NTPC INITIATIVES IN HYDRO POWER
ENTRY OF NTPC IN HYDRO-POWER SECTOR

- Government of India formulated hydro policy in 1998 which encourages more public & private participation.
- NTPC, the leading thermal power giant of Asia has responded to the need of nation.
- NTPC entered in the field of hydro power in 1998.
- The agreement of Koldam hydro electric power project with H.P. Govt. Was made in Feb.2000.
- Subsequently Implementation agreement has been signed for
  - Loharinag Pala HPP (600MW)
  - Tapovan Vishnugad HPP (520 MW)
  - Rupsiabagar Khasiyabara HPP (261 MW)
A wholly owned subsidiary company, NTPC Hydro Ltd (NHL) was formed for developing projects having capacity upto 250 MW.

PROJECTS TAKEN UP BY NHL:

- LATA TAPOVAN, UTTARAKHAND 171 MW
- RAMMAM STAGE-III, WEST BENGAL 120 MW
### CURRENT HYDRO PROJECTS

#### UNDER IMPLEMENTATION:

<table>
<thead>
<tr>
<th>Project</th>
<th>State</th>
<th>Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KOL DAM</td>
<td>HIMACHAL PRADESH</td>
<td>800</td>
</tr>
<tr>
<td>TAPOVAN VISHNUGAD</td>
<td>UTTARAKHAND</td>
<td>520</td>
</tr>
<tr>
<td>LOHARI NAG PALA</td>
<td>UTTARAKHAND</td>
<td>600</td>
</tr>
<tr>
<td>LATA TAPOVAN (NHL)</td>
<td>UTTARAKHAND</td>
<td>171</td>
</tr>
<tr>
<td>RAMMAM Stage-III (NHL)</td>
<td>WEST BENGAL</td>
<td>120</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>2211 MW</strong></td>
</tr>
</tbody>
</table>

#### UNDER INVESTIGATION:

<table>
<thead>
<tr>
<th>Project</th>
<th>State</th>
<th>Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUPSIBAGAR-KHASIYABARA</td>
<td>UTTARAKHAND</td>
<td>261</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>261 MW</strong></td>
</tr>
</tbody>
</table>

#### MoU SIGNED FOR DPR:

<table>
<thead>
<tr>
<th>Project</th>
<th>State</th>
<th>Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETALIN</td>
<td>ARUNACHAL</td>
<td>4000</td>
</tr>
<tr>
<td>ATTUNLI</td>
<td>ARUNACHAL</td>
<td>500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>4500 MW</strong></td>
</tr>
</tbody>
</table>

**GRAND TOTAL: 8742 MW**

NTPC PLANS TO SETUP 9000 MW BY 2017.
STRENGTH OF NTPC

- Proven Management capability to implement projects ahead of schedule
- Effective Project Cost Control system
- No constraints in arranging of Funds due to Financial soundness
- Detailed and thorough Geological investigations to minimize Geological risks
- Best practices of Quality, Safety, Environment & R&R
- Promotion of modern construction techniques.
- Has a strong team of Engineering, Contracts, Construction, Erection, Commissioning, O&M.
Practice adopted by NTPC for speedy construction of HEPs
Detailed investigations are carried out for DPR which includes:

- Geological mapping
- Drilling
- Drift
- Geophysical study
- Geotechnical Investigation
  - In Situ tests
  - Laboratory tests
- Geothermal investigation

This will minimize Geological surprises.
Engineering

- In house Engineering capability for preparation of DPR & detailed design.
- Latest design software are used for analysis & design.
- At construction stage, quick modifications to suit site conditions.
- NTPC explores latest modern techniques, suitable for construction and adopts the same.
- To avoid any delay construction drawing is submitted one month in advance to contractor.
Objective Specifications

- FIDIC specifications are followed for civil works.
- For different geology encountered during construction stage specifications have provision for resolution of variations and extra item.
- To avoid delay land for infrastructure facility for contractor are identified.
Award of contracts

Following steps are taken for selection of proper contractors / vendors:

• Formulation of proper QRs
• Pre-bid conferences
• Post bid discussions
Monitoring

- Corporate Monitoring group monitors progress of work using latest software like PRIMAVERA.
- Alternate contingency measures to make up delays.
- Monthly review meetings..
Infrastructure

• Telecommunication and other amenities are installed before award of main package.
• Main approach roads, bridges etc suitable for transporting heavy construction material & equipments is developed by NTPC during initial stages.
• To meet peak construction demand arrangements for construction power are done before award of main package.
Environmental Measures

• Project specific R&R scheme are implemented in consultation with state government & project affected persons (PAPs).
• All statutory clearances viz., Environment, Forest etc. are obtained prior to award of main works.
• Disaster management plan are developed for eventualities like land slide, flash floods etc. in advance and regular mock drill is carried out.
OVERVIEW OF NTPC - HYDRO POWER PROJECTS
KOL DAM
(800MW)
Project Components – A model view of Koldam HEP

- Dam
- Decanting
- Power Intake
- Spillway
- Plunge Pool
- Power House
- Diversion Tunnel Outlet
- River Satluj
- U/S
- D/S
SALIENT FEATURES

- DIVERSION TUNNELS
  - NUMBER/LENGTH : 2 No. (901 m & 933 m)
  - FINISHED DIAMETER : 14 m (Horse shoe shaped)

- DAM
  - TYPE : ROCK & GRAVEL FILL WITH CLAY CORE
  - HEIGHT : 163 m

- PENSTOCKS
  - NUMBER / TYPE : 04 nos.
  - SIZE : 6.45 m DIA

- POWER HOUSE
  - TYPE OF POWER HOUSE : SURFACE
  - TYPE OF TURBINE : 04 NOS. FRANCIS

- SWITCH YARD
  - TYPE OF SW YARD TRANSMISSION : SURFACE / CONVENTIONAL 400 kV
An aerial view of Dam under construction
Main Dam

- **TYPE**: ROCK & GRAVELFILL WITH CLAY CORE
- **HEIGHT**: 163 Mtrs.
- **CREST LEVEL**: EL 648 Mtrs.
- **CREST LENGTH**: 500 Mtrs.
- **CREST WIDTH**: 14 Mtrs.
- **MAX. RES. LEVEL**: EL 646 Mtrs
- **FULL RES. LEVEL**: EL 642 Mtrs.
- **MIN. D/DOWN LEVEL**: EL 636 Mtrs.

All quantities in Lac M$^3$

<table>
<thead>
<tr>
<th>Material</th>
<th>Amount</th>
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<tbody>
<tr>
<td>CLAY</td>
<td>20.62</td>
</tr>
<tr>
<td>QUARTZITE</td>
<td>7.89</td>
</tr>
<tr>
<td>GRAVEL</td>
<td>32.61</td>
</tr>
<tr>
<td>ROCK FILL</td>
<td>59.02</td>
</tr>
<tr>
<td>RIP RAP</td>
<td>1.84</td>
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</tbody>
</table>
DIVERSION TUNNEL

River Satluj Gurgling in to the Asia’s biggest dia. Twin Diversion Tunnels

INLET

Closure dyke

OUTLET

River Satluj streaming out from Twin Diversion Tunnels “Luv & Kush”

Asia’s Largest Twin diameter Diversion Tunnel constructed in record time
Power House- under construction (u/c)

Koldam
Decanting Chamber u/c

Koldam
Spillway u/c

Koldam
Township

Koldam
<table>
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<tr>
<th>MAJOR ACHIEVEMENTS</th>
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<tbody>
<tr>
<td><strong>EXCAVATION</strong></td>
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<tr>
<td><strong>DAM FILLING</strong></td>
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<tr>
<td><strong>ERECTION</strong></td>
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<tr>
<td><strong>GALLERY</strong></td>
</tr>
<tr>
<td><strong>CONCRETING</strong></td>
</tr>
<tr>
<td><strong>TUNNEL</strong></td>
</tr>
</tbody>
</table>
Loharinag Pala HPP (600 MW) (UTTARAKHAND)
Loharinag Pala Hydro Power Project Layout

Gangotri Shrine

BARRAGE & DESILTING CHAMBER

BHAGIRATHI RIVER

DABRANI ADIT INT_LVL 2164.24

GUNAGA ADIT INT_LVL 2103.61

KANALIYA GAD

MAMAPURI GAD

MALAPURI KHAL

HELGU GAD

POWER HOUSE

SURGE SHAFT JUNCTION
<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
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<tbody>
<tr>
<td>River</td>
<td>Bhagirathi</td>
</tr>
<tr>
<td>Type</td>
<td>RoR</td>
</tr>
<tr>
<td>Barrage</td>
<td>67.5 m long.</td>
</tr>
<tr>
<td>HRT</td>
<td>13.85 km long, 6 m dia.</td>
</tr>
<tr>
<td>Surge shaft</td>
<td>192 m high, 13 m dia.</td>
</tr>
<tr>
<td>Penstock</td>
<td>4 nos, 2.84 m dia.</td>
</tr>
<tr>
<td>Power house</td>
<td>Underground, 125 m X 22 m</td>
</tr>
<tr>
<td>TRT</td>
<td>510 m Long, 6 m dia.</td>
</tr>
<tr>
<td>Gen. Eqpt.</td>
<td>Pelton</td>
</tr>
<tr>
<td>Gross head</td>
<td>481.67m</td>
</tr>
<tr>
<td>Discharge</td>
<td>152.6 Cumecs</td>
</tr>
</tbody>
</table>
Adit to Gate operating chamber under construction (u/c)
Adit to HRT u/c

LNP HEP
Adit to Desilting Chamber
Diversion channel u/c
Tapovan Vishnugad HPP
(520 MW)
(UTTARAKHAND)
Badrinath Shrine

Tapovan Hydro Power Project Layout
<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>River</td>
<td>Dhauliganga</td>
</tr>
<tr>
<td>Type</td>
<td>RoR</td>
</tr>
<tr>
<td>Barrage</td>
<td>70 m long</td>
</tr>
<tr>
<td>HRT</td>
<td>11.64 km long, 5.4 m dia.</td>
</tr>
<tr>
<td>Surge shaft</td>
<td>13.5 m dia.</td>
</tr>
<tr>
<td>Penstock</td>
<td>3.6/2.6 m dia.</td>
</tr>
<tr>
<td>Power house</td>
<td>Underground</td>
</tr>
<tr>
<td>TRT</td>
<td>513 m long 5.4 m Horseshoe</td>
</tr>
<tr>
<td>Gen. Eqpt.</td>
<td>Pelton</td>
</tr>
<tr>
<td>Design head</td>
<td>525.67 m</td>
</tr>
<tr>
<td>Discharge</td>
<td>119.2 Cumecs</td>
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</tbody>
</table>
TV HEP - Desilting Basin u/c
TV HEP-Work in Progress at Barrage site
RUPSI BAGAR-KHASIABARA
(261MW)
(UTTARAKHAND)
<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>River</td>
<td>Goriganga</td>
</tr>
<tr>
<td>Type</td>
<td>RoR Dam, 62 m high</td>
</tr>
<tr>
<td>Intake</td>
<td>2 nos.</td>
</tr>
<tr>
<td>HRT</td>
<td>7.580 km long, 4.75 m dia.</td>
</tr>
<tr>
<td>Surge shaft</td>
<td>118.725 m high, 12.5 m dia.</td>
</tr>
<tr>
<td>Penstock</td>
<td>1 no., 4.1 m dia.</td>
</tr>
<tr>
<td>Power house</td>
<td>Surface</td>
</tr>
<tr>
<td>TRT</td>
<td>70 m length</td>
</tr>
<tr>
<td>Gen. Eqpt.</td>
<td>Pelton</td>
</tr>
<tr>
<td>Discharge</td>
<td>41.478 Cumecs</td>
</tr>
</tbody>
</table>
ETALIN HPP (4000MW)
&
ATTUNLI HPP (500MW)
(ARUNACHAL PRADESH)
ETALIN HEP (4000MW)- INDIA’S SINGLE LARGEST HYDROPOWER PROJECT
An aerial view of Etalin & Attunli HEP - Site location
ETALIN – 1500 MW on river Tangon

SALIENT FEATURES

- **RIVER**
  - Tangon

- **DIVERSION TUNNELS**
  - NUMBER/LENGTH: 1 No. / 600 M
  - FINISHED DIAMETER: 12 m (Horse shoe shaped)
  - DESIGN CAPACITY: 1600 Cumecs

- **DAM**
  - TYPE: CONCRETE
  - HEIGHT: 155 m

- **HEAD RACE TUNNEL**
  - NUMBER / TYPE: 2 nos. HORSE SHOE
  - SIZE: 8.0 m DIA
  - LENGTH: 12 & 12.5 KM

- **SURGE SHAFT**
  - 2 NO., 15m DIA, 125m HIGH

- **PRESSURE SHAFT**
  - 2 NO., 6.7mDIA, 361m DROP

- **POWER HOUSE**
  - TYPE OF POWER HOUSE: UNDERGROUND
  - TYPE OF TURBINE: 06 NOS. FRANCIS (VERTICAL) 250MW EACH
ETALIN – 2500 MW on river Dibang
SALIENT FEATURES

- **RIVER**
  - Dibang

- **DIVERSION TUNNELS**
  - NUMBER/LENGTH: 2 No. / 650 & 750 m
  - FINISHED DIAMETER: 10.5m (Horse shoe shaped)
  - DESIGN CAPACITY: 2300 Cumecs

- **DAM**
  - TYPE: CONCRETE
  - HEIGHT: 90 m

- **HEAD RACE TUNNEL**
  - NUMBER / TYPE: 2 nos. HORSE SHOE
  - SIZE: 10.5 m DIA
  - LENGTH: 9.7 & 9.9 KM

- **SURGE SHAFT**
  - 2 NO., 23m DIA, 125m HIGH

- **PRESSURE SHAFT**
  - 4 NO., 5.5/6.7m DIA, 379m DROP

- **POWER HOUSE**
  - TYPE OF POWER HOUSE: UNDERGROUND
  - TYPE OF TURBINE: 10 NOS. FRANCIS (VERTICAL) 250MW EACH
ATTUNLI HYDRO POWER PROJECT
SALIENT FEATURES

- **RIVER**: Tangon

- **DIVERSION TUNNELS**
  - NUMBER/LENGTH: 1 No. / 700 m
  - FINISHED DIAMETER: 11.5m (Horse shoe shaped)
  - DESIGN CAPACITY: 1500 Cumecs

- **DAM**
  - TYPE: CONCRETE
  - HEIGHT: 105 m

- **HEAD RACE TUNNEL**
  - NUMBER / TYPE: 01 no. HORSE SHOE
  - SIZE: 8.0 m DIA
  - LENGTH: 7.50 KM

- **SURGE SHAFT**
  - 1 NO., 16m DIA, 105m HIGH

- **PRESSURE SHAFT**
  - 1 NO., 6.6m DIA, 237m DROP

- **POWER HOUSE**
  - TYPE OF POWER HOUSE: UNDERGROUND
  - TYPE OF TURBINE: 04 NOS. FRANCIS (VERTICAL) 125MW EACH