Current status and Development plan for Grid Small Hydro Power in Thailand

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1. Thailand’s Energy Situation
2. Alternative Energy Development Plan (AEDP)
3. Hydro Power Potential
4. Showcase
5. Lesson Learned
Thailand’s Energy situation in 2012

Final Energy Consumption

- Fossil fuels: 77.40%
- Imported Hydro power: 1.20%
- Large Hydro power: 1.00%
- Alternative Energy & Traditional RE: 20.40%
  - Traditional RE: 10.5%
  - Biofuels: 1.6%
  - Heat (Solar/Biomass/MSW/Biogas): 6.9%
  - Power Generation (Solar/Wind/Biomass/MSW/Biogas): 1.3%
  - Small Hydro Power: 0.1%
  - Alternative & Renewable Energy: 9.9%
### PDP2010 Rev3 (2010-2030)

**Comprising total capacity (Dec.2011)** | 32,395
---|---
**Total added capacity** | 55,130
**Deduction of the retired capacity** | -16,839
**Grand total capacity** | 70,686

### Classification of added capacity during 2012-2030 of 55,130 MW

<table>
<thead>
<tr>
<th>Classification</th>
<th>Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Renewable energy power plants</strong></td>
<td>14,580</td>
</tr>
<tr>
<td>- Power purchase from domestic (9,481)</td>
<td></td>
</tr>
<tr>
<td>- Power purchase from neighboring countries (5,099)</td>
<td></td>
</tr>
<tr>
<td><strong>Cogeneration</strong></td>
<td>6,476</td>
</tr>
<tr>
<td><strong>Combined cycle power plants</strong></td>
<td>25,451</td>
</tr>
<tr>
<td><strong>Thermal power plants</strong></td>
<td>8,623</td>
</tr>
<tr>
<td>- Coal-fired power plant (4,400)</td>
<td></td>
</tr>
<tr>
<td>- Nuclear power plant (2,000)</td>
<td></td>
</tr>
<tr>
<td>- Gas turbine power plant (750)</td>
<td></td>
</tr>
<tr>
<td>- Power purchase from neighboring countries (1,473)</td>
<td></td>
</tr>
</tbody>
</table>

Unit: MW
China
MOU 12th Nov 1998: 3,000 MW
Potential: 694,000 MW
Source: wikipedia.org

Laos
MOU 22nd Dec 2007: 7,000 MW
Signed PPA: 2,913 MW
COD: 1,891 MW
Potential: 26,000 MW
Source: United Nations

Cambodia
MOU 3rd Feb 2000: no specific quantity
Potential: 10,000 MW
Source: European Commission

Myanmar
MOU 4th July 1997: 1,500 MW
Potential: 39,720 MW
Source: Ministry of Power, India

• High of potential areas => North & Northeast
• Available to Imported electricity from neighboring countries

Imported Electricity from neighboring countries
Installed Capacity of RE power generation

- Fossil Fuel: 28,140 MW
- Imported Hydro: 2,185 MW
- Large Hydro Power: 3,406 MW
- Alternative Energy: 2,786 MW

- Biomass: 70.4%
- Biogas: 6.9%
- MSW: 3.7%
- Solar: 13.5%
- Wind: 4%
- Small Hydro Power: 1.5%

- Biomass: 1,960 MW
- Biogas: 377 MW
- Solar: 193 MW
- Wind: 112 MW
- Small Hydro Power: 102 MW
- MSW: 42 MW


“Adder” : Feed-in Premiums

- Technology based premiums
- More incentives for smaller projects

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Adder (Baht/kWh)</th>
<th>Adder-VSPP (USD Cents/kWh)**</th>
<th>Special adder * (Baht/kWh)</th>
<th>Supporting period (Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VSPP</td>
<td>SPP</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Biomass</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Installed capacity &lt;= 1 MW</td>
<td>0.50</td>
<td>Bidding</td>
<td>1.66</td>
<td>1.00</td>
</tr>
<tr>
<td>- Installed capacity &gt; 1 MW</td>
<td>0.30</td>
<td></td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Biogas (all categories of production sources)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Installed capacity &lt;= 1 MW</td>
<td>0.50</td>
<td>Bidding</td>
<td>1.67</td>
<td>1.00</td>
</tr>
<tr>
<td>- Installed capacity &gt; 1 MW</td>
<td>0.30</td>
<td></td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Waste (community waste, not hazardous industrial waste, and inorganic waste)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- AD &amp; b LFG</td>
<td>2.50</td>
<td>2.50</td>
<td>8.33</td>
<td>1.00</td>
</tr>
<tr>
<td>- Thermal Process</td>
<td>3.50</td>
<td>3.50</td>
<td>11.67</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Wind power</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Installed capacity &lt;= 50 kW</td>
<td>4.50</td>
<td>3.50</td>
<td>15.00</td>
<td>1.50</td>
</tr>
<tr>
<td>- Installed capacity &gt; 50 kW</td>
<td>3.50</td>
<td>3.50</td>
<td>11.67</td>
<td>1.50</td>
</tr>
<tr>
<td><strong>Mini and micro hydropower</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- capacity 50-200 kW</td>
<td>0.80</td>
<td>-No-</td>
<td>2.67</td>
<td>1.00</td>
</tr>
<tr>
<td>- capacity &lt; 50 kW</td>
<td>1.50</td>
<td></td>
<td>5.00</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Solar power</strong></td>
<td>8.00/6.50</td>
<td>8.00/6.50</td>
<td>26.67</td>
<td>1.50</td>
</tr>
</tbody>
</table>

Now EPPO is studying to adjust the Adder to be “Feed-in-Tariff system”
Committed to the development of low-carbon society

10 years Alternative Energy Development Plan (AEDP-Master Plan 2012-2021)

Target 25% of RE in Total Energy Consumption By 2021

New energy
- Ocean & Tidal: 2 MW
- Geothermal: 1 MW
- Solar: 2,000 MW, 1,200 MW, 3,200 MW
- Wind: 3,200 MW
- Hydro power plant: 324 MW, 1,284 MW, 1,608 MW
- Bio-energy: 3,630 MW, 600 MW, 160 MW
- Biofuels: Ethanol: 9 ML/day, Bio-diesel: 5.97 ML/day, 2nd–Gen. Biofuels: 25 ML/day
- Renewable fuel 44%

Current RE Share of 9.9% (March 2013)
North
Total 1,458 MW
- Large Hydro = 1,279 MW
- Biomass = 110 MW
- Mini hydro = 40 MW
- Solar = 24 MW
- Geothermal = 0.3 MW
- Biogas = 5 MW

South
Total 430 MW
- Large Hydro = 312 MW
- Biomass = 48 MW
- Mini hydro = 4 MW
- Solar = 0.1 MW
- Biogas = 47 MW
- Wind = 2 MW
- MSW = 17 MW

Northeast
Total 1,377 MW
- Large Hydro = 737 MW
- Biomass = 352 MW
- Mini hydro = 24 MW
- Solar = 120 MW
- Biogas = 51 MW
- Wind = 93 MW

Central
Total 1,606 MW
- Large Hydro = 1,078 MW
- Biomass = 241 MW
- Mini hydro = 13 MW
- Solar = 230 MW
- Biogas = 43 MW
- Wind = 0.1 MW
- MSW = 1 MW
DEDE Strategy for Hydro Power

- Focus on “Micro+Pico Hydro+Pumped Storage”
- Targeted 1,608 MW with measurements
  1. Electricity from Small Hydro Power at village level, for non-electrified households
     => Off grid / isolated system
  2. DEDE supports Small Hydro Project in community
     => Owned by Local Administrative organization / People
     => Managed by Community
  3. Solve the barrier
     => Site located in conserved area / restricted area
  4. Research & Study Micro Hydro Turbine of Run-of-River
  5. Develop hydro turbine of low-head type
- Community Participation
10 yrs AEDP Target: 1,608 MW

Present Generating Capacity:
- 101.75 MW
- 500 MW

DEDE Hydro Power:
- Generate hydro power at Village level
- Very small power plant
- Non-electrified household (Off-Grid)

Support construction at community level

DEDE & EGAT develop small hydro power system of downstream irrigation dam

Small hydro power plant
- Local Admin Organization/people collaboration
- Project owner
Mae Hong Son Project since 1964
Mae Hong Son Canal
850 kW
Generate 4.51 GWh
0.4 km of 22 kV line
Sell power to PEA-Grid
# Current Capacity of Small Hydro Power

<table>
<thead>
<tr>
<th>Organization</th>
<th>Large Dam</th>
<th>Pumped Storage</th>
<th>Small Hydro</th>
<th>Micro-Pico Hydro</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGAT</td>
<td>21 projects 3,400 MW</td>
<td>2 projects 500 MW</td>
<td>2 projects (irregation dam) 36 MW</td>
<td>-</td>
</tr>
<tr>
<td>DEDE</td>
<td>-</td>
<td>-</td>
<td>22 projects 43.3 MW</td>
<td>48 projects 1.8 MW</td>
</tr>
<tr>
<td>PEA</td>
<td>-</td>
<td>-</td>
<td>8 projects 19.8 MW</td>
<td>2 projects 0.5 MW</td>
</tr>
</tbody>
</table>

* EGAT = Electricity Generating Authority of Thailand
DEDE = Department of Alternative Energy Development and Efficiency
PEA = Provincial Electricity Authority
22 Small Hydro Power Projects

- The Projects started since 1971
- Aims to secure power system
- Electricity sold to EGAT and PEA
- Performance = 140.867 GWh / 31.208 ktoe

DEDE Small hydro power project under construction ;

1. Klong Tung Pel Hydro Power Project , a royal initiated project
2. Upper Nan River Hydro Power Project , Nan Province
3. Mae Ka Nai Hydro Power Project , Mae Hong Son Province
4. Huay Mae U su , Tak Province
5. Extended small hydro power installed
48  Hydropower Projects at village level

- Capacity of 1.8 MW
- Very small with installed capacity below 200 kW
- Located far from grid
Mae Kam Pong Electric Project

- National Policy in 1980, aims to extend the use of electricity in rural area
- 1,300 m. than MSL with 23.5 sq.km.
- Located far from grid system distribution
- In 1982, DEDE started micro hydro project

- Site 1 = 20 kw
- Site 2 = 20 kw

“Small water resource = The cheapest energy resource”

Community Participation => Share holders cooperative

- Community
- DEDE

Provide Labour
Construction Material => Locally available ex. sand, gravel, wood etc.
Budget
Design /Technical Assistance
⇒ Generating equipment
⇒ advise, monitor civil work
⇒ organize cooperatives

After Construction
Transfer Ownership to Community
O & M
Showcase “Mae Kam Pong”

Mae Kam Pong Electric Project

- In 1994-2003 => increase capacity in the area to site 3 with 40 kw
- Managed by local cooperatives => one time charge payment
- In 1995, Electricity from PEA grid system came into “Mae Kam Pong” Area.

2 grid systems in area
1. Local micro hydro power
2. Grid connected power utility

Micro Hydro Power still operate
=> without interruption
✓ Strong unity of people in community
✓ Managing system
✓ Local rules & regulations
✓ Maintenance / Advise from DEDE
Showcase “Mae Kam Pong”

Benefit:

- Bring “Cheap Energy” to local people
- Electricity available for remote area people
- Benefit of cooperatives => used to develop public service in community
- Transfer technology to local people
- Saving from imported machinery / equipment
- Participation among people / between people & government
Lesson Learned

✓ Micro-Pico Hydro = Cheapest RE Resource

✓ Technology => Simple & Proven

✓ Needs Strong Community to
  - operate
  - maintenance

✓ Technical assistance and transfer to local people is still necessary for continuity of the projects.
Thank you for Your attention