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Thailand: Infrastructure Development and Challenges to Launch Nuclear Power Programme

Sirichai Keinmeesuke

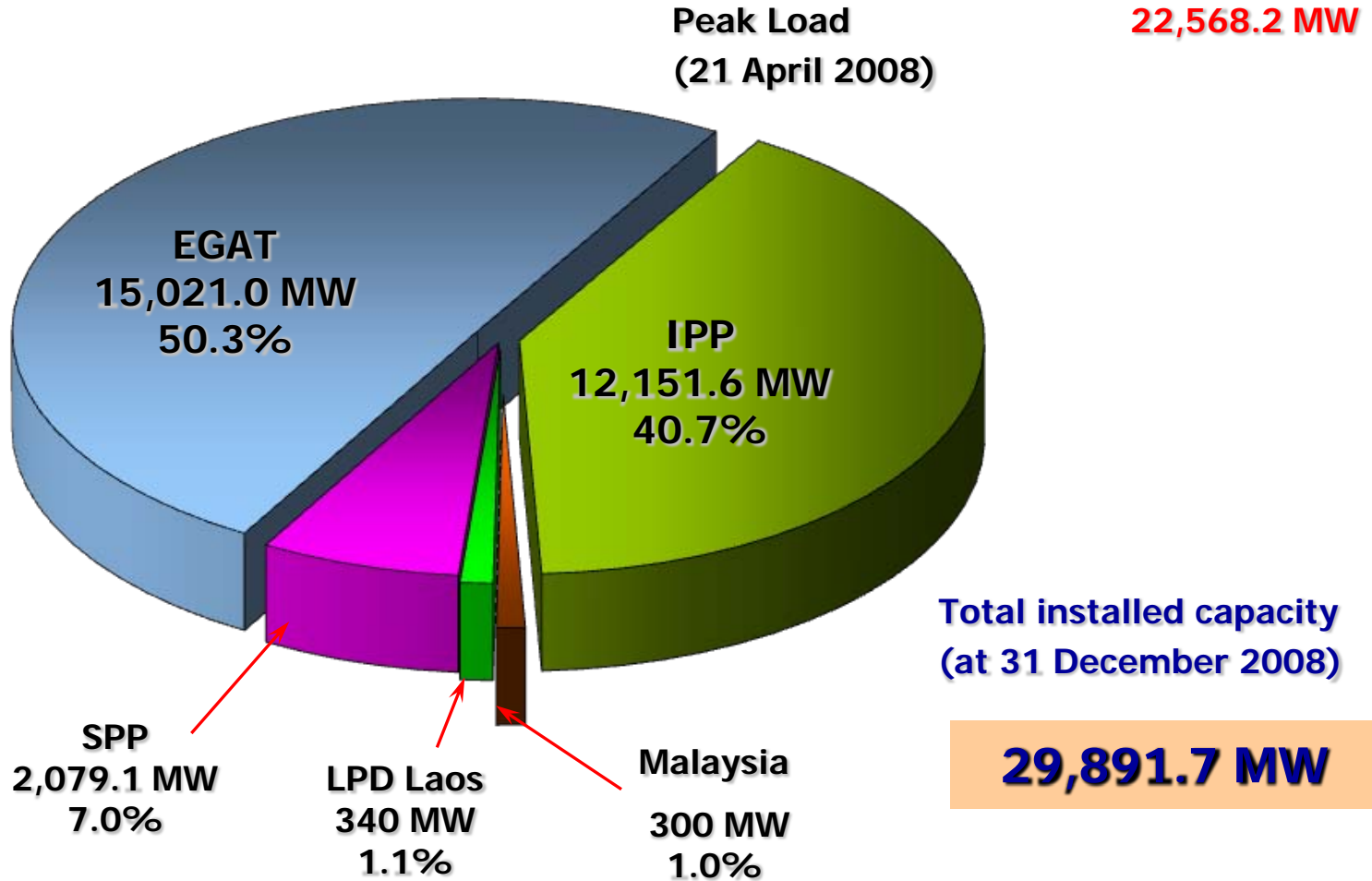
Office of Atoms for Peace (OAP)

Ministry of Science and Technology, Thailand

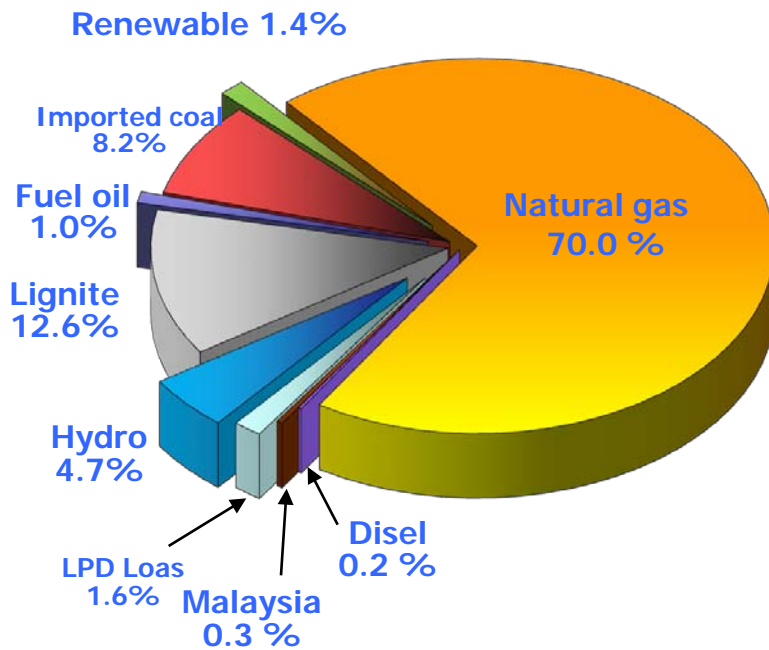
Outline

- **Thailand's situation of electricity production & utilization**
- **Major reasons for introducing nuclear power in PDP 2007**
- **Cost comparison by fuel types**
- **Nuclear Power Programme Kick-off**
- **Major issues to be considered to implement nuclear power plants**
- **Future Activities to be implemented and Challenges for developing nuclear power programme in Thailand**

Total Installed Capacity at December 2008

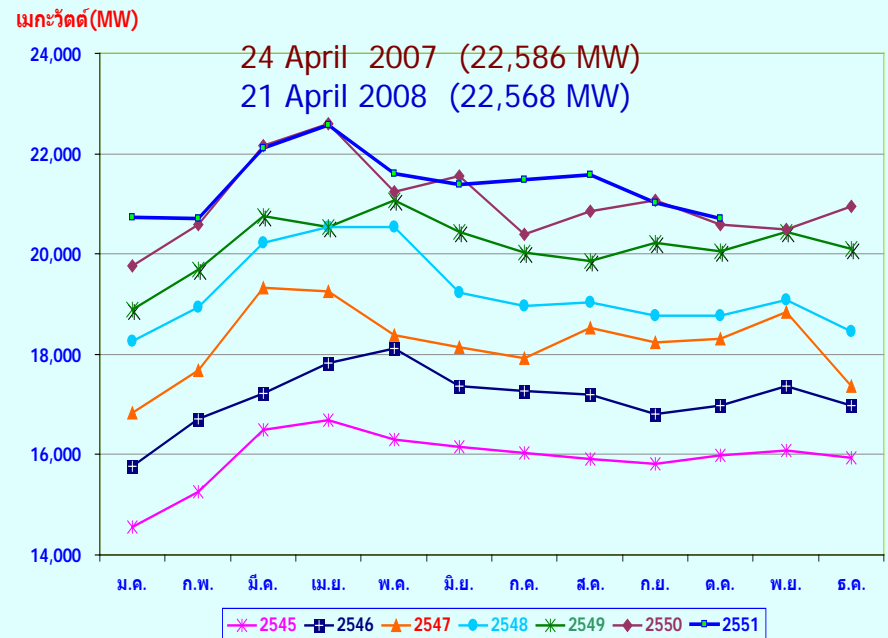


Electricity Generating by Fuel Types: December 2008



**Total power energy
148,197 million units**

Peak Load Comparison



**Peak Demand at 21 Apr 08 decreased 18 MW
from 2007**

Major Reasons for Introducing Nuclear Power → PDP 2007

1. Energy Security

At present, Thailand uses natural gas from the Gulf of Thailand and the Andaman Sea for power generation, accounting for a share of almost 70%. However, the R/P of domestic natural gas reserves is rather low (~ 30 years), which is considered a high risk in terms of energy supply and resources.

2. Concern over Global Warming and Climate Change

The global warming crisis has clearly and vigorously reflected itself in climate change, resulting in the global pressure to reduce GHG emissions urgently. This will cause a considerable increase in the prices of energy generated by fossil fuels.

3. Maintenance of Energy Price Stability & Competitiveness in the Long Run

In the past 5-6 years, there has been a 3-4 fold increase in the prices of petroleum and natural gas and the prices have been volatile. If there is no alternative energy sources with a rather stable price and without GHG emission, in the next 20-30 years energy prices could become much more volatile and expensive.

4. Retention of Natural Gas in the Gulf of Thailand for More Value-added Usage

- Transportation
- Petrochemical Industry

Cost comparison among various types of power plants

Types of power plant	Installed capacity (MW)	Plant Factor (%)	Cost (baht/unit)
Nuclear power plant	1000	85	2.08
Coal-fired power plant	700	85	2.12
Thermal power plant	700	85	2.29
Thermal-oil power plant	700	85	4.12
Gas turbine power plant	230	15	7.93
Renewable power plants			
-Solar	2	17	20.20
-Wind	4	20	5.98
-MSW	20	90	4.63
-Biomass	36	85	2.63
Source: EGAT			

The comparison of electricity generating from 1 Kg of each fuel type

Fuel Types	KWh
Woods	1
Coal	3
Fuel oil	4
Natural gas	6
Natural uranium	50,000
Enriched Uranium 3-4%	300,000

Nuclear Power Programme Kick-off

- The National Energy Policy Council (NEPC) approved Thailand's Power Development Plan 2007-2021 (PDP 2007) and the Thai cabinet acknowledged and approved the PDP in June 2007.
- One major issue stipulated in the PDP 2007 is the designation of nuclear power generation option to supply 1,000 MW of electricity in 2020 and another 1,000 MW in 2021 (revised 2009)
- To develop the preparatory work for Nuclear Power Programme the NEPC appointed the Nuclear Power Infrastructure Preparation Committee (NPIPC), chaired by former Deputy Minister of Science, Technology and Environment

Nuclear Power Programme Kick-off (cont.)

- **The NPIPC, in its first meeting on 11 May 2007, clarified that**
 - (1) Preparation work for nuclear power will proceed in two tracks:
 - Planning for Nuclear Power Infrastructure
 - Planning for Nuclear Power Utility,**
 - (2) The NPIPC will prepare its report in the form of a Nuclear Power Infrastructure Establishment Plan (NPIEP) to be submitted to the NEPC in October 2007.**

Nuclear Power Programme Kick-off (cont.)

- (3) The NPIPC will adopt the work approach of IAEA as represented in:
- 3.1) IAEA-TECDOC-1513: Basic Infrastructure for a Nuclear Power Project (June 2006)
 - 3.2) IAEA-GOV/INF/2007/2: Consideration to Launch a Nuclear Power Program (February 2007) later expanded to include
 - 3.3) IAEA-TECDOC-1555: Managing the First Nuclear Power Project (May 2007)
 - 3.4) IAEA-NE Series Guide NG-G—3.1: Milestones in the Development of a National Infrastructure for Nuclear Power (July 2007)

Nuclear Power Programme Kick-off (cont.)

- Nuclear power infrastructure planning work of the NPIPC was organized into 5 sub-committees (SCs):
 - SC1 on legal system, regulatory system and international protocols
 - SC2 on industrial and commercial infrastructure
 - SC3 on technology transfer and human resources development
 - SC4 on nuclear safety and environmental protection
 - SC5 on public information and acceptance

- Nuclear power utility planning work is the responsibility of another sub-committee (SC6) with 3 working groups (WGS):
 - WG1 on institutional structure preparation
 - WG2 on nuclear power utility technical aspects
 - WG3 on feasibility study of nuclear power plant

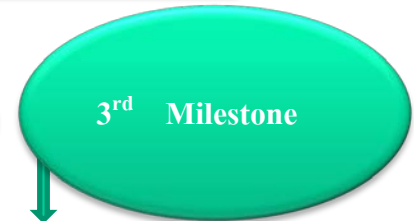
Framework & Approach of the NPIEP Implementation during 2008-2010

- On 30 October 2007, the Thai cabinet approved:
 - (1) The *Preliminary* Nuclear Power Infrastructure Establishment Plan (NPIEP)
 - (2) The establishment of the Nuclear Power Program Development Office (NPPDO) under the Ministry of Energy to coordinate the NPIEP implementation
 - (3) The work plan and budget for NPPDO and the NPIEP implementation during 2008-2010 (3 years), with an operating budget
- On 18 December 2007, the cabinet further approved:
 - (1) The *Final* Nuclear Power Infrastructure Establishment Plan (NPIEP)
 - (2) The appointment of the Nuclear Power Infrastructure Establishment Coordination Committee (NPIECC)

NPIEP Milestones for Nuclear Power Program Implementation

September 2007

- NPI** : Nuclear Power Infrastructure
- NPIEP** : NPI Establishment Plan
- NPPDO** : Nuclear Power Program Development Office
- NPP** : Nuclear Power Plant
- NRB** : Nuclear Regulatory Body



MS 0.1
(Nuclear power option
Included in PDP 2007)

MS 0.2
(To prepare for policy
Decision)

MS 1 : Policy Decision
(Knowledgeable Commitment)

MS 2 : Call for Bids
(Financial Commitment)

MS 3 : Start Operation
(Commissioning 1st NPP)

GO NUCLEAR

Phase 0.1 Preliminary Phase

- NPIPC & 7 SCs appointed
- Issues & Milestones considered
- NPIEP prepared

Phase 1 : pre-project Activity Phase

- approve NPIEP
- set up NPPDO
- infrastructure work started
- survey of potential sites
- feasibility study completed
- public information & participation

Phase 2 : Program Implementation Phase

- Implement NPIEP with Milestones
- full NRB established
- legislation & international protocols enacted
- suitable sites for bid selected
- technology / qualified suppliers selected
- prepare to call bids

Phase 3 : Construction Phase

- NPIEP fully implemented
- bidding process completed
- design & engineering
- manufacturing
- construction & installation
- test runs & inspection
- NPP commissioning license

Phase 4 : Operation Phase

- Commercial operation
- O&M
- planning for expansion
- industrial and technology development plan

1 year

3 year

3 year

6 year

Major issues to be considered to implement a nuclear power plant in Thailand

- (1) Nuclear Safety, Security and Safeguards (3Ss)*
- (2) Nuclear Safety Standards and Guidelines*
- (3) Nuclear Regulator and Nuclear Laws*
- (4) Nuclear Fuel: Supply, Spent Fuel and Waste*
- (5) Cost of Nuclear Power: Capital Cost, Operating Cost, Fuel Cost, Carbon Charge*
- (6) Technological and Industrial Infrastructure*
- (7) Manpower and HRD*
- (8) Siting*
- (9) Public Information and Public Acceptance*
- (10) Selection of Technology, Suppliers, and Fuel Systems*

Future Activities to be implemented for developing nuclear power plants in Thailand

MAJOR ISSUES	Activities
1. Legal and regulatory systems and international commitments	<p>1.1 Cooperation with IAEA to study about safety, security, and safeguard as well as to prepare to establish NRB</p> <hr/> <p>1.2 The Office of Atoms for Peace (OAP) is preparing the NRB laws and international commitments</p> <hr/> <p>1.3 In a stage of preparation for studying the standard of legal and regulatory systems and international commitments</p> <p>1.4 OAP is preparing to expand the existing NRB and develop its personnel</p>
2. Safety and environmental Protection	<p>2.1 In the stage of preparation for studying on</p> <ul style="list-style-type: none"> - the safety standard and environment as stipulating in IAEA documents - radioactive prevention - spent fuel and radioactive waste management plan, including cooperation with the Office of Natural Resources and Environmental Policy and Planning to prepare Safety Analysis Report (SAR) and establish EIA for NPP

Future Activities to be implemented for developing nuclear power plants in Thailand (cont.)

MAJOR ISSUES	Activities
3. Industrial and commercial infrastructure	<p>3.1 In preparation for conducting a survey of industrial data related to implement nuclear power plants</p> <p>3.2 Establish localization policy to support Thai industries to participate in NPP projects</p> <p>3.3 Study related issues to prepare for NPP maintenance</p>
4. Technology Transfer/Development and Human Resources Development	<p>In the stage of preparation for studying how to develop/train human resources</p>
5. Public information & public awareness	<p>Starting to inform all information related to NPP to people all around the country</p>
6. Prepare of the nuclear power utility establishment	<p>EGAT has hired Burn & Roes, USA to be its consultant to study FS on economics, environment, site selection, technology selection, and preparation of transmission</p>

Challenges and Assistance Needed for Thailand Nuclear Power Programme

- Drafting of comprehensive nuclear Laws, Regulations, Standards and Guides
- Expanding the NRB i.e. OAP and it's personnel capabilities development
- Preparation for Permits and License Requests and Issuing
- Transfer of and Knowledge building on 3S's and technical & industrial infrastructure
- Technical advise and knowledge transfer on Selection of Technology, Suppliers, and Fuel Systems
- How to conduct the Public understanding and Public acceptance efficiently



*Thank you
for your attention*

