:

1. **Mandatory RPO compliance reporting through web portal**: Appropriate provisions be incorporated in the RPO Regulations of respective SERCs / JERCs mandating RPO compliance reporting through the web portal. Following clauses may be incorporated in the RPO Regulations by SERC.

i. *For the purpose of RPO Compliance monitoring and reporting, the State Agency shall formulate procedures and develop RPO Webportal within six months from the date of notification of these Regulations.*

ii. *All Obligated Entities shall mandatorily register themselves with RPO Webportal and shall furnish requisite information to State Agency through RPO Webportal in the manner and form, as prescribed under the Procedures to be formulated by State Agency.*

iii. *Electrical Inspectorate and Nodal Agency for Open Access (SLDC/STU or Distribution Licensee, as the case may be) or Third Party Verifier appointed by State Agency, shall verify and confirm the data submissions by Obligated Entities from time to time in the manner prescribed under Procedures to be formulated by State Agency.*

iv. *The State Agency shall submit Quarterly Report of status of RPO Compliance by Obligated Entities in the State to State Commission.*

v. *Failure to provide necessary information, data, reports by Obligated Entities & stakeholders shall attract penal actions under Section 142 of EA 2003.*

2. **RPO as Percentage of Consumption or Input Energy**: It transpired that in so far as DISCOMS are concerned, even if 'sales' are used as reference for RPO computation, the energy at sales level will have to be grossed up by T&D losses to arrive at the purchase of RE by DISCOMS. This is the same as input energy. As such, it would be desirable to compute RPO for DISCOMS as a percentage of energy input, uniformly across States.

As regards consumption by OA and CPP consumers is concerned, it was agreed that RPO should be computed as a percentage of metered consumption recorded at drawal/consumption point. Following clauses may be incorporated in the RPO Regulations by SERC:

(i) In case of Distribution Licensee as Obligated Entity, RPO target percentage shall be applicable on the Energy Input for concerned Distribution Licensee (i.e. Energy Sales grossed up for transmission and distribution losses).

(ii) In case of any other Obligated Entity (other than Distribution Licensee), RPO target percentage shall be applicable on the actual Electricity Consumption (excluding consumption supplied by Distribution Licensee) recorded at Drawal point or Consumption point of such Obligated Entity.

3. **Rooftop Solar Projects as RPO Compliance** - As regards the point of crediting the generation (Gross) from Rooftop Solar Projects to the DISCOMs for the purpose of their Solar RPO, it was agreed that following Model Conditions may be incorporated in the RPO Regulations/Net Metering Regulations, as appropriate:-

The quantum of electricity generated by the Eligible Consumer from the Roof-top Solar PV System under the Net Metering arrangement shall, if such Consumer is not an Obligated Entity, qualify towards meeting the Solar RPO of the Distribution Licensee.

Provided that the quantum of electricity consumed by the Eligible Consumer from the Roof-top Solar PV System under the Net Metering Arrangement shall qualify towards his compliance of Solar RPO, if such Consumer is an Obligated Entity.

The Eligible Consumer shall install, at his own cost, a Solar Generation Meter conforming to the applicable CEA Regulations at an appropriate location to measure the energy generated from the Roof-top Solar PV system, if he is an Obligated Entity and desires that such energy be counted towards meeting its RPO.

The Distribution Licensee shall install, at its own cost and with the consent of the Eligible Consumer, a Solar Generation Meter conforming to the applicable CEA Regulations at an appropriate location to measure the energy generated from the Roof-top Solar PV System if it desires that such energy be counted towards meeting its RPO. The Solar Generation Meter shall be maintained by the Distribution Licensee at its cost.

4. Efforts should be made to incorporate these provisions in the State level Regulations at the earliest and the framework of web tool based RPO monitoring and compliance should be rolled out. Technical Committee Members advised that similar RPO Web Portal should be developed for Gujarat, so that RPO Web-tool is ready for at least two states (which can act as model for other states) by April, 2017.
5. In addition, standard requirements for web hosting of web tool / portal may also be specified.

Agenda 2(a): Presentation by WBSLDC on "Balancing and Deviation Settlement Mechanism in the State of West Bengal".

Representative of WBSLDC made a presentation before the Committee on "Balancing and Deviation Settlement Mechanism in the State of West Bengal" (enclosed as **Annexure-III**). It was conveyed that CERC principles of Deviation Settlement Mechanism have been adopted in West Bengal. However, the State has witnessed negative pool on some occasions. The Committee deliberated upon the matter and the following emerged.

1. The Model DSM Regulations already address the issues relating to DSM Pool management including the volume limit, etc, as under:-

*The over-drawal or under drawal of electricity by any Buyer during a time block shall not exceed 12% of its scheduled drawal or **[X] MW**, whichever is lower, when grid frequency is between range of '49.90 Hz and above to below 50.05 Hz.'*

*The Volume Limit of **[X] MW** for distribution licensee(s) and Buyers shall be determined as under:-*

i. *Minimum of (12% of schedule, (Peak Demand of Distribution Licensee or Buyer / ∑NCPD) x State Volume Limit)*
Where NCPD (Non-Coincident Peak Demand) represents the sum of Peak Demand of Distribution Licensee(s) and Buyer(s) subject to condition stipulated under following sub-clause (iii).

ii. *State Volume Limit shall be linked to Volume Limit (L) applicable to the State as per CERC DSM Regulations and its amendments thereof*

iii. *Where Peak Demand of the Distribution Licensee shall be recorded Peak Demand in the previous Financial Year or Projected Peak Demand of Buyer in ensuing Financial Year, whichever is higher;*

Provided that no over drawal of electricity by any buyer shall be permissible when grid frequency is "below 49.90 Hz" and no under drawal of electricity by any buyer shall be permissible when grid frequency is "50.05 Hz and above".

The under-injection or over-injection of electricity by Seller shall not exceed following when grid frequency is "49.90 Hz or above and below 50.05 Hz":

i. *12% of the scheduled injection or [10] MW, whichever is lower for a Seller*

Provided that in case schedule of a Seller, in a time block, is less than or equal to [40] MW, under-injection / over-injection in a time-block shall not exceed [5] MW, when grid frequency is "49.90 Hz or above and below 50.05 Hz".

2. The Model DSM Regulations would be circulated to all SERCs shortly and West Bengal could consider the provisions, to address the issues being faced in the State, in the Regulations.

Agenda 2(b): Presentation by WBERC on "Impact of RE Integration".

Representative of WBERC made a presentation on "Accommodation of RE Power by 2022" (enclosed as **Annexure-IV**). In order to meet the revised Solar RPO target of 4223 MW for 2021-22 and to accommodate the RE generation, the conventional thermal generation is required to be flexed by putting 25-year-old thermal units on two shift operation, operating the 15 year-old-plants at 55% of full load capacity during day peak and running the generating stations which are less than 15 years vintage, at 70%. It was stated that the above measures to accommodate RE power would have an impact and raise the power purchase cost by 42.13 paise per unit. In addition, the financial impact owing to implementation of new environmental norms is expected to be around 45 to 55 paise per unit on generation tariff. The Committee deliberated upon the matter and the following emerged.

1. Appropriate load forecast is required to be carried out to arrive at the accurate load duration curve. This would facilitate proper generation unit commitment including backing down or flexing of generation capacity to meet the required load.
2. JC (RA), CERC suggested that the scenario as presented by West Bengal - *of low load during day time in West Bengal and generation of solar power for the same*

part of the day - calls for a framework for cooperation among States for effective sharing of resources. The Committee while appreciating the observation suggested that FOR may evolve a blue print in this regard by availing services of a consultant.

3. It was informed that POSOCO and NREL, USA are jointly carrying out a study on similar issues and it was decided that the representatives of POSOCO / NREL may be invited to make a presentation before the Committee in its next meeting.

Agenda 3: Other Issues

TNERC Chair stated that at the State level, the Discoms, OA consumers and CPPs are given separate RPO targets and on certain occasions, some of these OEs (especially CPPs) exceed their RPO target. He suggested that the overall achievement of RPO targets by all OEs may be taken together so as to facilitate the Discoms to take benefit of the excess RPO achieved by the OA consumers and CPPs within their jurisdiction. The Committee noted the proposal for further discussion at a later date.

WBERC Chair suggested that FOR should initiate a study on the measures to reduce the cost of power.

On conclusion of the meeting, Shir A S Bakshi, Member CERC thanked the Chairperson, West Bengal Electricity Regulatory Commission (WBERC) and his team

for their painstaking efforts to host the meeting at Kolkata. He also thanked all the dignitaries present in the meeting.

The meeting ended with vote of thanks to the Chair.

Annexure-I

LIST OF PARTICIPANTS ATTENDED THE TENTH MEETING OF THE TECHNICAL COMMITTEE FOR "IMPLEMENTATION OF FRAMEWORK ON RENEWABLES AT THE STATE LEVEL" HELD ON 20.01.2017 AT WBERC OFFICE, KOLKATA.

1.	Shri A. S.Bakshi, Member	CERC
2.	Shri S. Akshayakumar, Chairperson	TNERC
3.	Shri R.N. Sen, Chairperson,	WBERC
4.	Shri P. Rama Mohan, Member	APERC
5.	Shri P.J. Thakkar, Member	GERC
6.	Shri D.B. Manival Raju,Member	KERC
7.	Shri A.B.Bajpai, Member	MPERC
8.	Shri Deepak Lad, Member	MERC
9.	Dr. Sushanta K. Chatterjee, JC(RA)	CERC
10.	Shri S.S. Barpanda, Additional General Manager	POSOCO
11.	Shri P. Mukhopadhyay, General Manager	WRLDC
12.	Shri Dibyendu Bhattacharya, Superintending Engineer	SLDC, West Bengal
13.	Shri Balawant Joshi, Managing Director	IDAM INFRA
14.	Shri Ajit Pandit, Director	IDAM INFRA

PARTNERSHIP TO ADVANCE CLEAN ENERGY-DEPLOYMENT TECHNICAL ASSISTANCE PROGRAM

Development of Generic Renewable Purchase Obligation Compliance Web-tool

Presented to: Forum of Regulators – 10th Technical Committee Meeting

Date: 20th January, 2017

Proposed Regulatory Intervention

USAID
FROM THE AMERICAN PEOPLE

Why Regulatory Intervention?

- Standardisation and Uniform application of conditions/definitions
  - Applicability to Captive/OA Users,
  - Definitions of Input Energy
  - Treatment for Solar Rooftop
- RPO Regulations of SERCs entrust the responsibility of data collection on State Nodal Agencies :
    - Obligated entities are not voluntarily declaring RPO compliance to SNAs on regular basis;
    - SNAs are facing difficulties in enforcing data collection from obligated entities specifically OA and CPP consumers;
    - SNAs are not empowered to issue notices to obligated entities;

Summary of Discussion during 9th Technical Committee Meeting

- **RPO as Percentage of Consumption or Input Energy:**
  - For DISCOMS, it would be desirable to compute RPO as a percentage of energy input, uniformly across States.
  - For OA and CPP consumers, RPO should be computed as a percentage of metered consumption
- **RPO Implementing and Monitoring Agencies:**
  - Regulations to mandate Obligated Entities to register and report data to Nodal Agency using Web tool platform
  - States could choose either of the options - Grid Coordination Committee (GCC) or an SNA for implementing and compliance monitoring of RPO in States.
  - Selected agency / committee should submit a quarterly report on compliance status to the State Commission.
  - Failure to provide information, data, reports by OE & stakeholders would attract penal actions under S142.
- **Data Verification by OE**
  - It was suggested that Electrical Inspectors can verify the data for CPPs and SLDCs can verify for other OEs. The consultant will develop a standard format for data verification as part of the web tool.

Model RPO Regulations to include above conditions viz. standard definitions for Energy Input, Obligated Entities, Compliance Monitoring, Verification & Reporting framework

Summary of Discussion during 9th Technical Committee Meeting

- **Rooftop Solar Projects as RPO Compliance –**
  - FOR Secretariat could write to MoP to suitably incorporate the provision of crediting generation (Gross) from Rooftop Solar Projects to the DISCOMs for the purpose of their Solar RPOin Tariff Policy, to ensure its uniform aplication across the country.
- **Web-Tool Hosting**
  - To define the required regulatory changes in the RPO regulations of States so that by April 2017, the web-tool is ready for at least 2 States
  - Standard requirements for Webhosting of Web tool/portal to be specified

Hardware Requirements

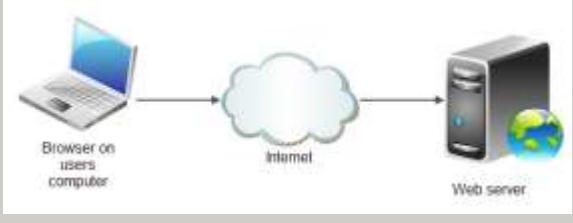
The user will be required to have the few prerequisites for accessing the web tool. This tool would be developed for the purpose of RPO compliance for the obligated entities and monitoring by the state agency.

Application Server: An application server is a component based product that resides in the middle tier of the server centric architecture. It provides middleware services for security and state maintenance along with data access and persistence.

Database Server: A database server is a computer program that provides database services to other computer programs or computers, as defined by the client –server model.

Minimum System Requirements for Application Server and Database Server :

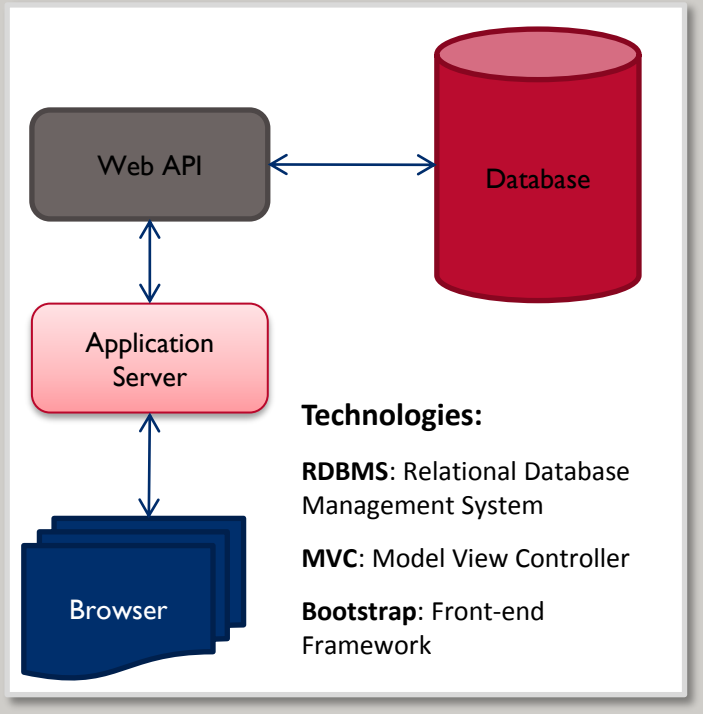
Processor	3.00 GHz or above
RAM	8 GB RAM
HDD	500GB HDD
IP	1 Live IP and FTP Access



Software Requirements

Software Specification for Renewable Purchase Obligation Compliance System (RPOCS):

- Windows Server 2008 R2 64 bit
- Microsoft .Net framework 4.5 or higher
- Internet Information Serves (IIS) – Version 7.0
- Database – PostgreSQL – Version 9.5 (Open source)
- High speed internet access



Tools for Application Development

- **.NET Framework**: A software framework developed by Microsoft that runs primarily on Microsoft Windows. It includes a large class library known as Framework Class Library (FCL) and provides language interoperability (each language can use code written in other languages) across several programming languages. Programs written for .NET Framework execute in a software environment (as contrasted to hardware environment), known as Common Language Runtime (CLR), and an application virtual machine that provides services such as security, memory management, and exception handling. FCL and CLR together constitute .NET Framework.

- **Web server IIS:** An **IIS** (Internet Information Server) application is a Visual Basic application that lives on a Web server and responds to requests from the browser. An IIS application uses HTML to present its user interface and uses compiled Visual Basic code to process requests and respond to events in the browser.

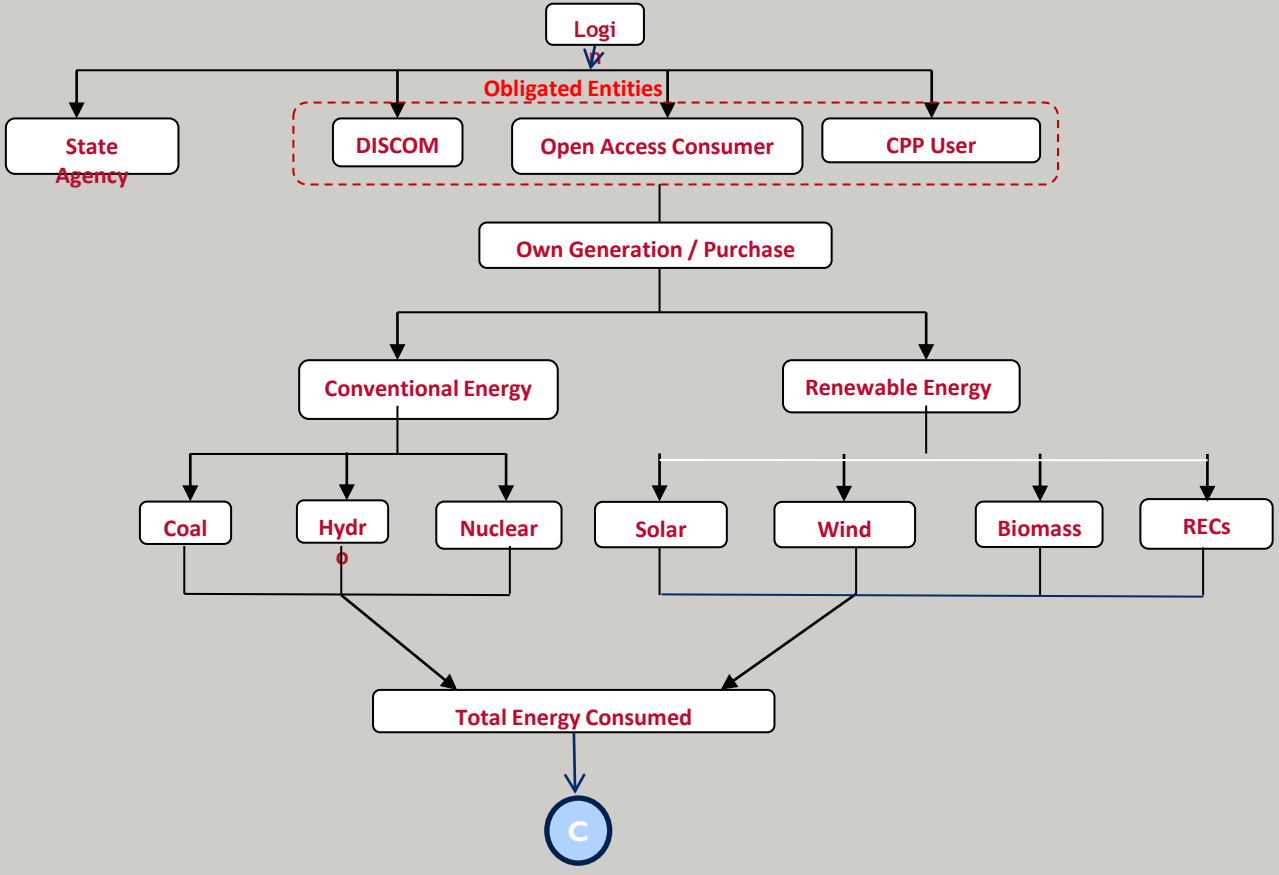
- To the user, an IIS application appears to be made up of a series of HTML pages. To the developer, an IIS application is made up of a special type of object called a web class, that in turn contains a series of resources called web items. The web class acts as the central functional unit of the application, processing data from the browser and sending information to the users. You define a series of procedures that determine how the web class responds to these requests. The web items are the HTML pages and other data the web class can send to the browser in response to a request.

- **Database Platform: PostgreSQL** Database is a commercially supported, open-source SQL relational database management system intended to support large commercial and government applications. This Database is fully open source with a global community of contributors.

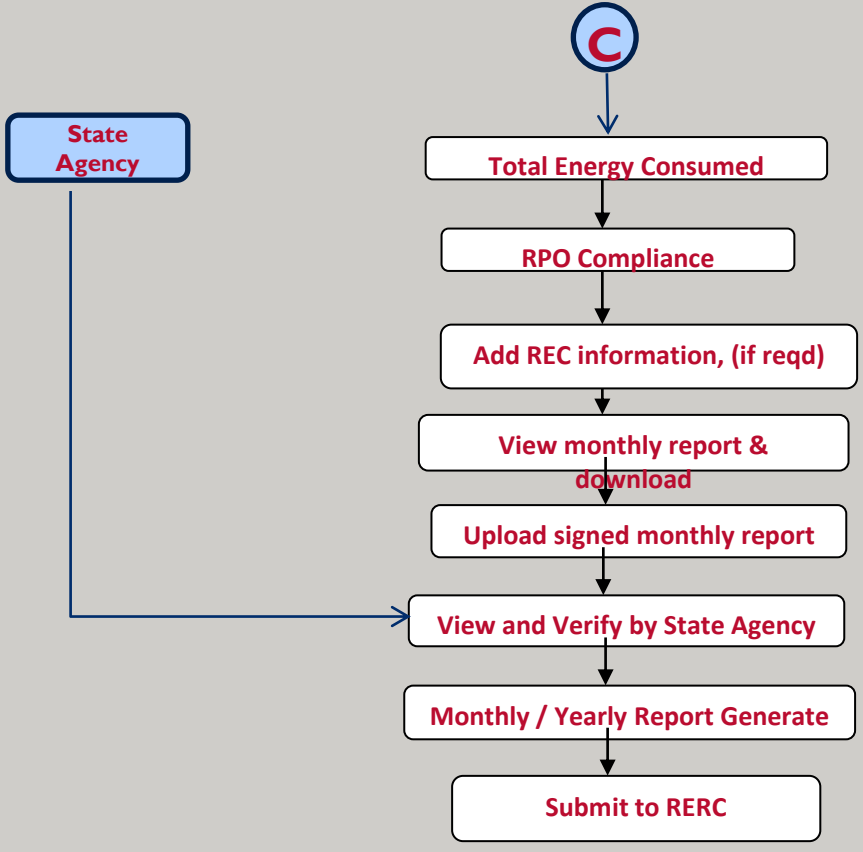
Web Tool Functionalities for RPO Compliance Monitoring

1. Defining System Users and their categories and access rights (Accreditation Process)
2. Regular update of data - consumption, generation and procurement (Forms/Formats)
3. Representation of data to web based online user interface
4. Presentation of Data in user friendly format (Excel/PDF)
5. Classification of data based on Obligated Entity/Type/DISCOM/ location
6. Alarm, Report generation, etc.
7. Monitoring, Verification and Validation Protocol and Information Exchange
8. Scalable system to incorporate future/Upcoming Obligated Entities
9. Mail services, System security and Compliance Reporting, Report Generation, etc.
10. Admin Interface for Incorporating new systems and changes

Functional Flow Diagram…1/2



Functional Flow Diagram…2/2



Note:

- All records should be maintained as per financial year
- No information will be saved without relevant documents
- Predefined grace period for data entry
- RPO compliances not applicable for energy procured from DISCOM

Demo of RPO Webtool for Rajasthan

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Balancing and Deviation Settlement Mechanism in the state of West Bengal

- WBSLDC

ABT constituents within the State

- Distribution licensees :
  - WBSEDCL
  - CESC
  - DPL
  - IPCL/DPSC

ABT constituents within the State(contd…)

- Generating Stations :
  - WBPDCL Generating Stations (Thermal) ----
    - BTPS
    - STPS
    - KTPS
    - BkTPP
    - SgTPP
  - NHPC Generating Stations ----
    - TLDP-III
    - TLDP-IV

ABT constituents within the State(contd…)

- IPP/CPPs :
  - HEL
  - TATA POWER, HALDIA (Co-generation)
  - CPL (Co-generation)
  - PCBL (Co-generation)
  - SIIPL (Solar)

Deviation Settlement in intra-state ABT – Regulatory guideline

- Supporting regulations:
  - Deviation Settlement mechanism and related matters regulations of Hon'ble CERC.
  - Terms and conditions of tariff regulations of Hon'ble WBERC
  - Balance and settlement code of Hon'ble WBERC
  - State Electricity Grid Code of Hon'ble WBERC

Deviation Settlement in intra-state ABT - Detailed Procedure

Following steps are followed for Deviation Settlement calculations

- **STEP-I :** Preparation of Final schedules from provisional final schedule. Then, these schedules are uploaded in oracle database.

- **STEP-II :** Boundary ABT meter data against all constituents except WBSEDCL come through e-mail to SLDC. These meter data are in raw format (machine readable format, ex .mri, .mrd, .dat etc). These raw data are converted into .npc format (man readable format) and then these converted ABT meter data are uploaded in oracle database.

- **STEP-III :** Several programs are run for validation of meter data and to segregate drawal energy and infirm energy from firm energy.

Deviation Settlement in intra-state ABT - Detailed Procedure(contd…)

- Key features:
  - Calculation of block-wise deviated energy which is the difference between final schedule and actual meter data for each constituent.
  - Schedule of WBSEDCL is the summation of all constituent schedule and actual drawal is the summation of all constituent actual meter data.
  - Frequency (Grid frequency of master meter- Korba meter , 1st stand-by and 2nd stand-by meter s are at Durgapur) based calculation of deviation charge.
  - Calculation mechanism of Deviation charge is guided by Deviation Settlement mechanism and related matters regulations of Hon'ble CERC

Deviation Settlement in intra-state ABT - Detailed Procedure(contd…)

- After Step-I, II and III, following procedures are carried out ----
  - On receiving Regional level Deviation bill, the block wise and day wise schedule, actual energy and deviation energy of West Bengal w.r.t REA is tabulated in excel format and uploaded in server.
  - Then, a program is run in server ------- which calculate deviation charge against all the constituents taking into account all relevant clauses of "Deviation Settlement Mechanism and related matters regulations" of Hon'ble CERC.
  - Details of deviation bill are spooled from the server and prepared in excel format.

Details of Deviation charge calculation

- Deviation charge rate/kwh for different frequency from 49.70 to 50.05 Hz.

RDC - Rate of Deviation Charge

SL No	NEW RATE FOR DEVIATION CHARGE
1	f>=50.05Hz, RDC=0
2	50.05>f>=50.00, RDC increases by 35.6 p/u for each 0.01Hz step
3	50.00>f>=49.7, RDC increases by 20.84 p/u for each 0.01Hz step
4	f<49.7,RDC=824.04p/u

Details of Deviation charge calculation(contd…)

- For over injection or under drawal deviation charge is:
  - If frequency<50.05 Hz. then, deviation charge receivable----
    - When deviated energy <=12% of schedule or 150 MW whichever is less then,
      - **Deviation charge = Deviated Energy * rate**
    - When deviated energy > 12% of schedule or 150 MW whichever is less then,
      - **Deviation charge = Deviated Energy (12% of schedule or 150 MW whichever is less) * rate + Deviated Energy (Above 12% of schedule or 150 MW whichever is less) * 0.00**

Details of Deviation charge calculation(contd…)

- For over injection or under drawal deviation charge is payable:
  - If frequency>=50.10 Hz. then, Additional deviation charge payable----
    - **Additional Deviation charge = Deviated Energy * 178paise/kwh**
- For under injection or over drawal, deviation charge payable is ---
  - **Deviation charge payable = Deviated Energy * rate**

Details of Deviation charge calculation(contd…)

- APM generator capped rate 303.04 paise/kwh (corresponding to frequency 49.94 Hz)

Details of Deviation charge calculation(contd..)

- For under injection or over drawal, Additional deviation charge payable is ---
  - When frequency>=49.7

a. 12% of Sch in a time block < = 150 MW

Overdrawal/ Underinjection	12-15% of schedule	15-20% of schedule	Above 20% of schedule
Additional Charges for Deviation	20 % of Normal Deviation Charge depending on average freq of that block	40 % of Normal Deviation Charge depending on average freq of that block	100 % of Normal Deviation Charge depending on average freq of that block

b) 12% of Sch in a time block > 150 MW

Overdrawal/ Underinjection	150-200MW	200-250MW	Above 250MW
Additional Charges for Deviation	20 % of Normal Deviation Charge depending on average freq of that block	40 % of Normal Deviation Charge depending on average freq of that block	100 % of Normal Deviation Charge depending on average freq of that block

  - If schedule <= 400 MW, percentage calculation against 400 MW instead of schedule
  - When frequency< 49.7,
    - Additional deviation charge =**Deviated Energy * 824.04 paise/kwh**

Deviation(U/I) bill preparation

- Sample calculation: 09.10.16 of BkTPP (Generating Station – under injection)

No of 15 minutes time block	Average Frequency in Hz	Scheduled Injection / Drawal (MWh)	Actual Injection / Drawal (MWh)	Injection / drawal Energy disallowed vide regulation no 6.5.1 and 6.5.2 in (MWh)	Injected / Drawal energy entitled for energy charges (MWh) with (+)ve or (-)ve sign*	Reasons of disallowance in Column 5	Rate of Deviation charge in Paise per Unit	Computed Deviation charge in Rs.	Additional Deviation charge payable in Rs.
05	49.95	174.379	145.682	0.00	-28.697		282.20	-80982.93	-5826.86

- Schedule: 174.379 MWH
- Actual : 145.682 MWH
- Deviated Energy: (Actual – Schedule) = -28.697 MWH (Under injection)
- Rate= 303.04 paise/kwh
- Deviation charge payable in Rs.= -(28.697*1000*282.20)/100=-80982.93

- 12% of schedule = 20.92 MWH = 83.70 MW <150 MW
- 15% of schedule = 26.15 MWH
- 20 % of schedule = 34.87 MWH

- Additional deviation charge payable in Rs.= -((28.697-26.15)*282.20*0.4+(26.15-20.92)*282.20*0.2)*1000/100)

= -5826.86

Deviation(U/I) bill preparation

- Sample calculation: 08.10.2016 of TPCL (Over injection above 50.10 Hz)

No of 15 minutes time block	Average Frequency in Hz	Scheduled Injection / Drawal (MWh)	Actual Injection / Drawal (MWh)	Injection / drawal Energy disallowed vide regulation no 6.5.1 and 6.5.2 in (MWh)	Injected / Drawal energy entitled for energy charges (MWh) with (+)ve or (-)ve sign*	Reasons of disallowance in Column 5	Rate of Deviation charge in Paise per Unit	Computed Deviation charge in Rs.	Additional Deviation charge payable in Rs.
53	50.15	18.746	20.248	0.00	1.50		0	0	-2673.56

- Schedule: 18.746 MWH
- Actual : 20.248 MWH
- Deviated Energy: (Actual – Schedule) = 1.502 MWH (over injection)
- Rate= 0 paise/kwh
- Deviation charge receivable in Rs.= 0
- Additional Deviation charge payable in Rs.
  = -(1.502*1000*178)/100=-2673.56

Deviation(U/I) bill preparation

- Sample calculation: date 06.10.16 of WBSEDCL (12% of schedule > 150 MW, over drawal)

No of 15 minutes time block	Average Frequency in Hz	Scheduled Injection / Drawal (MWh)	Actual Injection / Drawal (MWh)	Injection / drawal Energy disallowed vide regulation no 6.5.1 and 6.5.2 in (MWh)	Injected / Drawal energy entitled for energy charges (MWh) with (+)ve or (-)ve sign*	Reasons of disallowance in Column 5	Rate of Deviation charge in Paise per Unit	Computed Deviation charge in Rs.	Additional Deviation charge payable in Rs.
26	49.98	-997.967	-1055.2		-57.233		219.68	-125729.45	-11847.78

- Schedule: -997.967 MWH
- Actual : -1055.2 MWH
- Deviated Energy: (Actual – Schedule) = -57.233 MWH (Over drawal)
- Rate= 219.68 paise/kwh
- Deviation charge payable in Rs.= -(57.233*1000*219.68)/100=-125729.45

- 12% of schedule = 119.756 MWH = 479.024 MW >150 MW

- Additional deviation charge payable in Rs.
  = -((57.233-50)*219.68*0.4+(50-37.5)*219.68*0.2))*1000/100
  = 11847.78

Deviation(U/I) bill preparation

- Sample calculation: 19.05.2016 of WBSEDCL(Under drawal)

No of 15 minutes time block	Average Frequency in Hz	Scheduled Injection / Drawal (MWh)	Actual Injection / Drawal (MWh)	Injection / drawal Energy disallowed vide regulation no 6.5.1 and 6.5.2 in (MWh)	Injected / Drawal energy entitled for energy charges (MWh) with (+)ve or (-)ve sign*	Reasons of disallowance in Column 5	Rate of Deviation charge in Paise per Unit	Computed Deviation charge in Rs.	Additional Deviation charge payable in Rs.
46	50	-1028.64	-1022.03		6.611		178	11767.58	0

- Schedule: -1028.64 MWH
- Actual : -1022.03 MWH
- Deviated Energy: (Actual – Schedule) = 6.611 MWH (under drawal)
- Rate= 219.68 paise/kwh

- 12% of schedule = 123.436 MWH = 493.74 MW >150 MW

- Deviation charge receivable in Rs. = (6.611*1000*178)/100
  = 11767.58

Deviation(U/I) bill preparation

- Sample calculation: 24.11.16 of IPCL(DPSC)(Over drawal where schedule less than 400 MW)

No of 15 minutes time block	Average Frequency in Hz	Scheduled Injection / Drawal (MWh)	Actual Injection / Drawal (MWh)	Injection / drawal Energy disallowed vide regulation no 6.5.1 and 6.5.2 in (MWh)	Injected / Drawal energy entitled for energy charges (MWh) with (+)ve or (-)ve sign*	Reasons of disallowance in Column 5	Rate of Deviation charge in Paise per Unit	Computed Deviation charge in Rs.	Additional Deviation charge payable in Rs.
49	49.98	-10.075	-12.32	0.00	-2.245		219.68	-4931.82	0

- Schedule: -10.075 MWH
- Actual : -12.32 MWH
- Deviated Energy: (Actual – Schedule) = -2.245 MWH (Over Drawal)
- Rate= 219.68 paise/kwh
- Deviation charge payable in Rs.= -(2.245*1000*219.68)/100=-4931.82
- 12% of schedule = -1.209 MWH = 4.836 MW <150 MW
- 15% of schedule = -1.511 MWH
- 20 % of schedule =- 2.015 MWH
- Additional deviation charge payable in Rs.=0 as schedule<=400 MW as per regulation and deviation allowed up to 48 MW.

Certificate i.r.o Solar Generating Plant

- SIIPL (installed capacity : 5 MW) is the only Solar Plant in West Bengal under ABT framework and gives block-wise forecasted generation on daily basis. It is treated as a must run generating station.
- DPL is the sole buyer of the SIIPL generation.
- Actual generation of SIIPL is certified by WBSLDC.
- No Deviation Bill is prepared for SIIPL as per Regulations of Hon'ble WBERC. Deviated Energy of SIIPL is being absorbed by DPL.

Deviation Settlement for embedded generators

- Embedded Generators of WBSEDCL are JHP, RHP, TCF and PPSP.
- Embedded Generators of CESC are Budge-Budge, Southern and Titagarh
- There are three generators of DPL which are embedded in DPL system

No Deviation Settlement is done for these embedded generators. Schedule for these generators are declared by the individual distribution licensees and deviation from the schedules are absorbed by each of the licensees.

Problem faced by WBSLDC in implementation of Deviation Settlement Mechanism

- Negative Pool component -----
  - Same % -wise volume limit for Regional level and State level all constituents.
  - For Additional Deviation charges, constituents having schedule less than or equal to 400 MW, gets relaxation up to 48 MW. The state as a whole gets relaxation up to 150 MW. The cumulative deviation of state constituents are much above 150 MW. This causes additional penalty for the state by ERPC, whereas mostly no additional penalty for intra-state constituents. This results in negative pool balance in significant number of blocks in a day and sometimes negative in the week in total.

Problem faced by WBSLDC in implementation of Deviation Settlement Mechanism

- Negative Pool component -----
  - Arising several cases when state deviation crossing deviation limit and the state became penalized as a whole and at that time the summation of penalty amount of the state individual constituent is less than the penalty amount imposed to the state.
  - In case of receivable deviation charge also, Deviation charge receivable by the state from central pool is curtailed up to 12 % of schedule or 150 MW whichever is minimum(For West Bengal the limit is generally 150 MW). Whereas, the intra-state constituents receive deviation charges up to 12% of their individual schedules. The cumulative receivable quantity is generally much higher than the amount receivable by the state from REA.

Problem faced by WBSLDC in implementation of Deviation Settlement Mechanism

- WBSLDC has approached to Hon'ble WBERC for proper redressal of the problem.

Thank you

सत्यमेव जयते

Accommodation of RE Generation & its effect on tariff

WB's revised target for minimum solar RPO for 2021-22 is 4223 MW. [Ref. Letter dated 30-03-2016 of Sri Tarun Kapoor, Joint Secretary, MNRE]

Expected Evening peak demand of WB will be 12000 MW & Day peak demand will be around 10200 MW by 2022

Conventional thermal generators to be backed down to 6000 MW to accommodate 4220 MW peak solar generation during day time.

To meet evening peak 12000 MW conventional generators to ramp up 4000 MW after addressing balance 1000 MW by energy efficient lights & appliances & 1000 MW by Purulia pump storage & other source of generation.

Requirements to manage peak demand as well as accommodate RE generation

* Conventional coal based generation modulation to be done at the best possible way to accommodate RE generation.

* Evening peak demand to be curtailed by implementation of energy efficient lighting, appliance and electrical equipment.

* Pump storage facility like Purulia to be increased to support evening peak demand

* Hydro generators to optimize generation by ramping up during evening peak

* Bio-mass generation to be utilized to meet evening peak

* Battery back up / storage facilities to be installed in a limited way

सत्यमेव जयते

Modulation of thermal generating units

- Exploration of Technical and Commercial solution for modulation of Thermal Units from 20% to 105% without oil support and quick start & stop with higher ramping up rate.

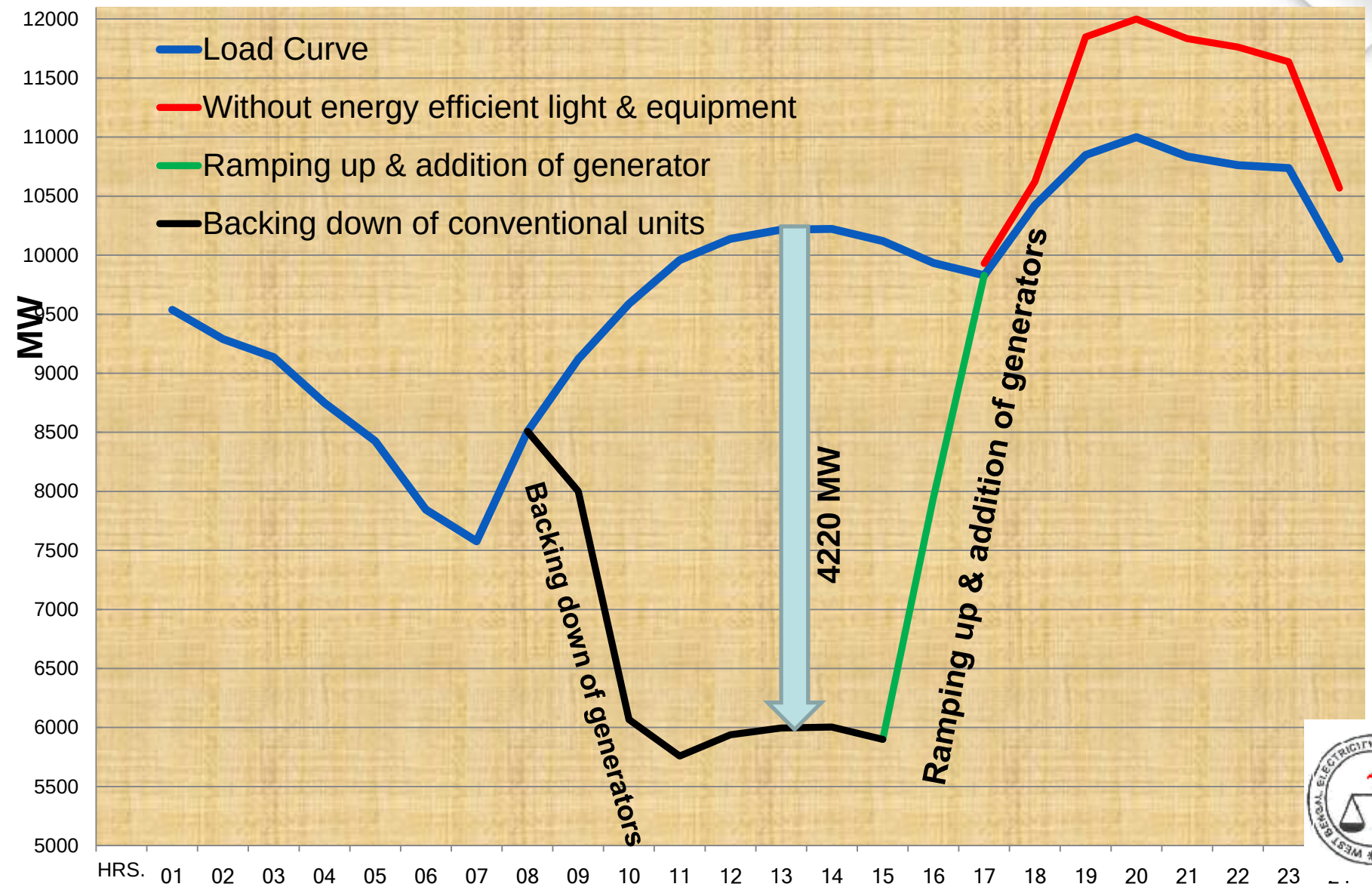
- Till this is achieved in majority of Thermal units we may have to go for alternate solution as follows.

1. Putting 25 year old thermal units for two shift operation. These units will be on bar during evening peak hours only.

2. 15-25 years old plant can be backed down to 50% of its full load capacity.

3. Other new generating station (less than 15 years old) can be run at 70% of its capacity to accommodate peak RE generation at its full capacity during solar peak generation.

Load Management (West Bengal Case Study)



सत्यमेव जयते

Accommodation of 4223 MW Solar Power

Conventional Thermal Units age wise	Generating capacity	Generation down by	Operating range
More than 25 years old plant	2870 MW	2870 MW	out of bar
15-25 years old plant	1510 MW	638 MW	50% backing down
Less than 15 years old plant	4382 MW	1117 MW	Upto 30% backing down
		4625 MW	

सत्यमेव जयते

Issues need to be addressed to accommodate RE Power

1. Modification / renovation of conventional thermal units more than 25 years old is required for handling two shift operation.

2. Modification / renovation of conventional thermal units to operate without oil support upto 20% of its capacity.

3. Modification / renovation of conventional thermal units for quick start up and ramp up.

4. To fix up Operation and Maintenance strategy, to ensure highest reliability and low load operation for two shift operation.

5. CERC and SERCs need to fix up operative norms for two shift operation as well as to run the machines at 20% to 55% of its capacity on regular basis.

- The modulation of old thermal generating station to accommodate RE generation will also address new environmental norms, provided the emission norms will be accepted and agreed by GOI on annualised basis.

- Emission norms to be fixed in terms of total emission / MW on annual basis as the old units will be operated at low PLF according to its age to accommodate RE generation considering their existing norms at 85% PLF.

  e.g. Earlier PM norms was 150 mg/Nm^3. So more than 25 years old plants will emit PM ¼th of earlier norms on annual basis and 15-25 years old plant will emit 2/3rd of earlier norms on annual basis. In both the cases their PM emission will be within current norms i.e. 100 mg/Nm^3 on annual aggregated basis. Rest of the units will comply current PM emission norms.

  Similarly emission of SO_x & NO_x of a old unit can be taken care of on annual aggregated basis considering its low load operation.

सत्यमेव जयते

Impact on tariff to accommodate solar power @8% and non solar power @6%

WBSEDCL's sales to consumers in 2016-17

Excluding Hydel & RE Power :	: 21848 MU
Solar power (8%) obligation would be	: 1748 MU
Non solar RE power (6%) obligation would be	: 1311 MU
Total RPO would be	: 3059 MU

To accommodate 3059 MU RPO the following steps has to be taken

1) 455 MW Bandel and 2 nos 210 MW units of Kolaghat Thermal Power Station have to be operated for two shift operation (5hrs on bar)

2) 4 nos. 210 MW units of Kolaghat Thermal Power Station will be backed down from 840MW to 420 MW (50%) for 10 hrs in a day

3) New units may be backed down upto 70% depending on the situation

सत्यमेव जयते

Change in Energy charge of Kolaghat Thermal Power Station due to 45% B/D

			Kolaghat at normative		4 units 45% BD for 10 hrs
(1)	(2)	(3)	(4)	(5)	(6)
1	Generation	MU	7997.79		3446.95
2	AUC rate	%	9.60%	up by 0.42%	10.00%
3	AUC in Units	MU	767.79		344.81
4	Ex bus generation (4=1-3)	MU	7230.00		3102.14
5	Station heat rete normative	Kcal/kWh	2700.00	up by 2.5%	2767.50
6	Total heat rate required (6=1X5)	M.kcal	21594033.00		9539434.13
7	Heat value of oil	Kcal/lt	9689.65		9689.65
8	Specific Oil consumption	ml/kWh	2.00		2.00
9	Oil consumption (9=1X8)	KL	15995.58		6893.90

सत्यमेव जयते

10	Heat from oil [10=(7X9)/1000]	M.kcal	154991.57		66799.48
11	Heat from coal (11=6-10)	M.kcal	21439041.43		9472634.65
12	Heat value of coal	kcal/kg	3549.79		3549.79
13	Coal consumption [13=(11/12)X1000]	MT	6039523.87		2668505.64
14	Coal requirement with permissible transit loss	MT	6088229.70		2690025.85
15	Average cost of oil	Rs/kL	61291.50		61291.50
16	Average price of coal	Rs/MT	2754.05		2754.05
17	Cost of oil [17=(9X15)/100000]	Rs.lakh	9803.93		4225.37
18	Cost of coal [18=(14X16)/100000]	Rs.lakh	167672.89		74084.66
19	Cost of fuel (19=17+18)	Rs.lakh	177476.82		78310.03
20	Average Fuel cost /kWh	Paise/kWh	**245.47**		**252.44**

सत्यमेव जयते

Change in Energy charge of Kolaghat Thermal Power Station due to 5 Hrs operation

		Units	Kolaghat TPS, (6X210) MW at normative		2 units 5 hrs. operation
(1)	(2)	(3)	(4)	(5)	(6)
1	Generation	MU	7997.79		535.50
2	AUC rate	%	9.60%	up by 100%	19.20%
3	AUC in Units	MU	767.79		102.82
4	Ex bus generation (4=1-3)	MU	7230.00		432.68
5	Station heat rete normative	Kcal/kWh	2700.00	up by 10%	2970.00
6	Total heat rate required (6=1X5)	M.kcal	21594033.00		1590435.00
7	Heat value of oil	Kcal/lt	9689.65		9689.65
8	Specific Oil consumption	ml/kWh	2.00	up by 500%	12.00
9	Oil consumption (9=1X8)	KL	15995.58		6426.00

सत्यमेव जयते

			Kolaghat TPS, (6X210) MW at normative		2 units 5 hrs. operation
10	Heat from oil [10=(7X9)/1000]	M.kcal	154991.57		62265.69
11	Heat from coal (11=6-10)	M.kcal	21439041.43		1528169.31
12	Heat value of coal	kcal/kg	3549.79		3549.79
13	Coal consumption [13=(11/12)X1000]	MT	6039523.87		430495.69
14	Coal requirement with permissible transit loss	MT	6088229.70		433967.43
15	Average cost of oil	Rs/kL	61291.50		61291.50
16	Average price of coal	Rs/MT	2754.05		2754.05
17	Cost of oil [17=(9X15)/100000]	Rs.lakh	9803.93		3938.59
18	Cost of coal [18=(14X16)/100000]	Rs.lakh	167672.89		11951.68
19	Cost of fuel (19=17+18)	Rs.lakh	177476.82		15890.27
20	Average Fuel cost /kWh	Paise/kWh	**245.47**		**367.25**

सत्यमेव जयते

Change in Energy charge of Bandel Thermal Power Station due to 5 hrs operation					
			Bandel at normative		Bandel 5 hrs. operation
(1)	(2)	(3)	(4)	(5)	(6)
1	Generation	MU	1507.20		580.13
2	AUC rate	%	9.70%	up by 100%	19.40%
3	AUC in Units	MU	146.20		112.54
4	Ex bus generation (4=1-3)	MU	1361.00		467.58
5	Station heat rete normative	Kcal/kWh	2725.00	up by 10%	2997.50
6	Total heat rate required (6=1X5)	M.kcal	4107120.00		1738924.69
7	Heat value of oil	Kcal/lt	9656.00		9656.00
8	Specific Oil consumption	ml/kWh	2.15	up by 500%	12.90
9	Oil consumption (9=1X8)	KL	3240.48		7483.61

सत्यमेव जयते

Change in Energy charge of Bandel Thermal Power Station due to 5 hrs operation

			Bandel at normative		Bandel 5 hrs. operation
10	Heat from oil [10=(7X9)/1000]	M.kcal	31290.07		72262.39
11	Heat from coal (11=6-10)	M.kcal	4075829.93		1666677.29
12	Heat value of coal	kcal/kg	3504.00		3504.00
13	Coal consumption [13=(11/12)X1000]	MT	1163193.47		475649.91
14	Coal requirement with permissible transit loss	MT	1172574.06		479485.80
15	Average cost of oil	Rs/kL	59702.00		59702.00
16	Average price of coal	Rs/MT	2972.00		2972.00
17	Cost of oil [17=(9X15)/100000]	Rs.lakh	1934.63		4467.90
18	Cost of coal [18=(14X16)/100000]	Rs.lakh	34848.90		14250.32
19	Cost of fuel (19=17+18)	Rs.lakh	36783.53		18718.22
20	Average Fuel cost /kWh	Paise/kWh	270.27		**400.32**

सत्यमेव जयते

	As per 2016-17 tarif order				To accommodate RE Power			
	Energy MU	cap ch Rs in lakh	E. Ch p/kWh	Amount Rs in lakh	Energy MU	cap ch Rs in lakh	E. Ch p/kWh	Amount Rs in lakh
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Kolaghat	7230	54674.02	245.47	232148.83	433	54674.20	367.25	180480.05
					3102		252.44	
					1288		245.47	
Bakreswar	7634	85349.07	216.33	250495.39	7634	85349.07	216.33	250495.39
Bandel	1361	8786.15	270.27	45569.90	468	8786.15	400.32	34054.85
					242		270.27	
Santaldih	2344	32944.51	217.05	83821.03	2344	32944.51	217.05	83821.03
Sagardighi	9341	106880.43	217.23	309794.98	9341	106880.43	217.23	309794.98
		288634.18		921830.1		288634.36		858646.30

सत्यमेव जयते

Energy from Kolaghat is down by (MU)	2407.64		
Energy from Bandel is down by (MU)	651.05		
Total	3058.69		
		Rate P/kWh	Rs in lakh
Solar RE Power (MU)	1747.82	704	123046.753
Non Solar RE Power (MU)	1310.87	500	65543.37
		Total	188590.123
Total power purchase cost from WBPDCL & RE power(Rs. In lakh)			1047236.42
Total increase in power purchase cost (Rs. In Lakh)			125406.3

सत्यमेव जयते

	Revised power purchase cost of WBSEDCL for the year 2016 – 2017 Ref page no 12			
		Energy (MU)	Amount Rs in lakh	
1	Power purchase cost from WBPDCL as per order	42965.13	1470304.52	
2	Increased power purchase cost due to RE power	42965.13	1595710.82	
3	Revised quantum of power purchase due to RPO	35364.18	1313414.03	
4	Earlier power purchase cost as per tariff order (Rs in lakh)		1210197.60	Rs in lakh
5	Increase in power purchase cost (Rs. In Lakh) (5=4-3)		103216.43	Rs in lakh
6	Revenue recoverable from sale of power to the consumers		1688843.51	Rs in lakh
7	Revised Revenue recoverable with RPO (7=6+5)		1792059.94	Rs in lakh

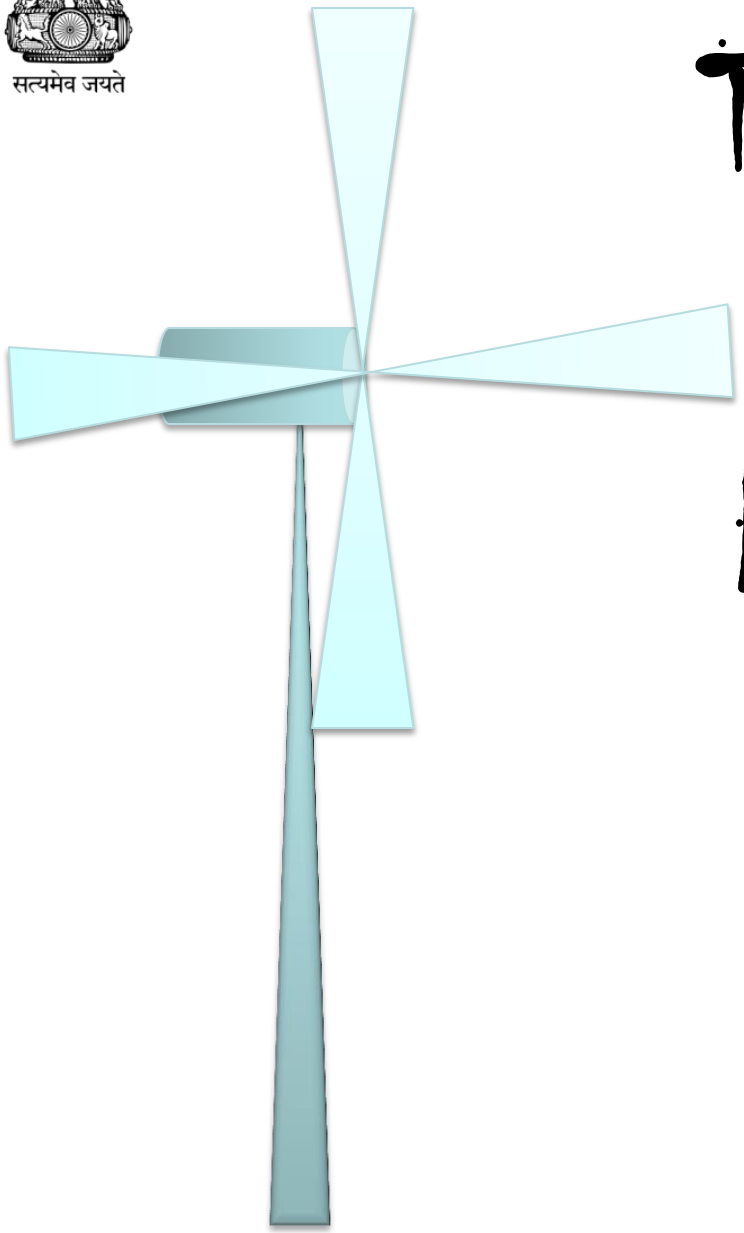
सत्यमेव जयते

	Revised power purchase cost of WBSEDCL for the year 2016 – 2017 Ref page no 12			
7	Revised Revenue recoverable with RPO (7=6+5)		1792059.94	Rs in lakh
8	Projected quanta of energy for sale to consumers		24500.00	MU
9	Average tariff for the consumers for the year 2016 with RPO (9=7/8)		731.45	P/kWh
10	Average tariff without RPO		689.32	P/kWh
11	Increase in average tariff (11=9-11)		42.13	P/kWh

This is only indicative and excluding capex and additional O&M charges, if any.

Impact of new Environmental norms is around 45 to 55 paise/kWh on generation tariff

सत्यमेव जयते



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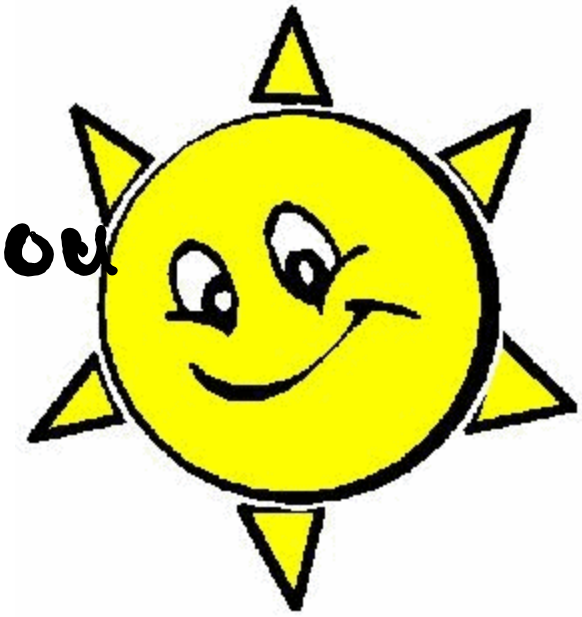
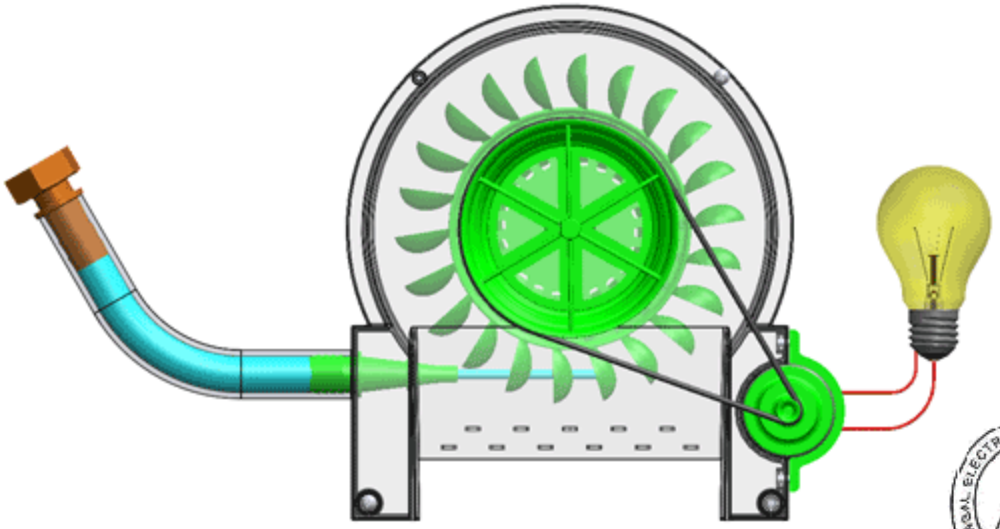




WEST BENGAL ELECTRICITY REGULATORY COMMISSION

सत्यमेव जयते

Generation during Evening peak by 2022

1. 25/15 years old plant capacity = 4380 MW
2. New plants capacity = 4382 MW
3. Purulia pump storage plant = 900 MW
4. Central sector thermal allocation to WBSEDCL = 777 MW
5. Future Central sector Thermal allocation to WBSEDCL = 1650 MW
6. Biomass/Co-generation + MSW = 320 MW

Total generation with availability factor of 85% = 10548 MW

Expected evening peak demand by 2022 = 12084 MW

Reduction in peak demand using energy efficient Lights and Appliances = 1000 MW

Net Demand = 11084 MW

Back Up Hydel Generation without firm commitment

- Existing Hydel generating units = 777 MW
- Future Hydel allocation expected by FY2022 = 586 MW
- Future Small Hydro Plant = 120 MW

सत्यमेव जयते

Modulation of conventional thermal generating station to accommodate 4223 solar peak generation

1. Putting 25 year old thermal units for two shift operation. The following units will be more than 25 years old by 2022

a) WBPDCL’s units at Bandel (455 MW) and Kolaghat (1260 MW)

b) DPL’s 110 MW unit

c) CESC’s units at Titagarh (240MW), Southern Generating Station (135MW), One unit at Budge Budge (250MW)

d) DVC’s one 210 MW unit each at DTPS and MTPS

Total :2870 MW. These units with 85% availability 2440 MW can be put on bar before evening peak

सत्यमेव जयते

2. 15-25 years old plant can be backed down to 55% of full load capacity during day peak. The following units will be more than 15 years old

a) WBPDCL’s 3 X 210 MW units at Bakreswar

b) DVC’s 3 X 210 MW units at MTPS

c) CESC’s 1X250 MW unit at Budge Budge

Total = 1510 MW, 45% off loading = 577.57 MW. (with availability 85%)

3. Other new generating station (less than 15 years old) can be reduced to 70% of its capacity to accommodate peak solar power at its full capacity during solar peak generation. Rest units are as follows:

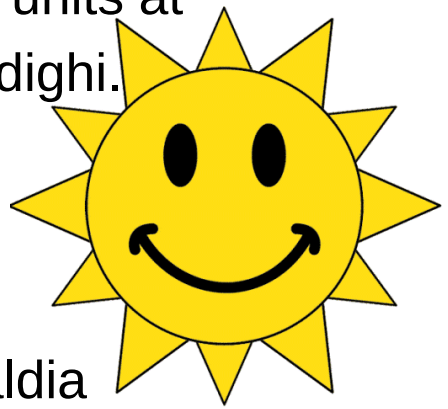
a) WBPDCL's 2 X 210 MW units at Bakreswar, 2 X 250 units at Santaldih, 2 X 300 MW + 2 X 500 MW units at Sagardighi.

b) DPL's 1X250 & 1X300 MW Units

c) CESC's 1X250 MW unit at Budge Budge

d) Haldia Energy Limited 2 X 300 MW

e) IPCL's 12 MW unit at Dishergarh, 3 X 150 MW at Haldia



Total = 4382, 30% offloading = 1117.41 MW (with availability 85%)

Total Solar peak power can be accommodated = (2870 + 577.57 + 1117.41) MW = 4564.98 MW whereas State's expected Solar RPO can be met with 4223 MW Solar Plant by 2022