“Western Regional Renewable Energy Management Center - System architecture, Handling of Challenges related to RE forecasting, scheduling & integration into grid and way ahead”

Sept 4 – 6, 2019
WR REMC: Overall Architecture

1. SCADA Real-Time Data
   - Real-Time Monitoring & Control System for RE Pooling stations

2. Internal Forecast Module
   - Generation of Forecast at RE pooling station Level With inputs available from weather & SCADA

3. Weather Forecast
   - Provision of day-ahead and weak-ahead weather forecast

4. Forecast Combination & Aggregation
   - Combination & Aggregation module to produce best forecast from all available forecasts.

5. FSP 1
6. FSP 2
7. FSP 3

8. RE Pooling Stations
   - Pooling substations for evacuating RE

9. Forecast from different Forecast Service Providers to be fed to combination module

10. Dedicated scheduling tool for RE resources

11. RE Scheduling Tool

12. SLDC/RLDC Scheduling Tool
   - Existing scheduling tool for overall resources
WR REMC: Communication within Control Centers

- Madhya Pradesh State REMC
  - SCADA
  - Forecasting
  - Scheduling
- Gujarat State REMC
  - SCADA
  - Forecasting
  - Scheduling
- Maharashtra State REMC
  - SCADA
  - Forecasting
  - Scheduling
- Western Region REMC
  - SCADA
  - Forecasting
  - Scheduling

RTUs at Pooling Stations:
- IEC 104
- ICCP

To respective SLDC Scheduling Tool
To respective SLDC SCADA/EMS System
To Western Regional RLDC SCADA/EMS System
To National REMC

RE Developers

2nd Int’l Conference on Large-Scale Grid Integration of Renewable Energy in India | New Delhi, India | 4-6 Sep 2019
WR REMC: Forecast of RE

Real-Time Data, Available Capacity, Injection Limit, Site Locations, Power Curves, Historical SCADA/ABT Data, Installed Capacity

Real-Time (Dynamic) Data

Pooling Station / QCA Location Details

WSP

Location Specific Weather Forecast

AI Layer

Static Data

Forecast (Day-Ahead, Weak-Ahead, Intra-Day Ahead)
Scheduling of RE

1. **Validity & Format Check**
2. 
   - **Message for Error & Resubmission**
   - **Yes**
     - **Curtailment Check**
   - **No**
     - **Is schedule error free?**
     - **Yes**
       - **Is proposed schedule violating constraints?**
       - **Yes**
         - **Prepare Schedule**
         - **Curtailment Information**
       - **No**
         - **Prepare Schedule**
         - **Schedule DB @ SLDC / RLDC**
     - **No**
       - **Schedule DB**
       - **Collating Schedules**
       - **Schedule Acceptance by SLDC/RLDC**

**Scheduling Entities**

**SLDC / RLDC Scheduling Tool**
Key Inputs & Factors

Inputs

• Static Data from PV Panels
• Static Data from Wind Turbines
• Topological arrangement of Pooling Stations
• Historical Generation Data
• Consistent SCADA Data
• Real-Time Weather Data
• Historical Weather Data

Factors

• State specific regulations
• Availability of Meters
• DSM Mechanisms
• Power Purchase Agreements
• Plant Level Infrastructure
Forecasts Results

Line Chart - Forecast/Actual (Duration: 2019-07-30) for WR-ISTS:

- Power [MW]

- Time:
  - 30 Jul
  - 02:00
  - 04:00
  - 06:00
  - 08:00
  - 10:00
  - 12:00
  - 14:00
  - 16:00
  - 18:00
  - 20:00
  - 22:00

- Chart Details:
  - FC-REV_16 [MW]
  - Actual [MW]

- Metrics & Static Info:

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<tbody>
<tr>
<td>376</td>
<td>20.13</td>
<td>17.8</td>
<td>0.18</td>
<td>332.6</td>
<td>257.87</td>
<td>248.99</td>
<td>160.63</td>
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Pie Chart:

- In_Range: 46
- Not_In_Range: 50

Submit
Forecast Results
# Key Lessons Learned

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<thead>
<tr>
<th>Issues</th>
<th>Way Ahead</th>
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<tr>
<td>Data Exchange between Internal Systems</td>
<td>Data Flows can be optimized</td>
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<td>Use of Industry Standard Protocols</td>
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<tr>
<td>Availability of real-time Data</td>
<td>Improvement in Feeder level infrastructure</td>
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<td>Improvement in last mile connectivity</td>
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<tr>
<td>Missing Parameters</td>
<td>Incorporation of Meter Data</td>
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<tr>
<td>Addressing Revenue Issues</td>
<td>Incorporation of DSMs</td>
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<tr>
<td>Evolving Regulation</td>
<td>Allow change in scope and back-to-back agreements</td>
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<td>Awareness about regulations and its impact</td>
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<tr>
<td>Topological Arrangements</td>
<td>Definition &amp; Consistency for Point-of-forecast &amp; point-of-forecast</td>
</tr>
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Thank You!

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