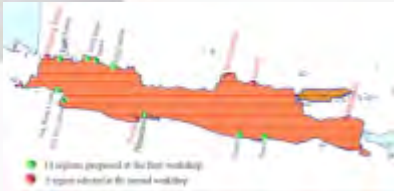


# Planning to Implement a Nuclear Power Programme **From Research Facilities to a Nuclear Power Plant**

Djarot S. Wlsnubroto



# Brief History of Nuclear Power Development in Indonesia

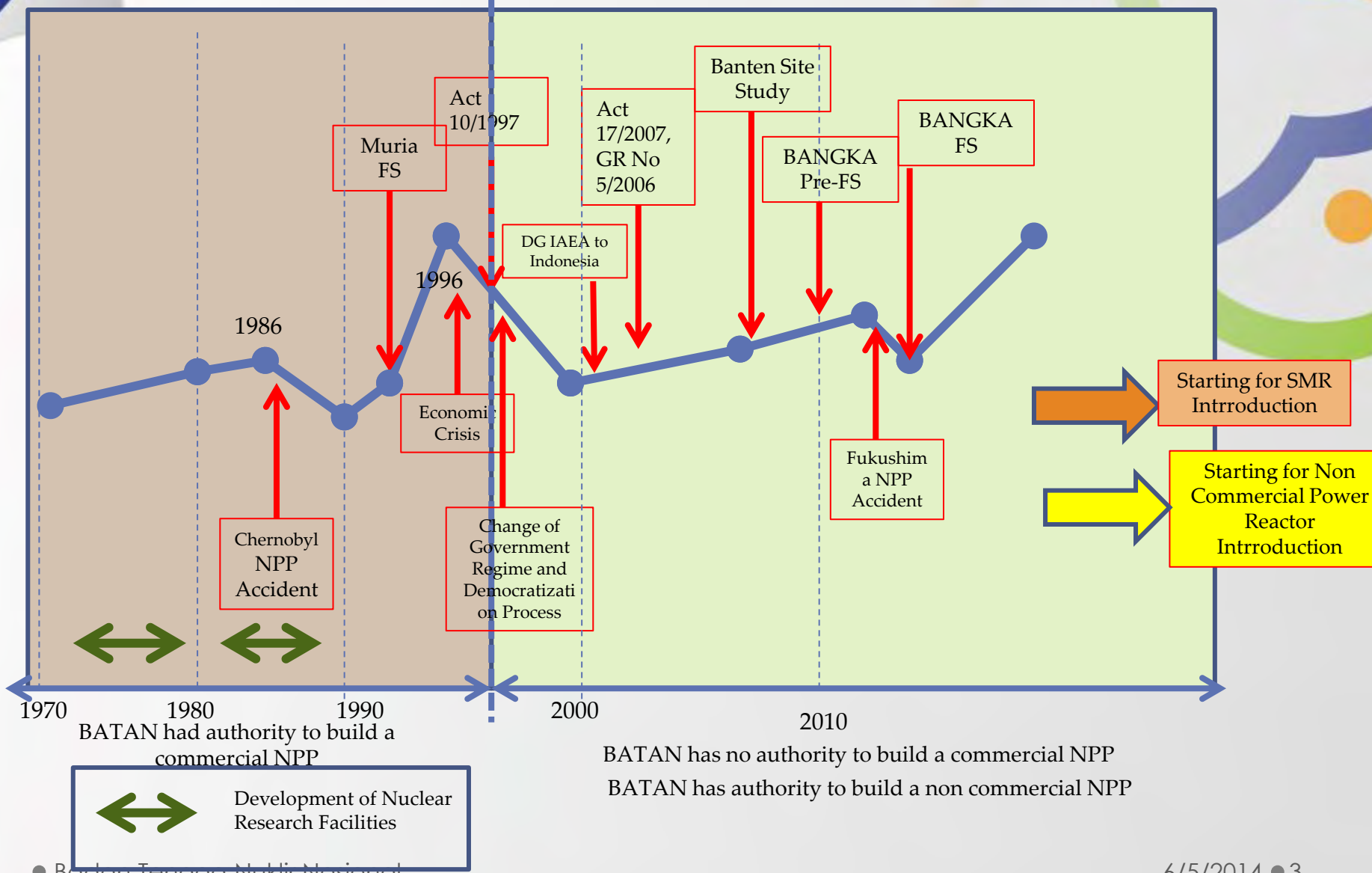


NPP has been initiated since the 1970's through Karangates seminars, and has selected 14 site candidates in Java, and then screened out produced 5 site candidates, one of them is Muria Peninsula

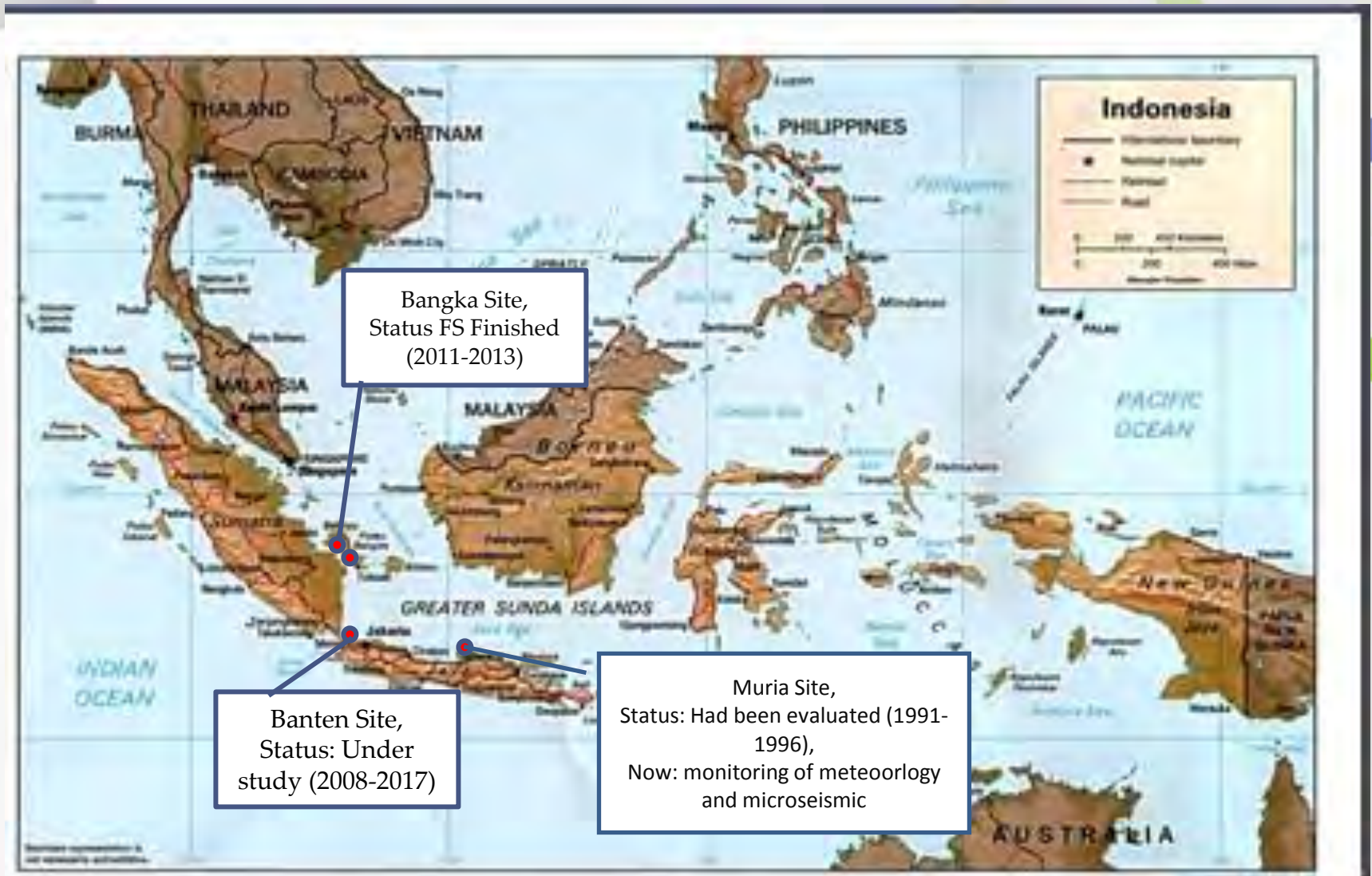
- 1980s: Screening process of sites, and it had been chosen 6 site candidates along the coastline of Muria Peninsula
- 1991-1996 : Comprehensive Feasibility Studies (site and non site) in Muria Peninsula, conducted by Newjtec Consultant: the result: Ujung Lemahabang had been chosen as preferred site and had been evaluated in detail. During the studies there was intensive IAEA site safety review mission (SSRM).
- 1996-2008: Some additional work after Newjtec have been conducted to fulfill some major issue related to the result of IAEA SSRM.
- 2008-2013: Site study for Banten Province
- 2010-2013: Comprehensive Feasibility for Bangka NPP Sites
- 2013: the emerging of the Idea for commercial SMR development in Indonesia : MoU BATAN and Utility Company
- 2013: the emerging of the Idea for non-commercial power reactor (mini scale)

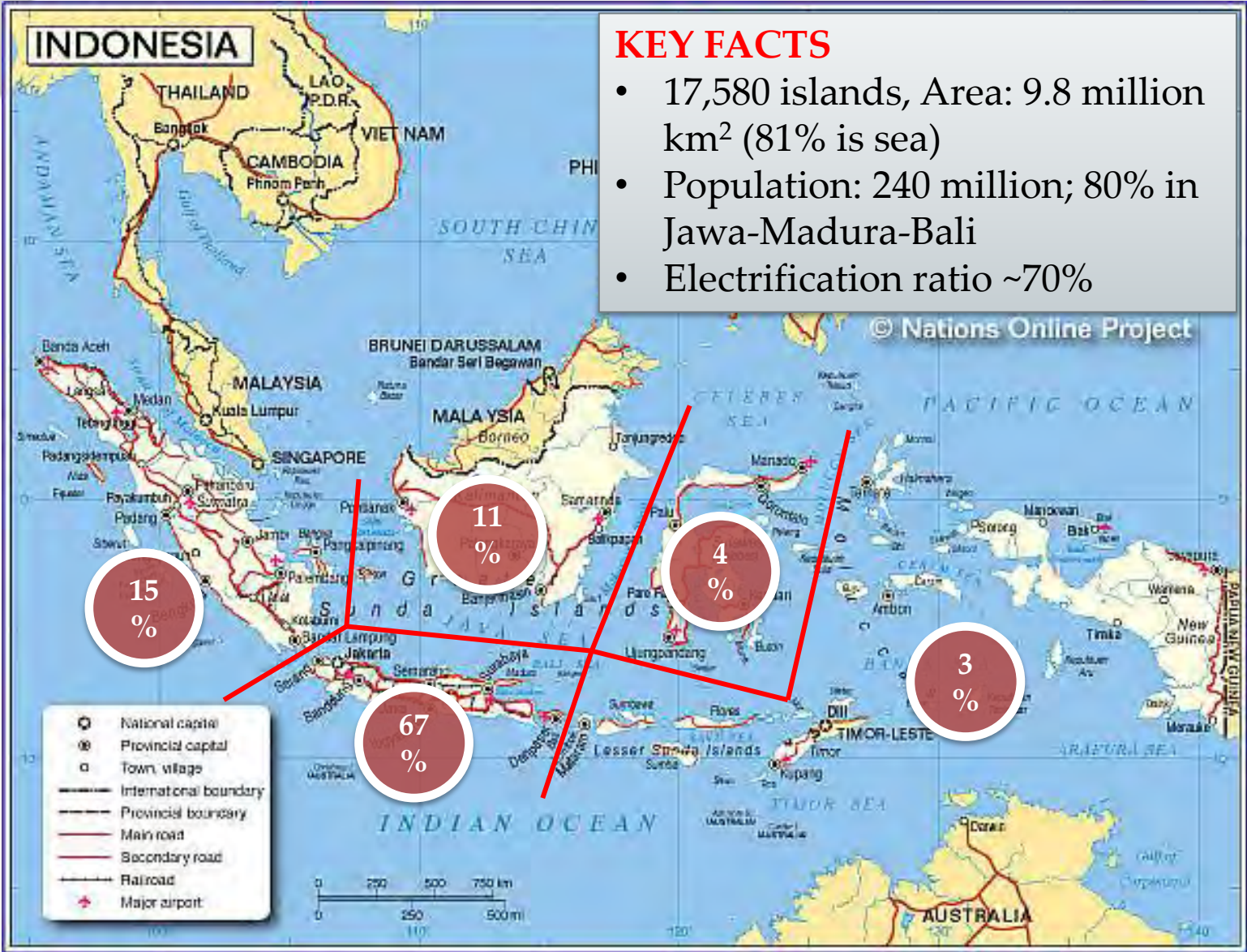
# Dynamics of Policy and Program Activity

## NPP in Indonesia



# Status of Site Preparation in Indonesia





● Distribution of Energy Consumption

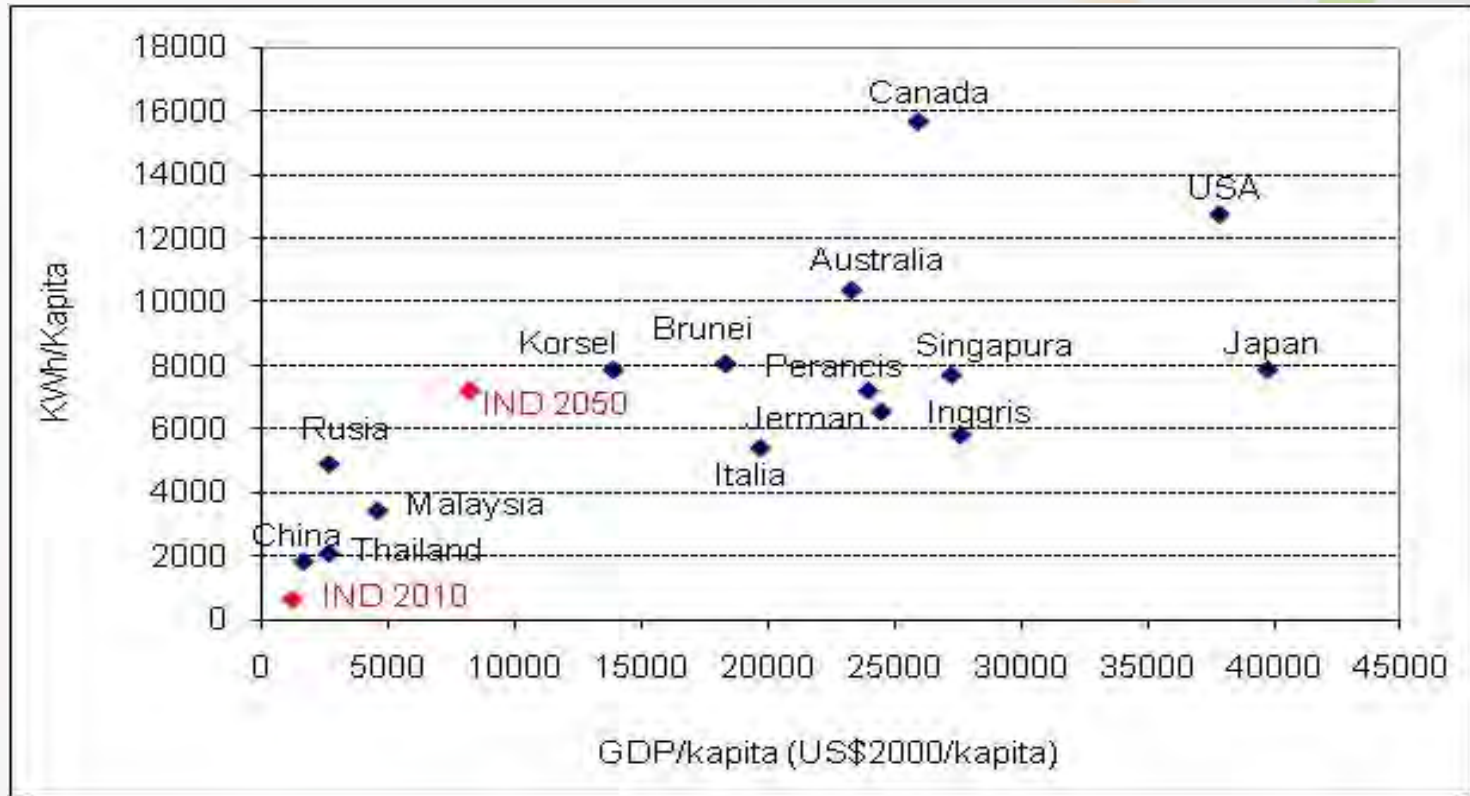
# Energy Problem in Indonesia

1. Decreasing of National Oil production and become net importer, the other hand oils still has significant role to fulfill energy (transportation, household, electricity) so oil demand tend to increase. The price tend to increase
2. Fossil fuel (gas and coal) export volume still significant compare to the production and reserve volume
3. Energy subsidy still high
4. Less of energy infrastructure development
5. Energy consumption per capita relatively low compare some ASEAN countries.
6. Fossil energy reserve, especially oil and gas, tend to depletion
7. Implementation of Presidential Regulation No. 5 of 2006 on National Energy Policy was not yet effective

# Electricity Problem/Situation

- Currently, total of electricity generation capacity in Indonesia only 38 GWe (Utility Co) + 4GWe (IPP) and it give the electricity for 70% Indonesia population.
- Development of Electricity Infrastructure is very low, in the period 10 years electricity capacity just increase 14 GWe.
- Energy consumption per capita growth in the last 10 years still low. Currently, energy consumption is 600 kWh/capita.
- Oil still used for electricity generation, especially for remote area
- Many regions in Indonesia do not have sufficient supply of electricity, especially in remote areas and small islands

# TARGET OF ELECTRICITY CONSUMPTION PER CAPITA YEAR 2050

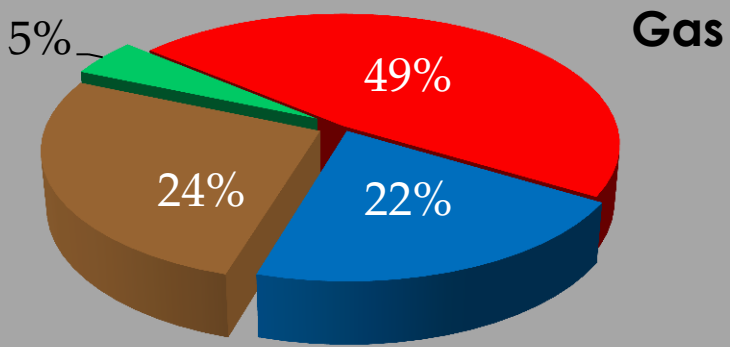


Target of Indonesia's electricity consumption per capita year 2050 will be equivalent to developed countries (2007)



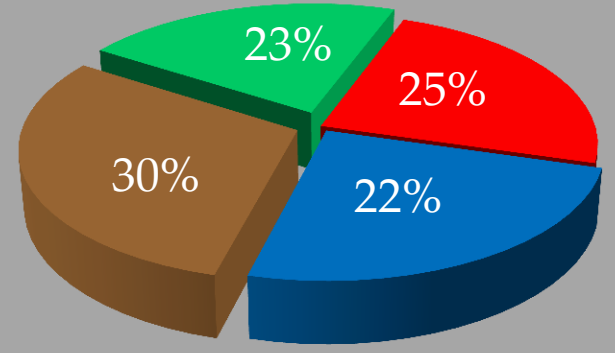
# NATIONAL ENERGY POLICY By NATIONAL ENERGY COUNCIL

2010

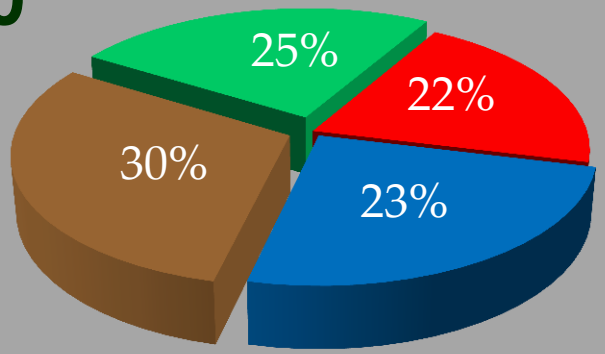


Oil ●  
Coal ●  
New & Renewable ●

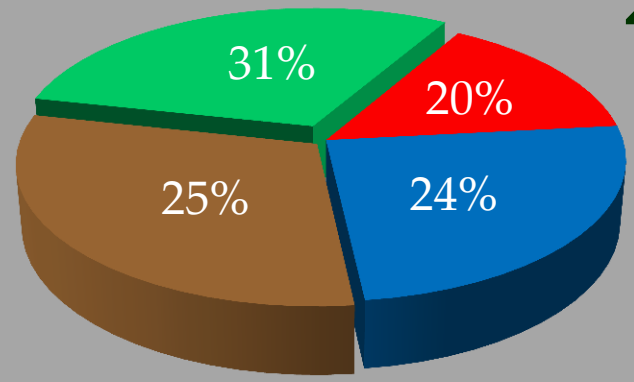
2025



2030



2050



# ELECTRICITY DEMAND PROJECTION

DESCRIPTION	UNIT	YEAR						
		2010	2015	2020	2025	2030	2040	2050
<b>ELECTRICITY CONSUMPTION</b>								
High Scenario	TWh	148	245	397	628	933	1680	2710
Low Scenario	TWh	148	208	341	511	733	1330	2100
Per capita (high scenario)	kWh	620	980	1521	2316	3332	5619	8827
Per capita (low scenario)	kWh	620	832	1308	1886	2618	4448	6840
Growth (low scenario)	%	7	7.1	10.4	8.4	7.5	6.1	4.7
Elasticity		1.06	0.89	1.30	1.05	1.00	0.9	0.7
<b>GENERATION CAPACITY</b>								
High Scenario	GW	35	58	92	145	203	340	550
Low Scenario	GW	35	49	79	115	159	270	430
<b>AVERAGE UTILISATION</b>								
High Scenario	Hours	4722	4731	4791	4805	5065	5435	5420
Low Scenario	Hours	4722	4754	4834	4977	5157	5468	5470

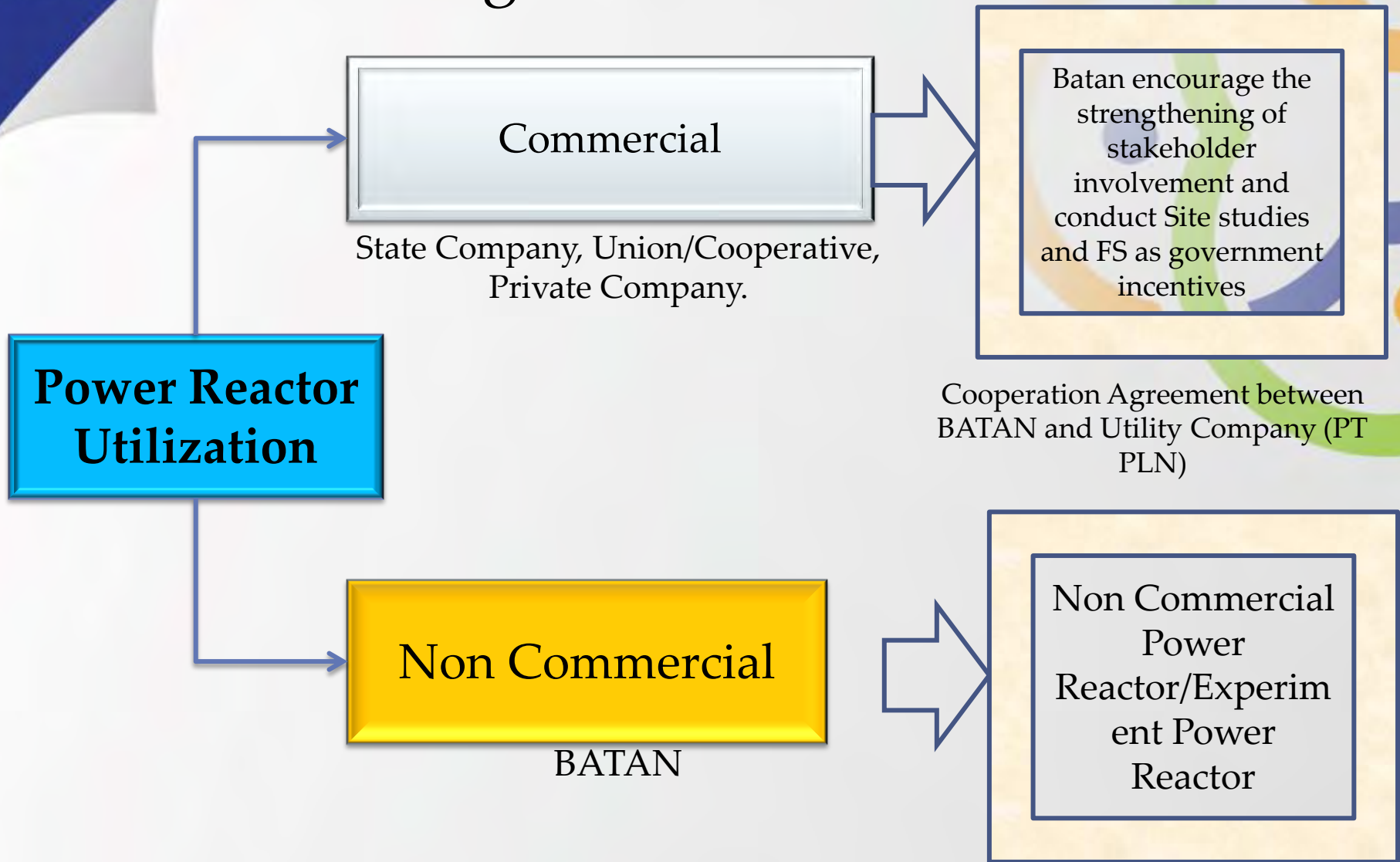
# ROLE OF NUCLEAR ENERGY IN NATIONAL ACTION PLAN FOR REDUCING GREEN HOUSE GAS

- President Susilo Bambang Yudhoyono (SBY) on September 20, 2011, has signed a Presidential Regulation Number 61 of 2011 on National Action Plan for Greenhouse Gas Emission Reduction
- This regulation is a follow-up to the agreement on the Bali Action Plan on the 13<sup>th</sup> Conference of Parties United Nations Climate Change Convention (COP UNFCCC) at Bali, December 2007, and it to meet the Indonesian government's commitment to voluntarily reduce GHG emissions 26% by its own efforts or achieve 41% with international assistance in 2020

# Challenges in the nuclear power programme development

- Indonesia is a big country and an archipelago consist of more than 17,000 islands. The condition of the electrical grid and its capacity is not the same for the entire island. Only the Java island , which has had a good power grid infrastructure with a large enough capacity.
- Indonesia has the economic equality programs in all parts of Indonesia, through the Master Plan for the Acceleration of Indonesian Economic Growth (MP3EI), which will require the development of energy infrastructure in large numbers for the entire island .
- The development of the first nuclear power plant in a large capacity ( $\geq 1000$  MWe) have a high financial risk
- Public acceptance is a key factor for NPP Development. Based on the polling/survey of public acceptance results, it still shows the weakness of public acceptance, although lately this has increased.
  - 2010 : 59,7 % agree
  - 2011 : 49,5 % agree (decreasing because of Fukushima NPP Accident)
  - 2012 : 52,8 % agree
  - 2013 : 60,4% agree

# Gov. Regulation No.43 Year 2006



# NPP for National Energy Security

## VISION:

Indonesia will survive in the long-term energy supply, improve the public welfare without reducing the quality of the environment and affordable electricity prices



## MISSION:

- **NUCLEAR ENERGY** WILL PLAY AN IMPORTANT ROLE IN THE NATIONAL ENERGY MIX IN THE FUTURE



## STRATEGY:

- Nuclear Energy Must be Competitive
- Nuclear energy must be safe and secure
- There is no problem with the NPT and in line with current global politic stream
- Can optimally utilize national resources
- Must be in accordance with the Indonesia geography condition
- Nuclear energy should be developed to increase the participation of national industry
- Environmental friendly
- The reactor would be applied not only for electricity production but can utilize heat production (cogeneration) or Multipurpose

- Non commercial PR should be **CUTTING-EDGE TECHNOLOGY**; for future National NPP Deployment
- Commercial NPP will be Proven Technology

# WHY EXPERIMENTAL (NON-COMMERCIAL) POWER REACTOR?

- The development of a **national nuclear power plants** with the aim to improve the Nation's ability to provide electricity, particularly with the nuclear option
- To improve the public perception of nuclear power plants with the aim of strengthening the Public Acceptance and Stakeholder Participation
- Based on the regulations, BATAN can do the construction and operation of non-commercial/experiments / research power reactors, with funding come from the government with a relatively small budget
- The development of non-commercial reactors will be a basis for the development of nuclear power plants in Indonesia, that are should be competitive compared to non-nuclear energy

# The Objectives of Experimental Power Reactor Development

- To demonstrate the operation of the reactor that can generate electricity, operate safely, and the development of cogeneration
- To improve the ability to master technology of nuclear power plants for deployment of commercial NPP in the future
- Development of R&D for Power Reactor and its supporting



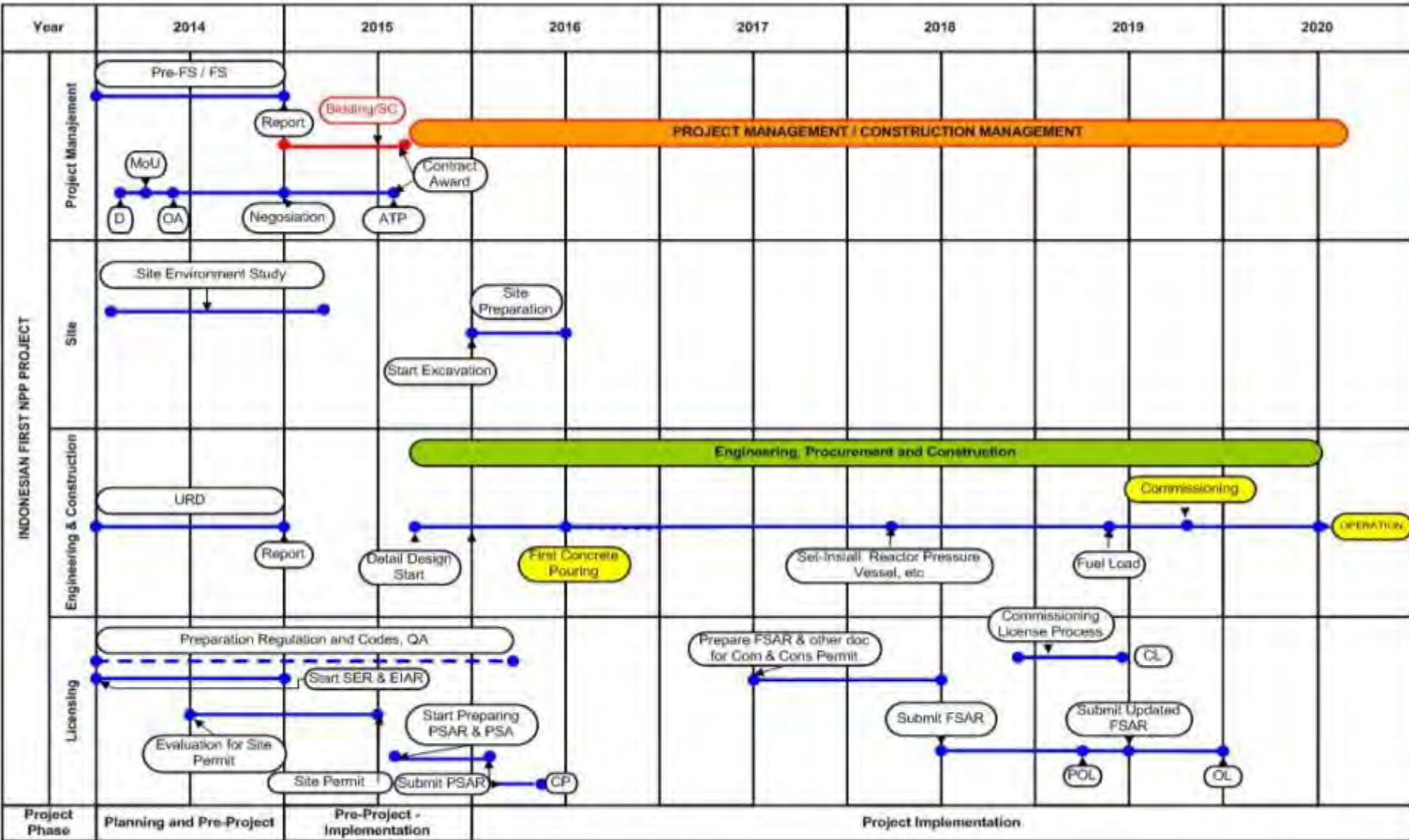
# BENEFIT OF EPR

- Capacity building of NPP Human Resources
- Practical training for NPP project management
- Increasing of Public Acceptance for NPP
- Potential use of Uranium and Thorium Resources in Indonesia
- To meet the needs of the of electricity majority for Sains and Technological Estate (Puspipstek) purposes and part of communities around.
- Development of integrated new and renewable energy research by utilizing thermal produced by reactor for research development such as desalination processes, coal liquefaction, coal gasification, hydrogen gas production, urea production, etc.
- The growth of national self-reliance in the field of energy
- Further strengthen nuclear safety (safety performance)

# Consideration for Technology Choice

- Flexibility in the use of heat for NRE Research
- Flexibility in fuel utilization (U, Th)
- Inherent safety is very high: “Melting core accident free reactor”
- EPC prices are still within the range of budget provided by the government
- Gen IV Technology

# PRELIMINARY ROAD MAP OF EPR DEVELOPMENT



**Legend:**  
 FS: Feasibility Study, D: Decision, OA: Organization/Applicant Establishment, MoU: Memo of Understanding, SC: Select Consultant-Management Project, CP: Construction Permit (needs 24 months), POL: Provisional Operation Licensing, OL: Operation Licensing, CL: Commissioning Licensing, ATP: Authorization To Proceed, URD: User Requirement Documents, FC: First Concrete.

# SITE EVALUATION

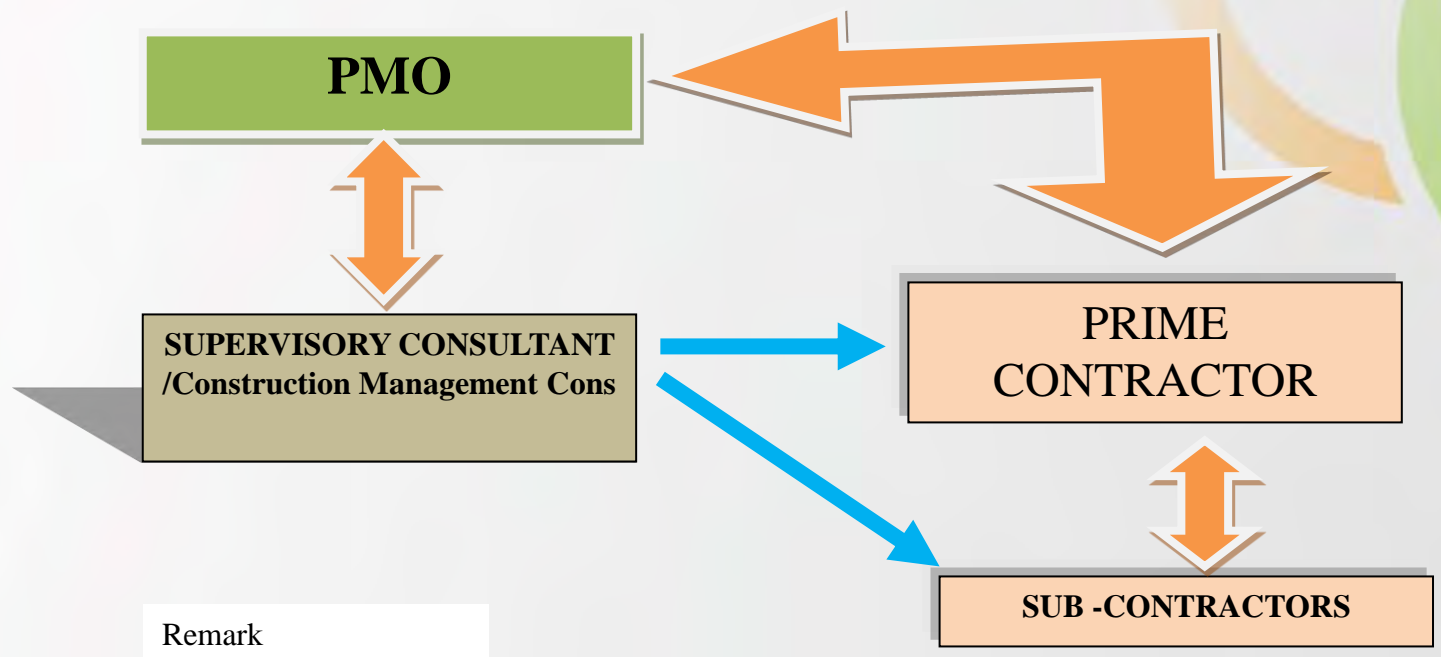


Preliminary Ranking : 1) Helipad; 2) Province Forest; 3) Water Treatment Installation; 4) Techno Business Incubator (TBI)

No 3 Was Chosen

TBI- Technology and Business Incubator

# ORGANIZATION

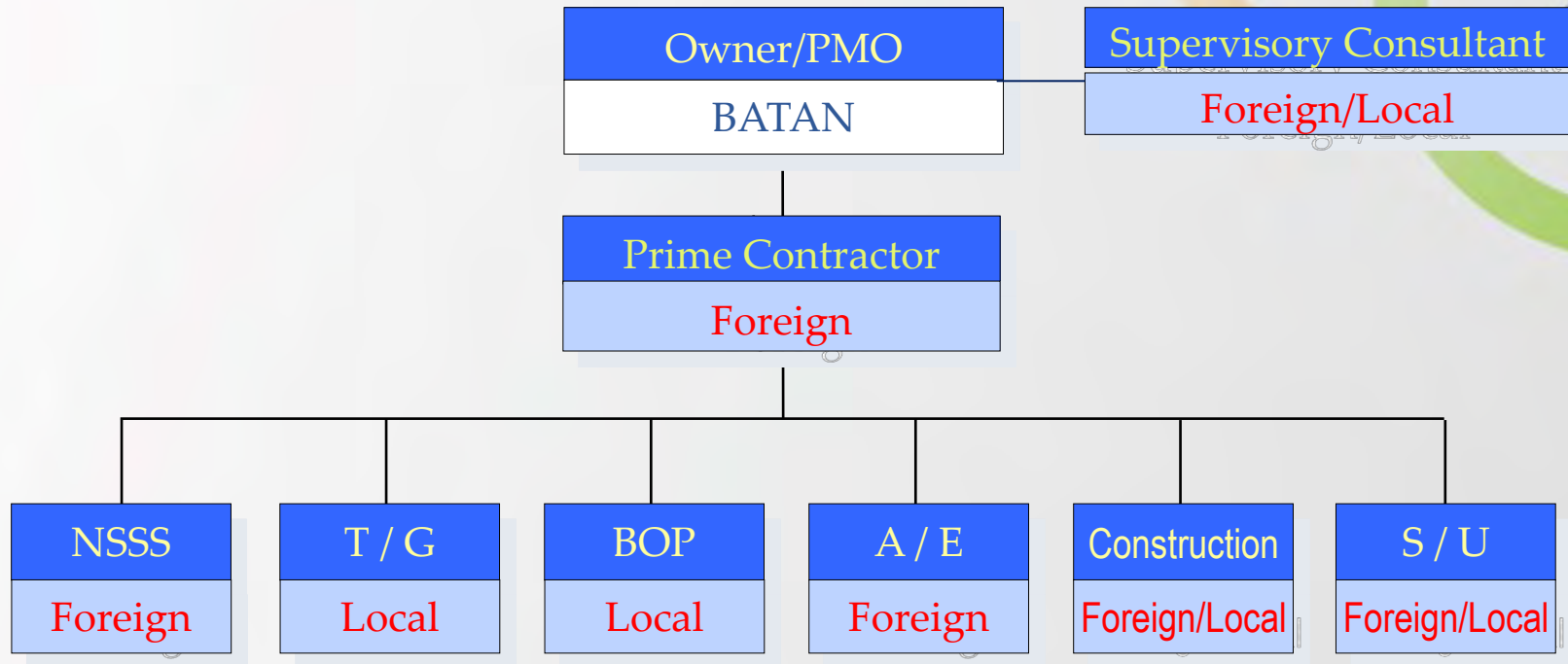


Remark

Contract

PENGENDALIAN DAN PENGAWASAN

# Project Structure on Turnkey Approach



**\* Implemented by Foreign Prime Contractor**

# Made in Indonesia

Deliver for  
Olkiluoto 3  
(1600 Mwe)

**Condenser**



**Stationary Blade Rings**



**LP Outer Casings**



**Tube's end weld**



**LP Inner Casings**



**Generator Casing**



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# PREPARATORY WORK

- Establishment Pre-Project Team
- Coordination meeting with relevant stakeholder:  
Financing and National Program
- **Preparation the EPR Blueprint**
- **Preparation URD**
- Communication with potential vendor
- Preparation for Site and environmental evaluation
- Communication with Regulatory Body for set up  
Licensing Plan



# THANK YOU