

The Role of Reactor Simulator in Supporting the Implementation of Nuclear Energy Program in Indonesia

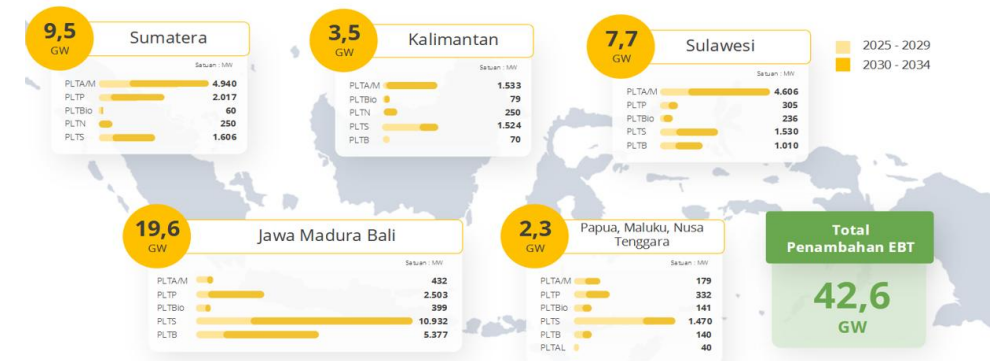
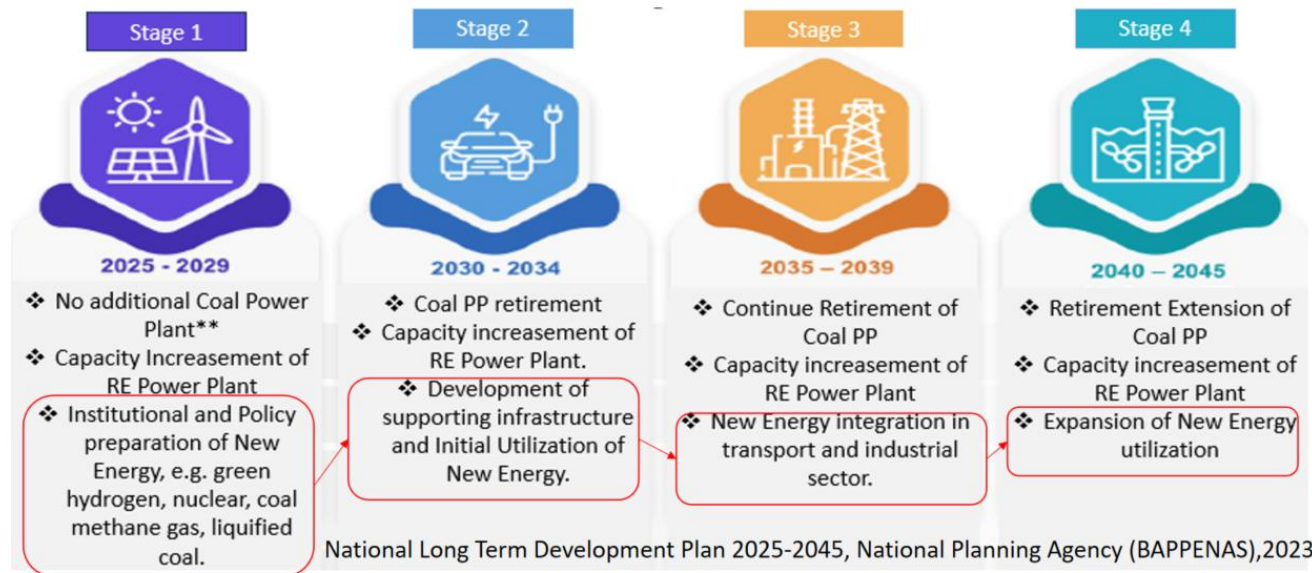
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I. Introduction

- ❑ Indonesia supports the commitments under the Paris Agreement and set a national target to achieve clean energy and reach net-zero emissions by 2060 or earlier.
- ❑ Government Regulation No. 40 of 2025 on National Energy Policy officially designated nuclear power as a core part of Indonesia's energy strategy.
- ❑ Reducing the use of fossil energy → replacing with new and renewable energy (NRE) resources including Nuclear Energy System



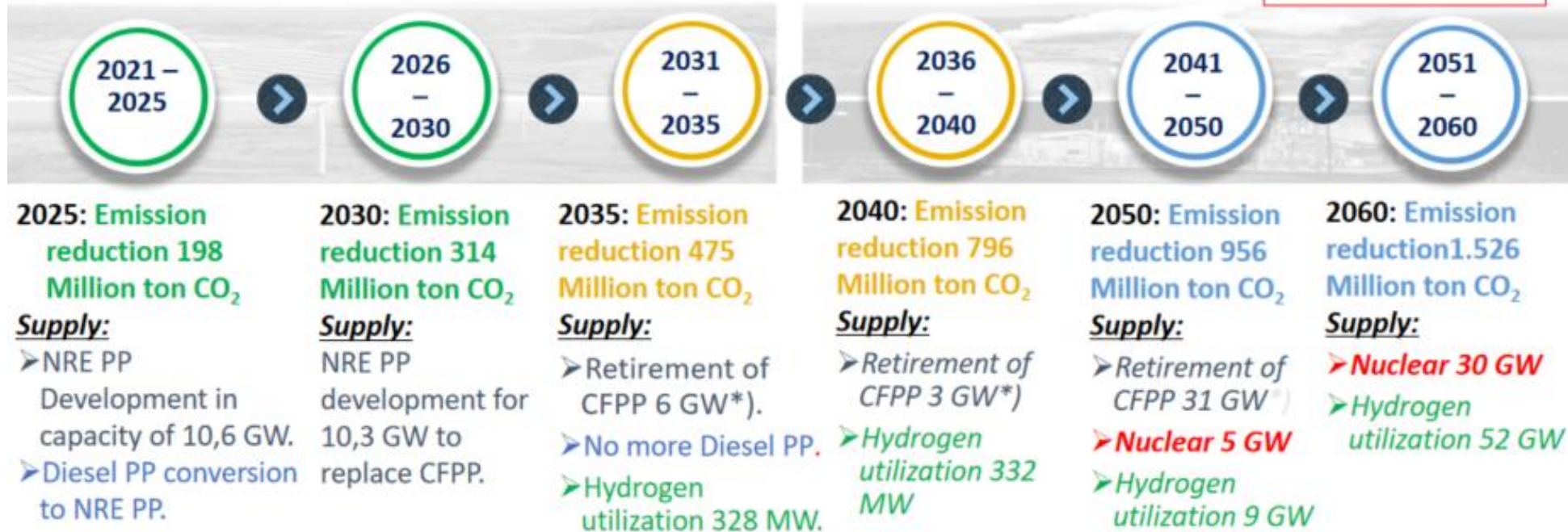
Additional capacity for NRE based on region (Electricity Supply Business Plan- RUPTL 2025-2034)

I. Introduction

ENERGY TRANSITIONS ROADMAP TOWARDS NET ZERO EMISSION

- 1) The timeline for strategic achievement towards net zero emission on energy sector
- 2) The roadmap is a joint commitment between the Government and stakeholders to achieve NZE by 2060

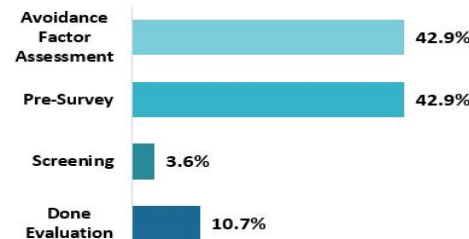
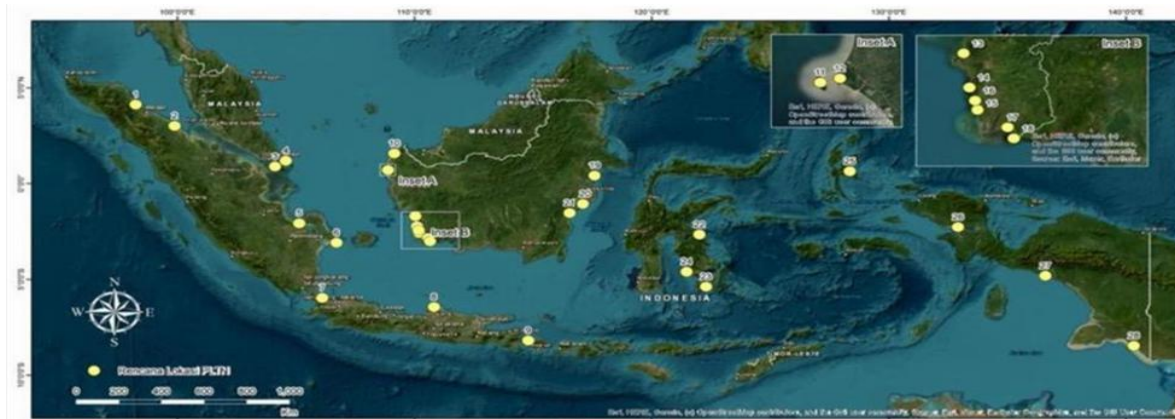
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- ❑ National Electricity General Plan : 35 GW total nuclear capacity by 2060
- ❑ 2060: Emission reduction 1.526 Million ton CO₂, Supply: Nuclear Energy 30 GW, Hydrogen utilization 52 GW

II. Progress and Activities

- ❑ Nuclear Energy Program Implementation Organization (NEPIO) will be established this year, 2025.
- ❑ User Requirement Documents for NPP is being finalized.
- ❑ Identification and evaluation of prospective reactor sites is continuously performed.



Further Consideration:

- Supporting Infrastructure
- Compliance with international nuclear safety and security standards.
- Comprehensive studies on geological, environmental, and social readiness.

No	Location	Capacity (MW)	Status
1	Pangkalan Susu, Langkat, Sumatera Utara	4	Avoidance Factor Assessment
2	Tanjung Balai, Asahan, Sumatera Utara	4	Avoidance Factor Assessment
3	Batam	0.5	Pre-Survey
4	Batam	0.1	Avoidance Factor Assessment
5	Bangka Selatan	4	Done evaluation
6	Bangka Barat	6	Done evaluation
7	Bojanegara, Banten	4	Screening
8	Muria, Jepara, Jawa Tengah	7	Done evaluation
9	P Semesta, Kalbar	1	Pre-Survey
10	Pantai Gosong	1	Pre-Survey
11	Sambas, Kalbar	1	Pre-Survey
12	Kramatjaya, Kndawangan, Ketapang, Kalbar	4	Pre-Survey
13	Muara Pawan, Ketapang, Kalbar	4	Pre-Survey
14	Pagar Mentimun, Ketapang, Kalbar	4	Pre-Survey
15	Kendawangan, Ketapang, Kalbar	4	Pre-Survey
16	Air Hitam, Ketapang, Kalbar	4	Pre-Survey
17	Kuala Jelai, Kalbar	4	Avoidance Factor Assessment
18	Sangata, Kaltim	1	Pre-Survey
19	PPU, Babulu laut, Kaltim	1	Pre-Survey
20	Samboja, Kaltim	1	Pre-Survey
21	Morowali, Sulteng	3	Avoidance Factor Assessment
22	Muna, Sultra	3	Avoidance Factor Assessment
23	Toari, Kolaka, Sultra	4	Avoidance Factor Assessment
24	Tanjung Kobul, Maba, Halmahera, Maluku	0.2	Avoidance Factor Assessment
25	Merauka, Papua Selatan	0.2	Avoidance Factor Assessment
26	Timika, Papua Tengah	0.2	Avoidance Factor Assessment
27	Teluk Bintuni, Papua Barat	0.2	Avoidance Factor Assessment
28	Gerokgak, Buleleng, Bali	0.1	Avoidance Factor Assessment

Source: Regional Development Policy Document for NPPs (2023)

II. Infrastructure for NES

- ❑ Improvement and follow up on the nuclear infrastructure issues (INIR Mission 2009) → strengthened National Position, Management and Stake holder's involvement.
- ❑ Assessment and evaluation on 19 nuclear energy infrastructure have been carried out and updated using appropriate methods and analytical tools.
- ❑ Assessment on both Reactor Technology and other non technical issues e.g. public acceptance, economic competitiveness of NES, etc.
- ❑ Human resource development: R&D on nuclear reactor technology, training programs, collaboration with stake holders, expert mission (INIR, SEED), Seminars and exhibitions, others.



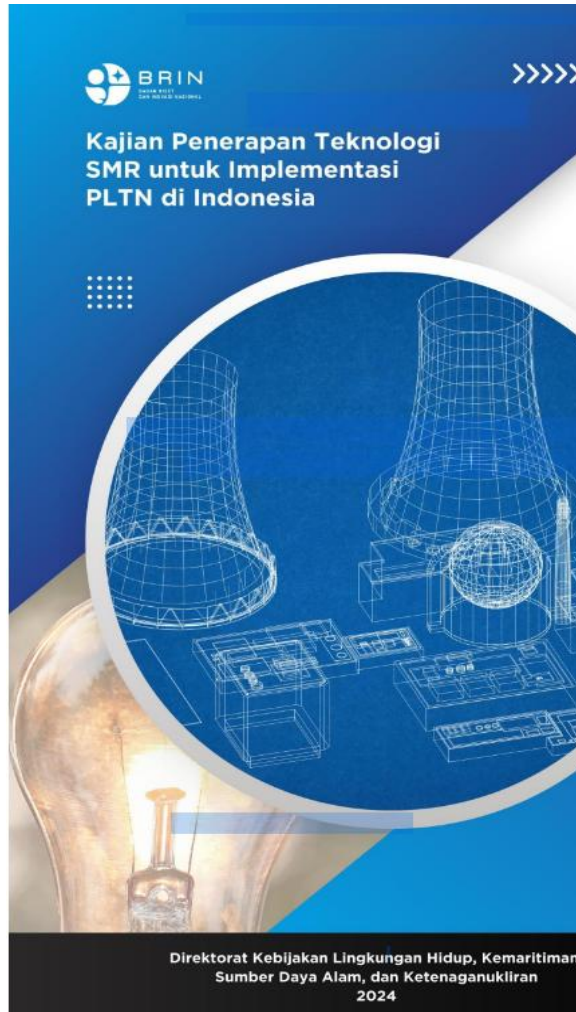
Training of nuclear reactor technology for stakeholders

Assessment on the implementation of SMR Technology - BRIN

Tabel 6. 1. Desain PLTN dan Perkiraan Waktu Implementasinya

Desain	Persyaratan Regulasi			NOAK	Perkiraan awal tahun Konstruksi di Indonesia	Perkiraan awal tahun operasi	Keterangan
	Teruji		Tapak darat*				
	Teknis*	Legal**					
PLTN Besar	✓	✓	✓	✓	2028	± 2035	Dari analisis, dalam 30 tahun terakhir rata-rata durasi konstruksi PLTN Besar (didominasi Gen III dan III+) adalah 7-8 tahun.
HTR PM	✓	✗	✓	✗	?	?	Perkiraan awal konstruksi di Indonesia sangat tergantung pada perkembangan HTRPM komersial (600MWe) di China.
RITM 200S/M	✓	✓	✗	✓	2028	2033	Diperlukan waktu untuk pengembangan regulasi dan perizinan di Indonesia. Perubahan atau penambahan definisi tapak pada Regulasi di Indonesia. Sedangkan terkait perizinan, dapat mengadopsi dari negara asal. Pemenuhan regulasi dapat dilakukan selama tahap persiapan.
ACP-100	✓	✗	✓	✗	2030	2035	Diperlukan waktu tunggu mencapai tahap NOAK. Hingga saat ini, konstruksi ACP100 (1 Unit) memperlihatkan kesesuaian dengan jadwal, sehingga diperkirakan akan beroperasi tahun 2026. Sedangkan, untuk mencapai NOAK maka diperlukan 1 kali proyek pembnagunan ACP100 lagi. Diasumsikan pula lama waktu pembangunan selama 4 tahun
VOYGR	✓	✗	✓	✗	2029	2034	VOYGR merupakan SMR Multi-modul, sehingga diasumsikan dalam 1 proyek pembangunan yang direncanakan saat ini telah tercapai tahap NOAK. Diasumsikan pula lama waktu pembangunan selama 4 tahun.
RITM 200N	✓	✗	✓	✓	2029	2034	Syarat teruji secara legal menunggu RITM 200N beroperasi. Sedangkan dari sisi ekonomi, seri RITM telah mencapai tahap NOAK
BWRX 300	✗	✗	✓	✗	?	?	Direncanakan akan dibangun 4 unit BWRX di Canada, dengan diawali pembangunan 1 unit dan dijadwalkan beroperasi tahun 2028. Tahap NOAK BWRX akan tergantung seri pembangunannya baik di Canada atau negara lain

* PP No. 2 Tahun 2014 pasal 6 ayat 4 (a)
 ** PP No. 2 Tahun 2014 pasal 6 ayat 4 (b)
 * PP No. 2 Tahun 2014 pasal 1 ayat 9



Reactor technology assessment and studies, 2024

III. Reactor Simulator in Supporting Nuclear Energy Implementation

- ❑ Effective tool for introducing the nuclear reactor operation, reactor safety and applied features.
- ❑ Building communication with institutions, universities and other nuclear stake holders → enhancing public participation and awareness on the progress of nuclear reactor technology.



III. Reactor Simulator in Supporting Nuclear Energy Implementation

- ❑ Developing a reactor design model/miniature as an attractive tool to help achieve public comprehensive understanding on reactor system
- ❑ Showcase the progress of research activities, and foster collaboration with key stakeholders.



InaRI EXPO 2025-Research and Innovation EXPO, and simulator development activities

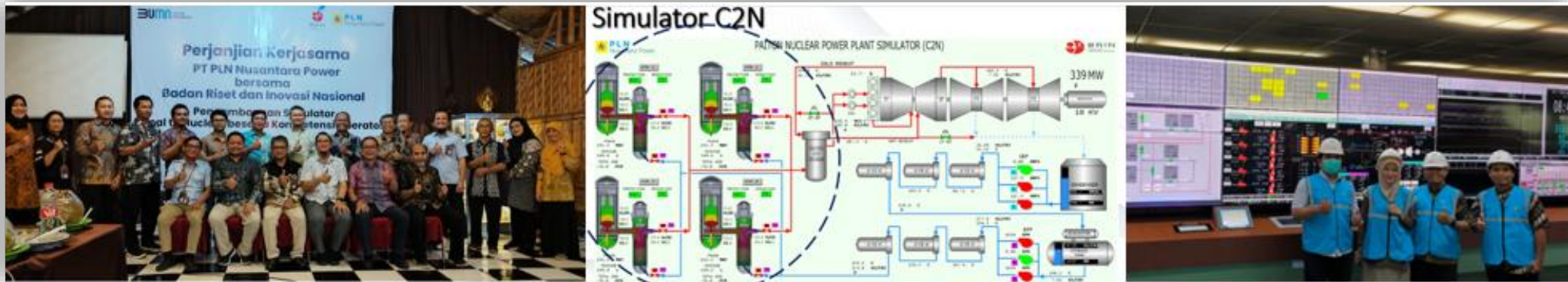
IV. Reactor Simulator Development and Collaboration

- ❑ Developing a basic computer-based nuclear power plant (NPP) simulator with Human factors consideration → nuclear capacity building, HR development
- ❑ Simulator for Experimental Power Reactor 10MWth – HTGR RDE → participation in the global nuclear technology development
- ❑ Developing a compact and simplified simulator model to increase portability → collaboration with national universities



IV. Reactor Simulator Development and Collaboration

- ❑ Collaboration with State-Owned Electric Company in developing a Coal-to-Nuclear (C2N) simulator.
- ❑ C2N was integrated in the existing coal-fired power plant simulator and was employed as a training platform for operators.
- ❑ Collaboration on Basic reactor control and operation Training for Coal-fired power plant Operators.



V. Summary

- ❑ Indonesia has prepared the infrastructure for implementation of nuclear energy program and made improvements on required aspects.
- ❑ Broader involvement of nuclear reactor stakeholders helps reinforce support and shared ownership of the national NES program.
- ❑ Nuclear reactor simulators serve as an effective tool for introducing reactor safety and technology, strengthening institutional support for nuclear energy development.



Thank you for your Attention

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