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The role of state-owned companies in Indonesia's energy transition

Deendarlianto
UGM

Strategic Issues



Rencana Umum Energi Nasional (KEN: PP No. 79 Tahun 2014)

National Energy Mix Target for NRE 23% By 2025

COP21 Paris Agreement

Target of Reducing Greenhouse gas (GHG) Emissions by 29% Against BAU by 2030

United Nations Framework Convention on Climate Change (UNFCCC)

The contribution of Indonesia to global responses in order to tackle climate change



Renewable Energy Potential

The potential to generate energy from green resource is 443.208 MW while the utilization is lower than the expectations

PLN Consumer Expectations for Reliable, Cheap and Green Electricity

premium renewable Energy products with green, blue, crystal service quality

High rank coal reserves low prices tend to rise

National coal reserves are at a low level. These include subbituminous and lignite.

ENERGY TRANSITION ROADMAP TO NZE



Source: Directorate General of New and Renewable Energy, Ministry of Energy and Mineral Resources

2021 – 2025

2026–2030

2031– 2035

2036 – 2040

2041– 2050

2051 – 2060



2025: Emission reduction of 231.2 million tons of CO₂

- Utilization of Rooftop Panels
- Acceleration of waste to energy
- Development of small-scale Micro Hydro Power Plant
- Cofiring for coal-fired power plants
- Hydropower Addition

(in line with RUPTL 2021-2030)

- Induction Stove 8.1 million households
- Dimethyl ether replaces LPG for Residential
- 300 thousand electric cars and 1.3 million electric motorcycles
- Gas Network for 5.2 million connections
- Mandatory 30% biodiesel by 2025

2030: Reduction in emissions of 327.9 million tons of CO₂

- Additional generation after 2030 is only from EBT.
- Pumped storage from 2025.

- Induction stoves for 18.1 million households
- 2 million electric cars and 13 million electric motorcycles
- Gas Network for SR 10.2 million
- Biofuels in the industrial and transportation sectors to 40%
- Energy Management and Energy Labeling for 11 Residential equipment

2035: Reduction in emissions of 388 million tons of CO₂

- Green Hydrogen from NRE from 2031 for the transportation sector
- Massive Battery Energy Storage System (BESS) by 2034
- Installed capacity of 11 GW Geothermal Power Plant by 2035

- Induction stoves for 28.2 million households
- 9.3 million electric cars and 51 million electric motorcycles
- Utilization of jargas for SR 15.2 million
- Biofuel use maintained at 40%
- Energy Management Implementation and Energy Labelling

2040: Emission reduction of 629.4 million tons of CO₂

- Nuclear use for electricity from 2039
- The development of Variable Renewable Energy (VRE) in the form of PLTS is increasingly massive, followed by Wind Power Plant both on shore and off-shore starting in 2037.

- CCS for cement and steel sector from 2036
- Low carbon fuel for shipping
- Use of Induction stoves for 37.9 million Cluster.
- 23 million electric cars and 101 million electric motorcycles
- Gas Network for 20.2 million connections
- Biofuels in the industrial and transport sectors maintained at 40%

2050: Emission reduction of 1043.8 million tons of CO₂

- Green hydrogen to replace fossil natural gas for high-temperature heating processes starting from 2041
- Primary energy from NRE is higher than total fossil-based primary energy

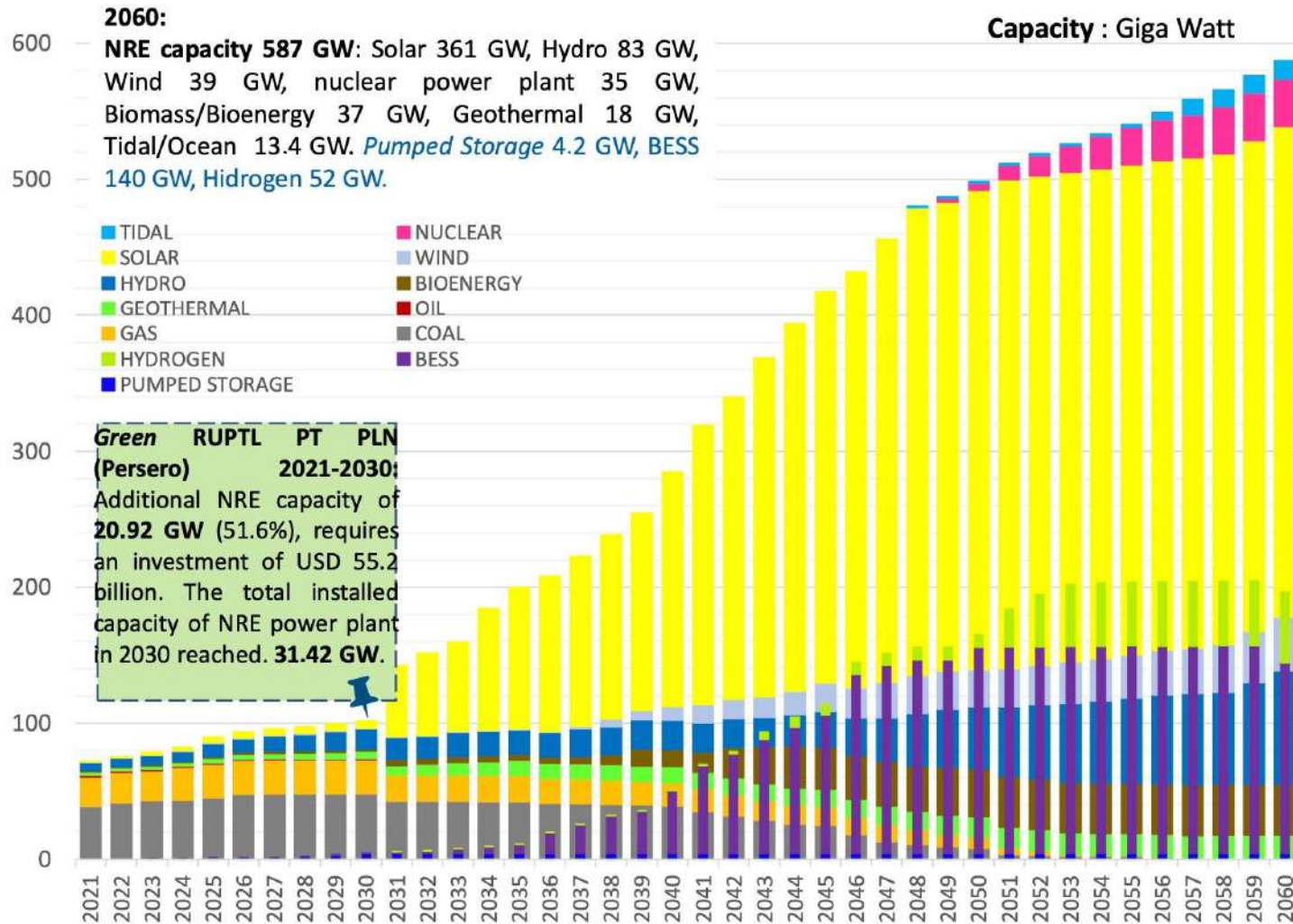
- Induction stove usage for 46.6 million households.
- The use of 50.2 million electric cars and 163 million electric motorcycles.
- Gas Network for SR 22.7 million connections
- The use of biofuels in the industrial and transportation sectors is maintained at 40%

2060: Emission reduction of 1798 million tons of CO₂

NZE by 2060

- Emissions in the electricity sector will reach zero and emissions of 129 million tons of CO₂-e in the industrial and transportation sectors
- Stop using gas for electricity
- Use of CCS in Industry 13 million tons of CO₂
- Induction stoves amounted to 54.3 million.
- 175 million electric motorcycles and 65 million electric cars
- Gas Network for 22.7 million connections
- Projected consumption demand electricity 1,942 TWh and electricity consumption per capita 5,862 kWh/capita

NRE POWER PLANTS DEVELOPMENT PLAN -NZE



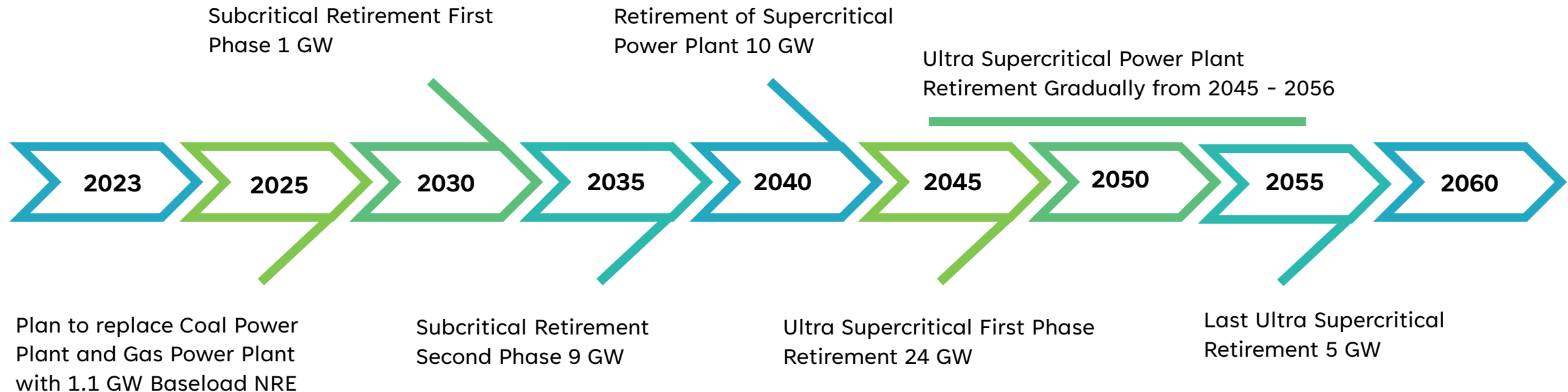
- Coal/Gas Power Plant:** No additional CFPP unless it has been contracted and constructed. PLN CFPP of IPPs retire after the PPA ended. Gas Fired PP retired after 30 years (remaining : <1GW, Coal:2057, Gas:2054)
- NRE:** Additional generation after 2030 only from NRE. Starting in 2035, it will be dominated by Variable Renewable Energy (VRE) in the form of Solar, in the following year it will be followed by Wind and Ocean.
- Geothermal:** Installed capacity of 11 GW by 2035 and continued development to 18 GW by 2060
- Nuclear Power Plan:** Will enter the system in 2049 to maintain system reliability, by 2060, it will need up to 35 GW
- Storage:** Pump storage enters the system in 2025, Battery Energy Storage System (BESS) to be utilized in 2031. Hydrogen is utilized gradually starting in 2031

Coal Power Plant Retirement Schedule Towards Carbon Neutral 2060



Presidential Decree No 112 Year 2022 on Renewable Energy Acceleration for Electricity , Article 3

- Retirement with consideration of capacity, age, utilization, emissions, economic value, funding and technology
- New Coal Fired Powerplants are prohibited with *the exception of* (1) CFPPs integrated with industry or part of Strategic National Projects ; (2) Committed to reduce emissions by 35% with 10 years, (3) Max until 2050

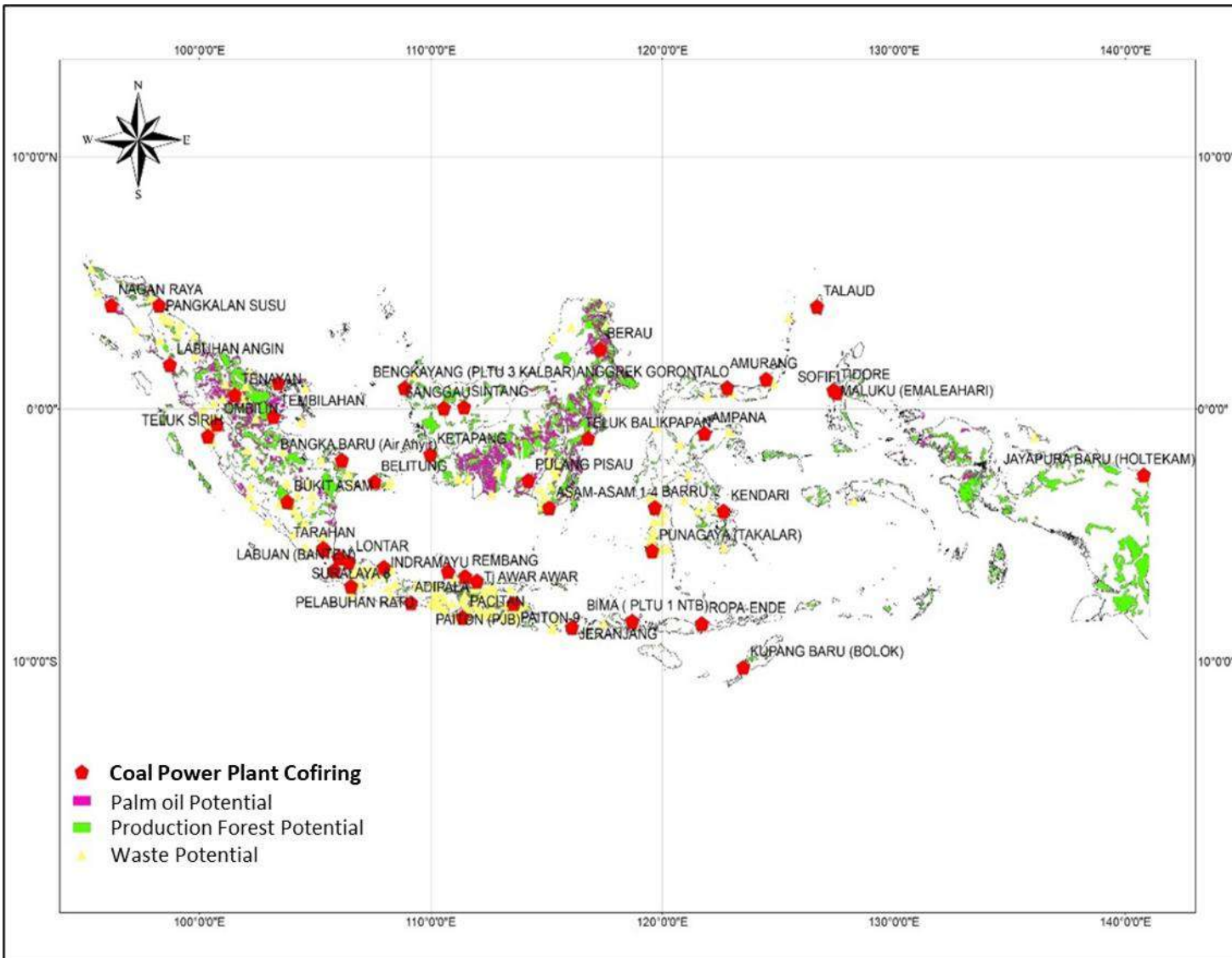


Source: PT. PLN (Persero) and Deputy for Coordinating Minister on Maritime Sovereignty and Energy Affairs (2021)

Cofiring Power Plant Inventory



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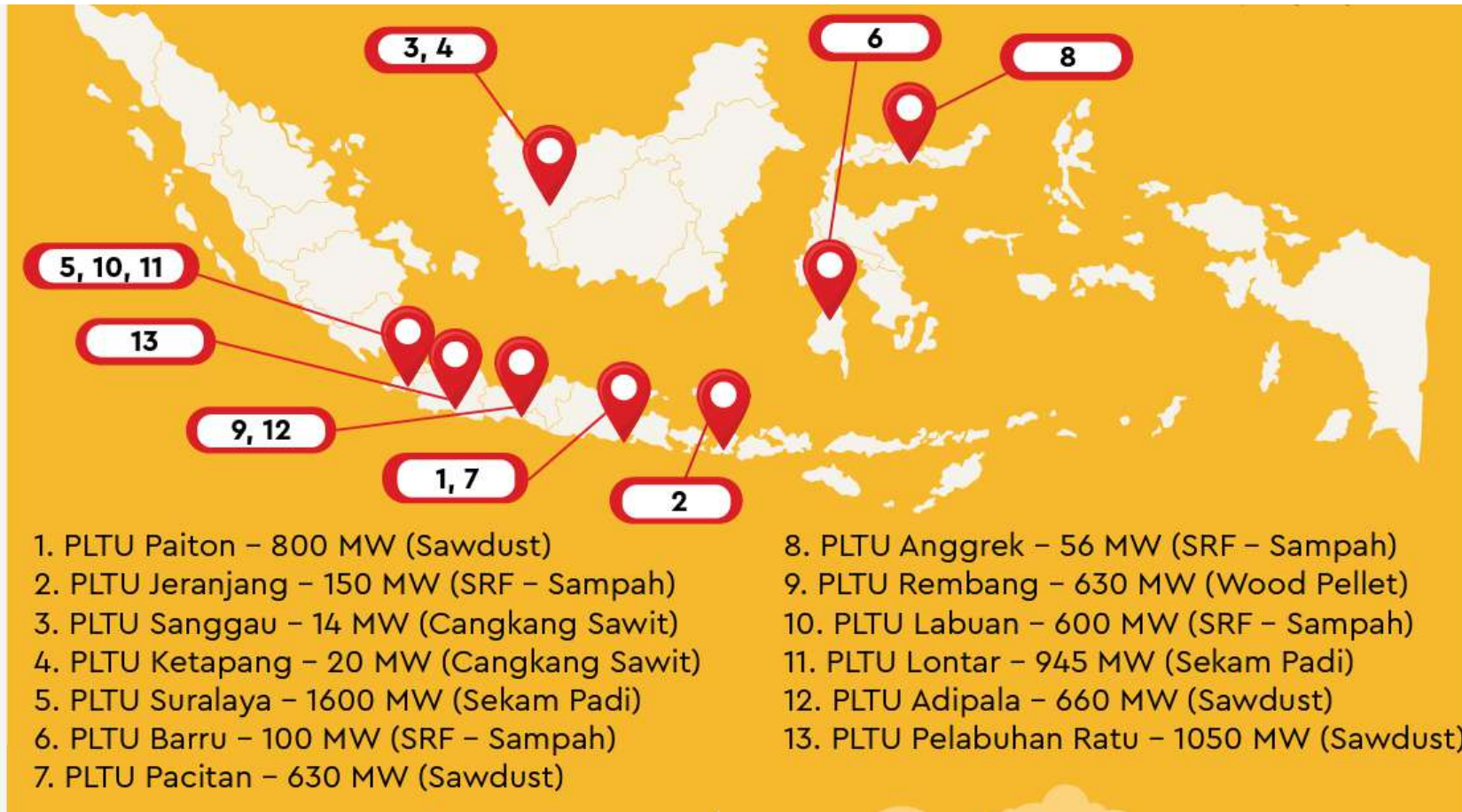


52 CFPPs were marked for co-firing:

- consisting of 3 types of boilers
 - 19 Types of CFPP with Circulating Fluidized Bed (CFB) boiler type
 - 21 types of coal-fired power plants with boiler type Pulverized Coal (PC)
 - 12 types of PLTU with Stoker boiler type
- total installed capacity of 18,665 MW
 - CFB: 2,580 MW
 - PC: 15,905 MW
 - Stoker: 180 MW

Source: CES UGM Analysis (2021) based on PLN (2020)

Cofiring Power Plant Inventory (Cont.)



In 2021, 26 CFPP have been tested, **13 coal-firing** power plants have implemented **commercial biomass co-firing**.

By mid-2022, 52 CFPP have been tested, and **32** have implemented **commercial biomass co-firing**.

Java : 13 CFPPs

Kalimantan : 6 CFPPs

Sumatera: 4 CFPPs

Sulawesi : 5 CFPPs

East Nusa Tenggara : 2 CFPPs

West Nusa Tenggara : 2 CFPPs

Source: MEMR (2021)

The Role of Stakeholders in the Cofiring Ecosystem (*Ekosistem Listrik Kerakyatan*)



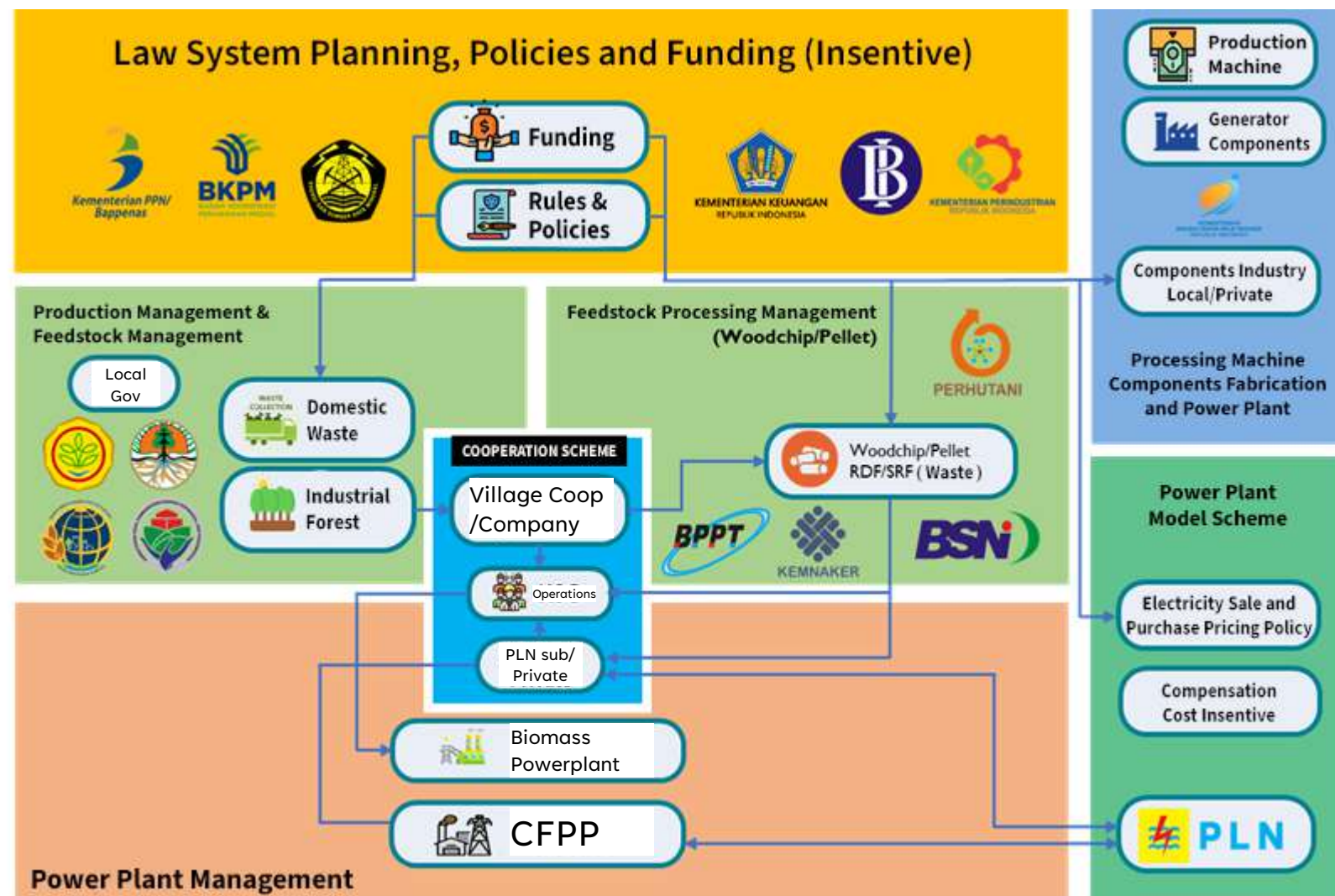
CHALLENGE

- Cost of plant preparation for co-firing
- Some developments are **not financially viable**
- There is no certainty of tariff **incentives/compensation** from the government
- **Sustainability of feedstock supply** → very climate dependent and quite expensive compared to coal
- There is **no reference standard** for bioenergy prices yet



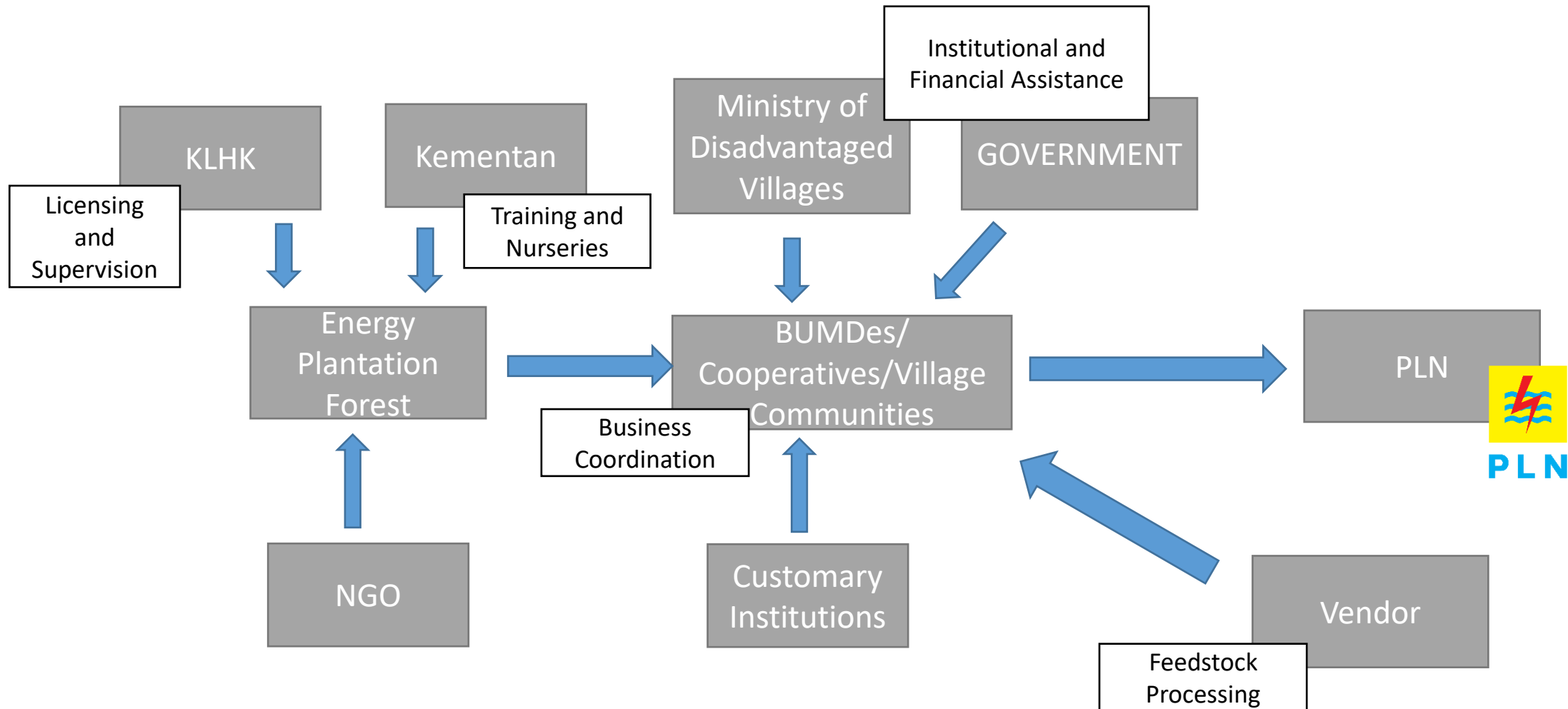
POLICY SUPPORT

- The determination of the type of feedstock plant is left to the **forest license holder**
- The minimum **selling price of electricity** from bioenergy should be higher than cost
- **Government incentives** for development
- **The use of biomass** in CFPP is calculated as the energy mix



Source: CES UGM (2021)

Business Scheme



Strategy PT. Pertamina optimizes the utilization of upstream oil and gas in the long term through strengthening business while building an environmentally friendly (low-carbon) energy foundation for the future



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Building a low-carbon business



Upstream

CCUS scale up & CCS commercialization



Gas

Acceleration of methanol & biomethane sales as well as CO2 pipeline infrastructure for CCUS/CCS



Refinery & Petrochemical

Accelerating biofuel production & exploration
Second & Third Generation Bioethanol



Commercial & Trading

Driving biofuel adoption through marketing & advocacy
Upgrading charging stations
Power/Swapping



Integrated Marine Logistic

Ammonia & H2 shipping as well as an exploration green terminal to support CCS (ship logistics)



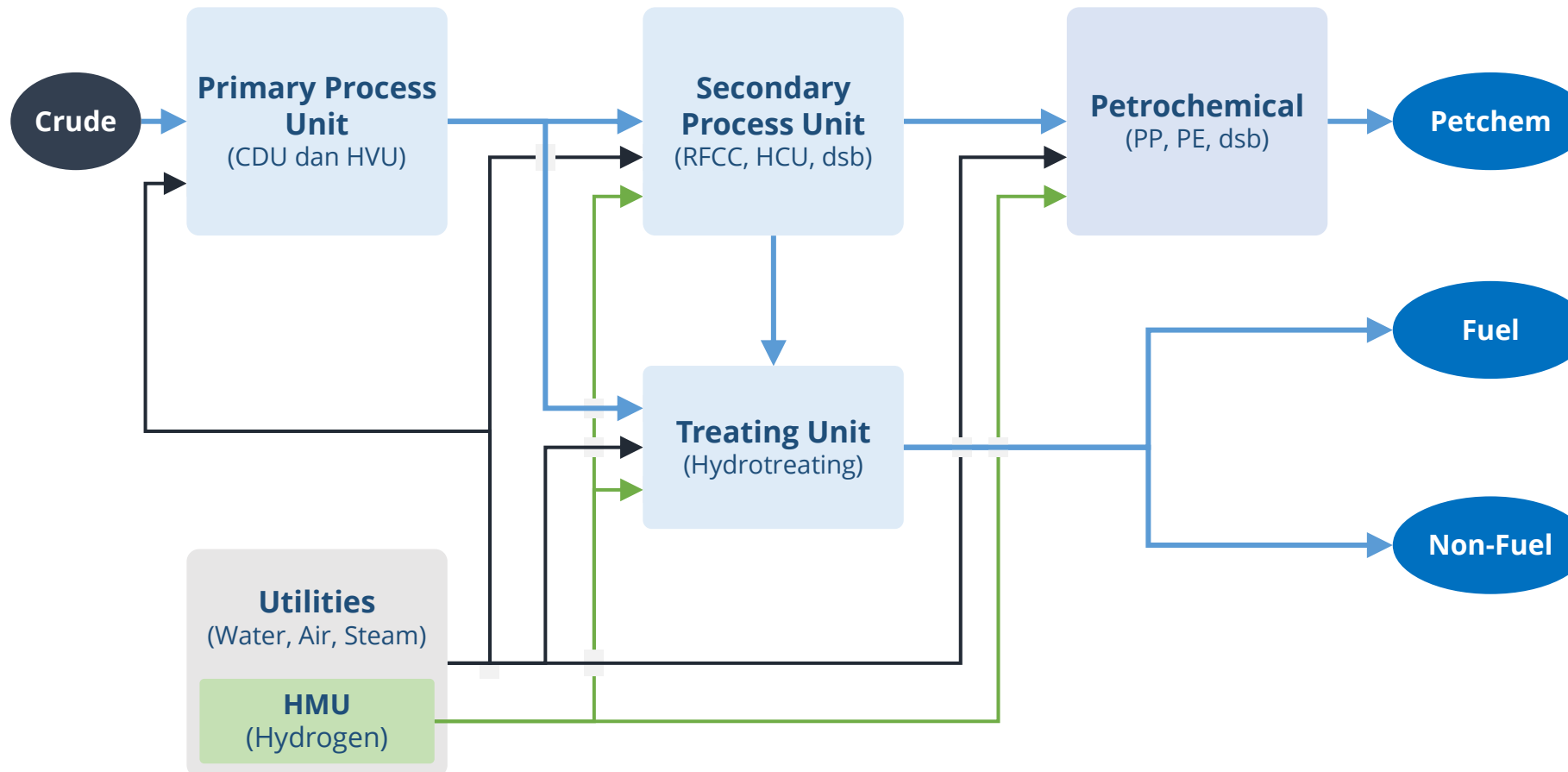
Power & New Renewable Energy

Leading the NRE battery & infrastructure market by 2030 (including E2W), clean hydrogen exploration, & carbon markets



Source: Pertamina

Hydrogen for Environmentally Friendly Fuel Production Treating Process



- ▶ Hydrogen (H₂) is a colorless and odorless gas that is a flammable gas.
- ▶ Hydrogen is a fuel and reducing material that is very effective for the treatment process
 - H₂ gas plays a very important role in the production of environmentally friendly fuels
 - Due to the largest need for H₂ compared to other industries, RU's produces its own H₂ gas through the proven and economical SMR (Steam Methane Reforming) process with Natural Gas raw materials

Sumber: Data inhouse

Mapping Hydrogen Needs for PT KPI



		Projects	H2 (kg/day)	Electricity (KW)	Water (L/day)	On Stream (year)
Small Scale	Pilot	• PPI Ulubelu untuk PP Plant RU III Plaju	100 (15 ¹)	300	1.300	current
	Quick Win	• Green Refinery Cilacap (Revamp TDHT Ph-2)	3.000 ²	9.000	40.000	2026
		• Green Methanol Balongan	25	75	325	2028
		• New PP Balongan	50	150	650	2025
		Projects	H2 (T/day)	Electricity (MW)	Water (T/day)	On Stream (year)
Next Phase		• DHT Plaju	24	180	310	TBD
		• DHT Cilacap	172	1.300	2.250	TBD
		• RDMP Balikpapan	260	2.000	3.375	TBD
		• DHT Kasim	3	25	40	TBD
Total Consumption		• RU II Dumai (Hydrocracker, Platforming, DHT)	190	1.500	3.300	TBD
		• RU IV Cilacap (NHT, Platforming, DHT, GSH)	175	1.300	2.250	TBD
		• RU V Balikpapan (Hydrocracker, DHT)	97	750	1.250	TBD
		• RU VI Balongan (DHT, GSH, Platforming)	88	670	1.500	TBD
		• RU VII Kasim (NHT)	3	17	30	TBD
Large Scale						

- ▶ There are 1 pilot project and 3 potential projects that can utilize Green Hydrogen in the near future with the needs that are still possible to be supplied by current green hydrogen technology
- ▶ Further utilization of Green Hydrogen for Compliance projects to the total implementation of green hydrogen for RU's is still not possible with current green hydrogen technology considering the huge demand from projects and existing RU's

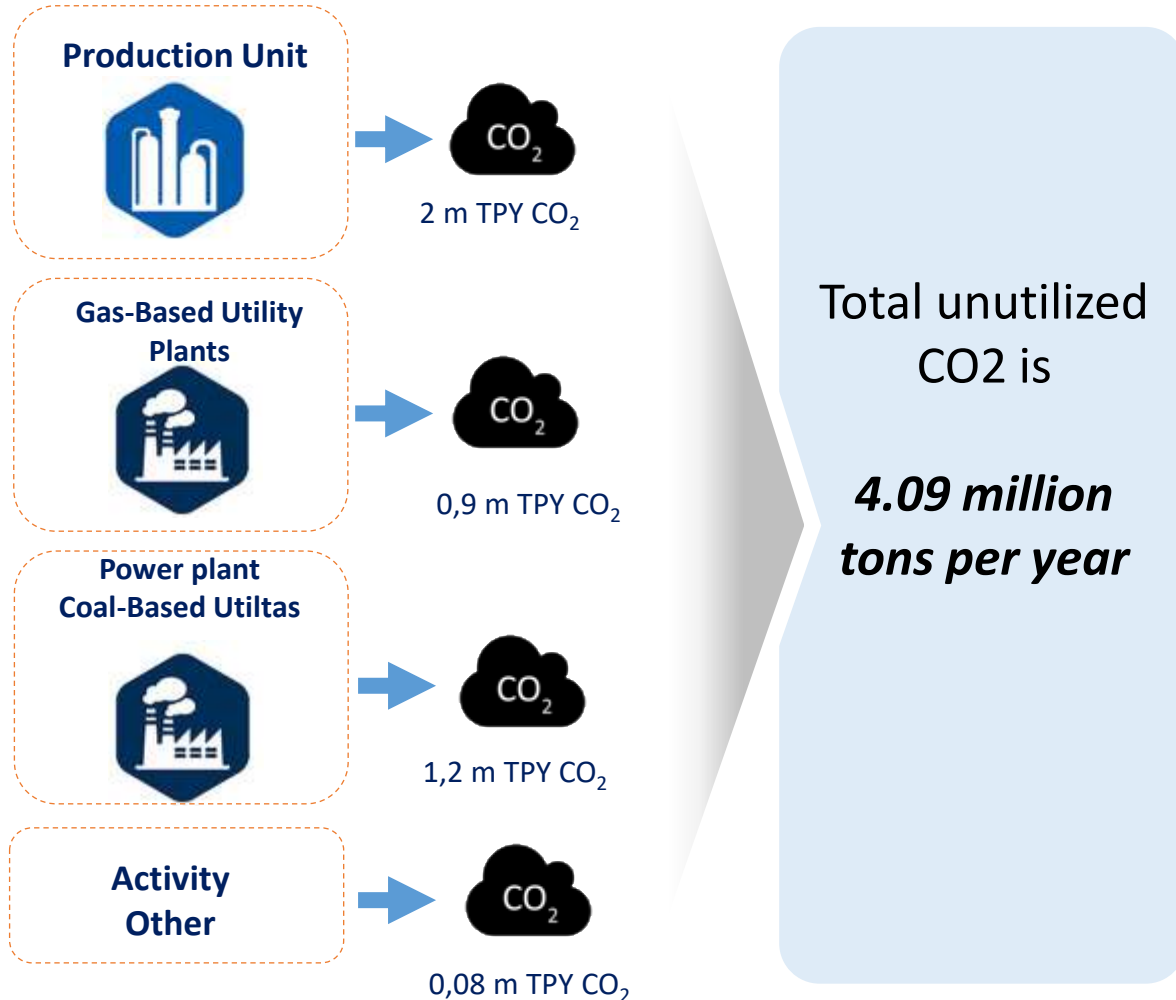
Sumber: Data inhouse, Jumlah kebutuhan hydrogen berdasarkan estimasi dari licensor proses yang terkait, dibulatkan

1. Pilot Proyek Ulubelu total kapasitas 100 kg/day namun hanya dimanfaatkan PP Plant Plaju 15 kg/day
2. Merupakan total kebutuhan Green Refinery. Kapasitas Green Hydrogen sesungguhnya akan lebih kecil, hanya sebagai backup

PKT Decarbonization Program



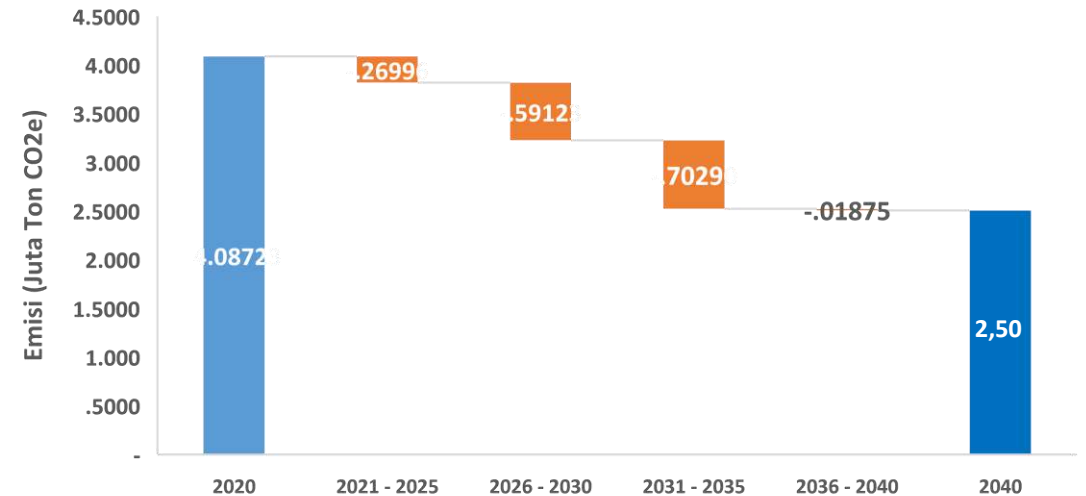
Emission CO₂ PKT*



PKT Decarbonization Program 2022-2040

Contribution to GHG Reduction

- A** Plant Efficiency 4.49%
- B** New Business/Technology Development 29.29%
- C** Substitution of Fossil-Based Raw Materials/Energy with NRE 2.93%
- D** Biological Approach 2.02%



Total GHG Emission Reduction 1.6 million tons per year (38.72%)

*Based on the 2020 Common Report Format Reporting Standards

Transition to Green Factory Operations

Utilization of Green Hydrogen into Green Ammonia



Rationalization of Green/Blue Ammonia Development



Decarbonisation

Global trend to reduce carbon emissions to the environment



New Market Opportunity

The use of Ammonia as an energy source (marine fuel) and co-firing boiler



Premium Price

Potential to obtain premium ammonia prices



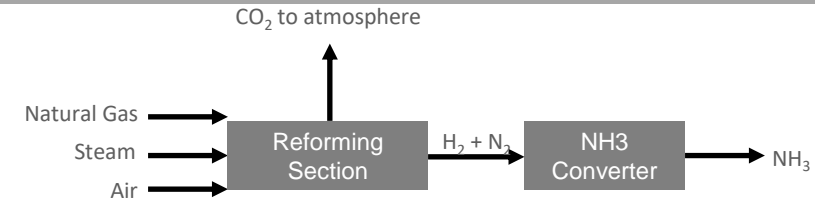
Easy Handling

Ease of delivery at a lower cost than handling in the form of hydrogen

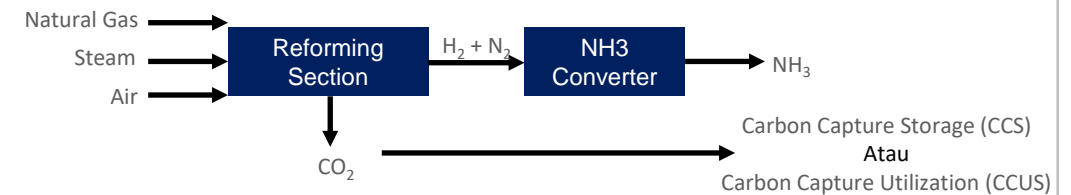


Comparison of Ammonia Technology Process

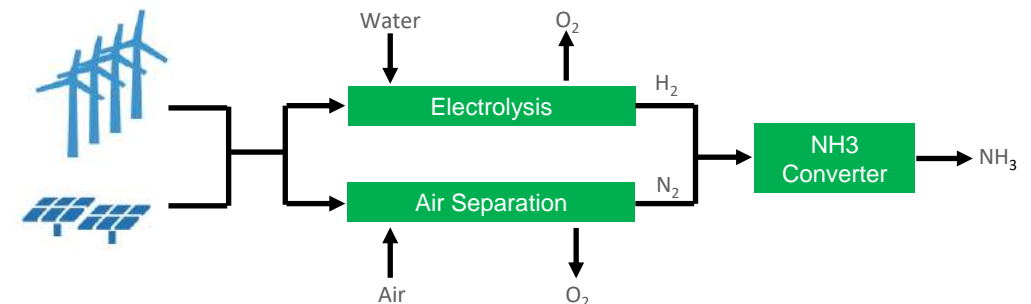
Grey/Conventional Ammonia (Stand Alone)



Blue Ammonia



Green Ammonia



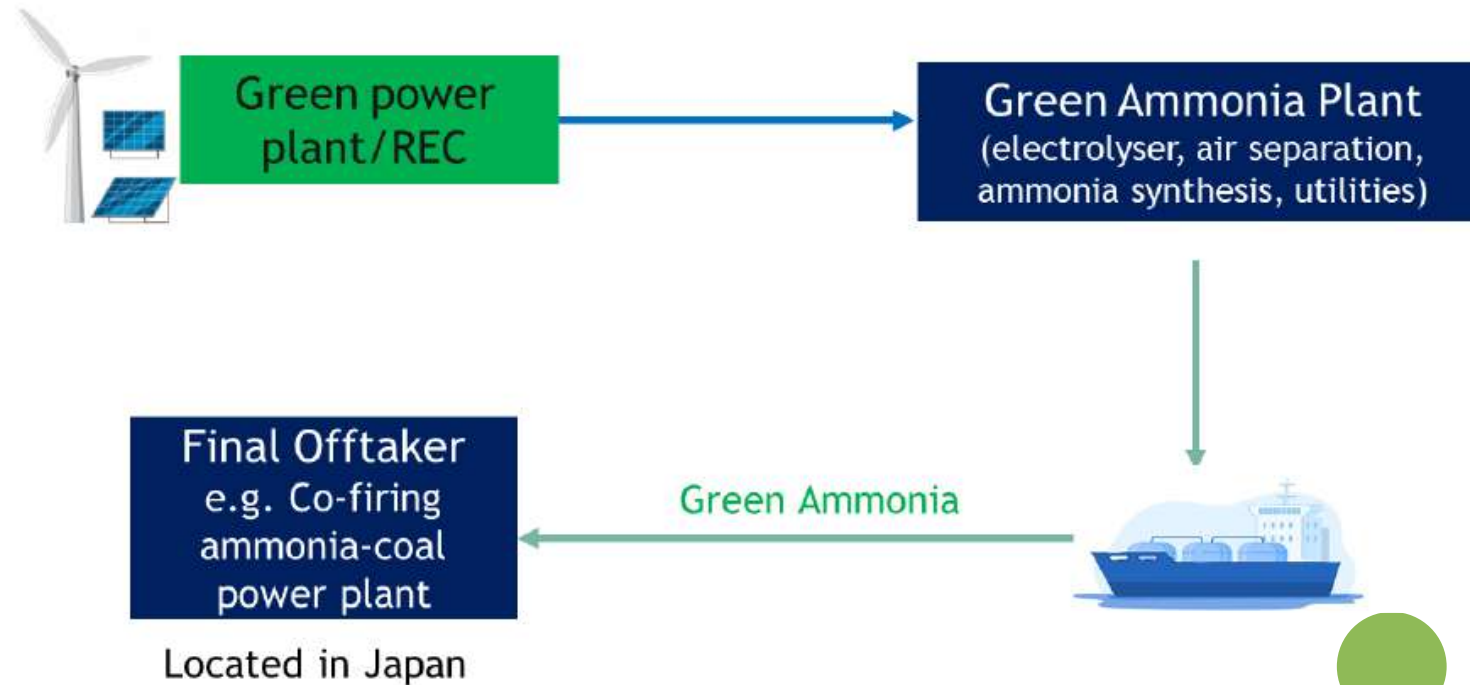
Cooperation with TOYO for Development Green Ammonia



PROJECT OVERVIEW

Feasibility Study on the Production of Green Ammonia from Hydrogen through Water Electrolysis Prooses

Stand Alone Green Ammonia



SECTOR

STRATEGY DESCRIPTION

Oil and Gas

- Revolutionize technology by implementing flare gas recovery as a by-product of oil and gas production
- Optimizing the use of geophysical and geological technology in an integrated manner for exploration
- Mapping the gas marketing supply chain network between producers and consumers
- Development of the petrochemical production sector that prioritizes ethylene production.

Coal

- Coal grouping and supply chain mapping to mine mouths
- Coal gasification and liquefaction for the utilization of low-calorie quality coal
- Production of olefins from low-quality coal

New and Renewable
Energy

- Study of the electricity system of intermittent power plants [PLTS, PLTB]
- Roadmap for the use of electric cars to reduce national fuel consumption
- Roadmap for the use of biofuels for vehicles and industry

Electricity

- Mapping and integration of the plant component industry
- HR certification: installation, maintenance and operator as well as Certification (SNI) of plant components
- High-tech plant optimization (4.0) [Coal tracking and Diagnostics & Monitoring]



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