HYDROPOWER DEVELOPMENT AND REGIONAL INTEGRATION FOR NEPAL

DR. XIAOPING WANG, ENERGY PROGRAM LEAD FOR NEPAL, THE WORLD BANK

MAY 2018
World Bank Group Engagement in Hydropower

Where we are today

- 15 years of dam-related projects (approved FY04-17)
- 322 projects in ~90 countries
- Project costs US$72 billion
- Bank Commitments >US$38 billion

Where we want to be tomorrow

- Integration of renewables
  - Integration of solar and wind backed up by hydro storage
- Large range of low-carbon capacity available
  - From kW to Gw in a single project
  - Option to export electricity in regional grids
- Operational flexibility and efficiency
  - Fast startup and shut-down
  - Highly efficient and adjustable output
  - Part of resilient power systems
- Storage and back-up
  - Rapid availability and ancillary services
  - Option to absorb surplus (pumped storage)
- Multiple freshwater services
  - Water supply, irrigation, navigation, tourism
  - Climate change adaptation (flood and drought management)
  - Safe dams that are part of an integrated river basin systems
  - Rehabilitation of dams for safety, reliability and storage
  - Addition of hydroelectricity in existing dams
  - Extending the life of reservoirs: sustainable sediment management practices
Electricity Supply in Nepal: Past
## Electricity Supply in Nepal: Future Projection

<table>
<thead>
<tr>
<th></th>
<th>FY18</th>
<th>FY19</th>
<th>FY20</th>
<th>FY21</th>
<th>FY22</th>
<th>FY23</th>
<th>FY24</th>
<th>FY25</th>
<th>FY26</th>
<th>FY27</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy Generation (NEA+IPP)</strong></td>
<td>4564</td>
<td>7344</td>
<td>11590</td>
<td>14652</td>
<td>19595</td>
<td>22389</td>
<td>25681</td>
<td>29517</td>
<td>31007</td>
<td>39680</td>
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<tr>
<td><strong>Import</strong></td>
<td>2505</td>
<td>1283</td>
<td>184</td>
<td>159</td>
<td>130</td>
<td>125</td>
<td>121</td>
<td>109</td>
<td>120</td>
<td>12</td>
</tr>
<tr>
<td><strong>Energy Deficit/Import</strong></td>
<td>153</td>
<td>461</td>
<td>330</td>
<td>423</td>
<td>373</td>
<td>309</td>
<td>303</td>
<td>268</td>
<td>293</td>
<td>27</td>
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<tr>
<td><strong>Energy Available</strong></td>
<td>7392</td>
<td>8938</td>
<td>12709</td>
<td>15885</td>
<td>20600</td>
<td>23415</td>
<td>26633</td>
<td>30362</td>
<td>32227</td>
<td>39720</td>
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<tr>
<td><strong>Energy Surplus/Export</strong></td>
<td>0</td>
<td>548</td>
<td>2571</td>
<td>3868</td>
<td>6649</td>
<td>8083</td>
<td>9765</td>
<td>11783</td>
<td>11643</td>
<td>16894</td>
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<tr>
<td><strong>T&amp;D Loss</strong></td>
<td>1504</td>
<td>1640</td>
<td>2205</td>
<td>2597</td>
<td>3162</td>
<td>3360</td>
<td>3555</td>
<td>3749</td>
<td>3658</td>
<td>4111</td>
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<tr>
<td><strong>Sales</strong></td>
<td>5987</td>
<td>6750</td>
<td>7933</td>
<td>9420</td>
<td>10789</td>
<td>11972</td>
<td>13313</td>
<td>14829</td>
<td>16927</td>
<td>18714</td>
</tr>
</tbody>
</table>

### Dry Season

- **Demand**: Blue bars
- **Generation (NEA+IPP+Import)**: Orange bars
- **Energy Deficit**: Red bars
- **Energy Surplus**: Yellow bars

### Wet Season

- **Demand**: Blue bars
- **Generation (NEA+IPP+Import)**: Orange bars
- **Energy Deficit**: Red bars
- **Energy Surplus**: Yellow bars
Around ~575 Bn NPR capital investment planned by NEA in next 10 years; additional 153 Bn NPR through its subsidiaries

<table>
<thead>
<tr>
<th></th>
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<th>FY20</th>
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<th>FY22</th>
<th>FY23</th>
<th>FY24</th>
<th>FY25</th>
<th>FY26</th>
<th>FY27</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NEA Owned</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>NEA generation</td>
<td>4035</td>
<td>6163</td>
<td>1500</td>
<td>0</td>
<td>0</td>
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<td>0</td>
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<td>0</td>
<td>0</td>
<td>11698</td>
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<tr>
<td>Energy Efficiency</td>
<td>3000</td>
<td>2000</td>
<td>2000</td>
<td>2000</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>1500</td>
<td>1000</td>
<td>1000</td>
<td>17000</td>
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<tr>
<td>Transmission*</td>
<td>12260</td>
<td>30979</td>
<td>36399</td>
<td>33202</td>
<td>30700</td>
<td>33767</td>
<td>27534</td>
<td>32115</td>
<td>47107</td>
<td>39223</td>
<td>323286</td>
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<tr>
<td>Distribution*</td>
<td>12678</td>
<td>16642</td>
<td>25168</td>
<td>17094</td>
<td>17443</td>
<td>17948</td>
<td>18425</td>
<td>18817</td>
<td>19652</td>
<td>19700</td>
<td>183567</td>
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<tr>
<td>Rural Electrification</td>
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<td>3818</td>
<td>38180</td>
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<tr>
<td><strong>Total</strong></td>
<td>35791</td>
<td>59602</td>
<td>68886</td>
<td>56114</td>
<td>53460</td>
<td>57033</td>
<td>51277</td>
<td>56250</td>
<td>71577</td>
<td>63741</td>
<td>573731</td>
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<tr>
<td><strong>NEA Subsidiaries</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capex in NEA Subsidiaries</td>
<td>24638</td>
<td>45932</td>
<td>38572</td>
<td>54991</td>
<td>128322</td>
<td>162142</td>
<td>176330</td>
<td>155219</td>
<td>106174</td>
<td>62271</td>
<td>954591</td>
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<tr>
<td>NEA's Share</td>
<td>2701</td>
<td>6811</td>
<td>7569</td>
<td>11072</td>
<td>22201</td>
<td>26323</td>
<td>26979</td>
<td>23749</td>
<td>16245</td>
<td>9527</td>
<td>153175</td>
</tr>
</tbody>
</table>

- Capex in generation sector is planned majorly through IPPs and NEA Subsidiaries; therefore NEA’s capex is mostly concentrated in Transmission and Distribution system strengthening and augmentation.
Approach: Maximizing Finance for Development

“Pursuing private sector solutions where they can help achieve development goals, and reserving scarce public finance for where it is most needed.” – Development Committee Paper, 2017

Maximizing Finance for Development:

MFD requires identifying the right investments, taking the financial risk to initiate them, and implementing them effectively and efficiently.

By leveraging the private sector:

Creates imperative to leverage the private sector for economically beneficial, sustainable investments that contribute to development goals.

... and optimizing the use of scarce public resources.

Public sector faces limitations in meeting this need, including in fiscal space, capacity, and governance.
Reforms initiated in the early 1990’s have been delayed by the long political transition in the country....

1992 Electricity Act allows entry of IPPs

1992

1994: Quasi-regulator ETFC established

1995

1994

2000

2001 Hydropower development policy mandates NEA restructuring and independent regulator

2000

2005

2010

2011: ETFC increases tariffs after a decade long freeze

2010

2015

2015

2016

2016

2017

2017

2018

2018

Maoist conflict

Constitutional process

Electricity Regulatory Commission Act adopted in August 2017

Planned Reforms:
- New Electricity Act
- NEA restructuring/
- Unbundling
- Power trade

A new National Transmission and Grid Company, Generation Company, Power Trading Company established

Emergency Action Plan 2016

Tariff increase since 2011
Barriers to Attract Investments in the Energy Sector

**Governance and sector structure**
- Overlapping roles of MOE, NEA, DOED create confusion
- Delayed implementation of NERC Act for tariff reforms
- Lack of new Electricity Act to govern reforms

**Strategic planning**
- Inadequate planning, underinvestment in generation, transmission, distribution
- Lack of least-cost generation expansion plan
- Lack of integrated river basin planning

**Financial viability & operational performance**
- Lack of creditworthiness of NEA
- Below-cost tariffs
- High losses in transmission and distribution

**Investment environment**
- Lack of standardized PDA and PPA to support international project financing
- Lack of transparent, rigorous licensing procedures
- Uneven playing field for IPPs due to NEA control
- Weak E&S policy framework

**Public investment & financial management**
- Weak institutional capacity for public procurement and contract management
- Weak project implementation capacity
- Lack of mechanisms to manage exchange risk on foreign-currency PPAs
Energy Sector MFD collaboration across the WBG

**Upstream: power sector reforms, financial viability and sector planning**

**World Bank**

DPC1-3 (DPC1 in July 2018)
- Reduce losses
- Regularize tariff
- Increase sector investments
- Standardized/streamlined PPA and E&S procedures
- Strengthen generation and river basin planning

**World Bank and IFC TA**
- Joint Implementation Plan/power sector strategy identifying hydro as priority area for private investment
- Provided TA to NP on power sector reforms, G+T planning, financial viability, operationalization of NERC Act, E&S hydro guidelines

**Downstream: WBG investments in G, T, and D**

**IDA projects enabling private sector/imports**
- Cross border transmission lines ($137m)
- Grid solar and distribution rehabilitation ($130m)
- Biogas and minigrids ($14.9 m total)

**IDA/IFC**

Kabeli A Hydro (37 MW)
- **IDA** provided $38 m on lent to private sector
- **IFC** provides $40m co-financing

**IFC/MIGA/IDA**

Upper Trishuli 1 Hydro (216 MW)
- **IFC** provides $90m financing + mobilizing up to $310m
- **MIGA** Political risk guarantee up to $150m of sponsor’s equity
- **IDA** partial risk guarantee and TA on foreign exchange risks
Kabeli A Hydro Debt Financing Structure

KABELI ENERGY LIMITED: Shareholding Structure

Butwal Power Company 40% → Gurans Energy Limited 69%

Infraco-Asia Singapore 60% → Kabeli Energy Limited 26%

Asia Pacific 5%

Ratio Equity/Debt = 20:80

Related Documents:
- JVA/sha
- MOA & AOA
- Industry Registration
- FDI permission/approval PAN

KABELI ENERGY LIMITED (An SPC): 79.6 MUSD Debt Financing

International Finance Corporation (IFC) + NIC Asia

Project Agreement

World Bank/IDA 46 MUSD Financing Agreement → GON (MOF/MEEn)

HIDCL

Capacity Building DOEDs IBN

GON (MOF/MEEn) 5MUSD HIDCL Subsidiary Agreement → HIDCL

40 MUSD KEL Subsidiary Agreement

PPA → NEA

Kabeli Energy Limited
Facilitating regional integration: Nepal-India Electricity Transmission and Trade Project

Components: (i) 400 kV Transmission Line (ii) 220 kV Transmissions, (iii) Substations, (iv) NEA Financial Management Information System support

Current Status:
• This particular project has contributed in reducing the load shedding hours by facilitation additional imports of 160 MW of electricity during the dry season.
• Transmission tower foundation works completed: 66% (792) in 400 kV, 69% (226) in one 220 kV line and 29% (246) in second 220 kV line
• Substations: Dhalkebar 95% completed, work has started with the new contractor and expected to be commissioned by September 2018.
• Bidding initiated for the remaining works for the Hetauda and Inaruw substation and the Bharatpur-Bardaghat line. The Bid Evaluation report is submitted for the Bank’s review.
# Energy Sector MFD: Future Opportunities

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Short Term Measures</th>
<th>Medium/Long Term Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>De-risk the sector through institutional and regulatory reforms</td>
<td>(a) make the NERC operational and submit the new Electricity Act to parliament for approval, (b) issue a roadmap for NEA restructuring, (c) approve the NEA financial viability plan, and (d) prepare and endorse a least cost generation plan</td>
<td>(a) complete NEA restructuring, (b) seek integration into the regional electricity market and/or establish a wholesale electricity market</td>
</tr>
<tr>
<td>Support large hydropower and renewable energy development</td>
<td>(a) Accelerate the construction of 3,000 MW domestic and export hydro projects under way (b) Implement a model large hydro project (c) Issue standardize PDA and PPA, and E&amp;S guidelines (d) Carry out competitive power purchase (e) Establish FX risk management mechanism</td>
<td>(a) deepen the domestic capital market to increase availability of long tenor loans for hydropower projects (b) introduce nonrecourse project finance to the sector</td>
</tr>
<tr>
<td>Undertake timely investments in the country’s transmission and distribution network to enable hydro and regional interconnections</td>
<td>(a) Increase investments in T+D (b) Implement the loss reduction master plan (c) Pilot smart meters</td>
<td>(a) countrywide adoption of smart meters (b) develop a transmission corridor (c) Consider PPP in T+D</td>
</tr>
</tbody>
</table>