Financial Mechanism for Renewable Energy

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Acting Director of Power Policy Bureau

Seminar on Financial Schemes for Renewable Energy Projects

27th November 2012 Landmark Hotel, Bangkok
1. Renewable Promotion History
2. Alternative Energy Development Plan: AEDP
3. Status of Power Purchased from Renewable Project
4. Financial Mechanism to Support Renewable Energy
5. Cost of Renewable Energy
6. Conclusion
2006
- Announcing VSPP project scale <10 MW
- Announcing Adder Program

2007
- Extending supported time for Solar and Wind from 7 to 10 years (without bank guarantee for RFP)

2009
- Announcing REDP 15yrs. (2008-2022)
- REDP target 5,608 MW
- Ft Impact < 8 satang/kWh
- Announcing Adder for project scale < 1 MW
- Bank guarantee for RFP was required
- Cabinet allow to buying RE more than REDP target as long as no significant impact to Ft

2010
- New Solar project proposal was ceased
- Adder for Soar was reduced from 8.0 to 6.5 THB/kWh
- Appoint the Managing Committee on Power Generation from Renewable Energy Promotion
- NEPC approved RE support transitioning from Adder to Feed-in Tariff (FiT); EPPO was assigned to revise RE promotion

2011
- Announcing AEDP (2012-2021)
- AEDP target 9,201 MW
- FIT was studied

REDP = Renewable Energy Development Plan 2008-2022
AEDP = Alternative Energy Development Plan 2012-2021
## Alternative Energy Development Plan
### AEDP 2012-2021

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td></td>
<td>MW</td>
<td>ktoe</td>
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<tr>
<td>Wind</td>
<td>800</td>
<td>89</td>
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<td>Solar</td>
<td>500</td>
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<td>Hydro</td>
<td>324</td>
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<td>1,933</td>
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<td>Biogas</td>
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<td>54</td>
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<tr>
<td>MSW</td>
<td>160</td>
<td>72</td>
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<tr>
<td>Other</td>
<td>3.5</td>
<td>1</td>
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<tr>
<td><strong>total</strong></td>
<td><strong>5,608</strong></td>
<td><strong>2,290</strong></td>
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## Status of Power Purchased from Renewable Project

### Install Capacity (August 2012)

<table>
<thead>
<tr>
<th>Source</th>
<th>Solar</th>
<th>Wind</th>
<th>Hydro</th>
<th>Biomass</th>
<th>Biogas</th>
<th>MSW</th>
<th>Other</th>
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<td>Propose</td>
<td>957</td>
<td>1,482</td>
<td>0</td>
<td>506</td>
<td>44</td>
<td>197</td>
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<td>Accept</td>
<td>78</td>
<td>293</td>
<td>9</td>
<td>474</td>
<td>49</td>
<td>81</td>
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<td>PPA</td>
<td>1,858</td>
<td>421</td>
<td>6</td>
<td>1,815</td>
<td>91</td>
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<td>COD</td>
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<td>0.38</td>
<td>14</td>
<td>1,553</td>
<td>142</td>
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<td>Total</td>
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<td>2,196</td>
<td>29</td>
<td>4,348</td>
<td>326</td>
<td>362</td>
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<td>REDP</td>
<td>500</td>
<td>800</td>
<td>324</td>
<td>3,700</td>
<td>120</td>
<td>160</td>
<td>0</td>
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<tr>
<td>AEDP</td>
<td>2,000</td>
<td>1,200</td>
<td>1,608</td>
<td>3,630</td>
<td>600</td>
<td>160</td>
<td>3</td>
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</table>
Financial Mechanism to support RE

- Low-Interest Loan: Revolving Fund
- Venture Capital: ESCO Fund
- Tax Incentives: BOI Privilege
- ADDER / Feed-in Tariff
Revolving Fund

- Provided via financial institutions for investment in:
  - Energy efficiency improvement projects
  - Renewable energy development and utilization projects

11 local financial institutions have participated.

Max. interest rate: 4%
Max. loan period: 7 years
January 2003 – present
7000M Baht

- The ENCON Fund imposes 0.5% interest rate on financial institutions, starting from Phase 2 onwards.

- Results
  - Reduce oil imports of over 400 million litre/yr.
  - Reduce power demand over 200 MW
A source of venture capital for ESCOs to jointly invest with private operators in energy efficiency and renewable energy projects. The program targets SMEs and smaller projects.

**Expected saving**
300 ktoe
Thailand’s Board of Investment (BOI)’s tax incentives for renewable energy

- Tax holidays up to 8 years
- Exemption or reduction of import duties on solar equipment
- Corporate income tax reduction
Adder program concept

- Supported 7 -10 year from COD
- Difference Adder rate on each type of renewable energy
- Burden pass through to end user by Ft mechanism

LCOE = Levelized cost of energy
<table>
<thead>
<tr>
<th>Type of Renewable Energy</th>
<th>2007 Adder Rate (Baht/kWh)</th>
<th>2009 Adder Rate (Baht/kWh)</th>
<th>2010 Adder Rate (Baht/kWh)</th>
<th>Special Adder for Diesel Replacement (Baht/kWh)</th>
<th>Special Adder for Three Southernmost Provinces (Baht/kWh)</th>
<th>Years Supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Biomass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>- Installed Capacity ≤ 1 MW</td>
<td>0.30</td>
<td>0.50</td>
<td>0.50</td>
<td>1.00</td>
<td>1.00</td>
<td>7</td>
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<tr>
<td>- Installed Capacity &gt; 1 MW</td>
<td>0.30</td>
<td>0.30</td>
<td>0.30</td>
<td>1.00</td>
<td>1.00</td>
<td>7</td>
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<tr>
<td>2. Biogas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>- Installed Capacity ≤ 1 MW</td>
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<td>0.50</td>
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<td>0.30</td>
<td>1.00</td>
<td>1.00</td>
<td>7</td>
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<tr>
<td>- Landfill and Digestor</td>
<td>2.50</td>
<td>2.50</td>
<td>2.50</td>
<td>1.00</td>
<td>1.00</td>
<td>7</td>
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<tr>
<td>- Thermal Process</td>
<td>2.50</td>
<td>3.50</td>
<td>3.50</td>
<td>1.00</td>
<td>1.00</td>
<td>7</td>
</tr>
<tr>
<td>4. Wind</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Installed Capacity ≤ 50 kW</td>
<td>3.50</td>
<td>4.50</td>
<td>4.50</td>
<td>1.50</td>
<td>1.50</td>
<td>10</td>
</tr>
<tr>
<td>- Installed Capacity &gt; 50 kW</td>
<td>3.50</td>
<td>3.50</td>
<td>3.50</td>
<td>1.50</td>
<td>1.50</td>
<td>10</td>
</tr>
<tr>
<td>5. Small / Microhydro</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>- 50 kW ≤ Installed Capacity &lt; 200 kW</td>
<td>0.40</td>
<td>0.80</td>
<td>0.80</td>
<td>1.00</td>
<td>1.00</td>
<td>7</td>
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<tr>
<td>- Installed Capacity &lt; 50 kW</td>
<td>0.80</td>
<td>1.50</td>
<td>1.50</td>
<td>1.00</td>
<td>1.00</td>
<td>7</td>
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<tr>
<td>6. Solar</td>
<td>8.00</td>
<td>8.00</td>
<td>6.50</td>
<td>1.50</td>
<td>1.50</td>
<td>10</td>
</tr>
</tbody>
</table>
Feed-in Tariff Concept

Why Adder is needed change:

- NEPC meeting on 28th June 2010 ordered reviewing renewable energy supportive program

- Adder is topped up on power tariff (Base tariff + Ft) which is fluctuated and depended on the global conventional energy price situation. Accurate energy price is difficult to precisely forecast, therefore the Adder rate might not accurately reflect levelized cost of energy (LCOE). Long term risk is happened to developer and end user.

- Adder is an upfront subsidy (7-10 years): The developer get a faster payback, meanwhile, end user get a faster burden on power tariff.

- There is a possibility of inefficiency technology implementation because of an upfront scheme.
FIT concept

FIT is for future

- FIT is not effected by the conventional energy situation.
- Less uncertainty on RE amount in the Power development planning
- Less risk to both developer and Fair Price for end user
- Support high efficiency technology
- Burden is more distributed over project time and decreased against the increasing of conventional price
- Possibility to parity with grid tariff !!!!
Cash flow of 1 MW solar project

Per unit cash flow of 1 MW Solar project

THB/kWh

- 12.00
- 11.00
- 10.00
- 9.00
- 8.00
- 7.00
- 6.00
- 5.00
- 4.00
- 3.00
- 2.00
- 1.00
- 0.00


- Loan&Interest
- O&M Cost
- Base tariff+ Adder 6.50
- FIT

Insert image of solar panels
Customer’s burden from 1 MW solar project

Solar 1 MW Project 's unit cost pass through the end user

THB/kWh

- 7.00
- 6.00
- 5.00
- 4.00
- 3.00
- 2.00
- 1.00
- 0.00


Adder
FIT vs AVG. Whole sale
FIT vs Marginal Gas
Levelized cost of energy in 2012

Compare LCOE of Power Plant COD in 2012

THB/kWh

- Fuel Cost
- Fix Cost

- Neighborhood Power
- Nuclear
- Coal
- Cogeneration (Pool Gas)
- Biomass
- Cogeneration (Marginal Gas-LNG)
- Wind
- Solar
Whole sale tariff 2012-2030 (PDP2010rev3)
Solar Module Pricing Trends

Solar Industry Growth has Produced Steadily Falling Prices

Module Pricing Trends 1985-2011

Re-structure of Bioenergy tariff

Component II: Fuel Cost Investment

Group I: Fuel Free
- Solar
- Wind
- Hydro

Group II: Fuel Cost
- Biomass & Energy Crop
- MSW
- Biogas

Component I: Fixed System Investment
The RE support mechanism (FiT) is revised with the following concept:

- more suitable financial mechanism with less risk and fair for both developer and end user.
- support future bioenergy market.
- allowed parity to the grid tariff