



Indonesia Nuclear Power Program

By **Bob S. Effendi** | Founder of Xpert Synergy Solution

Presented at

Australian Nuclear Association 2025

Conference, Sydney - Australia



XpertSynergy



- **About the Speaker**

Bob S. Effendi (61) is the Founder of **PT Xpert Synergy Solution**, a consultancy focused on promoting nuclear and clean energy adoption in Indonesia. With more than 30 years of leadership experience in the energy industry — covering oil & gas to nuclear — and ten years as Chief Operating Officer of PT Thorcon Power Indonesia, he has played a key role in developing Indonesia's nuclear energy policy. Bob is also well-known for his active involvement in policy advocacy, strategic advising, and engaging stakeholders across government, academia, and industry. He was recently honored with the **Indonesia Nuclear Society 2025 award** for his commitment to the nuclear sector and the advancement of nuclear technology – recognized as an **Indonesia Nuclear Champion**.



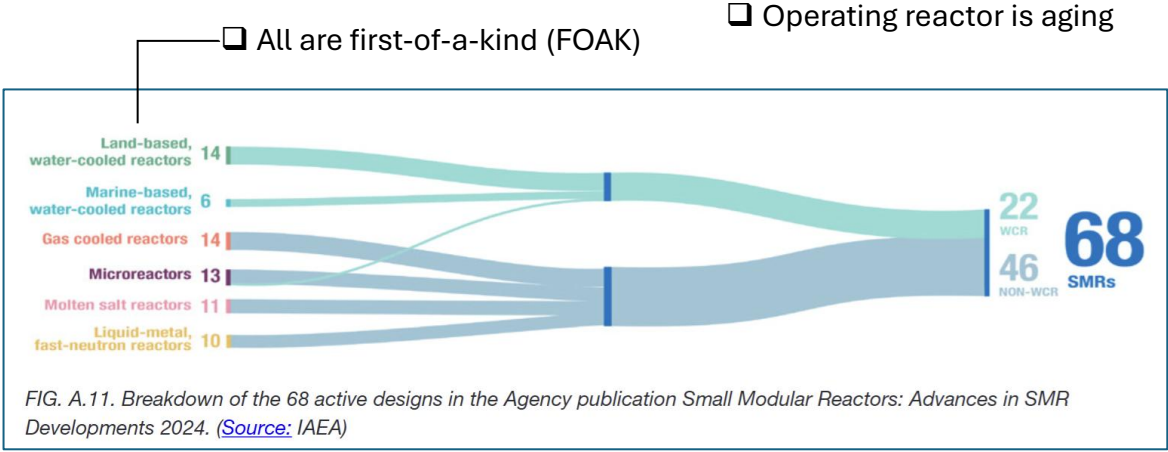
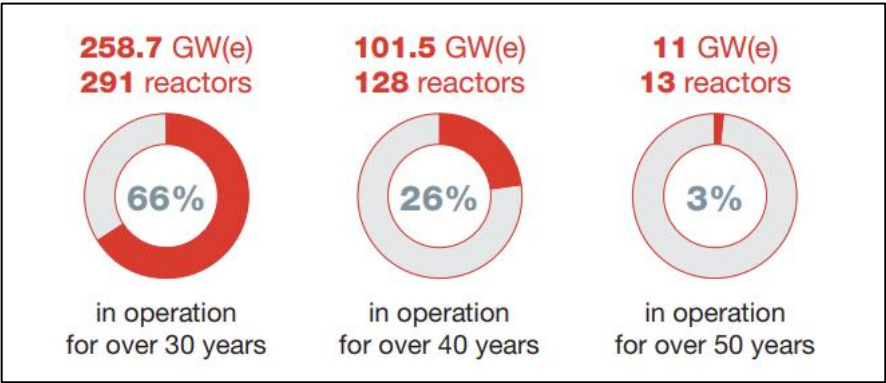
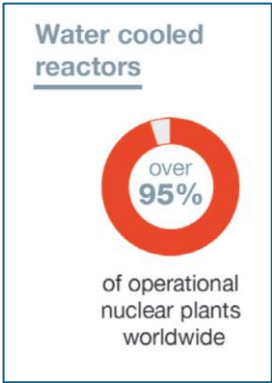
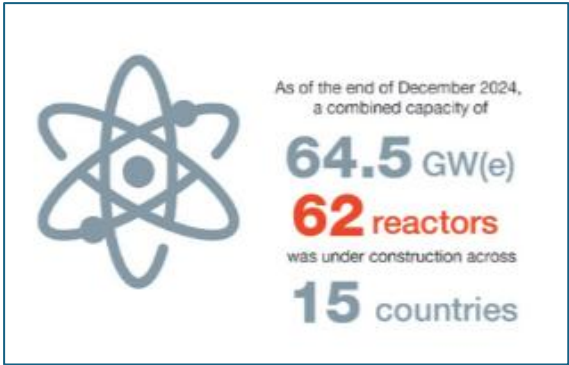
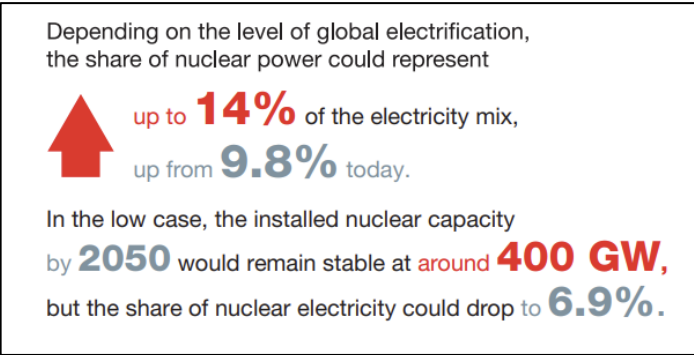
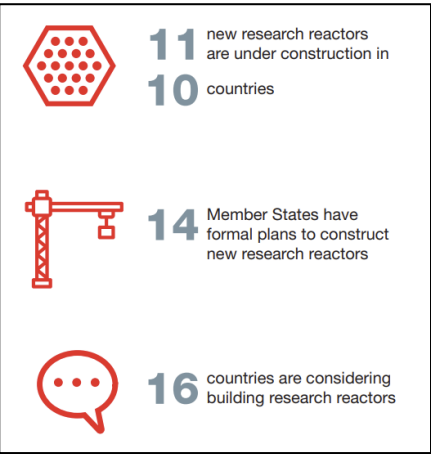
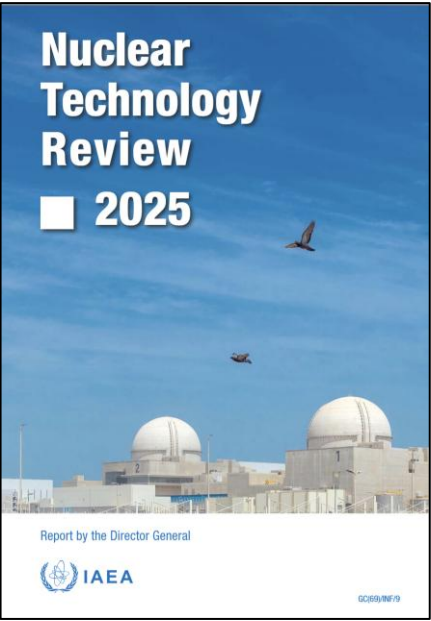


FIG. A.11. Breakdown of the 68 active designs in the Agency publication Small Modular Reactors: Advances in SMR Developments 2024. (Source: IAEA)

مضاعفة إنتاج الطاقة النووية ثلاث مرات بحلول عام 2050

الإمارات العربية المتحدة، ديسمبر 2023

TRIPLING NUCLEAR ENERGY BY 2050

United Arab Emirates, December 2023



ASEAN Power Grid Map



North Sub-system

ASEAN will be the 4th largest grid in the world by 2030 with current (2023) capacity 310,082 MW, projected to 466 GW by 2030

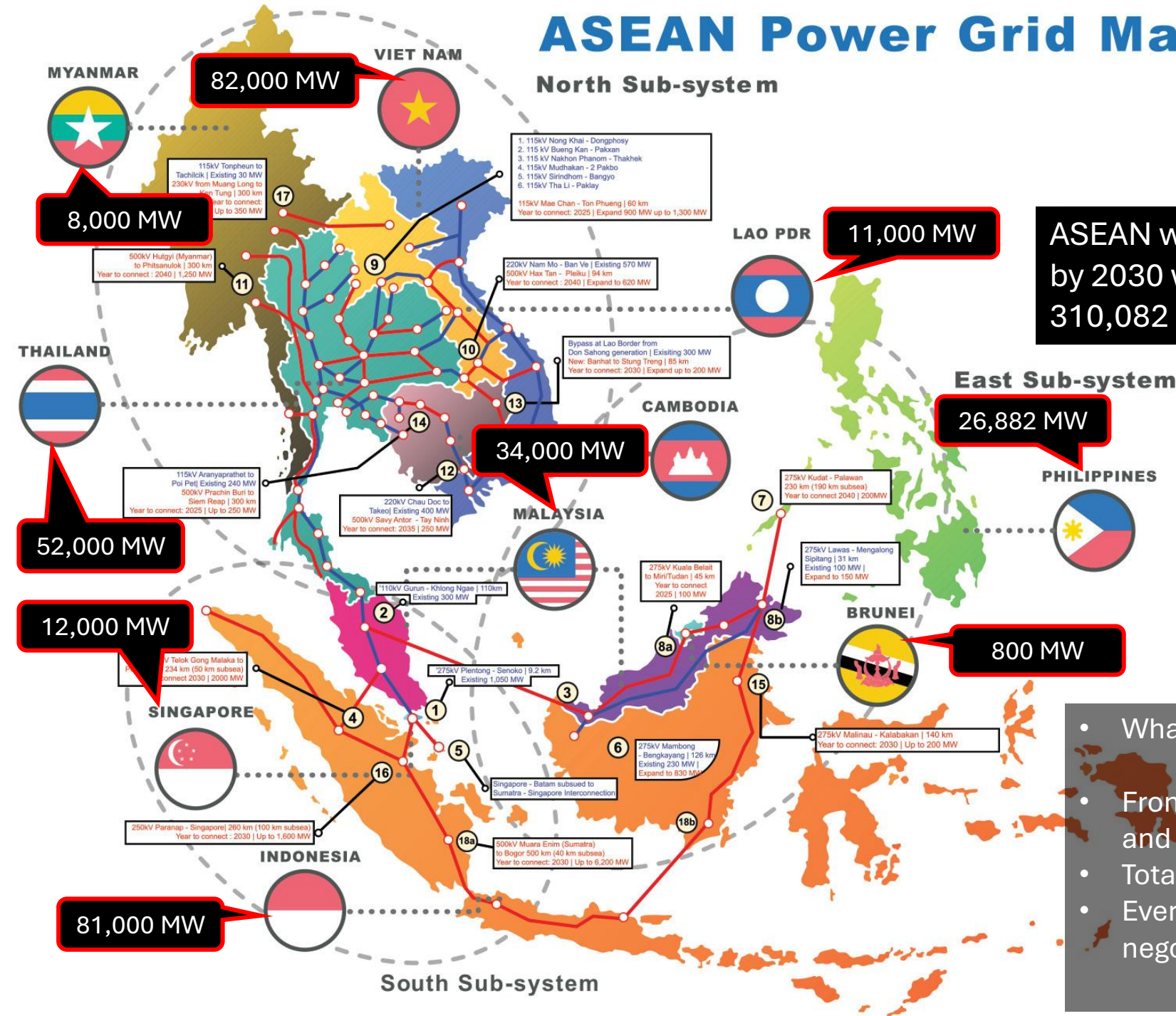
- CN 2920 GW
- EU 1059 GW
- US 1189 GW

Legend

- Existing Interconnection
- Planned Interconnection
- - - Sub-systems

• What does it mean?

- From Indonesia, IPP can export nuclear clean and reliable energy to anywhere in ASEAN
- Total nuclear capacity potentially can be triple
- Every ASEAN countries has different tariff, so can negotiate a better tariff



Indonesia long journey toward nuclear power



To be a great nation, Indonesia has to master nuclear and space technology

President Soekarno - 1952

Summary Table

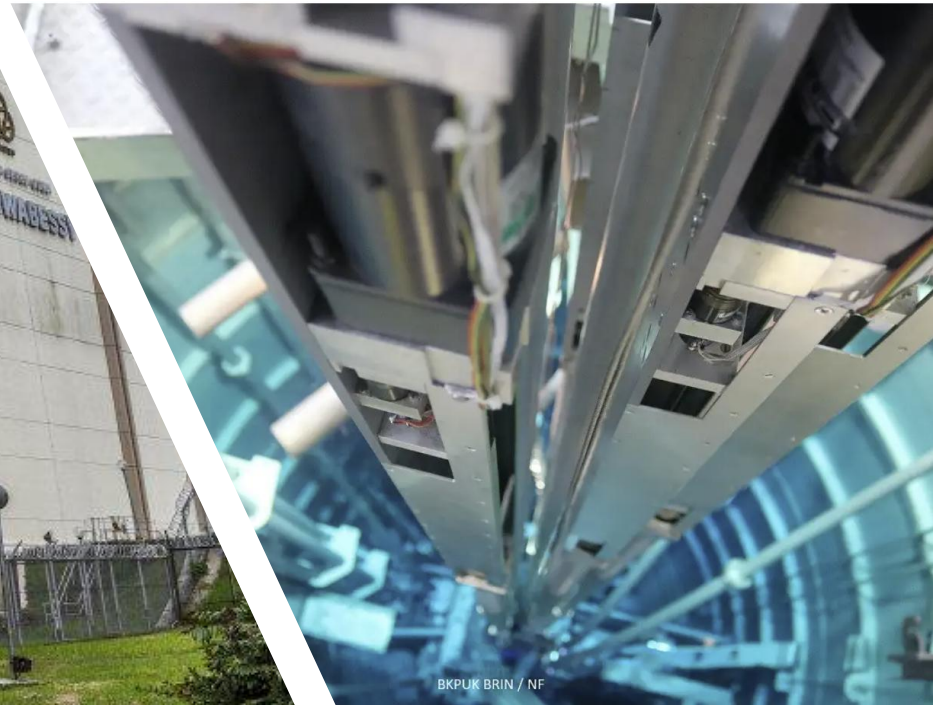
Year	Milestone	Institution / Reactor	Key Role
1958	Establishment of Dewan Tenaga Atom & Lembaga Tenaga Atom	Atomic Energy Council	Start of nuclear program
1964	Law No. 31/1964	BATAN	National nuclear R&D body
1965	Reactor TRIGA Mark II (Bandung)	250 kW → 1 MW	First reactor in Indonesia
1978	Reactor Kartini (Yogyakarta)	100 kW	Training & research reactor
1987	Reactor GA Siwabessy (Serpong)	30 MW	Multipurpose reactor & isotope production
1997	Law No. 10/1997	BAPETEN	Independent nuclear regulator
2014	Gov. Regulation No. 2/2014	BAPETEN strengthened	Updated safety oversight
2021	Presidential Regulation No. 78/2021	BRIN	BATAN merged into BRIN
2021–Now	Dual system (BRIN + BAPETEN)	Ongoing	Research & regulation separated
2025	GOI put nuclear on the mix through several regs – 1 st NPP by 2032	DEN, BRIN, MoE	

President Soekarno was planning by 1977 Indonesia already has NPP, **President Soeharto** was planning by 2016 Indonesia already has NPP but all failed **until NOW**

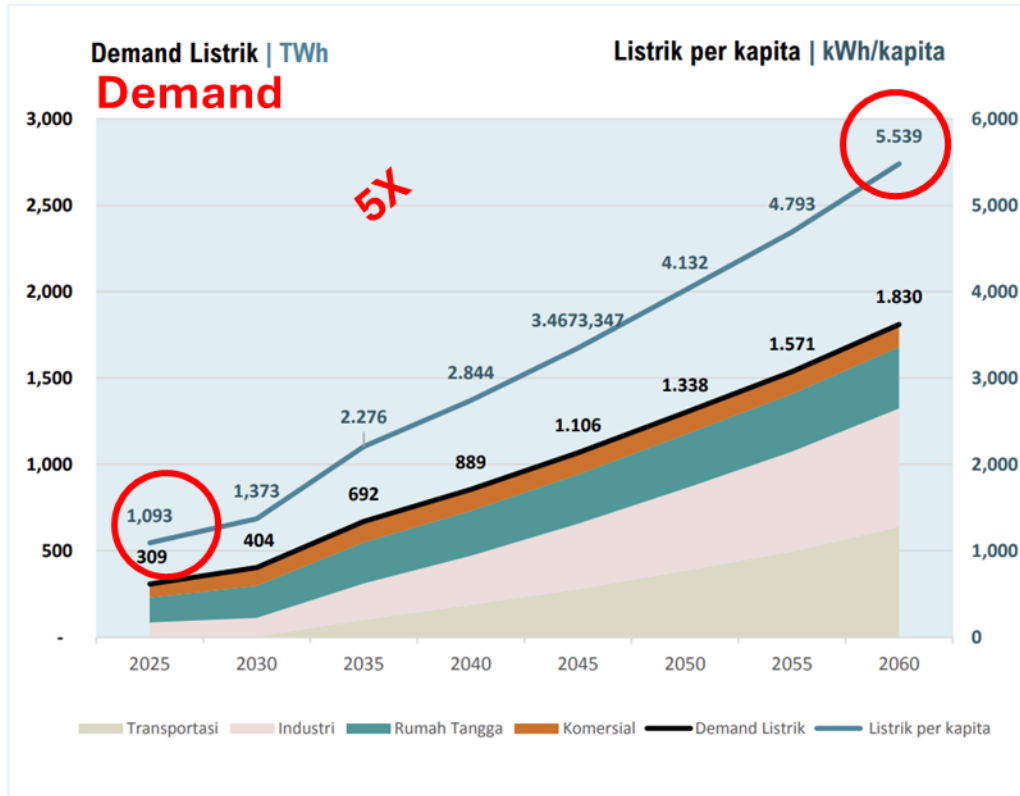
Indonesia has more than 50 years experience operating 3 research reactor

Several nuclear utilization in Indonesia

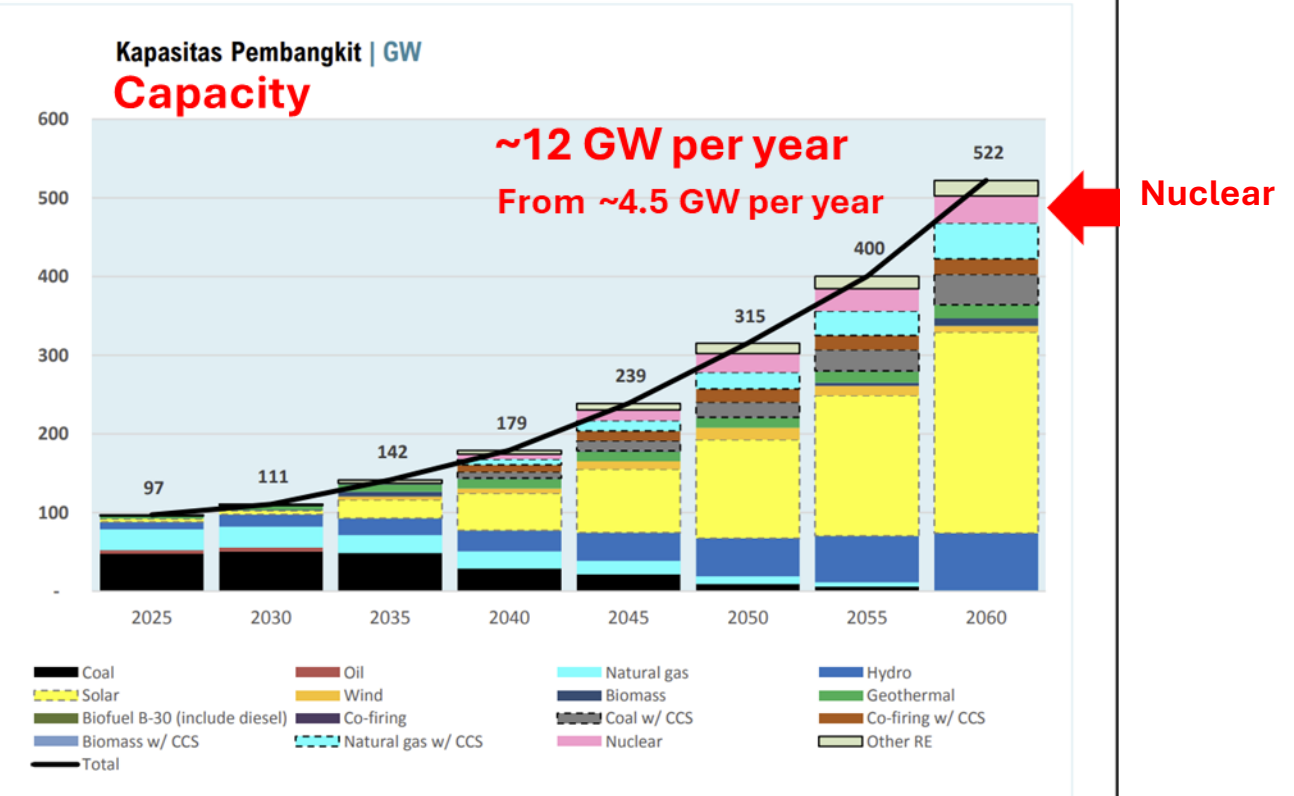
- Nuclear for electricity
- Nuclear for heat utilization
- Nuclear for ship propulsion (under discussion)



PROYEKSI *DEMAND - SUPPLY* LISTRIK (SKENARIO 1)

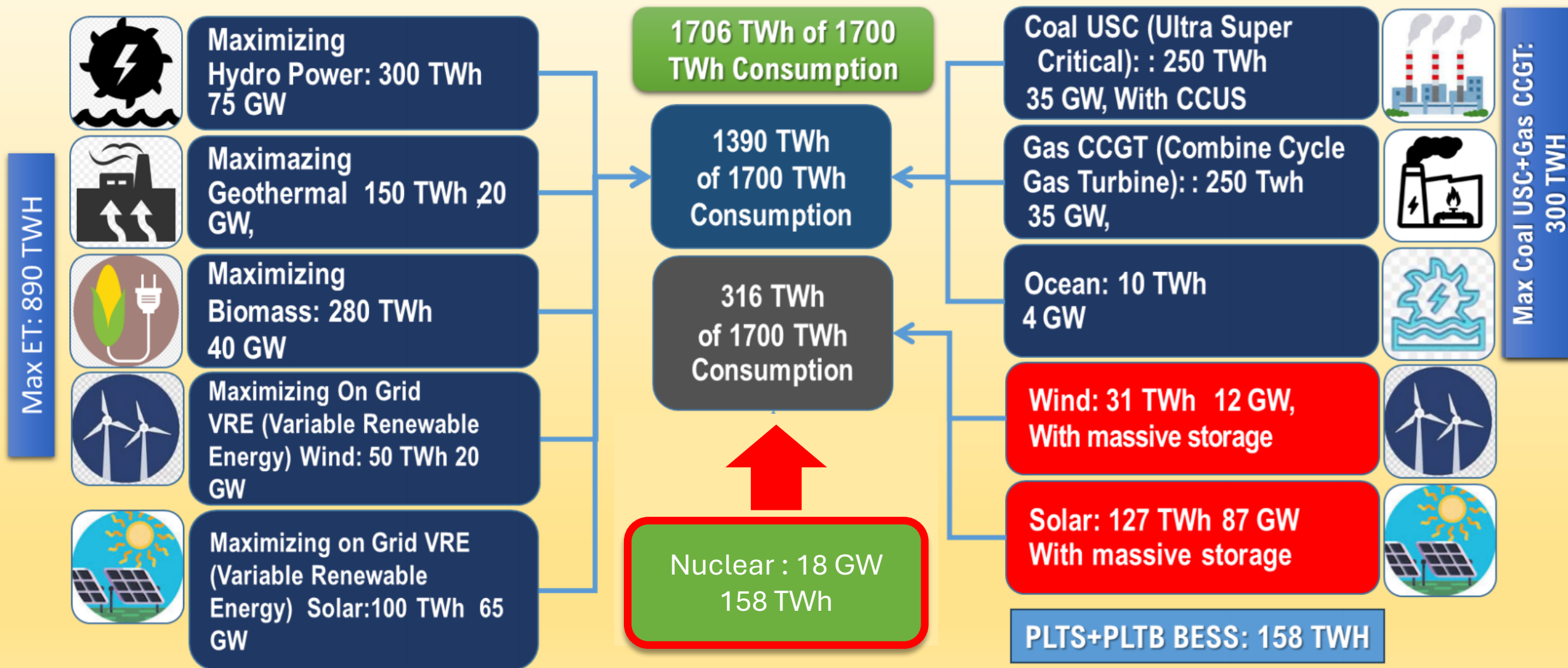


- Konsumsi listrik tahun 2060 mencapai 1.830 TWh yang didominasi sektor industri dan transportasi.
- Listrik per kapita mencapai 5.539 kWh per kapita.



- Pada tahun 2060, sebagian besar kebutuhan listrik disuplai oleh pembangkit berbasis energi terbarukan (384 GW) dan energi baru (PLTN) 45 GW dengan total kapasitas 522 GW.

Maximizing ET in 2045 (1700 TWh) With NPP



Indonesia has put nuclear on the grid by 2032

Nuclear





**MENTERI ENERGI DAN SUMBER DAYA MINERAL
REPUBLIK INDONESIA**

KEPUTUSAN MENTERI ENERGI DAN SUMBER DAYA MINERAL
REPUBLIK INDONESIA
NOMOR 314.K/TL.01/SEM.L/2024
TENTANG
RENCANA UMUM KETENAGALISTRIKAN NASIONAL
DENGAN RAHMAT TUHAN YANG MAHA ESA
MENTERI ENERGI DAN SUMBER DAYA MINERAL REPUBLIK INDONESIA,

Menimbang : a. bahwa sesuai dengan Pasal 5 ayat (1) huruf e Undang-Undang Nomor 30 Tahun 2009 tentang Ketenagalistrikan sebagaimana telah diubah dengan Undang-Undang Nomor 22 Tahun 2022
b. bahwa Peraturan Pemerintah Nomor 22 Tahun 2022
c. bahwa Peraturan Menteri Nomor 22 Tahun 2022
d. bahwa Peraturan Menteri Nomor 22 Tahun 2022

Mengingat : 1. Undang-Undang Nomor 30 Tahun 2009 tentang Ketenagalistrikan
2. Undang-Undang Nomor 22 Tahun 2022

- 4 -

KEDELAPAN : Pada saat Keputusan Menteri ini mulai berlaku, Keputusan Menteri Energi dan Sumber Daya Mineral Nomor 143 K/20/SEM/2019 tentang Rencana Umum Ketenagalistrikan Nasional Tahun 2019 sampai dengan Tahun 2038, dicabut dan dinyatakan tidak berlaku.

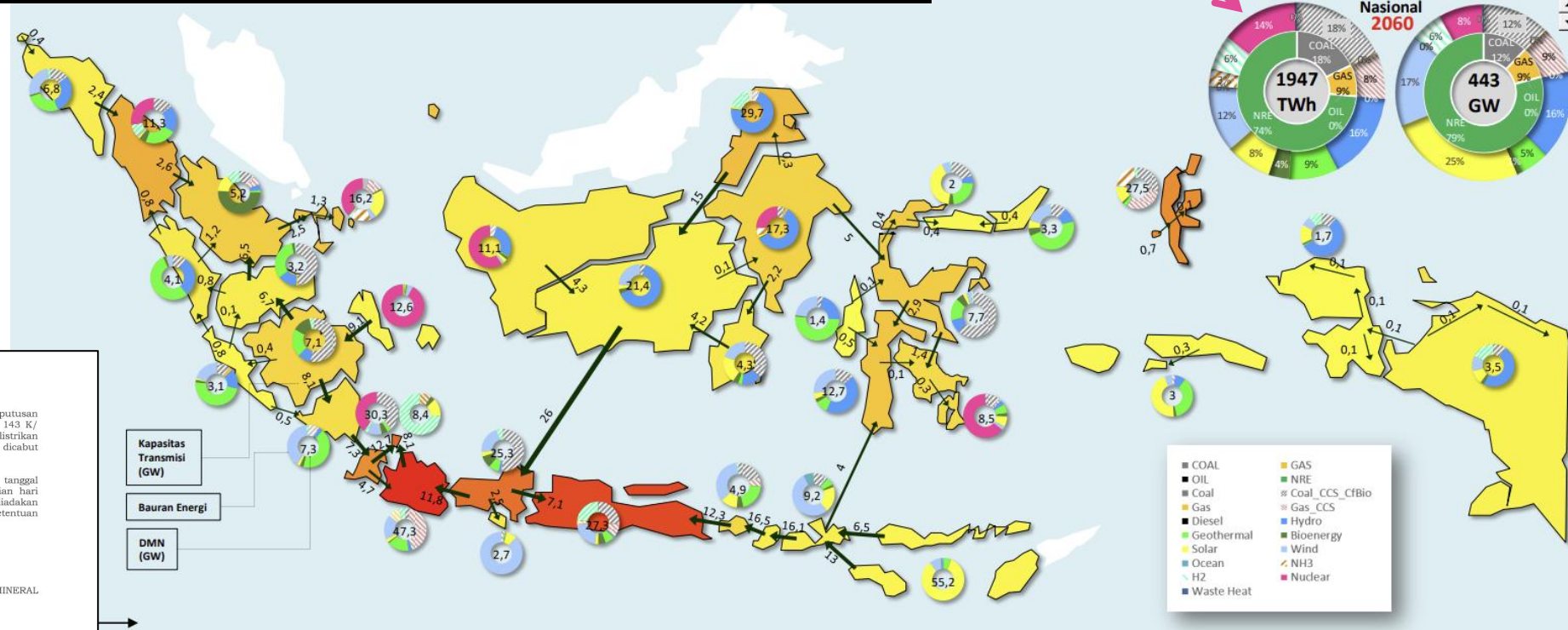
KESEMBILAN : Keputusan Menteri ini mulai berlaku pada tanggal ditetapkan, dengan ketentuan apabila di kemudian hari terdapat kekeliruan di dalamnya, maka akan diadakan perbaikan sebagaimana mestinya sesuai dengan ketentuan peraturan perundang-undangan.

Ditetapkan di Jakarta
pada tanggal 29 November 2024
MENTERI ENERGI DAN SUMBER DAYA MINERAL
REPUBLIK INDONESIA,

ttd.
BAHLIL LAHADALIA

Tembusan:
1. Menteri Koordinator Bidang Perekonomian
2. Menteri Dalam Negeri
3. Menteri Keuangan
4. Menteri Perencanaan Pembangunan Nasional/Kepala Badan Perencanaan Pembangunan Nasional
5. Menteri Perindustrian
6. Menteri Badan Usaha Milik Negara
7. Wakil Menteri Energi dan Sumber Daya Mineral
8. Sekretaris Jenderal, Kementerian Energi dan Sumber Daya Mineral
9. Inspektur Jenderal, Kementerian Energi dan Sumber Daya Mineral
10. Para Direktur Jenderal di lingkungan Kementerian Energi dan Sumber Daya Mineral
11. Para Gubernur di seluruh Indonesia
12. Kepala Satuan Kerja Khusus Pelaksanaan Kegiatan Usaha Hulu Minyak dan Gas Bumi
13. Para Pemegang Wilayah Usaha
14. Para Pemegang Izin Usaha Penyediaan Tenaga Listrik untuk Kepentingan Umum
15. Para Pemegang Izin Usaha Penyediaan Tenaga Listrik untuk Kepentingan Sendiri

Soliman, sesuai dengan aslinya
KEMENTERIAN ENERGI DAN SUMBER DAYA MINERAL
KEPALA BIRO HUKUM,
Bambang Sujito



MENTERI ENERGI DAN SUMBER DAYA
MINERAL REPUBLIK INDONESIA,

BAHLIL LAHADALIA

Regional Nuclear Capacity: The projections for power generation capacity for the year 2060 show the following:

- Sumatra: 15.0 GW
- Java and Bali: 10.0 GW
- Kalimantan: 7.0 GW or 15.8 GW

Nuclear Energy Regulation in Indonesia



	Regulation	Status	Note
1	The Nuclear Act (UU No 10/1997)	In effect – being revised	Revision will include floating, co-gen and propulsion
2	The Energy Act (UU No 30/2007)	In effect	Nuclear part of the mix
3	The Long-Term Development Planning Act 2025 – 2045 (UU no 12/2025)	In effect	Mandated that by 2045 Indonesia will have nuclear industries.
4	Draft – New Energy & Renewable Energy Bill	On-progress	Will give nuclear the same incentive as renewable – at par
5	Government Regulation on Energy Policy (PP no 40/2025)	In effect – replacing PP 79/2014	Open the nuclear door from last option – put 54GW by 2060
6	Minister of Energy Decree on National Electricity Plan no : 85.K/TL.01/MEM.L/2025	In effect	Put 45 GW of nuclear by 2060 and first NPP by 2034 – list NPP site
7	PLN Business Plan 2025 – 2034 – Minister Decree no 188.K/TL.03/MEM.L/2025	In effect	Put 250MW X 2 NPP by 2034
8	Presidential Decree on NEPIO	On-progress	Establishment of the implementing committee



Still need to be done by GOI to start NPP construction

- Setup the implementing organization (NEPIO)
- Selected the site for the first NPP
- Selected the vendor and technology for first NPP
- Determine the electricity tariff for NPP
- Make a G-to-G on nuclear development
- Determine the financing and type of PPA for first NPP



Nuclear roadmap according to Long Term Development Plan Act

Policy on Safety Aspects and Licensing of Nuclear Installations

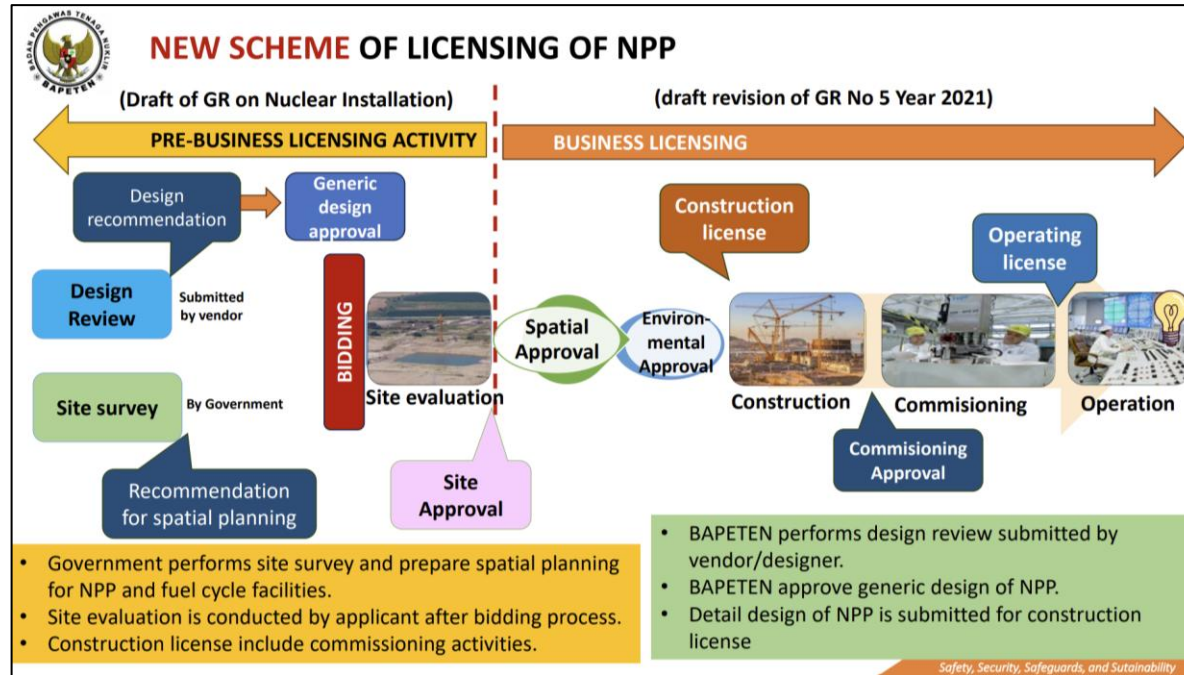
- ACT No.10/1997 on nuclear power – being revised to accommodate **floating, cogen and propulsion**.
- GR No.2/2014 on the licensing of nuclear installations and the use of nuclear materials – **NPP commercial has to be proven. Prototype can only be developed by BRIN or in JV with BRIN.**
- GR No. 54/ 2012 On the safety and security of nuclear installations - **establishes the regulatory framework for ensuring both safety and security of nuclear installations in Indonesia**
- GR No. 28 Tahun 2025 replacing GR No.5/ 2021 on risk-based business licensing –Where the Government has provided KBLI 43294 for NPP business – **private company can develop prototype reactor then commercial it after licensed.**
- GR No.52/2022 on Safety & Security of Nuclear Mining – **Private company can explore and developed radioactive minerals.**
- Other Bapeten Chairman regulation
- **Has been review by IAEA in 2011 and considered complete**



Homework :

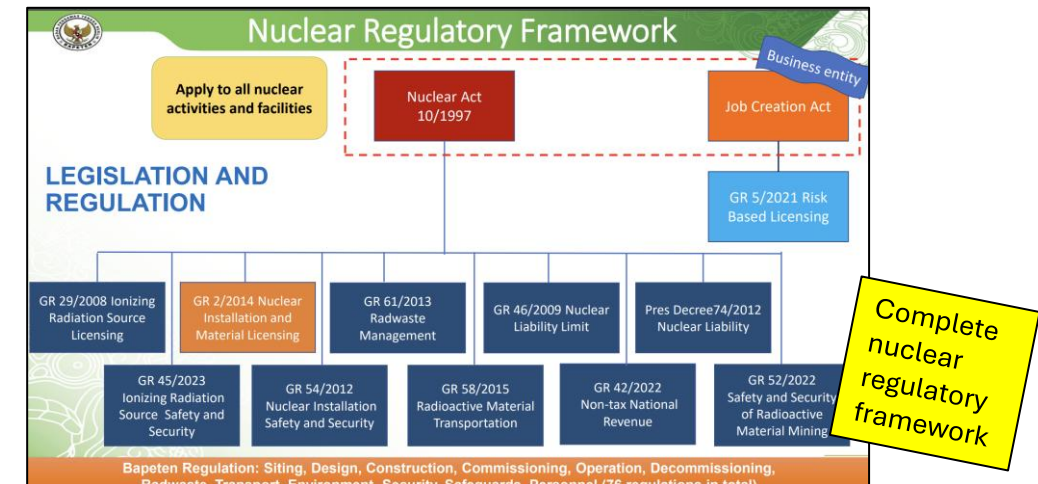
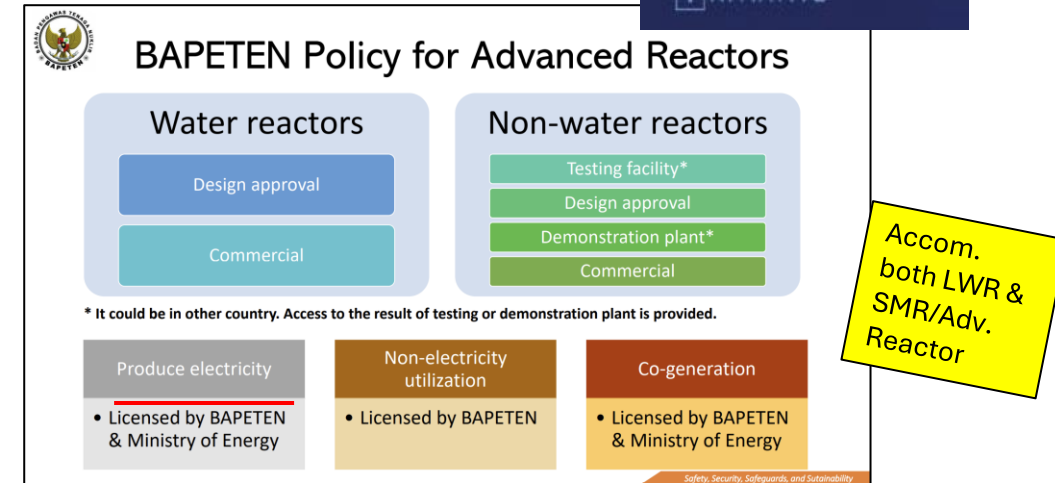
- Regulation in all thing regarding nuclear waste, final repository site and technology
- Synchronizing on nuclear commissioning (Bapeten) and electricity commissioning (MoE).
- Advanced reactor licensing - including IAEA NHSI

Indonesia has a complete regulatory framework and a clear nuclear licensing pathway – even for SMR or Advanced reactor



Advantages Licensing in Indonesia :

- A maximum time allowed, and budget by law to ensure a timely schedule and fraction of the cost in Western Countries.
- Licensing based on performance, not prescription thus open to non-LWR designs
- SMR licensing is developed to synchronize with IAEA's nuclear harmonization and standardization initiative (NHSI) - under development
- Limited nuclear liability.
- Direct transition from demonstration plant to commercial operations – under development
- Open to non-electricity utilization & floating plant - under development



Licensing a FOAK reactor in Indonesia offers developers unique advantages:

- **Performance-based, technology-neutral regulations** welcoming advanced designs.
- **Low, fixed licensing costs** without hidden fees.
- **Statutory timelines** ensuring efficient reviews.
- **Clear commercialization pathway**, aligned with national energy policy.
- **Experienced regulator** with regional leadership.
- Most importantly, **BAPETEN’s integration into IAEA harmonization initiatives** ensures that an SMR licensed in Indonesia carries international credibility, making it faster and cheaper for designs to be recognized in countries like Japan and South Korea.



Comparative Snapshot

Criteria	Indonesia (BAPETEN)	United States (NRC)	Japan (NRA)	South Korea (NSSC/KINS)
Regulatory Style	Performance-based, tech-inclusive	Historically prescriptive, shifting to Part 53	Highly prescriptive post-Fukushima	LWR-centric, prescriptive
Licensing Cost	<\$3M, fixed, mostly state-funded	\$148/hr → \$10–20M+	Very high (billions for compliance)	Lower direct fees, but hidden costs
Timeline	7.7 years (legal cap)	5+ years, no statutory limit	5–7+ years	4–6 years, no statutory cap
Global Harmonization	Active NHSI/IAEA participation, SMR-aligned	Emerging harmonization under Part 53	Participant in NHSI/SMR Forum	Participant in NHSI/SMR Forum
Regional Experience	Most experienced in SE Asia	Extensive	Extensive	Extensive

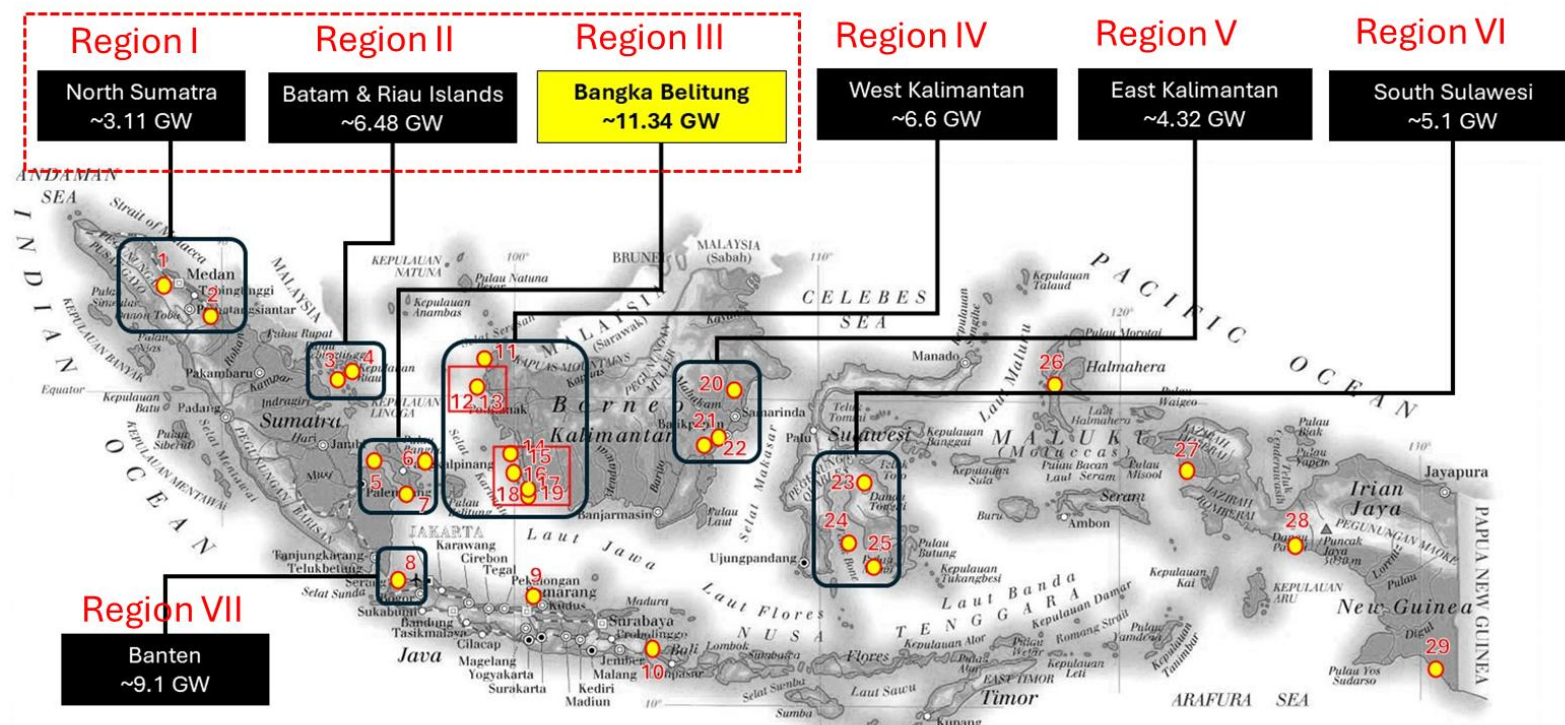
1	Site evaluation approval	± 6 months	BAPETEN
2	Site Permit (<i>Tapak</i>)	± 12 months	BAPETEN
3	Power generation permit (IUPTL)	± 3 months	ESDM (MEMR)
	PPA	± 3 months	PLN, IPP, dan ESDM (MEMR)
4	Design approval	± 9 months	BAPETEN
5	Construction permit	± 24 months	BAPETEN
6	Commissioning permit	± 12 months	BAPETEN
7	Commissioning certificate (SLO)	± 1 week	ESDM (MEMR)
8	Operation permit	± 24 months	BAPETEN

Max time allowed by law

1. While there is considerable discourse surrounding the anti-nuclear movement in Indonesia, the statistics indicate otherwise, with **77.5% support**—higher than in many countries with nuclear power.
2. Supporters of nuclear energy do not back it out of ignorance of the risks; rather, they are influenced by two main factors:
 - The belief that the **benefits outweigh the risks**.
 - **A trust in the government** to ensure safety measures are in place.
3. The opposition consists of five distinct groups:
 - **Uncompromised**
 - **Misinformed**
 - **Disappointed**
 - **Aggrieved**
 - **Influenced by peer pressure**
- After receiving education, four groups changed their stance, **except for the uncompromised**.



Potential Nuclear Power Location with Projected Capacity by 2060 according to draft RUKN 2024 - 2060



1	Pangkalan Susu	North Sumatra
2	Tanjung Balai	North Sumatra
3	Batam	Riau Islands
4	Bintan	Riau Islands
5	Bangka Barat	Bangka Belitung Islands
6	Bangka Tengah (Kelasa Island)	Bangka Belitung Islands
7	Bangka Selatan	Bangka Belitung Islands
8	Bojanegara	Banten

9	Muria	Central Java
10	Gerokgak	Bali
11	Sambas	West Kalimantan
12	Pulau Semesa	West Kalimantan
13	Pantai Gosong	West Kalimantan
14	Muara Pawan	West Kalimantan
15	Pagarantimur	West Kalimantan
16	Keramat Jaya	West Kalimantan

17	Kendawangan	West Kalimantan
18	Airhitam	West Kalimantan
19	Kualajelai	West Kalimantan
20	Sangatta	East Kalimantan
21	Samboja	East Kalimantan
22	Babulu Laut	East Kalimantan
23	Morowali	Central Sulawesi
24	Muna	Southeast Sulawesi

25	Toari	Southeast Sulawesi
26	Tanjung Kobul	Maluku
27	Teluk Bintuni	West Papua
28	Timika	Central Papua
29	Merauke	South Papua

Data from
ESDM, DEN & BRIN

Two (2) Pathway toward nuclear

New Build Nuclear

7 – 10 GW by 2040 (RUKN)

IPP – sell to PLN

Ideal target price
\$8 - \$10 cent per kwh

Industry own use (wilus)
– don't sell to PLN

Partnership with PLN
subsidiary (DA by PLN
CEO)

PLN subs has to
hold majority
share

Partnership with PLN
subsidiary (DA by GOI)

PLN subs can
hold minority

No Partnership – open
bidding

NO PLN subs
needed

DA : Direct appointment

Coal to Nuclear

Potential 35GW of
Repower by 2040

REPOWER
INDONESIA INITIATIVES

- Repower has been included in Energy Policy and Electricity Plan
- Nuclear Repower study has been done by ITB and submitted to GOI
- Nusantara Power has done simulation C2N.
- Detail on PPA extension has not been studied
- Feasible only if coal is not subsidized and carbon credit > \$20 ton
- Pilot project expected to start after 2027



Team Repower INI site visit to Tanjung Jati –B unit 1 & 2 on March 21st 2025



Bob S. Effendi



DR. Rino Mukti



Dr. Ir. Retno Gumilang Dewi, MEnvEngsc



Dr. Nanang Hariyanto



Ir. Erwin Mirza

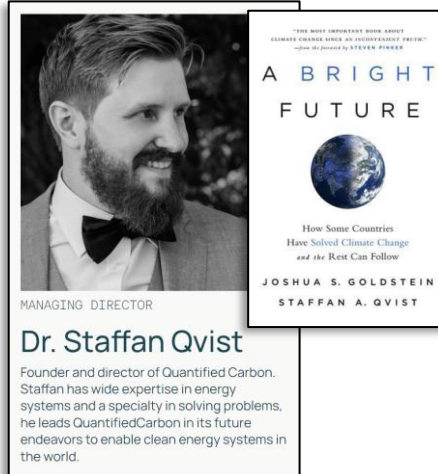


Ir. Eko Yuli Winarno

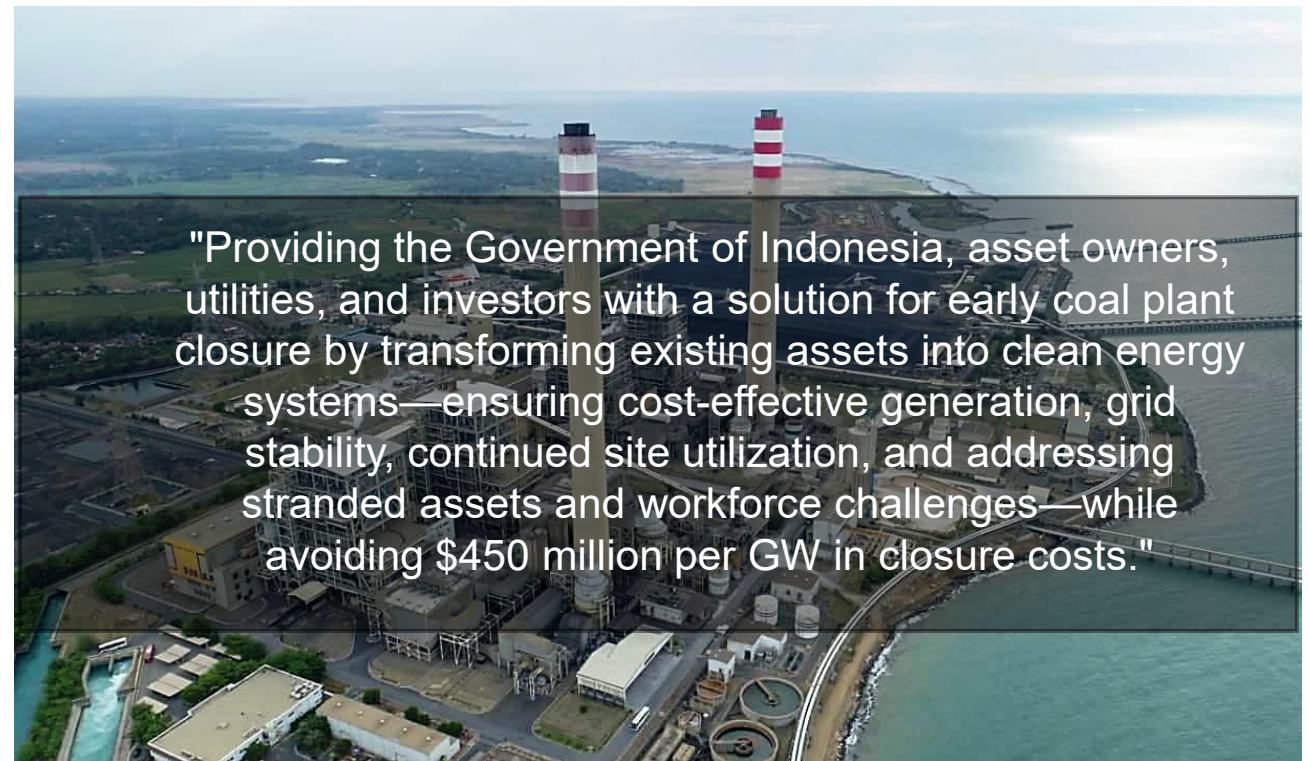


Luca Cada Lora

Repower
Indonesia
team



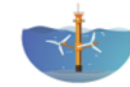
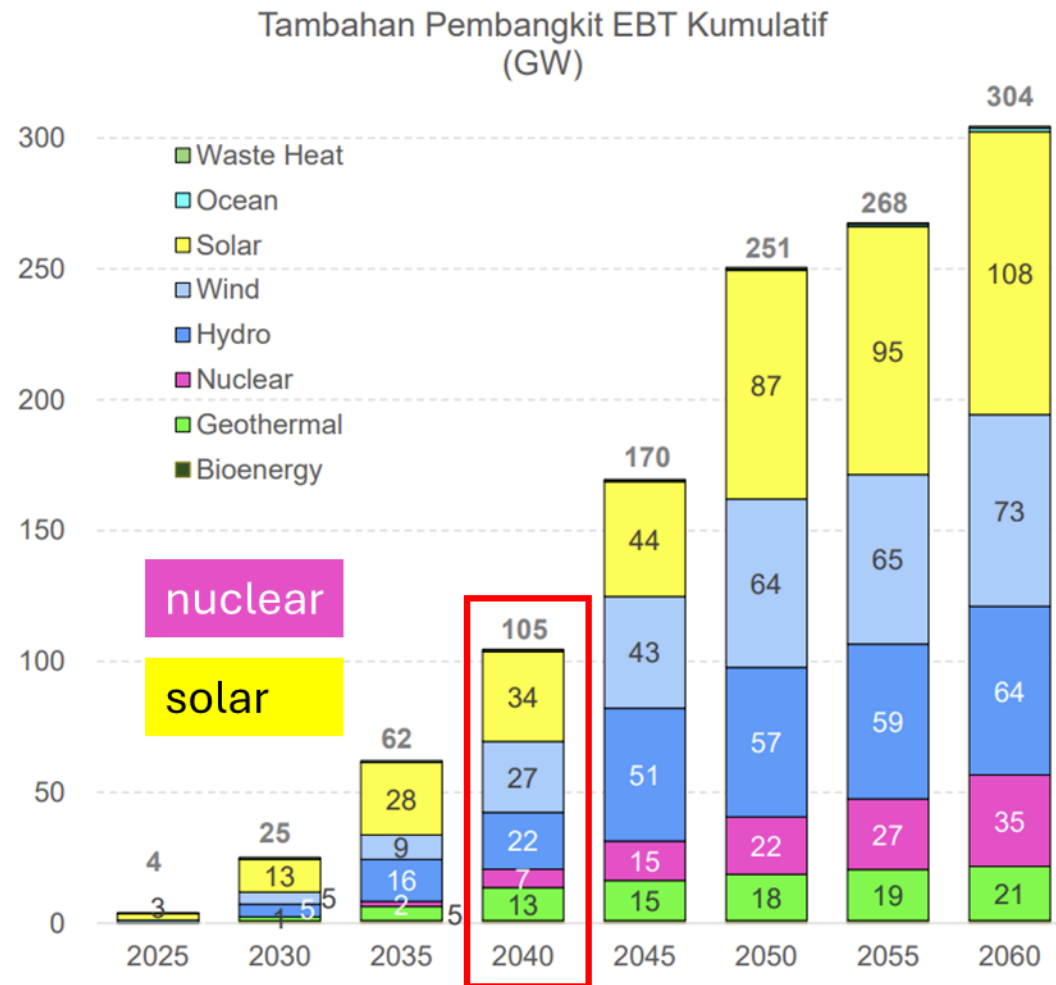
<https://www.repower.world>



"Providing the Government of Indonesia, asset owners, utilities, and investors with a solution for early coal plant closure by transforming existing assets into clean energy systems—ensuring cost-effective generation, grid stability, continued site utilization, and addressing stranded assets and workforce challenges—while avoiding \$450 million per GW in closure costs."



NEW & RENEWABLE ENERGY (NRE) MIX ACCORDING TO RUKN



PLTAL (Arus Laut) dimulai di Nusra 40 MW (*pilot project*)



Mendorong PLTS *Rooftop* dan PLTS *floating* dilengkapi BESS dikembangkan masif di danau dan waduk



PLTB *onshore* dan *offshore* di Utara dan Selatan Jawa, Kalsel, dan Sulsel



PLTA skala besar di Sumatera, Kalimantan & Sulawesi termasuk bendungan PU



Lokasi PLTN sesuai studi tapak oleh BRIN



PLTP terutama di Sumatera, Jawa, Maluku dan Nusra



Cofiring Biomassa untuk peningkatan EBT dan penurunan emisi PLTU

Total Capacity by 2040 will be 105GW where 75GW by PLN the rest by private co's - be nuclear 7GW

Nuclear company actively collaborating to developed nuclear in Indonesia



1. ThorCon Power:

- **Country:** United States

- **Initiative:** Through its subsidiary PT ThorCon Power Indonesia, ThorCon plans to construct a 500-megawatt thorium molten salt reactor (TMSR500) on Gelasa Island in Bangka Belitung province. The project is slated to commence commercial operations by 2031, with an estimated investment of approximately US\$1.4 billion.

2. NuScale Power:

- **Country:** United States

- **Initiative:** NuScale Power has expressed interest in building Small Modular Reactors (SMRs) in Indonesia. These advanced reactors can generate up to 300 MW of electricity per unit and are noted for their smaller carbon footprint and adaptability to existing power grids or remote areas. Discussions with Indonesia's Ministry of Energy and Mineral Resources have indicated potential operational readiness by 2032.

3. Ultra Safe Nuclear Corporation (USNC):

- **Country:** United States

- **Initiative:** Represented in Indonesia by its subsidiary PT Azet Surya Lestari, USNC has engaged in discussions with Indonesia's National Research and Innovation Agency (BRIN) regarding the establishment of nuclear power plants in the country. BRIN has opened opportunities for private sector collaboration to advance nuclear power development in Indonesia.

4. Rosatom:

- **Country:** Russia 

- **Initiative:** Rosatom has expressed readiness to provide Indonesia with both large-scale nuclear power plants and small modular reactors (SMRs). Recognizing Indonesia's archipelagic nature, Rosatom has proposed the development of floating nuclear power plants, which can be deployed to various locations, offering flexibility in power distribution.

Nuclear company actively collaborating to developed nuclear in Indonesia



5. Korean Hydro & Nuclear Power (KHNP):

•**Country:** South Korea

•**Initiative:** In December 2023, PT PLN (Persero), through its subsidiary PLN Nusantara Power, signed a memorandum of understanding with KHNP to conduct a preliminary feasibility study on implementing SMR technology in Indonesia. KHNP brings over 50 years of experience in building and operating nuclear power plants.

6. China National Nuclear Corporation (CNNC):

•**Country:** China

•**Initiative:** Indonesia's National Atomic Energy Agency (Batan) has signed agreements with China's Tsinghua University and China Nuclear Engineering Corporation (CNEC) to jointly develop high-temperature gas-cooled reactors (HTGRs) in Indonesia. This collaboration includes human resource capacity building and the establishment of a joint laboratory for HTGR technology.

7. Copenhagen Atomics:

•**Country:** Denmark

•**Initiative:** In May 2023, Copenhagen Atomics, along with other Danish companies, signed a memorandum of understanding with Indonesian state-owned enterprises Pupuk Kaltim and Pertamina New & Renewable Energy to explore building a facility in Bontang, East Kalimantan. The proposed plant aims to produce one million tonnes of ultra-low emission ammonia annually using Copenhagen Atomics' thorium molten salt small modular reactors (SMRs). The facility is expected to open in 2028, with an estimated investment of USD 4 billion.

8. Seaborg Technologies:

•**Country:** Denmark

•**Initiative:** In September 2023, Indonesian power company Pertamina NRE signed a memorandum of understanding with Seaborg to investigate the deployment of Seaborg's Compact Molten Salt Reactor (CMSR) Power Barge in Indonesia. The collaboration aims to assess the feasibility of deploying CMSR Power Barges with capacities between 200 MWe and 800 MWe, potentially supplying power to the grid, industry, or for the production of alternative fuels such as hydrogen, ammonia, and methanol.

Lesson learnt from Indonesia for Australia

1. Persistent – Never Give Up
2. Create narrative and several key words
3. Need several nuclear champion inside parliament and outside
4. Create NGO with nuclear evangelist in all level, high school, univ student, professionals and media people - all trained with the same narrative, fact & data
5. Use social media to spread the narrative and recruit evangelist
6. Put nuclear energy into the economic context
7. Show the Government the fact & data
8. Engage all level of government
9. Do not dance to the anti nuclear song



Thank You, 谢谢, Terima Kasih



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