

32nd Meeting of the APEC Expert Group on
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**FINANCIAL ASPECTS AND POTENTIAL
OF
SMALL GRID CONNECTED HYDROPOWER
IN VIETNAM**

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Outline of Presentations

**1. OVERVIEW ON
ENERGY/ELECTRICITY/RENEWABLE ENERGY
IN VIETNAM**

**2. FINANCIAL ASPECTS AND POTENTIAL OF
SMALL GRID CONNECTED HYDROPOWER IN
VIETNAM**

1. OVERVIEW ON ENERGY/ELECTRICITY/RE IN VN

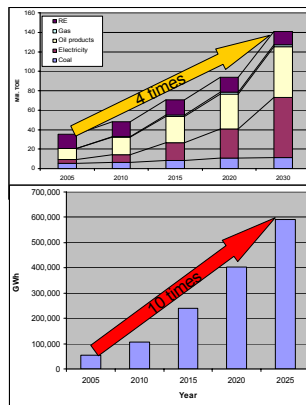
1.1. Demand on Energy & Electricity in VN Increasing Rapidly

❖ On the year 2030, energy demand of VN will increase about 4 times comparing with 2005.

Attending on after 2012, VN will have to import coal for electricity generation.

❖ The electricity demand in VN is forecasted growing up more than 10% per year until 2025. Currently, Vietnam purchases power from other countries to prevent shortages.

❖ The Government of VN has recognized the importance of RE and considered master plan for RE development for long term.



1.2. An Overview: Renewable Energy Development

- Despite the high potential, electricity production from RE is still negligible, only about 1% of total power generation (2007).
- The Government of VN has recognized the importance of RE for electricity generation.
- The Electricity Law requires support for RE
 - Decision No.110/2007/QD-TTg: targeting RE of 4,051 MW by 2025
 - Decision No.1855/2008/QD-TTg: sets up the target with share of RE (3% in 2010; 5% in 2020)
- August 2007, the Government has issued the decision 130/2007/QD-TTg on mechanisms and financial policies for projects invested in accordance with Clean Development Mechanism (CDM) that supports RE development.
- July 2008, jointly, the Ministry of Finance and the Ministry of Nature and Environment have issued the Joint Circular 58/2008/TTLT-BTC-BTN&MT to guide implementation of provisions of the decision 130/2007/QD-TTg.
- Clearly, this Joint Circular has also prescribed the object of subsidy, condition of subsidy, the calculation method of subsidy rate for one unit of electricity produced, annual subsidy amount, term of subsidy for CDM Projects in VN

2. FINANCIAL ASPECTS AND POTENTIAL OF SMALL GRID CONNECTED HYDROPOWER IN VN

2.1. Grid Connection RE Projects in VN

> In 2001 the Government of Vietnam launched the RE Action Plan which set the general directions of Government intervention to encourage renewable energy. Most of the effort (and the success) has been in the development of an institutional framework to facilitate grid-connected RE projects. Before 2004, only 67 MW of small hydro projects have already connected to the grid, and, up to 2008 more than 700 MW of small hydro power in 78 projects are under construction or at final stages of financing and licensing.

> A comprehensive package of reforms that will be in place by the end of 2008 has been a key enabling factor (including a new avoided cost tariff, a standardized power purchase agreement (SPPA), new regulations for licensing, a grid/distribution code) for grid-connected RE projects.

> The actual contribution of small hydro power generation (plants with capacity ≤ 30 MW) was 575 GWh, and is expected to reach 2,000 GWh in the next few years. Moreover, according to the new survey, there will be about 3,443 MW of SHP capacity in 319 identified projects – corresponding to some 16,600 GWh.

2.2. Financial aspects and potential of grid connected of SHP

❖ Hydro in Vietnam falls into four main classifications:

- i). Pico-hydro systems, owned by individual households in rural areas, between 200 W and less than 1,000 W in size.
- ii). Off-grid hydro systems that serve isolated mini-grids, typically from 1 kW to less than 1 MW in size.
- iii). Grid-connected small hydro systems in the 1-30 MW size range.
- iv). Large hydro, greater than 30 MW.

- ❖ Size of small hydro power not exceeding 30 MW (defined by 2006).
- ❖ Small hydropower potential: more than 4,000 MW breaks down by size category as below:

| Capacity range (MW) | Total capacity (MW) |
|--|---------------------|
| 0.1 - <1 | 126.8 |
| 1 - <5 | 1,030.2 |
| 5 - <10 | 1,048.3 |
| 10 - <15 | 648.0 |
| 15 - <20 | 562.8 |
| 20 - <25 | 309.0 |
| 25 - <30 | 290.0 |
| Total (≤ 30 MW) | 4,015.1 |

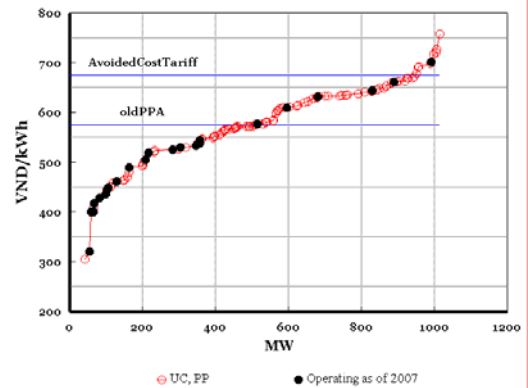
Existing utilization

| Capacity range (N) | Total | |
|--|-----------------|---------------|
| | No. of Stations | Capacity (kW) |
| $5 \text{ kW} \leq N < 50 \text{ kW}$ | 362 | 4,709 |
| $50 \text{ kW} \leq N < 100 \text{ kW}$ | 28 | 1,681 |
| $100 \text{ kW} \leq N \leq 10 \text{ MW}$ | 117 | 90,883 |
| Total: | 507 | 97,273 |

Project Pipeline

| | Number of projects | Total installed capacity | | Average project size |
|---|--------------------|--------------------------|-------------|----------------------|
| | | MW | MW | |
| MoU | 178 | 2,175 | 12.2 | |
| Under construction, no tariff information | 21 | 260 | 12.4 | |
| Under construction, tariff known | 67 | 630 | 9.4 | |
| Under construction, signed PPA | 11 | 101 | 9.2 | |
| In operation | 42 | 278 | 6.6 | |
| Total | 319 | 3,443 | 10.8 | |

Supply Curve of SHP Project Pipeline



This supply curve intersects with the new avoided cost tariff at around 950 MW.

Several existing projects lie above the average level of tariff of past PPAs – a reflection of the fact that in the past, capital costs for some projects were understated (in order to meet the acceptable range of FIRR required under the MoIT regulations).

There is limited information about the daily peaking capacity of many of the projects in the MoIT survey: daily peaking capacity would result in a higher remuneration under the new ACT because peak hour generation in the dry season attracts a capacity payment.

When LRMC is used as the proxy for economic costs, a capacity penalty must be added to the cost of non-dispatchable renewable energy. The magnitude of this penalty will depend upon the load factor (and the extent of daily peaking storage).

Master Plan for RE and SHP Development in VN

Strategy, Master plan for RE Development in VN in the period to 2015, with outlook to 2025 was prepared and submitted Gov (at 12/12/2008) for approval.

Set up the target of RE for grid connection

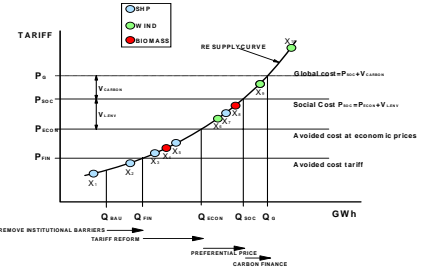
Set up the target of RE for off-grid

Set up the target of RE for heat utilization

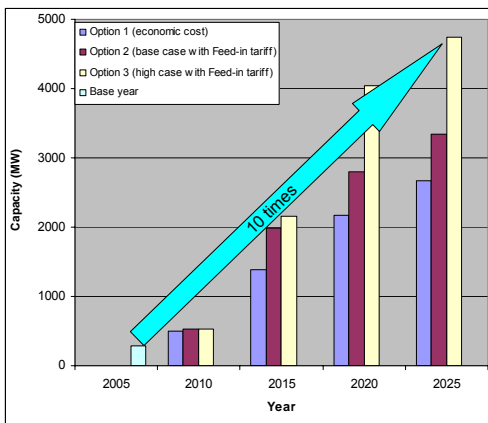
Establish framework for supporting RE

Establishing measures to implement (management, support mechanisms, procedures. etc.)

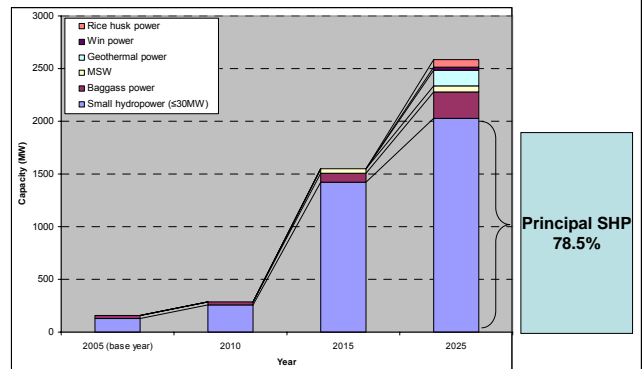
Supply curve of RE project based on existing tariff and reform tariff (Avoided cost in term of Financial & Economic)



Renewable Electricity Target



Grid Connected SHP Target by Type (Option 1)





VIETNAM ELECTRICITY

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Development of Small Grid-connected Hydropower at EVN's Power Distribution Companies

Presented by Ms. Phan Thi Thuy Tien
Director
Science Technology and Environment Department (EVN)

30 Mar - 30 Apr, 2009 - Honolulu, Hawaii, USA



Contents

- EVN's Overview in 2008
- EVN's Small Grid-Connected Hydropower Development



Contry and Sector issues

- Rapid Economic Growth and GoV:

Strategy Socio-Economic Development Plan 2006-2010:
transition Viet Nam for reaching middle-income country
status and continuing transition to a market economy by
2010;

Role of GoV: transformed from a major producer of
goods and services to regulator and provider of
foundations for a well-functioning, equitable, and
modern market economy.



Contry and Sector issues

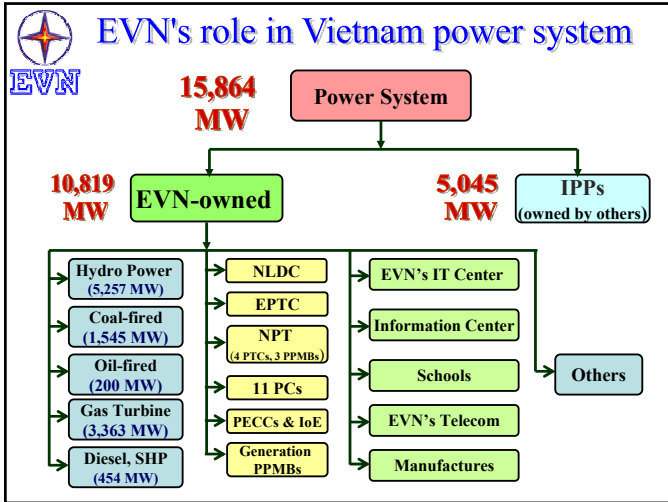
- Power Sector Dynamics:

Recently, economic growth of over 7%/year => many issues in
energy sector.

Electricity: met challenge well in 1995-2008, household access 50%
to ~94%; annual per capita consumption 156 kWh to ~800 kWh.
However, supply shortage has become more visible.

EVN: main electricity provider, owns 2/3 of all generation; owns
and operates transmission and MV distribution systems, LV
distribution to urban areas and LV distribution in some rural
areas.

Non-EVN: BOTs/IPPs own 1/3 of generation; 2/3 of LV
distribution owned and operated by local distribution utilities
(LDUs) received electricity from EVN.



Electricity Generation in 2008

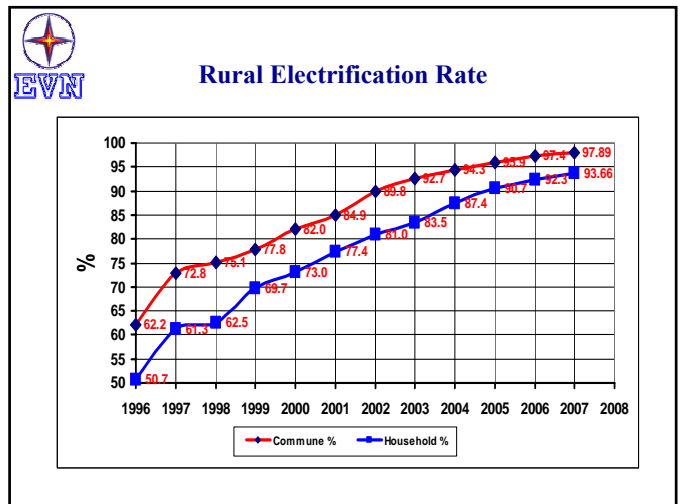
| | Installed Capacity | | Energy Output | |
|---|--------------------|--------------|---------------|--------------|
| | (MW) | % | (GWh) | % |
| TOTAL | 15,864 | | 75,955 | |
| EVN-owned | 10,819 | 68.20 | 52,875 | 69.61 |
| * HYDRO POWER | 5,257 | 33.14 | 23,627 | 31.11 |
| * COAL-FIRED | 1,545 | 9.74 | 8,921 | 11.75 |
| * GAS&OIL-FIRED | 3,563 | 22.46 | 20,311 | 26.74 |
| * SMALL HYDRO, DIESEL | 454 | 2.86 | (D) 16 | 0.02 |
| IPPs (owned by others) | 5,045 | 31.80 | 23,080 | 30.39 |
| * HYDRO POWER | 241 | 1.52 | | |
| * COAL-FIRED | 225 | 1.42 | | |
| * GAS&OIL-FIRED | 4,005 | 25.24 | | |
| * OTHERS (biogas cogeneration, SHP, imported) | 574 | 3.62 | 1,370 (SHP) | 1.80 |

Transmission & Distribution Network in 2008

| kV | km | MVA |
|-----|--------|--------|
| 500 | 3,286 | 7,050 |
| 220 | 7,101 | 18,639 |
| 110 | 11,751 | 23,834 |

Average buying tariff from non-EVN's IPPs in 2008:
903 VND/kWh ~ 5.16 US cents/kWh

EVN's average selling tariff to customers:
870.81 VND/kWh ~ 4.98 US cents/kWh





Contry and Sector issues

- **Rapid Economic Growth and GoV:**

A market-oriented Electricity Law passed in November 2004.

Electricity Regulatory Authority of Vietnam (ERAV) established in 2005.

Roadmap for reform is being implemented: Generation Competitive Market established & unbundle the sector (*separation of generation, transmission and distribution*) scheduled to be completed in 2009.



Contry and Sector issues

- **Major Power Sector Issues:**

Central task: is to meet demands for electricity in sufficient quantity and of an acceptable quality, in commercially and financially efficient way.

- *Optimizing power investments (particularly for generation);*
- *Financing investments;*
- *Implementing the reforms;*
- *Improving access and service quality;*
- *Addressing shortcomings in pricing and tariffs.*



Contry and Sector issues

- **Major Power Sector Issues (continued):**

- *Optimizing power investments:* Generating capacity increased 15,864 MW (2008) to 25,000 MW (2010), 41,000 MW (2015) and 60,000 MW (2020); Transmission and distribution system investments must accompany the increase in generation capacity.

- *Financing investments:* ~\$20 billion (2006-2010), or \$4 billion/year. About \$2.3 billion on expanding generation capacity, the balance on transmission and distribution.

- *Implementing the reforms:* EVN has separate generation, transmission and distribution operations in a group structure under a holding company.



Contry and Sector issues

- **Major Power Sector Issues (continued):**

- *Improving access and service quality:* better electricity supply to all consumers (to improve living standards and support development of local for economic growth and employment);

- *Addressing shortcomings in pricing and tariffs:* tariff is a key part of the power sector reform; increases in tariffs needed for EVN and its successor companies to retain earnings for investment and to attract outside investors (matching tariffs more closely to cost of supply; and setting tariffs in a way that is compatible with the reformed power sector).



Role of Renewable Energy

Challenges:

- Vietnam is well endowed with renewable energy resources.
- Small grid-connected hydropower potential: located mainly in north and central regions => supplement generation from large projects, reduce losses and improve grid stability by providing generation at the far reaches of the grid.
- Recently, developers (mostly private companies) interested in exploiting renewable energy resources to sell electricity to national grid.



Role of Renewable Energy

Barriers to large-scale development of grid-connected renewable energy:

- High transaction cost of negotiating a PPA with main player (EVN)
- Inhospitable and non-transparent regulatory framework with a lengthy approvals process;
- Absence of a procedure for allocating or re-allocating project sites to those most able to develop them;



Role of Renewable Energy

Barriers to large-scale development of grid-connected renewable energy (*continued*):

- Weakness of private sponsors to develop a site in a technically, socially and environmentally sustainable manner and take it to financial closure;
- Licensing burden as for large projects;
- Absence of suitably long financing tenors;
- Lack of skills among sponsors and bankers in assessing risk in such projects.



Small Grid-Connected Hydropower at EVN's Power Companies

- EVN's Rural Regional Power Companies (*North, Central*):

Renewable energy projects less than 30 MW: standardized “no negotiations” PPA is now mandatory – applied avoided cost tariff (based on costs EVN avoids by purchasing electricity from small generators).

To setting ACT, regulation permits developers to hedge against fuel price volatility by putting a cap and a floor of 10% of the ACT.



Small Grid-Connected Hydropower at EVN's Power Companies

Approved Master Plans of small hydropower development:

- **Power Company 1 (in the North):**

Potential of 344 subprojects with 3,978 MW located in 15 provinces => **heavy burden for grid connection.**

In 2009-2010: 97 subprojects with 1,232 MW put into operation (?).

- **Power Company 3 (in the Central):**

Potential of 337 subprojects with 3,044 MW located in 13 provinces.

Currently: 40 hydropower plants with ~187 MW put into operation.



Small Grid-Connected Hydropower at EVN's Power Companies

Lesson learn from PC3 (in the Central):

- In dry season 2008: Pmax ~890 MW; 700 MW from national grid, remains from local small hydropower generation about 247 million kWh at peak hours, 101 million kWh at normal hours, totally ~ 348 million kWh (even with higher tariff than buying from EVN's network). Some small grid-connected hydropower plants generated at higher energy output (~20% in comparison with average amount).
- Due to mostly as run-off-rivers => limitation of generating in dry season (while power demand is increased) that causes heavy power shortage.



Small Grid-Connected Hydropower at EVN's Power Companies

Lesson learn from PC3 (in the Central):

- Otherwise, many power plants located in remote areas that require capital investment for connection to national grid (with high cost) as well as causing high losses, poor electricity quality in operation.
- Lacking of forecasted information of water flows that is causing inefficient operation.
- Weakness of private sponsors to develop a site in a technically, socially and environmentally sustainable manner and take it to financial closure;



Small Grid-Connected Hydropower at EVN's Power Companies

Lesson learn from PC3 (in the Central): propose measures

- Environmental and using land issues: Planning for small grid-connected hydropower development mainly based on water resources not really considered about density of sites that cause wasting natural resources (such as land, forest).
- Unsuitable connection to national grid causes high technical loss (for example: local power demand is about 25 MW but planned small grid-connection hydropower is developed about 492 MW in Kontum province).



Small Grid-Connected Hydropower at EVN's Power Companies

Lesson learn from PC3 (in the Central): propose measures

- **Lacking of standardization of technical design that need to be issued soon.**
- **Added subprojects into approved Master Plan resulting inefficiently development and operation.**
- **Lacking of incentive financing mechanism issued by related Ministry for renewable energy development.**

THANK YOU