Modernisation & Renovation of a Conventional Power Plant
Presentation in the ‘Safe Future Now’ Summit on 15/10/14
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Modernisation & Renovation of a Conventional Plant

- NTPC’s installed capacity is 43,128 MW, comprising Coal & Gas based units
- Out of this, the commercial generating units are 127 in no. with 36310 MW
- Age profile is given below:

<table>
<thead>
<tr>
<th>Age (hours) Till 31 Aug 2014</th>
<th>No. of Units in Combined Cycle</th>
<th>Total Units</th>
<th>Total MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 25,000</td>
<td>Thermal Turbines</td>
<td>Gas Turbines</td>
<td>Steam Turbines in Combined Cycle</td>
</tr>
<tr>
<td>25,000 to 50,000</td>
<td>12</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>50,000 to 75,000</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>75,000 to 1,00,000</td>
<td>6</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>1,00,000 to 1,50,000</td>
<td>15</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>1,50,000 to 2,00,000</td>
<td>21</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>More than 2,00,000</td>
<td>27</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>95</td>
<td>22</td>
<td>10</td>
</tr>
</tbody>
</table>
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Age Profile of NTPC Fleet

Age of NTPC units

No. of Units

12
8
6
9
30
35
27

0-25000
25000-50000
50000-75000
75000-1 lakh
1-1.5 lakh
1.5-2.0 lakh
>2.0 lakh

No. of Units
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NTPC’s R&M activities started with the take over of Talcher TPS (4x60+ 2x110 MW) from Odisha in Jun 1995

- The Stage-I (4x60 MW) units were commissioned in 1967-69
- The Stage-II (2x110 MW) units were commissioned in 1982-83
- R&M Approved and implemented in Phases: Ph-I, Ph-II, Ph-III and Switchyard R&M
- R&M Ph-I was primarily for (1x60 MW), Ph II for (3x60 MW) and Ph III for (4x60+2x110 MW)
- Implementation in phases was to ensure that the sole beneficiary GRIDCO continues to get power without extra shutdowns for R&M
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**Issues prior to R&M in TTPS (4x60 MW) units**

- Poor PLF (36% max.), Heat Rate (4000 Kcal/kWh) before takeover.
- High stack emission ~ 600 mg/Nm³, High Flue gas temp.
- Super heater banks prone to high erosion rate.
- Deterioration of coal GCV by ~ 20% leading to inadequate milling capacity.
- Soot blowers were non-functional.
- Burners were eroded. Flame scanners and burner management/FSSS not provided
- Non-availability of many critical equipments like HPH, CW pumps, BFP's, etc
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Scope Covered in Talcher TPS:

- Extensive RLA and R&M of SG and TG
  - R&M of SG
    1. Design audit & thermal redesign of existing boiler
    2. Replacement of SH, economiser, boiler bank tubes
    3. Replacement of mills with higher capacity mills
    4. Replacement of air heater elements
    5. Replacement of soot blowers, Flue Gas ducting, insulation, cladding & refractory
    6. Conversion of HSD firing to LDO firing
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Scope Covered in Talcher TPS:

- Retrofitting of existing ESP + Addition of new fields
- Height of ESP increased from 9 m to 13.5 m, all internals replaced, New TR set & latest EPMS system added
- R&M of TG
  1. Replacement of most of the Buckets, Nozzle Plates, Diaphragms, all TG Bearings, Labyrinth Seals, ESV Parts, Control Valve parts, Governor parts
  2. Turning Gear parts, Steam seal, Condenser Tubes
  3. R&M of C&I of Stg I
  4. R&M of C&I of Stg II incl. FSSS
  5. Replacement of Gen. Rotor
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Scope Covered in Talcher TPS:

5. Replacement of Static Excitation System, Power & Control cables, Replacement/ Retrofit of HT/LT Switchgear, Augmentation of H2 plant

- Renovation of Cooling Towers
- Augmentation of Ash Handling
- New Ash Water Recirculation System
- New Railway Siding inside the plant
- New Coal Handling Plant
- R&M of Switchyard
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- R&M activities continued with the take over of Tanda TPS (4x110 MW) from UPSEB by NTPC in Jan 2000
- First three units were commissioned in 1988-90, declared commercial 1990-93
- Fourth unit commissioned & declared commercial in 1998
- R&M approved & implemented in phases:
  - Short, Medium & Long term R&M
  - ST & LT R&M were meant for revival of the station while LT was meant for sustenance of performance
  - Implementation in phases was to ensure that the sole beneficiary UPPCL continues to get power without extra shutdowns for R&M
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**Issues in Tanda at the time of Take over**

- Abnormally high no. of trippings, max. PLF 38% and very high Sp. Oil consumption.
- Extensive corrosion inside boiler tubes in all units.
- 2 mills in each unit not available. Other mills were in bad condition.
- Bottom ash handling system was inoperative
- All wall soot- blowers and air pre-heater soot blowers were out of service.
- APH baskets were heavily choked, ID fan impellers were eroded.
- Only 3 to 5 fields were available in each ESP.
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- **Scope Covered in Tanda TPS:**
  - Extensive RLA and R&M of SG and TG
    - R&M of SG incl. Coal Mill Reject System
    - Addition of one extra mill per boiler (Total 6+1= 7 mills per boiler)
    - Renovation of RH, SH & Ceiling SH tube/banks
    - Replacement of Economizer, LTSH tubes
    - Replacement of water wall panel, worn-out Burners & PF Pipes / bends
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- Scope Covered in Tanda TPS

- ESP Renovation
  - Replacement of controls with state of the art system for bringing down the particulate emission level
  - R&M of TG
    - Re-blading of HP, MP rotors
    - 1 set of LP rotor blades
    - 1 set of 6 TG Bearings and 2 nos JOP
    - 1 spare HP, MP & LP rotors & Generator rotor
    - 1 no. barring-gear assy.
    - 1 set of hydrogen coolers and seal oil coolers
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- **Scope Covered in Tanda TPS**
- **R&M of TG Aux.**
  - Replacement of condenser tubes, Nozzle Box of HP Turbine
  - HP Heaters and Tube nests of LP heaters
  - BFP Recirculation valve
  - Replacement of 6.6 KV & 11 KV Switch gear
  - Replacement of LT Switch Gear
  - Renovation of Fire Fighting system
  - New Stacker Reclaimer
  - Additional DM Stream
  - New DDCMIS for Units 1&2 and Up-gradation of DAS for Unit 4
  - Clarification of CW Make up water system & Effluent Treatment plant
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Tanda- Committed to a clean environment, the following activities have been undertaken:

- Renovation of ESP
- Raising of Ash Pond
- Installation of CO, Sox & Nox Analyzers
- Installation of Autoclave for Hospital Waste
- Revamping of Sewerage System
- Installation of Effluent Treatment Plant
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- Methodology adopted in Talcher and Tanda is individual packages and competitive bidding, with NTPC taking care of the interfacing.

- Achievements in Talcher and Tanda are:

<table>
<thead>
<tr>
<th>Project</th>
<th>PLF during Take over</th>
<th>PLF in 2013-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Talcher TPS</td>
<td>19%</td>
<td>95.02%</td>
</tr>
<tr>
<td>Tanda TPS</td>
<td>21%</td>
<td>92.80%</td>
</tr>
</tbody>
</table>
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CERC Tariff Regulations 2009-14 on R&M

- From Apr 2009 onwards, CERC Tariff Regulations started giving revised provisions for Mid Life and Post 25 year R&M of Coal stations and R&M of Gas stations after 15 years.
- These revisions have far reaching impact on the R&M investment decisions to be taken by the generator.
- For Coal stations, in the Mid Life Period from 11-25 years, a Compensation Allowance is included in Fixed charges of Tariff as follows:

<table>
<thead>
<tr>
<th>Life of Unit in Years</th>
<th>Compensation Allowance as of 2009-14</th>
<th>Compensation Allowance as of 2014-19</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rs Lakhs per MW per year</td>
<td>Rs Lakhs per MW per year</td>
</tr>
<tr>
<td>11-15</td>
<td>0.15</td>
<td>0.20</td>
</tr>
<tr>
<td>16-20</td>
<td>0.35</td>
<td>0.50</td>
</tr>
<tr>
<td>21-25</td>
<td>0.65</td>
<td>1.00</td>
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</table>

- For Coal stations, in the Post 25 year period, the generator can opt for a Special Allowance of Rs 5 lakhs/MW/year in Fixed charges of Tariff with escalation @ 5.72% p.a from 2009-10 (changed in 2014-19 as Rs 7.50 lakhs/MW/yr to be escalated @ 6.35% p.a. from 2014-15)
- Alternatively, the Generator can approach CERC with a DPR for R&M, to be serviced thro’ tariff, after deducting the accumulated depreciation already recovered from the original project cost.
- For Gas stations, full life is considered as 25 years and Renovation of Gas Turbines and R&M for obsolescence removal such as C&I are allowed in Tariff after 15 years (after removing items which are purely O&M in nature) (In 2014-19 Regulations GT Renovation will be allowed only after completing 25 year life, while C&I will be allowed between 15 & 25)
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R&M in Coal based stations (other than Take over stations)

- Apart from R&M in BTG island and BOP areas, Removal of Technological obsolescence in C&I Systems has been taken up extensively in
  - Singrauli Stg I & II (5x200+2x500 MW)
  - Korba Stg I & II (3x200+3x500 MW)
  - Ramagundam Stg I & II (3x200+3x500 MW)
  - Farakka Stg I & II (3x200 +2 x500 MW)
  - Vindhyachal Stg I (6x210 MW)
  - Rihand Stg I (2x500 MW)
  - Talcher Kaniha Stg I (2x500 MW)
  - Dadri Thermal (NCTPS) Stg I (4x210 MW)
  - Unchahar Stg I (2x210 MW) (*Take over station*)

- This initiative is aimed at bringing the old C&I Systems nearly on par with the New builds.
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R&M in Coal based stations (other than Take over stations)

- Committed to a clean environment, Renovation of ESP is in progress at the following stations for reduction in particulate emission levels:
  - Badarpur Stg II (2x210 MW)
  - Singrauli Stg I & II (5x200+2x500 MW)
  - Korba Stg I & II (3x200+3x500 MW)
  - Farakka Stg I (3x200 MW)
  - Vindhyachal Stg I & II (6x210+ 2x500 MW)
  - Rihand Stg I (2x500 MW)
  - Talcher Kaniha Stg I (2x500 MW) (Stg II- 4x500 MW)
  - Unchahar Stg I (2x210 MW) (Take over station)
  - Talcher TPS Stg II (4x110 MW) (Take over station)
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- Renovation of Gas Turbines and R&M of C&I of GT, ST & WHRB has been completed in Anta (3 GT+ 1 ST) (413 MW) - Agency - Alstom
- R&M of some BOP/Plant Auxiliaries covered in this programme
- Renovation of Gas Turbines and R&M of C&I of GT, ST & WHRB has been completed in both the modules of 2x (2 GT+ 1 ST) of Kawas of 645 MW Agency - GE/BGGTS
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- Renovation of Gas Turbines has been completed in 1 out of 3 GT’s of Gandhar- (3 GT+ 1 ST) of 648 MW. Agency- Alstom
- Renovation of Gas Turbines and R&M of C&I of GT, ST & WHRB for Auraiya has been completed in 1 GT and 1 ST and the 2\textsuperscript{nd} GT is in progress from 12/09/14 out of 2 x (2 GT+ 1 ST) of 652 MW-MHI/Marubeni
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Mega R&M (Life Extension) of NTPC Coal based Stations

- Approvals are in place for Post 25 year Life Extension (Mega R&M) of:
  - Singrauli Stg I (5x200 MW)
  - Korba Stg I (3x200 MW)
  - Ramagundam Stg I (3x200 MW)

- Forthcoming Mega R&M (under Planning & Approval stage)
  - Singrauli Stg II (2x500 MW)
  - Korba Stg II (3x500 MW)
  - Ramagundam Stg II (3x500 MW)
  - Farakka Stg I (3x200 MW)
  - Vindhyachal Stg I (6x210 MW)
  - Rihand Stg I (2x500 MW)
  - Unchahar Stg I (2x210 MW)