Thailand’s Energy Infrastructure Development Plan

Presented by
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at the National Launching of Thailand Country Development
Partnership for Infrastructure (CDP-INFRA)

Shangri-La Hotel, Bangkok, 31 January 2007
Electricity Infrastructure Development: Power Plants & Transmission System

Forecast of Generation Requirement (Revised April 2006: Base Case)

<table>
<thead>
<tr>
<th></th>
<th>2006 (actual)</th>
<th>2011</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Installed Capacity (MW)</strong></td>
<td>27,181</td>
<td>35,206</td>
<td>45,246</td>
</tr>
<tr>
<td><strong>Peak (MW)</strong></td>
<td>21,064</td>
<td>29,337</td>
<td>38,241</td>
</tr>
</tbody>
</table>

**New Plants 2008-2013**

- EGAT: 4 New Plants
- Purchase from IPPs
- Purchase from Laos
  - By 2011: Nam Theun 2, Nam Ngeum 2
  - By 2013: Nam Theun 1, Nam Ngeum 3

**New Plants 2014-2021**

- New EGAT Plants
- New IPPs
- Purchase from neighboring countries, e.g. Laos, Myanmar
# Approved Power Projects, with PPA Signed

<table>
<thead>
<tr>
<th>Project</th>
<th>Capacity (MW)</th>
<th>COD</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGAT New Power Plants (all are Combined Cycle):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Songkla Plant, Unit 1</td>
<td>747</td>
<td>Mar 2008</td>
</tr>
<tr>
<td>2. South Bangkok Plant, Unit 3</td>
<td>768</td>
<td>Mar 2009</td>
</tr>
<tr>
<td>3. Bang Pakong Plant, Unit 5</td>
<td>764</td>
<td>Mar 2009</td>
</tr>
<tr>
<td>4. North Bangkok Plant, Unit 1</td>
<td>723</td>
<td>Mar 2010</td>
</tr>
</tbody>
</table>

Source: EGAT, Oct06
## Approved Power Projects, with PPA Signed

<table>
<thead>
<tr>
<th>Project</th>
<th>Capacity (MW)</th>
<th>COD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IPP Power Plants:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. BLCP Power</td>
<td>2 x 673.25</td>
<td>#1 – Oct06</td>
</tr>
<tr>
<td>2. Gulf Power Generation</td>
<td>2 x 734</td>
<td>#1 – Mar07</td>
</tr>
<tr>
<td>3. Ratchaburi Power</td>
<td>2 x 700</td>
<td>#1 – Mar08</td>
</tr>
<tr>
<td><strong>Purchase from Abroad:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Nam Theun 2 (LPDR)</td>
<td>920</td>
<td>Nov 2009</td>
</tr>
<tr>
<td>2. Nam Ngeum 2 (LPDR)</td>
<td>597</td>
<td>Jan 2011</td>
</tr>
</tbody>
</table>

Source: EGAT, Oct06
## Transmission System Enhancement

### 1. Transmission Lines to Accommodate IPP Supply/Imported Electricity:

- Gulf Power Generation Plant
  - 230-kV Khaeng Khoi – Saraburi 2
  - 230-kV Thalan 3 – Khaeng Khoi
- 500-kV Transmission Project for power purchase from Nam Theun 2 (LPDR)
- 500-kV Transmission Project for power purchase from Nam Ngeum 2 (LPDR)

<table>
<thead>
<tr>
<th>Project Description</th>
<th>Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>230-kV Khaeng Khoi – Saraburi 2</td>
<td>Jun 2006</td>
</tr>
<tr>
<td>230-kV Thalan 3 – Khaeng Khoi</td>
<td>Sep 2007</td>
</tr>
<tr>
<td>500-kV Transmission Project for power purchase from Nam Theun 2 (LPDR)</td>
<td>Sep 2008</td>
</tr>
<tr>
<td>500-kV Transmission Project for power purchase from Nam Ngeum 2 (LPDR)</td>
<td>Sep 2010</td>
</tr>
</tbody>
</table>

### 2. Transmission Expansion/Upgrading:

- Transmission System Expansion Phase 10                   | 2005-2008 |
- Upgrading Central-Southern Transmission Line from 115 kV to 230 kV | Jun 2007 |
- Transmission Expansion in Greater Bangkok Area, Phase 2    | 2008-2010 |

Source: EGAT, Oct06
Power Purchase from Lao PDR

- Hongsa 1,400 MW
- Theun-Hin Boun (Extension) 400 MW
- Nakhon Phanom
  - Nam Ngeum 2 = 615 MW
  - Nam Ngeum 3 = 440 MW
  - Nam Theun 1 = 523 MW
  - Nam Theun 2 = 920 MW
- Xepian 390 MW
- SI SA KET
  - Nam Theun 2 = 920 MW
  - PPA signed
  - MOU being prepared
  - Under negotiation

- UDON THANI
  - MAE MOH 3
  - UDON THANI 3

- NORTHERN REGION
  - Nakhon Phanom
  - THAKHEK
  - Ban Na Bong

- NORTHEASTERN REGION
  - SAKON NAKHON
  - NAKHON PHANOM
  - YASOTHON
  - UBON RATCHTHANI
  - SI SA KET

- Power Purchase from Lao PDR
  - PPA signed
  - MOU being prepared
  - Under negotiation
Potential Power Purchase from Myanmar

Hydropower from

**Thanlwin River**

1. Tasang 7,000 MW
2. Hutgyi 1,200 MW
3. Thanlwin (Upper) 4,000 MW
4. Thanlwin (Lower) 500 MW
5. Yawathit 600 MW

**Tanintharyi River**

1. Tanintharyi 720 MW
Natural Gas Industry

Demand

NG demand is projected to increase ~6.4% during the next 15 years.

Factors:
- NG is clean energy and can be produced domestically.
- NG is the major fuel for power generation.
- NG is promoted in the industrial & transportation sectors.

Supply

- At present, most NG supply is from the Gulf of Thailand and import from Myanmar.
- In the future, more E&P from the Gulf of Thailand will be necessary, including import of LNG to meet the increasing demand.
Promotion of Greater Use of Natural Gas to replace fuel oil in the industrial sector

- In the industrial sector, Thailand will diversify energy supply from oil to natural gas, renewable energy and coal.
- It is targeted that natural gas could replace 5% of oil consumption.
Promotion of Natural Gas Utilization in the Industrial Sector

Initial Target
Industrial Estates in:
- BKK & vicinities
- Songkhla
- Chonburi + Rayong
- Saraburi + Ayuddhaya

2011: NG use = 5,400 M. litres of fuel oil
2020: NG use = 10,300 M. litres of fuel oil
Promotion of Greater Use of Natural Gas to replace fuel oil in the transportation sector

Target
- Replace 10% of oil by compressed natural gas, or “NGV,” by 2008.
- 500,000 NGV-fueled vehicles by 2010.
  Focus on public transport fleets, taxis & government car fleets
- Increase NGV stations from now 99 to 270 stations in 2007 and to 740 stations by 2010.
### NGV Promotion Implementation (as of Dec 2006)

#### No. of NGV Vehicles

<table>
<thead>
<tr>
<th>Category</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal cars/ Government fleets</td>
<td>15,993</td>
</tr>
<tr>
<td>Taxis</td>
<td>8,277</td>
</tr>
<tr>
<td>Tuk-tuks</td>
<td>360</td>
</tr>
<tr>
<td>BMTA Buses</td>
<td>93</td>
</tr>
<tr>
<td>Diesel-engine vehicles (Pilot)</td>
<td>153</td>
</tr>
<tr>
<td>Others</td>
<td>495</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>25,371</strong></td>
</tr>
</tbody>
</table>

#### No. of Service Stations

- **Already in operation**
  - BKK + Vicinities: 69
  - Provincial: 30
  - **Total**: 99

#### Distribution Volume/ Oil Replacement

NGV distribution volume = 14.0 MMSCFD

#### No. of NGV-Kit Installation Service Providers

- **104** Companies

#### Installation Certification

- **26** Authorized Entities

Source: PTT
Expand the NG transmission pipeline capacity to accommodate the increasing demand.

- The existing pipelines (4,866 MMSCFD) are fully used.

3rd Offshore NG Transmission Pipeline

- Phase 1: partly in operation since Jul 2006; the whole phase will be completed in early 2009
- Phase 2: COD 2007 – 2010
- Phase 3: COD early 2012

- After completion of the 3rd NG transmission pipeline as well as other expansion projects under the Master Plan No. 3 in 2012, the total capacity will increase to 7,687 MMSCFD.
NG transmission pipeline according to Master Plan No. 3

- EGAT’s Power Plants
- Areas of NG Demand
- Gas Fields
- Existing Pipelines
- Future Pipeline according to Master Plan
- Option for Pipeline Construction
Plan for Expansion of Distribution Pipeline System to Promote Use of Natural Gas in the Industrial & Transport Sectors

- **Expand City Gas**
  - Suvannabhumi – Suksawad - Siriraj
  - Sai Noi – Suksawad - Siriraj
  - Samut Prakarn – Bang Chak

- **Expand to Regional Estates/Industrial Areas**
  - **Central Region**
    - Ayuddhaya (Nakhon Luang district)
    - Samut Sakhon (Kratumbaen district)
    - Prachinburi (Gateway Estate, Sahapattana Group)
  - **Eastern Region**
    - Rayong (TPI)
  - **Western Region**
    - Ratchaburi (Ratchaburi Industrial Estate)
  - **Southern Region**
    - Songkhla (Chalung Industrial Estate)
Plan for the Expansion of Natural Gas Pipeline Networks

Expansion of Domestic NG Pipeline Networks

<table>
<thead>
<tr>
<th>Region</th>
<th>Offshore</th>
<th>Onshore</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Coast</td>
<td>2,010</td>
<td>1,200</td>
<td>3,000 km</td>
</tr>
<tr>
<td>Year 2011</td>
<td>3,910</td>
<td>3,700</td>
<td>4,400 km</td>
</tr>
</tbody>
</table>

Expansion of Cross-Border NG Pipeline Networks

- Accommodate domestic demand in the long term
- Preparedness to be “Gas Hub”
  - Natuna (Indonesia) 1,600 km
  - A1, M7/M9 (Myanmar) 1,200 km
  - OCA (Thailand-Cambodia Overlapping Area)
**LNG Receiving Terminal Project**

- **Location:** Map Ta Phut Industrial Estate (Map Ta Phut Industrial Port, Phase 2)
- **Capacity:**
  - Initial phase 5 M Tons/year (700 MMSCFD) as at 2011
  - Long Term 10 M Tons/year (1,400 MMSCFD) as at 2018
- **Lining of Onshore Pipeline No. 4 (42”), 1,300 km, linking with the Terminal and the existing pipeline system/New IPPs**
- **Value creation of LNG**
  - GSP 7 and 8
  - Power Plants/Petrochemical Industry
LNG Import to Enhance the NG Supply Security in the Long Term

- Import: ~3-10 Million Tons/yr (~ 400-1,300 MMSCFD), starting 2011
- Targets (under negotiation): Malaysia, Iran, Australia, Qatar, Russia
- LNG Receiving Terminal: Phase 1: ~3-5 Million Tons
  Phase 2: ~10 Million Tons
Thailand Refineries

Total Capacity: 1,022 KBD (as of Nov 2006)
Intake/Capacity = 91%

- BANGCHAK 120 KBD HYDROSKIM MMING
- ESSO 160 KBD COMPLEX (FCCU)
- THAI OIL 220 KBD COMPLEX (FCCU, HCU)
- BANGCHAK 120 KBD HYDROSKIM MMING
- RPC 17 KBD CONDENSATE SPLITTER
- RRC 145 KBD COMPLEX (HCU, VBU)
- IRPC 215 KBD CONDENSATE SPLITTER
- SPRC 145 KBD COMPLEX (RFCCU)
The drafting of the Energy Act, B.E. ..., is already underway so as to optimize the efficiency of the energy industry regulation in the long run.

When the Act takes effect, the Energy Regulatory Board will be established to regulate the operation of both the electricity and natural gas industry, pursuant to the government policy.
Entities with Regulatory Function during the Transitional Period

- **Electricity Industry Regulation**: 4 Sub-committees under the Committee on Energy Policy Administration, i.e.
  - Sub-Committee Regulating the Power Tariffs and Service Charges
  - Sub-Committee on Load Forecast
  - Sub-Committee on the Power System Interconnection Regulations
  - Sub-Committee on the Purchase of Power from Independent Power Producers

- **Natural Gas Industry Regulation**
  - Petroleum Regulatory Board
Development of Infrastructure to Promote Biofuel Utilization

Biofuel development and promotion has become one of the top agenda of the Thai government, aiming to reduce oil consumption.

- **Biofuels:**
  - Gasohol
  - Biodiesel
Gasohol Promotion & Future Demand

- **GASOHOL**

  **Target**
  - Reduce 10% of overall gasoline consumption

- **2006**: use of Gasohol 95 = 3.5 M lt/day.
  Gasohol 95 (“E-10” – a mixture of ethanol & gasoline octane 91 at a ratio 1:9)
- As of Nov06: 3,445 service stations.
- **2007**: target is to increase the use of gasohol to 9 M lt/day.
- **2011**:
  - 45 ethanol production plants
  - Total production capacity of 12 M lt/day

**Government Measures to Promote Gasohol**

**Price measure**
- Gasohol price is cheaper than the premium gasoline at 1.50 Baht (~4 US cents)/litre

**Government support:**
- BOI investment promotion for fuel-ethanol production plants
- Reduction of import & excise taxes for flexible-fuel vehicles (FFV)
- Soft-loans for domestic FFV manufacturing
- Liberalization of fuel ethanol plants and distribution
**Biodiesel Promotion & Future Demand**

- **BIODIESEL**
  - **Target**
    - Reduce diesel consumption by 10% in 2012.

<table>
<thead>
<tr>
<th>Target</th>
<th>Blending Ratio (to replace diesel consumption)</th>
<th>Distribution Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005-2006 (trial)</td>
<td>2% (B2)</td>
<td>certain areas</td>
</tr>
<tr>
<td>2007-2011 (commercial)</td>
<td>5% (B5)</td>
<td>certain areas (e.g. in the South, BKK)</td>
</tr>
<tr>
<td>2012 onwards</td>
<td>10% (B10)</td>
<td>nationwide</td>
</tr>
</tbody>
</table>

**Note:** The trial of B2 was successful and hence the distribution of a higher blending ratio “B5” earlier than scheduled.
# Status of Biodiesel Development & Promotion

## Biodiesel Specifications
- **Commercial scale** - announced 11Jul05 & effective 23Sep05
- **Community scale** for agricultural machinery - announced 30Jun06 & effective 21Jul06

## Commercial Biodiesel
- 3 production plants of B100, with a total production capacity of 590,000 litres/day. (2 plants just came on stream end of 2006)
- **Total actual production** 100,000 litres/day.
- As of Nov06: 311 service stations for B5 (PTT: 114 & Bangchak: 197), with a total sale of B5 at 200,000 litres/day.
  - sale to lorries & pick-up trucks
- Retail price of B5 is lower than diesel price at 0.50 Baht/litre.

## Community-Based Biodiesel (Pilot Project)
- **Production Capacity (each):** 100 litres/day
- **Raw Materials:** used cooking oil, palm oil, jatropha oil
- **Target Dec 2006:** 70 Communities (65 installed; 5 being installed)
- **Production:** 7,000 litres/day
  - Replace diesel 2.3 M litres/yr
The Thai government has clearly devised plans and strategies based on the concept of sustainable development with a view to creating energy balance between the demand side and the supply side, as this will eventually enhance energy security of the country.

Energy infrastructure development is essential and will require huge resources, especially technical expertise and financial support.

Continued collaboration and assistance from the private sector and financial institutions can very much contribute to Thailand’s achievement of balanced growth, improved efficiency and competitiveness of the country.
Energy Policy and Planning Office
Ministry of Energy
www.eppo.go.th