Power Tariff Structure in Thailand

23 October 2012, Singapore
Dr. Pallapa Ruangrong
Energy Regulatory Commission of Thailand
Population: 67 Million

Customers (at end-2011): 19 Million

- MEA (3.12 million) 44,195 GWh
- PEA (16.02 million) 102,947 GWh
- Direct EGAT customers 1,713 GWh
- Total Sale in 2011 148,855 GWh

Transmission Network: 19,190 km

Rural Electrification: 99.8%

Access, Transmission and Distribution:
- Population access to electricity: 99%
- Urban Population access to electricity: 100%
- Rural Population access to electricity: 99.8%
- Distribution and transmission losses: 8%
- National Grid Coverage: 99%
- Reliability of electricity service: Occasional brownouts

MEA: Metropolitan Electricity Authority
PEA: Provincial Electricity Authority

MEA’s service areas: Bangkok, Nonthaburi, Samut Prakan
PEA’s service areas: the rest of the country
Energy Regulatory Commission (ERC): Functions and Responsibilities

**Power Sector**
- Generation
- Transmission
- Distribution
- Retail
- System Operator

**Natural Gas Sector**
- Supply & Wholesale
- Transmission
- Retail & Distribution
- LNG Terminal

**Standards**
- Reliability & Security
- Engineering Standard
- Quality Service Standard
- Safety Standard

**Promotions**
- Tariff
- Competition
- Public Participation
- RE & EE Promotion
Electricity Structure: Enhanced Single Buyer Model

**Generation**
- EGAT generators (48%)
- IPPs (38%)
- SPPs (7%)
- VSPPs (<1%)
- Import/Exchange (7%)

**Transmission System Owner**
- EGAT (100%)

**Network System Operator & Single Buyer**

**Distribution & Retail**
- MEA (30%)
- PEA (68%)
- EGAT Direct Customers (2%)

**Management and Accounting Separation**

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

Note: % in (_) = market share as at Jun 2012

Govt. (policy framework)

ERC Regulation
## Private Power Producers (as of Sep 2012)

<table>
<thead>
<tr>
<th>Producers</th>
<th>Existing</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IPP</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firm</td>
<td>2,249.1 MW (43)</td>
<td>5,055.5 MW (57)</td>
</tr>
<tr>
<td>Non Firm</td>
<td>433.92 MW (19)</td>
<td>1,026 MW (17)</td>
</tr>
<tr>
<td><strong>SPP</strong></td>
<td><strong>12,811.6 MW (11)</strong></td>
<td><strong>3,740 MW (3)</strong></td>
</tr>
<tr>
<td>Firm</td>
<td>EGAT’s 5,474 MW (3)</td>
<td>Private 7,337 MW (8)</td>
</tr>
<tr>
<td>Non Firm</td>
<td>886.92 MW (324)</td>
<td>4,468.17 MW (911)</td>
</tr>
<tr>
<td><strong>VSPP</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non Firm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total:**

- Existing: 16,381.54 MW (397)
- New: 14,289.67 MW (988)

Remark: ( ) = numbers of firms
Power Tariff Structure as from July 2011

1. **Initial Base Tariff**
   - (2.2462 Baht/kWh)
   - (May-Aug 2011)
   - (0.9581 Baht/kWh)

2. **Base $F_t$**
   - $F_t$ (May-Aug 2011)
   - 0.9581 Baht/kWh
   - ≤90 units/month for Free (0.12 Baht/kWh)

3. **VAT**
   - 7%
   - 3.5570 Baht/kWh

4. **Adder**
   - 97(4)
   - Power Development Fund
   - 97(3)

**Power Plants**
- Power Development Plan

**Transmission line**
- Transmission Development Plan

**Distribution & Retail**
- Distribution Development Plan

**PTT**
- Gas Pipeline
  - Development Plan

**Fuel Cost**
- IPPs
- SPPs
- VSPP
- Import/exchange

1 Baht = ~ 0.032 USD

*PSO = Public Service Obligation (now adjusted to ≤50 units/month)*
Retail Tariff (status as of June 2012) broken down by business

<table>
<thead>
<tr>
<th>Total Retail Tariff:</th>
<th>3.2387 Baht/ kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Generation:</strong></td>
<td></td>
</tr>
<tr>
<td>EGAT Fuel Cost</td>
<td>0.6656</td>
</tr>
<tr>
<td>Investment Capital, OMA, Return of EGAT</td>
<td>0.3308</td>
</tr>
<tr>
<td>Power Purchasing Price (AP + CP)</td>
<td>0.3629</td>
</tr>
<tr>
<td>Power Purchasing Price (EP)</td>
<td>1.1668</td>
</tr>
<tr>
<td><strong>Transmission:</strong></td>
<td>0.2817 Baht/ kWh</td>
</tr>
<tr>
<td><strong>Distribution &amp; Retail:</strong></td>
<td>0.4210 Baht/ kWh</td>
</tr>
</tbody>
</table>

- Generation: 78.1%
- Transmission: 8.8%
- Distribution & Retail: 13.1%
8 Power Consumer Categories

Electricity Sales in June 2012 (13,357.58 GWh)

- Residential Service: 23.09%
- Small General Services: 10.54%
- Medium General Services: 15.40%
- Large General Services: 43.38%
- Specific Business: 3.33%
- Non-profit Organization: 3.35%
- Agricultural Pumping: 0.16%
- Temporary Power Customer: 0.75%

Source: EGAT data of actual power sale in Jun2012 (information as at 22Aug2012)
1. Residential

1.1 Normal tariff with consumption not exceeding 150 kWh per month

MONTHLY TARIFF: Energy Charge

First 15 kWh (1st – 15th)  1.8632  Baht/kWh
Next 10 kWh (16th – 25th)  2.5026  Baht/kWh
Next 10 kWh (26th – 35th)  2.7549  Baht/kWh
Next 65 kWh (36th – 100th)  3.1381  Baht/kWh
Next 50 kWh (101st – 150th)  3.2315  Baht/kWh
Next 250kWh (151st – 400th)  3.7362  Baht/kWh
Over 400 kWh (up from 401st)  3.9361  Baht/kWh

Service Charge (Baht/month): 8.19

1.2 Normal tariff with consumption exceeding 150 kWh per month

MONTHLY TARIFF: Energy Charge

First 150 kWh (1st – 150th)  2.7628  Baht/kWh
Next 250 kWh (151st – 400th)  3.7362  Baht/kWh
Over 400 kWh (up from 401st)  3.9361  Baht/kWh

Service Charge (Baht/month): 38.22

1.3 Time of Use Tariff (TOU Tariff)

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Energy Charge (Baht/kWh)</th>
<th>Service Charge (Baht/month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Peak</td>
<td>Off Peak</td>
<td></td>
</tr>
<tr>
<td>1.3.1 12 – 24 kV</td>
<td>4.5827</td>
<td>2.1495</td>
</tr>
<tr>
<td>1.3.2 Below 12 kV</td>
<td>5.2674</td>
<td>2.1827</td>
</tr>
</tbody>
</table>

On Peak: 09.00 AM to 10.00 PM. Monday – Friday and Royal Ploughing Day

Off Peak: 10.00 PM to 09.00 AM Monday – Friday and Royal Ploughing Day

: 00.00 AM to 12.00 PM Saturday – Sunday, National Labor Day and normal public holidays

(excluding Royal Ploughing Day and substitution holidays)
The Automatic Tariff Adjustment ($F_t$) is a mechanism for adjusting the power tariff so that it reflects the actual fuel cost for power generation at a given period of time, thus making the tariff charged on consumers fair, transparent and reflects the actual power supply cost.

$F_t$ will be adjusted in line with changes in EGAT fuel cost, the power purchase cost and the impact of policy expense which are beyond control of the Power Utilities.
**Base Fuel Cost : BFC**

**BFC** is calculated from the fuel cost, power purchase cost and policy expense, which correspond to the retail $F_t$ for the round of May – August 2011 included in the base tariff.

### Base Fuel Prices (May – August 2011)

- **Natural gas (Gulf of Thailand & Myanmar)**: 250.05 Baht/MMBTU
- **Fuel oil**: 23.64 Baht/litre

**Average BFC = 210.28 Satang/kWh***

*100 Satangs = 1 Baht = ~ 0.031 USD*
Principle of $F_t$ Calculation

**EFC**
- **EFC**: Estimated Fuel Cost
- **Estimation**: of the fuel cost, power purchase cost and policy expense for the present round

**BFC**
- **BFC**: Base Fuel Cost
- The fuel cost, power purchase cost and policy expense for the round of “May – Aug 2011” which is averaged at 210.28 Satangs/kWh, used as “Base”

**AF**
- **AF**: Accumulated Factor
- The accumulated difference between the “actually calculation-derived $F_t$” and the “$F_t$ charged” in the previous round

**FAC**
- **FAC**: Fuel Adjustment Cost
- The difference between the “Estimation” and the “Base” of fuel cost for the present round (the $F_t$ for the present round)

\[ F_t = \frac{FAC + AF}{EU} \]

**Round of Sep – Dec 2012**
- **EFC**: 139,151.98 Million THB 253.06 Satangs/kWh
- **BFC**: 210.28 Satangs/kWh
- **FAC**: 23,523 Million THB 45.34 Satangs/kWh
- **AF**: 11,882.18 Million THB 22.90 Satangs/kWh
- **F_t**: 35,401.26 Million THB 68.24 Satangs/kWh
- **EU**: 51,877.57 kWh
- **ES**: 54,988.28 kWh
**Fₜ Management** (by increasing the Fₜ for the Sep-Dec 2012 round by 18.00 Satangs/kWh and by 6.55 Satangs/kWh for each of the following rounds until end-2013)

Preliminary data as at 9Mar2012
### Impact of $F_t$ for the Round of Sep - Dec 2012 on Each Power Consumer Category

<table>
<thead>
<tr>
<th>Power Consumer Category</th>
<th>Average Tariff* June 2012 (Baht/kWh)</th>
<th>New $F_t$ (Baht/kWh)</th>
<th>Average New Tariff (Baht/kWh)</th>
<th>Increase (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>3.3799</td>
<td>0.4800</td>
<td>3.8599</td>
<td>4.89 %</td>
</tr>
<tr>
<td>Small General Services</td>
<td>3.7269</td>
<td>0.4800</td>
<td>4.2069</td>
<td>4.47 %</td>
</tr>
<tr>
<td>Medium General Services</td>
<td>3.3272</td>
<td>0.4800</td>
<td>3.8072</td>
<td>4.96 %</td>
</tr>
<tr>
<td>Large General Services</td>
<td>2.9833</td>
<td>0.4800</td>
<td>3.4633</td>
<td>5.48 %</td>
</tr>
<tr>
<td>Specific Business</td>
<td>3.0501</td>
<td>0.4800</td>
<td>3.5301</td>
<td>5.37 %</td>
</tr>
<tr>
<td>Non-profit Organization</td>
<td>3.1747</td>
<td>0.4800</td>
<td>3.6547</td>
<td>5.18 %</td>
</tr>
<tr>
<td>Agricultural Pumping</td>
<td>2.7935</td>
<td>0.4800</td>
<td>3.2735</td>
<td>5.82 %</td>
</tr>
<tr>
<td>Temporary Power Customer</td>
<td>6.2902</td>
<td>0.4800</td>
<td>6.7702</td>
<td>2.73 %</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>3.2387</td>
<td>0.4800</td>
<td>3.7187</td>
<td>5.09 %</td>
</tr>
</tbody>
</table>

Remarks: * The average tariff imposed by MEA and PEA in the month of June 2012 on customers under Categories 3, 4, 5, and 6 has already included the subsidization for residential consumers with consumption not exceeding 50 kWh/month at a rate of 0.0265 Baht/kWh.
# The Adder for RE Generators classified by RE type

<table>
<thead>
<tr>
<th>Type of Renewable Energy</th>
<th>Former Adder 2009 (Baht/kWh)</th>
<th>Current Adder As of 2010 (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 of Support (from COD) (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. ≤ 1 MW</td>
<td>0.50</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. ≤ 1 MW</td>
<td>0.50</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>3.50</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. ≤ 50 kW</td>
<td>4.50</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>0.80</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>1.50</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 Mar 24, 2009

**The Cabinet’s resolution on July 20, 2010: Applied to the projects that haven’t been accepted by the Power Utilities.
### Status of RE Generation in Thailand (on-grid: 2011)

**Unit: MW**

<table>
<thead>
<tr>
<th>Types</th>
<th>Commercial Operation Date (COD)</th>
<th>PPA signed (waiting for COD)</th>
<th>Proposal accepted (waiting for PPA)</th>
<th>Under consideration</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Biomass</strong></td>
<td>1,422.59</td>
<td>2,068.58</td>
<td>614.28</td>
<td>393.60</td>
<td>4,499.05</td>
</tr>
<tr>
<td><strong>Biogas</strong></td>
<td>113.42</td>
<td>82.66</td>
<td>58.57</td>
<td>74.49</td>
<td>329.14</td>
</tr>
<tr>
<td><strong>Waste</strong></td>
<td>38.91</td>
<td>141.49</td>
<td>6.70</td>
<td>100.66</td>
<td>287.76</td>
</tr>
<tr>
<td><strong>Hydro (Mini/Micro)</strong></td>
<td>14.36</td>
<td>6.12</td>
<td>0.39</td>
<td>1.08</td>
<td>21.95</td>
</tr>
<tr>
<td><strong>Wind</strong></td>
<td>0.38</td>
<td>398.22</td>
<td>593.30</td>
<td>398.14</td>
<td>1,390.04</td>
</tr>
<tr>
<td><strong>Solar</strong></td>
<td>168.62</td>
<td>2,302.75</td>
<td>108.94</td>
<td>1,104.95</td>
<td>3,685.26</td>
</tr>
<tr>
<td><strong>New Form of Energy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Total

|                  | 1,758.28                      | 4,999.82                     | 1,382.18                            | 2,072.92            | 10,213.2       |

**Remarks: Data as of 10Feb2012**

- **Former Target in 2022** (Former 15-yr REDP plan)
  - Total: 5,608
  - Biomass: 3,700
  - Biogas: 600
  - Waste: 160
  - Hydro (Mini/Micro): 160

- **New Target in 2021** (Current 10-yr AEDP plan)
  - Total: 9,201
  - Biomass: 3,630
  - Biogas: 600
  - Waste: 160
  - Hydro (Mini/Micro): 1,608
  - Wind: 1,200
  - Solar: 2,000

- **Geothermal:** 1 MW
- **Tidal:** 2 MW

**Hydrogen**

- Total: 3.5
- **Remarks:**
The Power Development Fund

### Source of Fund
- Collected from Electricity Business Operators through Licensing

### Retail License
- From Tariffs
- From Fines
- From Levy

#### System Operation License
- From Tariffs
- From Fines

#### Electricity Generation License
- From Levy

### Fund objectives (Section 97)
1. To compensate for expansion of electrification in rural areas
2. To subsidize services for underprivileged energy consumers (those using ≤ 50 units/month)
3. To compensate power consumers who pay more expensive rates due to failure in the work of SO
4. To develop and rehabilitate communities surrounding power plants
5. To increase knowledge, awareness, and participation of the public in power-related issues
6. To pay for the Fund administrative cost

### Source of Income
- Gas: 0.01 ฿/kWh
- Fuel Oil/Diesel: 0.015 ฿/kWh
- Coal/Lignite: 0.02 ฿/kWh
- Renew: 0.01 – 0.02 ฿/kWh

### License Types
- Retail License
- System Operation License
- Electricity Generation License
Proposed Tariff Structure

- **EGAT**
  - Capacity Payment (CP)
  - Energy Payment (EP)
  - Ancillary Service Payment

- **IPPP/Import**

- **SPP/VSSP**

**WPPM 1**

**T**
- Allowed Return
- Depreciation
- O&M/ Admin Cost
- Cost of Network loss
- Connection cost

**D**
- U of S^2 Capacity Charge
- U of S Energy Charge
- Connection Charge

**SB^3/SO**
- SB/SO Service Payment

**G**

**T**

**D**

**R**

- PDF 97(1)
- PDF 97(2)
- PDF 97(3)
- Adder/ 97(4)
- PDF 97(5)

**F_t adjustment**

**VAT**

**Note:**
1. Wholesale Power Purchase Mechanism
2. Use of System
3. Single Buyer
4. Weighted Average Cost of Capital

**CP / EP based on the following principle:**

- Imports
- Avoided Cost
- EGAT
- Allowed Revenue
- IPP
- Bidding Process
- SPP
- Avoided Cost

**Determine WACC 4**

- ΔEP
- Δ 97(1)
- Δ 97(2)
- Δ 97(3)
• The Energy Industry Act has opened the way for promoting more competition.

• The Energy Regulatory Commission has authorities and responsibilities under the Act.

• Future implementation includes:
  – Code of governance regime and ring-fencing of the system operator
  – Promotion of TPA in gas transportation
  – Retail Wheeling
  – Major tariff review completed, and preparations for a new tariff review are now underway
  – Investigation of distributed generation and demand response /price response issues
  – Preparation for a regulatory framework for smart grid
Pallapa Ruangrong
pallapa@erc.or.th

Energy Regulatory Commission
www.erc.or.th