

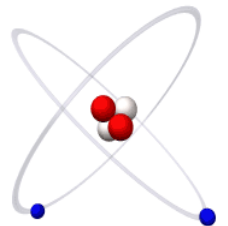
Preparatory Activities to Deliver Nuclear Electricity to TNB Power System, post-2020

(to be well-prepared and be ready for the First NPP project)



IAEA Workshop on Steps for Conducting Nuclear Power Plant Technology Assessment

IAEA, Vienna, 17 – 20 November 2008



CONTENTS

- 1. WHY Nuclear Power**
- 2. What, Who & When and How?**
- 3. Preparatory Activities**
- 4. Concluding Remarks**

WHY Nuclear Power in Peninsular Malaysia

- Energy Security
- Revival of global interest in nuclear energy
- Nuclear is PROVEN BASE LOAD electricity
- possible Technology lock out ?
- Lessons from top 15 nations of the world - all have nuclear programs (except Italy)

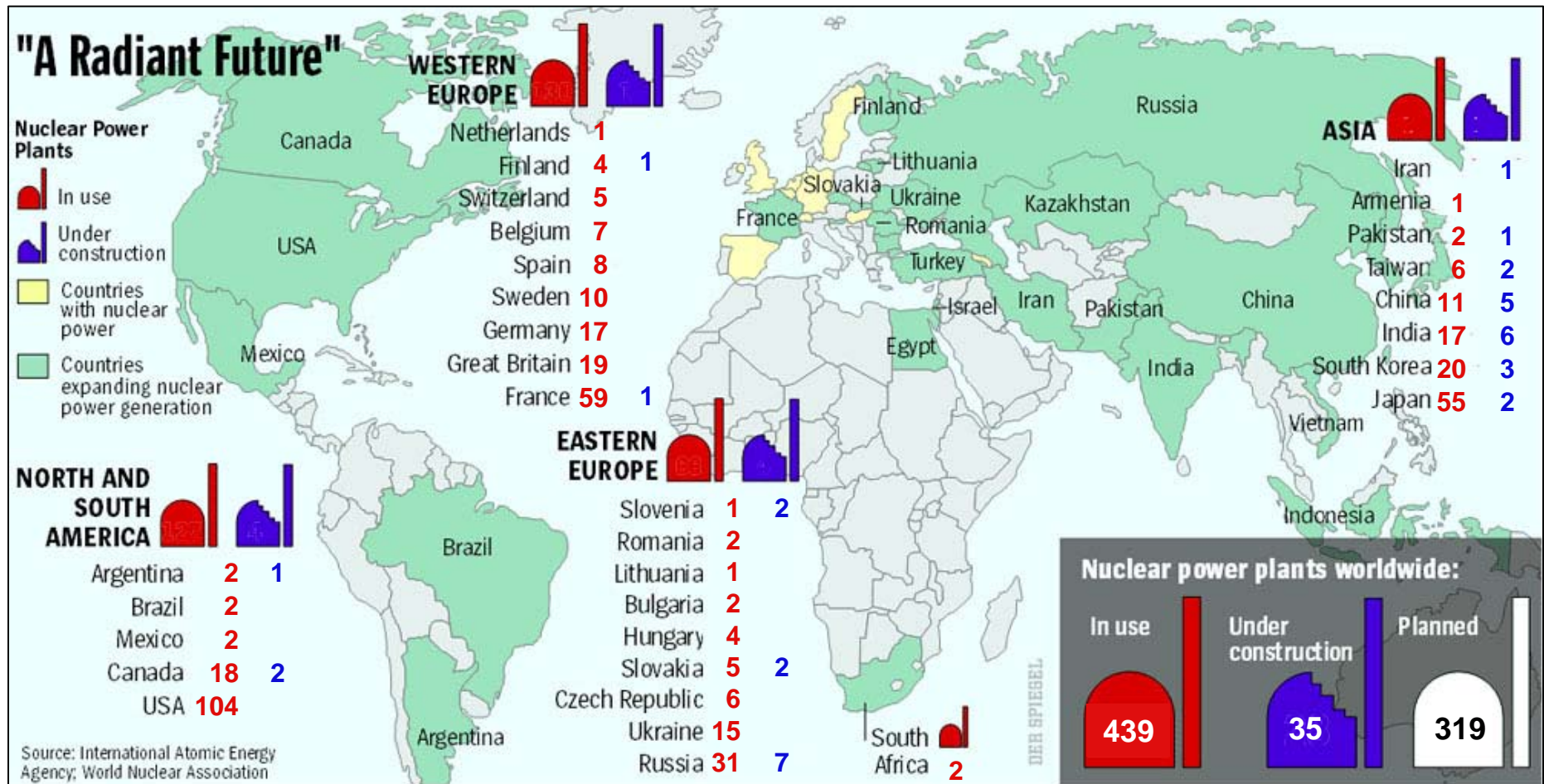
Peninsular Malaysia is already a net energy importer

- Extra gas supply is already imported from JDA and Natuna
- Coal supply relies on 100% import
- Crude oil production offshore Trengganu is probably insufficient to meet Peninsular Malaysia consumption of oil products (in '000 barrels/day)
- Alternative energy sources are small to make significant contribution in energy mix
- TNB serves customers in Peninsular Malaysia

ENERGY SITUATION

- **The first oil shock in 1973 (Arab Oil Embargo) caused many to move away from oil**
- **Malaysia adopted the 4-fuel diversification strategy in 1981, soon after the second oil price shock in 1979 (Iran Revolution)**
- **The 5-fuel diversification strategy was introduced in 2001 when Renewable Energy was added to the 4 main fuels – oil, hydro, gas and coal**
- **Today, the four main fuels still dominate electricity generation scene in Peninsular Malaysia (or TNB power system) - base-load electricity generation is provided by gas and coal power plants**
- **With oil, gas and coal prices expected to remain relatively high, nuclear power is viewed as a credible alternative energy source**
- **TNB cannot IGNORE nuclear energy – it is a PROVEN, viable and competitive BASE LOAD power source**

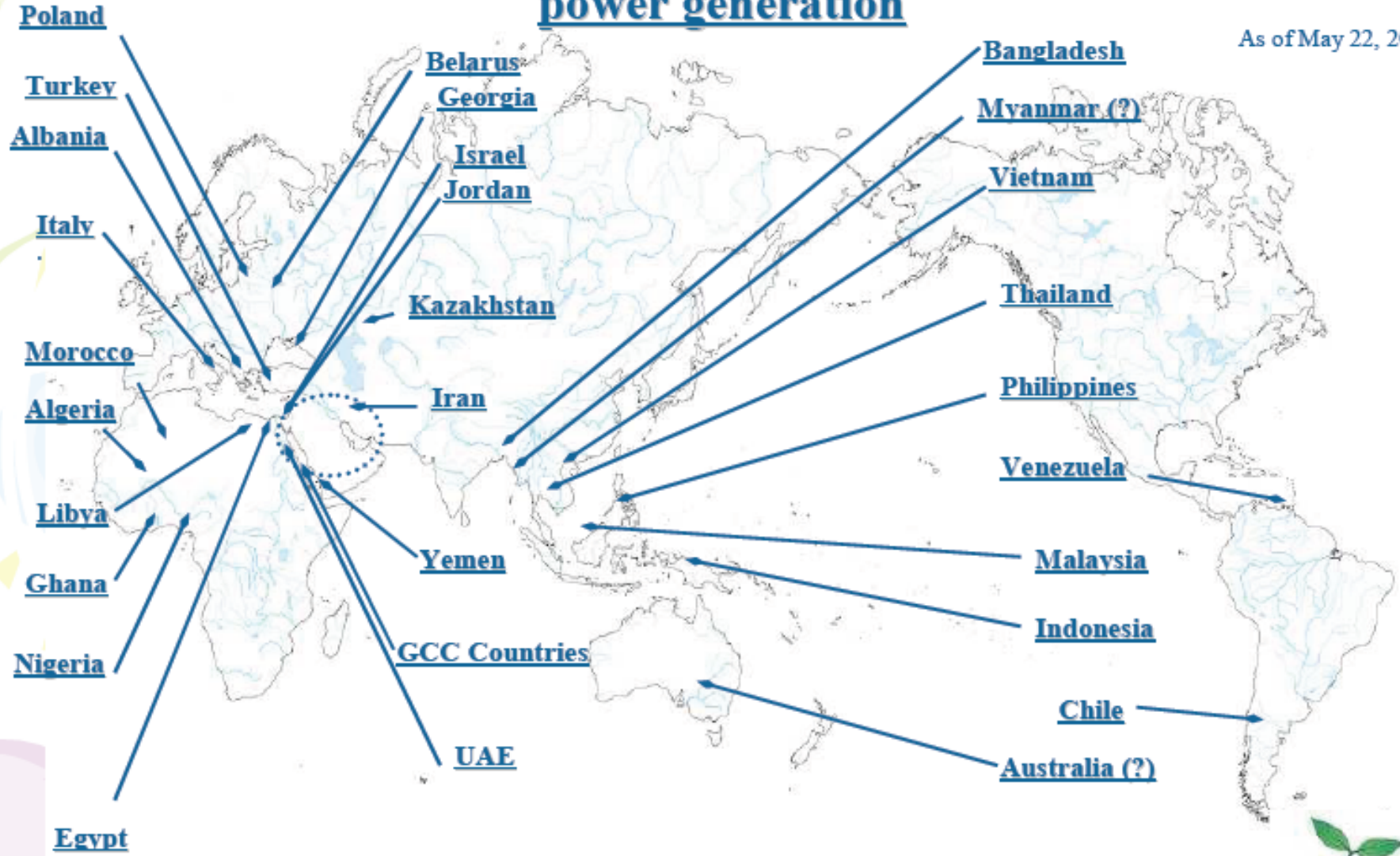
Global Expansion of Nuclear Power is Underway; Doubling of Demand Expected by 2050



<http://www.spiegel.de/international/spiegel/0,1518,460011,00.html> (updated WNA 4/17/2008)

Countries and regions proposing to newly introduce nuclear power generation

As of May 22, 2008



Created by MOFA and the Cabinet Office
Reference: Various reports etc.



Issues and Challenges (16/21)

Nuclear : The Race to Secure Fuel

<u>China</u>	<u>No.</u>	<u>Capacity</u>
Operable:	11	(8,587 MW)
Constructing:	6	(5,540 MW)
Planned:	29	(31,000 MW)
Proposed:	86	(68,000 MW)

<u>S. Korea</u>	<u>No.</u>	<u>Capacity</u>
Operable:	20	(17,533 MW)
Constructing:	3	(3,000 MW)
Planned:	5	(6,600 MW)

<u>India</u>	<u>No.</u>	<u>Capacity</u>
Operable:	17	(3,779 MW)
Constructing:	6	(2,976 MW)
Planned:	10	(8,560 MW)
Proposed:	9	(4,800 MW)

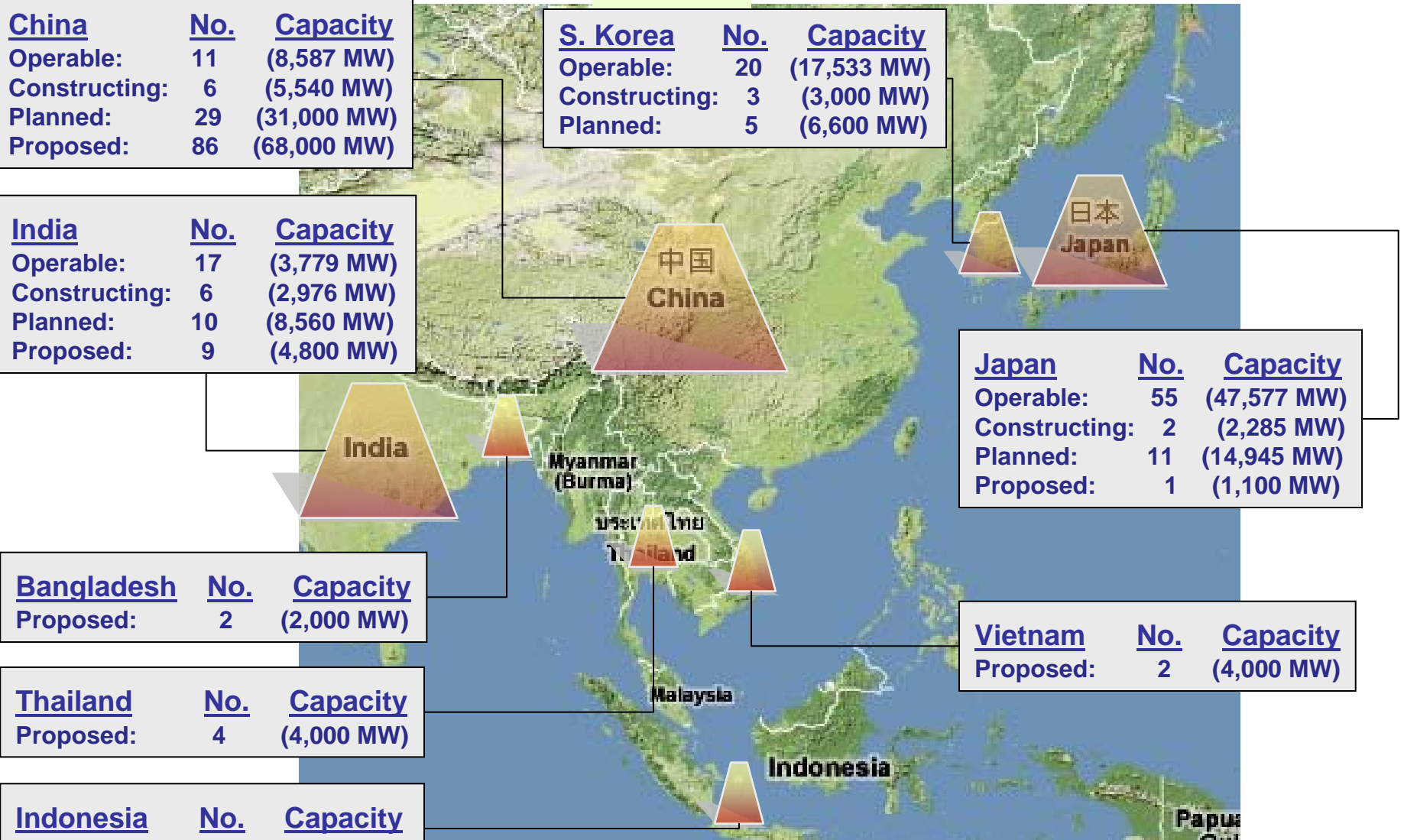
<u>Japan</u>	<u>No.</u>	<u>Capacity</u>
Operable:	55	(47,577 MW)
Constructing:	2	(2,285 MW)
Planned:	11	(14,945 MW)
Proposed:	1	(1,100 MW)

<u>Bangladesh</u>	<u>No.</u>	<u>Capacity</u>
Proposed:	2	(2,000 MW)

<u>Thailand</u>	<u>No.</u>	<u>Capacity</u>
Proposed:	4	(4,000 MW)

<u>Indonesia</u>	<u>No.</u>	<u>Capacity</u>
Proposed:	2	(2,000 MW)

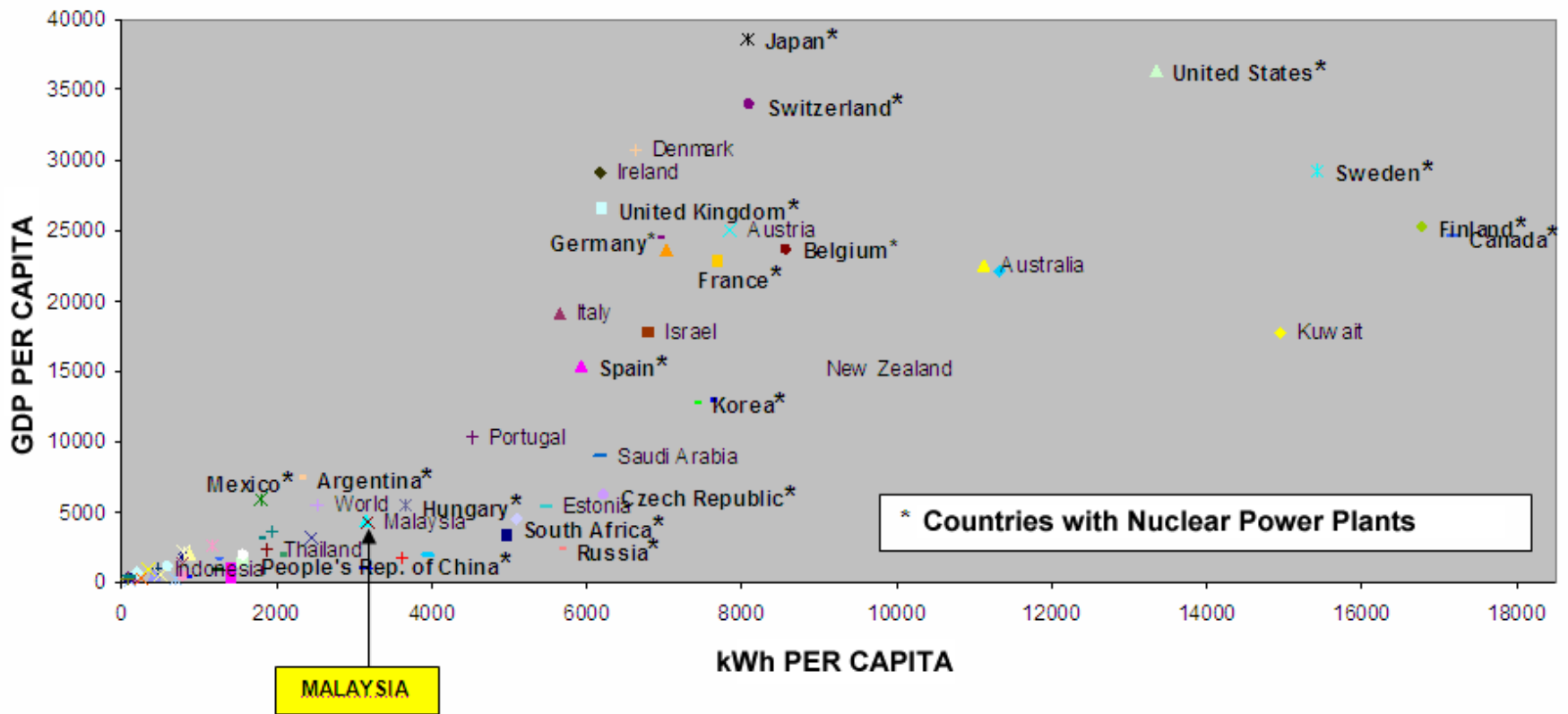
<u>Vietnam</u>	<u>No.</u>	<u>Capacity</u>
Proposed:	2	(4,000 MW)



“Asia Leads Way In Nuclear Power Development” IAEA, Oct. 2007

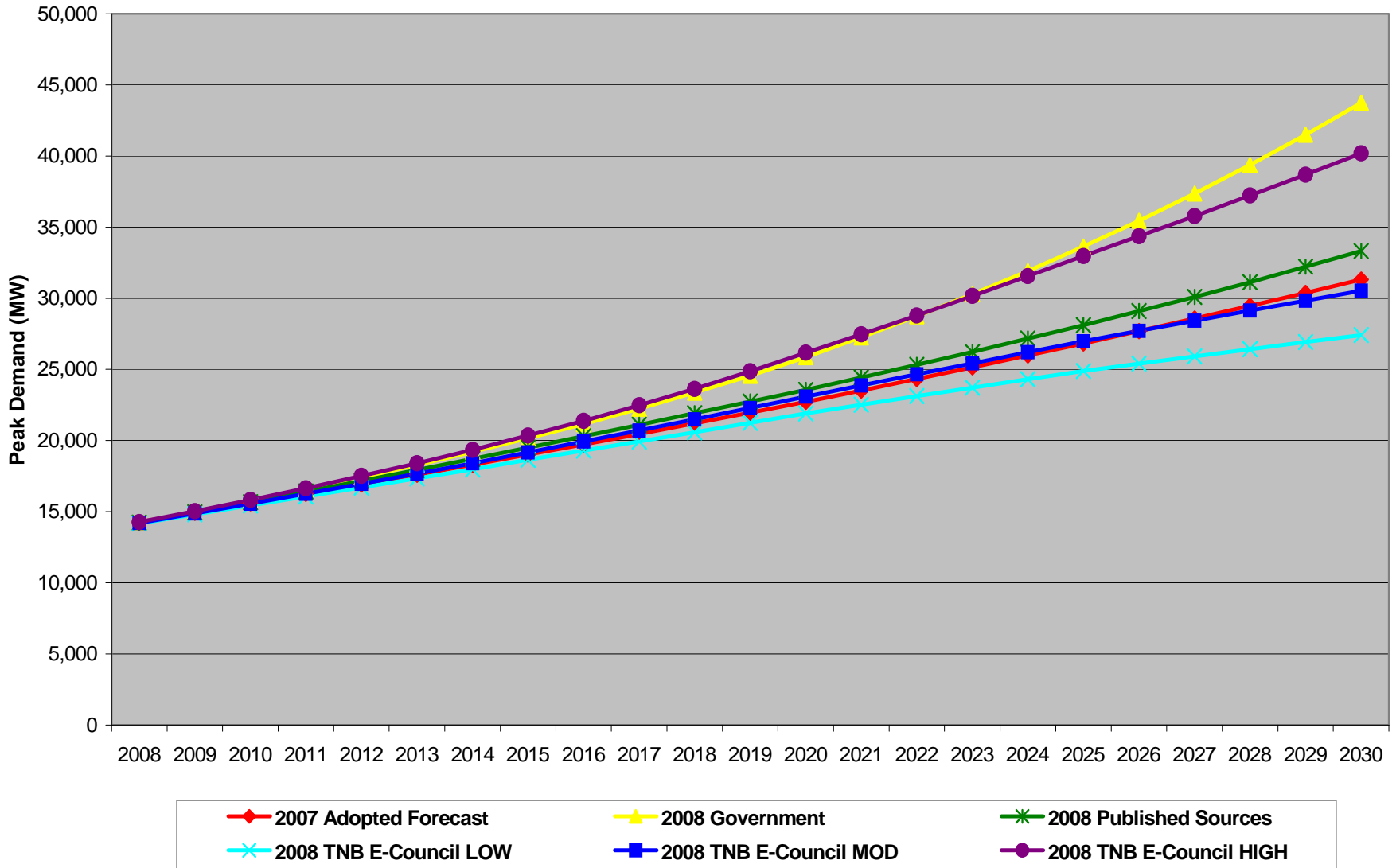
Japan, South Korea, China and India Driving Present Global Nuclear Power Expansion

COMPARATIVE GDP & ENERGY CONSUMPTION PER CAPITA



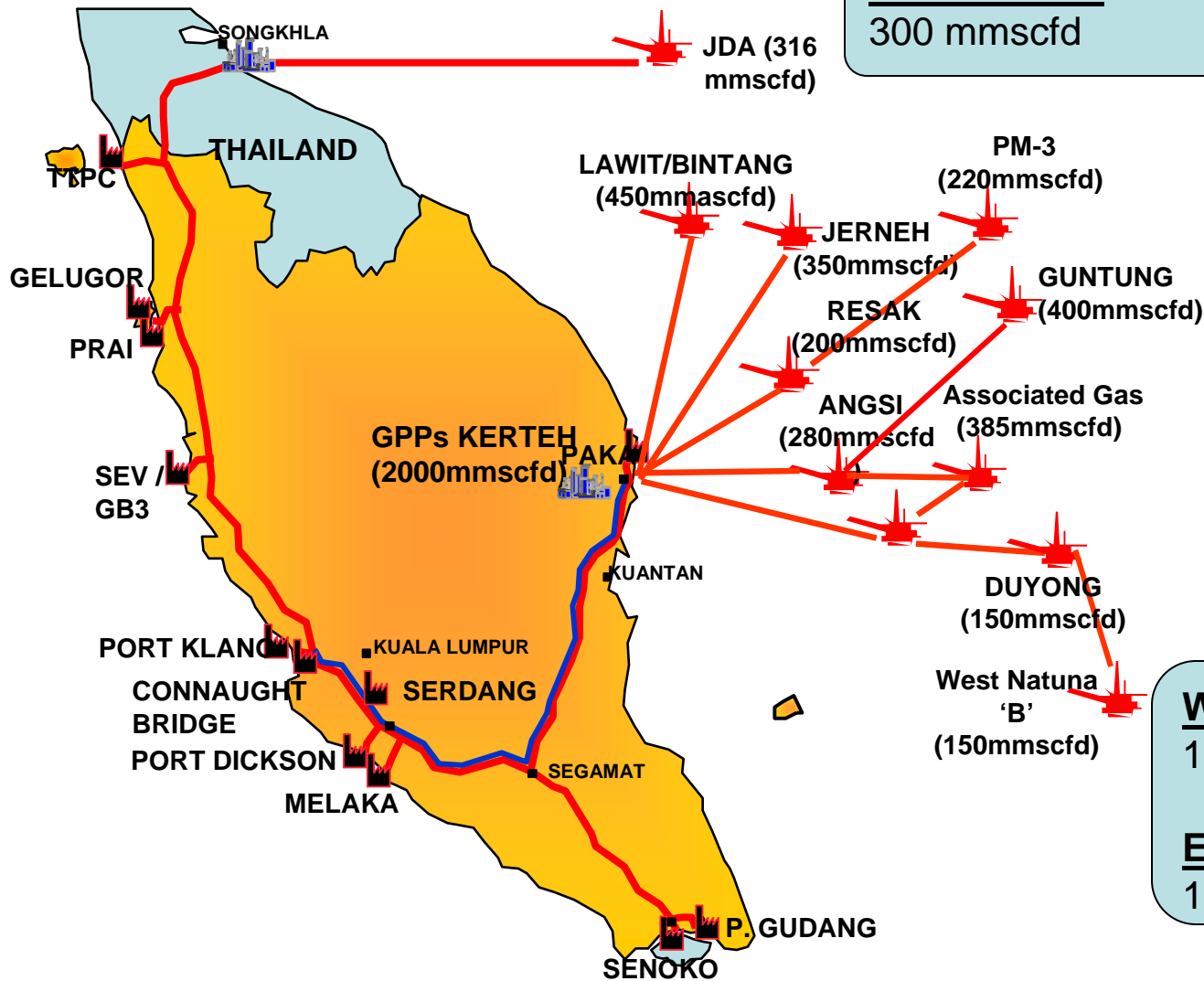
Source: Malaysian Nuclear Agency based on International Energy Agency (IEA) data

FORECAST PEAK ELECTRICITY DEMAND 2008-2030



Natural Gas : Possible New Sources of piped Natural Gas

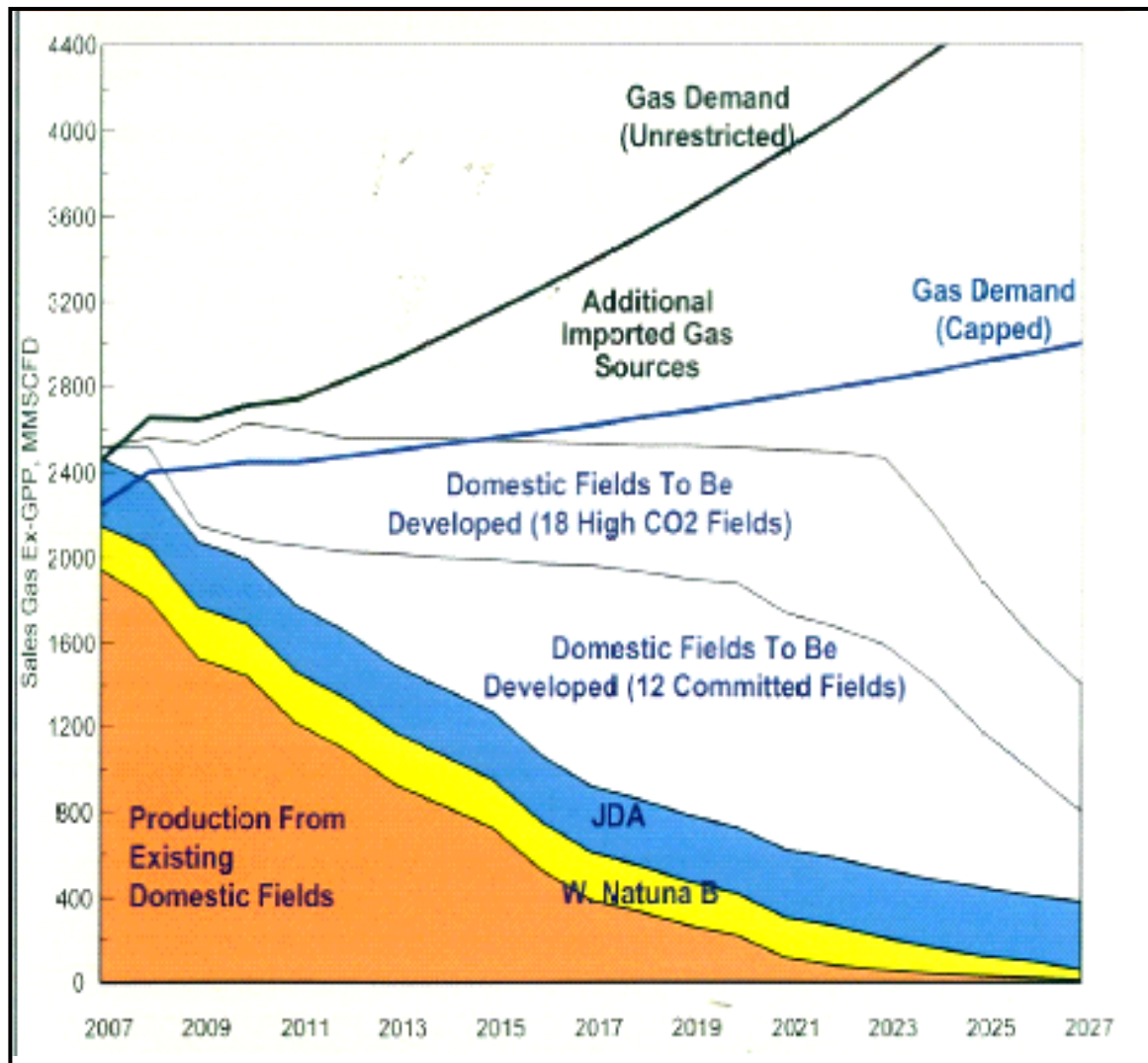
JDA Phase 2
300 mmscfd



West Natuna A
100 mmscfd

East Natuna
1000 mmscfd

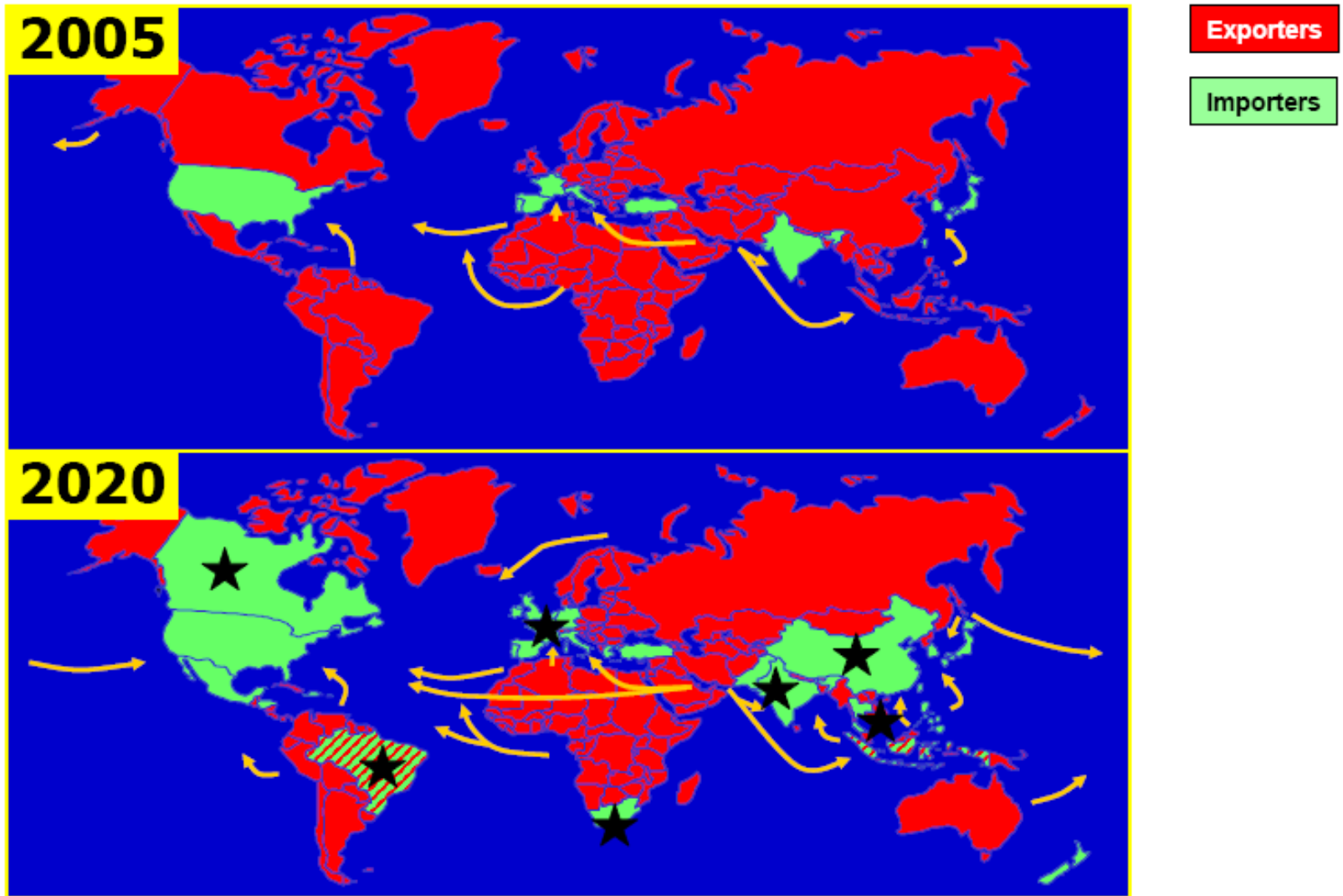
DEPLETING INDIGENOUS GAS SUPPLY



- Production from existing fields are depleting. More reserves need to be developed to sustain gas supply at 2000 mmscf/day
- Future gas development will be more challenging:
 - High CO₂
 - Smaller fields
 - Costly
- Future demand cannot be met from indigenous sources, need to import

Issues and Challenges

Natural Gas : Global LNG Trade Scenario by 2020

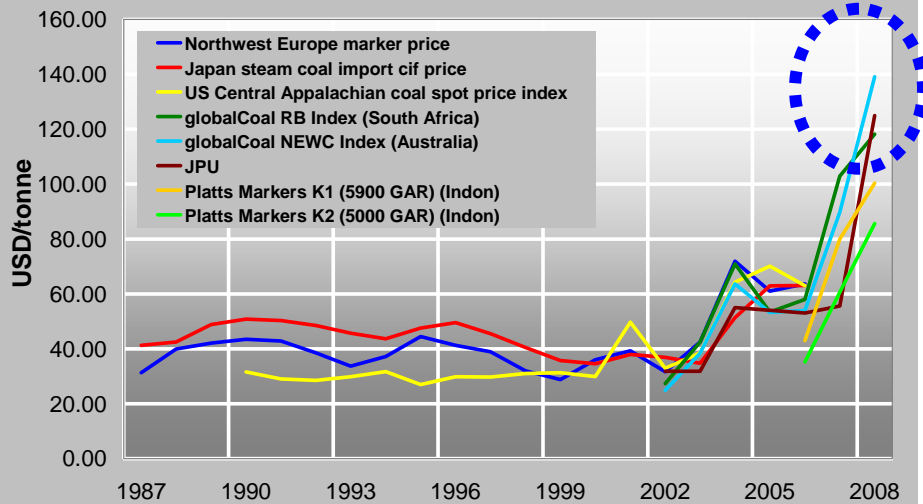


LNG Issues and Challenges

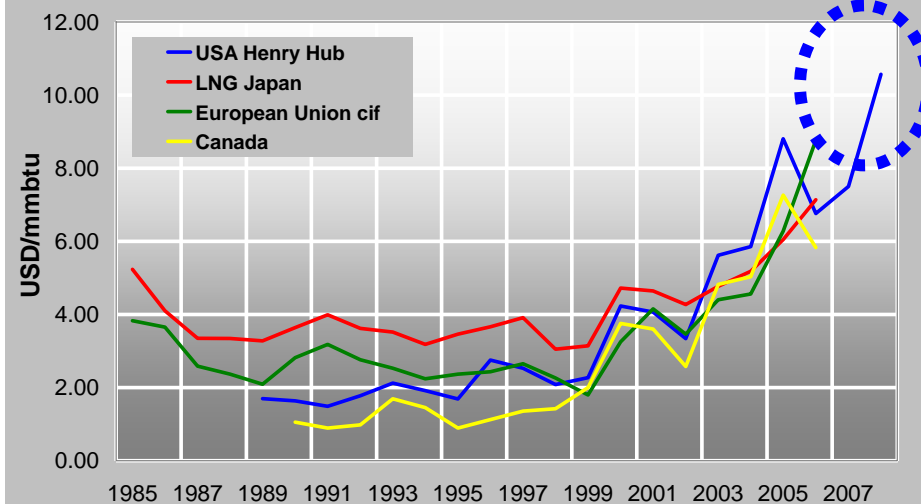
- Due to inadequate indigenous supply of natural gas, need to import LNG
- The design, engineering and construction of LNG facilities and securing of LNG contracts require a minimum lead time of 5 years
- Cost for LNG-CCGT is about 1.8 times higher than a conventional CCGT and comparable with coal technology
- LNG import terminals can be accommodated at potential coal sites
- TNB has officially requested Petronas to assist in procuring LNG
- Government decision on policy to import LNG is required

INCREASING FUEL COST

Coal Prices in US Dollars/tonne

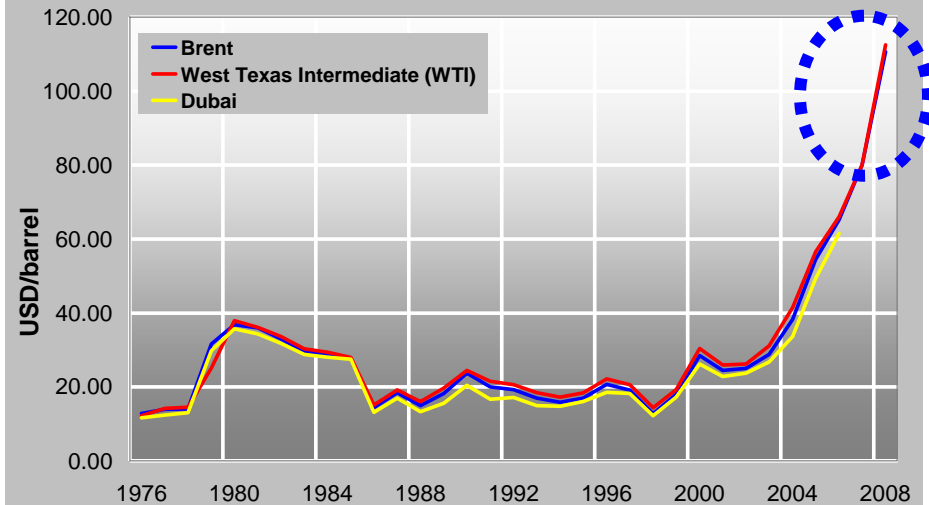


Natural Gas Prices in US Dollars/mmbtu



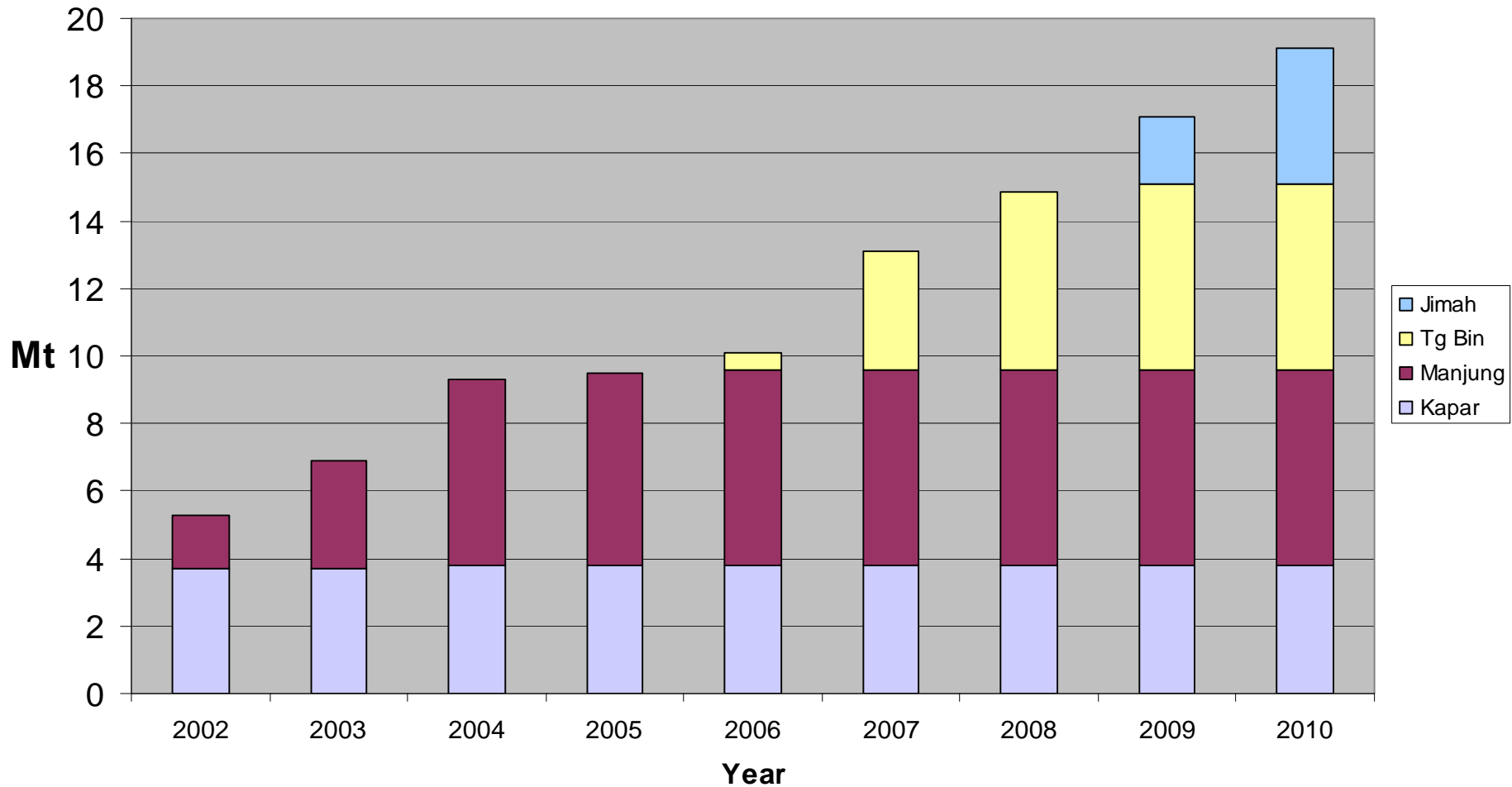
“Oil price per barrel reached \$147.02 on July 11, 2008 but average price last week (Nov 08) was ~\$56 or ~38% of highest level.”

Key Crude Oil Spot Prices in US Dollars/barrel



COAL DEMAND IN PENINSULAR M'SIA

(Million Tonne - Mt)



Issues and Challenges

Coal : Supply, Price and Environmental

“China's coal demand may top 3 billion tonnes in 2010”

China Coal Industry Association, Apr. 2008

“China down to 12 days worth of coal”

Reuters, May 2008

*...reserves are down to less than a week
...demand for coal has risen rapidly...motivating a construction frenzy in the power industry
...counts on coal for about 70 per cent of its energy consumption*

“Japan's Chubu Electric to agree to 94% coal price hike”

Reuters, May 2008

*The miners, Shenhua Energy and China Coal, have won a deal with Chubu, Japan's No. 3 utility, to sell 5.3 million tonnes of coal at **\$131.40 a tonne** this year.*

“Indian companies lapping up coal fields abroad”

The Times of India, May 2008

*Corporates are frantically lapping up coal mines from **Africa to Indonesia to Australia.***

*...ensures supplies and brings about a security
...wouldn't subject the industries to the vagaries of rising prices
...ensure quality of coal and drive in efficiencies in mining*

“Indonesia: Domestic coal consumption to exceed exports”

The Jakarta Post, April 2008

*...sometime between 2015 and 2020, if the government cap on coal exports remains in place
...domestic coal demand would jump to **75 million tons in 2009**, from 52 million tons in 2008
...The **export limit** was also made in anticipating the 2010 opening of new coal-fired power plants by state power company PT Perusahaan Listrik Negara (PLN).*

ISSUES WITH COAL SUPPLY

- **Stiff competition from the other coal buyers**
 - China and India coal demand growth – net importer
 - Japanese Power Utilities – setting of reference annual price
- **Logistic Glitches**
 - Australia – mismatch between rail capacity and port problems
 - Labour unrest, derailments, inadequate port allocation & equipment failures
- **Supply challenges**
 - Rising oil prices used for coal production led to shortage of mining equipment
 - Shortage of manpower
 - Lowering of coal quality
 - Weakening of the US\$
- **Action of authorities that interfere with coal supply**
 - Indonesia wants to re-negotiate supply contracts
 - Will Australia & Vietnam halt exports
 - Supply allocation limits by Port Authorities
- **Force Majeure & adverse weather conditions**

RENEWABLE POWER POTENTIAL

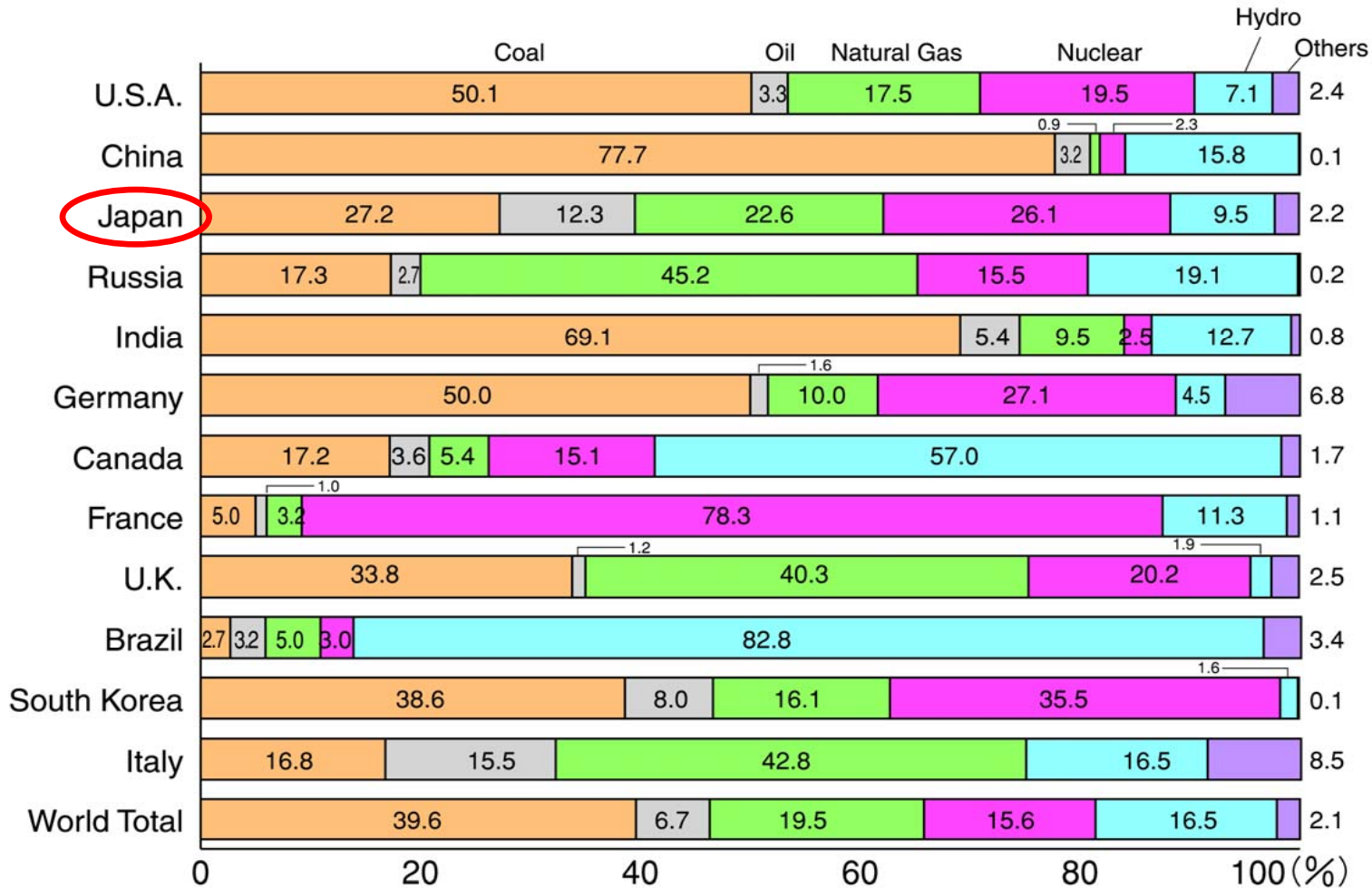
- **Wind energy**
 - Very low speed and limited suitable sites
 - Require electrical compensation and storage due to intermittency
- **Solar**
 - Huge area required to install panels
 - Expensive and requires subsidy
- **Biomass**
 - Competing use as input sources to other production
 - Insufficient quantity with current price
- **Mini hydro**
 - Competing with other uses
- **Other alternatives**
 - Require more R&D to ascertain feasibility



3-3. Power Generation Volume by Source

Each country has a different combination of power sources, depending on the abundance and type of domestic energy resources. Since Japan is deficient in energy self-sufficiency and is an island nation, it has tried to diversify power sources to improve its energy security.

(2004)

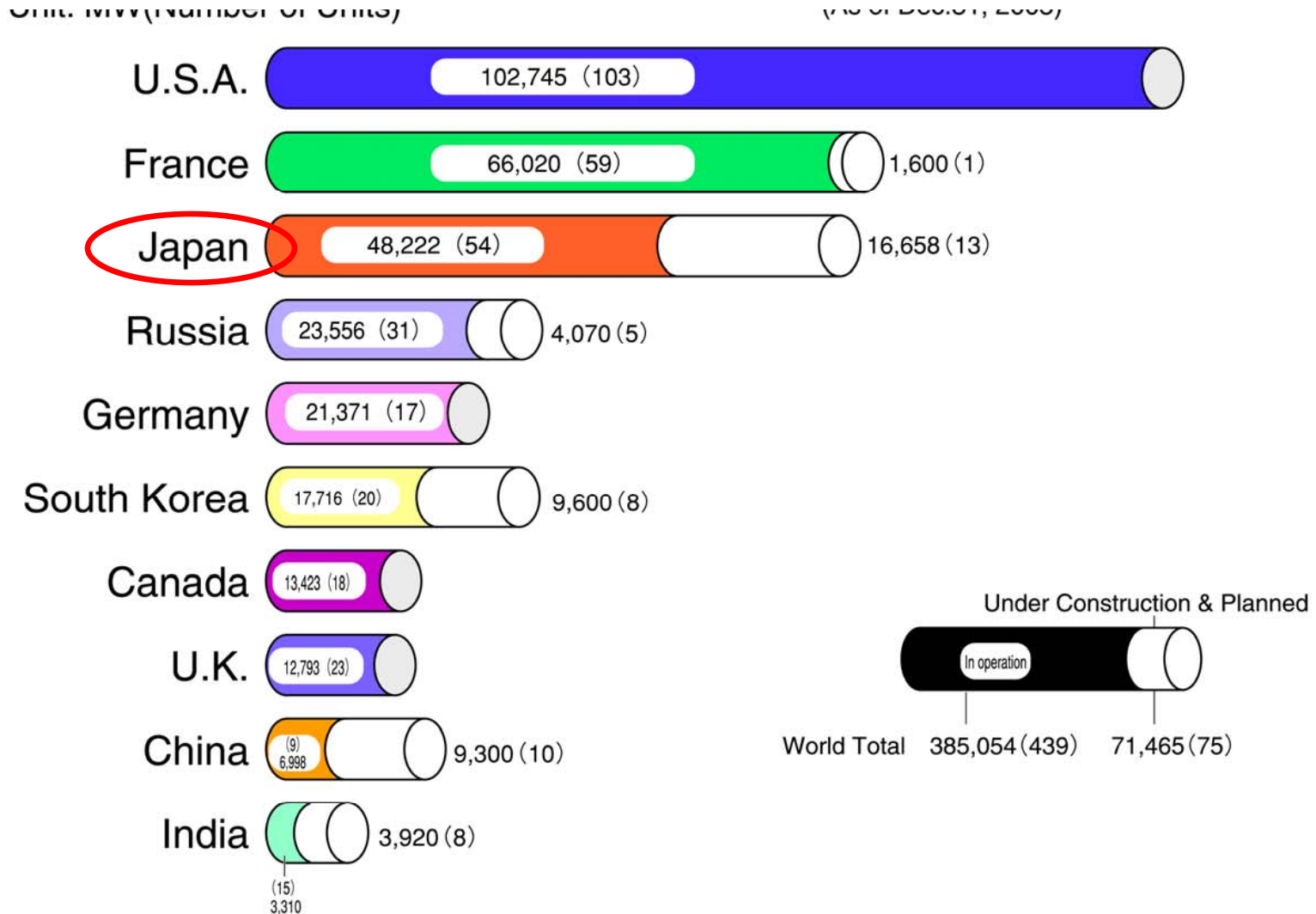


(Note) Figures do not necessarily total to 100% due to rounded numbers.

(Source) IEA Electricity Information 2006 Edition

3-4. Nuclear Power Plants in Major Countries

As of the end of December 2005, 439 nuclear power plants were in operation, with an additional 75 planned or under construction. Japan has the world's third largest nuclear power capacity, following the U.S. and France.



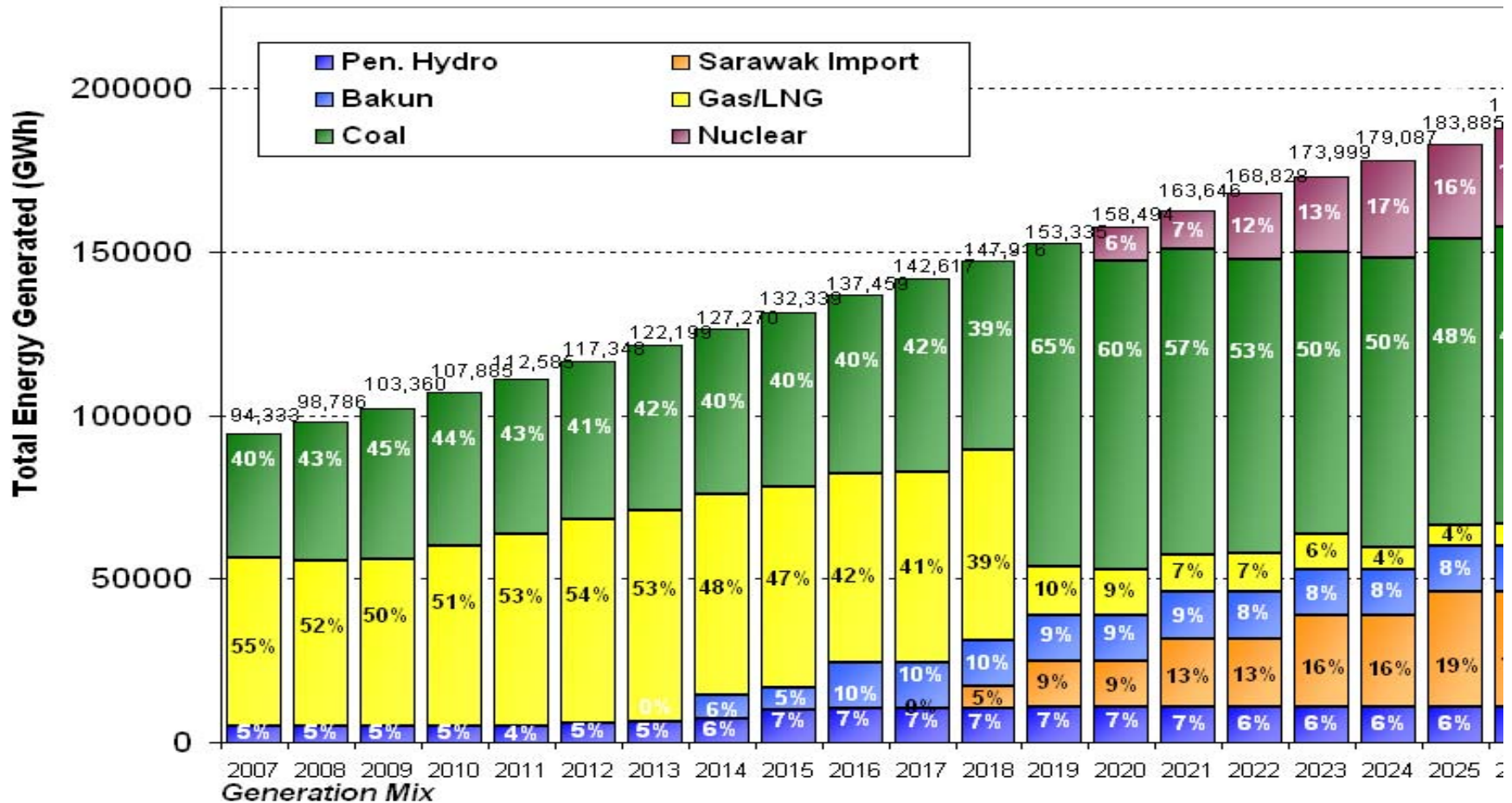
(Source) Japan Atomic Industrial Forum

ENERGY FUTURE (POST 2020)

- **Power Sector went away from expensive oil in 1970s. Will Power Sector also move away from expensive gas/imported LNG?**
- **Most “base load” Sarawak Hydro would be developed before 2020**
- **Energy Options for Base Load Electricity Generation limited to Coal, LNG or Nuclear?**
- **Intermediate and Peak Electricity Generation can expect contributions from gas, hydro including mini-hydro, biomass and solar but wind power is less likely in Malaysia**
- **If TNB must ensure **RELIABLE** and reasonably priced electricity, the **PROVEN BASE-LOAD** nuclear option must not be precluded**

GENERATION MIX TILL 2025

(based on forecast prior to 2008 global financial crisis)



WHY NUCLEAR IN PENINSULAR MALAYSIA ?

End Note!

- TNB cannot IGNORE nuclear energy
- It is a PROVEN, competitive BASE LOAD electricity source

- What, Who & When to do to keep nuclear as a VALID energy option and HOW ??

WHAT TO DO?

- **Multi-year Preparatory Activities are necessary to keep nuclear as a VALID energy option for Peninsular Malaysia**
- **IAEA has published documents to guide TNB**
- **Experiences of other countries e.g. France, Japan & Korea are good references**
- **Already ahead of Malaysia, ASEAN neighbours i.e. Indonesia, Vietnam & Thailand, can also guide TNB**

WHAT TO DO?

- **Stakeholder management & communication plan to win political and public support**
- **Legal and regulatory framework in place to ensure 3S compliance**
- **There must be suitable sites for FIRST and subsequent NPP projects**
- **Trained and competent Human Capital are necessary**
- **Industrial Capacity to support Nuclear Program**
- **Update nuclear information so that well-informed investment decision can be made**

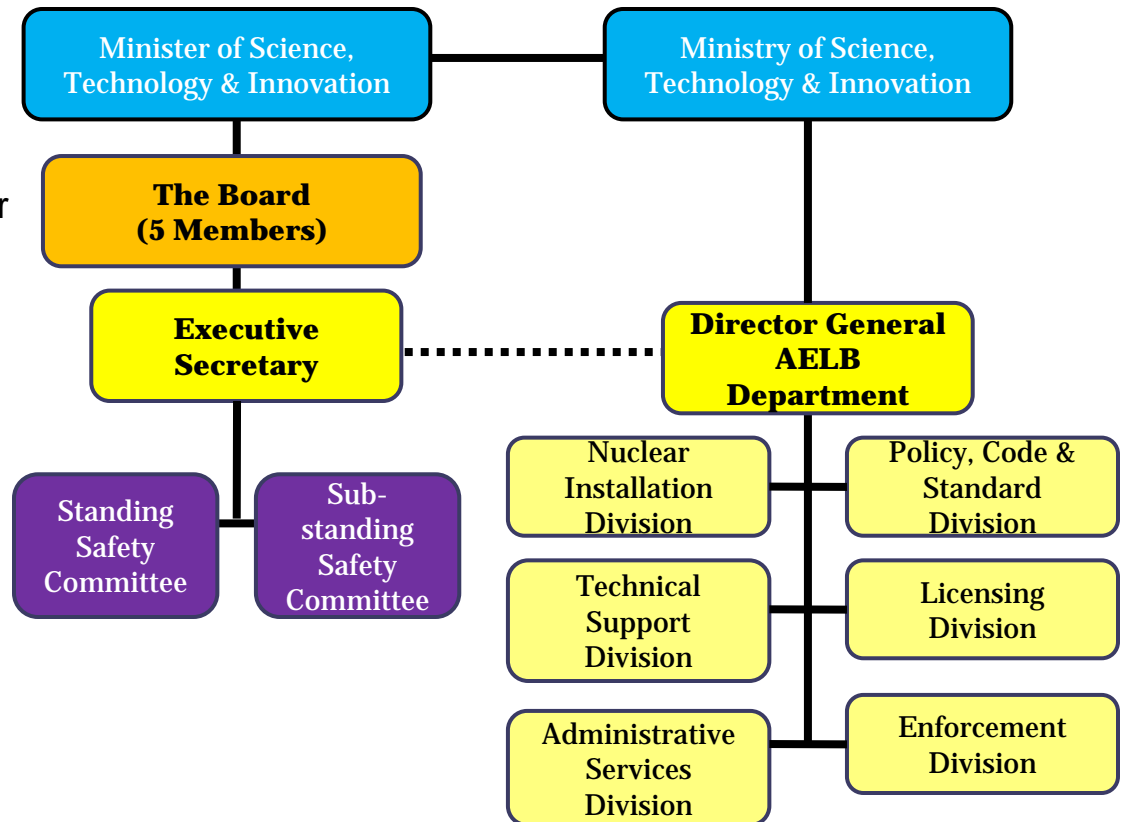
Legal and Regulatory System

- Main Act:
- Atomic Energy Licensing Act 1984 (Act 304)
 - To provide for the regulation and control of atomic energy;
 - For the establishment of standards on liability for nuclear damage; and
 - For matters connected therewith or related thereto.

- Regulatory Body:
Atomic Energy Licensing Board (AELB) was established under Section 3 of the Act. 304

Ensuring safety, security and safeguarding peaceful Nuclear Activities

Atomic Energy Licensing Board (AELB)



Current initiative on legal infrastructure:

- A comprehensive Nuclear Act is being reviewed (IAEA Standard) and AELB is discussing with various agencies in strengthening legal infrastructure of nuclear activities in Malaysia
- Anticipate to come out with a more comprehensive and effective act on nuclear activities e.g. CPPNM, AP, export control, compoundable offences or its criminalization etc.
- Adoption of 49 IAEA Standards related to research reactor and NPP
- Developing more guidance documents for licensee

Regulatory Activities-Roadmap

	2007				2008				2009				2010				2011				
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
Amendment/Repeal of Act 304	June 2009																				
Development of New Regulations	Nuclear Installation Licensing (2010), Safeguard Regulations (2010), Nuclear Security Regulations (2010)																				
Adoption of IAEA Standards	49 Documents related to RRx &																				
Bilateral Cooperation	MoU with BAPETEN, Indonesia (2008)								MoU with KINS, Korea												
Emergency Response Centre																					
Regional Nuclear Security Support Centre																					
Adoption & Application of IAEA Soft Laws	Safety, PP, & Security Fundamentals				COC on Research Reactor																
Safeguard Laboratory													Project initiation: 2010								

Atomic Energy(Nuclear Installation Licensing) Regulations 200__

- 1st Draft reviewed by IAEA Experts in 20-24 August 2007
- Continuous review by JKN:
 - Expert from Nuclear Malaysia, DOE, UKM, ST, MOSTI
 - 1st - 6th Review Meeting
- 15 Parts:
 - Preliminary
 - Type of License
 - General Condition to Obtain License
 - Site License, Design License, Construction License, Commissioning License, Operational License, Decommissioning License, Release from Regulatory Control
 - Duration , Amendment and Renewal of License
 - Security and Protection System
 - Miscellaneous
- This regulations cover 7 authorization stages which practice internationally
- This regulations also is comprehensive to support Radiation Protection (Licensing) Regulation 1986

Current status of Act, Regulations, Standards and Guides

Act - 1984

Regulations- 1986- to date

Standard - 2007

**Radiation Protection
(Basic Safety Standard)
1988***

*Approved by AG in Jun 2007

**Radiation Protection
(Nuclear Installation
Licensing) Regulation
200__**

**Radiation Protection
(Radioactive Waste Management)
Regulation 200__**

**Radiation Protection
(Nuclear Non Proliferation
Import & Export) Regulation 200__**

**Radiation Protection
(Security of Radioactive Material)
Regulation 200__**

**Radiation Protection
(Medical Devices) Regulation
200__**

**Radiation Protection
(Transport) Regulation 1989**

**Radiation Protection
(Licensing) Regulations 1986**

**Radiation Protection (Appeal)
Regulation 1990**

GS-G-1.6
Seismic Design and Qualification for NPP

GS-G-3.3
Evaluation of Seismic Hazard for NPP

GS-G-4.1
Format and Content of SAR for NPP

NS-G-1.1
Software for Computer Based System
Important to Safety in NPP

NS-G-1.2
Safety Assessment and Verification for NPP

NS-G-1.4
Design of Fuel Handling and Storage
System For NPP

NS-G-1.5
External Event Excluding Earthquake

NS-G-1.7
Protection Against Internal Fires and
Explosion In the Design of NPP

NS-G-1.8
Design of Emergency Power System for NPP

NS-G-1.9
Design of Reactor Coolant System and
Associated System in NPP

NS-G-1.10
Design of Reactor Containment System for NPP

NS-R-1
Safety for NPP Design

NS-G-1.11
Protection against Internal Hazard Other than
Fire and Explosion Design of NPP

NS-G-1.12
Design of Reactor Core for NPP

NS-G-1.13
Radiation Protection Aspect of Design for NPP

NS-G-2.1
Fire Safety in the Operation of NPP

NS-G-2.2
Operation Limit & Condition and Operating
Procedures For NPP

NS-G-2.3
Modification to NPP

NS-G-2.4
The Operating Organization for NPP

NS-G-2.7
Radiation Protection and Radioactive Waste
Management in the Operation of NPP

NS-G-2.8
Recruitment, Qualification & Training of
Personnel for NPP

NS-G-2.9
Commissioning for NPP

NS-G-2.10
Periodic Safety Review for NPP

NS-G-2.11
A System for the Feedback of Experience
From Events in Nuclear Installation

NS-G-3.1
External Human Induce Event in Site
Evaluation for NPP

NS-G-3.2
Dispersion of Radioactive Material in Air and
Water and Consideration of Population
Distribution in Site Evaluation
For NPP

NS-G-3.5
Flood Hazard for NPP on Coastal and River Site

NS-G-3.6
Geotechnical Aspect of Site Evaluation and
Foundation for NPP

WS-G-2.1
Decommissioning for Research Reactor and NPP

NS-R-2
Safety of NPP Operation

NS-R-3
Site Evaluation for Nuclear Installation

NS-G-2.5
Core Management and Fuel Handling for NPP

NS-G-3.4
Meteorological Event in Site Evaluation for NPP

**Act 304,
1984**

2007

**National Guideline on Safety
Assessment And Preparation of SAR**

**Standard for Certification and Re-certification
of Research Reactor Operator**

**Guideline for Approval Application of Transit
Of Nuclear Material**

**Guideline for IAEA Safeguard Inspector
Designation and Issuance of Multi-entrance
Visa**

2008

**Guideline of Inspection Procedure for
Research Reactors**

**Guideline for Approval Application of
Transshipment for Nuclear Material**

**Standard For Certification of
Inspector and Assessor**

**Guideline of Licensing Process for
Nuclear Installation**

2009

**Guideline for the Assessment of
Reactor Modification**

**Guideline on the Site Evaluation
For Nuclear Installation**

**Guideline on National Emergency
Preparedness and Response**

2010

**Guideline on Physical Protection of
Nuclear Installation**

TBD

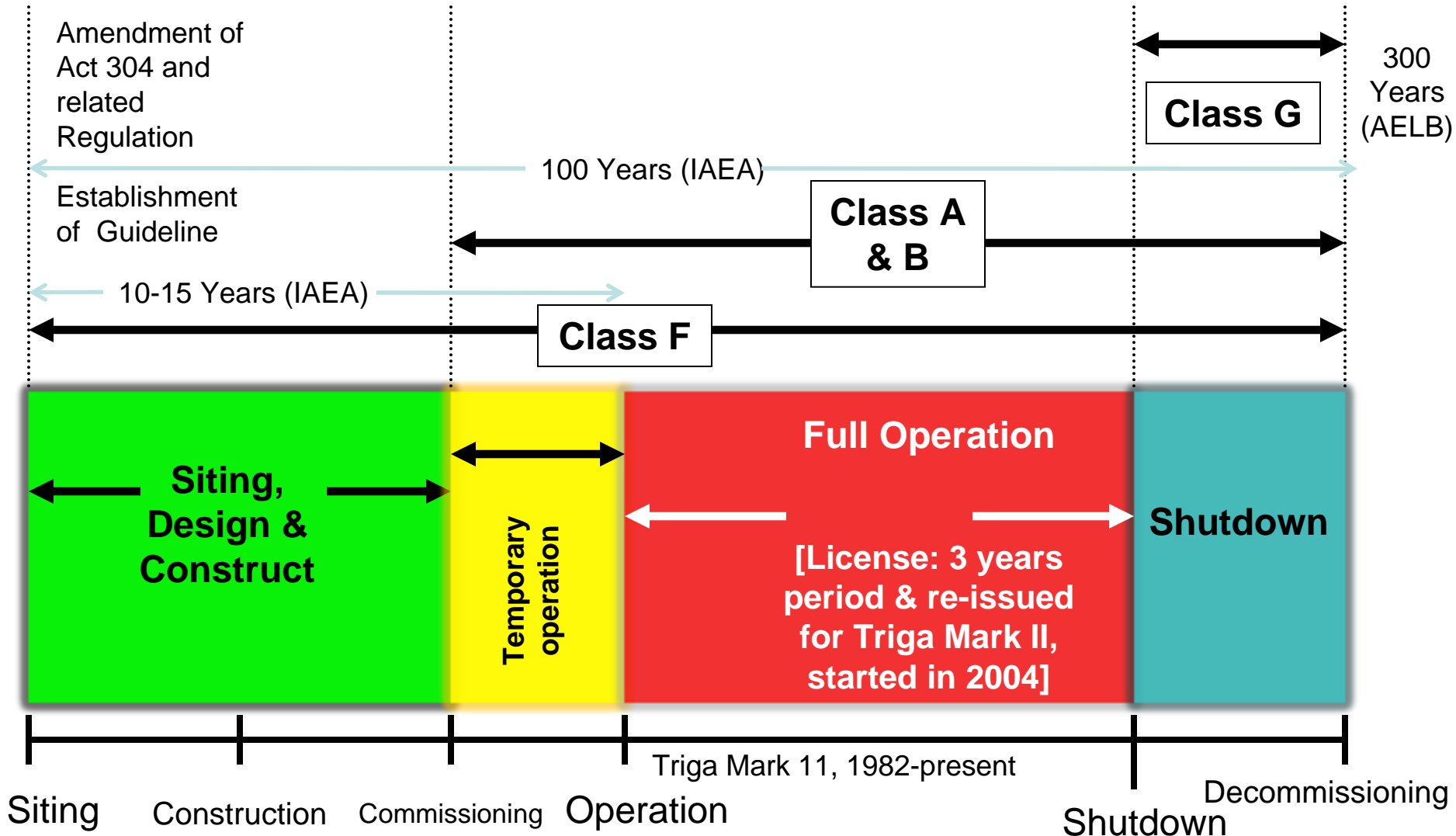
2011 -2015

TBD for 10th Malaysia Planning

Legend

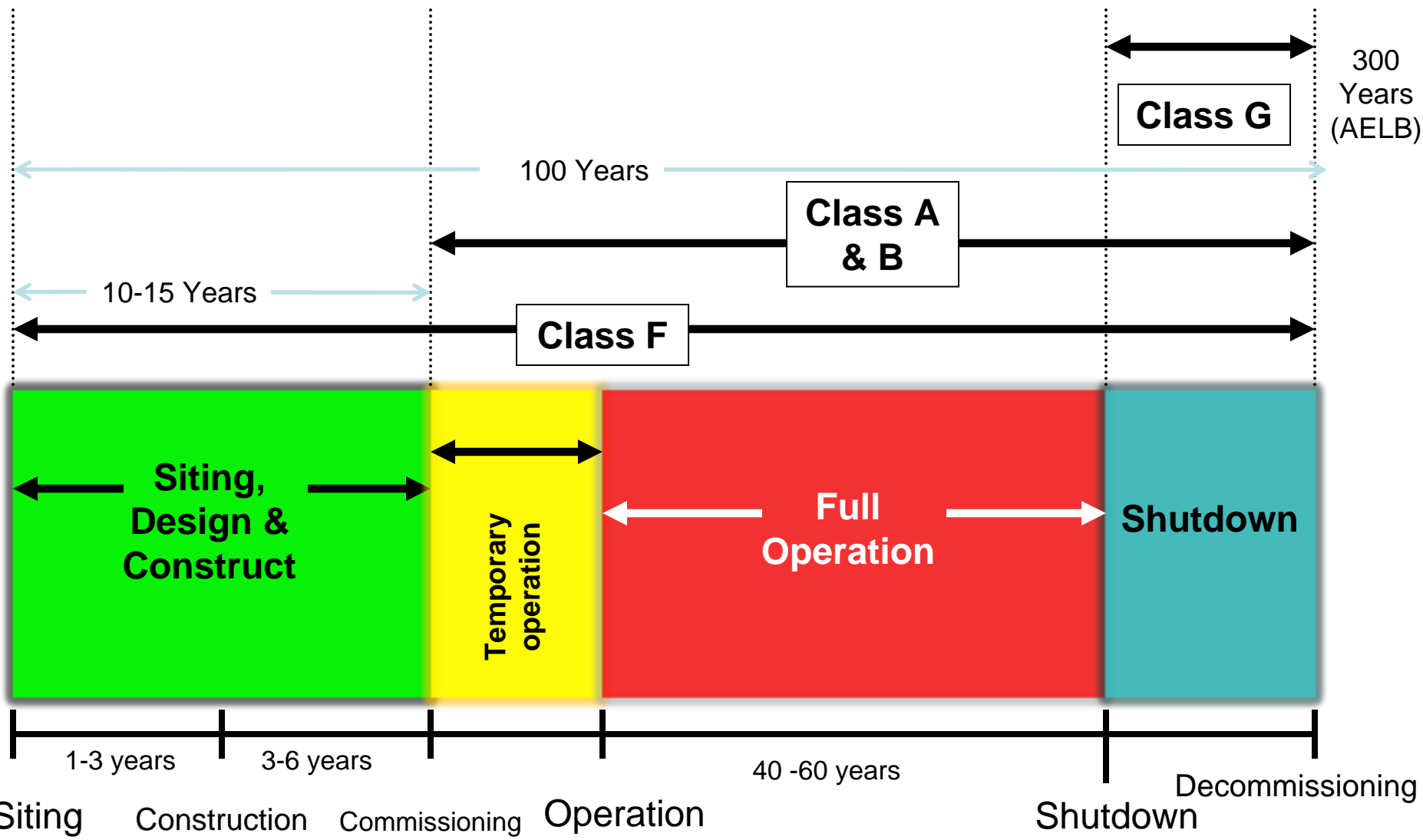
- Adopted (IAEA document)
- Preparation
- Planning
- Revision
- Published

Licensing Process for Nuclear Installation [Radiation Protection (Licensing) Regulation 1986]





Proses Perlesenan NPP di bawah Peraturan Perlindungan Sinaran (Perlesenan) 1986





Atomic Energy(Nuclear Installation Licensing) Regulations 200__

- 1st Draft reviewed by IAEA Experts in 20-24 August 2007
- Continuous review by JKN:
 - Expert from Nuclear Malaysia, DOE, UKM, ST, MOSTI
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- 15 Parts:
 - Preliminary
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 - Duration , Amendment and Renewal of License
 - Security and Protection System
 - Miscellaneous
- This regulations cover 7 authorization stages which practice internationally
- This regulations also is comprehensive to support Radiation Protection (Licensing) Regulation 1986

Licensing Stages

“whole life cycle”

Siting

Design

Construction

Commissioning

Operations

Decommissioning

Release

AELB Current Human Resource Development Program

- Application of Strategic Approach to Training
 - starts with TNA in 2007 and followed by design, development and implementation in 2008 & 2009. Evaluation Stage will be in 2010.
- Development and Adoption of a Guidance Document for AELB Human Capital Program – LPTA/SPP/10 (14 Mac 2008)
 - Includes national policy and strategy on HCD
- Internal Trainings
 - 10 trainings identified (based on 2007 TNA) planned in 2008 especially on critical knowledge areas
 - 2 seminar organized in 2008 for knowledge sharing among AELB officers. This will be an annual event (at least 2 seminars a year)
- External Trainings – to ensure AELB is up-to date
- Certification Program for AELB Assessor and Inspector
- “Computer Based Training / Evaluation” – for identified core competencies (Radiation Protection and Malaysian Nuclear Law)

Basic Nuclear Power Infrastructure

No.	I/Structure	Responsibility	Funding & Implementing Organization	Comment
1.	NPIA	Government	Minis. Of Energy	
2.	Nuclear Power Policy	Government	NPIA	
3.	Nuclear Related Laws	Government	NPIA	Done - Act 304
4.	Nuclear Regulatory Body	Government	Government	Done – AELB
5.	Educational Institutions	Government	NPIA	UKM, UTM
6.	Nat Lab	Government	NPIA	Nuclear Malaysia & AELB
7.	Economic Assessment	Utility	Utility, Finance & Commercial Dept.	
8.	Financing Assessment	Utility	Utility, Finance & Commercial Dept.	

Basic Nuclear Power Infrastructure ...cont

No.	I/Structure	Responsibility	Funding & Implementing Organization	Comment
9	Public Consultation	Utility	Utility Public Relations Dept.	To add in Law
10	Human Development	Utility	Utility Human Resource Dept	
11	Siting & Site I/structure	Utility	Utility Technical Department	AELB to evaluate
12	Grid Strengthening	Utility	Transmission Utility	
13	Transportation Means	Utility	Utility Technical Department	Partly : R/act Transport Reg
14	Env. Assessment	Utility	Utility Technical Department	Partly : Licensing Reg
15	Bid Request, Evaluation and Vendor Selection	Utility	Utility Technical & Commercial Departments	Licensing Process

Basic Nuclear Power Infrastructure ...cont

No.	I/Structure	Responsibility	Funding & Implementing Organization	Status
16	Licensing	Utility	Utility Technical Department	Act 304 & Regulations
17	Emergency Planning	Utility	Utility Technical Department	MKN – AELB on R.I
18	Engineering	Utility	Private Sector Companies	
19	Project Management & Commissioning	Utility	Private Sector Companies	
20	Fuel Supply	Utility	Utility through International Suppliers	AELB : Facilitation
21	Waste Management	Utility	Utility	Act 304 & Regulation

INFRASTRUCTURE ISSUES AND MILESTONES

Issues	Milestone 1	Milestone 2	Milestone 3
National position			
Nuclear safety			
Management			
Funding and financing	Conditions	Conditions	Conditions
Legislative framework			
Safeguards			
Regulatory framework			
Radiation protection			
Electrical grid			
Human resources development			
Stakeholder involvement			
Site and supporting facilities			
Environmental protection			
Emergency planning			
Security and physical protection			
Nuclear fuel cycle			
Radioactive waste			
Industrial involvement			
Procurement			

NEED FOR COMPLIANCE WITH INTERNATIONAL SYSTEM OF GOVERNANCE

What international nuclear treaties & conventions have the country not signed or acceded to?

Has the provisions in the treaties & conventions been adopted in national legislation & regulations?

Are the national nuclear legislation & regulations adequate to assure nuclear plant safety & security & nuclear weapons non-proliferation safeguards?

NUCLEAR TREATIES & CONVENTIONS THAT MALAYSIA IS A PARTY OR SIGNATORY TO

No.	Treaty, Convention or Agreement:	Status of Malaysia:
1.	1956 Statute of the International Atomic Energy Agency (IAEA)	Acceded to on 15 January 1969.
2.	1968 Treaty on the Non-proliferation of Nuclear Weapons (NPT)	Signed on 1 July 1968 and ratified on 3 May 1970.
3.	1972 Agreement between the Government of Malaysia and the IAEA for the Application of Safeguards in Connection with the NPT (Comprehensive Safeguards Agreement)	Concluded & entered into force on 29 Februari 1972.
4.	1997 Additional Protocol to the IAEA Comprehensive Safeguards Agreement	Signed on 22 November 2005, but yet to be ratified.

NUCLEAR TREATIES & CONVENTIONS THAT MALAYSIA IS A PARTY OR SIGNATORY TO

No.	Treaty, Convention or Agreement:	Status of Malaysia:
5.	1980 Agreement between the IAEA and the Governments of Malaysia and the United States of America Concerning the Transfer of a Research Reactor and Enriched Uranium (IAEA Project and Supply Agreement)	Concluded & entered into force on 20 September 1980.
6.	1959 Agreement on Privileges and Immunities of IAEA	Not a party to.
7.	1986 IAEA Convention on Early Notification of A Nuclear Accident	Acceded to on 1 September 1987 and entered into force on 2 October 1987.
8.	1986 IAEA Convention on Assistance in the Case of Nuclear Accident or Radiological Emergency	Acceded to on 1 September 1987 and entered into force on 2 October 1987.

NUCLEAR TREATIES & CONVENTIONS THAT MALAYSIA IS A PARTY OR SIGNATORY TO

No.	Treaty, Convention or Agreement:	Status of Malaysia:
9.	1979 Convention on the Physical Protection of Nuclear Material (CPPNM)	Cabinet approval to accede to made on 27 October 2003, but legal process to criminalise related offences still on-going.
10.	2005 Protocol to Amend the Convention on Physical Protection of Nuclear Material.	Yet to accede to, but related offences will be criminalised together with those for 1979 CPPNM
11.	1994 Convention on Nuclear Safety	Yet to accede to, but need to accede, especially with nuclear power.
12.	1963 Vienna Convention on Civil Liability for Nuclear Damage	Not a party to.

NUCLEAR TREATIES & CONVENTIONS THAT MALAYSIA IS A PARTY OR SIGNATORY TO

No.	Treaty, Convention or Agreement:	Status of Malaysia:
13.	1997 Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage	Yet to accede to, but may need to accede or adopt provisions in national legislation, especially with nuclear power.
14.	1997 Convention on Supplementary Compensation for Nuclear Damage	Yet to accede to, but may need to accede or adopt provisions in national legislation, especially with nuclear power.
15.	1997 Joint Convention on the Safety of Spent Fuel Management and on Safety of Radioactive Waste Management	Yet to accede to, but need to accede, especially with nuclear power.

NUCLEAR TREATIES & CONVENTIONS THAT MALAYSIA IS A PARTY OR SIGNATORY TO

No.	Treaty, Convention or Agreement:	Status of Malaysia:
16.	1963 Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water (Partial Test Ban Treaty, PTBT)	Signed and ratified on 15 July 1964.
17.	1967 Treaty on Principles Governing the States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Outer Space Treaty)	Signed on 20 February 1967, but yet to ratify.
18.	1972 Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the Sea Bed and the Ocean Floor and in its Sub-soil Thereof (Sea-bed Treaty)	Signed on 20 May 1971 and ratified on 21 June 1972.

NUCLEAR TREATIES & CONVENTIONS THAT MALAYSIA IS A PARTY OR SIGNATORY TO

No.	Treaty, Convention or Agreement:	Status of Malaysia:
19.	1995 Treaty on the South-East Asia Nuclear Weapons-Free Zone (SEANWFZ)	Signed on 15 December 1995 and ratified on 11 October 1996
20.	1996 Comprehensive Nuclear Test-Ban Treaty (CTBT)	Signed on 23 July 1998 and ratified on 17 January 2008.
21.	2005 International Convention on Suppression of Acts of Nuclear Terrorism	Signed on 16 December 2005, but yet to ratify.

NPT, IAEA SAFEGUARDS AGREEMENT & THE ADDITIONAL PROTOCOL

Malaysia is a State party to NPT, meaning that we have given up right to nuclear weapons, but we have no specific law to enforce the NPT, especially referring to prohibition on nuclear weapon. Also relevant for SEANWFZ Treaty & CTBT.

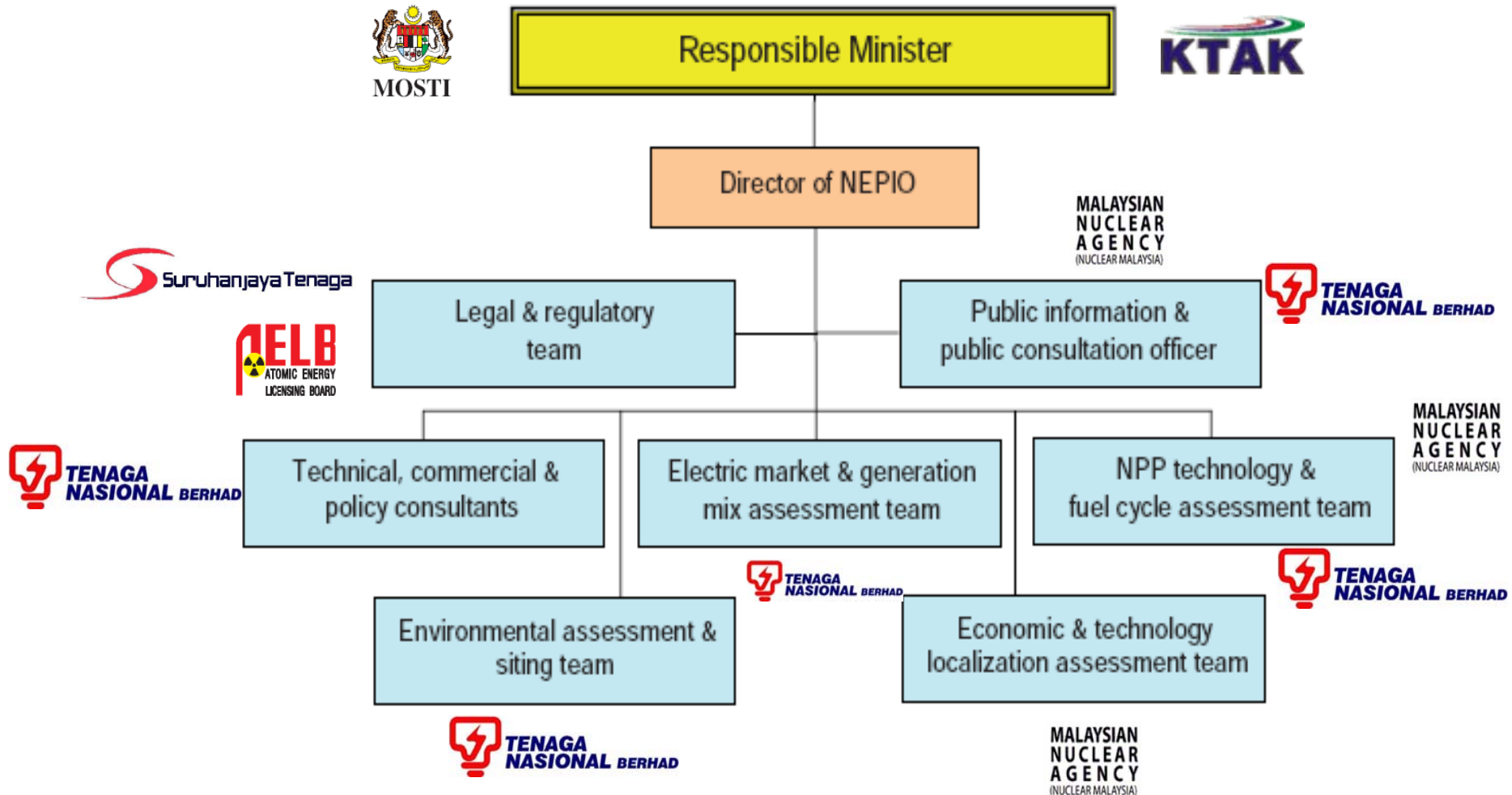
IAEA Safeguards Agreement implemented by the Atomic Energy Licensing Board (AELB).

Legal provision to enforce the Additional Protocol need to be in place, prior to ratification, to ensure access to nuclear power plant, nuclear fuel, nuclear fuel cycle services & related technologies, Since policy of supplier States requires this.

WHO TO DO?

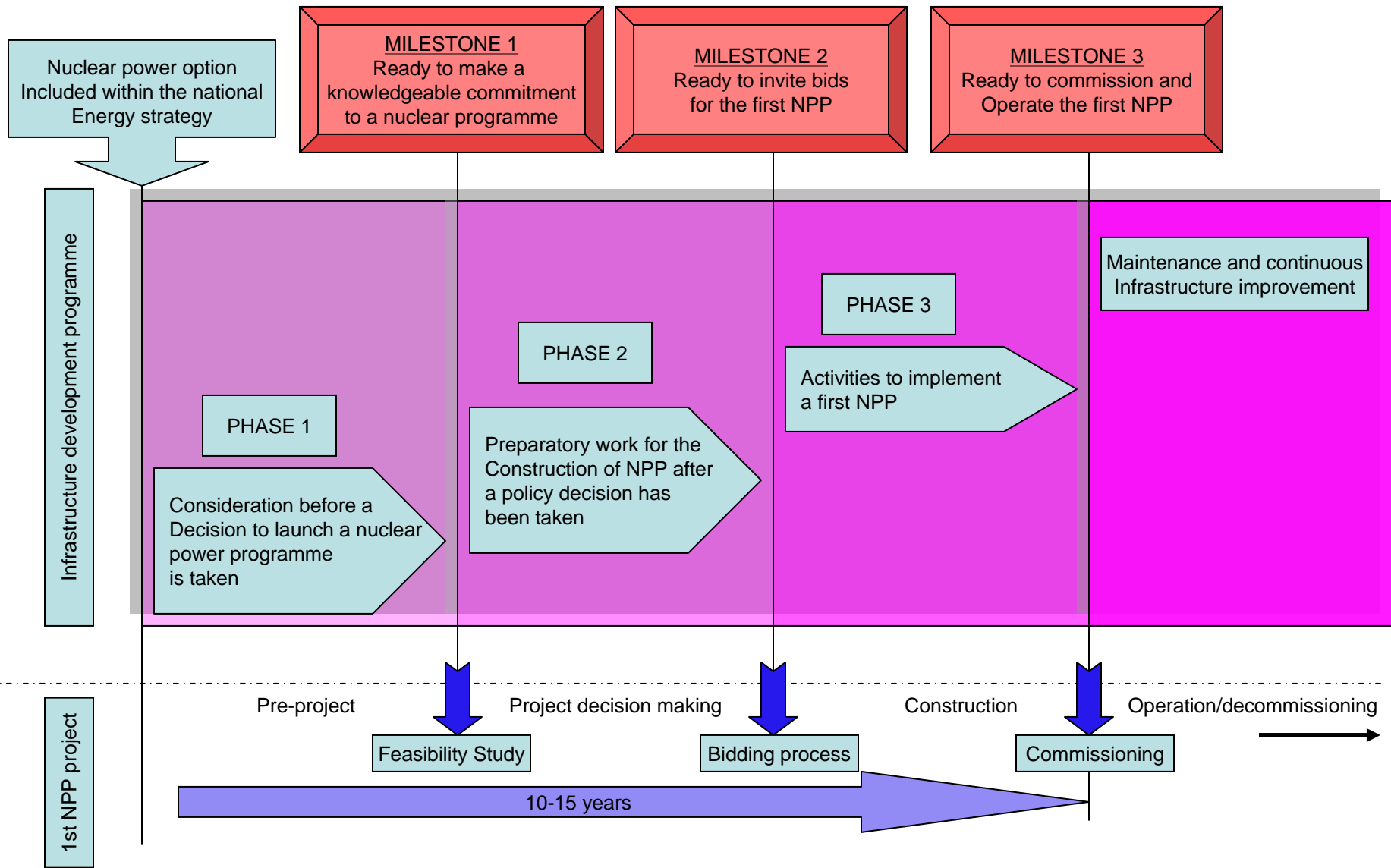
- **There must be a national Nuclear Energy Program Implementing Organisation (NEPIO)**
- **A Protem mini-NEPIO has started to function, comprising Malaysia Nuclear Agency (Nuklear Malaysia), Atomic Energy Licensing Board (AELB) and TNB**
- **Nuklear Malaysia is the national promoter, R&D, nuclear trainer, adviser & honest broker**
- **AELB is the nuclear regulator**
- **TNB's desired role is NPP developer-cum-operator**
- **Other organisations will join NEPIO**

NUCLEAR ENERGY PROGRAM IMPLEMENTATION ORGANISATION (NEPIO)



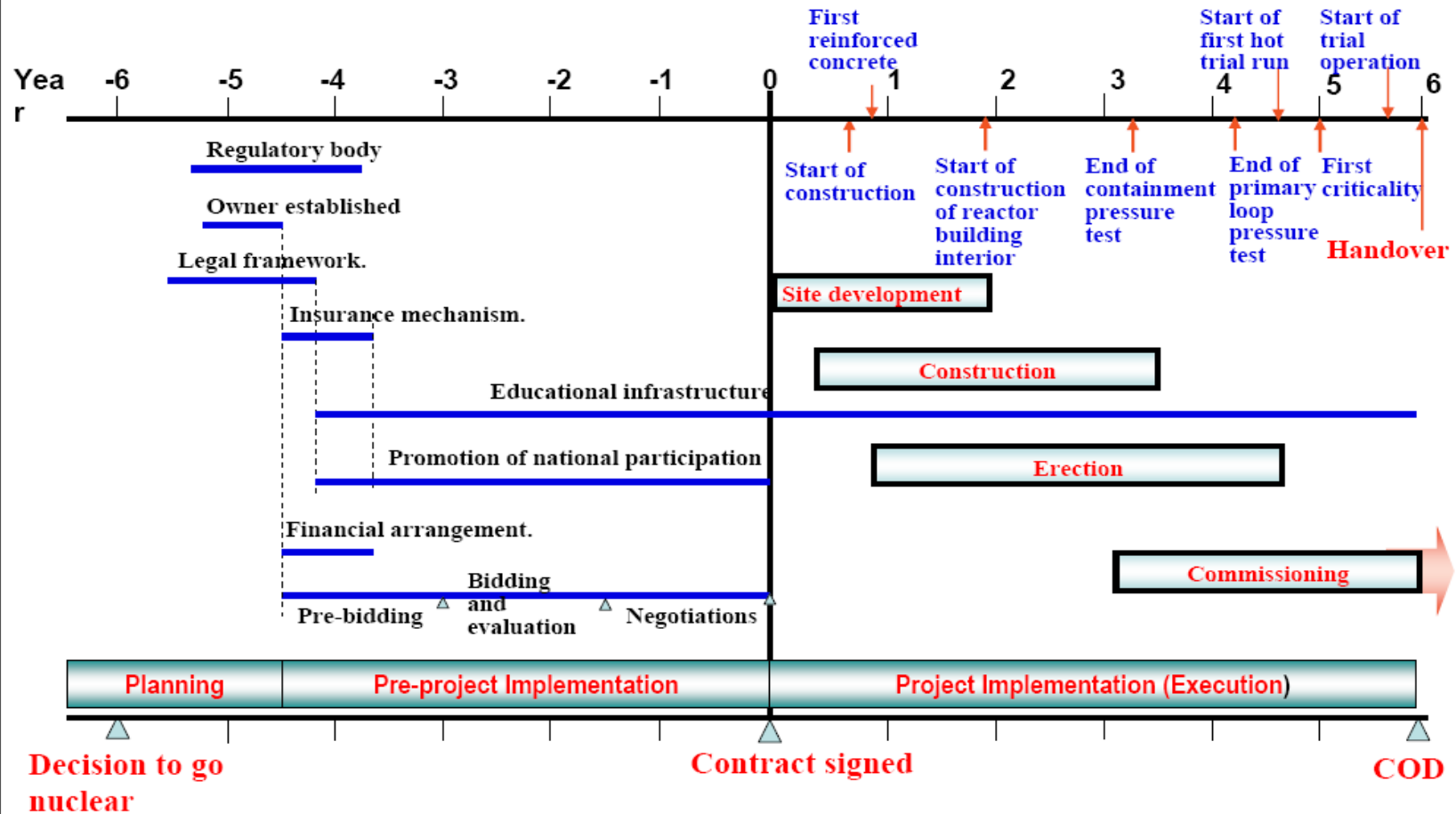
WHEN TO DO?

- **IAEA has indicative timelines & milestones**
- **Based on statements made, nuclear electricity will only be delivered to TNB power grid, post 2020**
- **If it takes 12 – 15 years to work from scratch, 2021 would be earliest date but 2023 would be more comfortable**
- **What activities to prioritise and carry out in sequence**



.Source : IAEA – TECDOC – 1555 Managing the First Nuclear Power Plant Project.

Key Milestone of a NPP Project



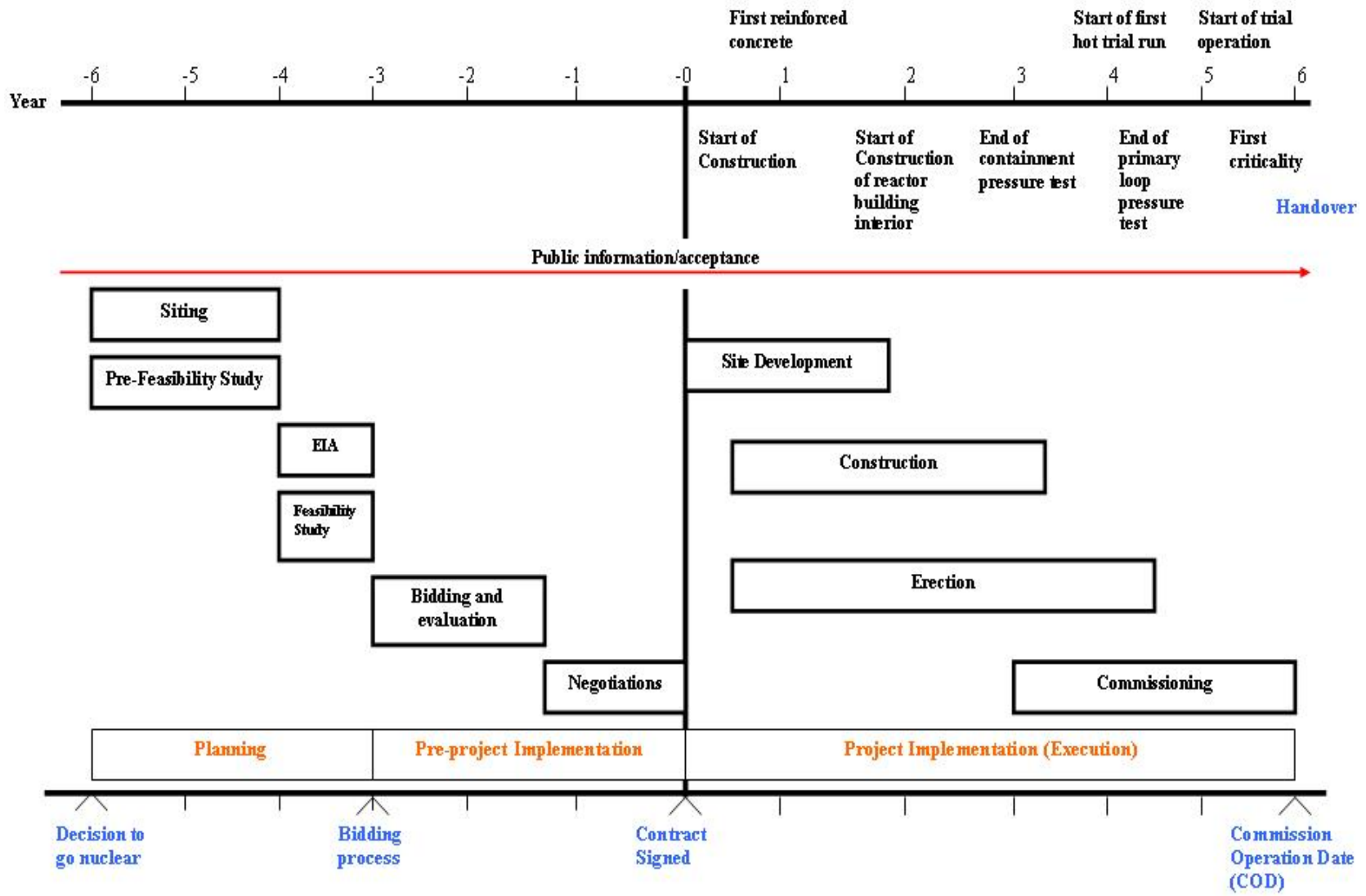
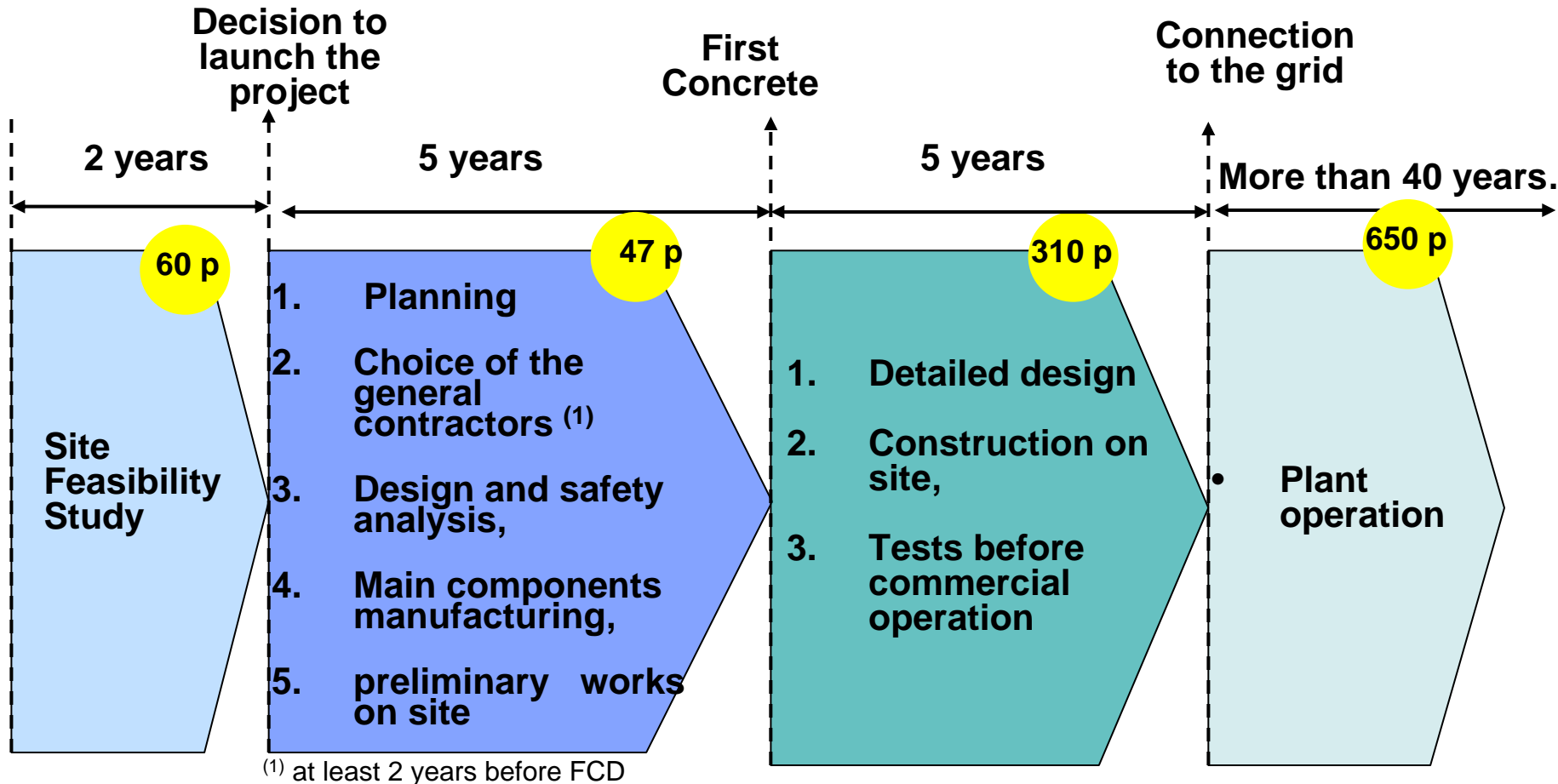


Figure 3: TNB Preliminary Roadmap of a NPP Project Implementation

Towards a first NPP : Main steps

- **Typical schedule to start a nuclear power plant**
 - (turnkey contract for a licensed reactor)



- **Manpower estimated for a two units site, a proven technology, a turnkey contract with no technology transfer for the design and the manufacture of the key components**

Licensing Stages

“whole life cycle”

Siting

Design

Construction

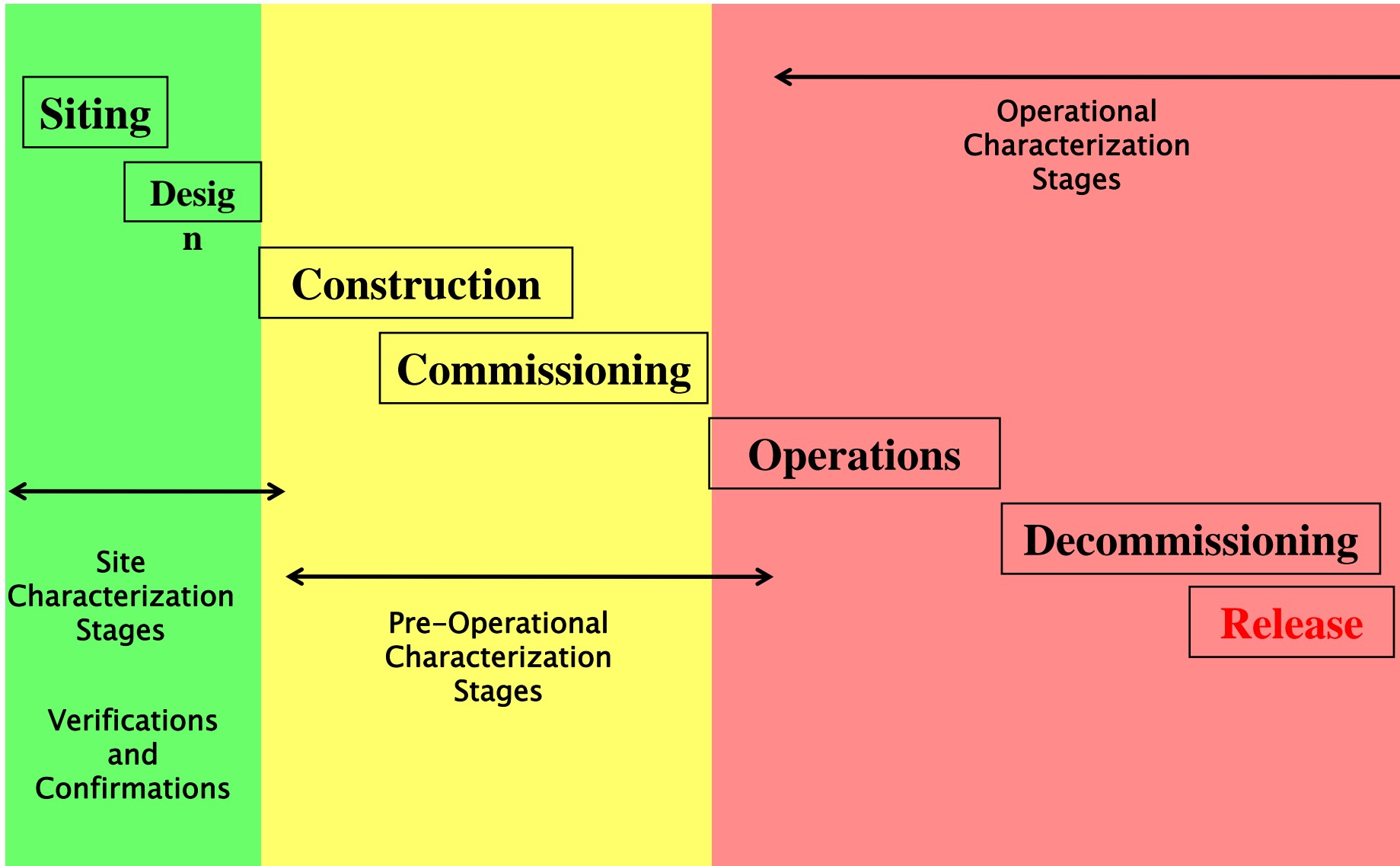
Commissioning

Operations

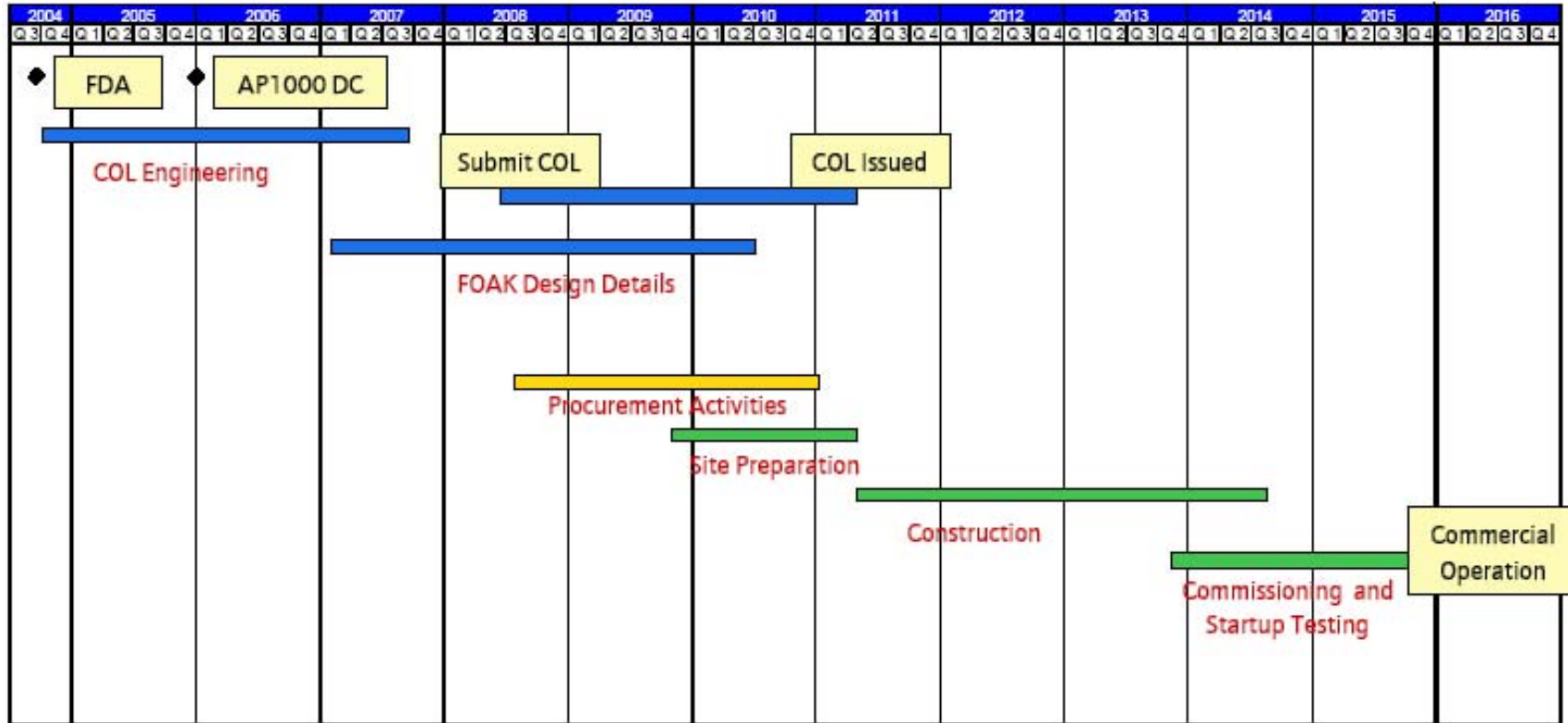
Decommissioning

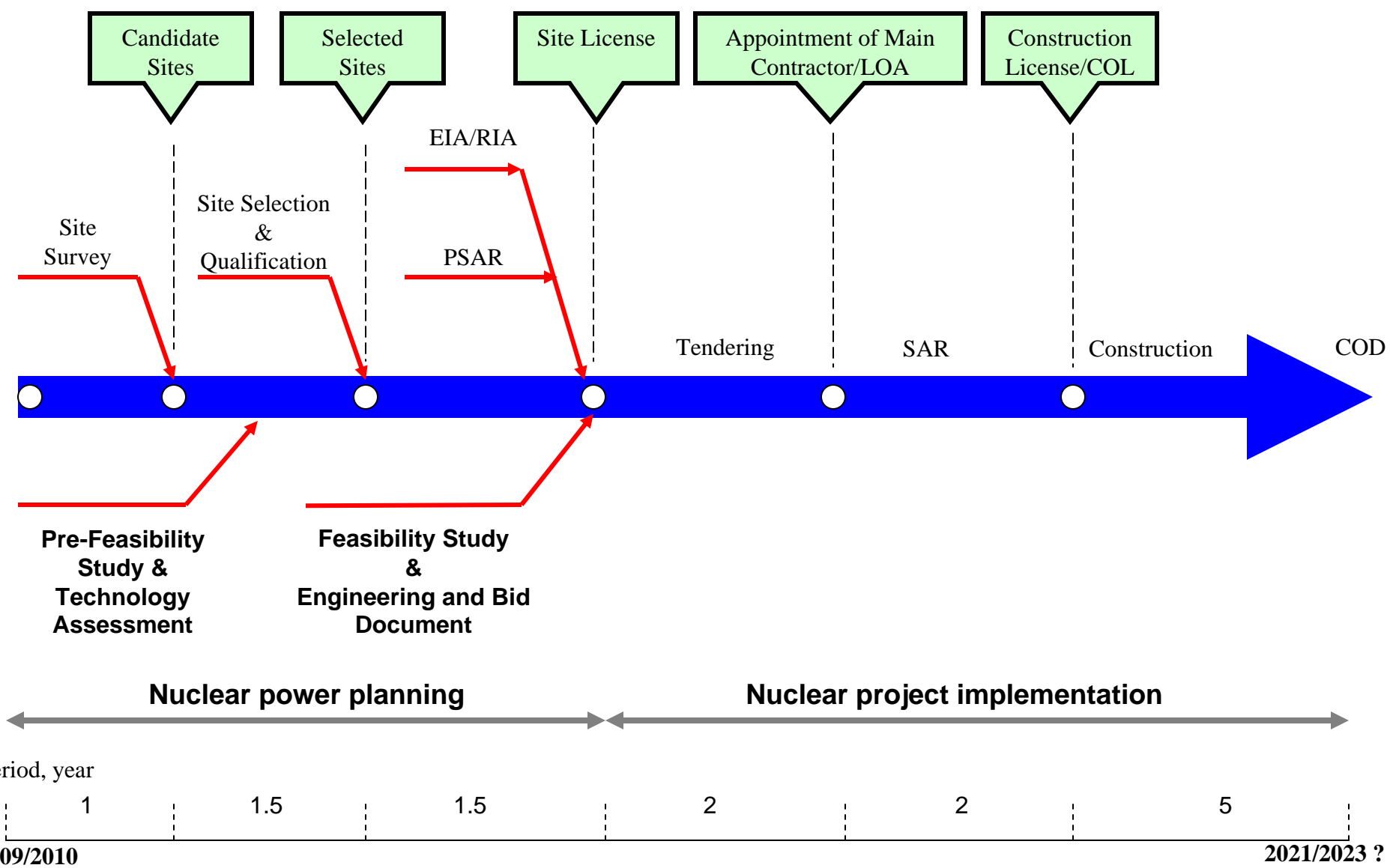
Release

Site Evaluation for NPP



The Steps to Bring a New Plant On-line in 2016 (United States)





*Not to scale

Figure: NPP project timeline

Concluding Remarks

CONCLUDING REMARKS

- **Interest in nuclear power is not new to NEB/TNB. TNB seriously considered nuclear power in the 1970s following the oil price increase. In the 1980s, TNB collaborated with Nuklear Malaysia and IAEA to carry out several preparatory activities**
- **The discovery of gas offshore Peninsular Malaysia in 1979 offered a win-win option - to develop a gas industry and use domestic energy resource for electricity generation**
- **Prior to 1994, TNB enjoyed virtual monopoly in the electricity supply business. Today, TNB shares the generation business with IPPs. Based of market feedback, the First NPP project will not be undertaken by private IPPs in view of perceived risks**

CONCLUDING REMARKS

- **With rising fossil fuel prices, nuclear power could be viewed as an INSURANCE proven technology to offset or prevent runaway prices of gas and coal**
- **Nuclear as a future energy option (post-2020 or the 12th Malaysia Plan period) will again to be considered seriously**
- **A NEPIO-like entity must be established to execute the pre-development activities in view of needed long lead time**
- **“National infrastructure” must be well prepared and be ready for the “inevitable” nuclear future**
- **All nuclear proponents must contribute towards educating the general public on the need for nuclear electricity and win public support/acceptance**

CONCLUDING REMARKS

- **TNB Nuclear Unit was formed on 1 June 2008, less than 6 months ago**
- **While we can draw from previous experience in pre-monopoly NEB era, the situation has changed drastically**
- **No NPP project can take off without compliance of 3S – safety, security and safeguards. Involvement of IAEA is a necessity**
- **Fortunately, IAEA has many publications to guide developing countries keen to embark on NPP program**
- **As a late starter compared to Indonesia, Thailand and Vietnam, Malaysia can learn from them and other countries e.g. France, Japan & Korea**

THANK YOU

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