MINISTRY OF ENERGY AND MINERAL RESOURCES
REPUBLIC OF INDONESIA

INDONESIA'S RENEWABLE ENERGY OPPORTUNITIES

Presented at Mentari Business Forum (Lunch)
30th October 2021

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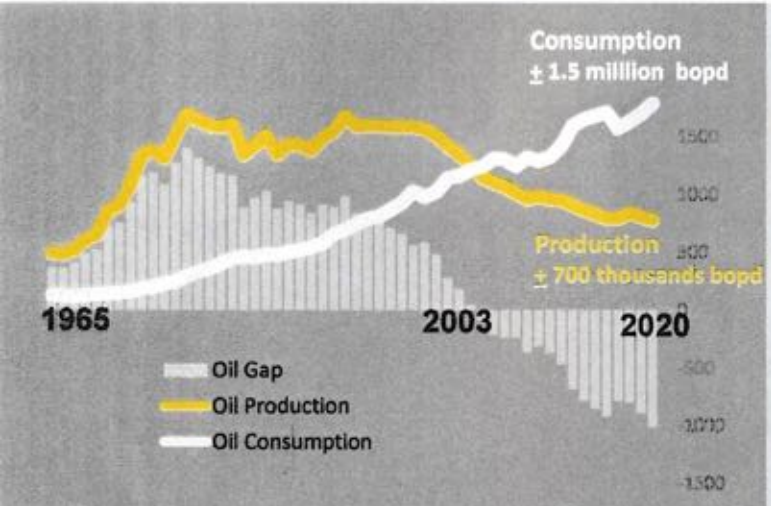
CURRENT ENERGY CONDITION

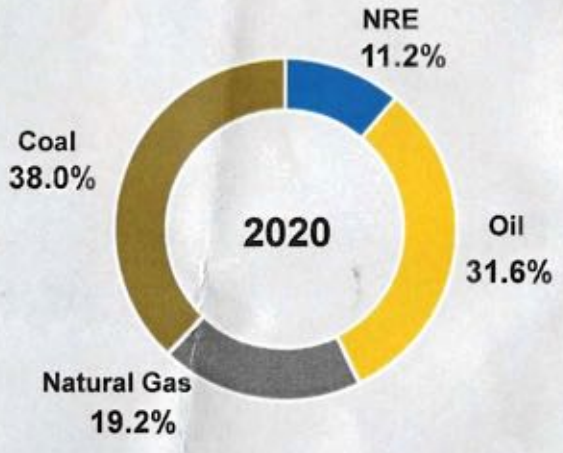
OIL CONSUMPTION IS HIGHER THAN PRODUCTION



01 Oil production continues to decline, while consumption is relatively increasing. Impact: an increase in imports and a trade balance deficit.

02 It is necessary to utilize alternative energy sources to reduce dependence and import fuel.

PRIMARY ENERGY MIX IS STILL DOMINATED BY FOSSIL ENERGY



01 Coal still dominates the share of national energy use. However, the carbon emissions released by coal are very large (not environmentally sustainable).

02 The utilization of renewable energy as an environmentally friendly energy sources is still low.

LARGE NRE POTENTIAL, NOT YET OPTIMIZED

ENERGY	POTENTIAL (MW)	UTILIZATION *) (MW)
SOLAR	400,000	194
HYDRO	90,000	6,432
BIOENERGY	45,000	1,923
WIND	60,600	154
GEOTHERMAL	23,700	2,186
OCEAN	18,000	0
NUCLEAR	11,000**)	0
TOTAL	648,300	10,889

01 The potential for new renewable energy in the predictable category is still being calculated. Currently, only 0.02% of the total potential has been utilized.

02 In addition to renewable energy, the potential for new energy that exists is still not widely developed.

*) As of September 2021

**)only uranium potential for nuclear power plant operation for 30 years and not including thorium potential

INDONESIA'S COMMITMENT IN EMISSION REDUCTION

Starting with Energy Transition, Energy efficiency, and Green Economy

NZE PRINCIPALS

01 **Increasing the utilization of New Renewable Energy (NRE)**

02 **Reducing fossil energy**

- Carbon tax & trading
- Steam PP Co-firing with NRE
- Steam PP Retirement

03 **Electric vehicle utilization in transportation sector**

04 **Increasing the use of electric home appliances in household sector and electric equipment in industrial sector**

05 **The utilization of Carbon Capture and Storage (CCS)**

THE PRESIDENT'S DIRECTIVES

UNFCCC - COP21, DECEMBER 2015

Reducing GHG emission for 29% or **41%** (by international assistance) by 2030 based on NDC.

LEADERS SUMMIT ON CLIMATE, APRIL 2021

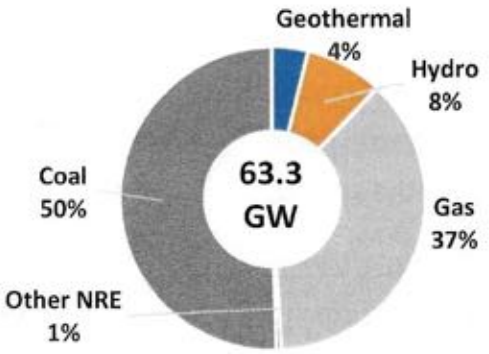
Opening up **energy transition** investment through the **development of biofuel, lithium battery industry, and electric vehicle.**

STATE ADDRESS 16 AUGUST 2021

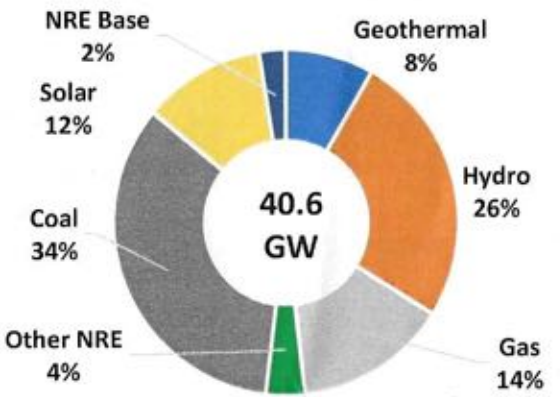
Transforming towards **NRE, as well well accelerating green technology-based economy**, will be a crucial change in our economy.

Plan to Add 40.6 GW Power Plants in RUPTL 2021-2030

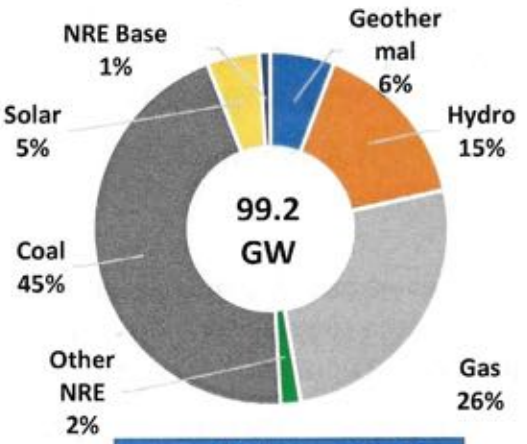
"Greener RUPTL as a Foundation for Achieving Zero Carbon 2060"



Installed capacity in 2020



New installation RUPTL 2021-2030



Installed capacity in 2030

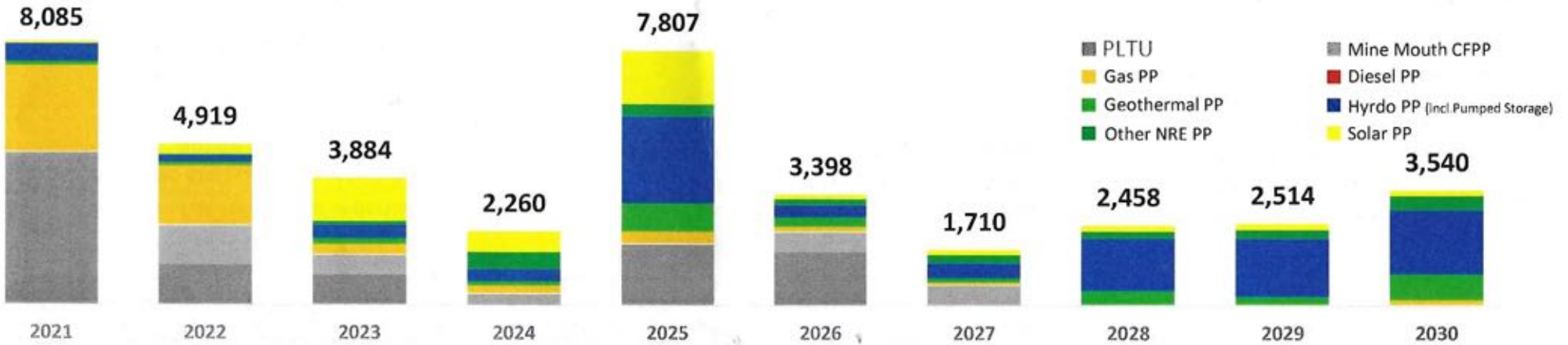
- The installed capacity of PLN's power generators in 2020 is **63.3 GW**.
- The total of new additional capacity will be **40.6 GW** for the next 10 years with the RE portion reach **20.9 GW or 51.6% (GREEN RUPTL)**
- The planned of retirement PLTU as much as **1.1 GW**
- The replacement of old Diesel/Gas PP around **3.6 GW**
- The total installed capacity in 2030 will be **99.2 GW**.
- Most of the new NRE PP (51,6% of new NRE capacity) will be built by the Private Sector

JENIS	TOTAL (MW)
NRE	**20.923**
HYDRO PP & PS	10.391
WIND PP	597
BIO PP	590
GOETHERMAL PP	3.355
SOLAR PP	4.680
NRE Base PP	1.010
BESS	300
FOSSIL	**19.652**
CFPP	13.819
GFPP/CCPP	5.828
DIESEL PP	5
TOTAL	**40.575**

Private sector participation is widely open

Category	MW	Portion in Category
New PP by Private Sector	**26.306**	**64,8%**
New NRE Capacity	**20.923**	**51,6%**
NRE by Private Sector	**11.779**	**56,3%**
Solar PP by Private Sector	**2.979**	**63,7%**

RUPTL 2021-2030: Achieving 23% of NRE in 2025



In order to achieve the 23% NRE mix in 2025 and reduce the coal energy mix from 67% to 59,4% in 2030, the following efforts are made:

1. Completion of 7 GW FTP II and 35 GW Program will be completed in 2026/2027. With the Low Carbon scenario, the coal energy mix will be reduced to 59.4% in 2030.
2. Implementation of biomass co-firing at CFPP PLN with an average portion of 10% for CFPP in Java-Bali and 20% for CFPP outside Java-Bali, with CF 70%, total capacity equivalent to 2,700 MW, and requires 8 to 13 million biomass tons/year.
3. The contribution of co-firing in the energy mix is about 3-6%.
4. The Dedieselization program spreads in 588 MW Diesel PP which equal to 1.2 GWp Solar PP and batteries
5. Construction of 4.7 GW of solar PV PP and 0.6 GW of Wind PP to achieve a 23% RE mix by 2025.
6. The need for 1.1 GW of new CFPP after 2025 are replaced with RE baseload PP such as Solar PV+BESS, Wind+BESS, Hydro PP, Biomass PP, and Geothermal PP.
7. Retirement of 1.1 GW of old Sub Critical CFPP in Muarakarang, Priok, Tambaklorok and Gresik in 2030

ROADMAP TOWARDS NET ZERO EMISSION

2021: Pres. Reg. on NRE, Pres. Reg on *Coal Retirement*, Steam PP *co-firing*, CCT, Diesel to gas & NRE conversion

2022: Law on NRE, electric stoves 2 million households/annum

2024: Interconnection, *smart grid* & *smart meter*

2025: NRE 23% dis dominated by Solar PP

- Electrification Ratio 100%,
- Electricity Demand 1.217 kWh/capita.
- Pumped Storage start COD
- Emission reduction 198 million ton CO_2

2031: First Stage Retirement for sub-critical CFPP, inter island interconnection start COD

- No more Diesel PP
- Start hydrogen use for electricity
- Increase Battery Usage

2035: NRE 57% is dominated by Solar PP, *hydro,* geothermal energy

- Electricity Demand 2.085 kWh/capita,
- Emission reduction 475 million ton CO_2

2048: Large Scale Ocean Current PP start COD

2049: First Nuclear PP starts COD

2050: NRE 93% is dominated by Solar, Hydro, and Bioenergy

- Reduce sales of conventional cars
- Electricity Demand 4.299 kWh/capita,
- Emission reduction 956 million ton CO_2

2021-2025 | **2026-2030** | **2031-2035** | **2036-2040** | 2041-2050 | **2051-2060**

2027: Gradual reduction of imported LPG

2030: NRE 42% is dominated by Solar PP

- No new fossil PP after 2030
- EV 2 million of four-wheelers and 13 million of two-wheelers
- BBG 300 thousand
- City gas for 10 million houses,
- The utilization of DME
- Electricity Demand 1.548 kWh/capita,
- Emission reduction 314 million ton CO_2

2036: Second Stage Retirement sub-critical, critical, & partly super critical CFPP

2040: NRE 66%, dominated by Solar, Hydro & Biomass

- Reduce sales of conventionall motorcycles
- LED Lamps 70%
- Electricity Demand 2.847 kWh/capita,
- Emission reduction 796 million ton CO_2

2051: Massive Utilization of Hydrogen

2054: Gas Fired PP cap. <1GW

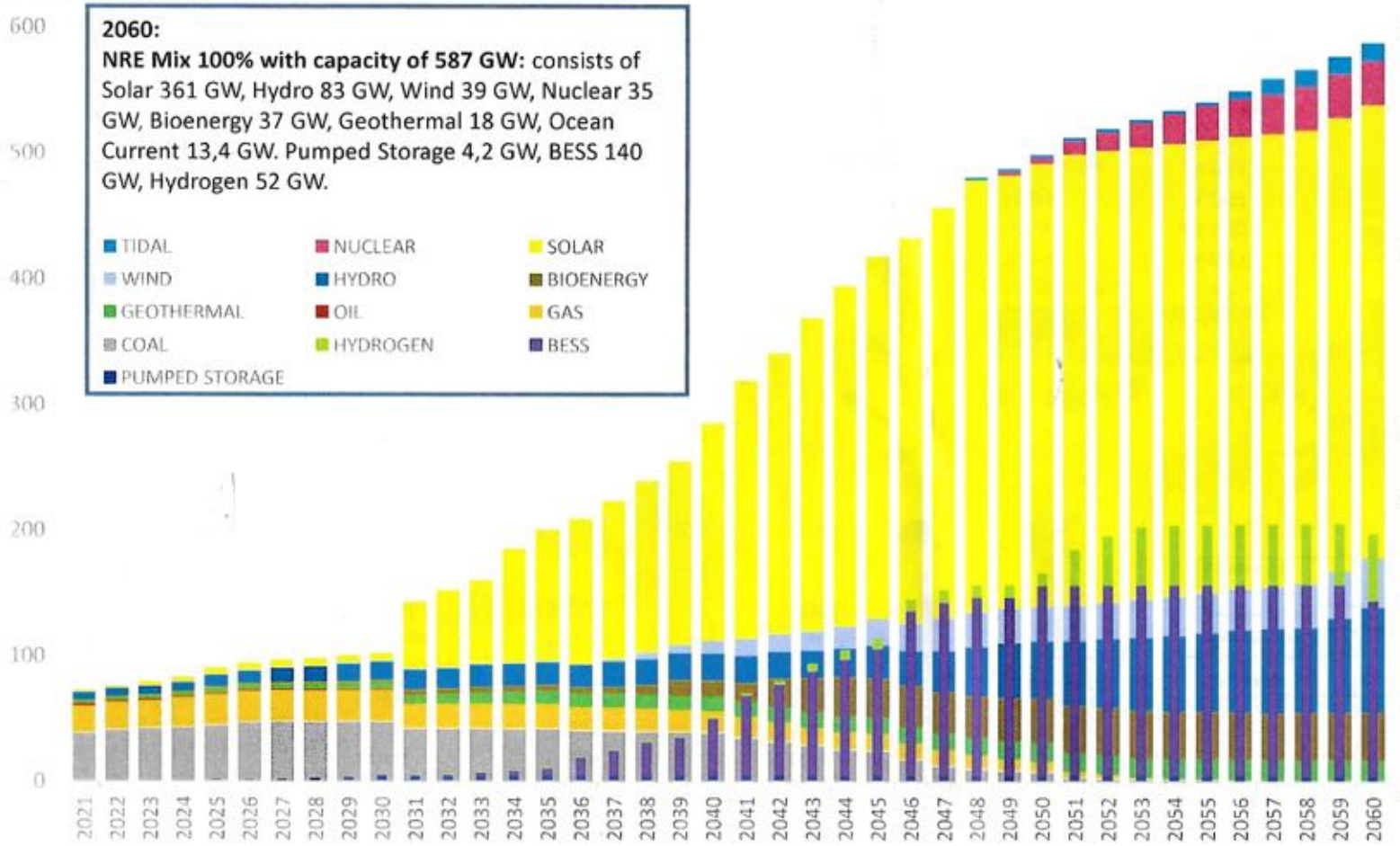
2057: Coal Fired PP cap. <1GW

2060: NRE 100%, is dominated by Solar PP, hydro, and wind

- All two-wheelers are electric-based
- Electric stoves 52 million households,
- City gas for 23 million SR
- Electricity Demand 5.308 kWh/capita
- Emission reduction 1.526 million ton CO_2

ELECTRICITY SUPPLY PLAN

Capacity: Giga Watt

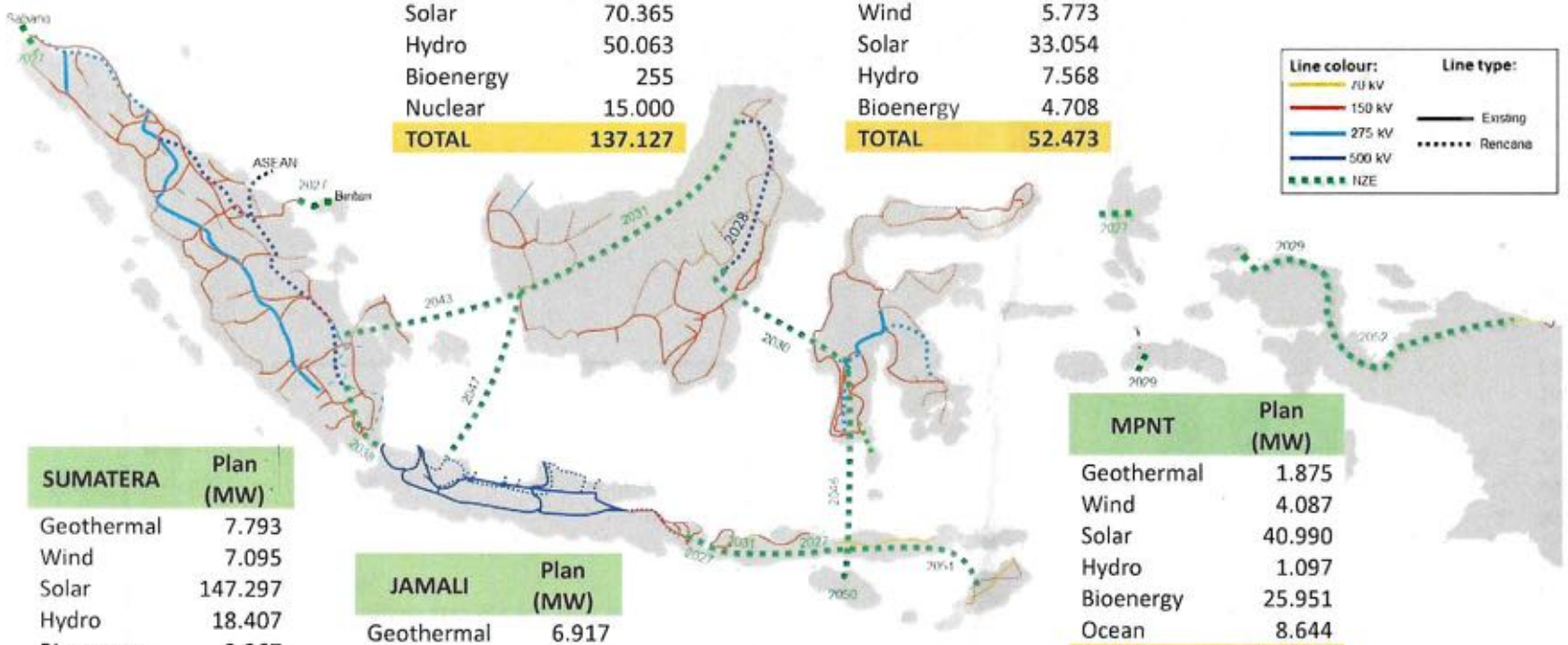


1. **Coal/Gas PP:** No additional CFPP unless contracted/under construction. PLN CFPP will be retired earlier than asset revaluation. IPP CFPP retired after PPA ends. Gas PP retired after 30 years (residual < 1 GW, CFPP: 2057, Gas PP: 2054)
2. **NRE:** Additional power plant after 2030 will only come from NRE. Starting from 2035, will be dominated by Variable Renewable Energy (VRE) in form of Solar PP, followed by Wind PP and Ocean Current PP in the following year.
3. **Geothermal PP:** Maximized up to 75% of potential.
4. **Hydro PP:** Will be maximized and sent to load center in other islands to balance VRE power plants.
5. **STORAGE:** Pumped storage start in 2025, Battery Energy Storage System (BESS) massively used in 2021. Hydrogen will be utilized gradually starting from 2031 and massively by 2051.
6. **Nuclear PP:** Enter system in 2049 to maintain system reliability and will reach 35 GW by 2060.

SUPER GRID AND SHARING RESOURCES FOR NRE DEVELOPMENT

KALIMANTAN	Plan (MW)
Wind	1.445
Solar	70.365
Hydro	50.063
Bioenergy	255
Nuclear	15.000
TOTAL	137.127

SULAWESI	Plan (MW)
Geothermal	1.370
Wind	5.773
Solar	33.054
Hydro	7.568
Bioenergy	4.708
TOTAL	52.473



SUMATERA	Plan (MW)
Geothermal	7.793
Wind	7.095
Solar	147.297
Hydro	18.407
Bioenergy	3.267
Ocean	3.414
Nuclear	20.000
TOTAL	207.272

JAMALI	Plan (MW)
Geothermal	6.917
Wind	20.826
Solar	69.197
Hydro	6.218
Bioenergy	3.282
Ocean	1.320
TOTAL	107.761

MPNT	Plan (MW)
Geothermal	1.875
Wind	4.087
Solar	40.990
Hydro	1.097
Bioenergy	25.951
Ocean	8.644
TOTAL	82.644

NATIONAL	Plan (MW)
Geothermal	17.955
Wind	39.226
Solar	360.902
Hydro	83.354
Bioenergy	37.463
Ocean	13.378
Nuclear	35.000
TOTAL	587.278

1. Overcome the mismatch between local renewable energy sources vs high demand locations
2. Reduce the intermittency impact of the increasingly massive VRE Power Plant
3. Private participation is needed because the capacity of State-Owned Enterprises and the State Budget is limited
4. Transmission availability drives power wheeling implementation.
5. The interconnection configuration can be drastically reduced if the development of industrial estates leads to Renewable Energy Based Industrial Development (REBID)
6. Nusantara Grid needs to start after 2025