Regional Power Market – Challenges and Opportunities from Nepalese perspective

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Outline of the Presentation

1. Energy sector of Nepal and market readiness
2. Challenges of entry to Indian market
3. Challenges and Opportunities for the stakeholders - bilateral and regional
4. Market evolution – Road Ahead
Electricity in Nepal

- Biomass: 87%
- Petroleum: 9%
- Coal: 3%
- Renewable, other: 1%

Electricity makeup: 2%
Status: Consumption kWh/Capita 2010

Key World Energy Statistics, IEA 2012

China: 2942
India: 644
Pakistan: 457
Sri Lanka: 445
Bhutan: 322
Bangladesh: 279
Nepal: 100
SA Avg.: 530
Load Forecast and Surplus / Deficit scenario
### Nepal Power System at a Glance

#### Load Forecast, Generation Plan and Balance

**Dry Season (2014)**
- Shortage during Peak and Short in Base Load (620MW)
- Gen ~ 500 MW at off-peak

**Wet Season (2014)**
- Surplus in Peak and Surplus in Base Load (620MW)
- Gen ~ 630 MW at off-peak

#### Yearly Load and Generation Data

<table>
<thead>
<tr>
<th>Year</th>
<th>Dry Season, MW</th>
<th>Wet Season, MW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gen</td>
<td>Peak</td>
</tr>
<tr>
<td>2013/14</td>
<td>641</td>
<td>1242</td>
</tr>
<tr>
<td>2014/15</td>
<td>665</td>
<td>1357</td>
</tr>
<tr>
<td>2015/16</td>
<td>940</td>
<td>1480</td>
</tr>
<tr>
<td>2016/17</td>
<td>1001</td>
<td>1612</td>
</tr>
<tr>
<td>2017/18</td>
<td>1694</td>
<td>1742</td>
</tr>
<tr>
<td>2018/19</td>
<td>1807</td>
<td>1880</td>
</tr>
</tbody>
</table>

**Dry Season (2017)**
- Shortage during Peak (48MW) and Surplus in Base Load (900MW)
- Gen ~1400 MW at off-peak

**Wet Season (2017)**
- Surplus in Peak and Large Surplus in Base Load
Himalayan River based ROR/PROR type projects and Electricity Market integration

Annual variation and adjustment

Export – 6 months

Import

Scenario >> Export = Import, Net zero
System adjustments in Nepal

1. Export RTC energy blocs during summer (6-8 months)

2. Adjust daily load variations from Exchange market and short term trading and Construct Reservoirs (and Thermal in Nepal?)
   - Need transport systems (Railway) and storage
   - Get secured/safe coal supply – Marginal costs increase.

Option -1 For winter, Purchase from Thermal power plants
- > Purchase from thermal plants in India – Capacity charges and Fixed O&M costs will be double, but fuel costs will be low

Option-2
- > Invest in thermal plants in India – incurring double of the capacity charges, operating only for six months – but fuel costs can be reduced by buying and transporting cheap and storing

If a Regional PTA happens and allows to invest in and purchase from Indian power plants or JV, costs will reduce =>>

Market efficiency will increase
A Market Need for repackaging the products

- **Short-Term RTC (bilateral)** -> Short Term 18 hour (Off-Peak) energy contracts

- **Medium Term** -> RTC 6-8 months contracts for 3 years

- **Long Term** -> RTC 6-8 months contract for 25 years *(while paying for annual open access charges)*

- **Trade-off** -> Cheaper energy deals for the region.
POWER DEVELOPMENT MAP OF NEPAL

EXISTING & UNDER CONSTRUCTION POWER STATIONS & TRANSMISSION LINES/ SUBSTATIONS
(Revised date: JULY 2013)
(NOT TO SCALE)
Energy Sector
Institutional Scenario and Readiness
Institutional Capacity in Nepal – existing institutions in energy sector

- **Policy Level**
  - Ministry of Energy
  - National Planning Commission
  - Water and Energy Commission

- **Regulatory Level**
  - Electricity Tariff Fixation Commission

- **Implementation Level**
  - Department of Electricity Development - DOED

- **Operation Level**
  - Nepal Electricity Authority
  - Independent Power Producers
Power Sector Reform required for Regional Market

Policy Level
- Ministry of Energy
- National Planning Commission
- Water and Energy Commission

Regulatory Level
- National Electricity Regulatory Commission
- Regional Electricity Coordinator – Regulator – Arbitrator

Implementation Level
- Department of Electricity Development - DOED
- Several Distribution companies
- CB Power Transmission cos.

Operation Level
- Nepal Electricity Holding Company
- National Transmission Authority/System Operator
- NEA - Generation SPVs
- Power Trading Company & Market Operators
- Independent Power Producers

Neutral Trader - Energy Brokerage

Water and Energy Commission

Power Trading Company & Market Operators
- India
- Bangladesh/ Bhutan/ Sri Lanka etc
Status Quo – Policy in Energy sector in Nepal

- **Water Resources Strategy, 2002**
  - 22,030 MW (including substantial portion for export) generation capacity by 2027 A.D

- **National Water Plan, 2005**
  - Investment (Government 30% and private sector 70%)
  - Implementing “one window mechanism” for private sector involvement

- **The Hydropower Development Policy, 2001**

- **Ten Year Hydropower Development Plan, 2008**
  - Storage type and Runoff type Hydropower Projects combination ratio 60:40

- **Twenty Year Hydropower Development Plan, 2066 BS**
Policy changes in Draft stage

- Draft National Energy Strategy

<table>
<thead>
<tr>
<th>Particulars</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity (MW)</td>
<td>984</td>
<td>1,579</td>
<td>2,773</td>
<td>5,620</td>
<td>11,480</td>
</tr>
</tbody>
</table>

- Draft Energy Vision 2050

<table>
<thead>
<tr>
<th>Particulars</th>
<th>2010</th>
<th>2015</th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity (MW) grid connected</td>
<td>1,258</td>
<td>2,318</td>
<td>4,000</td>
<td>6,720</td>
<td>11,317</td>
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<tr>
<td>Total Capacity (MW)</td>
<td>1,272</td>
<td>2,347</td>
<td>4,061</td>
<td>6,849</td>
<td>11,536</td>
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</tbody>
</table>

- In Parliamentary committees
- Electricity Bill
- Nepal Electricity Regulation Commission Bill
- AlsoRequired – Amendment to Nepal Electricity Authority Act
Regional Market Entry Challenges for Nepal
Role of NEA in creating Power Markets and Market Intermediaries

1. NEA to act as the Accumulator and Pooling of small to medium hydro-power projects.
2. NEA to provide long term PPA for those projects which can not go online with merchant / market price risks and assurances – purchasing Q40 or Q50 energy.
3. The mixture of long-term PPA and merchant energy can provide a good formula for developers to find Optimum size – Q25 or Q40 or PROR ??
4. NEA to act as wheeler - Large consumers can benefit from low prices in the market.

2/8/2016
NEA to act as the Pool for Excess Energy from Domestic and Small Projects – 2014/15

- Total PPA obligations of NEA– 2030 MW capacity and increasing
- Further PPA can be handled separately by a separate Power Trading Company (NPTC ?) or continue with NEA
- NEA acting as the buffer/storage for daily and seasonal variation (wholesale trade) of all small/medium projects and ROR.
- Questions --
  - NEA needs to discover the price for the Excess energy
  - Following such price prediction, then enter into PPA with tariff according to the market
1. NEA to deal with
   - a separate Power Trading Company in Nepal or in India / Region (trading OTC) and
   - participating in IEX etc/Regional Exchange

2. A broker for Cross-border Exchange / OTC deals?

What is required / Expected from the Regional Market (for now the Indian Market)?

Ensure
   - Best Price – Fair price – competition and price discovery (not High – not Low)
   - Easy access – to procure, to pay or get paid and
Energy Sector Nepal – Road Ahead

To do List -

- Transmission pricing – Wheeling charges yet to be fixed
- Access rights to transmission—physical & financial
- Congestion Management - Cross Border and internal
- Regionally Compatible Grid Code Enforcement
- Emergency Procedures etc. due to Synchronous link
Energy Sector Nepal – Road Ahead

Markets – To do List

▪ Establishment of Balancing Markets and Spot / Day Ahead Market (Exchange)

▪ National Regulations for
  ▪ Billing and Settlements
  ▪ Dispute Resolution
  ▪ Counterparty Rules and settlement processes
  ▪ Etc.

▪ Start small and meet the achievable goals

▪ Build on rather than retreat from impact
Negative Externalities of Energy Market Integration

- Consumer Energy Price – tends to find a regional balance
- Power system discipline – tends to affect instability and recovery process
Energy TARIFF – Will it find its level? At whose cost?

- Cross Country Tariff Rates in South Asia (US cents per KWh) in 2010/11

<table>
<thead>
<tr>
<th></th>
<th>Nepal</th>
<th>India</th>
<th>Pakistan</th>
<th>Bangladesh</th>
<th>Sri Lanka</th>
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<td>Domestic Consumer</td>
<td></td>
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<tr>
<td>Tariff</td>
<td>0-20 kWh: 5.6</td>
<td>0-200 kWh: 5.5</td>
<td>0-50 kWh: 2.2</td>
<td>0-100 kWh: 3.3</td>
<td>0-30 kWh: 2.7</td>
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<tr>
<td></td>
<td>21-250: 10.3</td>
<td>201-400: 8.8</td>
<td>0-100: 5.1</td>
<td>101-400: 4.2</td>
<td>31-60: 4.3</td>
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<tr>
<td></td>
<td>&gt;250: 13.9</td>
<td>&gt;400: 10.4</td>
<td>101-300: 7.6</td>
<td>&gt;400: 7.0</td>
<td>61-90: 6.8</td>
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<td></td>
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<td>301-700: 12.4</td>
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<td>91-120: 19.1</td>
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<tr>
<td></td>
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<td></td>
<td>&gt;700: 15.4</td>
<td></td>
<td>121-180: 21.8</td>
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<td>10.3</td>
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<td>3.5</td>
<td>6.2</td>
<td>2.6</td>
<td>13.6</td>
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</table>

Source: Websites of Ministry of Power, India; Nepal Electricity Authority, Nepal; Bangladesh Power Development Board; Ceylon Electricity Board; Sri Lanka and Pakistan Economic Survey, 2010-11; Bergner (2012)

Electricity Tariff – very large differences –

What will be the effect on the Energy cost and consequent consumer tariff of India and Nepal and when both Governments reduce the subsidy to Utilities?
Purchase price of energy from IPP Nepal

Average purchase price from IPP (2012/13)—NRs 6.9/unit (IRs 4.42/kwh)

- Major contributor to high price is Khimti and Bhotekoshi having PPA in $ with escalation for the full term
- Other $ PPAs
  - Upper Marsyangdi (50MW) – NRs 6.893 = IRs 4.3/kwh (assuming 100NRs= 1$, on 2015) – Limited escalation period
  - Lower Solu (82W) - NRs 5.38 = IRs 3.4/ kwh (assuming 100NRs=1$) Limited escalation period
  - Kabeli (37.6MW)- NRs 5.34 = IRs 3.4/kwh (assuming 100Rs=1$) Limited escalation period

- Adding transmission and trade charges, NEA will face losses unless energy prices go up in the Indian market. But still it is better than to spill the wet season energy
Regional Market
Challenge and Opportunity for India
- the Market Leader
Regional Optimization resulting from Grid and Market integration

1. **Better Energy Mix** –
   - **Security** and redistribution of individual technology uncertainties – coal, hydrology, solar, wind etc..
   - **Carbon reduction** from clean energy mix

2. **Generation cost optimization**, savings in investment/capital and lowest hanging fruits first regionally

3. **Transmission optimization** – resulting in economic generation, reserve capacity optimization

Nations can decide to subsidize/- invest in infrastructure etc – in return for long term returns to the state (esp. hydro-power) – & make projects financially **viable**
Regional Market optimization – Challenges and Road Ahead

- Enable **fair pricing** and rationalizing of price and supply across the borders -
  - Provide price **transparency** to **support long term contracts**
  - Assurance of market and price stability, and real price **discovery** for both buyers and sellers –
  - In Exchange - No **phantom** bidding and no capacity **withholding**.
    - *When price is not fair, large consumers abstain, which brings the price low – such behavior does not help investors’ trust in the price signals*

No subsidy and tariff-restrictions, and no market restriction

**Clean Energy Premium - Agree to a** Better market design for Hydropower-investment - eg. To cover hydrology risks – capacity payment, firm and secondary energy prices, Reserve capacity prices?
Market Design Issues as Regional Market evolution – The Leader to evolve

- Accept more participation in future market modelling and instrument designs from partner countries
  - Alternative **transmission pricing** - **financial vs. physical rights**, better congestion management methods, Nodal pricing? Regional Pool – operation
  - Reserve Capacity pricing ?? !!
  - VAR pricing ?? !!
  - Balancing market – UI evolution to ?? !!
  - Bilateral trading – OTC trading Neutral Broker
  - Evolution of Exchange over Short term trading
  - Dollar payment? Or Indian Rupees payment (as long as NRs is pegged to INR)

- Cross-border regulatory regime to evolve as **synchronous** operation evolves
Cross-border Energy Broker or Exchange

Broker
- IPPs can not build upon present short-term market for wet season energy (hydro)- Banks not yet ready for Merchant Projects.
  - Packaging and marketing of the 6-8 months RTC energy
Exchange
- Exchange is required on other sides?
  - Price differences on both exchanges should be zero if enough Tr. capacity is available- otherwise there will be some

✓ Presently, participating through the Indian Power exchange is the entry point- the beginning
✓ With such participation, NEA hopes to have a reliable base to offer better price to more PPAs and IPPs.
Thank You!!!