Thailand’s Power Development Plan 2015 (PDP 2015)

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Director General, Energy Policy and Planning Office
Current Power Generation Status

Power Generation by Fuel Type in 2014

- Natural Gas: 64%
- Clean Coal (inc. Lignite): 20%
- Imported Hydro: 7%
- Diesel/Fuel Oil: 1%
- Renewable Energy: 8%

Power Generation by Producers

- EGAT: 45% (15,482 MW)
- SPP: 10% (3,637 MW)
- IPP: 38% (13,166 MW)
- Imported and Exchange: 7% (2,405 MW)

Total 34,690 MW
PDP2015 Formulation Process

- Principle and Process Determination for PDP 2015
  - Sub-Committee

- Formulation of PDP 2015

- Revision Process for PDP 2015

- Propose to NEPC**

Open Public Hearing for PDP2015 Formulation Process

- Bangkok
  - 29 August 2014
  - Participants 817
- Chiang Mai
  - 16 September 2014
  - Participants 625
- Khon Kean
  - 10 September 2014
  - Participants 650
- Suratthani
  - 19 September 2014
  - Participants 556

Public Hearing for Drafted PDP2015

- Focused Group
  - 8 April 2015
  - Participants 161
- Public Hearing
  - 28 April 2015
  - Participants 557

*Sub-Committee on Load Forecast and Power Development Plan Formulation

**National Energy Policy Council
1. Regional and Domestic economic situation which affect domestic energy consumption in Thailand such as Government’s transportation infrastructure investment projects and the commencement of ASEAN Economic Community, AEC, in late 2015.

2. - National Energy Policy Council, NEPC, approved the Framework and Assumption as a principle for the formulation process of PDP2015 on the 22\textsuperscript{nd} October 2014.
   - Formulation of PDP2015 in accordance with the National Economic and Social Development Plan
   - Integration with the formulation of Energy Efficiency Development Plan, EEDP, and Alternative Energy Development Plan, AEDP.
3. Main Objectives

1) Security
   - Ensure the Security of all Power System Components
   - Power Generation, Transmission and Distribution
   - Fuel Diversification to reduce the risk of fuel dependency

2) Economy
   - Appropriate determination of Power Tariff to reflect the primary cost

3) Ecology
   - Reduce / Minimize Ecological Impact to Environment and Community
1. **Fuel Diversification**
   - Reduce fuel dependence on Natural Gas
   - Increase the fuel mixed proportion for Clean Coal Technology
   - Higher proportion of Imported Power from Neighboring Countries
   - Improved Renewable Energy Sources Percentage in fuel mix
   - Nuclear Power Plant Projects at the end of PDP2015

2. **Appropriate Reserve Margin** at above 15 percent of peak power demand

3. **Power System Infrastructure Investment Projects**
   - Transmission and Distribution Infrastructure to support the development of AEC and GMS power integration
   - Development of Smart Grid Technology to optimize the integration of Renewable Energy Sources

4. **Integration with EEDP and AEDP**
## Energy Efficiency Target for Power Sector

<table>
<thead>
<tr>
<th>Measure</th>
<th>Residential</th>
<th>Industrial</th>
<th>Business</th>
<th>Government</th>
<th>Total (GWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ENCON Act for Designated Factories and Buildings + Specific Energy Consumption</td>
<td>-</td>
<td>10,814</td>
<td>5,654</td>
<td>3,180</td>
<td>19,648</td>
</tr>
<tr>
<td>2. Building Energy Code (BEC)</td>
<td>-</td>
<td>-</td>
<td>11,975</td>
<td>1,711</td>
<td>13,686</td>
</tr>
<tr>
<td>3. High and Minimum Energy Performance Standards (HEPs &amp; MEPs)</td>
<td>8,936</td>
<td>6,226</td>
<td>7,609</td>
<td>-</td>
<td>23,760</td>
</tr>
<tr>
<td>4. Financial Incentive</td>
<td>-</td>
<td>9,133</td>
<td>5,941</td>
<td>-</td>
<td>15,074</td>
</tr>
<tr>
<td>5. Promoting Greater Use of LED</td>
<td>3,354</td>
<td>3,303</td>
<td>3,711</td>
<td>1,264</td>
<td>11,632</td>
</tr>
<tr>
<td><strong>Total (GWh)</strong></td>
<td><strong>13,633</strong></td>
<td><strong>31,843</strong></td>
<td><strong>37,052</strong></td>
<td><strong>7,144</strong></td>
<td><strong>89,672</strong></td>
</tr>
</tbody>
</table>

**Government** 7,144 GWh (8%)

**Residential** 13,633 GWh (15%)

**Business** 37,052 GWh (41%)

**Industrial** 31,843 GWh (36%)
# Alternative Energy Target

## PRINCIPLE for the formulation of PDP2015

<table>
<thead>
<tr>
<th>Type</th>
<th>Solar</th>
<th>Wind</th>
<th>Hydro</th>
<th>Mini Hydro (&lt;12MW)</th>
<th>MSW</th>
<th>Biogas</th>
<th>Energy Crops</th>
<th>Biomass</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Installed Capacity 2014</strong></td>
<td>1,298.5</td>
<td>224.5</td>
<td>2,906.4</td>
<td>142</td>
<td>65.7</td>
<td>311.5</td>
<td>-</td>
<td>2,541.8</td>
<td>7,490.4</td>
</tr>
<tr>
<td><strong>Installed Capacity 2036</strong></td>
<td>6,000</td>
<td>3,002</td>
<td>2,906.4</td>
<td>376</td>
<td>500</td>
<td>600</td>
<td>680</td>
<td>5,570</td>
<td>19,634.4</td>
</tr>
</tbody>
</table>

**Megawatts**

- **Energy Crops**
- **Biomass**
- **Biogas**
- **MSW**
- **Hydro**
- **Wind**
- **Solar**

![Graph showing energy targets from 2015 to 2036](#)
Benefit of RE fuel cost to community economy

<table>
<thead>
<tr>
<th>Year</th>
<th>Re (Energy Crops)</th>
<th>Biomass</th>
<th>MSW</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>41,929</td>
<td></td>
<td></td>
<td>116,275</td>
</tr>
<tr>
<td>2018</td>
<td>53,948</td>
<td></td>
<td></td>
<td>116,275</td>
</tr>
<tr>
<td>2019</td>
<td>65,965</td>
<td></td>
<td></td>
<td>116,275</td>
</tr>
<tr>
<td>2020</td>
<td>73,175</td>
<td></td>
<td></td>
<td>116,275</td>
</tr>
<tr>
<td>2021</td>
<td>74,677</td>
<td></td>
<td></td>
<td>116,275</td>
</tr>
<tr>
<td>2022</td>
<td>75,175</td>
<td></td>
<td></td>
<td>116,275</td>
</tr>
<tr>
<td>2023</td>
<td>75,477</td>
<td></td>
<td></td>
<td>116,275</td>
</tr>
<tr>
<td>2024</td>
<td>75,777</td>
<td></td>
<td></td>
<td>116,275</td>
</tr>
<tr>
<td>2025</td>
<td>76,077</td>
<td></td>
<td></td>
<td>116,275</td>
</tr>
<tr>
<td>2026</td>
<td>76,377</td>
<td></td>
<td></td>
<td>116,275</td>
</tr>
<tr>
<td>2027</td>
<td>76,677</td>
<td></td>
<td></td>
<td>116,275</td>
</tr>
<tr>
<td>2028</td>
<td>76,977</td>
<td></td>
<td></td>
<td>116,275</td>
</tr>
<tr>
<td>2029</td>
<td>77,277</td>
<td></td>
<td></td>
<td>116,275</td>
</tr>
<tr>
<td>2030</td>
<td>77,577</td>
<td></td>
<td></td>
<td>116,275</td>
</tr>
<tr>
<td>2031</td>
<td>77,877</td>
<td></td>
<td></td>
<td>116,275</td>
</tr>
<tr>
<td>2032</td>
<td>78,177</td>
<td></td>
<td></td>
<td>116,275</td>
</tr>
<tr>
<td>2033</td>
<td>78,477</td>
<td></td>
<td></td>
<td>116,275</td>
</tr>
<tr>
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<td>78,777</td>
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<td>79,077</td>
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<tr>
<td>2036</td>
<td>79,377</td>
<td></td>
<td></td>
<td>116,275</td>
</tr>
</tbody>
</table>
### Estimation of Fuel Mix for Power Generation in PDP2015

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Sep 2014 (percentage)</th>
<th>2026 (percentage)</th>
<th>2036 (percentage)</th>
<th>PDP2010 rev3 2030 (percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imported Hydro</td>
<td>7</td>
<td>10-15</td>
<td>15 – 20</td>
<td>10</td>
</tr>
<tr>
<td>Clean Coal (inc. Lignite)</td>
<td>20</td>
<td>20-25</td>
<td>20 – 25</td>
<td>19</td>
</tr>
<tr>
<td>Renewable</td>
<td>8</td>
<td>10-20</td>
<td>15 – 20</td>
<td>8</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>64</td>
<td>45-50</td>
<td>30 – 40</td>
<td>58</td>
</tr>
<tr>
<td>Nuclear</td>
<td>-</td>
<td>-</td>
<td>0 – 5</td>
<td>5</td>
</tr>
<tr>
<td>Diesel / Fuel Oil</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
Load Forecast from 2015 - 2036

Comparison of net Energy Consumption forecast including Energy Efficiency Measure

1. BAU Scenario includes the summation of former and current Energy Efficiency Measure at 22,456 GWh

2. Energy Consumption Reduction from Energy Efficiency
Compared to BAU Scenario (GWh)

<table>
<thead>
<tr>
<th></th>
<th>2015</th>
<th>2016</th>
<th>2021</th>
<th>2026</th>
<th>2031</th>
<th>2036</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base</td>
<td>-548</td>
<td>-7,969</td>
<td>-20,119</td>
<td>-38,446</td>
<td>-67,216</td>
<td></td>
</tr>
</tbody>
</table>

1 + 2 = 89,672 GWh
Summary of PDP2015

Comparison of net Power Consumption forecast including Energy Efficiency Measure

Investment Saving for 10,000 MW in 2036 or 500 MW/yr throughout the plan
## Summary of PDP2015

**Unit:** Megawatts

<table>
<thead>
<tr>
<th>Installed Capacity 2015-2036</th>
<th>PDP2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Installed Capacity at the end of 2014</td>
<td>37,612</td>
</tr>
<tr>
<td><strong>New Installed Capacity</strong></td>
<td>57,459</td>
</tr>
<tr>
<td><strong>Retired</strong></td>
<td>-24,736</td>
</tr>
<tr>
<td>Installed Capacity at the end of 2036</td>
<td>70,335</td>
</tr>
</tbody>
</table>

### New Installed Capacity 2015-2036

<table>
<thead>
<tr>
<th>Technology</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clean Coal Technology</td>
<td>7,390 (9 Plants)</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>17,478 (15 Plants)</td>
</tr>
<tr>
<td>Nuclear</td>
<td>2,000 (2 Plants)</td>
</tr>
<tr>
<td>Gas Turbine</td>
<td>1,250 (5 Plants)</td>
</tr>
<tr>
<td>Cogeneration</td>
<td>4,119</td>
</tr>
<tr>
<td>Renewable</td>
<td>12,105</td>
</tr>
<tr>
<td>Pumped Storage Hydropower</td>
<td>2,101</td>
</tr>
<tr>
<td>Imported</td>
<td>11,016</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>57,459</strong></td>
</tr>
</tbody>
</table>
Summary of PDP2015

Fuel Mix by Energy Generation

- **Renewable**
- **Hydropower**
- **Imported Hydropower**
- **Natural Gas**
- **Import Coal**
- **Lignite**
- **Nuclear**

Energy mix and generation trends from 2015 to 2029.
Summary of PDP2015

Carbon Emission

Comparison of Carbon Emission per unit

Comparison of Accumulate Carbon Emission
Summary of PDP2015

- Estimation of retailed power tariff

Levelised Capital Cost = 1.32
Levelised Fuel Cost = 2.16
Levelised Transmission and Distribution Cost = 0.52
VSPP Levelised = 0.59

Lev. price 2015-2036 = 4.587 Baht/kWh
(Average Growth = 1.89%)
High portion of Reserve Margin (RM)

- GDP Growth Rate slows down from average 4.49 to 3.94 percent/year
- Improved Energy Efficiency Measure for PDP2015 at 100 percent compared to former version at 20 percent
1. Key measure to decrease reserve margin is so difficult because many projects are binded from the previous PDP plan.

2. Emphasize on energy efficiency, renewable energy and fuel diversification to increase security and decrease environmental impacts, especially the global warming.

3. Retailed power tariff is appropriated reflecting the primary cost.

4. The Committee on Energy Policy Administration is assigned by the National Energy Policy Council, NEPC, to find out the measure to solve high reserve margin.
Thank you