Grid Integration of Renewables

K.V.S. Baba
General Manager
National Load Despatch Centre
Some of the Large Power Grids in the World

- **Elia Group (Belgium)**
  - 29 GW, 30 m
- **National Grid (UK)**
  - 61 GW, 62 m
- **KPX (South Korea)**
  - 76 GW, 50 m
- **MISO (USA)**
  - 98 GW, 39 m
- **PJM (USA)**
  - 164 GW, 60 m
- **SO UPS (Russia)**
  - 157 GW, 144 m
- **SGCC (China)**
  - 544 GW, 1100 m
- **Tepco (Japan)**
  - 64 GW, 45 m
- **CSG (China)**
  - 129 GW, 240 m
- **AEMO (Australia)**
  - 35 GW, 19 m
- **REE (Spain)**
  - 44 GW, 46 m
- **Terna (Italy)**
  - 57 GW, 60 m
- **RTE (France)**
  - 100 GW, 100 m
- **PGCIL (India)**
  - 135 GW, 1200 m

Source: GO 15 (2013 Leaflet)
Some Typical Numbers ... 

• All India Installed Capacity : ~ 232 GW
• Fuel Mix : Hydro 17%, Thermal 70%, RES 13%
• Peak Demand Met : ~ 125 GW
• Energy : ~ 2800 MU/day
• Wind Generation : ~ 55 MU/day
• 400kV & above Trans. Line : ~ 1050 Nos.
• No. of Generating Units : ~ 1750 Nos.
• Short Term Open Access : ~ 240 MU/day
Evolution of the Grid

Five Regional Grids
Five Frequencies
Pre – October 1991

October 1991
East and Northeast synchronized

March 2003
West synchronized With East & Northeast

August 2006
North synchronized With Central Grid

December, 2013
All India Synchronized Grid

Five Regional Grids
Two Frequencies
Post August 2006

One Frequency
Post 2013
ALL INDIA POWER NETWORK

Flow Gates

- 765 KV
- 400 KV
- 500 KV HVDC
Variation in Demand

Kerala

Assam

All India

Maharashtra

Delhi
Variation in Hydro Generation

Summer

Monsoon

Winter
Regional Geographical Diversity

Diversity on account of geographical location, seasons, time of day, load, etc.
Renewable Energy Scenario in India
Renewable Installed Capacity (in MW)

<table>
<thead>
<tr>
<th>Resources</th>
<th>Grid-Interactive Capacity (MW) as on 31.12.2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind Power</td>
<td>20149</td>
</tr>
<tr>
<td>Small Hydro Power</td>
<td>3763</td>
</tr>
<tr>
<td>Biomass Power &amp; Gasification</td>
<td>1285</td>
</tr>
<tr>
<td>Bagasse Cogeneration</td>
<td>2513</td>
</tr>
<tr>
<td>Waste to Power</td>
<td>99</td>
</tr>
<tr>
<td>Solar Power (SPV)</td>
<td>2180</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>29989</strong></td>
</tr>
</tbody>
</table>
Peculiarities of Regional Grids in India

**Deficit Region**
- Snow fed - run-of-the-river hydro
- Highly weather sensitive load
- Adverse weather conditions: Fog & Dust
- Storm

**Very low load**
- High hydro potential
- Evacuation problems

**Low load**
- High coal reserves
- Pit head base load plants

**Industrial load and agricultural load**

**High load (40% agricultural load)**
- Monsoon dependent hydro

**Regional Grids**
- Southern Region
- Western Region
- Eastern Region
- North-Eastern Region
- Northern Region
All India Wind Penetration (in Energy terms)

- High Wind generation during June to August.
- All India level penetration – 9% (max achieved)

- State-wise penetration level achieved (appx):
  1. Tamil Nadu – 37%
  2. Rajasthan – 26%
  3. Karnataka – 25%
  4. Gujarat – 22%
  5. Maharashtra – 12%
## Proposed Renewable capacity addition programme

<table>
<thead>
<tr>
<th>Resource</th>
<th>12&lt;sup&gt;th&lt;/sup&gt; Plan Projection for RE Addition</th>
<th>Total Projected Capacity by end of 12&lt;sup&gt;th&lt;/sup&gt; Plan (2017)</th>
<th>13&lt;sup&gt;th&lt;/sup&gt; Plan Projection for RE Addition</th>
<th>Total Projected Capacity by end of 13&lt;sup&gt;th&lt;/sup&gt; Plan (2022)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind Power</td>
<td>11200</td>
<td>27300</td>
<td>11200</td>
<td>38500</td>
</tr>
<tr>
<td>Small Hydro Power</td>
<td>1600</td>
<td>5000</td>
<td>1600</td>
<td>6600</td>
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<tr>
<td>Biomass</td>
<td>500</td>
<td>1525</td>
<td>1000</td>
<td>2525</td>
</tr>
<tr>
<td>Bagasse Cogen</td>
<td>1400</td>
<td>3216</td>
<td>700</td>
<td>3916</td>
</tr>
<tr>
<td>Waste to Energy</td>
<td>200</td>
<td>324</td>
<td>500</td>
<td>824</td>
</tr>
<tr>
<td>Solar Power</td>
<td>3800</td>
<td>4000</td>
<td>16000</td>
<td>20000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>18700</strong></td>
<td><strong>41400</strong></td>
<td><strong>31000</strong></td>
<td><strong>72400</strong></td>
</tr>
</tbody>
</table>
Wind generation pattern for RE rich States-2013
Tamil Nadu typical daily Wind Generation Pattern Month wise (Source-TAN SLDC)
Rajasthan Typical Daily Wind Generation Pattern Month wise (Source-Raj SLDC)
Specific IEGC Provisions for Renewables

- **Clause 3.4(b)-(vi)**
  
  CTU shall carry out the planning process including *Renewable capacity addition plan issued by MNRE*

- **Clause 5.2 (u)**
  
  - Must-run stations in normal conditions
  - curtail its reactive power injection /drawl
  - Data Acquisition System facility shall be provided for transfer of information to concerned SLDC and RLDC.

**Clause 6.1(d)**

*RRF Mechanism*

- ✔ *Wind farms with collective capacity of 10 MW and above,*
- ✔ *Solar generating plants with capacity of 5 MW and above*
- connected at >=33 KV level
- ✔ wind generators to forecast upto an accuracy of 70%

**Clause 6.5 (23)**

- Revisions upto a max 8 times in day (1 for each 3 hr time slot)
- Revisions after a 6 time block notice
Integration issues
Integration issues

• Planning criterion for RE
• Variability and Intermittency
• Scheduling
• SCADA / telemetry
• Network related Problems and Congestion
• Protection
• Commercial mechanism implementation
Planning criterion for Wind Power Integration
Planning Transmission system for RE

- System Studies
- Trade off between network optimal utilization and redundancy
- Network development and O&M
- Dynamic Line Rating- to be duly factored while designing evacuation systems.
- Diversity Factor- to be duly factored while designing evacuation systems.
- Wind/Solar farms are known to be providing lesser grid support during system disturbances/exigencies than the conventional.
Variability and Intermittency
Sudden large variation in Load/ generation

- High Ramp rate of load- evening peak hours
- Sharp change in load, particularly at the hour boundaries mainly due to agricultural load changes with consequent frequent spikes
- Frequency fluctuations:
  - due to generation or load loss
  - poor Frequency Response Characteristics (FRC) of individual sub-systems
- Impact of Wind Generation variability on Host state – UI implication
Typical All India daily load curve - High Ramp rate of load

Ramp rate during this period is 211 MW/Min

111558 MW at 19:00 Hrs

103115 MW at 18:20 Hrs
Sharp change in agricultural load - Hourly spikes at hour boundaries
### Impact of large contingencies - large fluctuations in frequency

<table>
<thead>
<tr>
<th>Sno.</th>
<th>Event</th>
<th>NEW Grid FRC (MW/Hz)</th>
<th>SR Grid FRC (MW/Hz)</th>
<th>All India FRC (MW/Hz) when SR is synchronized</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Talcher-Kolar trip on 31.01.2012 @ 2149 hrs</td>
<td>2575</td>
<td>1597</td>
<td>4172</td>
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<tr>
<td>2</td>
<td>Talcher Kolar trip on 29.02.2012 @ 0310 hrs</td>
<td>2125</td>
<td>1373</td>
<td>3498</td>
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<tr>
<td>3</td>
<td>Bhadrawati HVDC Trip on 08.03.2012 @ 1622 hrs</td>
<td>1990</td>
<td>2042</td>
<td>4032</td>
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<tr>
<td>4</td>
<td>Bhadrawati HVDC Trip on 14.03.2012 @ 2122 hrs</td>
<td>1214</td>
<td>1177</td>
<td>2391</td>
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<tr>
<td>5</td>
<td>Talcher-Kolar Bipole Tripping on 22.04.2012 @ 14:32 hrs</td>
<td>2336</td>
<td>1071</td>
<td>3407</td>
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<tr>
<td>6</td>
<td>Talcher-Kolar pole-I Tripping on 01.052012 @ 17:17 hrs</td>
<td>3233</td>
<td>1729</td>
<td>4962</td>
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</tbody>
</table>
Growth of variability and uncertainty with time and associated resources & reserves available to maintain power-balance.
Management of Intermittency & Variability in Wind generation-Southern Region (July 2011)
Management of Intermittency & Variability in Wind generation - All India (July 2011)

Typical Pattern of all India Electricity Demand and Supply from different Sources

- **Demand (GW)**
  - 55
  - 60
  - 65
  - 70
  - 75
  - 80
  - 85
  - 90
  - 95
  - 100
  - 105
  - 110

- **Hour**
  - 00
  - 02
  - 04
  - 06
  - 08
  - 10
  - 12
  - 14
  - 16
  - 18
  - 20
  - 22

- **Types of Generation**
  - **Wind Generation**
  - **Hydro Generation**
  - **Thermal Generation (Coal, Gas & Nuclear)**

- **Legend**
  - **Green** - All India Demand
  - **Blue** - All India Hydro
  - **Gray** - All India Thermal
Variability of Wind Generation in States
DEALING WITH WIND VARIABILITY

• Flexible Generation and Generation Reserves
  ✓ Primary reserve/ Frequency response reserve
  ✓ Secondary reserve - Spinning & non spinning reserves
  ✓ Tertiary reserve
  ✓ Hydropower Plant with Reservoir
  ✓ Pumped Storage Power Plant

• Flexibility for market participants

• Scheduling of Thermal & Wind power as per forecast and revisions thereof

• “smart” demand-response management to shift flexible loads to a time when more renewable energy is available

• Inter-State and Inter-regional transfer of power to harvest diversity
Pumped Storage Plants

- Pump Storage Plants:
  - Purulia (4x225 MW)
  - Srisailam (6x150 MW)
  - Kadamparia (4x100 MW)

- Pumping Mode:
  - Purulia
    - Fixed timing
    - Typically between 00 to 06 hours
    - Irrespective of frequency
  - Kadamparia
    - Frequency dependent
    - Generally during 00 to 06 hours
  - Srisailam
    - Seasonal
  - Generator mode during day/peak hours.
    - Kadamparia
      - During Morning Peak (06 to 09 hrs)
      - During Evening Peak (16 to 21 hrs)
Balancing Renewable Generation

**Challenges**
- Variability, intermittency and ramping
- Sudden onset or offset of wind generation

**Remedies**
- Generation balancing by the conventional energy sources.
- Greater the penetration, greater the balancing requirement.
- Forecasting of renewable generation (Solar and wind)
- Ramp forecast is also essential.
Scheduling
Need for Scheduling

- To maintain Load Generation balance
- Increasing penetration of Renewable power
- To handle the absence of spinning reserve
- To handle the effect of variability and intermittency
- Grid code provisions
- Revising to minimize UI
- Real Time monitoring (SCADA requirements)
- Implementation of RRF Mechanism
Uncertainty in a narrow band, hence it is possible to forecast wind generation.
SCATTERED PLOT OF UNCERTAINTY VS ACTUAL GENERATION OF GUJRAT WIND GENERATION (HOUR WISE) (April11 to Sep11)
SCADA / telemetry
SCADA and telemetry

• Telemetering the data is a challenge - due to wide geo-graphical diversity
• Real time data from wind turbines to be metered and shall be transmitted to the local control centre of each wind farm
• The net injection of the wind farm to be measured at pooling station
• Deployment of synchrophasor technology i.e., PMUs/WAMS on pooling stations and interconnection with centralized control centre for real time information, monitoring and control.
• Real time monitoring system using Synchrophasor Technology
• As of now only partial data is being transmitted to RLDCs/SLDCs
• State-of-the-art in Centralized Forecasting centre and integration with SCADA through telemetry

Telemetry is a must for scheduling and monitoring
Commercial mechanism implementation
Commercial mechanism

• Market mechanisms would further help large scale integration of renewable sources of energy:
  ✓ Suitable market design to handle reserves for power balancing
  ✓ Flexible Generators
  ✓ Ancillary Market
  ✓ Evening markets-through PXs

• Renewable Energy Certificate (REC) Mechanism

• Renewable purchase Obligation (RPO) – promotes the market mechanisms
Options for RE generators

**REC Option**

- Sale of Electricity at Market Price in open market
- Sell to DisComs at Price ≤ Pooled Cost of Power Purchase*

**REC**

- [Solar & Non-Solar]
- Green Attributes

**Sale of RECs at Power Exchange**

**Preferential Tariff**

- [State Regulated Tariff]
- Sale of electricity to Obligated Entities at State regulated tariff

* - Weighted Average Pooled Price at which distribution licensee has purchased electricity (including cost of self generation, long-term and short term purchase) in the previous year, but excluding the cost of RE power purchase
Projected RPO targets

STATE WISE RPO in % of Energy Requirement for FY-2017

(Source – FOR report-Mar’12)
REC Mechanism
What is REC?

The Electricity Act, 2003, the policies framed under the Act, as also the National Action Plan on Climate Change (NAPCC) provide for a roadmap for increasing the share of renewable in the total generation capacity in the country. However, Renewable Energy (RE) sources are not evenly spread across different parts of the country. Read More >>

Total Signed Up RE Generators Till Now - 2380

**Steps for REC**

The basic procedure for accreditation of the RE generation project shall cover following steps:

**Step 1:** An application for availing accreditation shall be made by the generating company to the host State Agency, as defined under Clause 2(1) of the CERC REC Regulations. Read More >>

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**REC Graph**

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**REC Summary**

<table>
<thead>
<tr>
<th>Month, Year</th>
<th>Opening Balance</th>
<th>REC Issued</th>
<th>REC Redeemed</th>
<th>Closing Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb, 2013</td>
<td>1775130</td>
<td>316700</td>
<td>155195</td>
<td>1934734</td>
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<tr>
<td>Mar, 2013</td>
<td>1930743</td>
<td>271240</td>
<td>431054</td>
<td>1770925</td>
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<tr>
<td>Apr, 2013</td>
<td>1775109</td>
<td>261743</td>
<td>463766</td>
<td>1961956</td>
</tr>
<tr>
<td>May, 2013</td>
<td>1991936</td>
<td>253194</td>
<td>546712</td>
<td>2180519</td>
</tr>
<tr>
<td>Jun, 2013</td>
<td>2190519</td>
<td>295730</td>
<td>73965</td>
<td>2412284</td>
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<tr>
<td>Jul, 2013</td>
<td>2141224</td>
<td>461010</td>
<td>163431</td>
<td>2729042</td>
</tr>
<tr>
<td>Aug, 2013</td>
<td>2729042</td>
<td>501714</td>
<td>43248</td>
<td>3187508</td>
</tr>
<tr>
<td>Sep, 2013</td>
<td>3187508</td>
<td>635500</td>
<td>55643</td>
<td>3764648</td>
</tr>
<tr>
<td>Oct, 2013</td>
<td>3764645</td>
<td>511208</td>
<td>1589897</td>
<td>4117775</td>
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<tr>
<td>Nov, 2013</td>
<td>4117776</td>
<td>404032</td>
<td>315282</td>
<td>4206528</td>
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<td>Dec, 2013</td>
<td>4205620</td>
<td>445963</td>
<td>411744</td>
<td>4239745</td>
</tr>
<tr>
<td>Jan, 2014</td>
<td>4239745</td>
<td>594279</td>
<td>365982</td>
<td>5297327</td>
</tr>
<tr>
<td>Total:</td>
<td>9765933</td>
<td>5297327</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Key Highlights:

- Provides commercial mechanism for promoting renewable Energy
- Translates Government Policy to Action
- Brings in Investment in the Renewable Sector
- Platform for Environmentally conscious Individuals and Corporates to Contribute
* Self consumption by CPPs based upon renewable generation are eligible for RECs
Salient Features of REC Mechanism

- RE Generator
- Grid Connectivity
- Trading
- REC
- 1 MWh
- Central Agency
- State Agency
RENEWABLE ENERGY CERTIFICATE MECHANISM (REC): ELIGIBILITY

Grid Connected RE technology approved by MNRE

- **Self Consumption/Captive use**
  - No Promotional Wheeling
  - No Promotional Banking
  - Eligible if both conditions mentioned above are met

- **Third party sale/Open Access**
  - Sale at Mutually Agreed Price
  - Eligible

- **PPA with Distribution Licensee**
  - PPA at Average Power Purchase Cost
  - PPA at rates as determined under section 62 and 63 of Act
  - Eligible
  - Not Eligible
Information to be furnished by the applicant

Owner Details, RE Generating Station details, Certificate of Accreditation
Commissioning Schedule, Details of Fee & Charges, Declaration
Latest Developments

- Eligibility criteria for issuance of Certificate for:
  - Renewable energy contracted through competitive bidding
  - Self consumption by a seasonal RE generator
  - Self consumption by a renewable energy based captive generating plant (CGP) and by a renewable energy generator other than a CGP

- Clarity on minimum capacity requirement for eligibility for Certificate

- Procurement of electricity at Average Pooled Purchase Cost (APPC) rate as determined by appropriate Commission

- Extension of time period for applying for issuance of Certificate

- Extension of shelf life of the Certificate

- Self-retention of RECs by RE Generators

- Clarity on issuance of RECs to an eligible entity from date of registration.
• REC- Current Status
Status Update
(up to 5th Feb, 2014)

• Registration:
  ➢ 868 Projects with Capacity 4030 MW

• Accreditation:
  ➢ 950 Projects with Capacity 4419 MW

• REC Inventory:

<table>
<thead>
<tr>
<th></th>
<th>Solar</th>
<th>Non Solar</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>RECs Issued</td>
<td>1,60,026</td>
<td>96,05,967</td>
<td>97,65,993</td>
</tr>
<tr>
<td>RECs Traded</td>
<td>61,366</td>
<td>52,35,961</td>
<td>52,97,327</td>
</tr>
<tr>
<td>Balance RECs</td>
<td>98,660</td>
<td>43,70,006</td>
<td>44,68,666</td>
</tr>
</tbody>
</table>
Forbearance Price (till Mar,12) = ₹ 3,900/MWh

Forbearance Price (w.e.f. Apr,12) = ₹ 3,300/MWh

Floor Price = ₹ 1,500/MWh
Prices Discovered (Solar RECs)

* Prices discovered at IEX
Market Trend Solar RECs

Solar REC Trading Trend

- Sale Bid
- Buy Bid
- RECs Traded

No. of RECs

- May, 12
- Jun, 12
- Jul, 12
- Aug, 12
- Sep, 12
- Oct, 12
- Nov, 12
- Dec, 12
- Jan, 13
- Feb, 13
- Mar, 13
- Apr, 13
- May, 13
- Jun, 13
- Jul, 13
- Aug, 13
- Sep, 13
- Oct, 13
- Nov, 13
- Dec, 13
- Jan, 14
Market Trend – Trading of RECs

REC Issued till 5th Feb, 2014: 97,65,993
REC Traded till Jan, 2014: 52,97,327

Total Value of REC Traded ~ Rs. 1034 Crores

FLOOR & FORBEARANCE PRICE
(w.e.f. FY 2012-13 to 2016-17)

<table>
<thead>
<tr>
<th></th>
<th>Non Solar REC (₹/MWh)</th>
<th>Solar REC (₹/MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forbearance Price</td>
<td>3,300</td>
<td>13,400</td>
</tr>
<tr>
<td>Floor Price</td>
<td>1,500</td>
<td>9,300</td>
</tr>
</tbody>
</table>
Monetary Value of Solar REC Traded

Total Trade of Solar RECs ~ Rs. 63 Crores

Transaction Value (₹ Lakhs )

Rs. in Lakhs
Monetary Value of total RECs Traded

Transaction Value (₹ Lakhs)

Total Value of Transactions upto Jan, 14 ~ 1034 Crores

<table>
<thead>
<tr>
<th>Year</th>
<th>Transaction Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mar/11</td>
<td>12</td>
</tr>
<tr>
<td>May/11</td>
<td>4</td>
</tr>
<tr>
<td>Jul/11</td>
<td>289</td>
</tr>
<tr>
<td>Sep/11</td>
<td>246</td>
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<tr>
<td>Nov/11</td>
<td>1066</td>
</tr>
<tr>
<td>Jan/12</td>
<td>3051</td>
</tr>
<tr>
<td>Mar/12</td>
<td>2588</td>
</tr>
<tr>
<td>May/12</td>
<td>3293</td>
</tr>
<tr>
<td>Jul/12</td>
<td>1568</td>
</tr>
<tr>
<td>Sep/12</td>
<td>4014</td>
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<td>Nov/12</td>
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<td>Jan/13</td>
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<td>Mar/13</td>
<td>3566</td>
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<td>1225</td>
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<tr>
<td>Nov/13</td>
<td>935</td>
</tr>
<tr>
<td>Jan/14</td>
<td>5977</td>
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</tbody>
</table>

Total Value: 1034 Crores
Issues and Way Forward

- Lack of enforcement of RPOs.
- Demand Supply mismatch impacting trading.
- Bankability and longer term visibility of Floor and Forbearance price.
- Absence of Sunset clause.
- Significant mismatch between Solar Certificate prices and Solar PV tariff.
- Separate Floor and Forbearance price for Solar PV and Solar Thermal technology.
- Vintage based multiplier for Solar Certificates.
- Liquidity in REC Trading
RRF Mechanism
Implementation of RRF Mechanism

- **IEGC Regulations, 2010 notified on 28.04.2010**
  - Implementation of RRF Mechanism from 1\textsuperscript{st} Jan 2011

- **RRF Procedure**
  - CERC examined the proposal submitted by NLDC and the modified procedure was notified on 18.02.2011
  - Mock Exercise: 1\textsuperscript{st} July 2011
  - Implementation: 1\textsuperscript{st} Jan 2012

- **Task Force by MNRE**
  - MNRE has convened a meeting on 23.03.12
  - MNRE constituted the Task Force on 28.03.2012
  - MNRE Submitted the Task Force Report to CERC on 04.09.2012

- **CERC Order dated 16.01.2013**
  - Mock Exercise to be started from 01.02.2013
  - RRF Shall be Implemented from 01.07.2013

- **CERC order dated 09.07.2013**
  - RRF Mechanism to be implemented from 15.07.2013

- **CERC order dated 07.01.2014**
  - suspended the Commercial mechanism
  - Forecasting and scheduling of wind generation shall continue
Implementation difficulties of RRF Mechanism

• **Jurisdiction Issues related to Intra-State entities**
  
  – Applicability of CERC Regulations for intra-state entities.
  
  – RLDCs are entrusted for collection / disbursement of renewable regulatory charges from RE Generators/ State Utilities for Intra-State transactions.
  
  – SLDCs may be entrusted for all commercial settlements for Intra-State transactions.
  
  – Most of the SERCs haven’t notified the Grid Code consistent with the IEGC, with regard to RRF Mechanism.
    
    ➢ Many SERCs has exempted Wind Generators from scheduling. Due to this, RE generators are not providing schedules.

    ➢ Intra-State Deviation Settlement mechanism - not in operation in many States.
Implication of Renewable Regulatory Charge on States

- The operation of RRF involves payment of Renewable Regulatory Charge to be shared by all States.
- The States which have low potential of wind and solar generating capacity are likely to default / delay in making payment to RRF which may jeopardize the mechanism.
- States that are meeting the peak demand load on higher side shall be required to pay higher charges, and may be opposed by them on ground of discrimination among States
- Some SLDCs have informed that RE Generators are apparently resorting to Gaming by over declaring to avoid capping beyond 150%.
- It is apprehended by SLDCs that RRF Mechanism has negative commercial implication on States and they may end up in paying huge amount of money to Private Generators.
Implementation difficulties of RRF Mechanism

Non-submission of Schedules

– Eligible Pooling stations are not submitting the schedules on regular basis.
– Solar generating units are not covered under the commercial mechanism, the quality of forecast services under this category has been poor.

Learning from operationalization of other Funds

– Maintenance of accounts, utilization, monitoring, audit, income tax, other statutory taxes, etc. are required to be addressed
– To avoid taxation related issues, it needs to be categorically provided in the regulation that RRF will not be a part of income of the implementing agency.
Other Issues

• Till date, none of the SLDCs have submitted the details of Coordinating agency to respective RLDCs for implementation of the RRF Mechanism.

• Data communication facilities are yet to be made available by the most of the Pooling Stations

• Due to strict enforcement of Deviation Settlement Mechanism and related matters Regulations 2014, states are resorting to Curtailment of RE generation

• Settlement of accounts in case of non-receipt of schedules from Pooling Stations

• Special Energy meters, compliant to CEA Regulations, are yet to be installed on some of the eligible pooling stations

• Actual energy data is not being validated by SLDCs
Conclusions

• With Larger Grid interconnection the variability can be better handled.
• With Forecasting, Operational planning can be better executed
• With Scheduling accountability is induced
• With REC mechanism and trading across seams, RE will be an attractive business
• Concerns of System Operators to be taken care of
• Separate Control Centre for Renewable Power at each LDC
Thank You