TRANSFORMING DATA INTO ACTION

Ankit Takle
Adityan Sainath

Tata Power
TATA POWER

India’s largest integrated private power utility.

8521 MW Installed capacity (Thermal, Hydro, DG, Solar and Wind)


Expanding its horizon beyond India in countries like Australia, Bhutan, Singapore, Indonesia, Nepal, Africa, Netherlands & the Middle East.
TRANSFORMING DATA INTO ACTION

SOLUTIONS FOR TRANSMISSION
Transmission Grid Availability

INTEGRATION WITH SAP
OSI SCADA Availability

IN-HOUSE BUSINESS SOLUTIONS
Smart Soot Blowing Solution
Solar plant performance analysis

WAY AHEAD
CMDC
Mobile App

AGENDA
SOLUTIONS FOR TRANSMISSION
Transmission Grid Availability

- Mumbai Transmission grid includes 71 transmission lines and 71 Transformers.

- Status of each equipment of Switchyard of all Generation and Transmission stations made available on PI System.

- Some of the required parameters for this analysis are Station Transformer breaker status, LT breaker status, Line breaker status etc.

- The number of outages are calculated according the data available from the respective PI tags.
Transmission Grid Availability

- Sequential calculations developed in PI System for calculating outage details of lines and Transformers.

- PI Performance equations developed according to the standard Grid calculations and formulae.

- Availability of each line and each Transformer was calculated to provide Grid Availability of entire Transmission grid.
SOLUTIONS FOR TRANSMISSION

SCADA Availability

- Requirement of monitoring SCADA availability at unified as well as station level by Transmission O&M.

- This required calculation of Gateway & RTU availability at instantaneous and daily level.

- Uptime for each station and Total SCADA availability were calculated.

- AF Structure for the system created
SOLUTIONS FOR TRANSMISSION

UNIFIED SCADA AVAILABILITY

Filter

- Category: Current Value
  - SCADA AVAILABLE
    - Value: 1

- Category: Daily Values
  - UNIFIED SCADA AVAILABILITY DAILY
    - Value: 98.82952 %

- Category: Hourly Values
  - UNIFIED SCADA AVAILABILITY HOURLY
    - Value: 94.04581 %

- Category: Monthly Values
  - UNIFIED SCADA AVAILABILITY MONTHLY
    - Value: 98.82952 %

- Category: Uptime Daily
  - AMBERNATH DAILY
    - Value: 83120 s
  - BACKBAY DAILY
    - Value: 55760 s
  - DHARAPAN DAILY
    - Value: 85852.98 s
  - VERSOVA DAILY
    - Value: 55400 s

- Category: Uptime Hourly
  - AMBERNATH HOURLY
    - Value: 300 s
  - BACKBAY HOURLY
    - Value: 3906.98 s
  - DHARAPAN HOURLY
    - Value: 300 s
  - VERSOVA HOURLY
    - Value: 300 s
## BI DASHBOARD

### Gateway Availability

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<thead>
<tr>
<th>Gateway</th>
<th>Average of Gty_Dly_AV</th>
<th>Time_Stamp</th>
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<tbody>
<tr>
<td>ABB 560A</td>
<td>99.47</td>
<td>04/06/2013 0:02</td>
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<tr>
<td>ABB 560D</td>
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<tr>
<td>AREVA</td>
<td>100</td>
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<td>CALISTO</td>
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<tr>
<td>HARRIS</td>
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### Station Gateway Availability

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Ambarnath</th>
<th>Chembur</th>
<th>Kolshet</th>
<th>Mahalakshmi</th>
<th>Vikhroli</th>
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<tbody>
<tr>
<td>110KV</td>
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Grand Total: 99.47
BI DASHBOARD

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<td>SIEMENS BSS</td>
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**STATION GATEWAY AVAILABILITY**

<table>
<thead>
<tr>
<th>Voltage</th>
<th>BackBay</th>
<th>Carnac</th>
<th>Dharavi</th>
<th>GrantRoad</th>
<th>Malad</th>
<th>Parel</th>
<th>Saisette</th>
<th>Versova</th>
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<tbody>
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</table>

Grand Total: 99.22909091

Time Stamp: 04/06/2013 0:02
INTEGRATION WITH SAP
INTEGRATION WITH SAP

SAP-COE plans to automate performance monitoring drill down using SAP-BI report tools.

Trombay Unit 5 heat rate was decided upon as a pilot project.

PI system is used for performing automated calculations and data transfer.

Since Steam Tables cannot be deployed in SAP, it was decided to use the steam tables function of PI system for thermodynamic calculations.
INTEGRATION WITH SAP

PI SERVER

PI OLEDB

SSIS

ORACLE

SAP BI REPORT
INTEGRATION WITH SAP

Heat Rate

Boiler Efficiency
- Dry flue gas
- Moisture present in fuel
- Unburnt carbon in fly ash
- Unburnt CO in flue gas
- Sensible heat in bottom ash
- Convection
- Radiation
- Evaporation of water formed due to H2 in fuel
- Moisture present in Air
- Unburnt carbon in bottom ash
- Sensible heat in fly ash

Turbine Heat Rate
- HP Turbine Efficiency
  - Plant Load Factor
  - Throttle pressure
  - RH Steam temperature
  - Condenser TTD
  - Feed water LP TTD
  - Makeup
  - Feed water temperature
  - Main steam temperature
  - Condenser vacuum
  - Feed water HP TTD
  - STOPP steam consumption
  - Rise in RH Steam pressure dr...
INTEGRATION WITH SAP

**Losses in Turbine Heat Rate**

- **HP Turbine Efficiency**: 85.5%
- **IP Turbine Efficiency**: 88.79%
- **Plant load factor**: 84.43 kcal/kwh
- **Feed water temperature**: 0 kcal/kwh
- **Throttle pressure**: 0 kcal/kwh
- **Main steam temperature**: 10.22 kcal/kwh
- **RH Steam temperature**: 0 kcal/kwh
- **Condensor vacuum**: 0 kcal/kwh
- **HP Feed water TTD**: 0 kcal/kwh
- **LP Feed water TTD**: 0 kcal/kwh
- **Makeup**: 2.09 kcal/kwh
- **Rise in RH Steam pressure drop**: 0 kcal/kwh
- **Loss due to RH spray**: 10.57 kcal/kwh
INTEGRATION WITH SAP

**Heat Rate**

- 2580.54 kcal/kwh

**Boiler Efficiency**
- 83.63%

**Turbine Heat Rate**
- 2226.23 kcal/kwh

**Losses in Boiler Efficiency**

<table>
<thead>
<tr>
<th>Loss Description</th>
<th>Efficiency</th>
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</thead>
<tbody>
<tr>
<td>Dry flue gas</td>
<td>5.96%</td>
</tr>
<tr>
<td>Evaporation of water formed due to H2 in fuel</td>
<td>4.45%</td>
</tr>
<tr>
<td>Moisture present in fuel</td>
<td>4.87%</td>
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<tr>
<td>Moisture present in Air</td>
<td>0.31%</td>
</tr>
<tr>
<td>Unburnt carbon in fly ash</td>
<td>0.62%</td>
</tr>
<tr>
<td>Unburnt carbon in bottom ash</td>
<td>0.15%</td>
</tr>
<tr>
<td>Unburnt carbon in flue gas</td>
<td>0%</td>
</tr>
<tr>
<td>Sensible heat in fly ash</td>
<td>0%</td>
</tr>
<tr>
<td>Sensible heat in bottom ash</td>
<td>0%</td>
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<tr>
<td>Convection</td>
<td>0%</td>
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<tr>
<td>Radiation</td>
<td>0%</td>
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</tbody>
</table>
Applications developed by combining the features of PI functionality, MS Excel/Processbook and VBA.

Historical data obtained from PI system is processed using VBA.

Advice given to users using this empirical data.

Application also consists of a User-friendly front end.
IN-HOUSE BUSINESS SOLUTIONS

Smart Soot Blowing Solution

- Traditional Soot Blowing operations to clean ash deposited on Boiler tubes cannot have an overall impact on Boiler efficiency.

- Application is developed that analyzes effect of individual soot blowers in various conditions.

- Application developed for Trombay Thermal power plant.
Smart Soot Blowing Solution

The salient features of the application:

- Dynamically updating historical data
- Coal Mill combination using PI-ACE
- Pattern recognition
- Frequency/Impact/Elevation based guidance of soot blower operation
- Control flow feature of VBA
IN-HOUSE BUSINESS SOLUTIONS

Smart Soot Blowing Solution

- Group of most effective soot blowers is suggested to Operators for prioritizing operation of soot blowers.

- Maximum impact on Boiler Efficiency, its effect is evident in improvement in SH temp, DM Water consumption and Heat Rate.
# IN-HOUSE BUSINESS SOLUTIONS

## Smart Soot Blowing Solution

### Coal Mill Combination

<table>
<thead>
<tr>
<th>SH N Temp</th>
<th>SH S Temp</th>
<th>SH Spray</th>
<th>RH N Temp</th>
<th>RH S Temp</th>
<th>RH Spray</th>
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<tbody>
<tr>
<td>543.2</td>
<td>541.9</td>
<td>19.77</td>
<td>540.8</td>
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### Blow-Timer

- **SH 1**: 19:54, 10:27, 10:29, 10:31, 10:35, 10:37, 10:39, 10:47
- **SH 2**: 4:10, 4:12, 4:27, 4:25, 4:23, 4:19, 4:17, 4:15, 4:29, 4:31

<table>
<thead>
<tr>
<th>RH 10</th>
<th>RH 11</th>
<th>RH 12</th>
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<tbody>
<tr>
<td>4:18</td>
<td>22:05</td>
<td>4:16</td>
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### Click to Execute

- **SH 68**: 24:00, 25:35:02, 2:38, 254:300, 2:36, 104:09, 2:34, 104:09, 137:51, 104:00, NO
- **SH 90**: 328:02, 11:04, 1126:44, 11:02, 11:00, 105:7, 10:55, 105:0, 1126:31, 10:46, 10:43

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**osisoft. REGIONAL SEMINARS**
Solar plant performance analysis

- Application is developed which provides direct relationship between solar irradiation and current in the form y = f(x).

- Alarming condition is provided if any deviation from normal condition is observed.

- Helps in predictive analysis of future deviations for solar power plant.

- Application developed for Mulshi Solar power plant.
Solar plant performance analysis
# Solar plant performance analysis

<table>
<thead>
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WAY AHEAD
Way Ahead

Centralized Monitoring and Diagnostic Centre

- Data from decentralized plants to Centralized location
- Facilitates Centralized diagnostics and analytics
- Expert advice from centralized location to decentralized locations
PI System Mobile App

- Application being developed on new generation smart phones to view live real time and cumulative dashboard of Tata Power generation.

- Convenient, easy to use application which is very similar to OPMS web based dashboard.

- Application supports all Blackberry, Android and iPhone.

- Convenient, easy to use opening/closing, zooming, navigation, login facilities as well as simultaneous use on multiple phones provided.