



The Role of Nuclear Energy in the Optimum Energy Mix

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The Republic of Indonesia

1. The country is lead by the President,
2. Population is around 230 Millions,
3. The country has more than 3000 islands,
4. Indonesia is an agriculture country.



Archipelago of Indonesia





Three nuclear reserach reactor In Indonesia

- 1. Triga 2000, Bandung, first operated in 1965,**
- 2. Kartini Reactor, 250 kW, in Yogyakarta,
Central of Java,**
- 3. Reaktor GA Siwabessy, 30 MW, Serpong,
Banten, Java.**



1. Global Energy Situation



❖ We are facing serious challenges in energy sector :

- The global economy is set to grow four-fold between now and 2050 and growth could approach ten-fold in developing countries like China and India.
- Involves much more energy.
- Unsustainable pressure on natural resources and on the environment is inevitable if energy demand is not decoupled from economic growth and fossil fuel demand reduced.



❖ The situation is getting worse

- Since the 2006, global CO₂ emissions and oil demand have increased steadily (BaU : 70% increase in oil demand by 2050 and a 130% rise in CO₂ emissions).
- According to IPCC, a rise in CO₂ emissions of such magnitude could raise global average temperatures by 6⁰C (eventual stabilisation level), perhaps more.

❖ A Global revolution is needed in ways that energy is supplied and used :

For greater energy efficiency is a care requirement.

Renewables, **nuclear power**, and CO₂ capture and storage (CCS) must be developed on a massive scale, and carbon-free transport developed.



❖ Climate Change and Energy Security

In the energy sector, climate change mitigation and energy security go hand in hand. Investment in clean energy technologies will ensure better energy security while at the same time mitigating climate change. **And nuclear power has a key to play in this regard.**

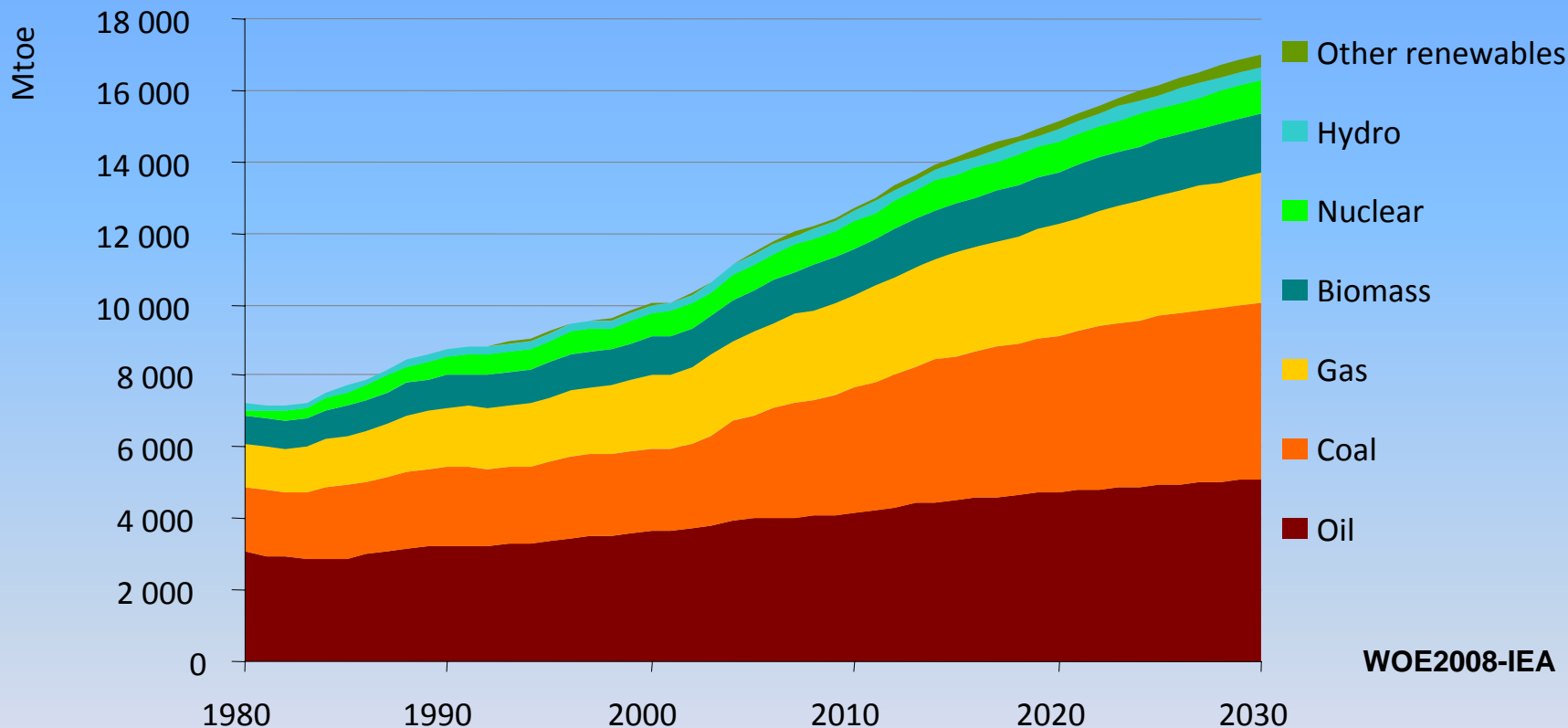
World Energy Outlook, 2008 :

- World primary energy demand will grow by 45% from 2006 to 2030.
- Annual energy growth rate of 1.6%.
- 60% of CO₂ emissions, this energy demand growth will obviously have huge implications for climate change.

In light of the CO₂ challenges:

WEO-2008 set two alternative energy policy scenarios to take the world to a lower emissions future : 550 ppm, and 450 ppm in the atmosphere

World Primary Energy Demand (Reference Scenario)



World energy demand expands by 45% between now and 2030 – an average rate of increase of 1.6% per year – with coal accounting for more than a third of the overall rise

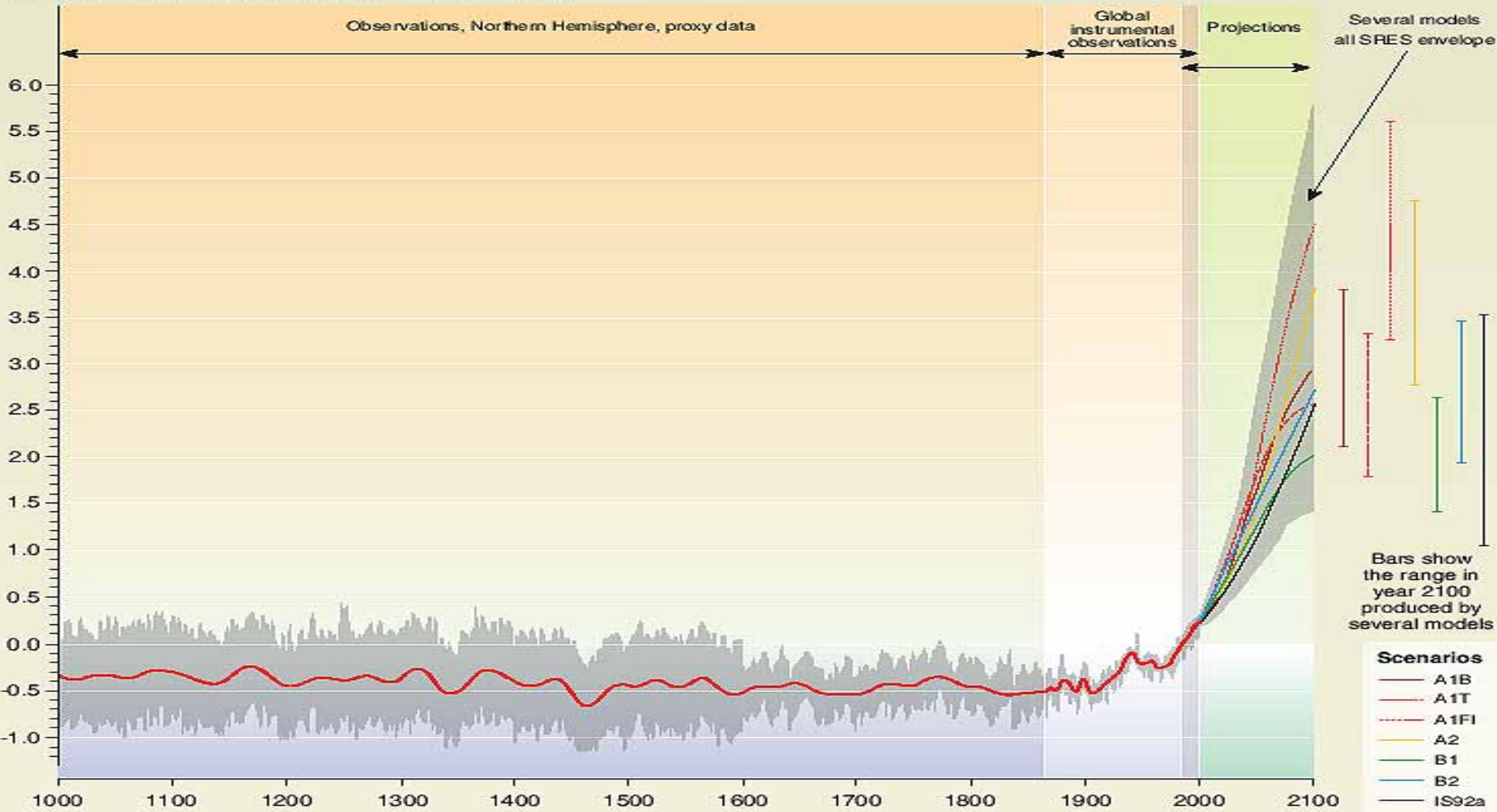
Unsustainable — socially, environmentally & economically



Climate Change

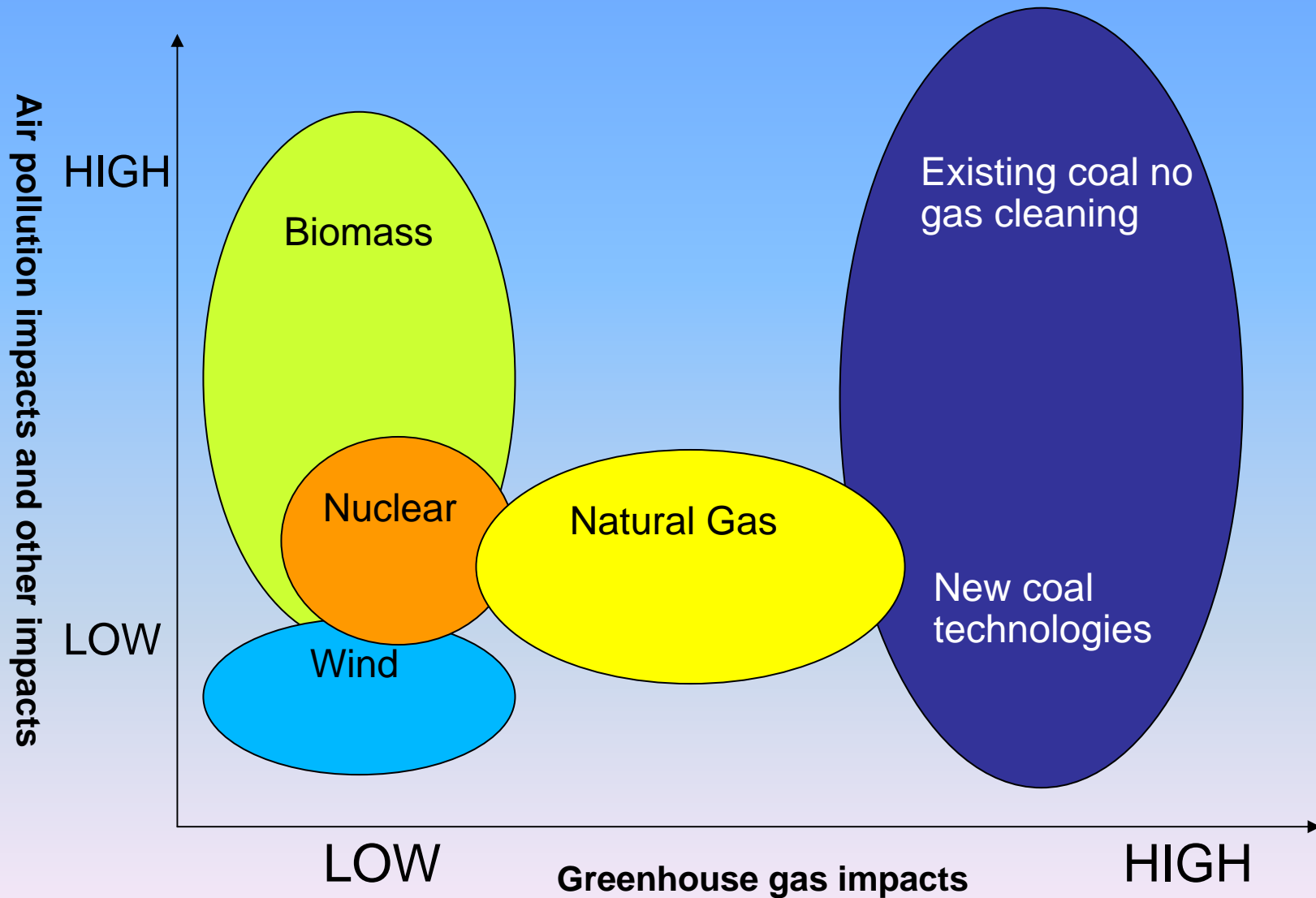
Variations of the Earth's surface temperature: years 1000 to 2100

Departures in temperature in °C (from the 1990 value)



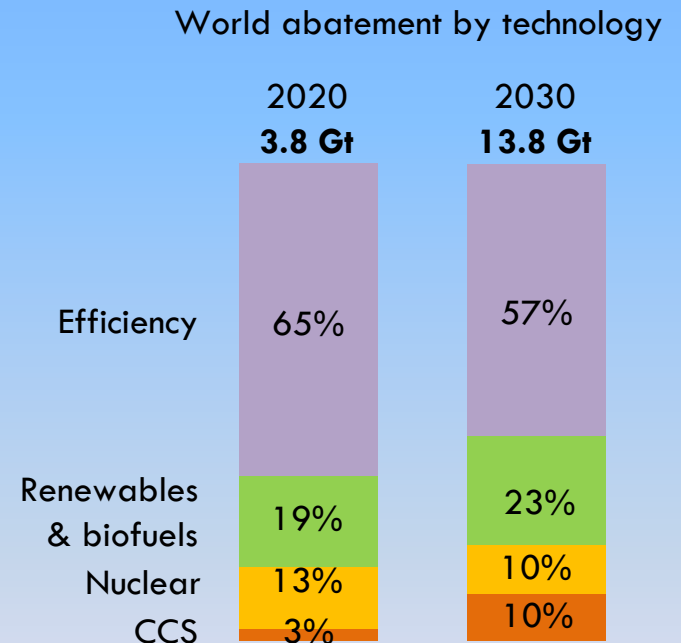
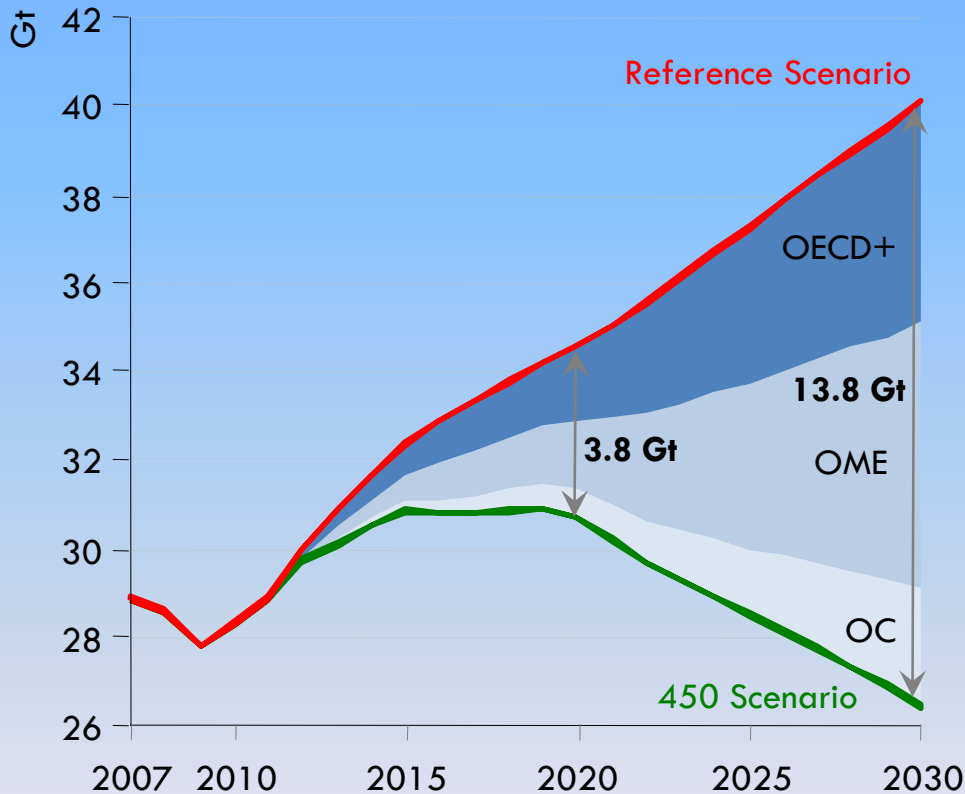


Relative environmental impacts from emission of different electricity generating technologies (European Commission 2003)





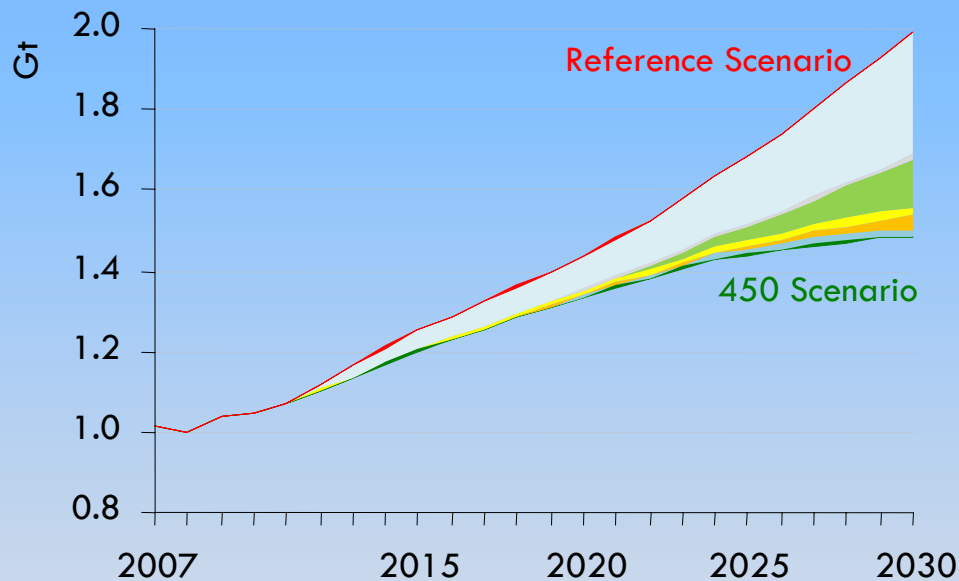
World abatement of energy-related CO₂ emissions in the 450 Scenario



• An additional \$10.5 trillion of investment is needed in total in the 450 Scenario, with measures to boost energy efficiency accounting for most of the abatement through to 2030



ASEAN energy-related CO₂ emissions by scenario



	Abatement in 450 vs Reference Scenario (Mt CO ₂)	
	2020	2030
Efficiency	84	319
End-use	82	308
Power plants	1	11
Renewables	2	121
Biofuels	9	20
Nuclear	3	33
CCS	1	18
TOTAL	100	501

Cumulative additional investment in 450 vs Reference Scenario	2010-2020	2021-2030
	\$82bn	\$306bn

- ASEAN CO₂ emissions in 2030 are 25% lower in the 450 Scenario compared with the Reference Scenario, thanks mainly to efficiency gains, but they still rise appreciably



2 . Introduction of Nuclear Power

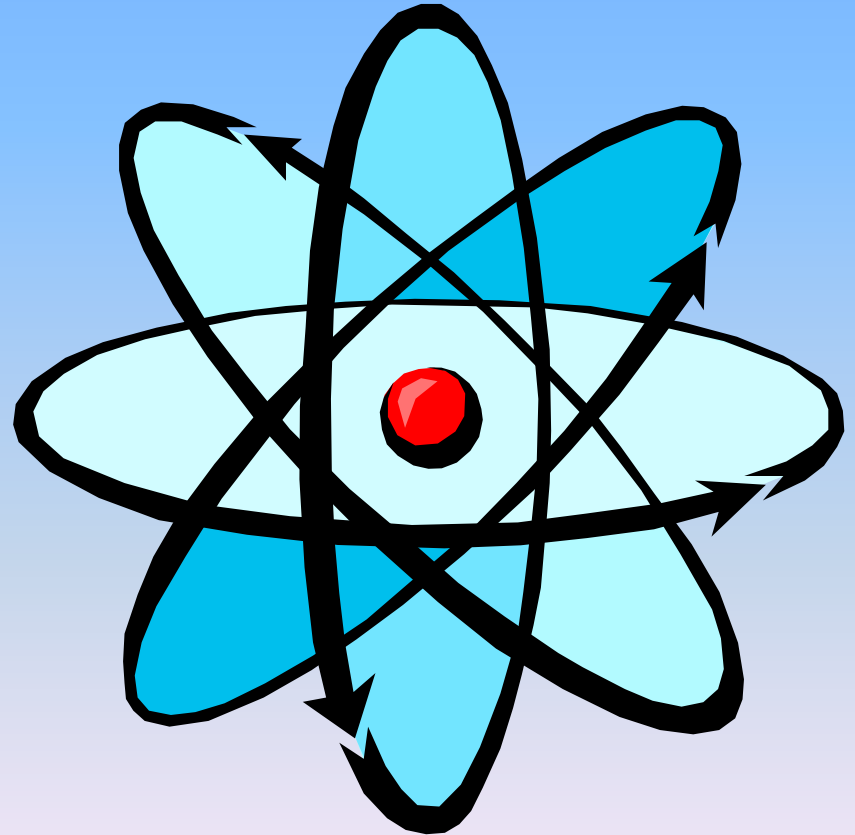


- Indonesia has for a long period planned for the introduction of nuclear power.
- Act No 10 of 1997 on Nuclear Energy. This is the primary legislation in Indonesia
- Act No. 17 of 2007 on Long-Term National Development Plan of Indonesia for 2005 to 2025. This is the basis act of establishing long term commitment for the use of nuclear energy to meet national energy demand.
- Presidential Regulation No 5 of 2006 on National Energy Policy



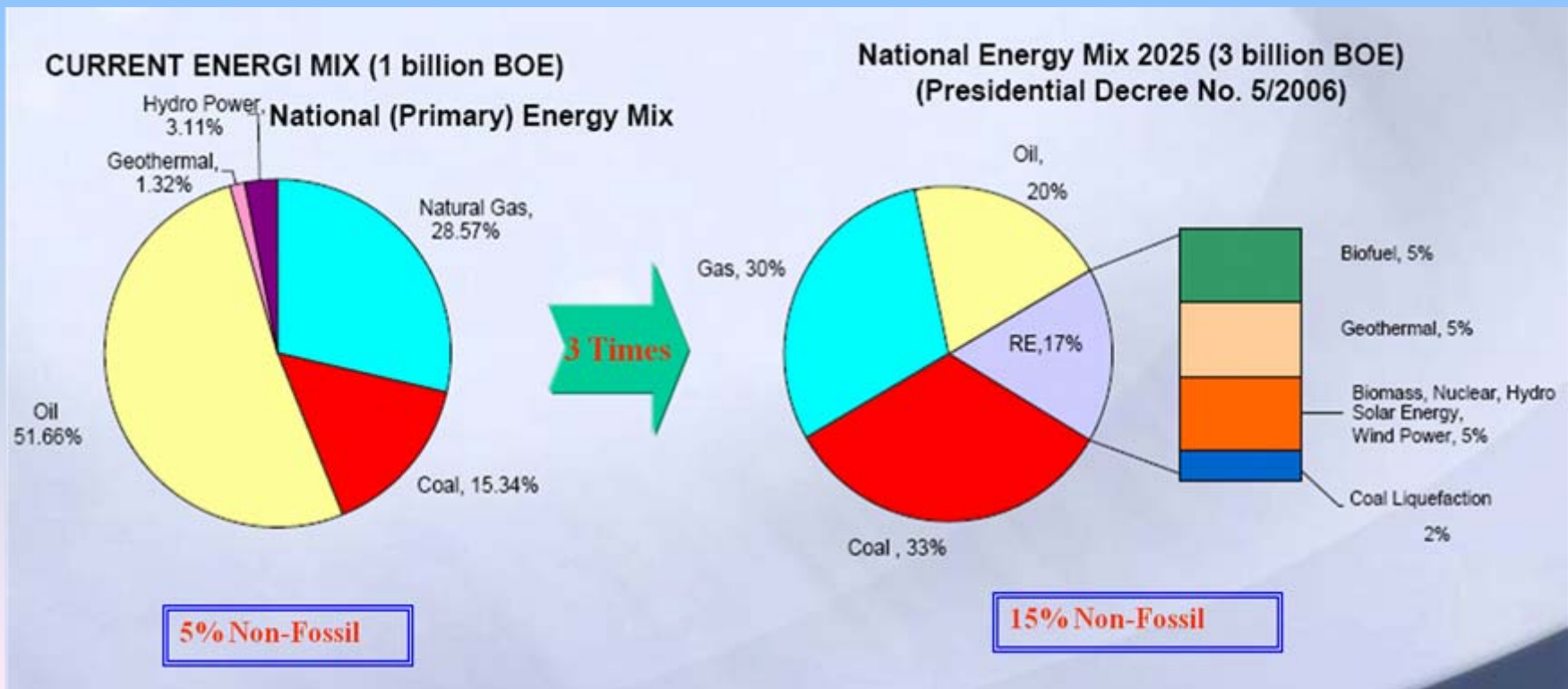
FOUNDATION PHYLOSOPHY

- **APPLICATION AND DEVELOPMENT IN NUCLEAR SCIENCE & TECHNOLOGY IS FOR PEACEFUL USES ONLY**
- **SAFETY & SECURITY IS THE PRIME CONSIDERATION**
- **DEMAND DRIVEN AND STAKEHOLDER SATISFACTION**



National Energy Policy

- The government of Indonesia intends to apply an optimum energy mix comprising all viable prospective energy sources
- The Presidential Regulation No.5 year 2006 indicates the target of energy mix until 2025 including nuclear energy





THE NECESSITY OF NUCLEAR ENERGY

Energy Security and Climate Change Mitigation

Energy Diversification

- Diversity primary energy use for power generation and reduce fossil fuel dependency (esp. Oil)

Energy Conservation

- Energy efficiency to reduce total domestic energy and electricity demand and increase added value

Environmental Protection

- Reduce SO_x, NO_x and Green-House-Gases emission to support sustainable development and minimize externalities



❑ Electricity Production Cost

- Economically competitive and stabilize electricity tariff.

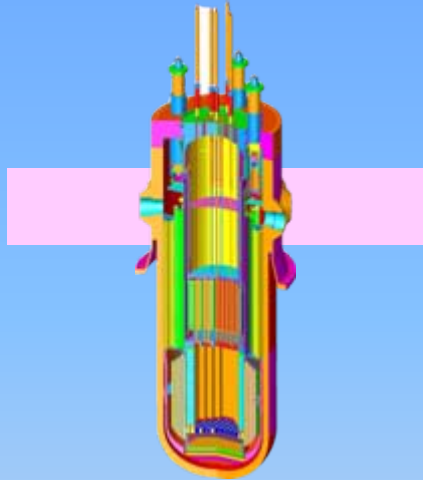
❑ Acquiring of High-Tech Power Generation

- High Technology utilization will increase national industrial capacity

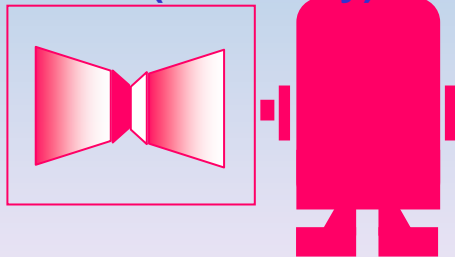
Note : *Optimum Energy Mix with non-discriminative and non-depletion to realize security of energy supply and to mitigate climate change in order to support national sustainable development*



GCR/HTR



Turbin/power generation
(electricity)

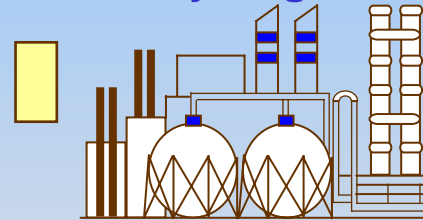


Enhanced Oil Recovery

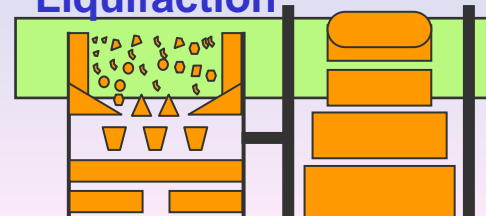


Desalination

Hydrogen

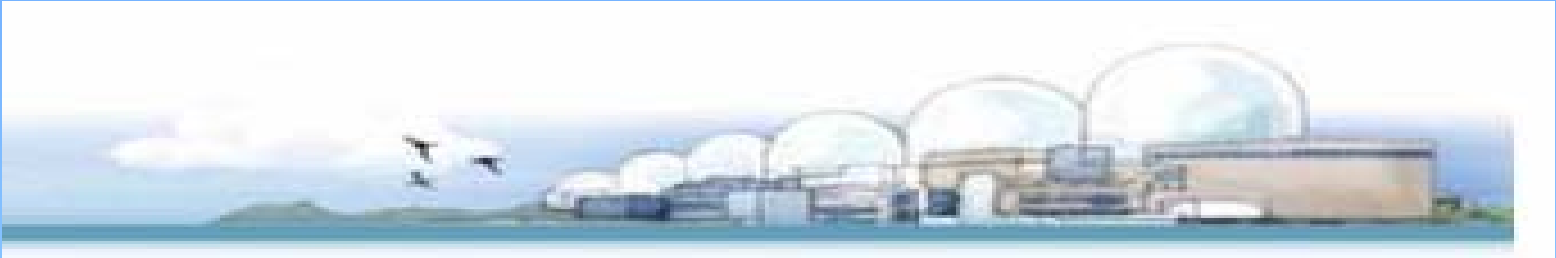


Coal Gasification & Liquifaction





3. Indonesia has long been a strong advocate in promoting nuclear energy for peaceful proposes



- ❖ Indonesia is a state party to the NPT, SEANWFZ, and member of IAEA, ANSN and FNCA
- ❖ Article IV of the NPT not only recognizes, but also justifies the inalienable right of every state to develop nuclear for peaceful purposes without discrimination.
- ❖ To show its commitment to nuclear non-proliferation, Indonesia has put in place integrated safeguards system which covers both the comprehensive safeguards and the additional protocol of IAEA to its nuclear facilities



SAFEGUARDS CONCLUSIONS :

For 13 States (Australia, Croatia, Ghana, the Holy See, Hungary, **Indonesia**, Jordan, Monaco, New Zealand, Norway, Peru, Slovenia and Uzbekistan) having both Comprehensive Safeguards Agreement (CSA) and Additional Protocol (AP) in force, the IAEA concluded that all nuclear material had been placed under safeguards and remained in peaceful nuclear activities.



STATUS OF INDONESIA: INTERNATIONAL CONVENTION ON NUCLEAR ENERGY

No.	INTERNATIONAL CONVENTIONS	STATUS
1.	Non-Proliferation Treaty (NPT) - Safeguard Agreement with IAEA - Additional Protocol to Safeguards	Ratified: Act No. 8 Th. 1978 signed Signed
2.	Convention on Physical Protection of Nuclear Material and its Amendment	Ratified by Presdeg No. 49 Th. 1986
3.	Convention on Early Notification of A Nuclear Accident	Ratified by Presdeg No. 81 Th. 1993
4.	Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	Ratified by Presdeg No. 82 Th. 1993
5.	Treaty on the Southeast Asia Nuclear Weapon Free Zone	Ratified: Act No. 9 Th. 1997
6.	Convention on Nuclear Safety	Ratified by Presdeg No.106 Th. 2001
7.	Comprehensive Nuclear Test-Ban Treaty (CTBT)	Under process for ratification
8.	Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management	Signed (1997)
9.	Protocol to Amend the Vienna Convention	Signed (1997)
10.	Supplementary Compensation for Nuclear Damage	Signed (1997)
11.	Bilateral cooperation and supply agreement(s)	Signed (1997)



Major Concerns on NPP Preparation



- Public Acceptance – Socialization
 - National level
 - Local site
- Siting
 - Site and Environmental study
(safety related, non safety, and social aspects)
- Safety Concerns
 - Technology (proven technology)
 - Culture
- The choice of NPP Technology
 - Proven Technology



- Financial Scheme
- Human Resources Development for NPP
- Lesson learned from NPP Fukushima accident.



Collaboration on Physical Protection for Indonesia Research Reactors and others

- 1. IAEA and US-DOE from 2002-2006 on Physical Protection for nuclear reactor areas and maintenance of devices till 2010,**
- 2. IAEA-ANSTO Australia since 2010 on Training of Trainers for Nuclear Security,**
- 3. Center for NPP and Nuclear Security Japan, started to develop on NPT,**
- 4. Indonesia Nuclear Regulatory Body with other Foreign Nuclear Regulatory Bodies**



5. Conclusion

- Nuclear energy is available to contribute, in sustainable development manner, to meeting the energy needs of the 21st century.
- For most countries, expanding nuclear power would increase the diversity of their energy supplies and thus their energy supply security as well as climate change mitigation
- The introduction of NPP is not only to reach an optimal energy mix based on costs and environmental protection, but also to relieve the pressure arising from increasing demand for oil and gas as well as to support sustainable development.



- The role of NPP to suffice conservation, intensification, diversification and sustainable of energy supply will be symbiotic and synergetic to fossil and new as well as renewable energy supply.
- Nuclear power can be utilized for electricity production and non electricity application (such as ; Desalination, EOR, Hydrogen production, Coal gasification and liquifaction etc).



THANK YOU

