STATUS OF NEPAL CROSS-BORDER INTERCONNECTION WITH INDIA AND EXPECTED BENEFITS

SOUTH ASIA REGIONAL WORKSHOP ON COMPETITIVE ELECTRICITY MARKETS – DESIGN, IMPLEMENTATION AND BENEFITS

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Outline of the Presentation

- Cross-border Nepal-India – existing transmission lines
- Nepalese power sector- proliferation of Private sector pushing towards operational modality of a Market
- Seasonal Surplus of Power in Nepal – necessitating power trade
- Recent Initiative by NEA – Purchasing Winter energy from Export Projects
- Understanding Indian Market for Power Export
- Nepal-India 400 kV transmission line – current status
- Long term Vision – Energy sufficiency and security for the region
NEPAL-INDIA EXISTING INTERCONNECTIONS

- 33 kV level – Radial connections at 14 points along the southern border districts of Nepal
  - Supplied by state electricity companies (holding companies) – appx. 50 MW

- 132 kV level – Radial connections at 3 points at East (Duhabi), Middle (Gandak) and West (Tanakpur)
  - Supply by State electricity companies and Power Trading Company (PTC) – appx. 130 MW
POWER DEVELOPMENT MAP OF NEPAL

EXISTING & UNDER CONSTRUCTION POWER STATIONS & TRANSMISSION LINES/ SUBSTATIONS

(Revised date: JULY 2013)  
(NOT TO SCALE)

CHINA

INDIA

LEGENDS

NEPAL ELECTRICITY AUTHORITY
GRID DEVELOPMENT
TRANSMISSION LINE CONSTRUCTION DEPARTMENT

Prepared by: Dr. Manajit Gajjar Shresthe
One third of the Capacity is Private-owned, More power plants in Private (35 nos.) than NEA (public utility)
Proliferation of Private Sector in Hydro Power Generation in Nepal

- 1999 till 2006 – 12 IPPs with total capacity of 168.5 MW
  - Major contribution by 2 IPPs with International investors totalling 104 MW

- After 2006 till 2009 (3 years) – 9 IPPs with total 13.1 MW capacity
  - All are small IPPs with national equity and lending sources

- From 2010-2013 (4 years) - 14 IPPs with total 64.8 MW capacity
  - All are small IPPs with national equity and lending sources
Proliferation of Private Sector in Hydro Power Generation in Nepal

- In **2014** - 44 nos of IPPs with total capacity of **221 MW** are slated to come online
  - Some may be aborted, some may be delayed by a year. But there is definite acceleration in generation.
- In **2015** – 27 nos. of IPPs with total of **268 MW** capacity planned for commercial operation –
  - Many may be delayed due to transmission line delays
- In **2016** – 15 nos. of IPPS with total of **691.3 MW** capacity lined up for commercial operation
  - Possible Delays – financial closure and not enough equity
- In **2017** – 18 nos of IPPs with **346 MW** - More PPAs are in line. The total capacity-on-line will increase.
- **Scenario** – Private sector capacity is increasing – Larger projects but lesser number of developers
Private sector in hydropower generation

- Hopes
  - Sufficient maturity and understanding of the sector by the Investors
    - Financial processes consolidated
    - Various instruments of capital available – Bonds, Debentures, Special Funds created for investment.
    - Special Purpose banks for long-term loans - HIDCL
  - High Public trust – Recent hydropower company IPO --90 times oversubscribed
  - Technical maturity
  - Manageable Local/ community issues
Private sector in hydropower generation

- **Despairs**
  - Tariff not in step with Inflation, Rate of return is low, Most projects have cost overruns and time overruns
  - No pass-through of costs to consumers – So Purchase tariff by NEA is also tethered
  - PPA in dollar/convertible currency – poses the USUAL problems – Who bears Risks?
  - Regulations need to be simplified – Different govt. entities – forestry, environment, tax office, customs, licensing and PDA etc.
Next Issue - Seasonal Surplus of Clean Energy from Private Sector

- By 2016 end –
  - New IPPs with 1200 MW are slated for operation
    - If 25% casualty is assumed, still 900 MW will be available.
    - Nepal Electricity Authority will add 104 MW
    - Existing capacity of 720 (hydro) MW
  - Total Nepal System capacity in Wet season (Peak Generating capacity) – 1720 MW
  - Change of status by 2016 end/ 2017 wet season allowing 1 year delay (FY 2016/17)
    - from net Deficit to Surplus in Wet season (>500 MW)
## Capacity scenario – Post 2015
## Wet season – (May – November)

<table>
<thead>
<tr>
<th>FY</th>
<th>Generation (MW)</th>
<th>Import from India (MW)</th>
<th>Load (MW) w/o trans loss</th>
<th>Surplus Power (MW)</th>
<th>Load (MW)</th>
<th>Surplus Power (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015-16</td>
<td>1278</td>
<td>150 (Peak)</td>
<td>1400</td>
<td>0</td>
<td>700</td>
<td>530</td>
</tr>
<tr>
<td>2016-17</td>
<td>1710</td>
<td>None</td>
<td>1530</td>
<td>129</td>
<td>800</td>
<td>900</td>
</tr>
<tr>
<td>2017-18</td>
<td>1926</td>
<td>None</td>
<td>1748</td>
<td>116</td>
<td>900</td>
<td>1000</td>
</tr>
</tbody>
</table>
Daily Load Curve – Peak and Base Load variation

System Load Curve of Peak Load Day
November 13, 2012 Tuesday

Peak Load 1094.62 MW at 18.05 hr

Graph showing daily load curve with peak load of 1094.62 MW at 18.05 hours on November 13, 2012 Tuesday.
## Capacity scenario – Post 2015

**Dry season – (December – April)**

<table>
<thead>
<tr>
<th>FY</th>
<th>Generation (MW)</th>
<th>Import from India (MW)</th>
<th>Load (MW) w/o trans. Loss</th>
<th>Load Shedding (MW)</th>
<th>Load (MW) w/o Trans loss</th>
<th>Surplus</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015-16</td>
<td>&lt;970</td>
<td>150 (Peak 6 hours)</td>
<td>1398</td>
<td>300</td>
<td>700</td>
<td>250</td>
</tr>
<tr>
<td>2016-17</td>
<td>&lt;1418</td>
<td>150 (Peak 6 hours)</td>
<td>1531</td>
<td>60</td>
<td>800</td>
<td>550</td>
</tr>
<tr>
<td>2017-18</td>
<td>&lt;1594</td>
<td>150 (Peak 6 hours)</td>
<td>1702</td>
<td>100</td>
<td>920</td>
<td>600</td>
</tr>
</tbody>
</table>

Access to Market and Trading will remove Load Shedding, and contribute to Clean Energy for the Region.
Himalayan River based ROR/PROR type projects and
Need for Electricity Market integration

Capacity curve for Projects designed at Q40 exceedence
Recent Initiative by NEA – Purchasing Dry/ Winter Energy from Export projects

- Bidding notice was published (February 2014) for supplying energy for only 5 months (mid Dec – mid May)
- Energy to be delivered from 2020.
- Ceiling price NRs 10.60/unit (INR 6.625) without any escalation.
- No contract period specified.
- No convertible currency, currency risk born by the seller.
- Wet energy (7 months) – no obligations of NEA, the Project to evacuate power to India/Region on its own.
- Support the system as a Virtual annual Reservoir.
Recent Initiative by NEA – Purchasing Dry / Winter Energy from Export projects

- 5 projects offered their energy – total capacity 1680 MW
- Total Energy in 5 months – apx. 1975 GWH (averaging 550MW dry capacity)
- 2 projects in the West of Nepal – connecting to Kohalpur s/s at 400 kV
- 2 projects in the central Nepal – connecting to the 220 kV Marsyangdi corridor s/s
- 1 project in the eastern Nepal connecting to the Dhalkebar s/s 220kV
- All project offering to complete within 2020 and prices within NRs 10.60/unit
- Further negotiation and discussions regarding project feasibility, reliability, terms of sale going on.
WHAT IT ALL MEANS -> REGIONAL MARKET FOR ELECTRICITY

- Long term PPA with IPPs – required by Banks
- Creates for NEA an obligation to pay due to Take-or-Pay conditions
- Differential tariff
  - Dry season - Rs 8.40 with 3% x 5 times escalation till Rs 9.66 / unit
  - Wet season - Rs 4.80 till Rs 5.52
    - = > IRs. 3.00 till IRs.3.45
- Wet season energy export at lower rate is paid for by higher tariff of domestic dry season energy
- Still the Indian Market is priced low for export

- Long term contract for Seasonal energy blocks – 6 months Firm power – Instrument to be designed? Explore Indian Market ??
- Alternative for Nepal summer energy – Isolate certain systems and supply to Tibet/China – Not feasible, load centers are distant (>300-500km tr line for seasonal energy – not economic)
Understanding Indian Energy Market for Export potential

- Short Term Energy Market
  - Exchanges markets – day-ahead and short-term prices
  - Licensed Traders – PTC, Global Energy etc.
  - Unscheduled Interchange (UI) as a balancing market
  - Bilateral power transactions directly with DISCOMS/Producers

- Volume of trade is about 11% of total load and increasing.

- Traders and Exchanges – more than 60% of that pie.
Understanding Indian Energy Market for Export potential – Short Term

- Short Term Energy Market
  - Not suitable for off-loading seasonal energy from Long term PPAs
  - Not suitable for Export-oriented IPPs, as the Project will not be Bankable

- IPPs can not build upon this market - Banks not yet ready for Merchant Projects.

- Short Term Prices decreased from 2008-2011
- Then stabilised at around INR 4.3 for Traders and INR 3.6 for Exchanges
- (reference Report on Short term power markets in India 2012- 2013)
Understanding Energy Market for Export potential – Long Term

- Long term – via Traders and Bilateral transactions
- Case I and II bidding by central/state electricity companies
  - Prices varied according to source
  - Average INR 1.19 to 4.28 / kwh for lignite/coal based stations
  - Average between INR 0.77 to INR 5.9 / kwh for hydro stations
  - Long term prices – INR 2.345 – INR 3.324
  - Medium term – INR 4.1 – INR 4.85
- Medium term prices normally higher
- Medium term Bilateral Transactions with neighboring State companies and through PTC to rest of the market – is it the way to go?
- Welcome Signals - Recent removal of Restriction of Import upon electricity
- More signals sought – participating in the market eg. In the bidding for Long term energy.
Energy markets of India and Nepal – made for each other

- Indian market – 25% Hydro, 5% nuclear, 10% gas, predominantly coal (total 170,000MW installed, about 120,000MW delivered)
  - Coal prices are rising, coal is getting deeper, low quality, causing more imports. Not sufficient coal mining
  - Thermal power plants down-time is high, requiring longer period of maintenance shutdowns

- Indian peak load in summer appx.112,000 MW in 2013 in summer and appx.102,000 MW in winter, with a difference of 10,000 MW
  - Indian Hydro-power stations – lower productions during winter.
  - Still room for shutting down more thermal stations in summer using neighbor’s hydropower.
  - Export from Nepal will allow that much thermal stations – for maintenance shutdowns.

- **Medium Term contracts** may be best suited for this exchange arrangement?

- Helps to **bring down the higher prices of energy in India in summer**
Nepal-India Cross-border transmission line - necessary step towards a regional electricity market

Three CBTL are under consideration –

- **400 kV DC Dhalkebar – Muzaffarpur**
- **400 kV DC (Butwal / Bardghat) – southwards (Gorakhpur)**
- **400 kV DC (Kolahpur) – southwards (Bareilly)**

Two more lines in the East / planned
- **400 kV DC trunk line East-West under construction**

**One CBTL is under construction**
- **400 kV DC from Dhalkebar (Nepal) to Muzaffarpur (India)**
- Features – 40 km in Nepal, 100 km in India
- Double Circuit Twin-conductor, Moose
- Initially to be charged at 220 kV

**Further CBTL as transaction increases**
Dhalkebar-Muzaffarpur 400kV CBTL

Two JVC created for two sides of the line

- Crossborder Power Transmission Company (CPTC) – India side
- The JV companies shall develop, own, operate and maintain the CBTL of respective sides.

PTCN shareholding
• NEA: 50%
• Power Grid India: 26%
• HIDCL 14%
• IEDCL India: 10%

CPTC shareholding
• Power Grid India: 26%
• SJVNL: 26%
• NEA: 10%
• IL&FS India: 38%
NEA signed **PSA** with PTC (India) for **150 MW for 25 years** – that made the CBTL financial closure (**December 2011**)

NEA signed **ITSA** with both PTCN and CPTC (**December 2011**)

**NEA** has booked full transmission capacity of the lines, and shall pay the **TSC**

**NEA** can contract with IPPs in Nepal / India and PTC for export/import using the transmission capacity
Under PSA, the Delivery Date – 2015 June 12th (Not later) take or pay or resell

- The Nepalese grid – substation, and transmission lines should be ready
- The Indian side (Muzaffarpur line bays are assumed as ready)
- The Line will be initially charged at 220 kV.
- At Dhalkebar (Nepal), 220/132/33 kV substation is under construction to evacuate the power to rest of national grid.
PTCN – contract signed for transmission lines (40 km) – 19 December 2013 - Completion Period – 16 months
  ● Contractor - Tata Projects Limited
  ● Probable Operational date - **May 2015**

CPTC – contract signed (100 km ) – 4 February 2014
  ○ Completion period 16 months
  ○ Probable Operational date – **May 2015**
Dhalkebar-Muzaffarpur 400kV CBTL

Progress

- **Route survey** completed
- **EIA** of the line completed
- Consultant – approved Tower profile, Check Survey of the line
- **Land Acquisition** – 11 hectares- planned to complete this FY
- If **no community disturbance** – operational in May 2015

- Necessary work in Nepal for evacuation -
- Duhabi-Dhalkebar-Hetauda 220 kv line and substation project
- Substation with 220/132/33 kV transformer at Dhalkebar
Duhabi -Dhalkebar- Hetauda 220 kV Nepal Grid

- Project finance from World Bank
- Survey, EIA, Design completed
- Tr Line Tender floated, under evaluation.
- Completion Period 19 months. (by 2015 end)

Substation project need to be completed earlier
- 220/132/33 kV Transformer tender floated

- Khimti-Dhalke 220 kV line – almost complete, but charge at 132 kV
- 220/132 kV substation – probable delays

- All of above works must be in place by 2015 end for full utilization of the CBTL
Nepal Experiences with Indian power grid / market

- Exchanges – From State Electricity companies (Bihar) (Kataiya and Balmikinagar)
- Bulk Consumer (Bihar, UP) w/o capacity charges
- RTC trading contracts (from PTC) - Tanakpur
- PSA (from PTC) – Muzaffarpur/Dhalkebar, also from Tanakpur if required. *And from other points along border if Open access / deregulation reaches to State / distribution levels*

**NEXT**

- Reverse roles at CBTL – Export to India (still as two grids with a Tie-line)
- Interspersing the Grid – feeding some area from Nepal, and some area in Nepal from India as usual avoiding Loop flows.
- Nepalese grid supplying to border areas using existing 132 kV lines –
  - Define transmission charges within NEA Grid – need for regulations
  - To Operate as a single market, through a distribution company?
  - **When Retail sale of power through the market is realized in India, Nepalese and Indian power system may be truly integrated in one market.**
LONG TERM VISION – ENERGY SUFFICIENCY AND SECURITY for THE REGION

- The Key – Regional Electricity Market and access to the Market
- G-to-G Power Trade agreements, and Regional (SAARC) Power Trade Agreements
- Uniformity of Grid Code – harmonization for synchronous operation – single Grid
- Policy in Transmission charges for export to third country - Transmission pricing, Point of connection or Nodal pricing?
LONG TERM VISION – ENERGY SUFFICIENCY AND SECURITY for THE REGION

- Nepal power sector – ready for unbundling
- Legislation to that effect (unbundling and a regulatory commission) is waiting in the parliament, and its passage has been promised by the parties to the government.

- Indian CEA, CERC and PGC should take lead to formulate Regional Grid operation, Grid code, Pool operation, and fill in regulatory gaps in the nations,

- Lead the region towards a Market Formation, market clearing and financial arrangements – and allow a mix of the regional energy sources to ensure energy sufficiency for the region, efficient energy economy, and thereby, Sustainable Energy Security for itself and South Asia

- (All roads lead to Rome, so they said then. Here and now in electricity, it leads to Delhi)
Towards a Regional Electricity Market

Every Journey began with a single step!
Good bye! See you in the Market!!