VIETNAM HYDROPOWER – CURRENT SITUATION AND DEVELOPMENT PLAN

Speaker: Dr. Nguyen Huy Hoach

POWER ENGINEERING CONSULTING JSC 1 (PECCI)
1. Overview of the role of hydropower in Vietnam economic development
2. Current and future trends in national energy demands
3. Contribution of hydropower development to Vietnam energy sector
I. OVERVIEW OF THE ROLE OF HYDROPOWER IN VIETNAM ECONOMIC DEVELOPMENT

1.1. VIETNAM HYDROPOWER POTENTIALS

- Vietnam has 2360 rivers of ≥ 10km long, including 9 systems with a basin area of ≥ 10,000 sq km.
- Nation-wide average waterway density is 0.6km/sq km.
- 10 major river systems with hydropower development potentials.
- Review of studies on Vietnam hydropower planning shows that the total theoretical capacity of the rivers assessed reaches 300 bn KWh p.a., and the installation capacity is valued at about 34,647 MW.
- Technical-economic capacity is assessed to be about 80-84 bn KWh p.a., and the installation capacity is valued at about 19,000 - 21,000MW.
VIETNAM HYDROPOWER POTENTIALS

HYDROPOWER POTENTIAL

300 TWh
80 TWh
17-18 GW

> 10 MW
60/16-16.5 GW

100-10,000 kW
500/1,400-1,800 MW

5-100 kW
2,500
100-150 MW

0.1-5 kW
1,000,000
50-100 MW

- 2,360 rivers; 0.6 km/km²
- 333,000 km², 50% Mountainous Area Higher than 500m

(VN hydropower evaluation, Information Center, MOE, 1990)
<table>
<thead>
<tr>
<th>River basins</th>
<th>Area, sq. km</th>
<th>Number of dams</th>
<th>Total capacity, MW</th>
<th>Power amount, GWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Da River</td>
<td>17.200</td>
<td>8</td>
<td>6800</td>
<td>27.700</td>
</tr>
<tr>
<td>Lo-Gam-Chay</td>
<td>52.500</td>
<td>11</td>
<td>1.600</td>
<td>6.000</td>
</tr>
<tr>
<td>Mả-Chu</td>
<td>28.400</td>
<td>7</td>
<td>760</td>
<td>2.700</td>
</tr>
<tr>
<td>Cả</td>
<td>27.200</td>
<td>3</td>
<td>470</td>
<td>1.800</td>
</tr>
<tr>
<td>H- ọng</td>
<td>2.800</td>
<td>2</td>
<td>234</td>
<td>990</td>
</tr>
<tr>
<td>Vũ Gia-Thu Bồn</td>
<td>10.500</td>
<td>8</td>
<td>1.502</td>
<td>4.500</td>
</tr>
<tr>
<td>Sẻ San</td>
<td>11.450</td>
<td>8</td>
<td>2.00</td>
<td>9.100</td>
</tr>
<tr>
<td>Srêpôk</td>
<td>12.200</td>
<td>5</td>
<td>730</td>
<td>3.300</td>
</tr>
<tr>
<td>Ba</td>
<td>13.800</td>
<td>6</td>
<td>550</td>
<td>2.400</td>
</tr>
<tr>
<td>Đông Nai</td>
<td>17.600</td>
<td>17</td>
<td>3.000</td>
<td>12.000</td>
</tr>
<tr>
<td>Micro-hydropower</td>
<td></td>
<td></td>
<td>1.000-3.000</td>
<td>4.000-12.000</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td>19.000-21.000</td>
<td>80.000-84.000</td>
</tr>
</tbody>
</table>
LOCATION OF HYDROPOWER PROJECTS IN LO - GAM - CHAY RIVER BASIN
LOCATION OF HYDROPOWER PROJECTS IN DA RIVER BASIN

HPP Project Status
- Existing
- Under Construction
- Selected in Stage 1
- Towns

Production date: September 2004
Data source: PECC 1-4
Projection: UTM Zone 48
Datum: WGS 84
Map production: Joint Venture for National Hydropower Plan Study, Vietnam
LOCATION OF HYDROPOWER PROJECTS IN MA-CHU RIVER BASIN
VŨ GIA-THU BỒN RIVER BASIN

LOCATION OF HYDROPOWER PROJECTS IN VU GIA-THU BON RIVER BASIN

HPP Project Status
- Under Construction
- Committed
- Selected
- Towns

Production date: September 2004
Source: PECC 1-4
Projection: UTM Zone 48
Datum: WGS 84
Production: Joint Venture for National Power Plan Study, Vietnam

Da Nang
Song Con 2
Vu Gia
Song Bung 5
A Vuong
Song Bung 2
Song Bung 4
Dak Mi 4
Thu Bon
Song Tranh 2
Dak Mi 1
DONG NAI RIVER BASIN

LOCATION OF HYDROPOWER PROJECTS IN DONG NAI RIVER BASIN

HPP Project Status
- Existing
- Committed
- Under Construction
- Selected in Stage 1
- Towns

Production date: September 2004
Data source: PECC 1-4
Projection: UTM Zone 48
Datum: WGS 84
Map production: Joint Venture for National Hydropower Plan Study, Vietnam
HYDROPOWER PROJECTS WITH INTEGRATED FUNCTIONS

- **Phu Yen East**
  - 1000MW

- **Phu Yen West**
  - 1000MW

- **Bac Ai**
  - 1000MW
1.2. THE ROLE OF HYDROPOWER IN VIETNAM ECONOMIC DEVELOPMENT

Before 1945: small hydropower stations built by the French to serve mining and recreational purposes.

- 1945-1975: Thác Bà Hydropower Plant (HP) Nlm=108MW
  Đa Nhim HP Nlm=160MW
  Trị An HP Nlm=400MW (1989)
  Vịnh Sơn HP Nlm=66MW (1994)
  Thác Mơ HP Nlm=150MW (1994)
  Yaly HP Nlm=720MW (2001)
  Sê San 3 HP Nlm=260MW (2007)
  Tuyên Quang HP Nlm=342MW (2008) etc.

And many others being under construction like Son La Nlm=2400MW, Bến Vẽ Nlm=320MW, Sê San 4 Nlm=360MW etc.

- Trị An and Hòa Bình, since first put into operation, have brought about enormous economic benefits and are predominant in Vietnam power system.
## CAPACITY OF DISTRIBUTED POWER SOURCES IN 1982 AND 1992

<table>
<thead>
<tr>
<th>Power source</th>
<th>1982</th>
<th></th>
<th>1992</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MW</td>
<td>%</td>
<td>MW</td>
<td>%</td>
</tr>
<tr>
<td>Hydropower</td>
<td>268</td>
<td>21,8</td>
<td>2.120</td>
<td>60,4</td>
</tr>
<tr>
<td>Coal-fired thermal power</td>
<td>205</td>
<td>16,7</td>
<td>645</td>
<td>15,4</td>
</tr>
<tr>
<td>Oil-fired thermal power</td>
<td>198</td>
<td>16,1</td>
<td>198</td>
<td>5,6</td>
</tr>
<tr>
<td>Diesel</td>
<td>440</td>
<td>35,7</td>
<td>390</td>
<td>11,1</td>
</tr>
<tr>
<td>Gas turbins</td>
<td>120</td>
<td>9,7</td>
<td>157</td>
<td>4,5</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1231</td>
<td>100</td>
<td>3.510</td>
<td>100</td>
</tr>
</tbody>
</table>
### CAPACITY OF POWER PLANTS AS OF 1 JAN 2008

<table>
<thead>
<tr>
<th>Power sources</th>
<th>Total capacity, MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entire system</td>
<td>12,357</td>
</tr>
<tr>
<td>EVN’s power plants</td>
<td>9,418</td>
</tr>
<tr>
<td>Hydropower</td>
<td>4,583</td>
</tr>
<tr>
<td>Coal-fired thermal power</td>
<td>1,245</td>
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<tr>
<td>Oil-fired thermal power</td>
<td>198</td>
</tr>
<tr>
<td>Gas turbins</td>
<td>3,107</td>
</tr>
<tr>
<td>Outside EVN-IPP</td>
<td>2,939</td>
</tr>
</tbody>
</table>
PROPORTION OF POWER SOURCE DISTRIBUTION
(EARLY 2008)

- Hydropower: 37.09%
- Coal: 25.14%
- Oil: 23.78%
- Gas: 10.08%
- Diesel and SHP: 1.6%
- Outside of EVN: 2.28%
- Imported: 0.03%
II. CURRENT AND FUTURE TRENDS IN NATIONAL ENERGY DEMANDS

Based on National power development planning for 2006-2015, with consideration for 2025

- LOAD FORECASTS:
  • Satisfy socio-economic development demands at GDP growth rate of 8.5-9% p.a. in 2006-2010, and higher power demands + 17% growth rate p.a. (baseline scenario), 20% p.a. (high scenario)
  • 2006-2015: 22% increase p.a. (high scenario)

- DEVELOPMENT OF POWER SOURCES (GUARANTEEING ENERGY SECURITY AND SUSTAINABLE DEVELOPMENT):
  • Ensure progress of construction of hydropower plants with multiple benefits such as flood control, water supply and power generation.
  • Logical and effective development of gas-fired thermal power sources, boosting up coal-fired thermal power generation, developing micro hydropower, new and renewable resources for remote, mountainous, border and island areas.
  • Efficient and proactive power trade with countries in the region.
  • Preparation for investment and construction of nuclear power plant project.
## ENERGY DEVELOPMENT FORCASTS FOR 2010-2025

<table>
<thead>
<tr>
<th>Type of energy</th>
<th>Capacity MW in 2010</th>
<th>Capacity MW in 2025</th>
<th>Capacity MW in 2011-2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydropower</td>
<td>9.412</td>
<td>20.178</td>
<td>10.766</td>
</tr>
<tr>
<td>Coal-fired thermal power</td>
<td>6.595</td>
<td>36.290</td>
<td>29.695</td>
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<tr>
<td>Gas-fired thermal power</td>
<td>9.072</td>
<td>17.224</td>
<td>8.152</td>
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<tr>
<td>Diesel and oil</td>
<td>472</td>
<td>2.400</td>
<td>1.929</td>
</tr>
<tr>
<td>Nuclear power</td>
<td>0</td>
<td>8.000</td>
<td>8.000</td>
</tr>
<tr>
<td>Imported power</td>
<td>658</td>
<td>4.756</td>
<td>4.098</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>26.209</strong></td>
<td><strong>88.848</strong></td>
<td><strong>62.639</strong></td>
</tr>
</tbody>
</table>
## ENERGY DEVELOPMENT FORCAST FOR 2025

<table>
<thead>
<tr>
<th>Hydropower</th>
<th>Total capacity in 2025, MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Put into operation in 2010</td>
<td>9.412</td>
</tr>
<tr>
<td>Plants under construction</td>
<td>2.296</td>
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<tr>
<td>Plants to be built between 2011-2025</td>
<td>4.610</td>
</tr>
<tr>
<td>Micro hydropower and integrated-function hydropower</td>
<td>3.860</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>20.178</strong></td>
</tr>
</tbody>
</table>
III. CONTRIBUTION OF HYDROPOWER DEVELOPMENT TO VIETNAM ENERGY SECTOR

• More than half of a century: long period of difficulties to hydropower development in Vietnam, yet enormous contribution to national economy
• Hydropower playing significant role in power generation, flood control, water supply, socio-economic development, etc.
  By 2010 about 50 hydropower plants put into operation
  2020: 80 large and medium hydropower plants put into operation
• Hydropower plants constructed in less developed regions help boost up their socio-economic development
• 1980 hydropower accounted for only 20% of Vietnam total power capacity; 1992 increased to 60.4%; early 2008 accounted for 37.09%.
• Economically, the higher the proportion of hydropower in the system, the lower the power price.
• Technically, hydropower improves quality of power and flexibility of operation.
THANK YOU VERY MUCH FOR YOUR ATTENTION