PDP & Tariff Review

Presentation for NARUC Partnership Activity 2
Portland, Oregon Tuesday 21 September 2010

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ERC does not have any mandate to approve PDP. The PDP is prepared by EGAT under the supervision of the Ministry of Energy.
Electricity Industry

**Generation (% market share)**
- EGAT (45%)
- IPPs (42%)
- SPPs (10%)
- Imports (3%)
- VSPPs (<< 1%)

**Transmission**
- EGAT (100%)

**Distribution**
- PEA (66%)
- MEA (32%)
- Direct Customer (2%)

**Remarks**
- EGAT = Electricity Generating Authority of Thailand
- MEA = Metropolitan Electricity Authority
- PEA = Provincial Electricity Authority
- IPPs = Independent Power Producers (Cap. sold to EGAT ≥ 90 MW)
- SPPs = Small Power Producers (Cap. sold to EGAT < 90 MW)
- VSPPs = Very Small Power Producers (Cap. sold to MEA/PEA < 10 MW)

**Govt. (policy framework)**

**ERC (regulation)**
• 63 Million people
• 17 Million energy users
• Cover 99% of service area

76 Provinces of THAILAND:
- Metropolitan Area (3 Provinces: Bangkok, Nonthaburi, Samutprakan) served by MEA
- Provincial Area (73 Provinces are served by PEA)

MEA’s service area
2.7 Million Customers

PEA’s service area
14.2 Million Customers

The rest of country is serviced by PEA

Northern area
North Eastern area
Central area
Southern area
Enhanced Single Buyer

Five Classes of Licenses

- Generation License: 181
- Transmission License: 5
- Distribution License: 42
- Retail License: 39
- System Operation License: 1
### Private power producers in Thailand

#### Producers

<table>
<thead>
<tr>
<th>Producers</th>
<th>Existing</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IPP</strong></td>
<td>12,151.6 MW (10)</td>
<td>4,400 MW (4)</td>
</tr>
<tr>
<td><strong>SPP</strong></td>
<td>2,079 MW (41)</td>
<td>~2,000 MW (~27)</td>
</tr>
<tr>
<td><strong>VSP</strong></td>
<td>238 MW (118)</td>
<td>&gt; 2,000 MW (&gt;300)</td>
</tr>
</tbody>
</table>

#### SPP (Firm)

- **Firm**: 2,079 MW (41) (~2,000 MW (~27))
- **Non Firm**: 243 MW (19) (>10)

#### VSPP

- 238 MW (118) (>2,000 MW (>300))

**Remark:** ( ) = numbers of firms

### IPA (IPP)

- Gas: 11%
- Coal: 89%

### SPP (Firm)

- Gas: 14%
- Coal: 18%
- Renewable: 68%

### VSPP

- Gas: 3%
- Renewable: 97%
### IPP First Round Bidding

IPP First Round Bidding commenced on 2000-2008

<table>
<thead>
<tr>
<th>IPPs</th>
<th>Fuel Type</th>
<th>Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. IPT</td>
<td>Natural Gas</td>
<td>700</td>
</tr>
<tr>
<td>2. TECO</td>
<td>Natural Gas</td>
<td>700</td>
</tr>
<tr>
<td>3. Ratchburi Power</td>
<td>Natural Gas</td>
<td>1,400</td>
</tr>
<tr>
<td>4. Gulf Power</td>
<td>Natural Gas</td>
<td>1,468</td>
</tr>
<tr>
<td>5. BLCP</td>
<td>Coal</td>
<td>1,346.5</td>
</tr>
<tr>
<td>6. Glow IPP</td>
<td>Natural Gas</td>
<td>713</td>
</tr>
<tr>
<td>7. EPEC</td>
<td>Natural Gas</td>
<td>350</td>
</tr>
</tbody>
</table>

Total Capacity: 6,677.5 MW

### IPP Second Round Bidding

IPP Second Round Bidding is expected to commence on 2012-2014

<table>
<thead>
<tr>
<th>IPP</th>
<th>Equity Structure</th>
<th>Fuel</th>
<th>Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. GHECO-One</td>
<td>GLOW IPP2 = 65% Hemaraj = 35%</td>
<td>Coal</td>
<td>660</td>
</tr>
<tr>
<td>2. National Power supply (NPS)</td>
<td>NPS = 99.99% 6 Thai Individuals =0.01%</td>
<td>Coal</td>
<td>540</td>
</tr>
<tr>
<td>3. Siam Energy</td>
<td>Gulf JP = 99.94% 6 Thai Individuals =0.06%</td>
<td>Gas</td>
<td>1,600</td>
</tr>
<tr>
<td>4. Power Generation Supply</td>
<td>Gulf JP = 99.94% Individual Investors =0.06%</td>
<td>Gas</td>
<td>1,600</td>
</tr>
</tbody>
</table>

Total Capacity: 4,400 MW
SPP Power Purchase Regulation 2007

<table>
<thead>
<tr>
<th>Firm</th>
<th>Non Firm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cogeneration</td>
<td>Cogeneration</td>
</tr>
<tr>
<td>Renewable</td>
<td>Renewable</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Target</th>
<th>Firm 4,000 MW</th>
<th>No limit</th>
<th>No limit</th>
<th>No limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchased Cap.</td>
<td>&gt;10 - 90 MW</td>
<td>&gt;10 - 90 MW</td>
<td>&gt;10 - 90 MW</td>
<td>&gt;10 - 90 MW</td>
</tr>
<tr>
<td>Contract Period</td>
<td>20 - 25 Year</td>
<td>20 - 25 Year</td>
<td>5 Year (renew contract)</td>
<td></td>
</tr>
<tr>
<td>Fuel</td>
<td>gas, coal</td>
<td>Renewable</td>
<td>Renewable</td>
<td></td>
</tr>
<tr>
<td>Condition</td>
<td>Steam</td>
<td>&gt;= 5%</td>
<td>Conventional fuel &lt;= 25%</td>
<td>Conventional fuel &lt;= 25%</td>
</tr>
</tbody>
</table>

Source: EGAT
Tariff Structure

EGAT Gen

Power Plant
PDP 2010 Power Generation

Transmission line
PDP 2010 Transmission System

Distribution & Retail
PDP 2010 Distribution System

EGAT Trans

MEA PEA

Base Tariff

Automatic Fuel Adjustment (Ft)

VAT 7%

PTT

Gas Pipeline

Gas Pipeline Development Plan

Cost of power purchased from EGAT

Cost of Power purchase from private providers

Adder

PDF

IPP SPP VSPP Int

(27%) (72%) (1%)
The Structure of Current Electricity Price

- The Fuel Adjustment Clause according to the Automatic Adjustment Mechanism.
- Increase or decrease based on changes in the costs of fuel and purchased power costs which are out of utilities’ control.
- Adjusted every 4 months.

- 7% of electricity price

Base Tariff
2.2462 Baht
(0.0642 USD)

Fuel Adjustment Charge (Ft)
0.9255 Baht
(0.0264 USD)

VAT 0.2220 Baht
(0.006 USD)

3.3939 Baht
(0.96 USD)

Remark: 1 USD = 35 Baht

- Reflects investment costs of utilities in developing power plants, transmission lines, distribution lines and energy costs with certain assumptions pertaining to fuel prices, inflation rates (or CPI), exchange rates.
- Reviewed every 3-5 years.
- Effective since 2000.
The Adjustments of Ft

6 times of Ft adjustment have been done by the ERC.

Remark:
100 Satang = 1 Baht
35 Baht = 1USD
Revenue Requirement and financial criteria

Revenue Requirement: based on meeting financial criteria on average over tariff period (2006 - 2008)

Financial Criteria

<table>
<thead>
<tr>
<th>Description</th>
<th>EGAT</th>
<th>MEA</th>
<th>PEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return on Capital Invested: ROIC (%)</td>
<td>8.39</td>
<td>4.80</td>
<td>4.80</td>
</tr>
<tr>
<td>Debt Service Coverage Ratio: DSCR (x)</td>
<td>≥ 1.30</td>
<td>≥ 1.50</td>
<td>≥ 1.50</td>
</tr>
<tr>
<td>Debt /Equity (x)</td>
<td>≤ 1.50</td>
<td>≤ 1.50</td>
<td>≤ 1.50</td>
</tr>
</tbody>
</table>
Tariff design in Thailand

**Progressive Rate**
- Residential
- Small General Service
- Government
- Energy Charge + Service Charge

**Two part tariff**
- Demand < 1,000 kW
- Before October 2000
- Energy Charge + Demand Charge
Tariff design in Thailand

Time of Use

TOD
- Demand > 1,000 kW
- Before October 2000
- Energy Charge + Demand Charge

TOU
- Demand > 30 kW
- After October 2000
- Energy + Demand + Service Charge
เปรียบเทียบลักษณะของพลังไฟฟ้า

ลักษณะของพลังไฟฟ้า
ในวันที่มีการใช้พลังไฟฟ้าสูงสุด
ปี 2536 - 2551

เวลา (ชั่วโมง)
Daily Load Curve: 5 Minutes Scan

- 70 MW/min
- 90 MW/min
- 75 MW/min
- 75 MW/min
## Retail Tariff

<table>
<thead>
<tr>
<th>Categories</th>
<th>Energy Consumption</th>
<th>Peak Demand</th>
<th>Tariff Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Residential</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Small</td>
<td>&lt; 150 kWh</td>
<td></td>
<td>Progressive</td>
</tr>
<tr>
<td>- Large</td>
<td>&gt; 150 kWh</td>
<td></td>
<td>Progressive and TOU Rate</td>
</tr>
<tr>
<td>2. Small General Service</td>
<td>Not Specified</td>
<td>&lt; 30 kW</td>
<td>Progressive and TOU Rate</td>
</tr>
<tr>
<td>3. Medium General Service</td>
<td>&lt; 250,000 kWh</td>
<td>30 - 999 kW</td>
<td>Two part tariff and TOU Rate</td>
</tr>
<tr>
<td>4. Large General Service</td>
<td>&lt; 250,000 kWh</td>
<td>&gt; 1,000 kW</td>
<td>Two part tariff and TOU Rate</td>
</tr>
<tr>
<td>5. Specific Business</td>
<td>Not Specified</td>
<td>≥ 30 kW</td>
<td>Two part tariff and TOU Rate</td>
</tr>
<tr>
<td>6. Government and Non Profit Organization</td>
<td>&lt; 250,000 kWh</td>
<td>&lt; 1,000 kW</td>
<td>Progressive and TOU Rate</td>
</tr>
<tr>
<td>7. Water Pumping for Agriculture</td>
<td></td>
<td></td>
<td>Progressive and TOU Rate</td>
</tr>
</tbody>
</table>
# The Adder* for RE generator classified by types of RE

<table>
<thead>
<tr>
<th>Types of Renewable Energy</th>
<th>Former Adder (Baht/kWh)</th>
<th>Current Adder (Baht/kWh)</th>
<th>Additional for Diesel Substitution (Baht/kWh)</th>
<th>Additional for RE generators in the most 3 southern provinces (Baht/kWh)</th>
<th>Period (Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Biomass</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Installed Cap. &lt;= 1 MW</td>
<td>0.30</td>
<td>0.50</td>
<td>1.00</td>
<td>1.00</td>
<td>7</td>
</tr>
<tr>
<td>- Installed Cap. &gt;1 MW</td>
<td>0.30</td>
<td>0.30</td>
<td>1.00</td>
<td>1.00</td>
<td>7</td>
</tr>
<tr>
<td>2. Biogas (all sources)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Installed Cap. &lt;= 1 MW</td>
<td>0.30</td>
<td>0.50</td>
<td>1.00</td>
<td>1.00</td>
<td>7</td>
</tr>
<tr>
<td>- Installed Cap. &gt;1 MW</td>
<td>0.30</td>
<td>0.30</td>
<td>1.00</td>
<td>1.00</td>
<td>7</td>
</tr>
<tr>
<td>3. Waste (MSW and non-toxic industrial waste)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Fertilizer/Landfill</td>
<td>2.50</td>
<td>2.50</td>
<td>1.00</td>
<td>1.00</td>
<td>7</td>
</tr>
<tr>
<td>- Thermal Process</td>
<td>2.50</td>
<td>3.50</td>
<td>1.00</td>
<td>1.00</td>
<td>7</td>
</tr>
<tr>
<td>4. Wind</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Installed Cap. &lt;= 50 kW</td>
<td>3.50</td>
<td>4.50</td>
<td>1.50</td>
<td>1.50</td>
<td>10</td>
</tr>
<tr>
<td>- Installed Cap. &gt; 50 kW</td>
<td>3.50</td>
<td>3.50</td>
<td>1.50</td>
<td>1.50</td>
<td>10</td>
</tr>
<tr>
<td>5. Hydro (Mini/Micro Hydro)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Installed Cap. 50 kW - &lt;200 kW</td>
<td>0.40</td>
<td>0.80</td>
<td>1.00</td>
<td>1.00</td>
<td>7</td>
</tr>
<tr>
<td>- Installed Cap. &lt;50 kW</td>
<td>0.80</td>
<td>1.50</td>
<td>1.00</td>
<td>1.00</td>
<td>7</td>
</tr>
<tr>
<td>6. Solar</td>
<td>8.00</td>
<td>6.50</td>
<td>1.50</td>
<td>1.50</td>
<td>10</td>
</tr>
</tbody>
</table>

* The Cabinet’s resolution on 24 Mar 2009
The Power Development Fund

Source of Fund

Electricity Business Licenses

- D
- R

From tariffs

Fund

(1)
Compensation and Subsidization for Licensees who provide universal service

System Operation License

From Fines

(2)
Compensate through Ft

Electricity Generation License

Gas
0.01 B/kWh

Fuel Oil
0.015 B/kWh

Coal/Lignite
0.015 B/kWh

Renew
0 – 0.02 B/kWh

From Levy

(3)
(4)
(5)
(6)

Develop and rehabilitate a community near Power Plant
Promote Renewable
Promote people participation
Fund management
Regulated Tariff

ERC is in the process of developing the rules for the electricity rates and the supply of electricity, with the principle objective of encourage the efficient use of resources; reducing environmental impact while ensuring the balanced development of the power sector and the economic development of the country.

Issues being considered include

- Opening the sector to demand side participation to provide the opportunity to compete with energy production
- Offering demand response where a tariff paid to reduce consumption (Interruptible tariff)
- Open demand response to competition
Regulated Tariff (cont)

- Tariffs will be unbundled into generation, transmission, distribution, and supply, including the various subsidies.
- Subsidies will be paid through the Power Development Fund under clear rules and monitoring.
- The National Uniform Tariff will remain for customers as appropriate.
- Tariffs will remain cost reflective and ERC will take on the role of collecting and monitoring cost data.
New Wholesale Tariff Structure

Wholesale Power Pricing Mechanism: WPPM

- Imports
- EGAT Gx
- IPP/SPP
- Demand Side

EGAT Single Buyer

- PEA
- MEA
- EGAT Retail

VSPP < 10 MW

Load Aggregation
Total Energy Generation
By Fuel Type

2009

- Natural Gas: 71.8%
- Imported Coal: 0.4%
- Lignite: 11.6%
- Diesel: 0.03%
- Hydro: 4.8%
- Lao PDR: 1.6%
- TNB: 0.1%
- Renewable: 1.5%

Energy Generation: 145,233 GWh

2030

- Natural Gas: 39.1%
- Imported Coal: 11.1%
- Power Import: 11.3%
- Hydro: 4.4%
- Lignite: 2.2%
- Diesel: 0.01%
- Lao PDR: 0.3%
- Renewable: 5.7%
- TNB: 0.1%

Energy Generation: 347,948 GWh
Thailand Power Development Plan

List of Projects from 2010 – 2021
Thailand Power Development Plan (Con.)

List of Projects from 2022 – 2030

<table>
<thead>
<tr>
<th>Year</th>
<th>Retired Capacity</th>
<th>Foreign Purchase</th>
<th>Domestic Purchase</th>
<th>EGAT</th>
<th>Glow IPP</th>
</tr>
</thead>
<tbody>
<tr>
<td>2022</td>
<td>(500)</td>
<td>(726)</td>
<td>(836)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2023</td>
<td>(1,000)</td>
<td>(3,653)</td>
<td>(1,000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2024</td>
<td>(1,500)</td>
<td>(820)</td>
<td>(1,800)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2025</td>
<td>(2,000)</td>
<td>(2,664)</td>
<td>(508)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2026</td>
<td>(2,500)</td>
<td>(2,056)</td>
<td>(600)</td>
<td></td>
<td>(808)</td>
</tr>
<tr>
<td>2027</td>
<td>(3,000)</td>
<td>(880)</td>
<td>(600)</td>
<td></td>
<td>(270)</td>
</tr>
<tr>
<td>2028</td>
<td>(3,500)</td>
<td>(1,600)</td>
<td>(600)</td>
<td></td>
<td>(396)</td>
</tr>
<tr>
<td>2029</td>
<td>(4,000)</td>
<td>(1,000)</td>
<td>(600)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2030</td>
<td></td>
<td>(2,000)</td>
<td>(600)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PDP Assumptions

• Load Forecast based on regression analysis of recorded retail electricity retail and GDP growth
• Data from current DSM programs was acquired from the Ministry of Energy and included in regression analysis. New programs will be deducted from the forecast demand afterward.
• Power generation using renewable energy in 2010-2022 was estimated as per AEDP (2008-2022) of the Ministry of Energy, while that in 2023-2030 is estimated.
• SPP purchase 2010-2021 to comply with the NEPC’s resolution thereafter planned to be 360 MW annually in 2022–2029 and 540 MW in 2030.
• The minimum annual reserve margin was constraint to 15%
• Gas fired power plants to be retired would be replaced with combined cycle generating units.
• Greenhouse gas emission per unit of generated electricity in 2030 was set to be lower than that of PDP 2007 Revision 2.
• Proportion of Fuel Use:
  – Renewable energy as per the 15 Years AEDP; Cogeneration SPP took first priority and was followed by other alternative technologies.
  – Nuclear power plant was limited to 1 unit/year and allowed only 2 years in a row with a pause of 2 years to comfort the investment plan.
  – Power purchase from neighboring countries must not exceed 25% of the total generating capacity.
  – Other generating capacity was a well considered mix of replacing gas fired combined cycle power plants and clean coal thermal power plants.
PDP 2010 Definition

DSM programs and measures aim to promote and support target groups of customers to improve their electricity consumption.

Promotion of New T5 Fluorescent Lamp Program

Program Target: To promote new T5 fluorescent lamps to replace old T8 fluorescent lamps, especially in business and industrial sectors, amounting 83 million lamps within 2015.

DSM Considerations

DSM from energy savings from appliances is not included in load forecast. Plan for savings from new DSM programs to be included in load forecast. Such new programs must be:
1. Continuous; and,
2. Must affect consumption behaviour.

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<tr>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak (MW)</td>
<td>43</td>
<td>129</td>
<td>215</td>
<td>344</td>
<td>473</td>
<td>584</td>
<td>498</td>
<td>369</td>
<td>198</td>
</tr>
<tr>
<td>Energy (MWh)</td>
<td>210</td>
<td>629</td>
<td>1049</td>
<td>1,678</td>
<td>2,307</td>
<td>2,852</td>
<td>2,433</td>
<td>1,804</td>
<td>965</td>
</tr>
</tbody>
</table>

Source: EPPO
The ERC would like to consider the following:

| Ways to regulate the scope of contents and the procedures of power development planning |
| Ways to introduce more competition into DSM and DR including setting the right incentives for the parties involved |