4 February 2025

Seize the moment: Indonesia can surpass national renewables targets by fast-tracking prospective projects

Recognising Indonesia's vast and untapped potential in becoming a leader in clean energy, the Centre for Research on Energy and Clean Air (CREA) conducted further research on the recently announced commitments, against the current state of play. Current targets — 75 GW of renewable energy (RE) and 5 GW of nuclear power by 2040 announced at COP29, and trajectories outlined in the national electricity plan *(RUKN) 2024-2060 — can be significantly exceeded by fast-tracking prospective projects today. This fast-tracked implementation is a precondition for realizing the fossil-free power by 2040 vision announced by President Prabowo and would make the plan more cost-effective, as shown by a comparison to the cost-optimized fossil-free pathways prepared for the Sixth Assessment Report (AR6) of the Intergovernmental Panel on Climate Change (IPCC).*

Key findings

- To realize Prabowo's climate-focused goal of phasing out fossil fuel power and adding 75 GW of renewable energy (RE) by 2040, the clean energy targets in the national electricity plan (RUKN 2024-2060) plan need to be substantially increased.
- The renewable energy (RE) and nuclear power projects that are in construction, pre-construction, and have been announced today, reach 45 GW. Realizing these projects alone would quadruple Indonesia's new and renewable energy capacity, and could put the country on track to achieve the 75 GW RE capacity addition target well ahead of schedule if progress is monitored to ensure implementation.
- Out of the 45 GW of prospective RE and nuclear power projects, 30.6 GW have designated start years. Specific start years need to be assigned to the rest of the projects (13.6 GW in total — out of 10.7 GW of solar, 1.8 GW of wind, and 1.1 GW of geothermal).
- Solar power offers the best opportunity to secure the 75 GW target ahead of schedule. There are currently at least 16.5 GW of prospective solar power projects in Indonesia — over five times higher than what is outlined in the JETP CIPP (3.1 GW), and 30% higher than the 2030 RUKN target (12.8 GW). There is time to deploy much more than the current

project pipeline by 2030 and particularly before RUKN's 2035 target, as shown by the experiences of other countries, such as Vietnam and especially China.

- Compared to cost-optimized pathways modeled for the IPCC AR6 report for Indonesia's future fossil-free power system, the RUKN heavily under-invests in solar and wind, and over invests in more expensive and slower-to-deploy solutions. This is a missed opportunity for Indonesia in realizing a fossil-free vision and securing clean energy investments during these defining decades.
- In contrast to solar, the development of wind power – with 2.5 GW of projects in development – lags even behind the RUKN targets (4.8 GW in 2030). The gap to wind power potential and cost-optimal deployment is even larger, showing the need to put in more efforts on wind power development and creating an enabling environment to attract the required investments.

Prabowo's fossil-free vision, followed by RUKN 2024-2060

As highlighted in CREA's commentary released following **President Prabowo's announcement for a full phase-out of fossil fuel power by 2040**, there is a need to revisit clean energy targets and deployment strategies to realise this vision. On 29 November 2024, the long-awaited 2024-2060 National Electricity Plan, namely *Rencana Umum Ketenagalistrikan Nasional* (RUKN) was ratified. The previous versions were RUKN 2019-2038, released in 2019, and RUKN 2008-2027, released in 2008, detailing electricity supply and demand scenarios for the next 20 years. The latest release covers projections up to 2060, aligning with the 8% economic growth target from 2027 and beyond to make Indonesia a developed country by 2045. **RUKN 2024-2060 marks Indonesia's commitment to achieve Net Zero Emissions (NZE) by 2060 or sooner**. It is the first regulation that outlines the transition of the power sector year by year until 2060.

The RUKN outlines two notable scenarios of the national capacity projections, which includes both on-grid and off-grid or captive power systems — the 'base scenario' and the 'green hydrogen scenario' with higher solar, hydropower, and nuclear power added for green hydrogen production. In 2060, total power generation capacity is projected to reach 443 GW in the base scenario and 630 GW in the green hydrogen scenario. Power generation in the two scenarios reaches 1,947 TWh and 2,306 TWh, respectively.

While the share of renewables in the primary energy mix is set to reach 50% and 54% in 2060, respectively, the rest comes from nuclear power and abated fossil fuels, namely coal and biomass co-fired power plants equipped with Carbon Capture and Storage (CCS) and gas-fired power plants with CCS. To note, the majority of the 187 GW of additional capacities in the green hydrogen scenario comes from solar power expansion in Nusa Tenggara (158 GW), hydropower in Papua (21 GW), and nuclear power in Kalimantan (9 GW). Apart from this, although President Prabowo has announced a fossil-free vision by 2040, the RUKN outlines a sizeable share of unabated fossil fuel power generation, namely coal-fired power plants at 41% and gas at 17%, to meet the energy demand of 1,140 TWh in 2040 — while setting 36% RE share for the year.

Figure 1 is provided to gauge the level of commitment, benchmarking the targets announced at COP29 for on-grid non-fossil power capacity additions until 2040 and the implied six-year 2030 target additions outlined in the RUKN against currently operating and prospective capacities. Note that the COP29 announcement called for additions of 75 GW of RE and 5 GW of nuclear by 2040, while RUKN 2024-2060 plans to reach 38.4 GW of RE in 2030 (implying 25 GW of RE addition from the current capacity), and 106 GW of RE and 7.3 GW of nuclear in 2040 (implying 95 GW of RE and 7.3 GW of nuclear addition from the current capacity).

Current renewables capacity reaches 13.5 GW. Meanwhile, prospective projects tracked by the Global Energy Monitor for solar, hydropower, nuclear, wind, geothermal, and bioenergy, show a total clean energy potential of nearly 45 GW. As shown in Figure 1, prospective projects mapped for solar, wind, hydro, and geothermal well exceed the 2030 targets outlined in the RUKN.

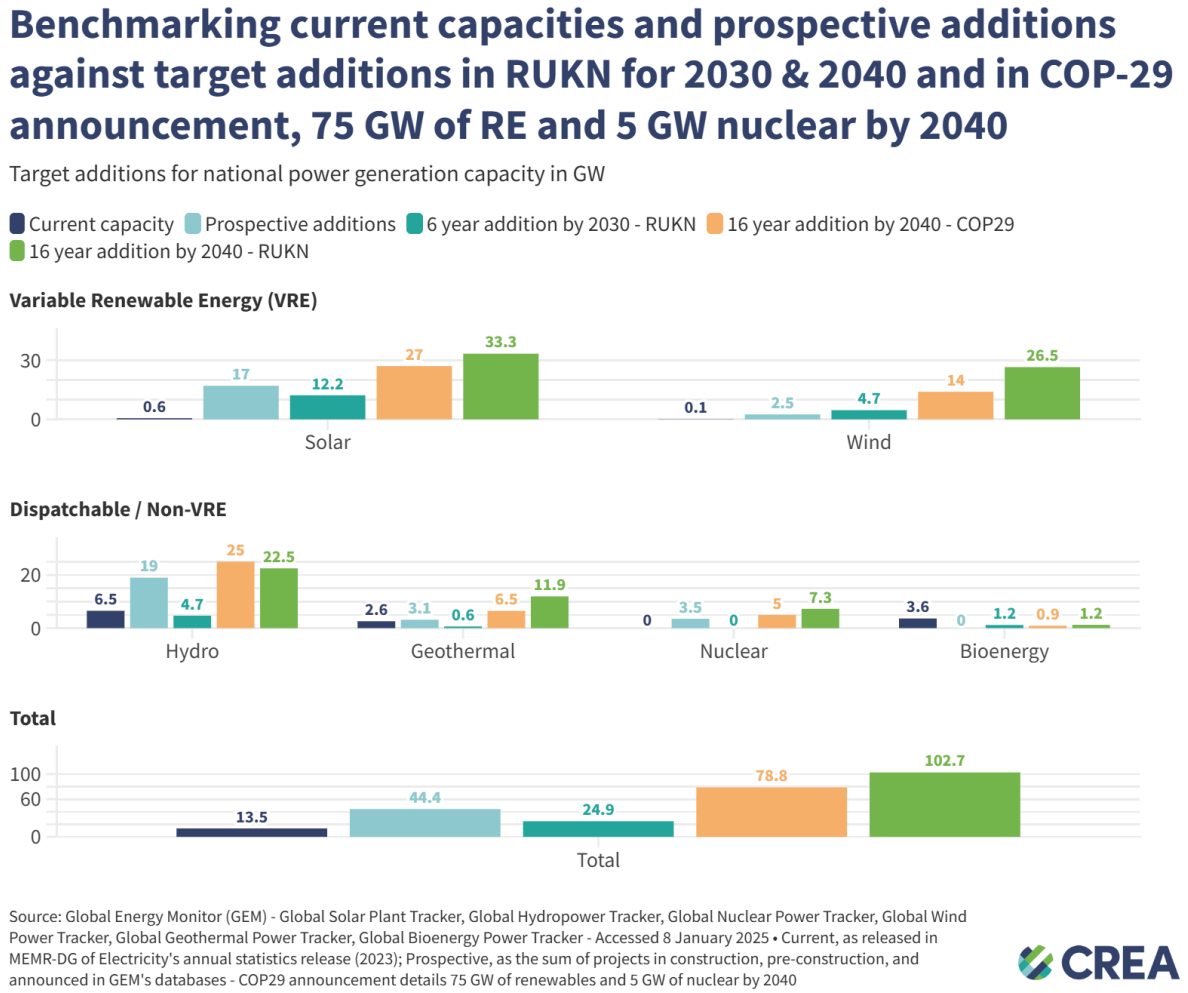

Figure 1. Comparison of operational and prospective additions against target additions in RUKN and COP-29 announcement

Note: The COP29 announcement called for 75 GW of RE and 5 GW of nuclear additions by 2040; RUKN 2024-2060 plans for 25 GW of RE additions by 2030, and 95 GW of RE and 7.3 GW of nuclear additions by 2040.

GEM's identification of 30.6 GW of prospective projects with designated start years, if fast-tracked, would help Indonesia reach 58% of the 2035 capacity target in the RUKN (44.1 GW out of 75.6 GW). Beyond this, strategically mapping prospective projects without a start year, will realize all 45 GW of nuclear and RE additions, making up 77% of the 2035 targets (58 GW out of 75.6 GW).

Accelerating prospective projects that could be launched and fast-tracked today would quadruple Indonesia's RE capacity, surpassing the RUKN targets for 2030 (38.4 GW); however, efforts must be ramped up to reach the capacity targets set beyond the end of this decade — to reach 75.6 GW target set for 2035, and 116.2 GW for 2040.

Securing additional 75 GW of RE by 2040 by prioritizing 45 GW of prospective projects would bring Indonesia well ahead of targets

The 2040 new and renewable energy additions announced at COP29 show that having prospective capacities coming online at accelerated pace, particularly for dispatchable sources, would help Indonesia meet the 15-year addition target by 2040. In addition, variable renewable energy (VRE) from solar and wind, particularly requires better mapping to ensure strategic deployment by 2040.

Shown in Figure 2, the distribution of prospective nuclear and RE projects based on start year, and RUKN's target capacity for 2035. As illustrated, if all projects tagged with a start year are deployed on time, Indonesia would only reach 44 GW of capacity by 2035. The remaining 31.5 GW of additions is still required to meet RUKN's 2035 target. This shows an opportunity to link specific start years for GEM's prospective projects without a start year (13.6 GW), and prioritise immediate mapping for the remaining 18 GW not yet considered in any national planning.

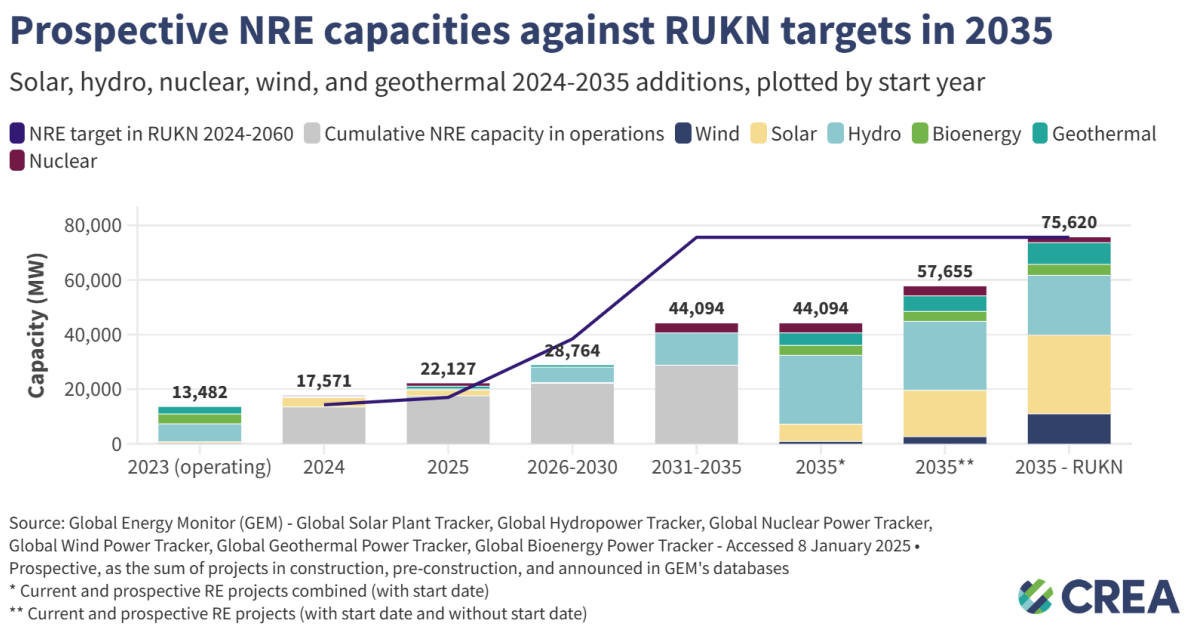

Figure 2. Prospective RE capacity additions mapped by GEM by start year against RUKN 2035 target

The JETP Secretariat has outlined 3.1 GW of prospective total capacity from 64 projects in the 2023 Comprehensive Investment and Policy Plan (CIPP), estimated to require USD 2.38 billion in investment needs. For solar, GEM's Global Solar Plant Tracker indicates a total over five times higher, at 16.5 GW of prospective solar projects, with 5.7 GW tagged to start by 2026. As for wind power, the JETP CIPP outlines 5.2 GW of prospective projects from 53 projects, requiring USD 4.48 billion in investment. GEM's Global Wind Power Tracker, on the other hand, only shows half of the JETP CIPP priority projects — 2.46 GW of prospective projects, with 0.70 GW tagged to start by 2026.

For solar and wind, the RUKN plans for 12.8 GW and 4.8 GW target capacity in 2030, respectively — both can be well exceeded through fast-tracking prospective solar farms mapped by GEM and the wind power project list in the JETP CIPP. Given the possibility to streamline planning and permitting to keep deployment timelines to just over one year for utility-scale solar farms, all prospective projects in particular can be easily completed by 2030. Wind projects deployment time can be accelerated to 4.5 to 5.5 years for onshore and offshore wind, suggesting 2025 and 2026 as ideal time frames for better mapping of prospective wind projects. **Strategic mapping of both solar and wind power projects is crucial to ensure timely VRE deployment in the next decade.**

Current solar capacity reported in Indonesia's 2023 Annual Electricity Statistics report[1] shows that out of 598 MW, 88% comes from private investments, namely 260 MW from the Independent Power Producers (IPP), and 265 MW from Public Private Utility (PPU) and private owners operating with specific licenses for own use.[2] Merely 34 MW are operated by PLN, and 39 MW by the provincial governments. As for wind power, the 154 MW of currently operating plants are owned and operated by IPPs. This means, to date, there is no PLN-owned or government-owned solar operating in the country. **This also highlights a significant lag in adoption, and a massive potential that should be seized by both PLN and the government to spearhead VRE deployment.**

Looking beyond the national lens, Indonesia should set the ambition to become a solar leader in the region, given the country's massive untapped solar potential that ranges between 3,400 to 19,800 GWp, as well as successes and notable progress in clean energy deployment across Asia. China, the global leader in solar power, reached a total installed capacity of 887 GW at the end of 2024, with the highest single-year deployment last year at 277 GW. India follows, achieving 218 GW of RE capacity at year-end, with 24.5 GW of solar and 3.4 GW of wind power installed in 2024 alone.

Across Southeast Asia, GEM maps over 28 GW of utility-scale solar and wind power in operations in 2023. Vietnam has the largest capacity (19.5 GW), having 13 GW of utility-scale solar farms and 6.5 GW of utility-scale wind. The country's master power plan targets 20.6 GW of solar capacity by 2030 and 189 GW by 2050, aiming for NZE by 2050 and has solar as the backbone of the power system – utilizing 963 GW of the country's solar potential. The government is actively pushing for rooftop solar deployment across the country, setting an aim to have half of offices and homes to have solar power installed by 2030. At present, Vietnam has 9.5 GW of total rooftop solar capacity from 103,000 installations in residential, commercial, and industrial buildings combined.

[1] Released by the Ministry of Energy and Mineral Resources's Directorate General of Electricity

[2] Private owners could be classified as Public Private Utility (PPU), or be granted with a specific license granting permission to generate electricity for own use, *Izin Usaha Penyediaan Tenaga Listrik Untuk Kepentingan Sendiri* (IUPTLS)

RUKN vs. IPCC AR6 scenario for fossil-free power generation

There is global urgency to limit warming well below 2°C and it will require substantial changes over the next decades, specifically targeting net zero in the global electricity system between 2045 and 2055. Pathways to NZE will be diverse, depending on country needs and circumstances, but all countries share common aims and challenges during the transition — to make sizable reductions in fossil fuel use, to shift towards low- and zero-carbon energy sources, and to make electrification widespread in end uses and increase use of alternative energy carriers.

As the first regulation that outlines the trajectory of Indonesia's power system, the release of RUKN 2024-2060 cemented Indonesia's commitment to achieve NZE by 2060. RUKN 2024-2060[3] outlines the targets to deploy a mix of renewables, and includes general directions stipulated for fossil fuel-based power plants, specifically coal, gas, and diesel.

Presidential Regulation No. 112 Year 2022 remains the main guideline for coal power development, specifying the entire coal fleet to be retired by 2050 and limiting new capacity additions to projects listed in the prior electricity supply business plan, *Rencana Usaha Penyediaan Tenaga Listrik* (RUPTL) and plants integrated to strategic industries. The latter, referred to as captive coal power, has been looming large particularly in the past five years.

Fuel switching to ammonia, biomass, and possibly nuclear through retrofitting is mentioned as preferred transition strategy for coal fired power plants (CFPPs), citing lower costs compared to decommissioning, and explicitly pointing to the need to prioritise power supply security and resilience.[4] The same strategy is mentioned for gas-fired power plants on the grounds of reducing base operating costs and meeting the needs of inertia, peaks and followers in the electrical system. Additionally, **a target phase-out of diesel power plants by 2033** is mentioned, to be replaced with interconnection to larger power systems, new and renewable power plants, or conversion to alternative fuels.

RUKN 2024-2060 outlines 13 sources of electricity production in 2060:

- dispatchable fossil fuels from (7) coal co-fired with biomass, equipped with carbon capture and storage (CCS), (8) gas, (9) gas equipped with CCS;
- dispatchable renewables from (4) hydropower, (5) geothermal, (6) bioenergy;
- VRE from (1) solar, (2) wind, and (3) ocean;
- dispatchable new, alternative sources from (10) ammonia, (11) hydrogen, (12) waste heat, (13) nuclear.

[3] Legalised in the Ministerial Decree of Energy and Mineral Resources No. 314.K/TL.01/MEM.L/2024
[4] Mention of rotational inertia that would be gradually reduced as VRE displaces conventional generating units – a technical challenge requiring close cooperation between policymakers, technology providers, and experts to inform policies and decarbonisation pathway

Among numerous energy system models developed in the IPCC AR6 scenarios for Indonesia, one scenario for fossil-free and cost-effective power generation is selected for further review. JETP CIPP's projection for on-grid capacity and power generation mix in 2050 is also taken into account as reference. To note, the IPCC AR6 scenario in review excludes fossil fuels entirely, as well as ammonia, hydrogen, and ocean, while JETP CIPP includes gas in the mix, and also hydrogen.

Figure 3 shows the distribution shares in the capacity and generation mix when Indonesia would achieve NZE in power generation. **The immediate, striking observation is the low ambition for solar capacity in the RUKN's base scenario, being only 40% to the targets set in both JETP CIPP for on-grid integration by 2050 and in IPCC AR6 for a fossil-free 2060.** In spite of higher ambition in RUKN's green hydrogen scenario, the additional solar capacity in Nusa Tenggara, would be designated to green hydrogen production instead of contributing to the national VRE generation for the grid.

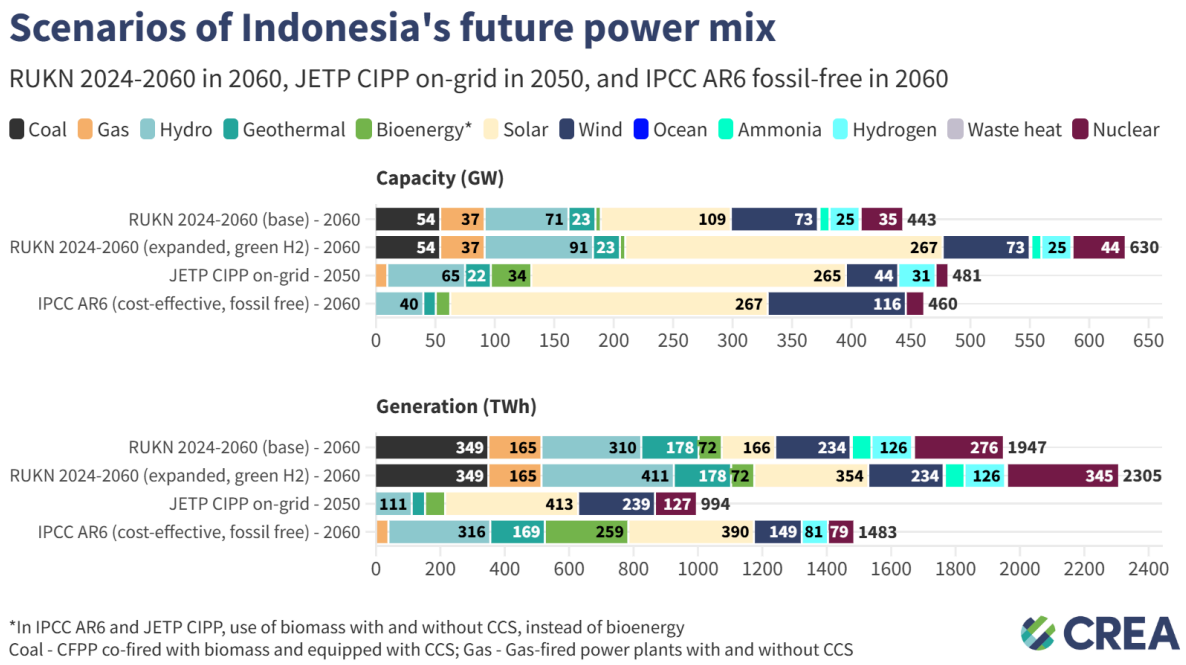

Figure 3. Capacity and generation mix projected for 2060 in RUKN 2024-2060, JETP CIPP for on-grid, and IPCC AR6 for a fossil-free and cost-effective energy system in Indonesia

Wind makes up a sizable portion in the IPCC AR6's scenario after solar — over 1.5 times the planned capacity in RUKN. This indicates an opportunity to further expand wind ambition, noting ¾ of the modeled wind power capacity tagged for onshore wind farms (89 GW) and the remaining for offshore (27 GW). Meanwhile, JETP CIPP targets 44 GW in 2050, a much smaller portion of solar, citing limited resource availability and needing to install low-speed turbines in many locations.

A recent publication on Indonesia's wind power investment plan cites a total potential of 155 GW — 61 GW onshore and 94 GW offshore and discusses challenges behind the low uptake. The limited availability of long-term and spatial wind data is identified as the first challenge to be immediately addressed in order to lower the risk profile for developers and investors and create an enabling environment for investors.

Finally, the 2060 projected mix in the RUKN shows an oversized share for dispatchable power generation, implying plenty of scope to explore cost-effective pathways, which require a VRE share that is at least twice as high. The base scenario shows a 79% contribution from dispatchable power sources — 26% from fossil-based and 53% from new and renewable energy, and the remaining 21% from VRE (solar, wind, and ocean). Studies indicate that the cost-optimal share of VRE in the 2050 global power generation would ideally fall between 45 to 74%. The International Energy Agency's (IEA) Announced Pledges Scenario also highlights Indonesia's VRE generation share reaching 60% in the annual 2050 generation mix, and emphasises a diverging mix at the peak which requires sufficient dispatchable capacity when the VRE share from solar and wind drops to 10%, with a negligible solar contribution.