DIRECTORATE OF VARIOUS OF NEW AND RENEWABLE ENERGY
DIRECTORATE GENERAL OF NEW RENEWABLE ENERGY AND ENERGY CONSERVATION
MINISTRY OF ENERGY AND MINERAL RESOURCES

#EnergyTransition

HYDROGEN READINESS

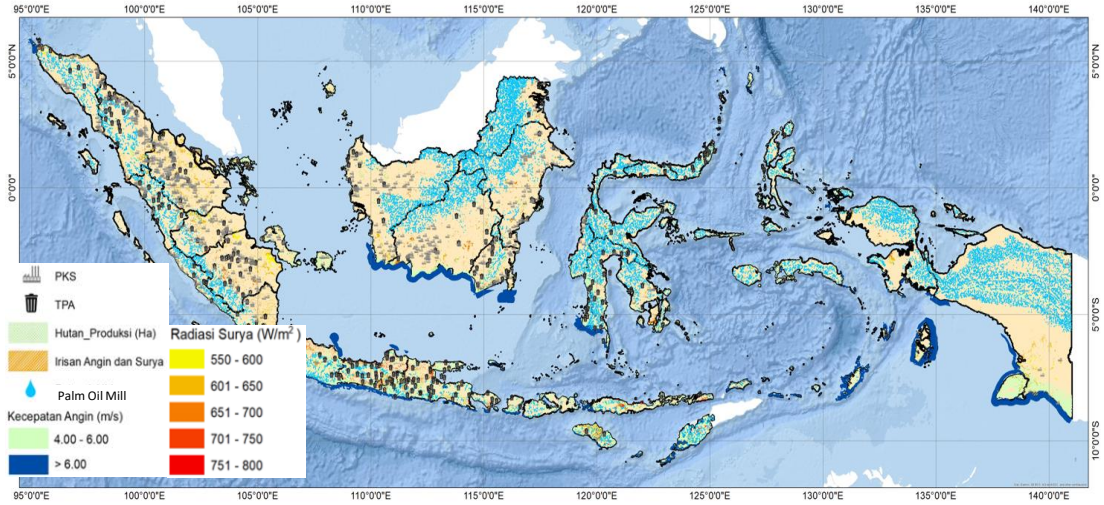
Eniya Listiani Dewi
Director General, New and Renewable Energy and Energy Conservation of Indonesia

Tokyo, 9 October 2024

NRE Potential to Support Energy Transition

National NRE Potential and Utilization

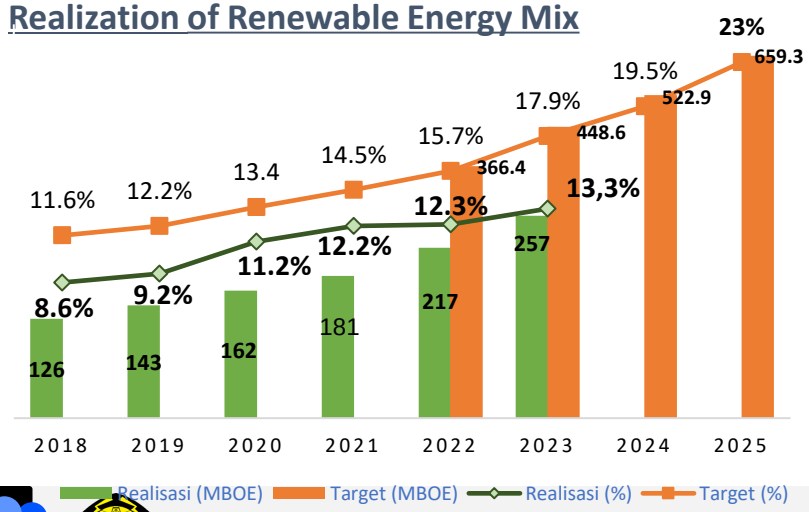
Indonesia's NRE resources are **abundant, diverse and spread** throughout the country. Currently**, only 0.3% of the total potential has been utilized.**



		POTENTIALS (GW)	UTILIZATION (MW)
	SOLAR | available all over Indonesia, particularly in East Nusa Tenggara, West Kalimantan and Riau which has higher radiation	**3,294**	**675.1**
	HYDRO | available all over Indonesia, particularly in North Kalimantan, NAD, North Sumatra and Papua	**95**	**6,697.2**
	BIOENERGY | available all over Indonesia in the form of main products, forestry/plantation land waste, waste in industry. Potential types include biofuels, biomass and biogas.	**57**	**3,408.4**
	WIND (>6 m/s) | available in East Nusa Tenggara, South Kalimantan, West Java, NAD & Papua.	**155**	**152.3**
	GEOTHERMAL | located in the «Ring of Fire», including Sumatra, Java, Bali, Nusa Tenggara, Sulawesi, & Maluku.	**23**	**2,597.5**
	OCEAN | **available** all over Indonesia, particularly in Maluku, East Nusa Tenggara, West Nusa Tenggara and Bali	**63**	**0**
	COAL GAS.		**250**
	TOTAL	**3,687**	**13,781**

Note: (1) Status of Semester I 2024, total numbers are rounded up (2) Including "LTSHE" ; Nuclear pot.: Uranium 89,483 tons - Thorium 143,234 tons

Realization of Renewable Energy Mix

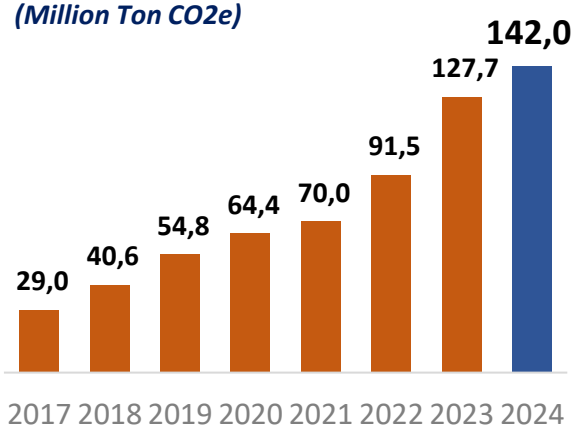


Enhanced NDC 2030

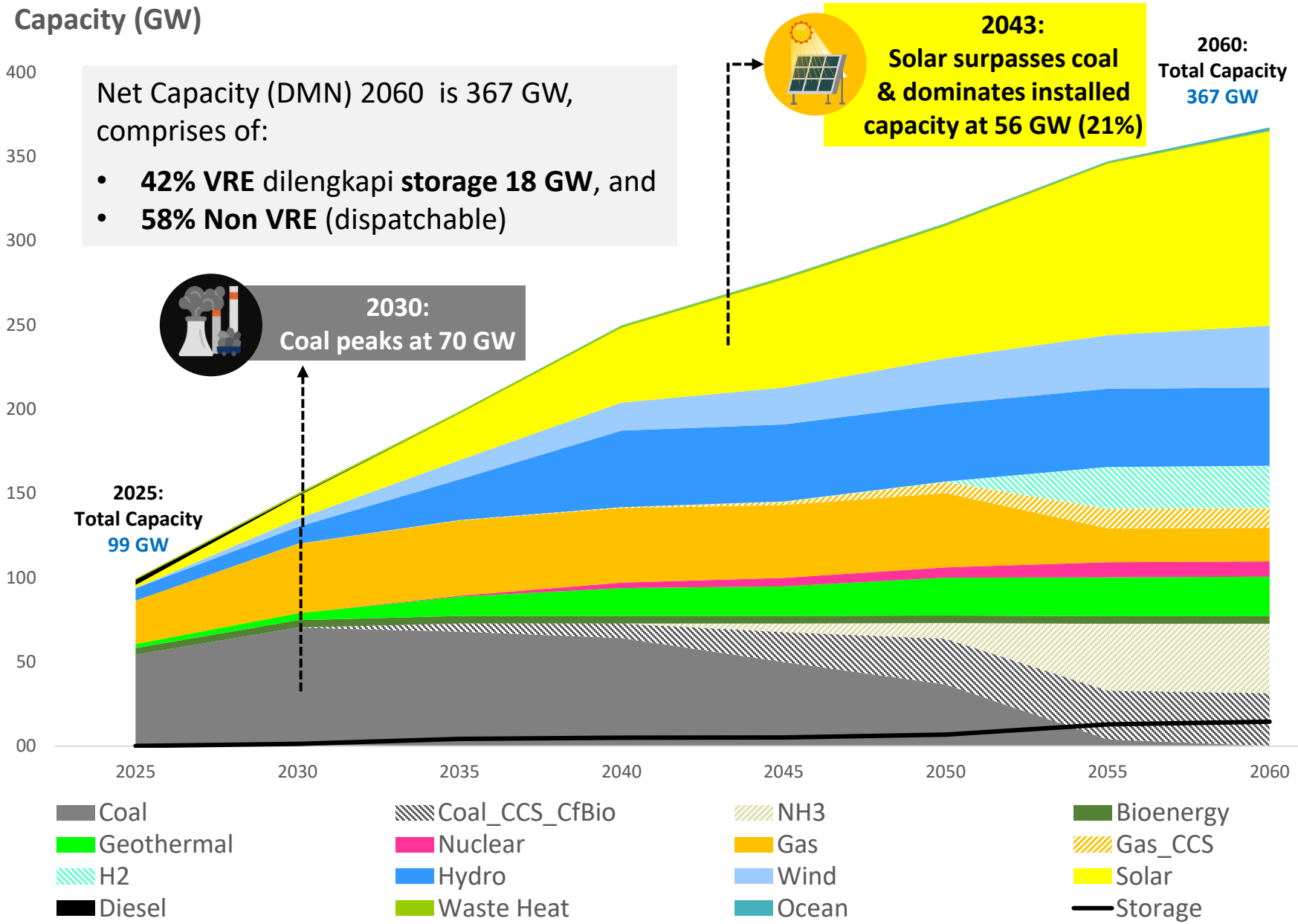
No	Sector	GRK Emission 2010 (Million Ton CO_2e)	2030 GRK Emission			Decline	
			BaU	CM1	CM2	CM1	CM2
1.	Energy	453,2	1.669	1.311	1.223	358	446
2.	Waste	88	296	256	253	40	43,5
3.	IPPU	36	69,6	63	61	7	9
4.	Agriculture	110,5	119,6	110	108	10	12
5.	Forestry	647	714	214	-15	500	729
TOTAL		**1.334**	**2.869**	**1.953**	**1.632**	**915**	**1.240**

Energy Sector Mitigation Actions

(Million Ton CO2e)



Improving Sustainability Through NZE in Electricity Sector (Draft Roadmap)



Installed Capacity (GW)

	Energy Type	2025	2060	Diff.
	Ocean	0	2	+2
	Solar	2	115	+113
	Wind	0	37	+37
	Hydro	7	46	+39
	Hydrogen	0	25	+25
	Gas/ Gas+CCS	26	32	+6
	Nuclear	0	9	+9
	Geothermal	2	24	+22
	Bioenergy	4	4	0
	Ammonia	0	41	+41
	Storage	0	18	+18
	Others	58	32	-26
	TOTAL	99	367	+268

Disclaimer: draft for discussion purpose only

INDONESIA'S HYDROGEN NATIONAL STRATEGY

Objective:
to establish a hydrogen economy that contributes to the energy transition and plays an essential role in decarbonizing the global energy system

Indonesia will reduce dependence on fossil fuels to ensure sovereignty and security of energy

Indonesia will pursue its decarbonization target by developing the domestic hydrogen market

Indonesia will export hydrogen and its derivatives to the global market by taking advantage of its uniqueness as a maritime country

Outcome

- NZE target achieved
- High NRE penetration
- High foreign investment in green industry
- Creation of green jobs
- Universal energy access meets SDGz 7 criteria
- Exports of low-carbon hydrogen and ammonia increased

LOW CARBON HYDROGEN AND AMMONIA DEVELOPMENT FOCUSED IN FOUR SECTORS IN INDONESIA

Industrial

- **As a gradual substitution for high carbon (existing) hydrogen.** Low-carbon hydrogen and ammonia produced from NRE sources supports the decarbonization of the industrial sector, and increases industrial competitiveness when a carbon tax is implemented.
- Reducing emissions for industries that require high temperatures (cement and steel)

Transportation

- Starting in 2030, **low-carbon hydrogen** will be used in the transportation sector **for long-distance vehicles** such as trucks, heavy transport and shipping.
- **Hydrogen vehicles** as a diversification of electric vehicles such as batteries

Electricity

- **Low carbon hydrogen/ammonia cofiring in fossil fuel plants**. This option can be considered in the 2030-2050 period, when there are high EBT penetration and curtailment, EBT prices are already cheap, carbon prices are quite high
- **Storage options** for off grid generation
- Storage technology options to overcome curtailment of NRE generators

Hydrogen and ammonia have the potential trading on regional and international markets, taking into account: Indonesia's strategic position as a maritime country, the potential for monetization of NRE sources for power generation with low demand, and the high interest of market players in capturing opportunities for trading low-carbon hydrogen and ammonia.

As an export commodity

National Hydrogen and Ammonia Roadmap

"Demand Driver based Method"

Power Plant

Hydrogen in gas turbine

Ammonia Co-firing in power plant

Transportation

50% of transportation is electric or hydrogen by 2035

(PR No.63 / 2022)

Industry

Ammonia production, Methanol production, Cement Industry, Steel Industry, Refineries, Textile Industry, Pulp-Paper Industry, Machinery-Transport Industry, Food-Beverage, Wood Industry.

City gas

2038: 20% H_2 & 80% NG

2038-2045: 80% H_2

2045: 100% H_2

- Finalization of the National Hydrogen and Ammonia Roadmap document is currently underway.
- This document uses the "Demand Driver based Method" approach to projection calculation.
- The source of demand data in hydrogen utilization is obtained from several sectors, namely: **industry, transportation, power plants, and gas networks.** While the source of supply data comes from hydrogen to be produced through electrolysis and biogas technology.
- Business entities involved in the discussion and data collection such as: Pertamina, Pupuk Indonesia, Krakatau Steel, PLN, Kaltim Parna Industri, NZE team, Indonesia Fuel Cell and Hydrogen Energy (IFHE), Center for Energy Studies (PSE) UGM, Panca Amara Utama, Semen Indonesia, Transportasi Gas Indonesia, Kaltim Methanol Industri, and more than 50 others.

Hydrogen Roadmap Action Plan

INITIAL STEPS

2025

- Develop a comprehensive hydrogen strategy and plan for Indonesia.
- Establish a National Hydrogen Working Task Force to oversee the development of the hydrogen strategy.
- Conduct feasibility studies for hydrogen production, storage and transportation.
- Promote research and development (R&D) in hydrogen technology.
- Initiate in building partnerships with international organizations for knowledge sharing and collaboration.
- Establish regulatory and safety standards for hydrogen production and transportation.

LAYING THE FOUNDATION

2030

- Initiate pilot projects for green hydrogen production, initially for use in transportation. Develop a domestic supply chain for hydrogen-related infrastructure.
- Increase green hydrogen production and storage facilities. Establish a national network of hydrogen refueling stations for transportation.
- Continue to promote research and development (R&D) in hydrogen technology.
- Develop a regulatory framework for low-carbon hydrogen certification.

EXPANSION & INFRASTRUCTURE

2035

- Promote the use of hydrogen in industrial sectors such as steel, chemical, power generation and transportation.
- Strengthen international cooperation for technology transfer and investment.
- Evaluate progress and make adjustments to the road plan as necessary.
- Encourage the private sector to invest in hydrogen-related projects.

HYDROGEN INTEGRATION

2040

- Increase the use of hydrogen in the industry sector.
- Support the growth of the domestic hydrogen supply chain.
- Continue international cooperation in technology and market development.
- Evaluate the environmental impact value of hydrogen production.

Hydrogen Roadmap Action Plan

HYDROGEN ECONOMY ACCELERATION

2045

- Promote hydrogen adoption in various sectors, including maritime transportation.
- Implement incentives for the use of green hydrogen in various applications.
- Form partnerships with neighboring countries for cross-border hydrogen projects.
- Continue R&D efforts to improve hydrogen technology and reduce costs.

MATURE HYDROGEN ECOSYSTEM

2050

- Achieving a significant reduction in the cost of hydrogen production.
- Expand hydrogen use in all sectors, including home heating and fuel cells.
- Invest in robust domestic hydrogen infrastructure, including pipelines.
- Evaluate regulation of the carbon footprint of hydrogen production.
- Evaluate the feasibility of hydrogen exports to neighboring countries.

LEADING HYDROGEN PLAYER

2055

- Position Indonesia as a regional and global leader in the hydrogen economy.
- Enhance export capabilities, especially for low-carbon hydrogen.
- Enhance cooperation with international partners to create hydrogen trade agreements.
- Promote innovation in hydrogen technology and applications.
- Conduct evaluations in improving the hydrogen supply chain.

SUSTAINABLE HYDROGEN FUTURE

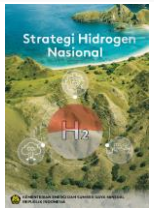
2060

- Consolidate Indonesia's position as a hydrogen hub.
- Expand the use of hydrogen to achieve sustainability and decarbonization goals.
- Continue R&D efforts to drive sustainable hydrogen technology.
- Promote hydrogen as a clean energy source.
- Update the road plan to adjust to changing market conditions and technologies.

POLICIES PREPARED BY MEMR

Complete/Published

1 Hydrogen National Strategy



- The document covers the current condition, direction and goals of hydrogen development in Indonesia.
- The National Hydrogen Strategy document was launched on December 15, 2023 and can be downloaded on link: https://bit.ly/StrategiHidrogenNasional

2 Hydrogen Technical Committee

Technical Committee 27-11 Hydrogen Technologies has been established with a scope: Mirroring ISO/TC 197 Hydrogen Technologies & IEC/TC 105 Fuel Cell Technologies.

3 Standar Nasional Indonesia (SNI)

3 SNIs have been issued in 2024, including:

- ✔ **SNI ISO 14687:2019**, *Hydrogen fuel quality - Product specifications*
- ✔ **SNI ISO 19880-1:2020**, *Hydrogen gas - Refueling stations - Part 1: General requirements*
- ✔ **SNI ISO/TR 15916:2015**, *Basic considerations for hydrogen system safety*

4 Green Hydrogen Supply Chain Feasibility Study (Upstream-Downstream)

- Detailed study and guidelines for hydrogen utilization in the transportation sector for the preparation of a hydrogen pilot project in DKI Jakarta.
- Overview of study results:
  - Potential Green H2 Source: PLN REC from Geothermal Plant Kamojang
  - Potential Green H2 Storage: pressurized tanks (low and high → max. 200 bar)
  - Potential H2 distribution method: using gas transmission pipeline (max. pressure 200 bar)
  - Potential utilization: at Hydrogen Re-fueling Station (HRS) with 12 potential locations

On Progress

1 National Roadmap of Hydrogen and Ammonia

A detailed action plan, as well as hydrogen development targets up to 2060, is outlined.

2 Guidance of HSE for HRS

Document is being finalized

3 Indonesian Standard Industrial Classification (KBLI) Code for Hydrogen

Urgency script for the proposal of KBLI Hydrogen is being finalized

4 Master Regulation for Hydrogen

Academic Paper on Draft of Hydrogen Government Regulation as the main regulation for hydrogen development in Indonesia is being prepared.

5 Preparation of Derivative Regulations

The Ministry of Energy and Mineral Resources is currently preparing a revision of Government Regulation No. 14/2012 with the addition of articles related to the purchase of electricity from new energy to accommodate the purchase of electricity from Hydrogen Power Plants.

POSISI INDONESIA TERHADAP PERKEMBANGAN HIDROGEN GLOBAL

At the 14th APEC Energy Ministerial Meeting, APEC Economies agreed on the endorsement of the document:

APEC POLICY GUIDANCE TO DEVELOP AND IMPLEMENT CLEAN AND LOW-CARBON HYDROGEN POLICY FRAMEWORKS IN THE ASIA-PACIFIC

Hydrogen has an important role in **energy transitions strategies** in Indonesia.

In the power supply sector, Hydrogen will contribute **21 GW by 2060**, replacing natural gas in gas power plants starting in 2051.

Hydrogen will not only be utilized as a new energy, but also as an **energy storage and carrier** to optimize the utilization of variable renewable energy, as well as to connect energy resources and demand

Thank You

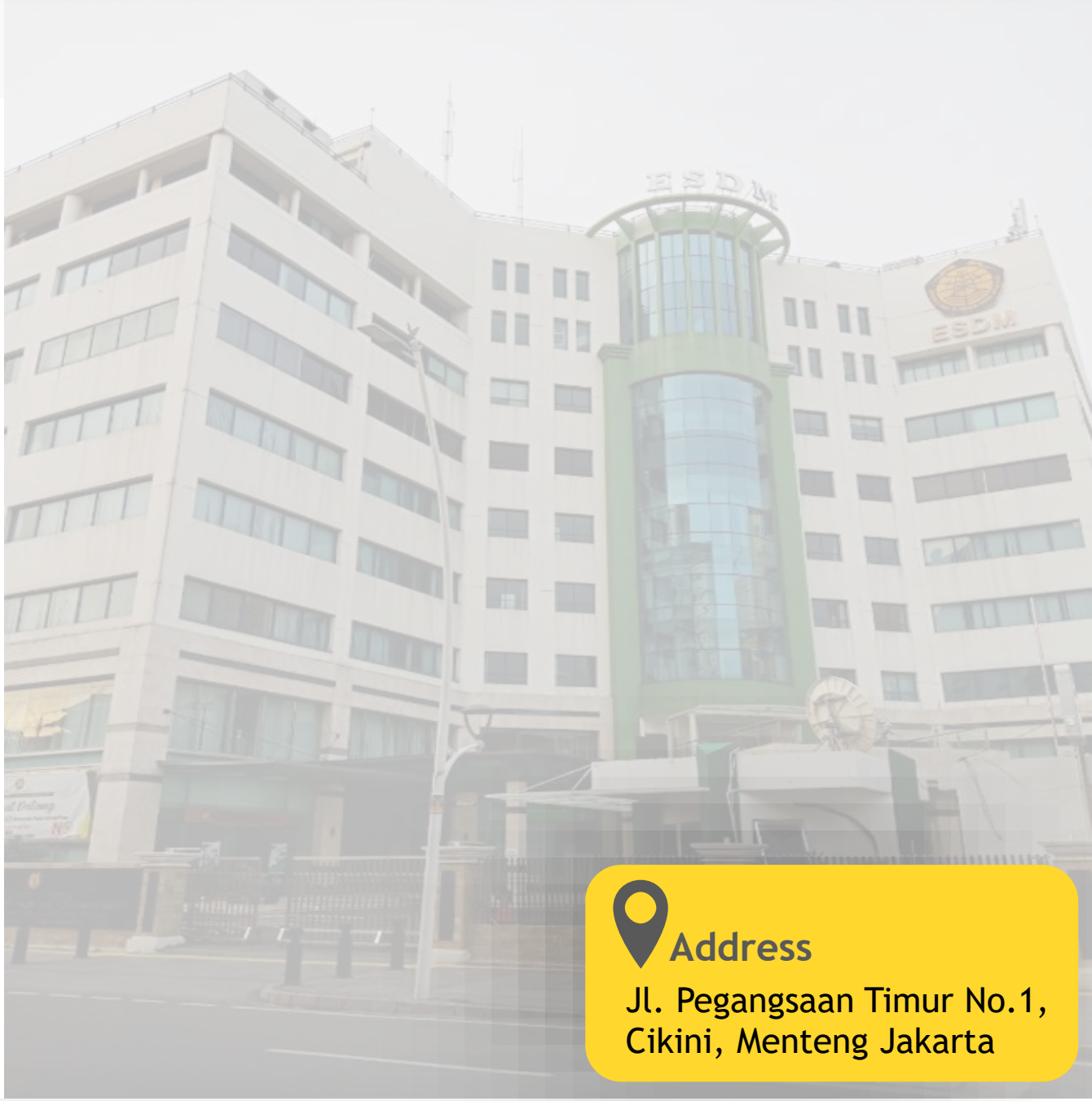
www.esdm.go.id

Kementerian Energi dan Sumber Daya Mineral

@kesdm

@KementerianESDM

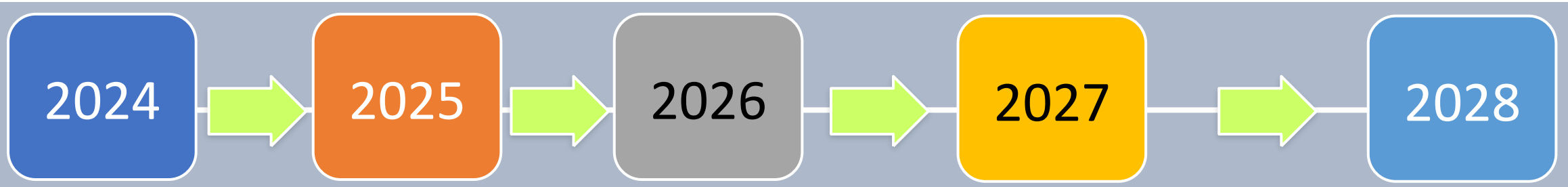
KementerianESDM



Address

Jl. Pegangsaan Timur No.1,
Cikini, Menteng Jakarta

Roadmap for the Development of National Hydrogen Standards



2024

1. ISO 14687:2019, *Hydrogen fuel quality — Product specification*
2. ISO/TR 15916:2015, *Basic considerations for the safety of hydrogen systems*
3. ISO 19880-1:2020, *Gaseous hydrogen — Fuelling stations — Part 1: General requirements*

2025

1. Indonesia's low-carbon hydrogen standard
2. ISO 22734:2019 *Hydrogen generators using water electrolysis — Industrial, commercial, and residential applications*
3. ISO 19880-8:2019, *Gaseous hydrogen — Fuelling stations — Part 3: Valves*
4. ISO 19880-8:2019, *Gaseous hydrogen — Fuelling stations — Part 5: Dispenser hoses and hose assemblies*
5. ISO 19880-8:2019, *Gaseous hydrogen — Fuelling stations — Part 8: Fuel quality control*

2026

1. ISO 17268 - *Gaseous hydrogen land vehicle refuelling connection device*
2. ISO 13985:2006, *Liquid hydrogen — Land vehicle fuel tanks*
3. ISO 19881 - *Gaseous hydrogen — Land vehicle fuel containers*
4. ISO 11114-1 - *Gas cylinders — Compatibility of cylinder and valve materials with gas contents*

2027

1. ISO 16110-1 *Hydrogen generators using fuel processing technologies – Part 1: Safety*
2. ISO 16110-2 *Hydrogen generators using fuel processing technologies – Part 2: Test methods for performance*
3. ISO 11114-4 *Transportable gas cylinders – Compatibility of cylinder and valve materials with gas contents – Part 4: Test methods for selecting steels resistant to hydrogen embrittlement*
4. ISO 16111 *Transportable gas storage devices – Hydrogen absorbed in reversible metal hydride*
5. IEC 62282-3-100:2019, *Fuel cell technologies - Part 3-100: Stationary fuel cell power systems – Safety*
6. IEC 62282-3-200:2015, *Fuel cell technologies - Part 3-200: Stationary fuel cell power systems - Performance test methods*
7. IEC 62282-3-201:2017, *Fuel cell technologies - Part 3-201: Stationary fuel cell power systems - Performance test methods for small fuel cell power systems*
8. IEC 62282-3-300:2012, *Fuel cell technologies - Part 3-300: Stationary fuel cell power systems – Installation*

2028

1. IEC 62282-3-400:2016, *Fuel cell technologies - Part 3-400: Stationary fuel cell power systems - Small stationary fuel cell power system with combined heat and power output*
2. IEC 62282-4-101:2022, *Fuel cell technologies - Part 4-101: Fuel cell power systems for electrically powered industrial trucks – Safety*
3. IEC 62282-4-102:2022, *Fuel cell technologies - Part 4-102: Fuel cell power systems for electrically powered industrial trucks - Performance test methods*
4. IEC 62282-4-600:2022, *Fuel cell technologies - Part 4-600: Fuel cell power systems for propulsion other than road vehicles and auxiliary power units (APU) - Fuel cell/battery hybrid systems performance test methods for excavators*
5. IEC 62282-5-100:2018, *Fuel cell technologies - Part 5-100: Portable fuel cell power systems – Safety*
6. IEC TS 62282-7-1:2017, *Fuel cell technologies - Part 7-1: Test methods - Single cell performance tests for polymer electrolyte fuel cells* (PEFC)