Pakistan Entering into the Era of HVDC Technologies

HVDC MATIARI - LAHORE TRANSMISSION PROJECT

ABDUR RAZZAQ CHEEMA, EX-GENERAL MANGER (GRID SYSTEM CONSTRUCTION PROJECTS) NTDC
SEQUENCE OF PRESENTATION

- OVERVIEW
- GENERATION PROPOSED IN SOUTH (2011)
- EVACUATION OF POWER GENERATION FROM LOCAL/IMPORTED COAL POWER PROJECTS
- POWER SYSTEM STUDY (2011-13)
- SNC – LAVALIN RECOMMENDATIONS - BASIS OF FUTURE BULK POWER EVACUATION SCHEMES IN SOUTH
- UPCOMING POWER GENERATION IN SOUTH – PRESENT SCENARIO
- GOP TRANSMISSION POLICY – 2015 FOR DEVELOPMENT OF TRANSMISSION PROJECTS UNDER PRIVATE REGIME
- HVDC MATIARI-LAHORE TRANSMISSION PROJECT
- PROJECT FEASIBILITY REPORTS
- TECHNO-COMMERCIAL SUPPORT NEEDED
OVERVIEW

- ALLEVIATION OF POWER SHORTAGE / FUTURE GENERATION PLANS
- THAR / IMPORTED COAL LARGE THERMAL POWER GENERATION POTENTIAL
- NATIONAL POWER SYSTEM EXPANSION OF PAKISTAN FOR 2011-2030 ENVISAGES DEVELOPMENT OF THAR COAL FIELD TO ULTIMATE GENERATION CAPACITY OF ABOUT 40000 MW
- ISLAMABAD AND CENTRAL PUNJAB LOAD CENTRES - 60% OF TOTAL LOAD OF PAKISTAN
- SNC-LAVALIN ENTRUSTED (2011) SYSTEM STUDY FOR EVACUATION OF POWER FROM SOUTH
- STUDY SUBMITTED IN 2013.
- BASIS OF HVDC INDUCTION IN NTDC POWER SYSTEM
Geographic connection diagram of Pakistan's 220 kV and above power grids in 2013.
THAR COAL BASED POWER GENERATION POTENTIAL

- NATIONAL POWER SYSTEM EXPANSION PLAN FOR THE PERIOD 2011-2030 ENVISAGES DEVELOPMENT OF THAR COAL FIELD UPTO 40000 MW

- YEAR 2011 COAL POWER GENERATION SCENARIO.

- 500 KV D/C THAR – MATIARI YEAR 2015-16 INSTALLED CAPACITY 1200 MW (THAR), 1200 MW (IMPORTED COAL AT KARACHI)

- 500 KV AC IN / OUT FROM EXISTING 500 KV HUB-JAMSHORO LINE

- YEAR 2017-18 REACH TO 4000 MW

- WHAT NEXT OPTIONS FOR EVACUATION OF POWER
**GENERATION ADDITIONS PROPOSED INITIALLY IN SOUTH - 2011**

<table>
<thead>
<tr>
<th>Power Plant</th>
<th>Location</th>
<th>MW</th>
<th>COD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imported Coal (Public Sector)</td>
<td>Karachi</td>
<td>1,000</td>
<td>2014-15</td>
</tr>
<tr>
<td>Imported Coal (IPP)</td>
<td>Karachi</td>
<td>1,200</td>
<td>2015-16</td>
</tr>
<tr>
<td>IPP</td>
<td>Thar</td>
<td>1,200</td>
<td>2015-16</td>
</tr>
<tr>
<td>Public Sector</td>
<td>Thar</td>
<td>1,200</td>
<td>2015-16</td>
</tr>
<tr>
<td>Additional IPPs</td>
<td>Thar</td>
<td>2,600</td>
<td>2017-18</td>
</tr>
<tr>
<td>Nuclear</td>
<td>Karachi</td>
<td>1,000</td>
<td>2018-19</td>
</tr>
<tr>
<td>Nuclear</td>
<td>Karachi</td>
<td>1,000</td>
<td>2019-20</td>
</tr>
<tr>
<td>Sub-total</td>
<td></td>
<td>9,200</td>
<td></td>
</tr>
<tr>
<td>Additional IPPs</td>
<td>Thar</td>
<td>15,000</td>
<td>2019-2030</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>24,200</strong></td>
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POWER SYSTEM STUDY-KEY OBJECTIVES

- EVALUATION OF TRANSMISSION ALTERNATES AND SELECTION OF OPTIONAL TRANSMISSION SYSTEM BASED ON TECHNO – ECONOMIC CONSIDERATIONS.

- EVALUATION OF SYSTEM PERFORMANCE BY MEANS OF SYSTEM STUDIES (LOAD FLOW, SHORT CIRCUIT, TRANSIENT STABILITY STUDIES).

- FIELD INVESTIGATIONS / SURVEY, PRELIMINARY ROUTE.

- BASIC DESIGN, BOQ, COMPARISONS, ECONOMIC ANALYSIS.

- COST ESTIMATE, TIMELINES
SNC-LAVALIN ENTRUSTED FEASIBILITY STUDY REPORT FOR EVACUATION OF 2500-3000 MW IMPORTED COAL POWER GENERATION AT KARACHI TO NORTH REGIONS (2011)

DUE TO UNCERTAINTY OF IMPORTED COAL, FEASIBILITY STUDY SCOPE CHANGED TO TRANSMISSION PROJECT FOR LARGE COAL POWER GENERATION POTENTIAL AT THAR

DRAFT FEASIBILITY STUDY SUBMITTED IN JULY 2012

REVIEWED BY NTDC, GAVE COMMENTS JANUARY 2013.

SUBMITTED FINAL FEASIBILITY REPORT MARCH – 2013.
FEASIBILITY STUDY - SCHEME OF PREPARATION

- **PHASE – I:**
  - CONCEPTUAL PLANNING / DESIGN STUDY
  - SYSTEM STUDIES
  - SELECTION OF TECHNOLOGY & VOLTAGE
  - PRELIMINARY SURVEY / INITIAL ENVIRONMENTAL STUDY ETC

- **PHASE – II:**
  - PROJECT SPECIFIC DETAILED SYSTEM STUDIES FOR SELECTED TRANSMISSION OPTION
    - DETAILED SYSTEM STABILITY ANALYSIS PROPOSE MEASURES: NEW LINKS SYSTEM BEHAVIOUR, REACTIVE POWER COMPENSATION.
    - COSTING, EIA, LARP, IPSA
    - DESIGN, FUNCTIONAL SPECS
ALTERNATIVES EVALUATED BY SNC-LAVALIN

- 500 KV AC
- MIX OF 500KV & 765KV AC
- MIX OF 500KV AC AND ± 600 KV DC
- THE MOST FEASIBLE OPTION BASED ON TECHNO-ECONOMIC ANALYSIS

- 500KV AC FROM THAR TO MATIARI, AND
- ± 600KV DC FROM THAR TO LAHORE
CONCLUSIONS / RECOMMENDATION BY SNC – LAVALIN CANADA

- FOCUSED ULTIMATE SPOT YEAR OF STUDY 2030
- CONSTRUCTION OF TOO MUCH 500 KV AC LINES UNDERSCORED DUE TO HIGHER COST, MORE LOSSES, CORRIDORS LIMITATIONS AND OTHER ADMINISTRATIVE.
- RECOMMENDED MIX OF 500 KV AC AND ±600 KV DC FOR DEVELOPMENT OF COAL POWER GENERATION AT THAR.
- 500 KV D/C FROM THAR TO MATIARI
- ±600 KV DC THAR TO 500 KV LAHORE (SOUTH)
UPCOMING POWER GENERATION IN SOUTH – PRESENT SCENARIO

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>THAR COAL FIRED PROJECT</td>
<td>660</td>
</tr>
<tr>
<td>BIN QASIM IMPORTED COAL POWER PLANT</td>
<td>1320</td>
</tr>
<tr>
<td>SSRL THAR COAL POWER PLANT</td>
<td>1320</td>
</tr>
<tr>
<td>HUBCO COAL FIRED POWER PROJECT</td>
<td>1320</td>
</tr>
<tr>
<td>SIDDIQUE SONS COAL POWER PLANT</td>
<td>330</td>
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Contd.
UPCOMING POWER PLANTS IN SOUTH - PRESENT SCENARIO

LUCKY POWER PROJECT (PORT QASIM) 660 MW
JAMSHORO (COAL FIRED) POWER PLANT 1320 MW
K-2 COASTAL AREA KARACHI 1100 MW
K-3 COASTAL AREA KARACHI 1100 MW

TOTAL CAPACITY: 9130 MW
GOP TRANSMISSION POLICY – 2015

- CPEC PROJECTS
  - PRIORITY PROJECTS
  - ACTIVELY PROMOTED PROJECTS.

- DEVELOPMENT OF TWO TRANSMISSION PROJECTS FOR EVACUATION OF POWER GENERATION IN SOUTH

- ±660 KV HVDC MATIARI – LAHORE PROJECT
- ±660 KV HVDC PORT QASIM – FAISALABAD PROJECT
• ± 660 kV HVDC Bipole T/Line from Matiari to Lahore (about 870 KM).

• HVDC Converter & Switching Control Stations at Matiari & Lahore

• Transmission capability of Power - 4000 MW
CONVERTER STATION LOCATIONS

• CONVERTOR STATION MATIARI SITE – NATIONAL HIGHWAY, ABOUT 8 KM NORTH MATIARI VILLAGE SIAKHART.

• CONVERTOR STATION LAHORE – PHOOL NAGAR MORE KHUNDA ROAD 4 KM WEST HEAD BALLOKI VILLAGE WAIZIR, ABOUT 60 KM TO LAHORE.
- ABOUT 870 KM

- IN SINDH PROVINCE, PASSES THROUGH DISTRICTS OF MATIARI, SANGHAR, KHAIRPUR, SUKKUR, GHOTKI (ABOUT 320 KM)

- IN PUNJAB PROVINCE, PASSES THROUGH DISTRICTS OF RAHIM YAR KHAN, BAHAWALPUR, BAHAWAL NAGAR, PAK PATTAN, OKARA, KASUR, NANKANA (ABOUT 550 KM).
INTEGRATED TRANSMISSION SCHEME FOR DISPERSAL OF POWER FROM COAL BASED POWER PLANTS IN SOUTH
INTERCONNECTION SCHEME AT MATIARI
INTERCONNECTION SCHEME AT LAHORE
PROJECT FEASIBILITY REPORTS

- LOAD FLOW STUDY
- SYSTEM STABILITY ANALYSIS REPORT
- GENERAL REPORT
- TECHNICAL SPECIFICATION
- EPC COST
- UPFRONT TARIFF STRUCTURE
As per Cooperation Agreement Between State Grid China and NTDC (20.04.2015):

• Feasibility study to be finalized by SGCC/CET upto end of July, 2015
• Design completed upto December, 2015
• Construction period 24 months after design finalized
Abdur Razzaq Cheema
Ex-GM GSC/Consultant

Anjum Aziz
Manager (GSC)

Tariq Shafi
Manager (EHV-I)

Muhammad Shabbir
Dy. GM Finance (WPPO)

Team Leader
Coordinator
Progress Monitoring
Commercial Team Leader
IMPLEMENTATION TEAM

- Chief Engineer (EHV-I) Lahore
- Chief Engineer (EHV-II) Hyderabad
- Chief Engineer (WPPO)
- Manager Environment NTDC
- Chief Security Officer NTDC
- Finance Director NTDC
- Legal Advisor NTDC
- Project Manager NESPAK
• Issues of system stability with proposed induction of HVDC Transmission Scheme.
• Protection & Control
• Telecom / SCADA
• System losses (Permissible / Recommended)
• Standards / controlling specifications adopted internationally dealing with:
  • Availability of System
  • Noise level / ROW
• Sending End / Receiving End System Topology
• Central Control Mechanism at NPCC for System Stability
• Lenders’ concern-Insurance of T/Line Section
Thank you!