

Indonesia Power Sector Action Plan

Towards an Inclusive and Net-Zero Power System

Abbreviation List

CCS	carbon capture and storage
CCUS	carbon capture, utilisation and storage
DEN	Dewan Energi Nasional
GW	gigawatt
IRENA	International Renewable Energy Agency
KEN	national energy policy (Kebijakan Energi Nasional)
km	kilometre
kVA	kilovolt ampere
kW	kilowatt
kWh	kilowatt hour
LisDes	rural electrification (Listrik Desa)
MEMR	Ministry of Energy and Mineral Resources
MNPT	Maluku, Nusa Tenggara and Papua

PES	Planned Energy Scenario
PLN	PT Perusahaan Listrik Negara
PV	Photovoltaic
PSO	Public Service Obligation
RPJMN	National Medium-Term Development Planning (Rencana Pembangunan Jangka Menengah Nasional)
RUED	Regional Energy Plan (Rencana Umum Energi Daerah)
RUEN	General Plan for National Energy (Rencana Umum Energi Nasional)
RUKN	General Plan for National Electricity (Rencana Umum Kelistrikan Nasional)
RUPTL	National Electricity Supply Business Plan (Rencana Usaha Penyediaan Tenaga Listrik)
SWIFT	Specialised Workforce for Indonesia's Future Transition in Energy
TBBM	Fuel Terminal (Terminal Bahan Bakar Minyak)

TES	Transforming Energy Scenario
TFEC	Total Final Energy Consumption
VRE	variable renewable energy
1.5-S	1.5 Degree Scenario

Indonesia at a Glance

- The 2025 Indonesia Energy Outlook projections are made in 7 regions, namely: Sumatera, Java-Bali, Kalimantan, Sulawesi, Nusa Tenggara, Maluku, and Papua.

"World's 4th largest population, archipelago of 17,000+ islands — the planning challenge is geographic before it is technical"

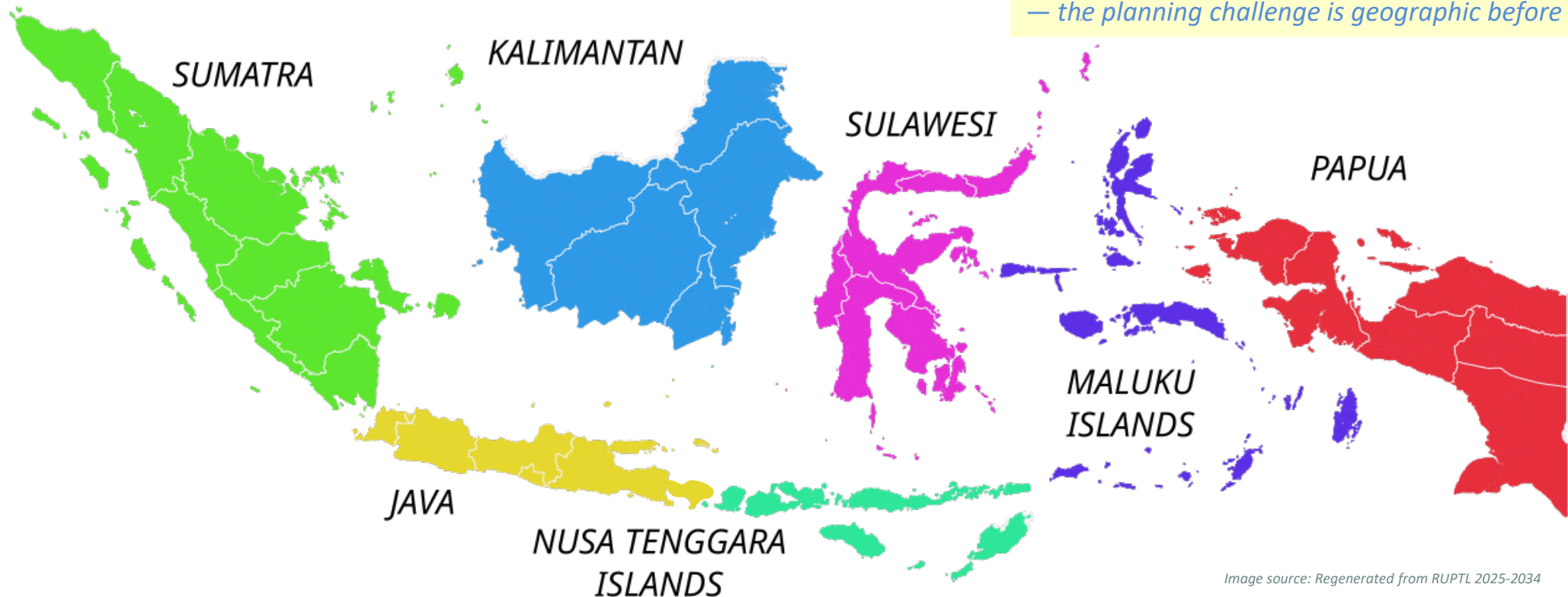


Image source: Regenerated from RUPTL 2025-2034

- Population: 280M
- GDP growth target: 8% in 2029
- Electrification ratio: ~99.8%
- Power Plant Capacity: 101 GW

Action Plan Framework

- Translating national energy policies into executable sectoral action



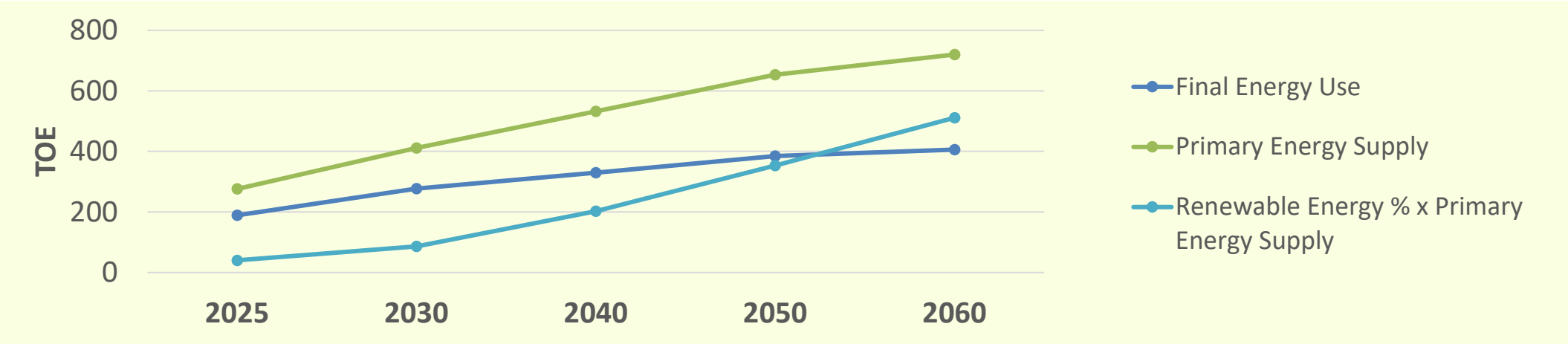
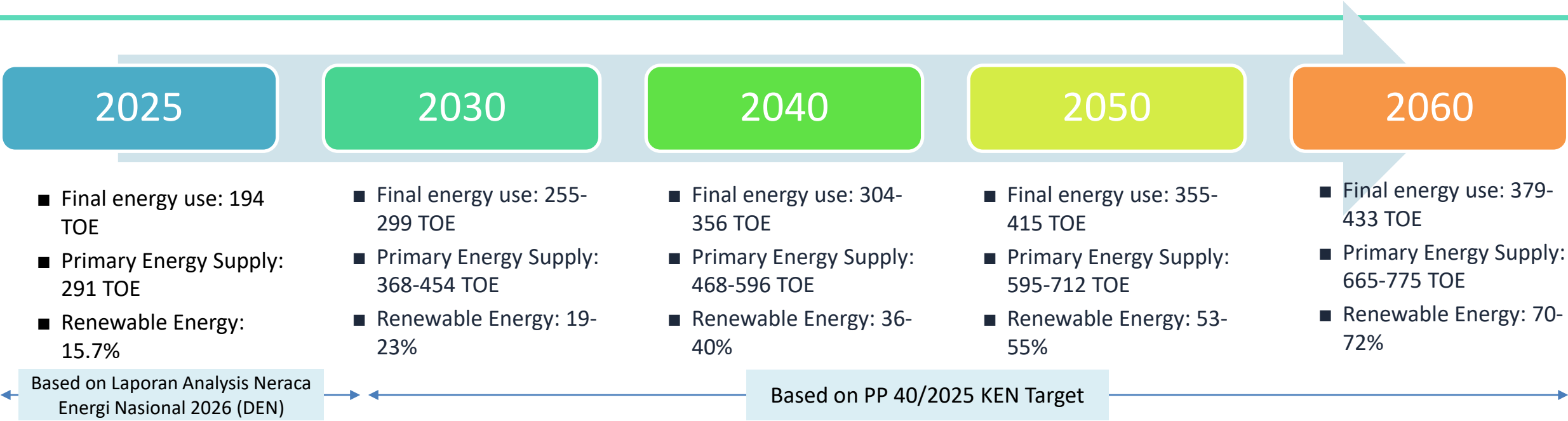


Indonesia

INDONESIA'S ACTION PLAN

PLANNING

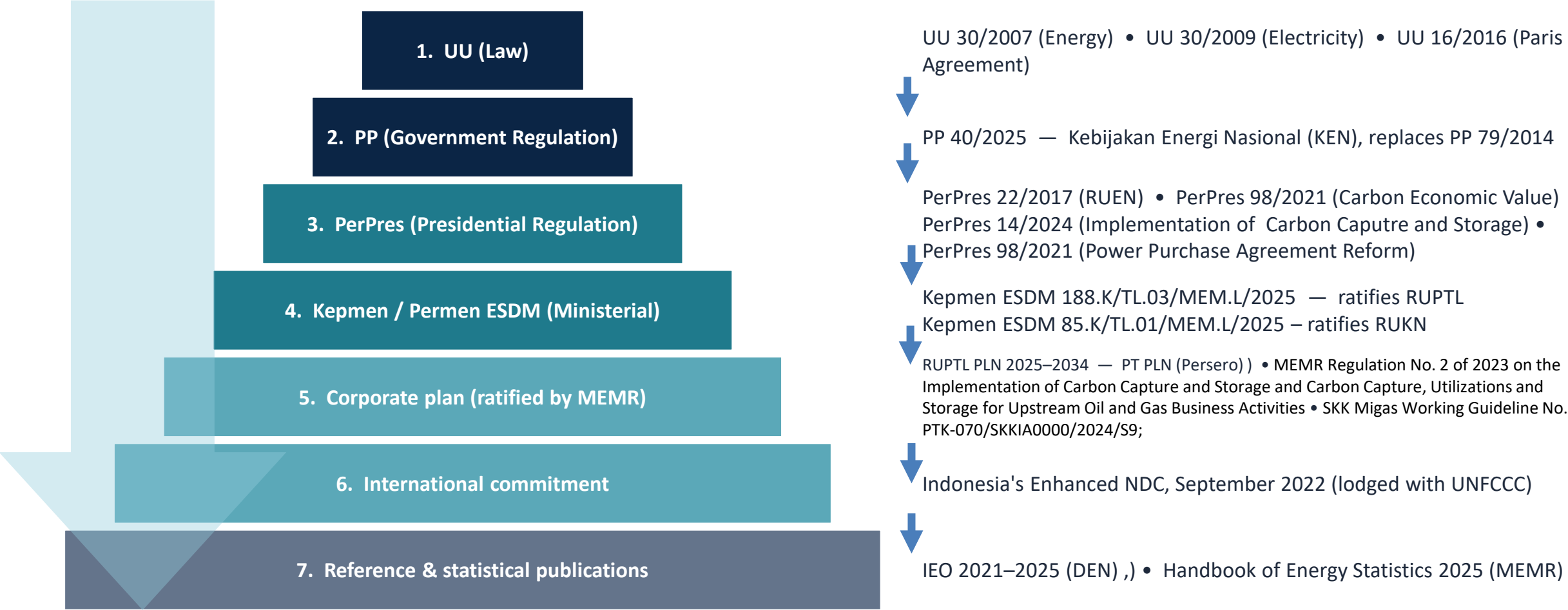
Vision and Ambition: KEN 2025



Source: PP 40/2025 KEN, Laporan Analisis Neraca Energi Nasional 2026

Indonesia Planning Hierarchy

Legal hierarchy — from Law to official reference sources

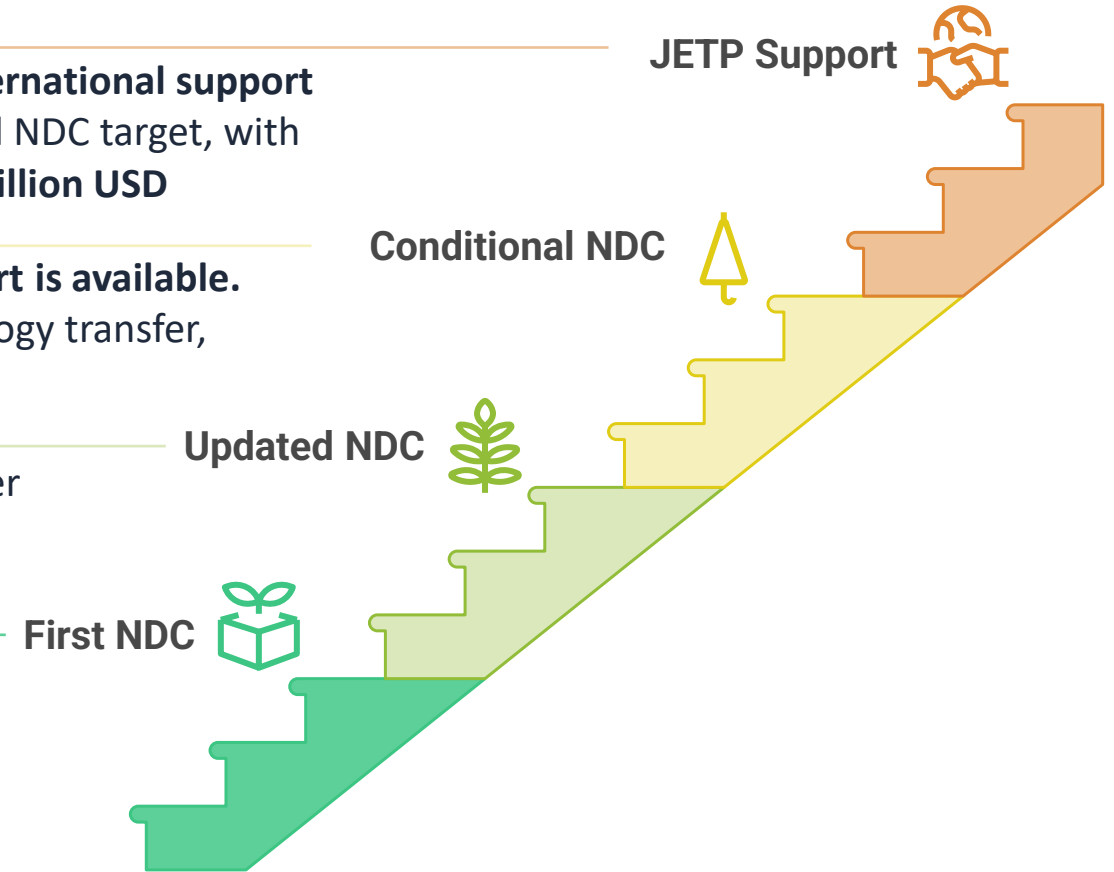


Reference publications inform but do not bind higher-tier instruments. The new RUEN aligned to PP 40/2025 is being drafted by MEMR.

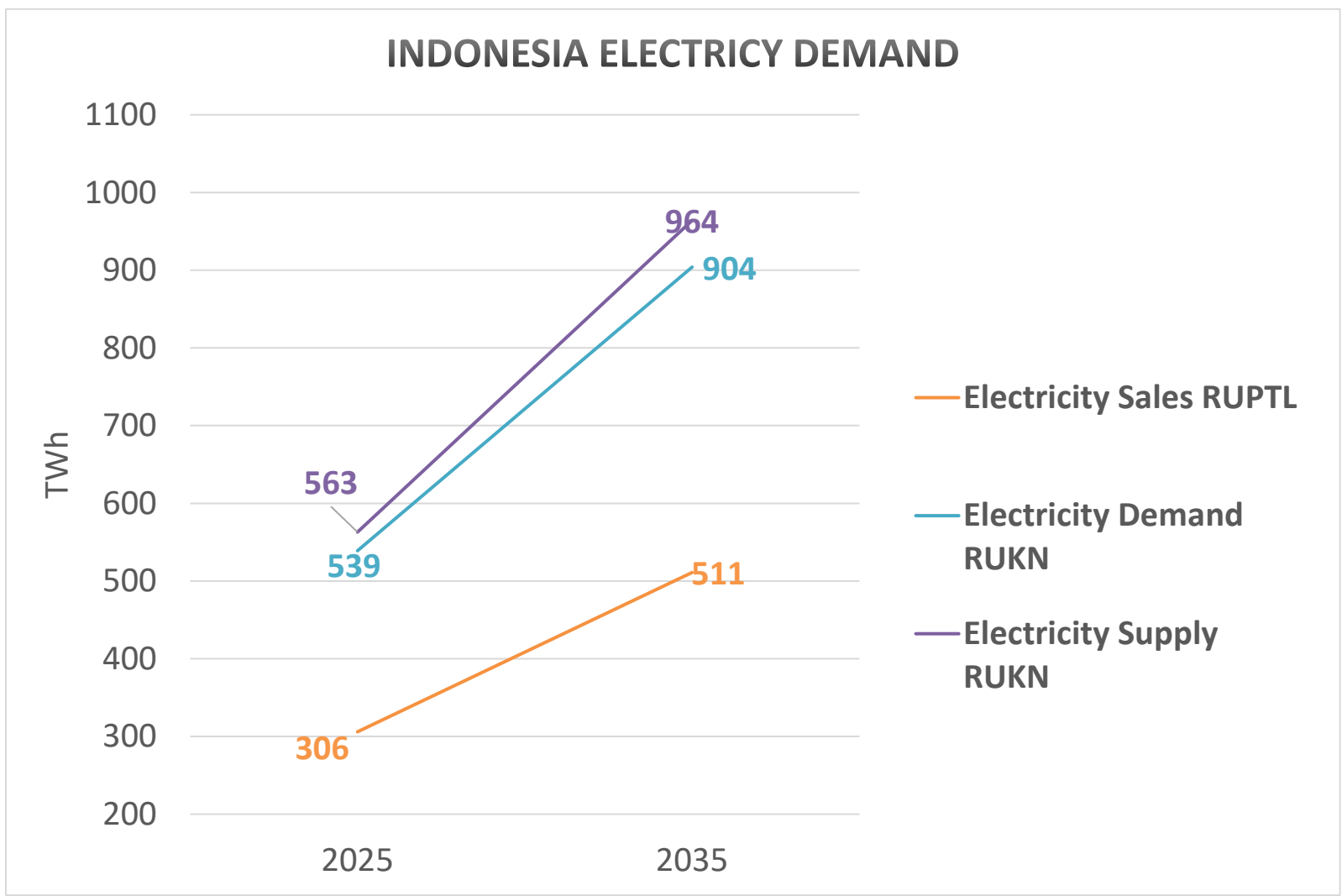
Climate alignment: NDC 2022 and the energy sector

Achieving Indonesia's Climate Goals

- **JETP** (Just Energy Transition Partnership) is essentially one of the main **international support mechanisms** intended to help Indonesia achieve the conditional Enhanced NDC target, with **committed support in the power and energy sector** approximately **21.6 billion USD**
- a more ambitious target that Indonesia can achieve if **international support is available**. Support may include climate financing, grants/concessional loans, technology transfer, capacity building, international cooperation
- Indonesia submits **Enhanced NDC** to the UNFCCC Secretariat by September 2022 with increased emission reduction to **31.89% unconditionally** and **43.20% conditionally**.
- Indonesia submits **first NDC** to the UNFCCC Secretariat in November 2016 with emission reduction target from **29% unconditionally** and **41% conditionally**



Demand Outlook to 2034



Source: RUPTL 2025–2034, and RUKN

- **RUPTL** develop projection for **electricity sales** based on economic growth of 5.2% per year for the next 10 years.
- **RUKN** develops projections for **electricity demand** based on economic and population growth, electricity tariffs, and additional electrification driven by national development and the NZE 2060 energy transition
- **Main driver demand: industry (28%) and household (28%)**
- **Main source for supply: coal (50%) and gas (19%)**

Rapid electricity demand growth will require simultaneous expansion of generation, transmission, and system flexibility to maintain reliability while supporting Indonesia’s energy transition.

- Excess power is needed for reserve margin* (capacity minus demand)

Note: *assumption

Sectoral Growth Analysis

- Future energy demand will mainly be driven by **industry, transport, and buildings**.
- Industry remains the largest consumer, transport continues to grow despite electrification, and buildings see increasing electricity demand from cooling and household use.



Industry

- Largest future electricity demand
- Smelters and manufacturing growth
- Partial fossil fuel dependence remains



Transport

- EV adoption increases electricity demand
- Oil remains dominant for heavy transport



Buildings

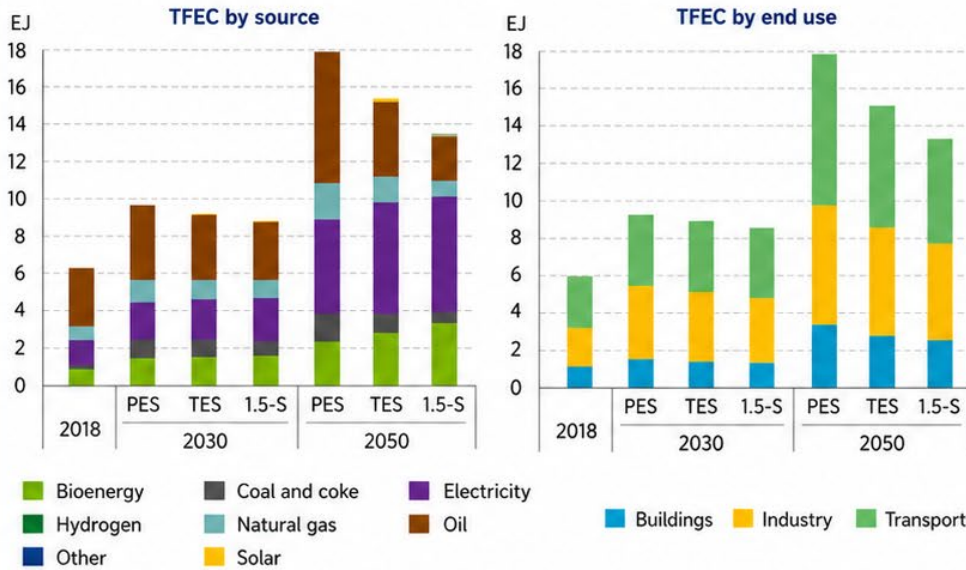
- Cooling becomes the fastest-growing load
- Greater electrification of households



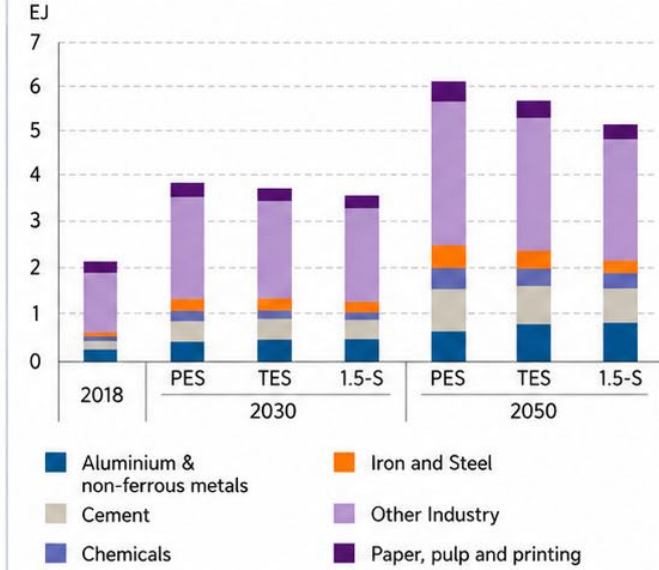
System Implication

- Electricity becomes the dominant energy carrier
- Requires renewables, storage, and stronger grids

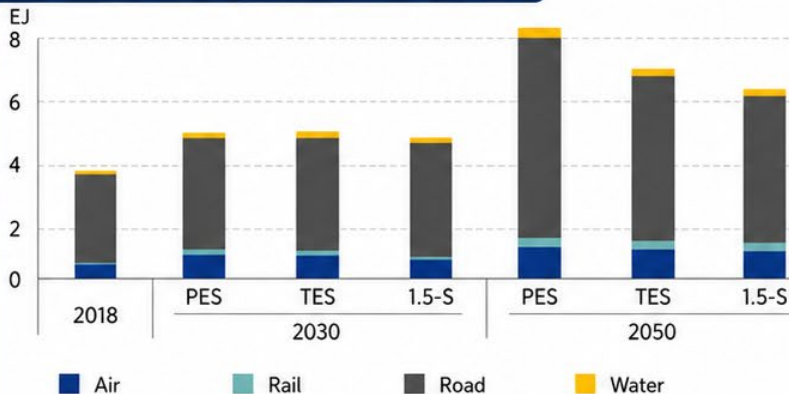
A. TFEC by source and end use, Indonesia, 2018–2050



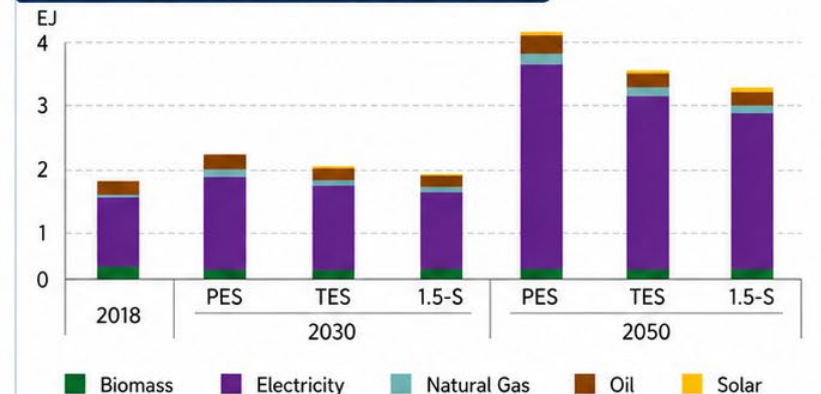
B. Industry energy consumption by sub-sector



C. Transport energy consumption by mode



D. Building energy consumption by carrier



Generation Pathway: The RUPTL 2025–2034 Plan

The RUPTL 2025–2034 ARED (Accelerated Renewable Energy Plan)

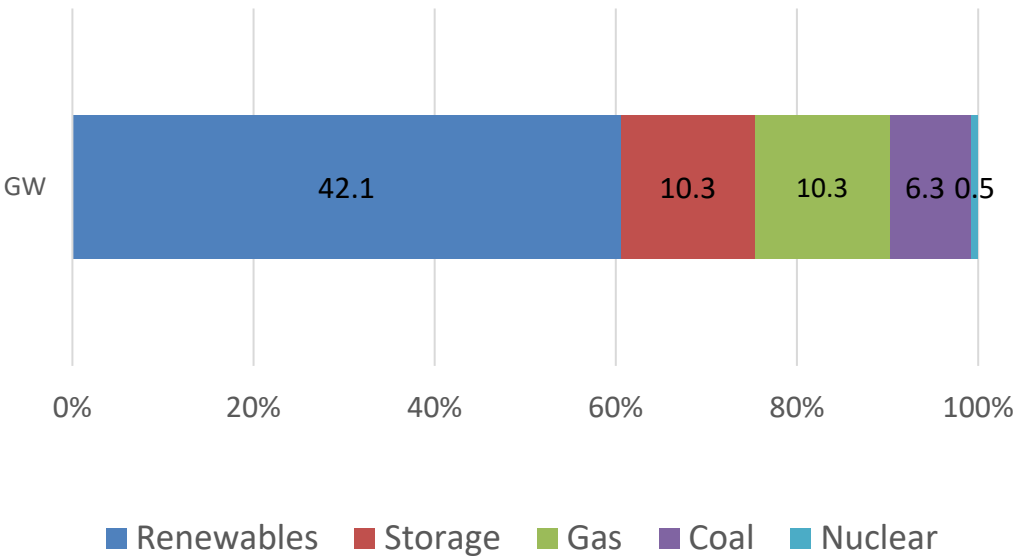
Planned Additions Renewable Energy & Storage

Increased from
5.3 GW in 2025
to 69.5 GW in
2034.



76%

69.5 GW in 2034 Indonesia's Energy Plan



Renewable Share of Generation by 2034

Increased from
12% in 2025 to
34% in 2034.



34.3%

IPPs Deliver New Capacity Additions

71% of new
capacity is
expected to come
from IPPs.

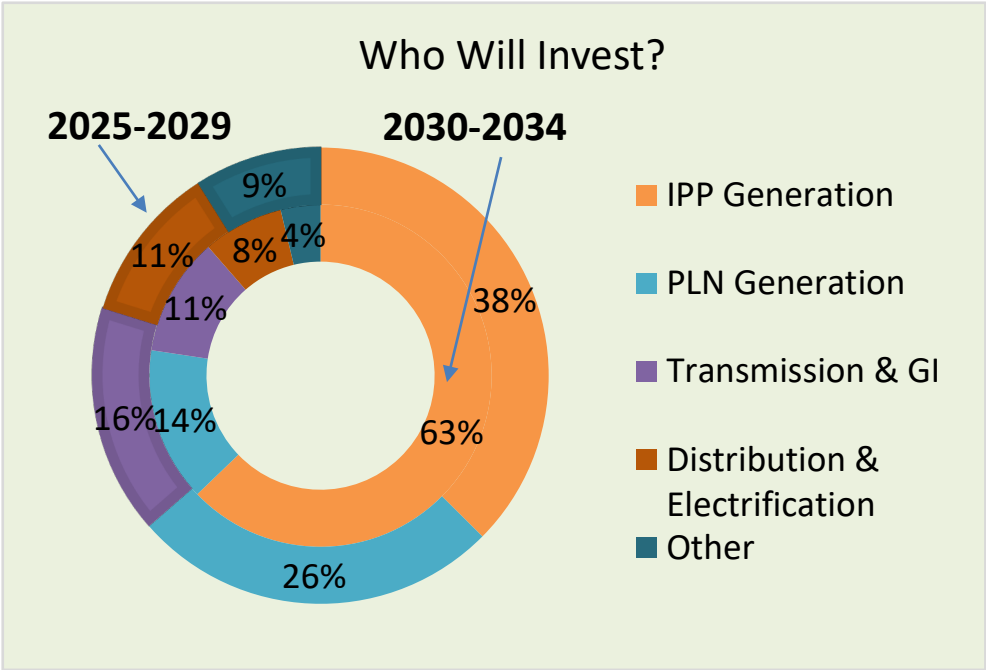
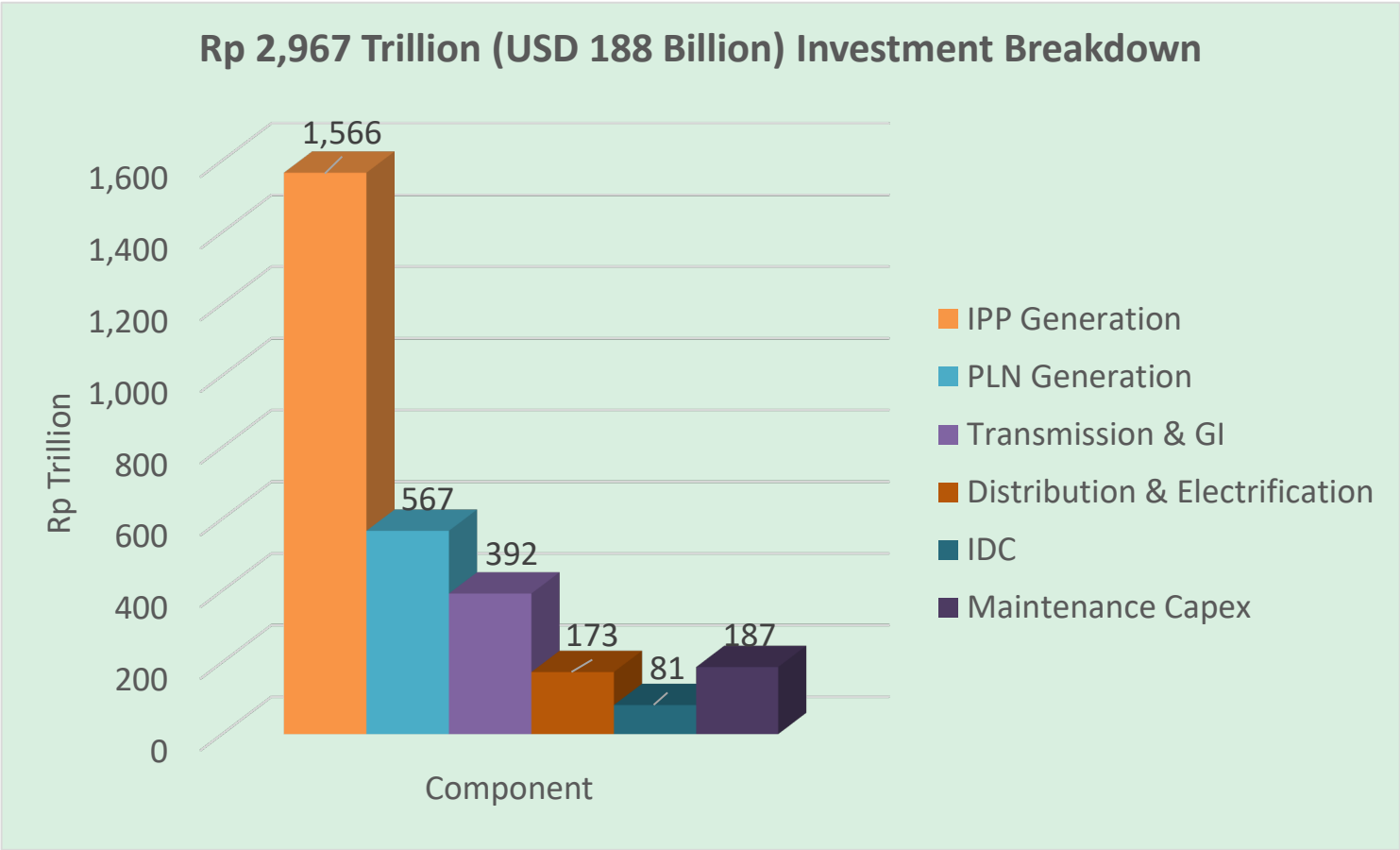


71%

■ The RUPTL 2025–2034 shifts Indonesia's power sector expansion toward renewables and storage, while relying heavily on private investment to deliver new capacity and support NDC-aligned decarbonization.

Investment Plan / Financing Indonesia's Power Transition

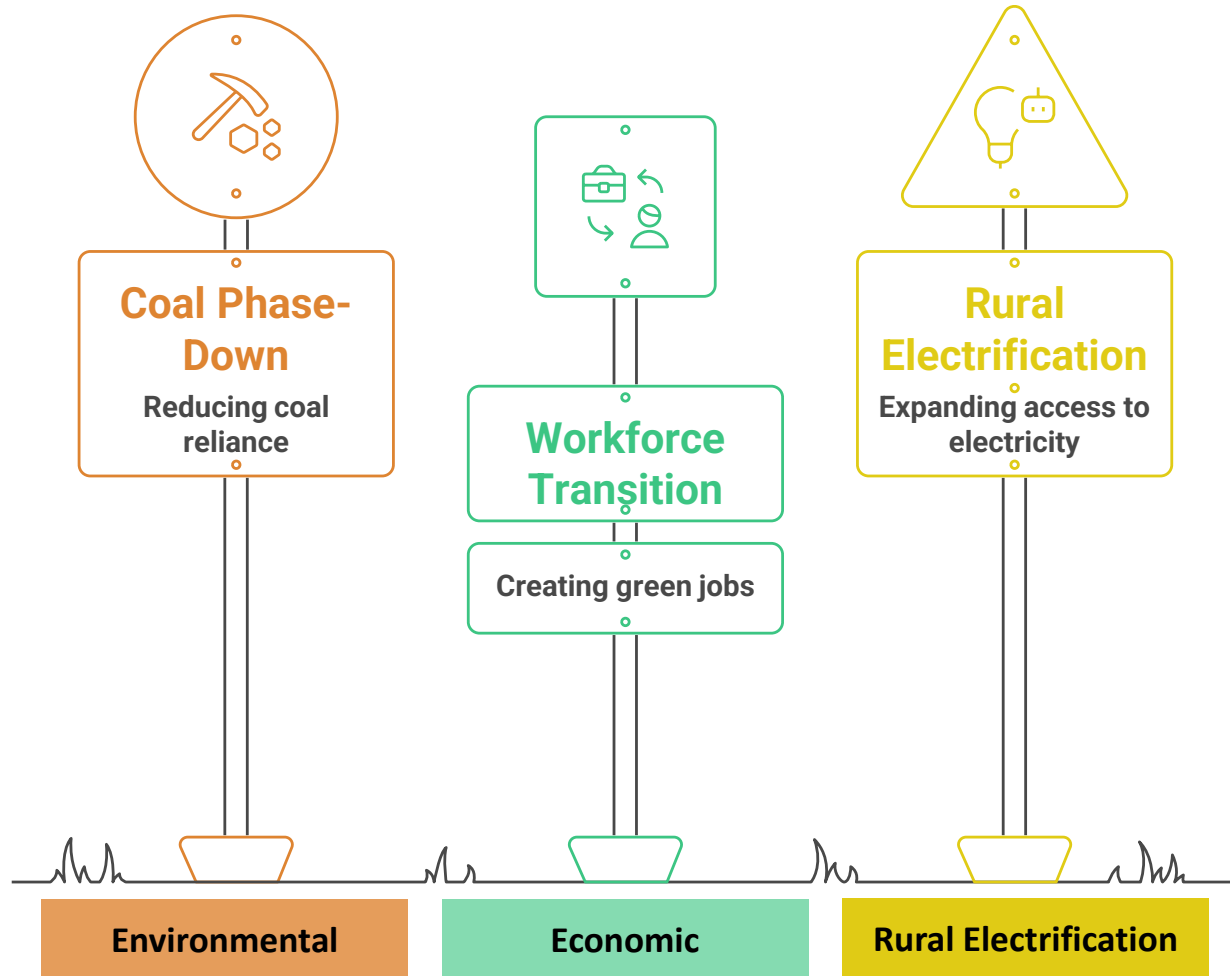
■ Rp 2,967 trillion (USD 188 billion) required to deliver the RUPTL 2025–2034 expansion program.



Note:

- IPP = Independent Power Producer
- GI = Gardu Induk / Substation
- IDC = Interest During Construction

Indonesia's Energy Transition Challenges



- **Coal remains part of the power system in the medium term** but progressively declines toward the NZE pathway. Based on KEN PP 40/2025 **coal share declines from 41% in 2030 to 8-12% by 2060**
- **Renewable energy deployment**, storage systems, and grid expansion are expected to create approximately **1.7 million jobs** (based on RUPTL), with the vast majority associated with clean energy technologies.
- Energy transition is not only about reducing emissions but also improving electricity access and development outcomes. **The RUPTL includes a dedicated rural electrification program to expand access to electricity in underserved communities across the archipelago.**

Note:

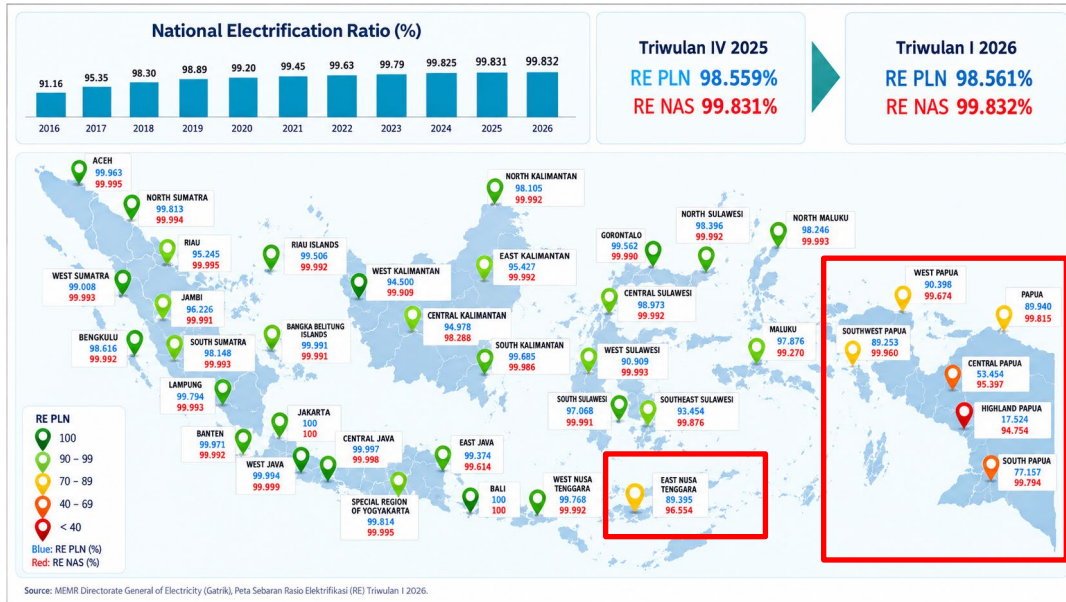
- KEN = Kebijakan Energi Nasional / National Energy Policy
- PP = Peraturan Pemerintah / Government Regulation

Just Transition and Labor (SWIFT Project)

- **SWIFT (Specialized Workforce for Indonesia's Future Transition in Energy)** project, is a national roadmap for developing a skilled workforce to support Indonesia's energy transition (2025–2060)
- Developed by the Ministry of Energy and Mineral Resources (**MEMR/BPSDM ESDM**) with support from the Energy Transition Partnership (**ETP**) and **UNOPS**.

Pillar	2025–2030	2031–2045	2046–2060
A. Institutional Strengthening	Establish national coordination body and governance framework	Strengthen regional coordination and policy integration	Institutionalize monitoring and continuous policy improvement
B. Training & Certification	Update competency standards and launch digital learning & certification	Expand training centers and instructor capacity	Continuous upskilling aligned with emerging green technologies
C. Green Labor Market Information (LMIS)	Develop national Green LMIS and workforce database	Integrate labor market forecasting into workforce planning	Real-time labor market intelligence supporting policy decisions
D. Inclusive Workforce Development	Pilot inclusive training programs in transition regions	Expand participation of women, youth, and vulnerable groups	Ensure equitable access to green jobs nationwide
E. Green Skills Investment	Mobilize public and private investment for green skills	Link training investments with industry demand	Sustainable financing mechanism for lifelong green skills development
F. Partnerships	Build government–industry–academia collaboration	Align curricula with industry needs and expand international cooperation	Establish Indonesia as a regional hub for green workforce development

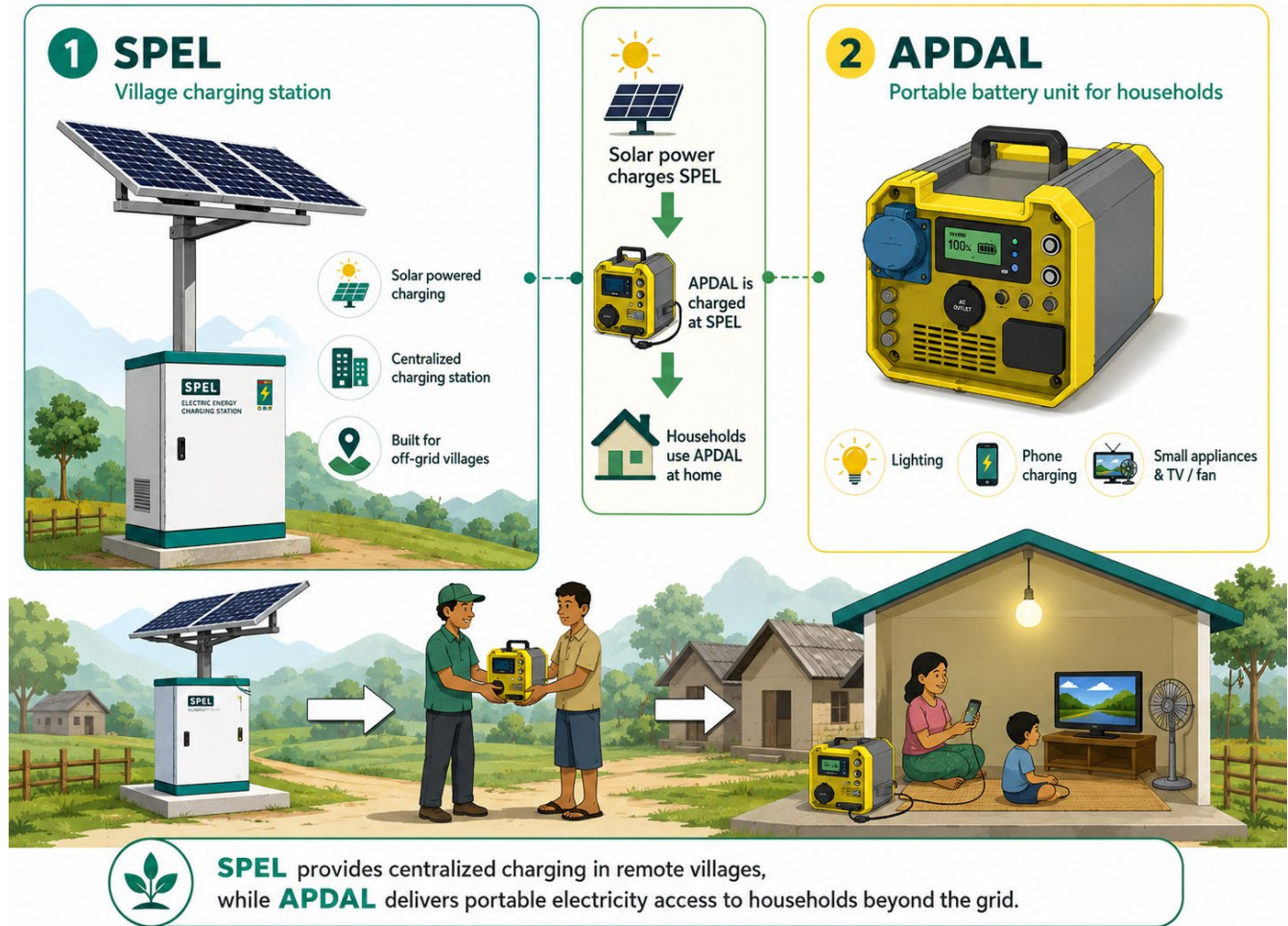
Energy Access and Inclusion



Lisdes 2025–2029: 5,758 villages | 394 MW | 780k connections

- High national electrification, but uneven access remains
- Priority regions: Papua, Maluku, Nusa Tenggara, remote Kalimantan
- Access must be **inclusive**: women, low-income households, indigenous communities
- Affordability matters: electricity and LPG subsidies remain central to equitable transition

SPEL and APDAL for rural area in Papua, that aren't connected to the grid





Indonesia

INDONESIA'S ACTION PLAN

BUILDING

Renewable Scale-Up: Solar at the Front

Solar is the largest renewable addition under the RUPTL. Cirata demonstrates deployment readiness, while TKDN supports domestic manufacturing.

South East Asia Largest Floating PV

- Built in 2022
- 192 MWp (145 MWac), operational since 2023
- Demonstrates the viability of large-scale floating solar



Image source:
https://id.wikipedia.org/wiki/Berkas:PLTS_Cirata_Jelang_Uji_Coba.jpg

Next Plan

- Target for 2034, 17.1 GW utility-scale solar + 3 GW rooftop quota
- Expansion of floating PV across major reservoirs in Java and Sumatera Island (e.g., Gajah Mungkur, Karangates, Saguling, Jatiluhur, Kedung Ombo, Koto Panjang).

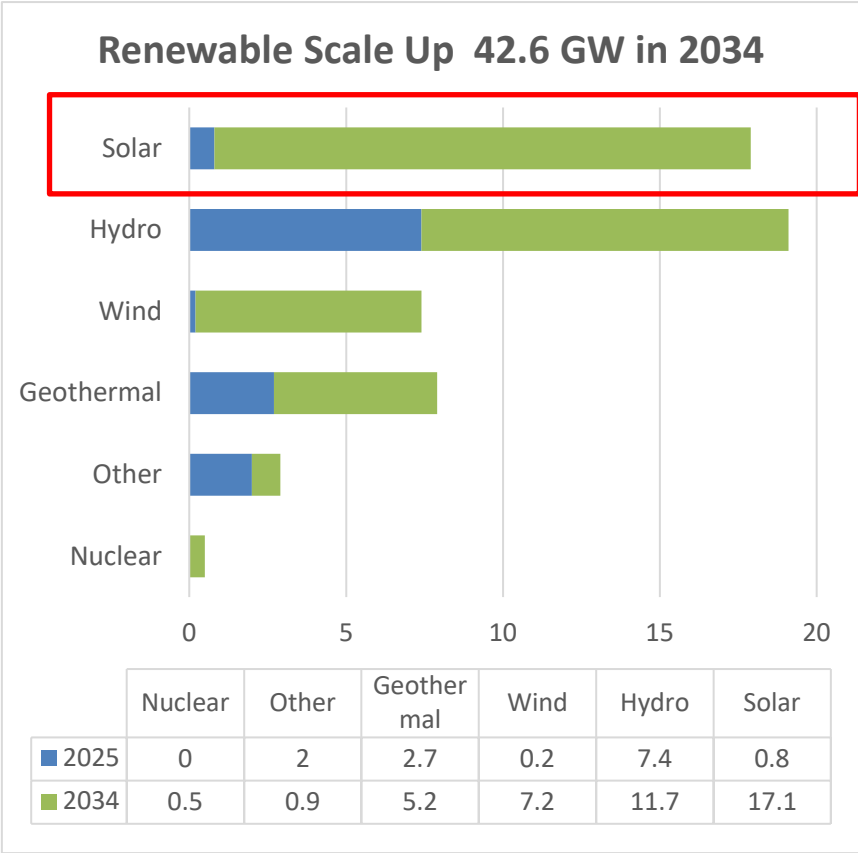
Permen ESDM 11/2024 on TKDN

Opportunity (+)

- Accelerates renewable deployment through temporary TKDN flexibility
- Builds Indonesia's renewable manufacturing industry
- Increases local investment and job creation

Constraint (-)

- Domestic manufacturing capacity is still developing
- Limited availability of TKDN-compliant equipment may delay projects
- Some advanced technologies still rely on imports



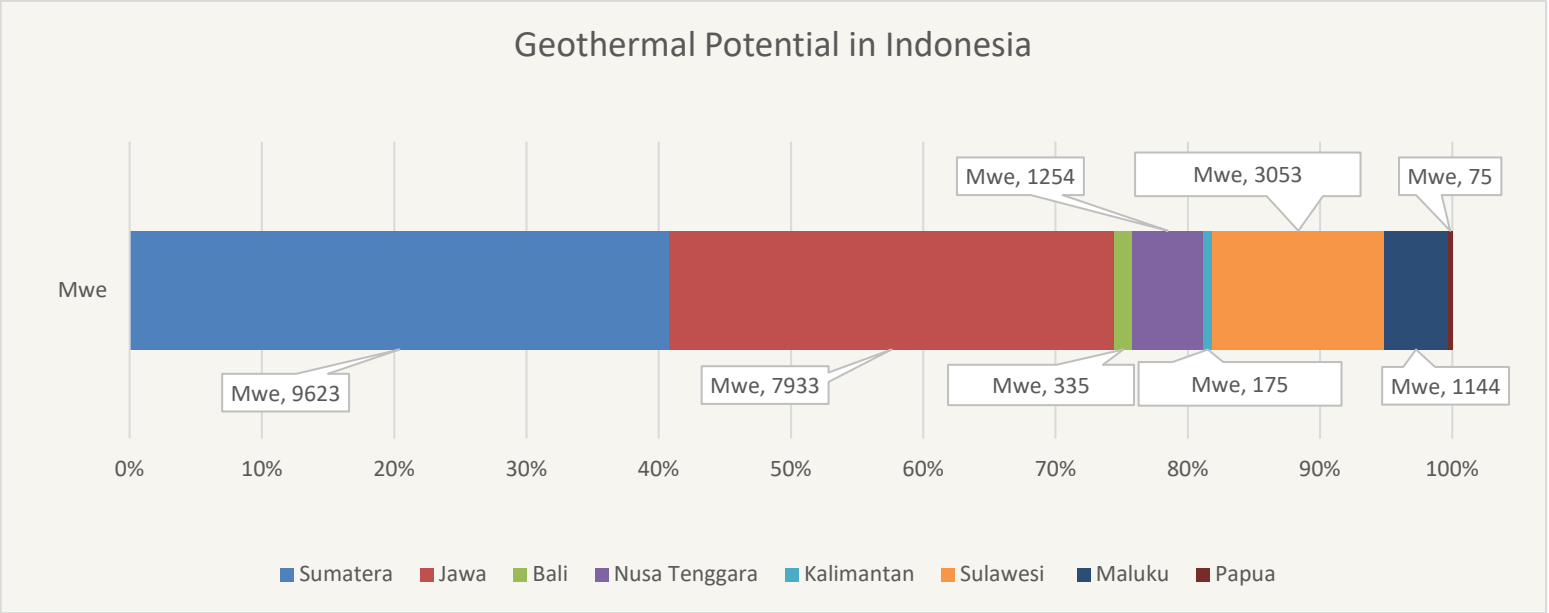
Note:

- TKDN = Tingkat Komponen dalam Negeri / Domestic Component Level

Renewable Scale-Up: Geothermal, Hydro, Wind, Bio

Geothermal Potential

- Based on MMER (Ministry of Energy and Mineral Resources) data in 2025, total potential of geothermal resources is 23.742 MWe.
- **With 2,776 MW of installed capacity as of year-end 2025**
- Require continued regulatory support and mechanisms to reduce exploration risks, helping attract greater private investment in geothermal development.



Hydro, Wind, and Bio

- Most new hydropower projects are planned in collaboration with PUPR using existing dam infrastructure. But there are some constrained in terms of permit, land acquisition, and construction complexity.
- For wind, several location resources have been identified across Sumatera, Jawa, Kalimantan, Sulawesi, Nusa Tenggara, and Maluku. This project is still on assessment, because the fluctuation of generating electricity, and requires flexible grid and back up powerplant.
- For other/bioenergy, with 0.9 GW based on RUPTL, deployment of coal co-firing program is the primary strategy for accelerating biomass utilization in existing coal-fired power plants.

Note:

Source: RUPTL 2025-2034

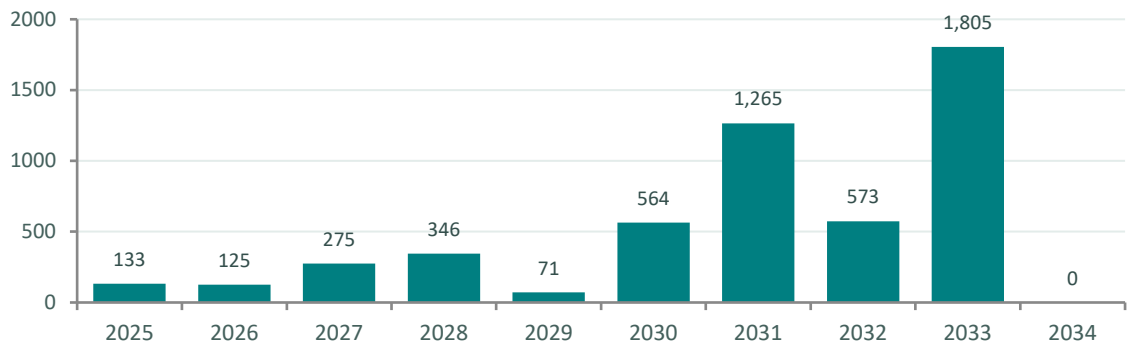
• PUPR = Ministry of Public Works and Housing

Geothermal Scale-Up: Capacity Target to 2034

Indonesia's estimated geothermal potential is 23,203 MW. Of that, 2,776 MW is in operation today. The RUPTL 2025–2034 plans to add a further 5,157 MW, which would give Indonesia the largest geothermal fleet in the world by 2030. (MEMR, Aug 2026; Badan Geologi MEMR, Dec 2025)

Planned capacity addition by year (MW)

Source: MEMR, Aug 2026; RUPTL PLN 2025–2034



PLTP Patuha, West Java. Photo: MEMR (esdm.go.id)

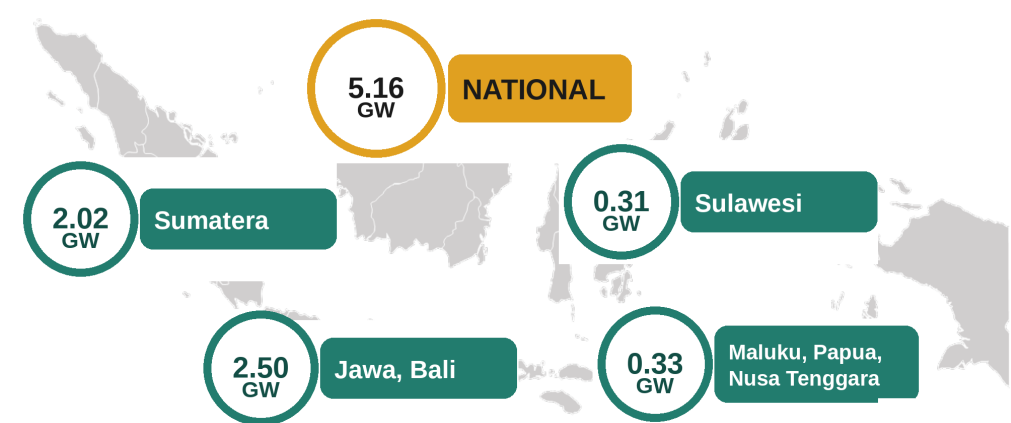
Delivery profile

- Most of the capacity arrives late.
- Only 950 MW is planned before 2030.
- The other 4,207 MW falls in 2030 to 2034.
- The biggest year is 2033, at 1,805 MW.
- Nothing is scheduled for 2034.

Source: MEMR, Aug 2026; RUPTL PLN 2025–2034

Where the 5,157 MW addition is targeted

Source: MEMR, Aug 2026; RUPTL PLN 2025–2034



23,742 MW

Total estimated geothermal potential, spread across 368 locations

MEMR, Dec 2025

2,776 MW

Installed and operating today, 11.9% of the estimated potential

Badan Geologi MEMR, Dec 2025

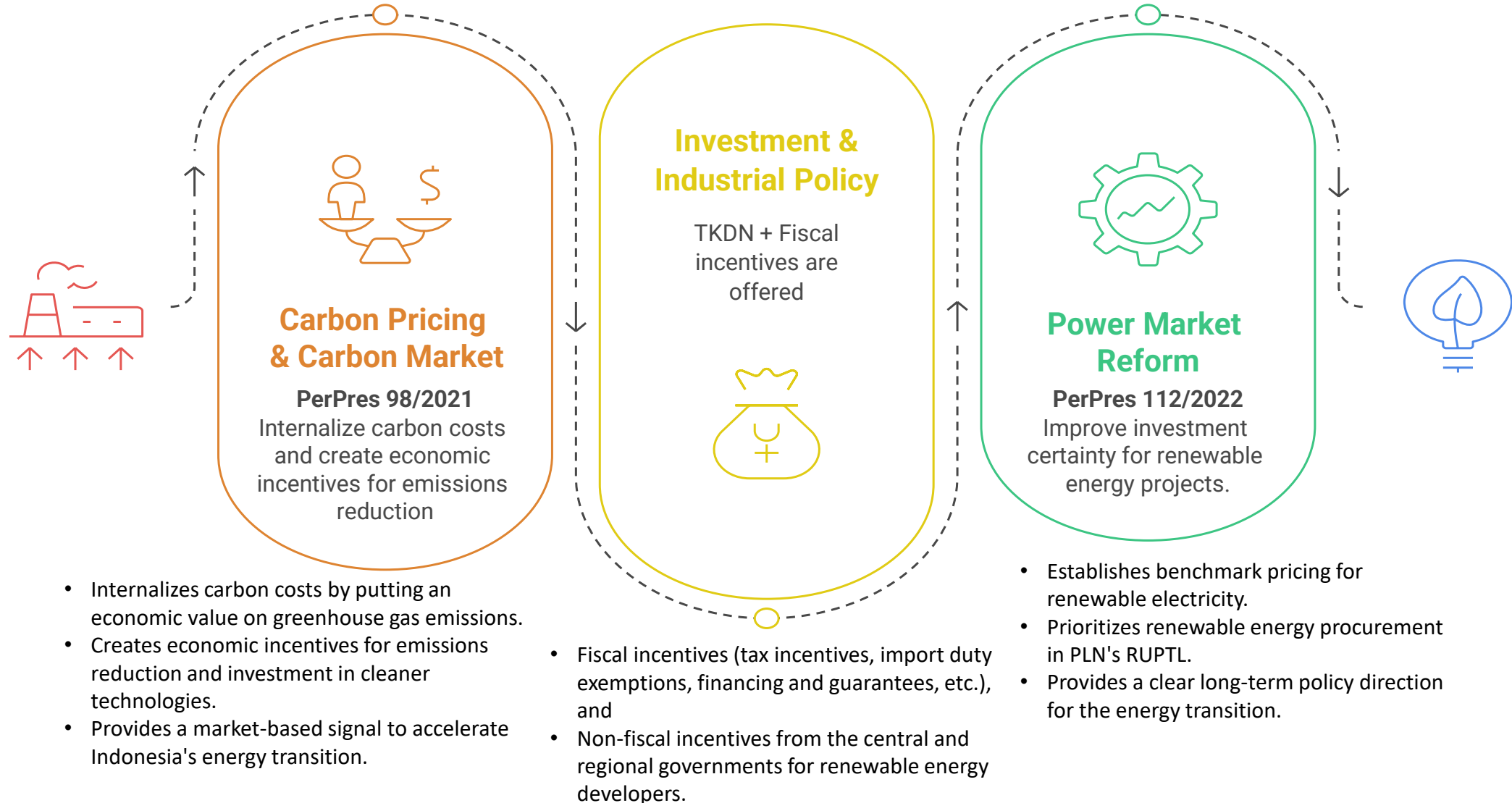
4.1 GW

Fleet projected for 2030, ahead of the United States at 3.9 GW

MEMR, Aug 2026

Note: the 23,203 MW potential and the 5,157 MW planned addition measure different things. The first is the estimated resource in the ground. The second is new power plant capacity, of which 950 MW falls in 2025–2029 and 4,207 MW in 2030–2034. United States comparison: ThinkGeoEnergy Research, January 2025, as cited by MEMR.

Economic Policies for Renewable Energy

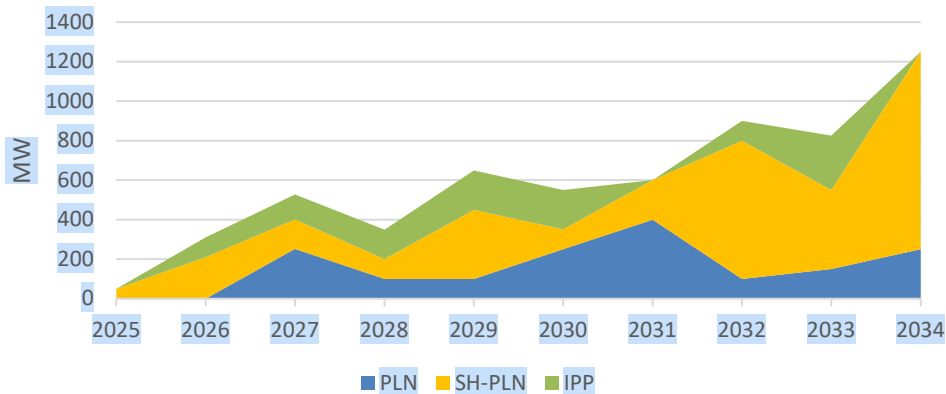


Storage Build: BESS + Pumped Hydro

10,256 MW

Total Energy Storage System (ESS) additions by 2034,
Ratified alongside 42,569 MW of new renewables (ARED scenario)
Delivered through two complementary technologies

Additional Power Generation - BESS
(ARED Scenario)



BATTERY ENERGY STORAGE SYSTEM (BESS)

Fast response, short duration

Two roles in the Indonesian system

- **Integrating variable renewables** on the main grids, absorbing rapid fluctuations from utility-scale solar and wind.
- **Stabilizing isolated and low-load-factor systems**, paired with hybrid PLTS + PLTD in areas with under 12 hours of daily operation, generally in Eastern Indonesia.

Source: RUPTL 2025 to 2034, Chapter III (VRE strategy, point 7)



PUMPED HYDRO STORAGE

Long duration, large energy shifting

Two roles in the Indonesian system

- **Daily peak balancing**, shifting large blocks of energy across hours to smooth out demand peaks on interconnected systems.
- **Absorbing surplus renewable generation**, storing off-peak solar, wind and hydro energy for release during evening peak, in regions with suitable elevation and water resources.

Source: RUPTL 2025 to 2034, storage additions grouped under total ESS

TWO ROLES FOR STORAGE IN INDONESIA

1

Enabling variable renewables on the main grids

Storage additions accompany the utility-scale solar, wind, and hydro build-out under the ARED scenario. Regional and annual storage additions are documented in the regional tables (5.84 to 5.127).

Source: RUPTL 2025 to 2034, Chapter V.5.7

2

Stabilizing isolated and low-load-factor systems

The RUPTL prioritizes hybrid **PLTS (solar Power Plant) + PLTD (Diesel Power Plant)** development in areas with low operating hours (under 12 hours per day), equipped with batteries or BESS to keep voltage stable. This applies generally to Eastern Indonesia and isolated systems.

Source: RUPTL 2025 to 2034, Chapter III strategy point 7

First-Time Inclusion: Nuclear

Nuclear Potential

- Indonesia has identified approximately 5,234 tonnes of uranium (U_3O_8) and 4,729 tonnes of thorium resources, primarily located in **Bangka Belitung** and **West Kalimantan**.

Policy and Regulatory Framework

- Nuclear energy is included in the RPJPN 2025–2045 as part of Indonesia's long-term strategy to diversify the energy mix and achieve decarbonization targets.
- RUKN 2025–2060 and RUPTL 2025–2034 establish the roadmap for the first nuclear power plant deployment.

Infrastructure Readiness

- Indonesia has **completed 16 of 19 IAEA nuclear infrastructure milestones** and is currently in the pre-decision/evaluation phase toward NPP implementation.
- Remaining milestones focus on institutional, regulatory, and implementation readiness.
- The use of nuclear power plant technology in Indonesia is not limited to small modular reactor technology and capacity, but also includes other nuclear power plant technologies and capacities (large-scale, medium-scale, pressurized water reactors (PWR), boiling water reactors (BWR), floating, land-based, etc.).

Source: RUKN 2025, RUPTL 2025-2034



Infrastructure Readiness

- BATAN/BRIN has identified **28 potential NPP sites**, with an estimated development **potential of up to 70 GW**.
- The **first deployment** phase is planned in the **Sumatra and Kalimantan** power systems for 2032 (based on KEN).

The Green Enabling Super Grid (Transmission Backbone)

The Green Enabling Super Grid enables large-scale renewable integration by connecting resource-rich regions with major demand centers.

Green Enabling Super Grid

- Increase renewable energy utilization
- Improve power system reliability
- Strengthen inter-island transmission
- Connect renewable resource areas to demand centers



Total:
47,758 km
transmission +
107,950 MVA
substations

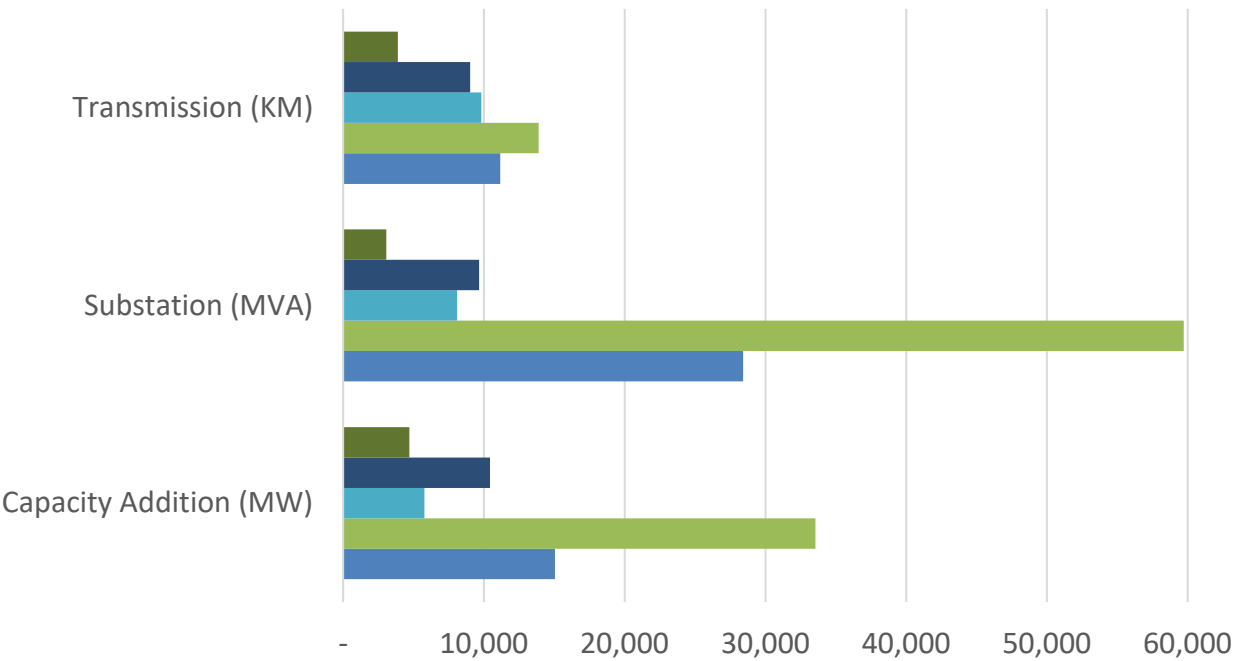
- 1 Export hydro & geothermal surplus to Java
- 2 Export hydropower to Java

- 3 Integrate Solar and Wind Resources
- 4 Sulawesi Backbone

- 5 Share Surplus Renewable Energy
- 6 Support Industrial and Data Center Demand

Regional Grid Build-Out

Regional Grid Build-Out (RUPTL 2025-2034)

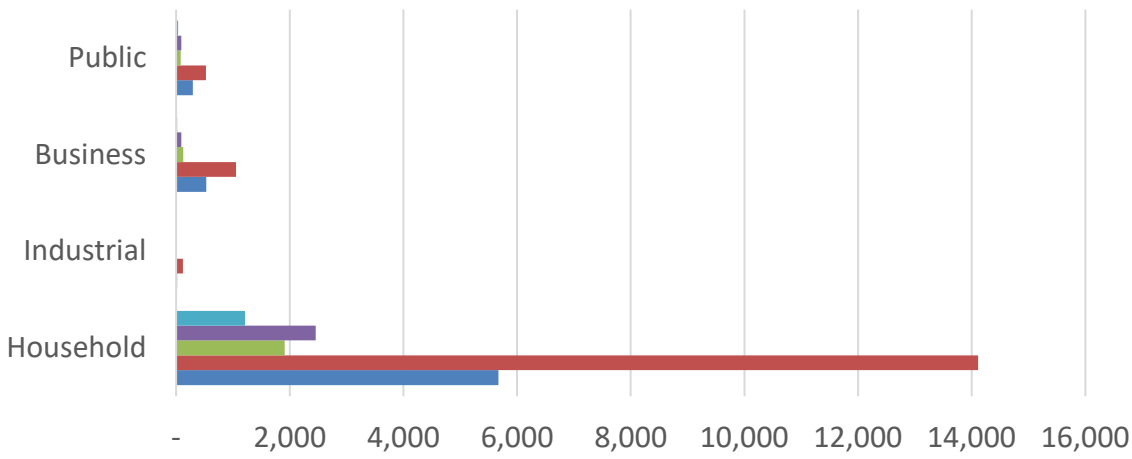


	Capacity Addition (MW)	Substation (MVA)	Transmission (KM)
MNPT	4,713	3,070	3,883
Sulawesi	10,423	9,670	9,019
Kalimantan	5,768	8,080	9,812
Jawa-Bali	33,552	59,730	13,889
Sumatera	15,057	28,410	11,155

Indonesia Total Grid 2025

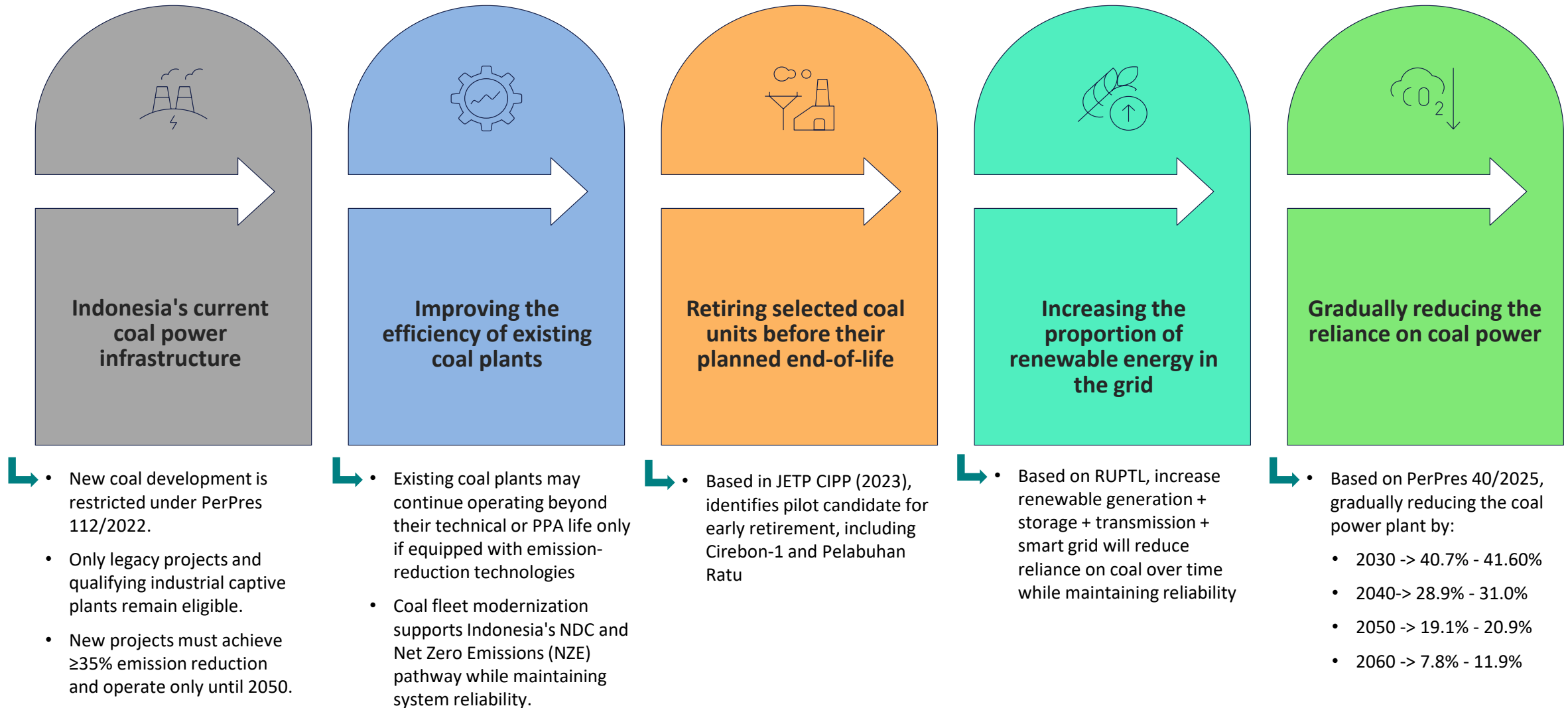
47,758 KM 107,950 MVA 65,512 MW

Number of Customers Growth from 2015 to 2025



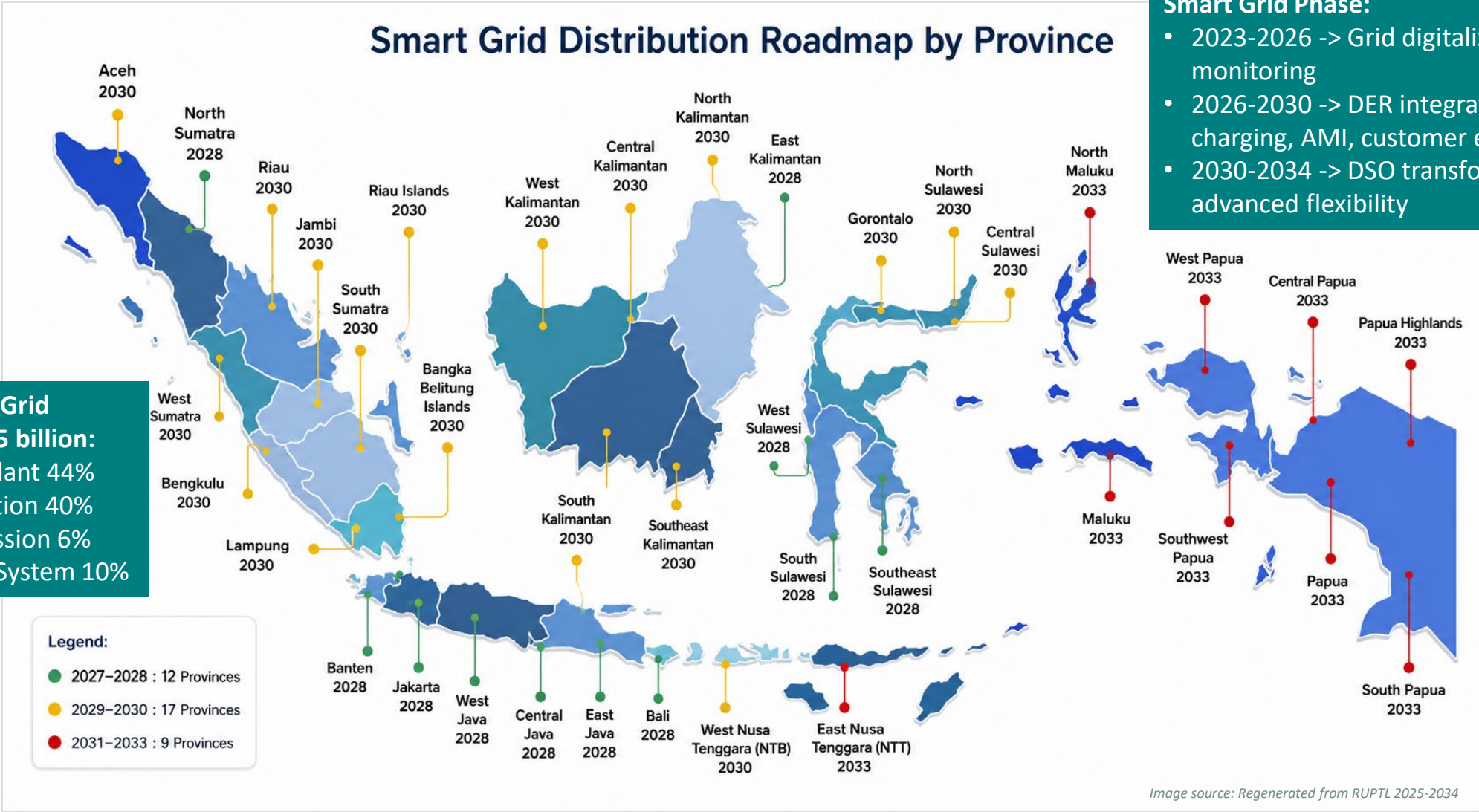
	Household	Industrial	Business	Public
MNPT	1,212	-	17	37
Sulawesi	2,458	4	90	89
Kalimantan	1,912	2	123	81
Jawa-Bali	14,114	119	1,055	527
Sumatera	5,671	17	532	294

Coal Transition Pathway

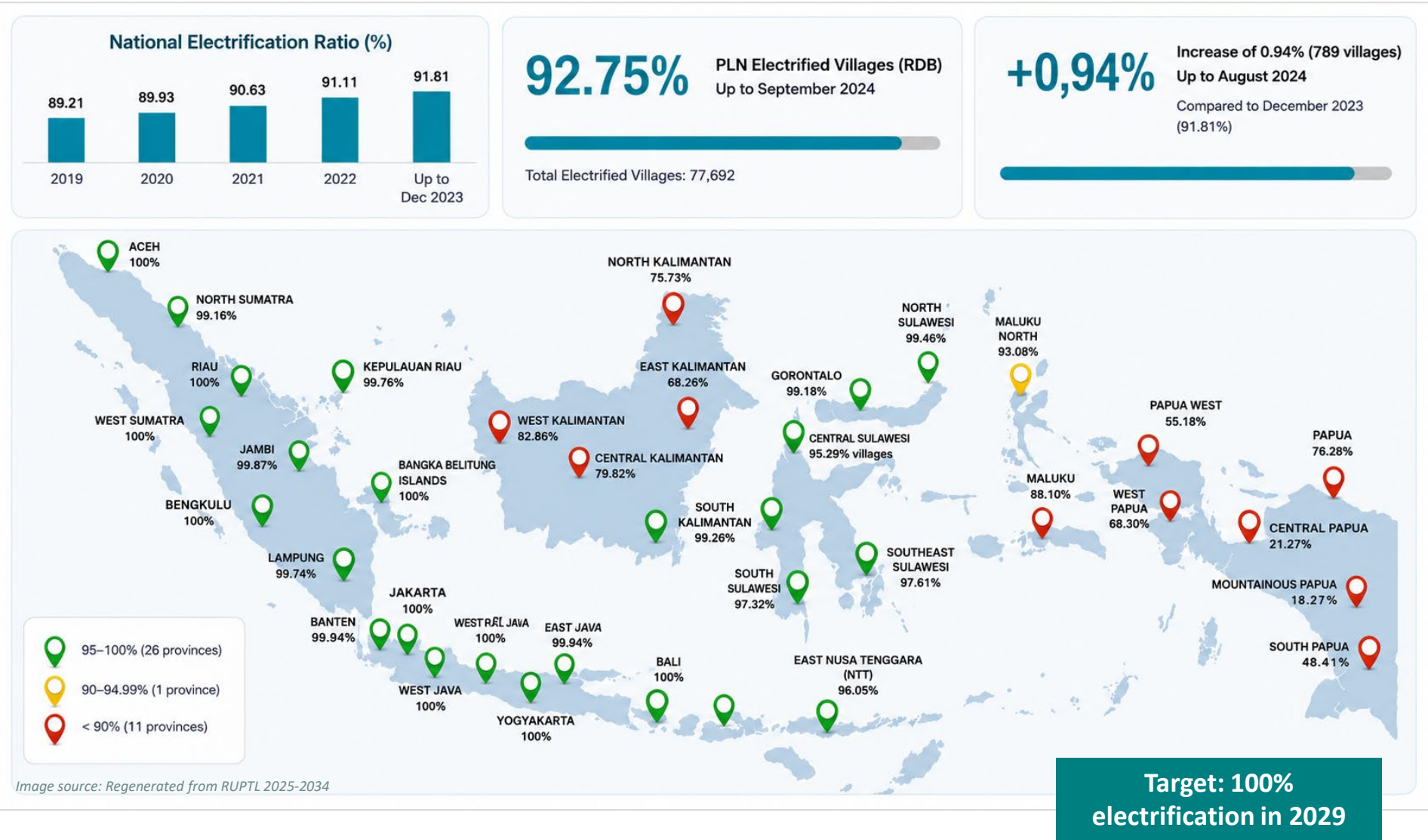


Smart Grid Roadmap and Implementation

- Smart Grid Phase:**
- 2023-2026 -> Grid digitalization and monitoring
 - 2026-2030 -> DER integration, EV charging, AMI, customer empowerment
 - 2030-2034 -> DSO transformation and advanced flexibility



Lisdes: Electrifying the Last Mile



Lisdes Program (2025–2029)

- 🏠 5,758 Villages
- ⚡ 394 MW
- 🏠 780,000 Household Connections
- 💰 Rp 42.3 Trillion

Grid extension is prioritized, with renewable-based microgrids deployed for remote and isolated communities.

- ➡ Total 433 Village in Maluku, Papua, and Southwest Nusa Tenggara -> Grid (61), Solar (52), Hybrid (23), Battery (297)
- ➡ Total 97 Village in Maluku, and North Maluku -> Grid (95), Solar (2)
- ➡ Individual Consumers -> Solar (Photovoltaic + Battery)

Job Creation and Capacity Building

- Indonesia has developed the SWIFT Roadmap as its national framework for preparing an inclusive and skilled workforce to support the energy transition, in line with the NZE 2060 target, NDC, and RUKN 2025–2060
- The roadmap is structured around six pillars
- To support the future energy supply chain, SWIFT promotes local industrial skills development, training aligned with industry demand, and greater investment in workforce development.

The Six Main Pillars of the 2025–2060 National SWIFT Roadmap



Institutional Framework

Strengthening the framework to prevent overlap, policy inconsistencies, and inter-agency inefficiencies.



Training and Certification

Improving training quality and certification to align skills with industry needs and global competitiveness.



Labor Market System

Developing a data-driven, real-time labor market information system to anticipate skill needs.



Inclusive Development

Increasing access to training for underrepresented groups like women and people in remote areas.



Skills Investment

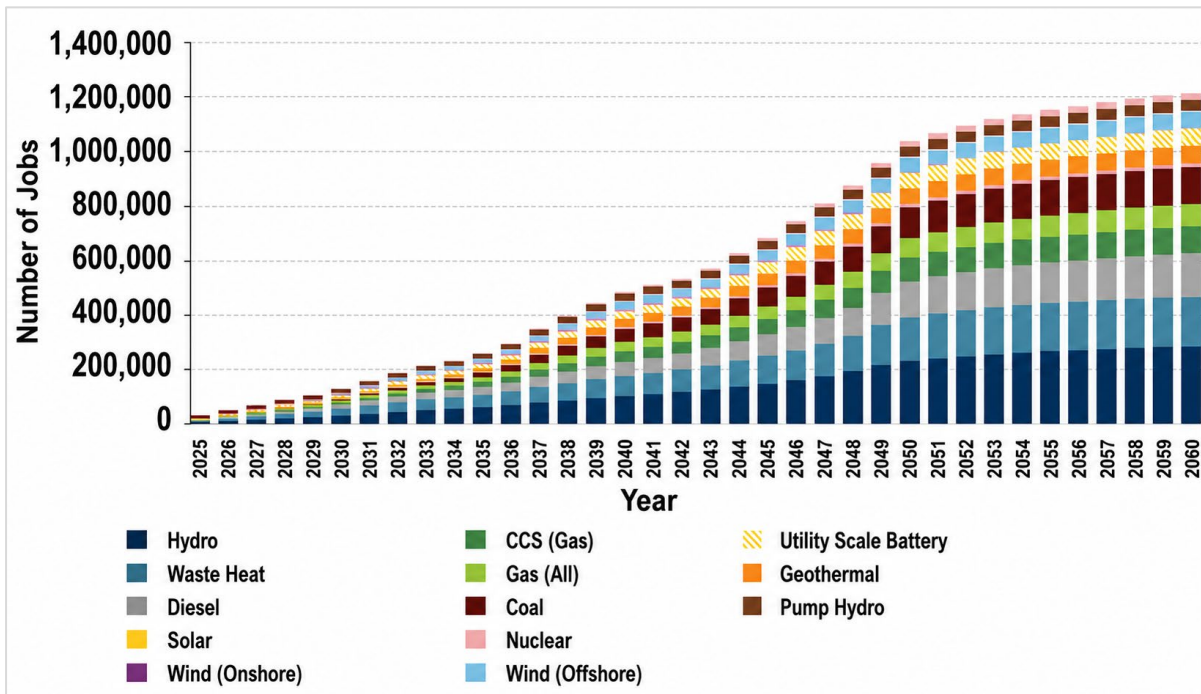
Mobilizing public and private funds to support training and capacity building for human resources.



Strengthening Partnerships

Collaborating among government, industry, academia, and international partners to enhance strategy.

Cumulative Job Creation (National) by Sector per Year



- 1.26 million cumulative jobs by 2060.
- 2046–2050: highest workforce demand.
- Long-term shift from construction to operation & maintenance.

Carbon Capture Storage (CCS)



MEMR has set goal for 16 CCS/CCUS projects by 2030

1

Regulatory Framework for CCS / CCUS in Indonesia

MEMR Reg. 2/2023	CCS/CCUS implementation for upstream oil & gas
Presidential Regulation 14/2024	Expands CCS beyond upstream O&G and enables cross-border CO ₂ storage
SKK Migas PTK-070/2024	Technical guidelines for CCS project implementation

2

CCS / CCUS Implementation in Indonesia

- **1st option**, involves CCS implementation under the Oil and Gas Cooperation Contract, allowing Cooperation Contract Contractors to propose CCS activity plans in POD I, ongoing POD, or revisions
- **2nd option**, allows for the development of CCS as a standalone venture through obtaining a Carbon Storage Target Injection Zone Exploration Permit and Operation Permit



3

Institutional Capacity Building & Collaboration

- Develop a CCS/CCUS Center of Excellence.
- Expand global industry and research partnerships.
- Strengthen supporting regulations.



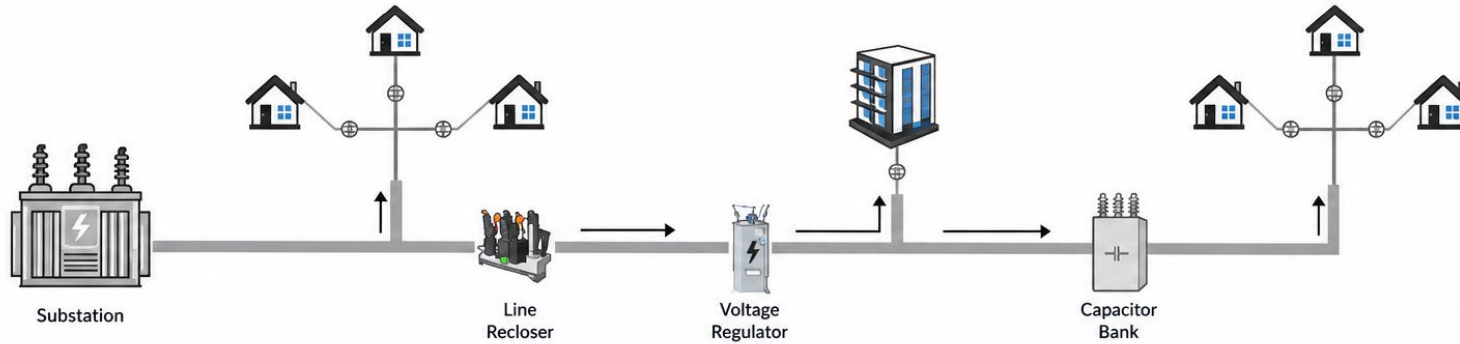
Indonesia

INDONESIA'S ACTION PLAN

OPERATING

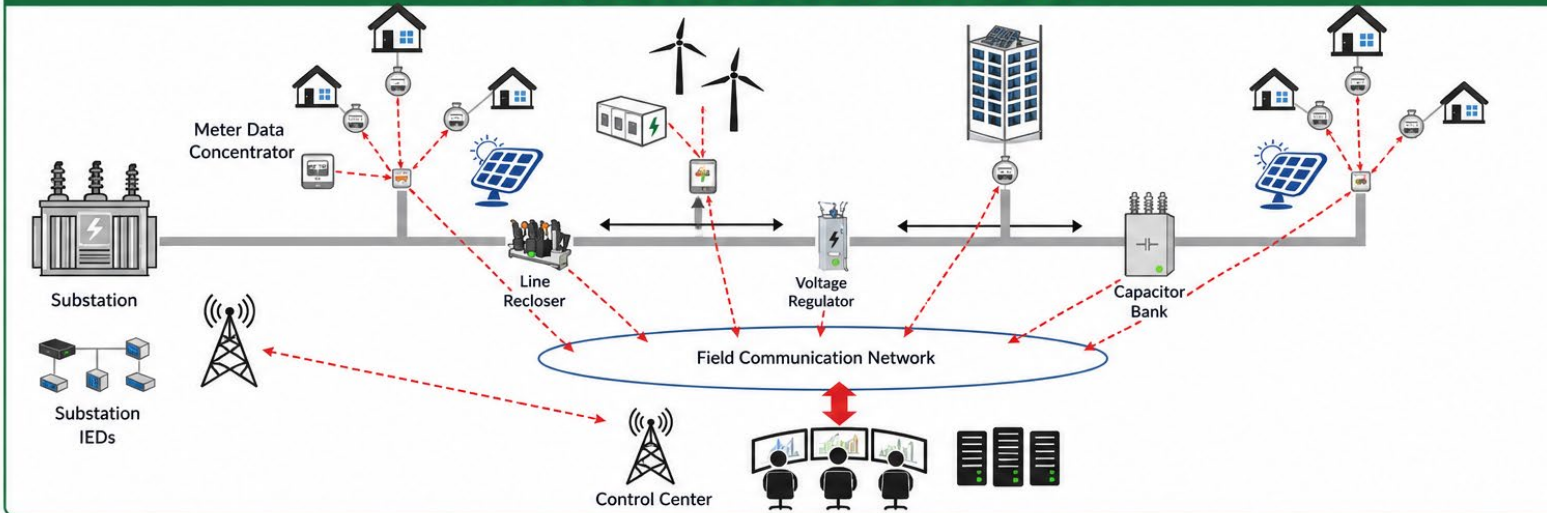
System Operations: PLN P3B and Dispatch

TRADITIONAL DISTRIBUTION SYSTEM



- Centralized operation through PLN P3B (Java–Bali) and Regional Control Centers.
- One-way power flow from large power plants to end users.
- Limited SCADA visibility with minimal field automation.

SMART, AUTOMATED DISTRIBUTION SYSTEM



- Integration of weather forecasting, load forecasting, and economic dispatch (AGC).
- Reserve Margin Monitoring, Production–Marginal Cost System, and advanced grid analytics.
- Enterprise Information System, Wide Area Monitoring System (WAMS), and Cyber Security.

Image source: Regenerated from RUPTL 2025-2034

System Reliability Trough Reserve Margin and Resource Adequacy

Determining the Optimal Reserve Margin

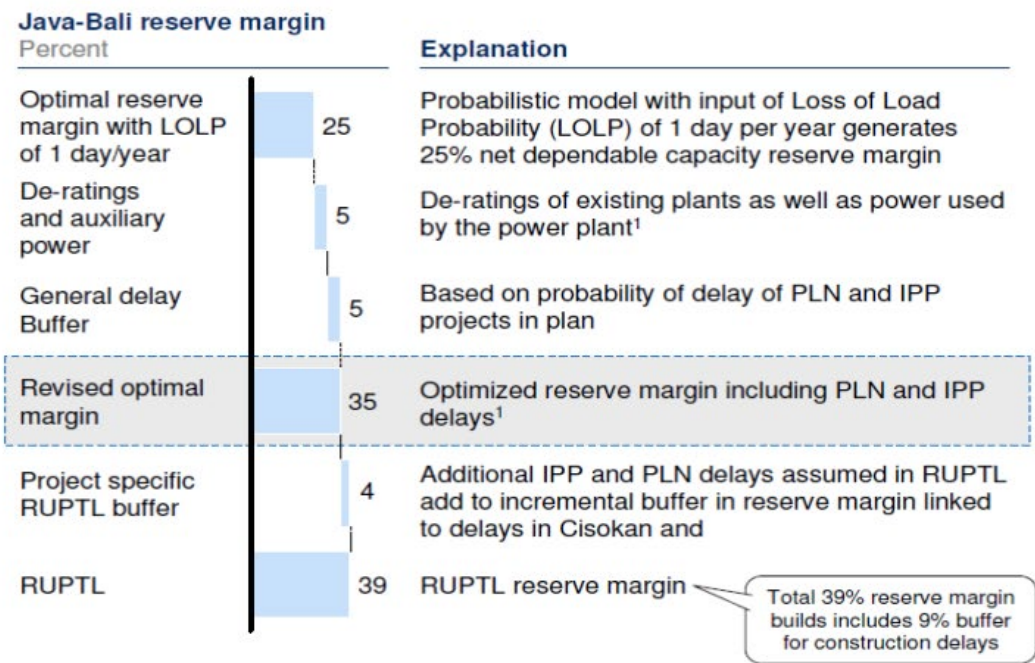
Assessment Approach	Key Finding
PLN Probabilistic Model	LOLP-based assessment ensures adequate reliability
International Benchmark	Typical reserve margins range from 15–40%
Bottom-Up Deterministic Method	Considers outages, derating, reserve requirements, demand growth, and seasonal effects

Recommended Reserve Margin

Java–Bali	35%
Outside Java–Bali	Higher reserve margins are applied for: • Smaller and isolated power systems • Lower system reliability and larger unit size • Project delivery risks and future demand uncertainty

A PLN plans are based on an optimal reserve margin of 35% for Java-Bali and 40% outside Java-Bali with additional contingencies for delays

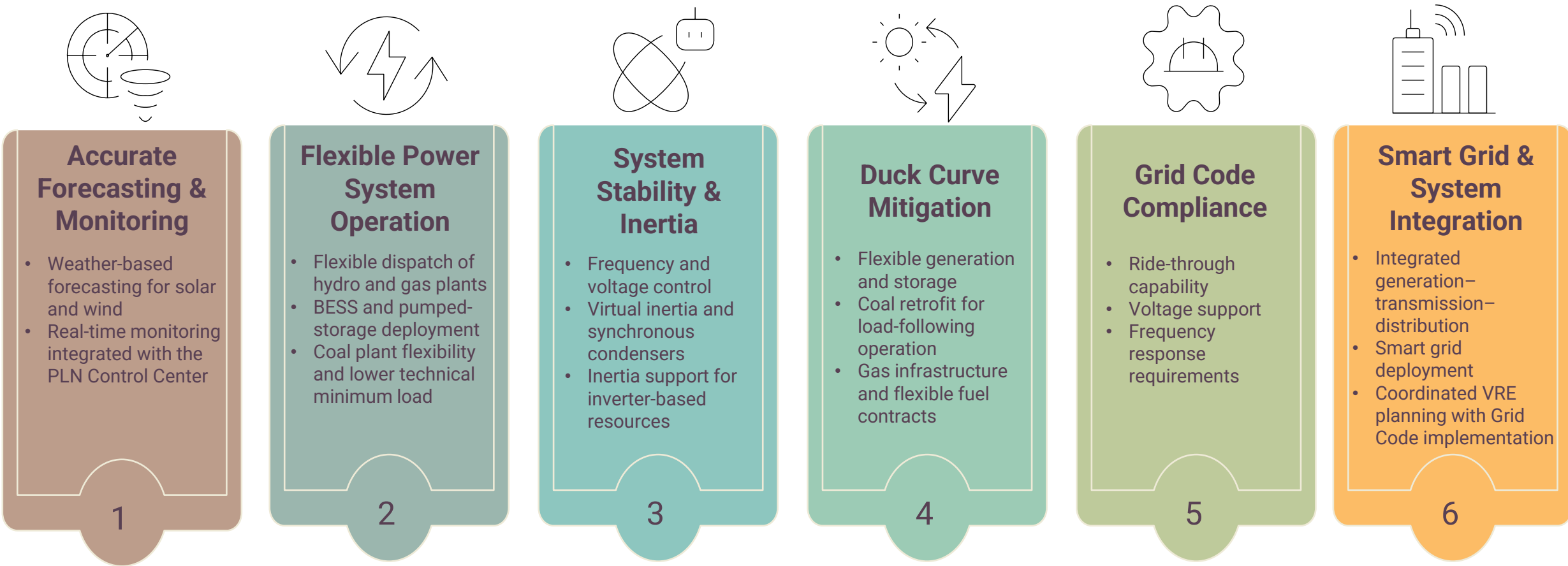
Example for Java-Bali reserve margin



- PLN adopts an optimal level of reserve margin or **35% for Java Bali** and **40% for systems outside Java Bali**
- RUPTL plans for higher reserve margins to account for **high probability of delay** incorporating both a “general” delay buffer (e.g. 5% for Java-Bali) and a **project-specific delay buffer** (e.g. 4% for Java-Bali)

VRE Integration: Six Key Strategies

Based on the RUPTL 2025–2034, PLN has identified six key strategies to enable the integration and development of Variable Renewable Energy (VRE) while maintaining power system reliability.



Flexibility Resources

To support higher VRE integration, three key flexibility resources: flexible thermal generation, energy storage, and demand-side flexibility, with natural gas continuing to provide complementary system support

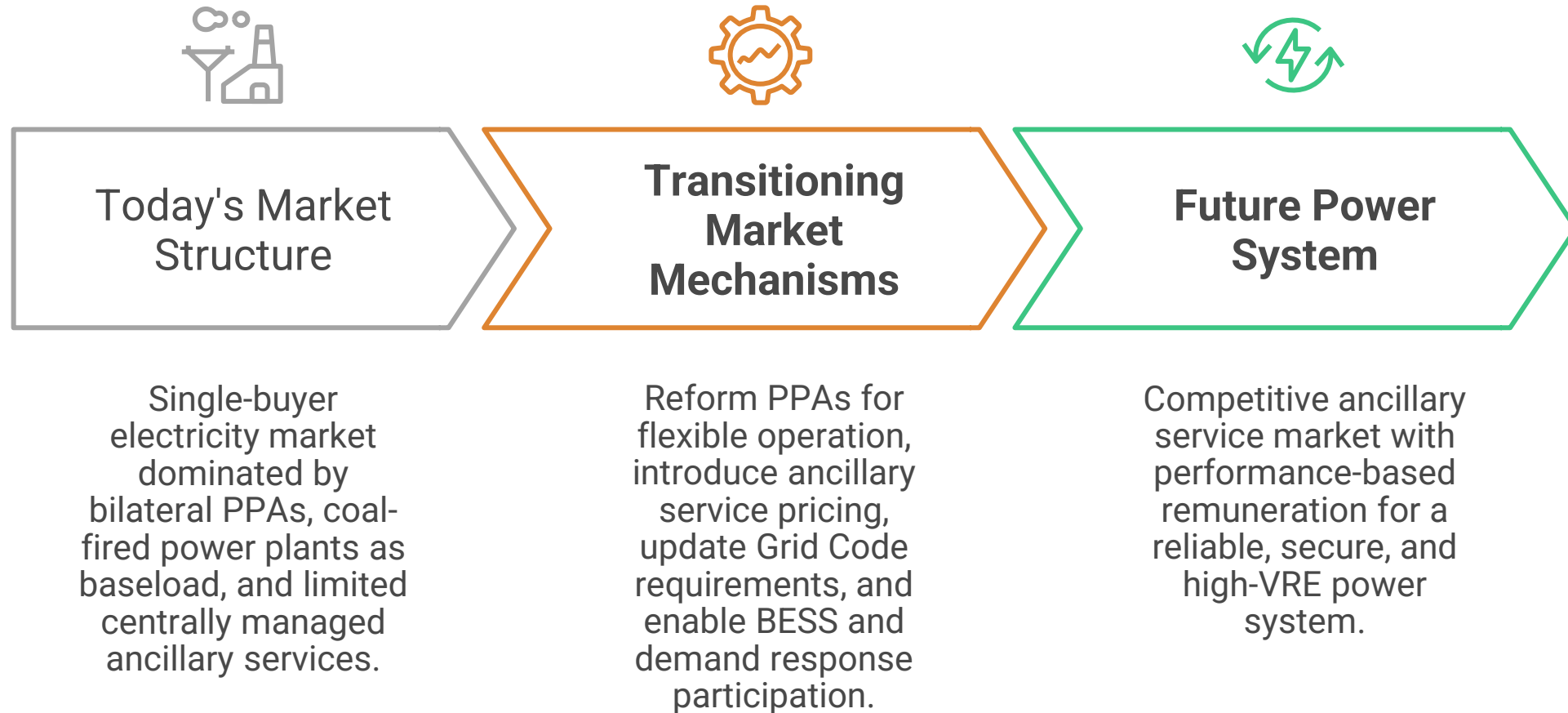
Flexibility Resource	 Flexible Thermal Generation	 Energy Storage	 Demand-Side Flexibility
Key Components and Strategies	Lower TML, improved ramping, load-following operation	BESS and Pumped-storage hydropower	Demand Side Management (DSM) and Demand Response (DR)
Primary Function	Accommodate solar and wind variability	Buffer short-term VRE fluctuations and support balancing	Shift electricity demand to match renewable generation



Natural gas continues to play a complementary role by:

- providing peaking and follower generation,
- supporting system reliability,
- requiring flexible LNG and gas infrastructure as renewable penetration increases.

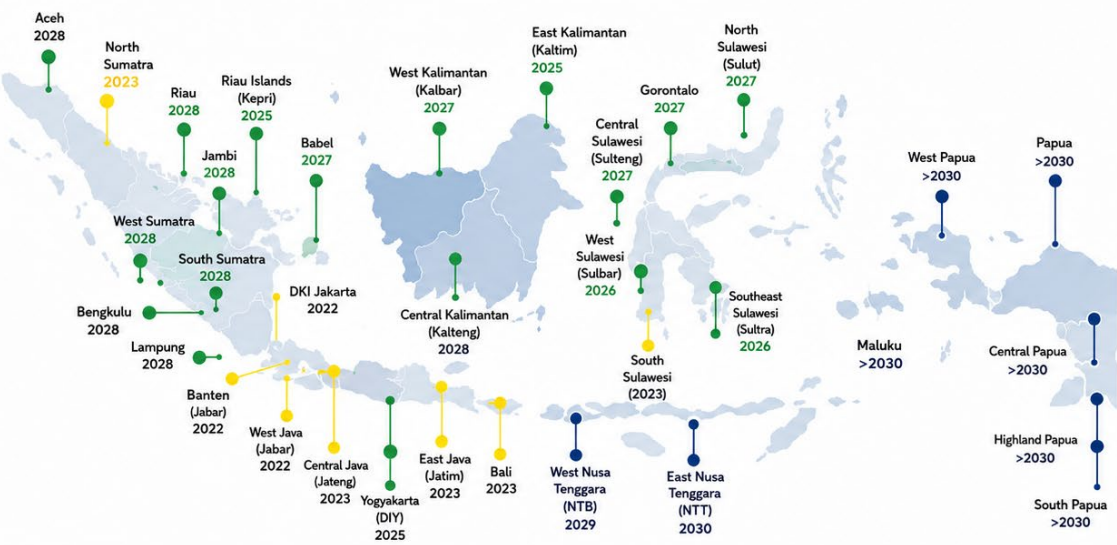
Ancillary Services and Market Design



Real-Time Monitoring and Digitalization

AMI IMPLEMENTATION MAP BY PROVINCE 2022–2037

AMI implementation for **1.2 million customers** has been carried out in phases in line with the development of smart grid from 2023–2025 in **8 provinces**, 2026–2028 in **more than 20 provinces**, and 2029–2037 in **additional 10 provinces**.



Note: cust = customers

>

AMI Implementation
as of Nov 2024

Postpaid Cluster

BALI	: 529 thousand cust
JAKARTA	: 183 thousand cust
BANTEN	: 144 thousand cust
WEST JAVA (JABAR)	: 133 thousand cust
CENTRAL JAVA (JATENG)	: 52 thousand cust
EAST JAVA (JATIM)	: 84 thousand cust
SOUTH SULAWESI (MAKASSAR)	: 55 thousand cust
NORTH SUMATRA (MEDAN)	: 42 thousand cust
TOTAL	: 1.2 Million cust

Development Plan:

- Postpaid Cluster (2025)
- Implementation Roadmap (2025–2037)

Information:
Implementation Period of AMI
by Province

● 2023–2025	8 Provinces
● 2026–2028	>20 Provinces
● > 2029	+10 Provinces

Image source: Regenerated from RUPTL 2025-2034

Advanced Metering Infrastructure (AMI)

- Enables two-way communication between utilities and customers.
- Supports real-time monitoring and integration of Distributed Energy Resources (DERs).
- Improves grid reliability, operational efficiency, and customer participation (prosumers).

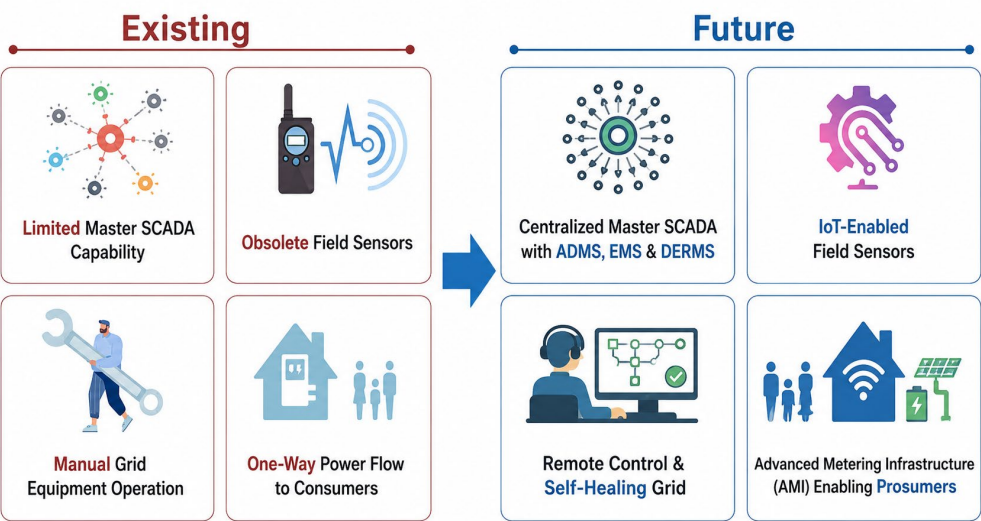


Image source: Regenerated from RUPTL 2025-2034

Future Digitalization

- Real-time monitoring and remote control
- Faster fault detection and service restoration
- Improved grid reliability and operational efficiency
- Enhanced integration of renewable energy and DERs
- Data-driven planning through GIS-based asset management

System Resilience: PLN's Anti-Blackout Strategy

SYSTEM RISKS

- **Climate Hazards**
Flooding, heat stress
- **Geophysical Risks**
Earthquakes, volcanic activity
- **Rising Complexity**
Higher VRE penetration

PLN ANTI-BLACKOUT PROGRAM — SIX LINES OF DEFENSE



- Stronger Transmission Backbone**
Reinforcement & looping of backbone lines
- Digital Transformation**
SCADA, telecommunications & automation upgrades

Source: RUPTL 2025–2034 — PLN Anti-Blackout Program (Six Lines of Defense)



Indonesia

INDONESIA'S ACTION PLAN

INTERNATIONAL COOPERATION

Engagement Stake Holders

Government



National Energy Council (DEN)



BAPPENAS
Ministry of National Development Planning / National Development Planning Agency (Bappenas)



Ministry of Energy and Mineral Resources (MEMR)



Ministry of Foreign Affairs (MFA)



Ministry of Forestry (MoF)



Ministry of Environment (MoE)

State Owned Enterprise



PLN



PERTAMINA



PLN
Nusantara Power



PERTAMINA
GEOTHERMAL ENERGY

State Investment / Financial Institutions



Private



MEDCOENERGI
Power



International



ASIAN DEVELOPMENT BANK



THE WORLD BANK



G2G and Multilateral Cooperation

Which technology areas should Indonesia prioritize when seeking international cooperation and multilateral support

Priority Area	Potential G2G and Multilateral Sector Role	Expected Outcome
Solar PV	Technology cooperation, project development, financing, grid integration, capacity building	Accelerated solar PV deployment
Rural Electrification (Listrik Desa)	Concessional finance, technical assistance, off-grid solutions, project preparation and capacity building	Expanded electricity access in remote and underserved areas
Biofuel / Biomass-based Fuel	Technology transfer, feedstock development, R&D, sustainable supply chains and investment support	Diversified low-carbon fuel supply and reduced fossil fuel dependence
Geothermal	Resource assessment, exploration risk mitigation, technology cooperation, project financing and capacity building	Accelerated geothermal development

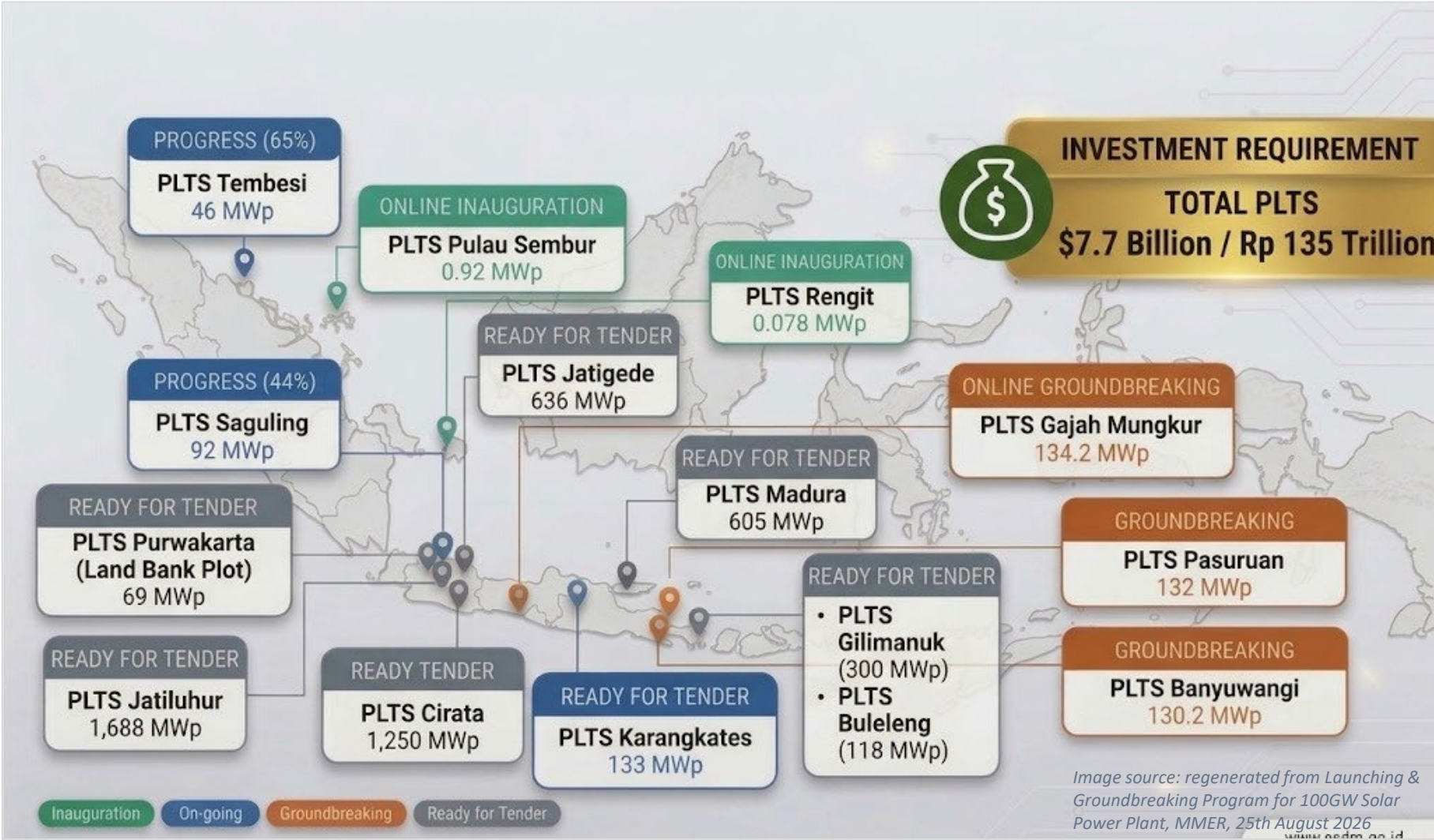
Potential International Support Mechanisms

- Concessional & blended finance
- Grants & technical assistance
- Technology & knowledge transfer
- Project preparation & feasibility support
- Capacity building & workforce development
- Policy & regulatory cooperation

Potential Financing Sources:

- PLN Corporate Financing
- Independent Power Producer (IPP) Equity & Debt
- Commercial Banks
- Multilateral Development Banks
- Climate Finance & JETP
- Green Bonds / Green Sukuk

Solar Power Plant - 100GW



**14 Pilot Projects
Development Benefits**

Potential Savings State
Budget: Rp 4.6 Trillion / year
(State Budget savings on electricity costs)

Employment Potential
(In Job Years):
Construction & Installation
234 thousand job creation
Manufacture
281 thousand job creation*

Potential Savings on Fuel:
319,998 kL/year

Potential Savings on Natural Gas: 35.66 thousand
MMSCF/year or 36.98 BBTU

Note: *assumption 100% domestically produce

Geothermal: Investment Need and International Cooperation

Building the 5,157 MW needs USD 24.24 billion over ten years. The resource is there. What slows projects down is the cost of exploration drilling and the chance that a well comes up dry, a risk private developers find hard to finance on their own. (MEMR, Aug 2026)

Investment needed and what it returns

Source: MEMR, Aug 2026

USD 24.24 billion

Investment needed to build the 5,157 MW, 2025–2034

Source: MEMR, Aug 2026; RUPTL PLN 2025–2034



USD 35.4 bn

Contribution to GDP by 2034

MEMR, Aug 2026

Rp 13.85 tn

State revenue from geothermal PNB, 2025 to 2029

MEMR, Aug 2026

Rp 1.28 tn

Foreign exchange saved each year by replacing 111,579 kL of diesel

MEMR, Aug 2026

Government measures to lower investor risk

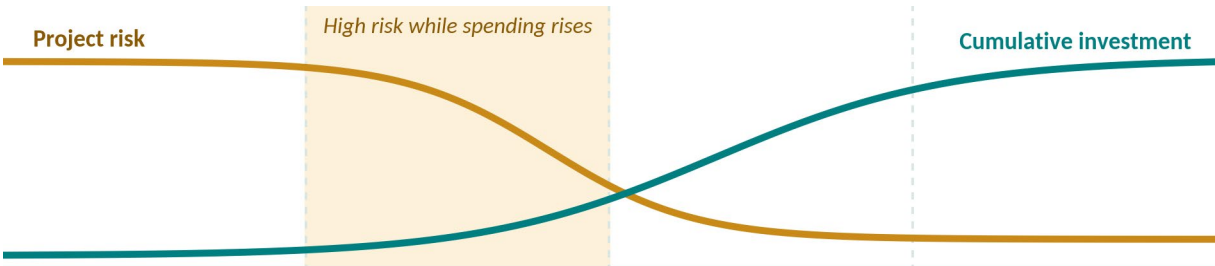
Source: MEMR, Aug 2026

- Geothermal licences issued within 7 working days, KKPR exemption under PP 28/2025
- Lower PNB and tax obligations to raise long term net margin for developers
- Revision of PP 7/2017 and PerPres 112/2022 in progress
- 4 working areas (WKP) and 7 survey and exploration areas (WPSPE) offered in 2026

Note: WKP = geothermal working area; WPSPE = preliminary survey and exploration assignment area; PNB = non tax state revenue; KKPR = spatial use conformity approval; GREM = Geothermal Resource Risk Mitigation facility.

International cooperation, stage by stage

Source: MEMR, Aug 2026; PT SMI / World Bank GREM



Schematic of risk and cumulative investment across project stages, adapted from ESMAP (2012). Not to scale.

1 Survey

2 Drilling

3 Construction

4 Operation



Government survey and drilling programmes. Joint resource assessment. Data sharing with partner geological surveys.



GREM facility, USD 651.25 million from the World Bank, GCF and CTF through PT SMI. Up to USD 30 million per developer, with cost sharing if a well fails.

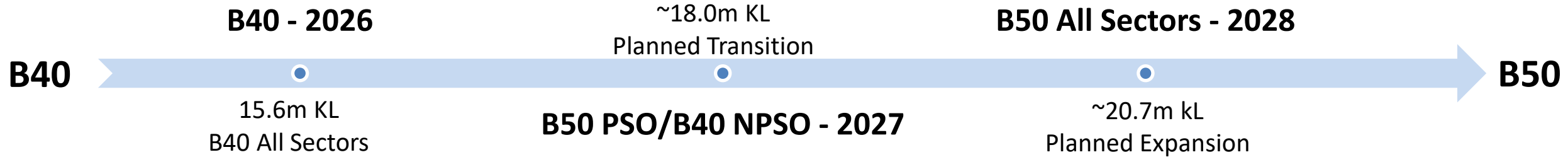


Concessional and blended finance. Export credit. Technology transfer for binary units and co-generation.



Carbon crediting under PerPres 98/2021. Direct use and associated minerals. Workforce training with universities.

B50 Biodiesel: Supply, Technical & Infrastructure Readiness



Supply and Feedstock

Ensuring sufficient supply

- Biodiesel demand increases from 15.6 million kL in 2026 to ~18.0 million kL in 2027
- CPO requirement increases to ~16.8 million tonnes
- Additional biodiesel production capacity is planned
- Feedstock availability must balance biodiesel, food-oil and industrial demand



Technical Readiness

Validating technical compatibility

- B50 requires sector-specific technical testing
- Early testing indicates shorter filter replacement intervals
- Storage stability and water absorption require attention
- OEM compatibility is an important consideration



Infrastructure & Distribution

Preparing distribution infrastructure

- TBBM and blending infrastructure need upgrading
- Dual-mode B50/B40 distribution creates operational complexity
- Storage tanks, terminals and transport systems need to accommodate different blends
- Distribution to eastern Indonesia requires additional logistics considerations

Mineral Downstreaming: Nickel and Silica for Clean Energy

The downstreaming program:

Rp584.1 trillion in downstream investment realized in 2025 (+43.3% YoY), driven by a nickel ore export ban and a Domestic Market Obligation (~30%, rising toward 35–40%) that channels ore to domestic smelters over raw export.

Nickel

19.15 bn t	Ore resource (2024)
5.9 bn t	Ore reserve
62 mn t	Metal reserve
44	Licensed smelters (Kemenperin, 2024)

Where it's used in clean energy

Ore → smelting (NPI, matte, MHP) → nickel sulphate → precursor/cathode (NMC/NCA) → lithium-ion battery cells for BESS and EVs

Silica (Quartz Sand)

26.4 bn t	Total resource, 611 locations (2024)
7.81 bn t	Total reserve, 23 provinces
USD 8–9/kg	Current polysilicon cost (IESR)
Not yet built	Domestic polysilicon/wafer industry (IESR)

Where it's used in clean energy

Quartz sand → metallurgical-grade silicon (arc furnace) → polysilicon (Siemens process, >99.9999% pure) → wafer → solar cell → PV module

Source: : Neraca Sumber Daya dan Cadangan Mineral dan Batubara Indonesia 2025 (Badan Geologi, MEMR); Kemenperin (2024); BKPM/Ministry of Investment and Downstream Industry (2025); IESR (2024)



Indonesia

INDONESIA'S ACTION PLAN

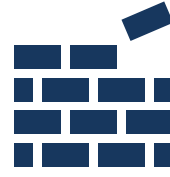
NEXT STEPS

Five-to-Ten Year Horizon



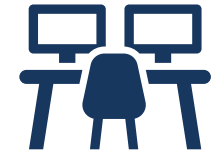
Planning

- New RUEN issuance
- mid-term RUPTL revision
- Second NDC



Building

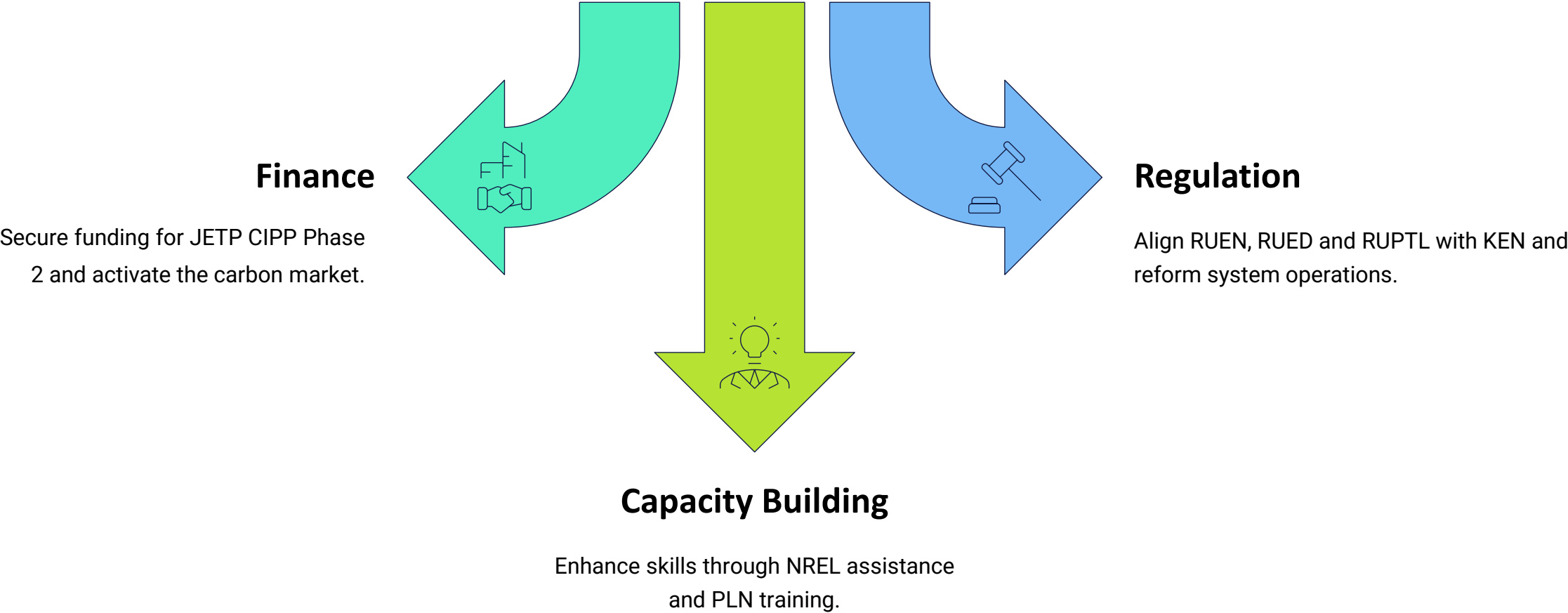
- Super-grid commissioning milestones
- Nuclear FID
- Coal early-retirement portfolio



Operating

- Ancillary services market launch
- RE forecasting at scale
- DR programs

Implementation Enablers



Bibliography

1. Legal & Policy Framework

- **UU 30/2007 – Energy Law** → overarching energy legal framework
- **UU 30/2009 – Electricity Law** → electricity-sector legal framework
- **UU 16/2016 – Paris Agreement** → international climate commitment
- **PP 40/2025 – KEN** → national energy policy and long-term targets
- **PerPres 22/2017 – RUEN** → national energy implementation plan

2. Electricity Planning

- **Kepmen ESDM 85/2025 – RUKN 2025–2060** → long-term national electricity demand and supply planning
- **Kepmen ESDM 188/2025 – RUPTL 2025–2034** → PLN's 10-year electricity supply and investment plan

3. Energy Transition & Market Framework

- **PerPres 98/2021 – Carbon Economic Value** → carbon pricing and carbon market
- **PerPres 112/2022** → renewable electricity development and procurement/pricing
- **PerPres 14/2024 + MEMR Reg. 2/2023** → CCS/CCUS framework
- **SKK Migas PTK-070/2024** → CCS/CCUS implementation guidance

4. Data & Analytical References

- **IEO 2021–2025** → energy scenarios and demand/supply outlook
- **Laporan Analisis Neraca Energi Nasional 2026** → historical data
- **Handbook of Energy Statistics 2025** → historical baseline data