PATHWAYS FOR CLEAN AIR AND CLEAN ENERGY ON POLICY, FINANCE, AND TECHNOLOGY SOLUTIONS IN INDONESIA

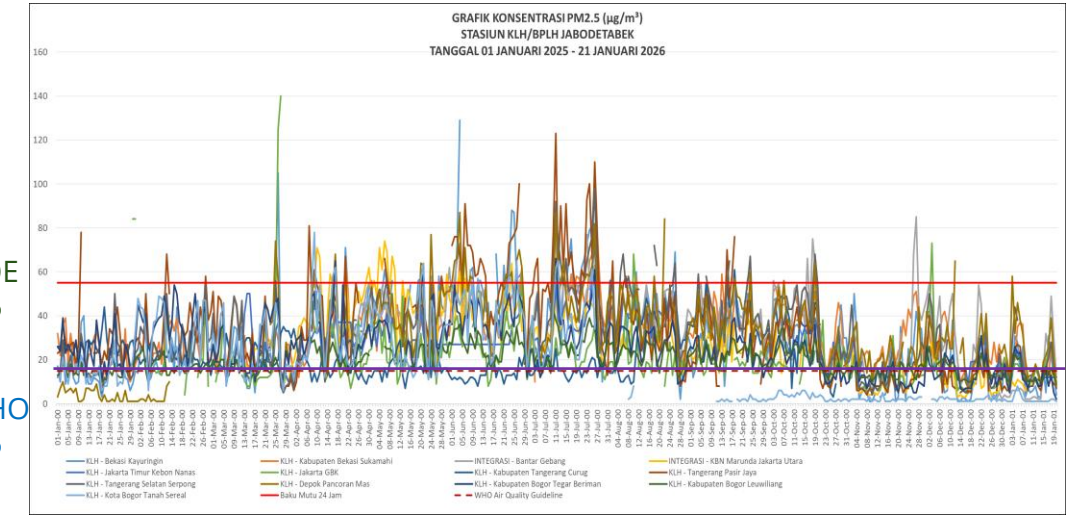
Marhasak Denny T. Silaban

Directorate of Protection and Management of Air Quality
Deputy for Pollution and Environmental Damage Control
Ministry of Environment, Indonesia

Bangkok, March 11th 2026

BACKGROUND

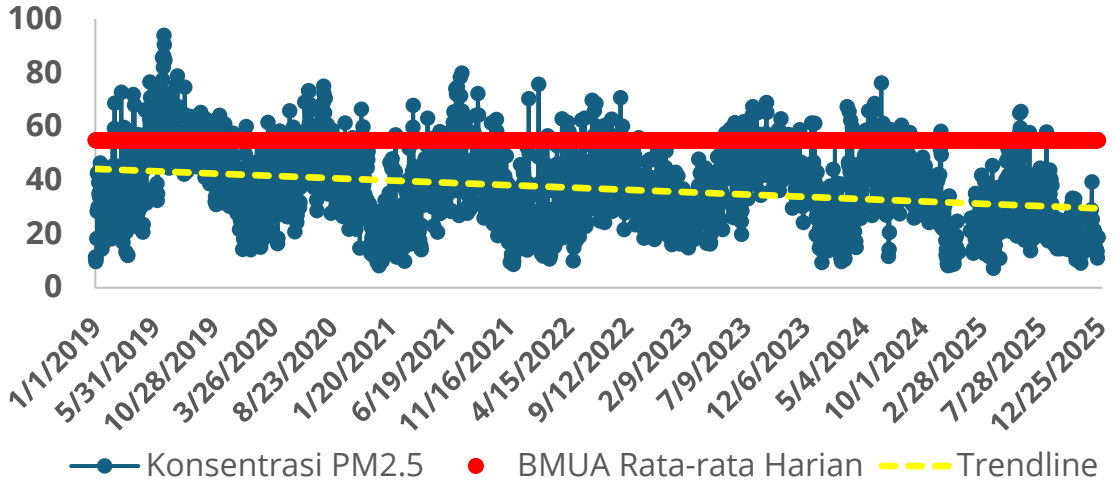
Annual Air Quality Trends



MOE 55

WHO 5

Historical PM2.5 level daily average in Jakarta

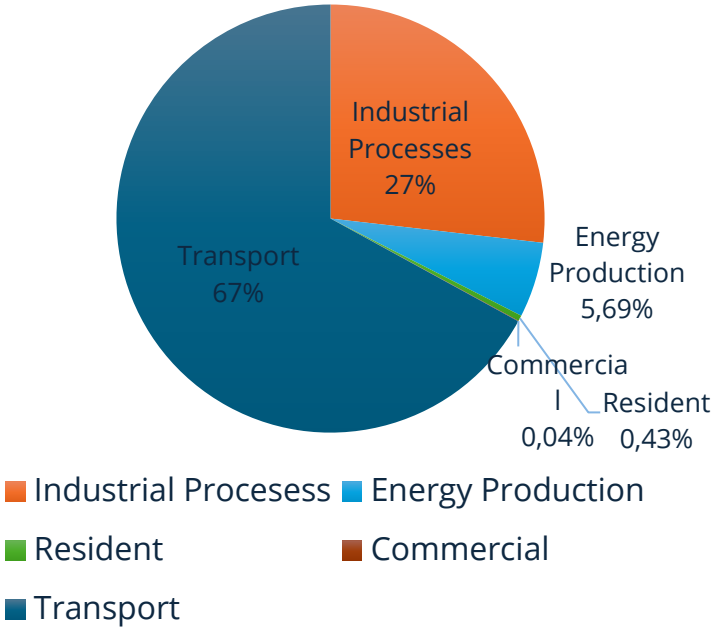


Distribution of AQMS

Distribution of CEMS

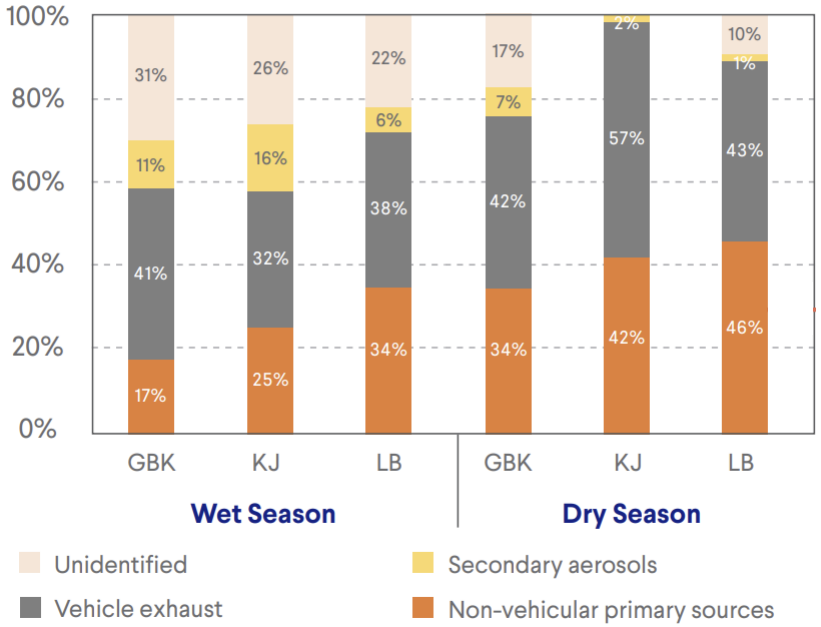
SOURCE OF AIR POLLUTION IN JAKARTA METROPOLITAN AREA

Percentage Contribution of $PM_{2.5}$ Emission Load in DKI Jakarta by Sector



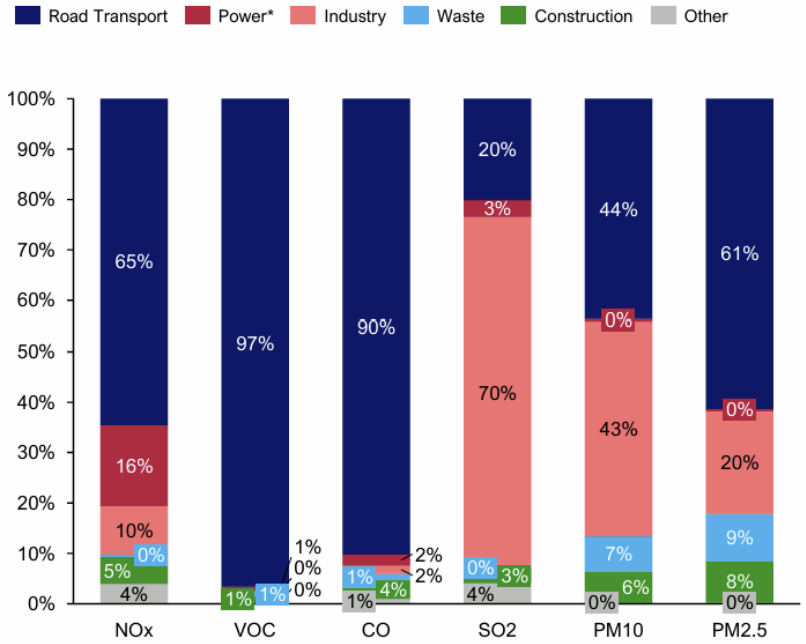
Source: Environmental Agency of DKI Jakarta, 2020

Source contribution (%) to $PM_{2.5}$ concentratior in Jakarta



Source: Vital Strategies & ITB, 2019

Source of Air Pollution in Jakarta, 2023 Based on sectoral energy consumption



Source: Systemiq & ITB, 2024

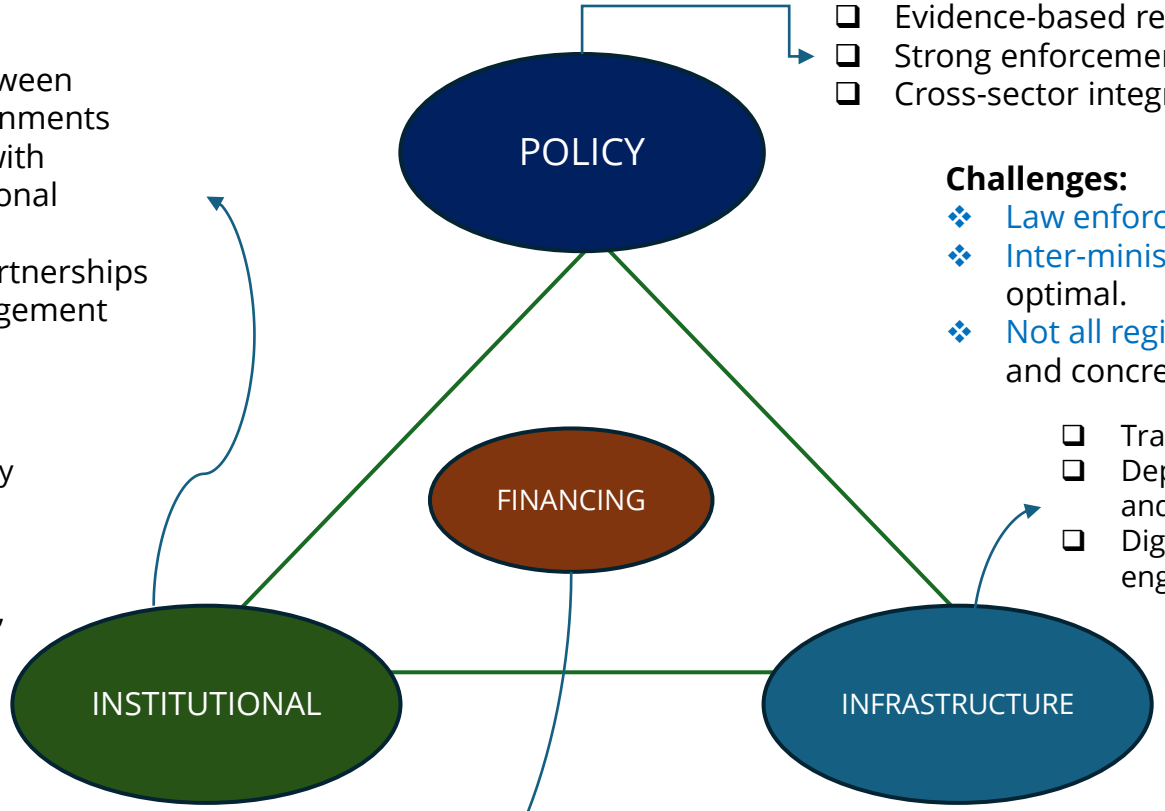
Based on emission inventory and source apportionment, the transportation sector is identified as the primary contributor to $PM_{2.5}$ emissions in Jakarta. Therefore, air pollution reduction policies in the city are primarily focused on this sector

KEY DRIVERS OF AIR QUALITY MANAGEMENT

- ❑ Strengthened coordination between national and subnational governments
- ❑ Clearly mandated institutions with sufficient technical and operational capacity
- ❑ Promotion of public–private partnerships and inclusive stakeholder engagement

Challenges:

- ❖ Institutional frameworks remain insufficiently strengthened and highly decentralized; subnational governments often face limited resources and technical capacity.
- ❖ Cross-sector coordination (transport, industry, and energy) remains weak, hindering integrated clean air and clean energy implementation.



- ❑ Evidence-based regulations grounded in scientific data
- ❑ Strong enforcement mechanisms (sanctions and incentives)
- ❑ Cross-sector integration (transport, energy, and industry

Challenges:

- ❖ Law enforcement remains weak and inconsistent.
- ❖ Inter-ministerial and inter-agency coordination is not yet optimal.
- ❖ Not all regions have established implementing regulations and concrete action plans.

- ❑ Transparent and reliable air quality monitoring systems.
- ❑ Deployment of low-emission technologies in transport and industry.
- ❑ Digitalization and open data access to strengthen public engagement.

Challenges:

- ❖ Monitoring networks remain limited and do not yet cover all regions.
- ❖ Not all industries have adopted environmentally friendly technologies.
- ❖ Air quality data is not fully transparent or available in real time.

- ❑ Long-term financing mechanisms from the state budget (APBN), development partners, or other authorized funding schemes.
- ❑ Subsidies and investment support for low-emission solutions (e.g., public transportation, clean energy).
- ❑ Fiscal incentives for industry and households to accelerate the adoption of cleaner technologies

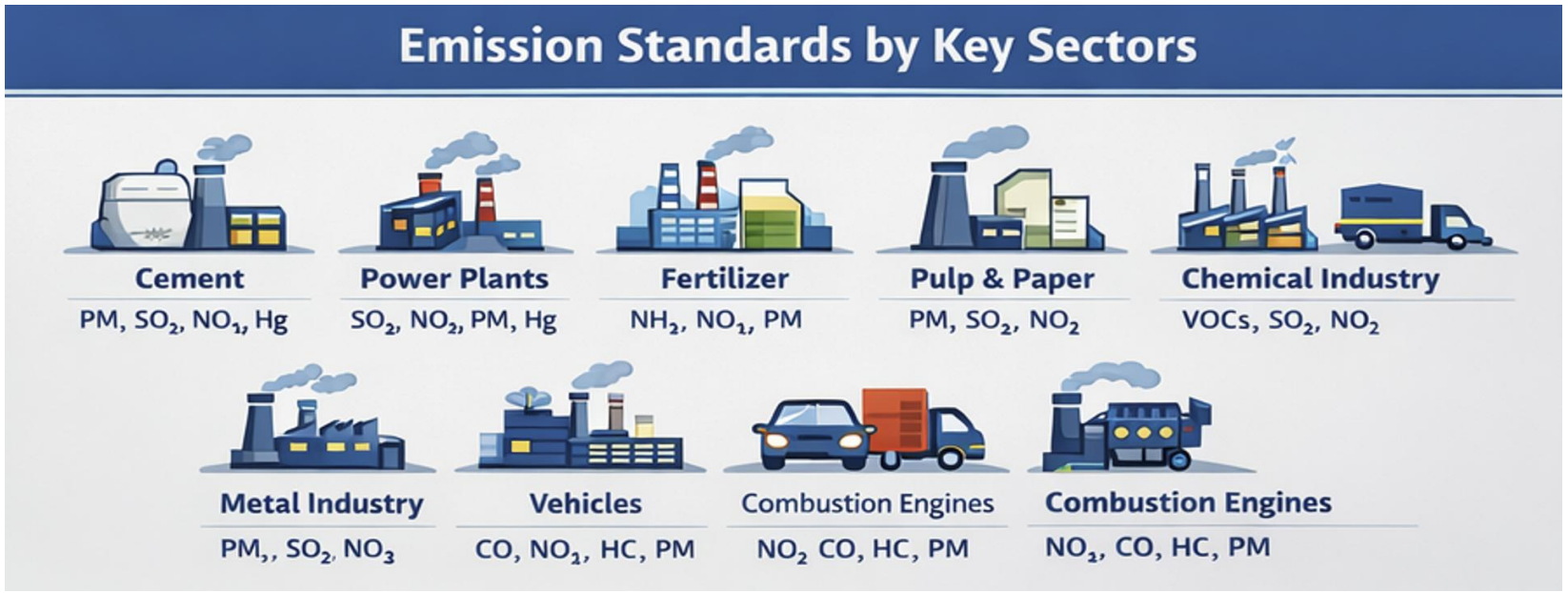
Challenges

- ❖ Funding is not yet specifically earmarked for large-scale air quality control programs, limiting the ability to implement comprehensive and sustained interventions.
- ❖ Many subnational governments face budget constraints and remain heavily dependent on central government allocations, reducing flexibility and responsiveness in addressing local air pollution challenges..

AIR POLLUTION CONTROL POLICY

Legal Basis

- **Law 32/2009** on Environmental Protection and Management (PPLH)-- legal foundation for air quality management, EIA, monitoring, and enforcement.
- **Government Regulation 22/2021** on the Implementation of Environmental Protection and Management → ambient air quality , air pollution control, monitoring, and compliance.
- **MoEF/MoEF Regulation on Emission Standards** sets the maximum allowable air pollutant emissions from stationary sources, such as industries and power plants.



NATIONAL ACTION PLAN FOR AIR QUALITY MANAGEMENT

1.1. Strengthening Emission Standards for Stationary Sources (Target: Dec 2026)

Consolidation of sectoral emission standards into **a single harmonized regulation**

A single harmonized regulation will consolidate all existing and upcoming emission standards into one unified set of air quality benchmarks, ensuring consistency, clarity, and enforceability across sectors.

Alignment with updated environmental quality standards & Best Available Techniques (BAT)

Phases:

1. 2025: Preparation, technical consultations, and draft consolidation, including discussions on Emission Standards (Baku Mutu Emisi) with various industrial sectors and their associations
2. 2026 :
   i. Q1–Q2 2026: Drafting, stakeholder engagement & drat harmonization
   ii. Q3 2026: Legal review and alignmemt
   iii. Q4 2026: Official Issuance

1.2. Technical Guideline Revision (Target: Dec 2027)

- ❑ Update Decree of the Minister of Environment No. 205/1995 concerning Technical Guidelines for Controlling Stationary Sources of Air Pollution
- ❑ Provides guidance on emission control equipment, monitoring methods, placement of AQMS, and stack emission sampling, as updated in the revised Kepdal 205/1996.
- ❑ Serves as the foundation for stationary source emission management in Indonesia and supports implementation of Government Regulation 22/2021 on the Implementation of Environmental Protection and Management

NATIONAL ACTION PLAN FOR AIR QUALITY MANAGEMENT

1.3. Ministerial Regulation on Air Quality Protection & Management (AQPM)

Target: Mid-2026

Establish provisions on:

1. Emission Inventory
2. Air Quality Protection Areas (WPPMU)
3. Air Quality Management Plans (AQPMP)

2026: Issuance + institutional strengthening

Priority Area: AQPMPs will be developed for high-pollution areas, including Greater Jakarta (Jakarta, Bogor, Depok, Tangerang, and Bekasi). **AQPMP** is a legally mandated, time-bound, sector-integrated action plan designed to

a. Reduce PM2.5 concentrations
b. Control major emission sources
c. Protect vulnerable populations
d. Align with climate and energy transition targets
e. strengthen central–regional coordination

1.4. Greater Jakarta Pilot Program (2025–2028)

(National Model for Transboundary Air Pollution Governance)

2025: Baseline modeling & source apportionment (with *Clean Air Asia*)

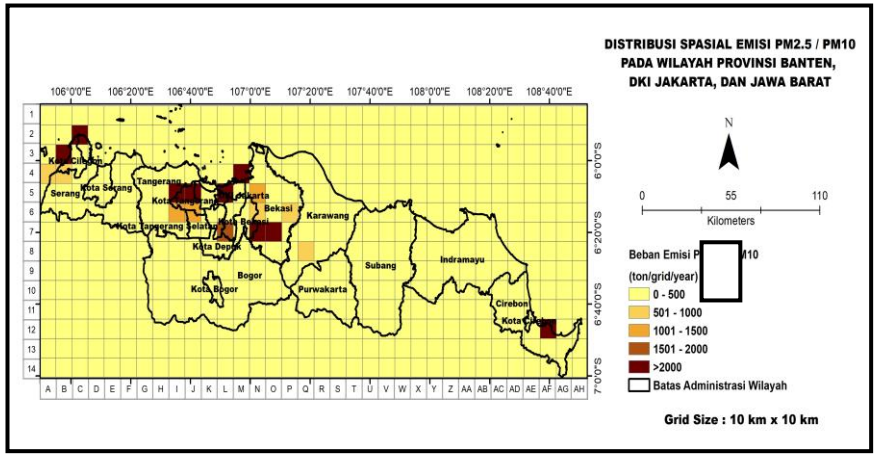
2026: Comprehensive emission inventory

2027: $PM_{2.5}$ reduction scenario modeling and hotspot identification

2028: Adoption of legally grounded Air Quality Management Plan

Pilot approach to be replicated in major metropolitan regions.

Mapping Emission Load for PM10/PM2.5 for Gareater Jakarta



REGULATION OF THE MINISTER OF ENVIRONMENT AND FORESTRY NUMBER 15/ 2019 EMISSION STANDARD FOR COAL FIRED POWER PLANT

Parameter	Before 31 December 2019	Revision (*) Before 31 December 2019	After 1 January 2020	Revision (*) After 1 January 2020
Particulate Matter (PM)	100	**75**	50	**50**
Nitrogen Oxide (NOx)	550	**500 - 520**	100	**100**
Carbon Dioxide (CO2)	550	**500 - 520**	100	**100**
Mercury (Hg)	0,03	**0,02**	0,03	**0,02**

(*) still under discussion with stakeholder (ministry of energy and mineral resources, association, and industries)

CFPPs usingA co-firing, whether with RDF (Refuse-Derived Fuel) or SRF (Solid Recovered Fuel), typically blend around 5–30%, and the same emission standard values are applied.

POLICY AIR POLLUTION CONTROL

Regulation of the Minister of Environment and Forestry No. 13 of 2021 concerning the Industrial Continuous Emission Monitoring Information System.

Coal-fired power plants with an installed capacity exceeding 25 MW are required to install Continuous Emission Monitoring Systems (CEMS) that must be integrated with the Ministry of Environment.

204 Jumlah Perusa — **number of integrated companies**

410 Jumlah — **number of emission stacks installed with CEMS and integrated with the system**

557.365.830 Jumlah Data Terintegrasi — amount of CEMS data integrated

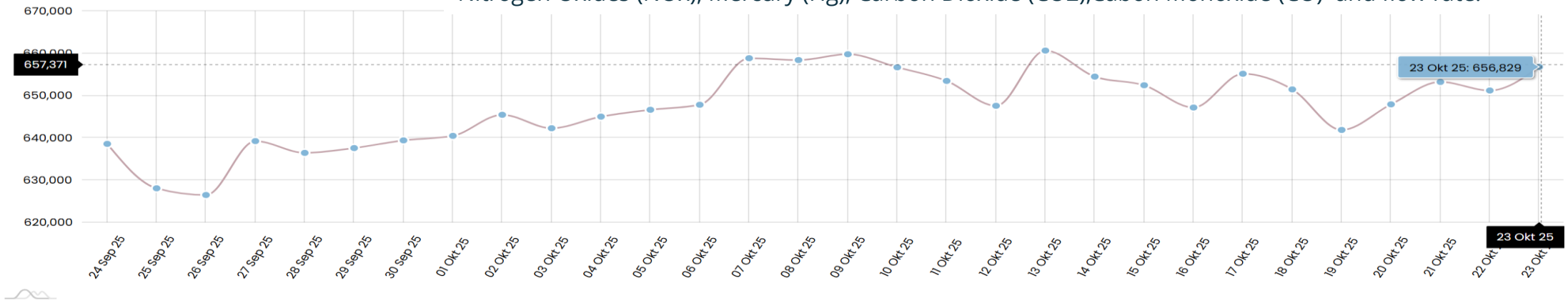
29 Jumlah Provinsi Terintegrasi

90 Jumlah Kabupaten/Kota Terintegrasi

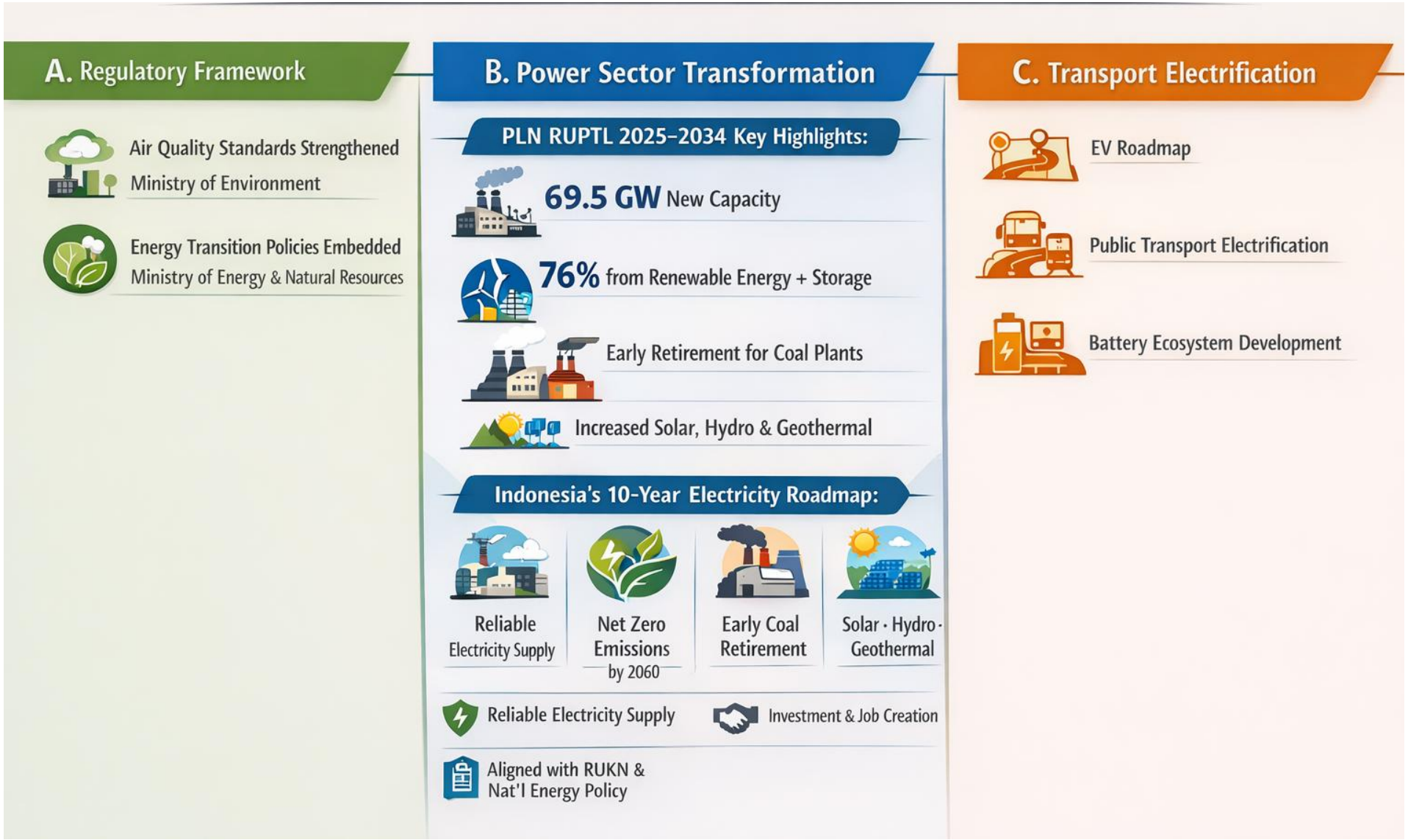
3 Jumlah Kategori Terintegrasi

Diagram Data Laporan

CFPP - The integrated emission parameters include Particulate Matter (PM), Sulfur Oxides (SOx), Nitrogen Oxides (NOx), Mercury (Hg), Carbon Dioxide (CO2),Cabon Monoxide (CO) and flow rate.



PATHWAYS TO CLEAN AIR AND ENERGY TRANSITION IN INDONESIA

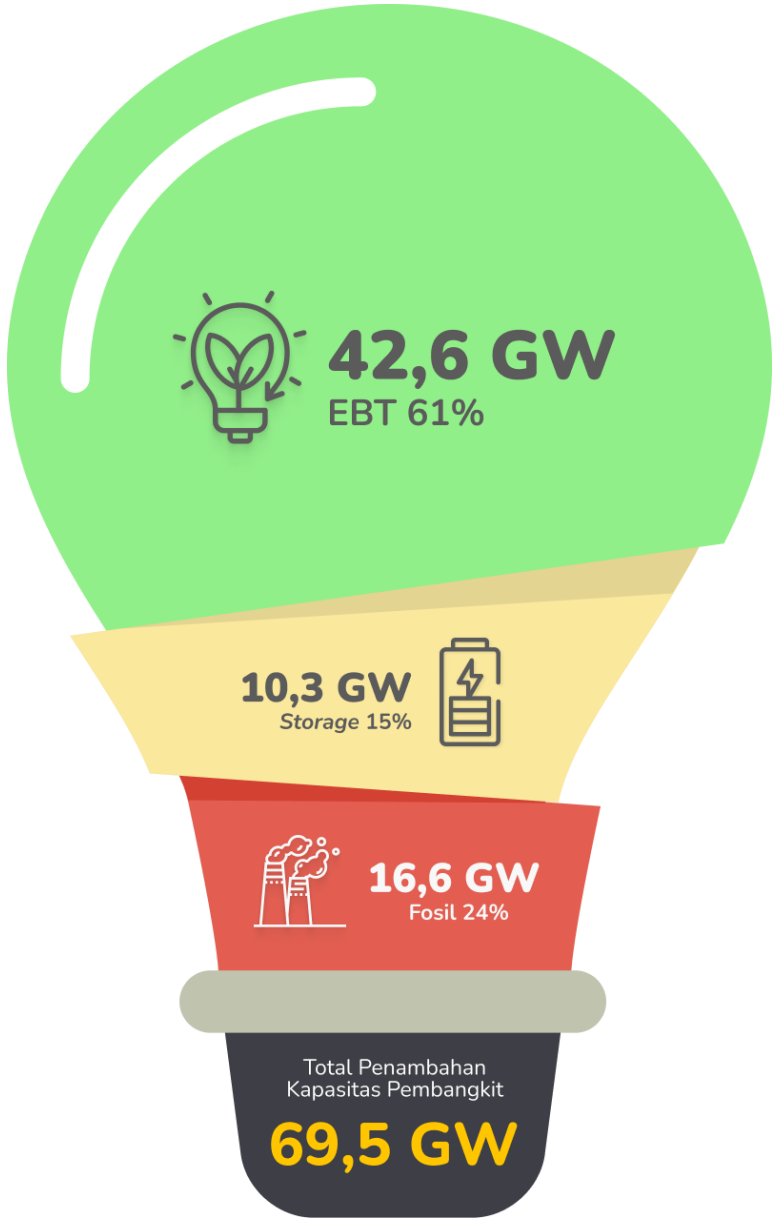


TOTAL ADDITIONAL GENERATION CAPACITY

Realizing Energy Mix Transformation: 76% of New Capacity from Renewable Energy

The planned power generation capacity additions for 2025–2034 increase to **69.5 GW**, comprising:

- **42.6 GW of Renewable Energy**
- **10.3 GW of Energy Storage**



TOTAL ADDITIONAL GENERATION CAPACITY

Total Additional Generation Capacity

69,5 GW

42,6 GW
61%
Renewable Energy

- Solar 17,1 GW
- Hydropower 11,7 GW
- Wind 7,2 GW
- Geotherma 5,2 GW
- Bio Energi 0,9 GW
- Nuclear 0,5 GW

10,3 GW
15%
Storage

- Baterai 6,0 GW
- PLTA *Pumped Storage* 4,3 GW

16,6 GW
24%
Fosil

- Gas 10,3 GW
- Coal 6,3 GW

PLANNED POWER PLANT CAPACITY ADDITIONS 2025-2034

27,9 GW

First Five Years

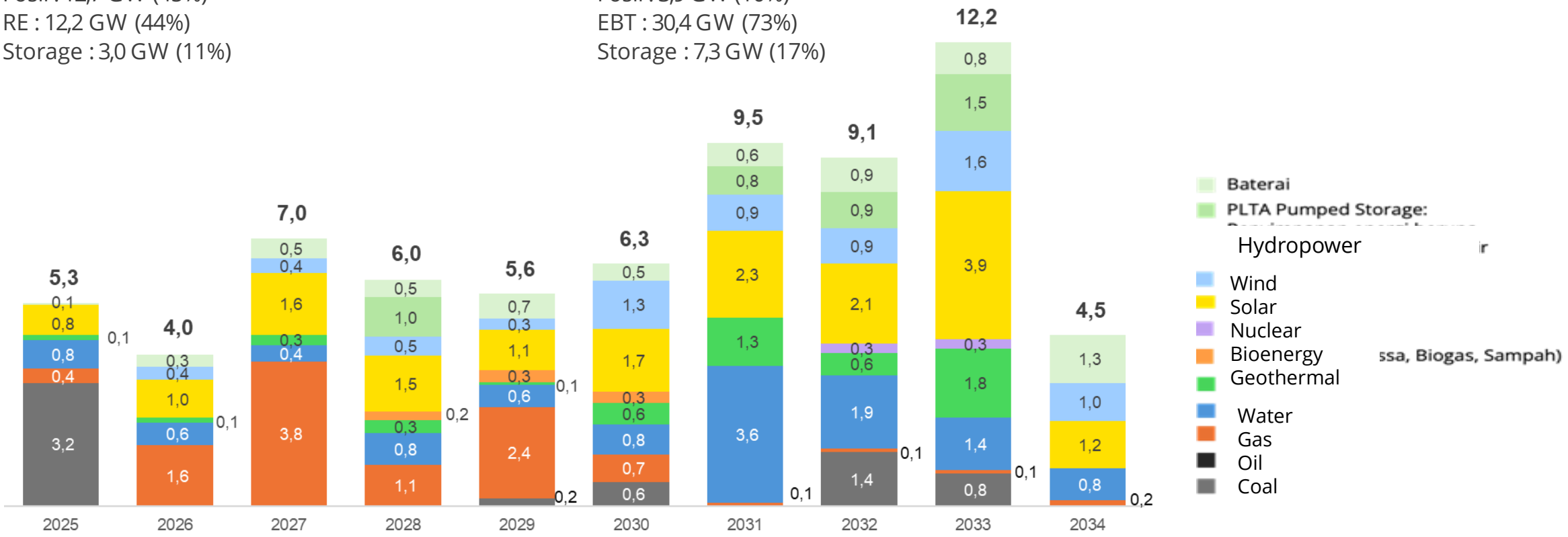
Fosil : 12,7 GW (45%)
RE : 12,2 GW (44%)
Storage : 3,0 GW (11%)

41,6 GW

Second Five Yrats

Fosil : 3,9 GW (10%)
EBT : 30,4 GW (73%)
Storage : 7,3 GW (17%)

Total : 69,5 GW

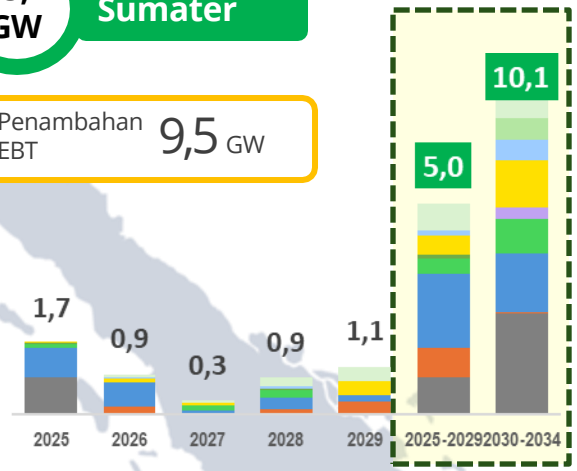


Source: MOEM, 2026

DEVELOPMENT POWER PLANT 2025-2034 BY REGION

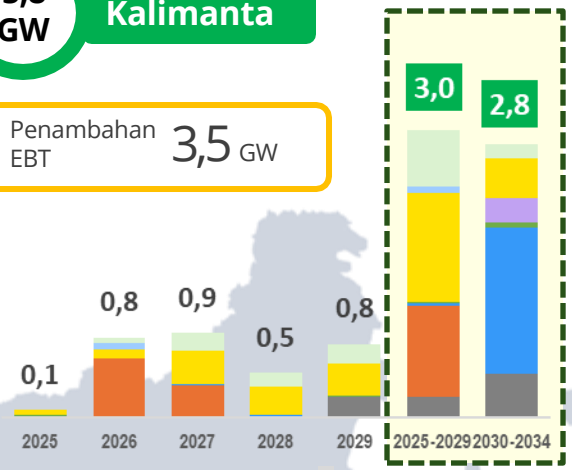
15,1 GW Sumater

Penambahan EBT 9,5 GW

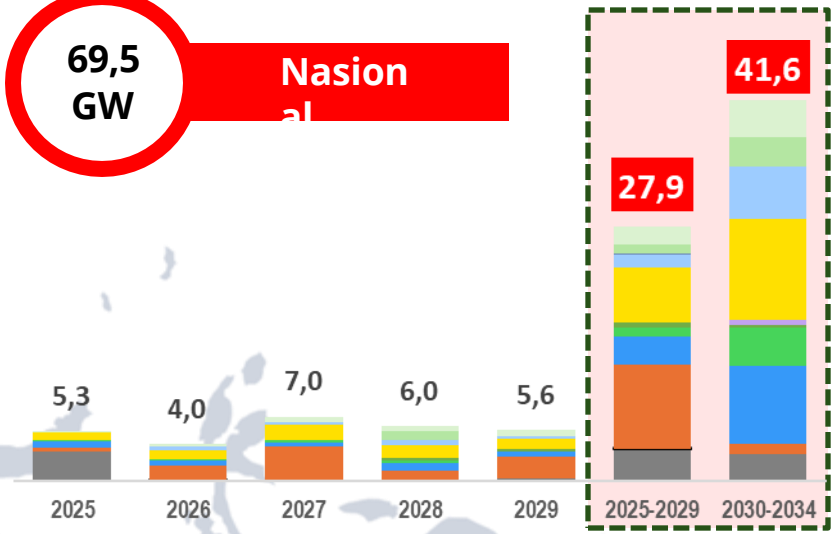


5,8 GW Kalimanta

Penambahan EBT 3,5 GW

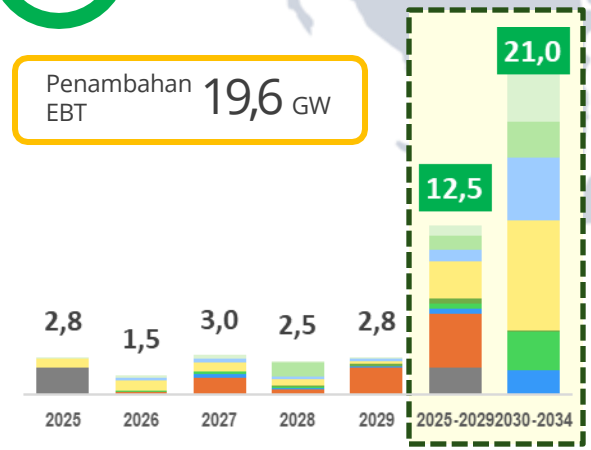


69,5 GW Nasional



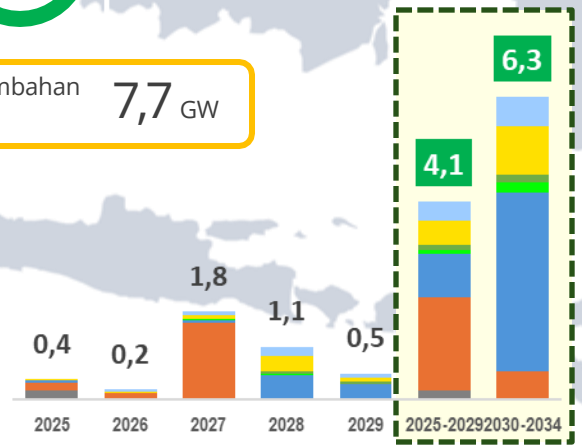
33,5 GW Jawa, Madura, Bali

Penambahan EBT 19,6 GW



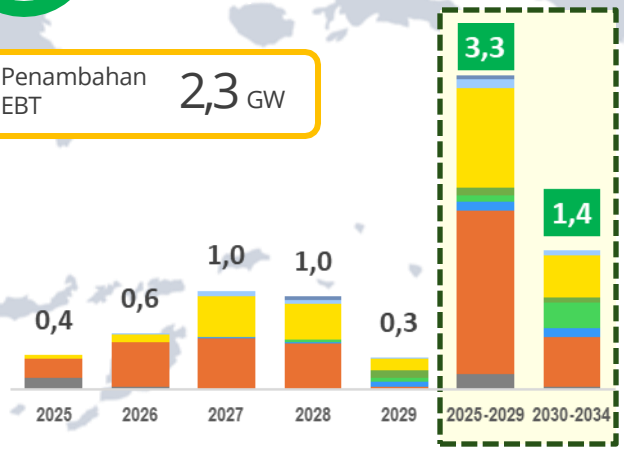
10,4 GW Sulawesi

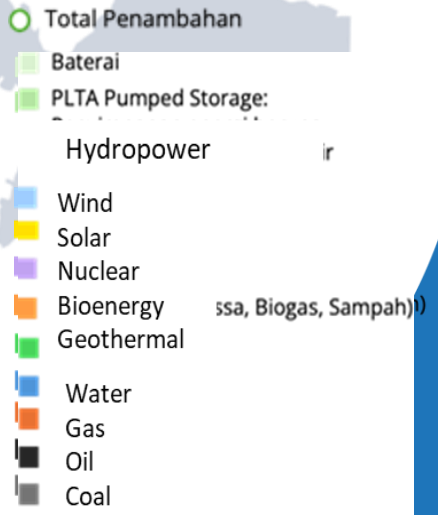
Penambahan EBT 7,7 GW



4,7 GW Maluku, Papua, Nusa Tenggara

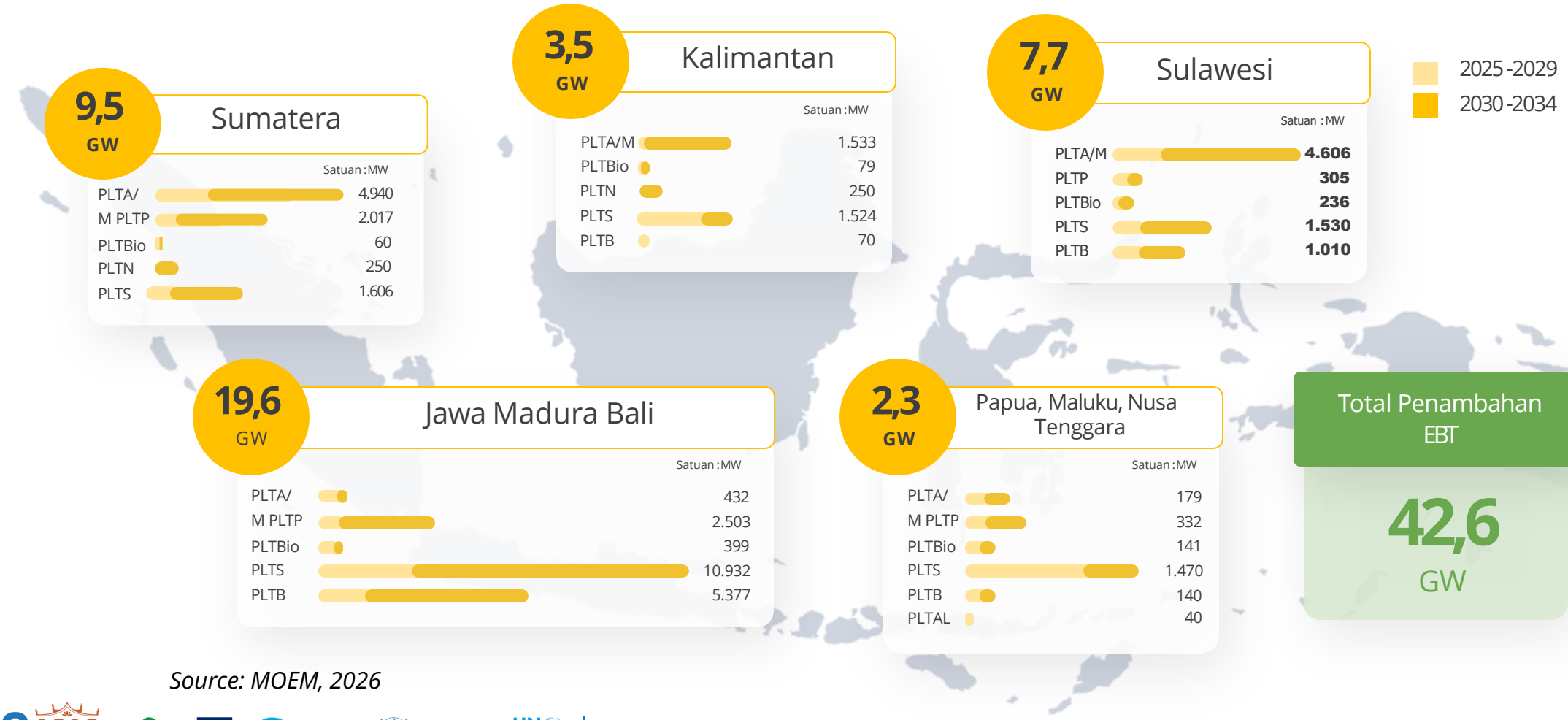
Penambahan EBT 2,3 GW





Source: MOEM, 2026

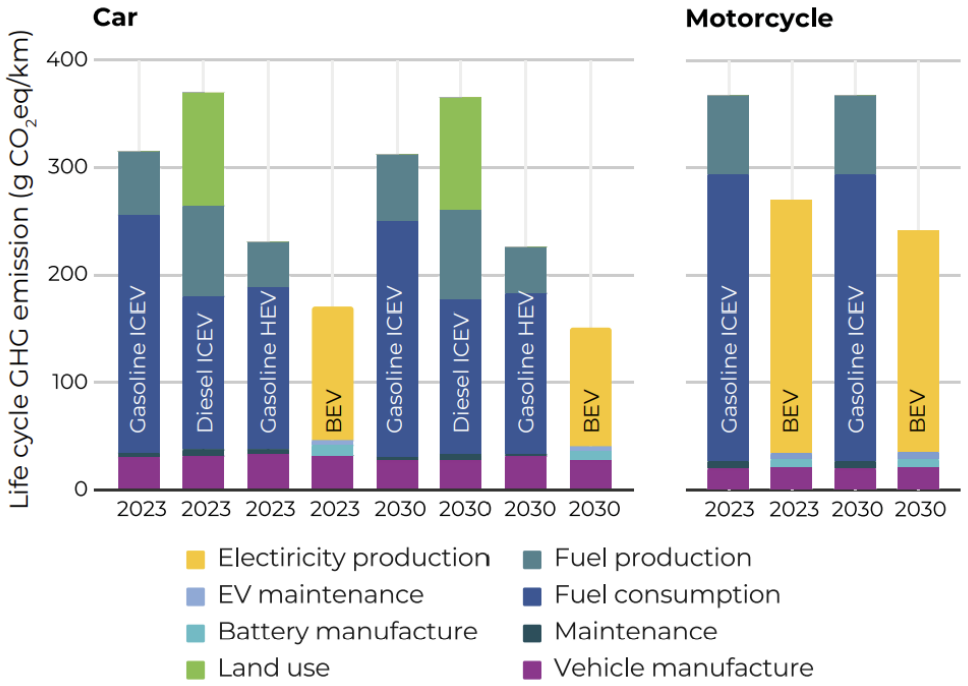
PLANNED RENEWABLE ENERGY CAPACITY ADDITIONS 2025–2034 BY REGION



Source: MOEM, 2026

BATTERY ELECTRIC VEHICLES (BEVS): EMISSIONS AND AIR QUALITY IMPLICATIONS

CO_2 emission throughout lifecycle for various types of cars (left) and motorcycles (right) in Indonesia



Source: ICCT, 2023

1. **Lower lifecycle CO_2 emissions**: BEVs emit 40–50% less CO_2 than conventional vehicles. Based on the 2023 electricity grid mix, BEVs produce 169 gCO_2e/km, which is:
   - 46% lower than gasoline ICEVs
   - 54% lower than diesel ICEVs
   - 41% lower than HEVs
2. **Local air quality benefits**: BEVs produce zero tailpipe emissions, reducing direct exposure to air pollutants in dense urban areas
3. **Upstream air pollution challenge**:
   - From a lifecycle perspective, BEVs currently generate higher SO_2, PM_{10}, NO_x, and N_2O emissions from power generation.
   - Monetized impact: EVs incur approximately **USD 5 per 100 km** in emission costs, which is:
     - 77% higher than ICEVs and
     - 37% higher than PHEVs within the same SUV class (IESR, 2025).
4. **Policy implication:** Power plant emissions are easier to regulate than vehicle tailpipe emissions.Potential mitigation measures:
   a. Renewable Energy Expansion & Coal Phase Out
      - Could reduce air pollution costs by 97.6% under a 1.5°C-aligned scenario.
   b. Mandatory Air Pollution Controls (APCs)
      - Expected reductions by 2035: SO_x: 73%NO_x: 64%; Dust/PM: 86%Mercury: 71%

SHIFTING FROM CONVENTIONAL TO ELECTRIC BUSES

Jakarta Provincial Government's Commitment to Zero-Emission Public Transport 50% of Transjakarta Fleet to Be Zero-Emission by 2027, 100% by 2030

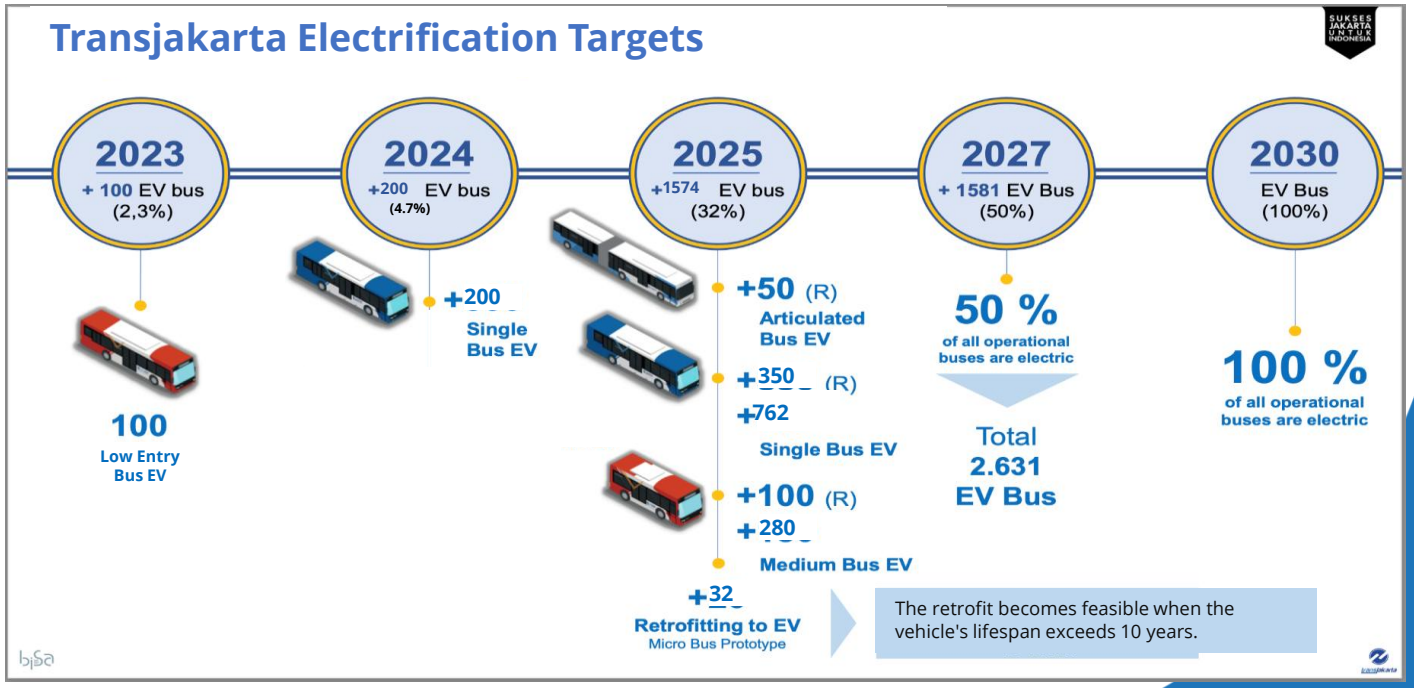
This initiative is aligned with Presidential Regulation No. 79/2023, which supports sustainable urban transportation.

Key policies supporting this program include:

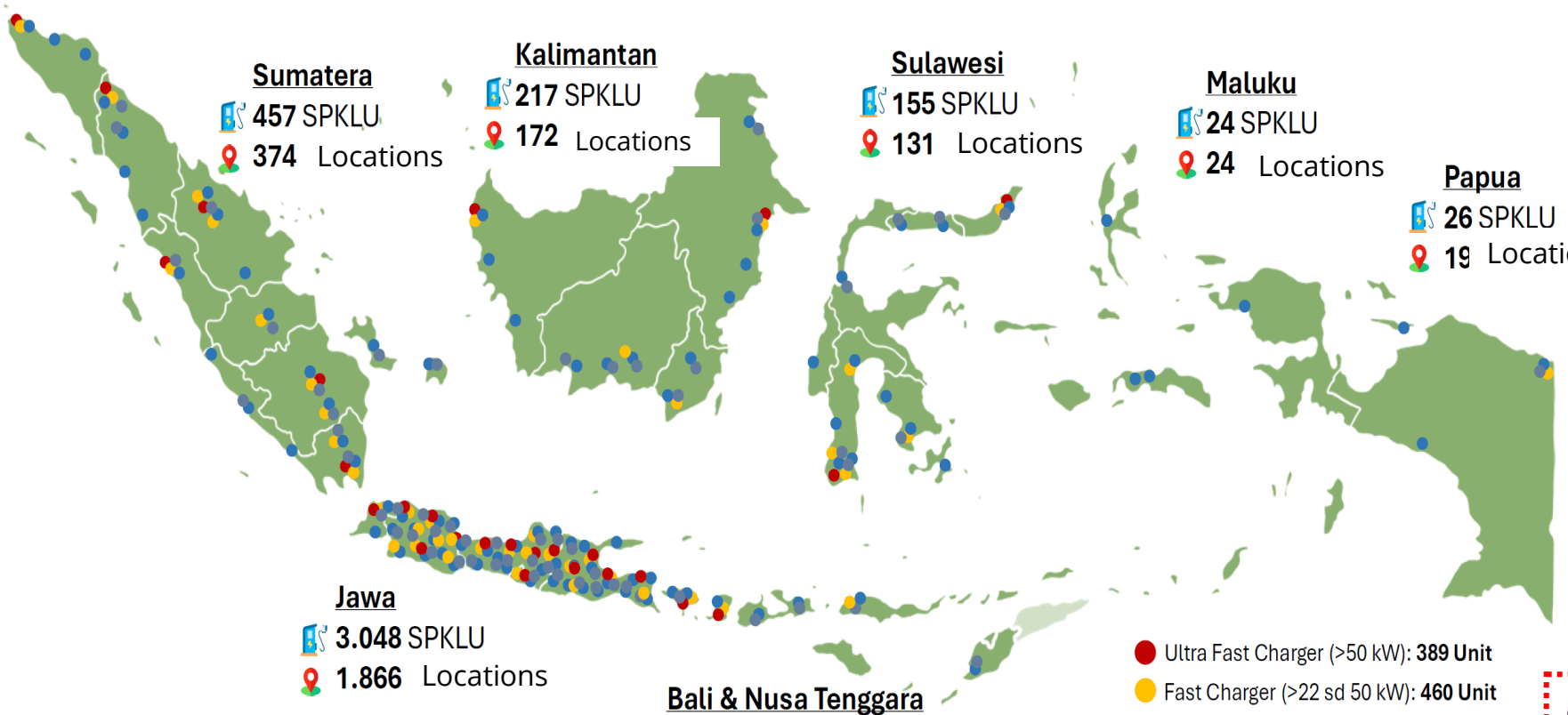
- Governor Instruction No. 66/2019 on Air Quality Control
- Governor Decree No. 1053/2022 on Guidelines for Accelerating the Use of Battery Electric Vehicles (KBLBB) for Transjakarta
- Governor Decree No. 576/2024 on Air Pollution Control Strategy, including plans for electric bus procurement and fleet retrofitting

Electric Bus and Retrofit Plan:

	2024	2025	2027	2030
Total	4,661	5,256	5,262	5,262
ICE Bus (unit)	4,461	3,574	2,631	0
EVs (unit)	300	1,874	2,631	5,262
% EV (unit)	4.7%	32%	50%	100%



DEVELOPMENT OF CHARGING STATION TO SUPPORT ELECTRIC VEHICLE MOBILITY IN INDONESIA



Sumatera
457 SPKLU
374 Locations

Kalimantan
217 SPKLU
172 Locations

Sulawesi
155 SPKLU
131 Locations

Maluku
24 SPKLU
24 Locations

Papua
26 SPKLU
19 Locations

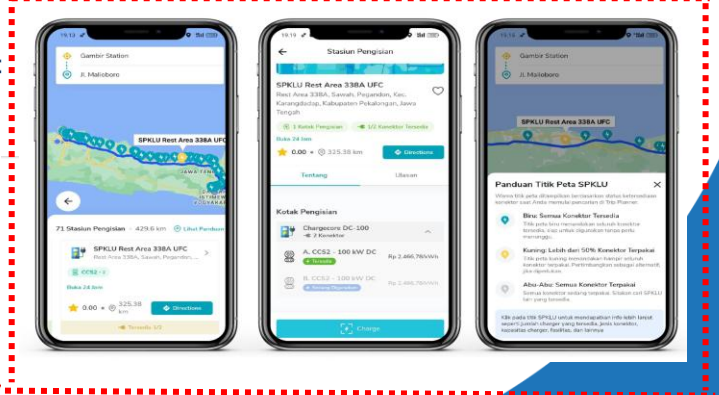
Jawa
3.048 SPKLU
1.866 Locations

Bali & Nusa Tenggara
258 SPKLU
182 Locations

- Ultra Fast Charger (>50 kW): **389 Unit**
- Fast Charger (>22 sd 50 kW): **460 Unit**
- Medium Charger (>7 sd 22 kW): **2.515 Unit**
- Standard Charger (≤ 7 kW): **821 Unit**

As of August 2025, a total of 4,185 Charging Stations (SPKLU) are available at 2,768 locations

Source: PLN, 2025



Charging Station (SPKLU) locations via Road Trip Planner

BAQ 2026
BETTER AIR QUALITY CONFERENCE
11-13 MAR • BANGKOK

CLEAN AIR ASIA · ADB · CLIMATE & CLEAN AIR COALITION TO REDUCE SHORT-LIVED CLIMATE POLLUTANTS · ESCAP Economic and Social Commission for Asia and the Pacific · UN environment programme

Thank you