



MINISTRY OF ENERGY AND MINERAL RESOURCES OF REPUBLIC OF INDONESIA  
DIRECTORATE GENERAL OF NEW, RENEWABLE ENERGY AND ENERGY CONSERVATION



# INDONESIA'S ENERGY TRANSITION ROADMAP TOWARDS NET ZERO EMISSION BY 2060



Directorate General of New, Renewable Energy and Energy Conservation

Presented on:  
National Dialogue on Energy Transition

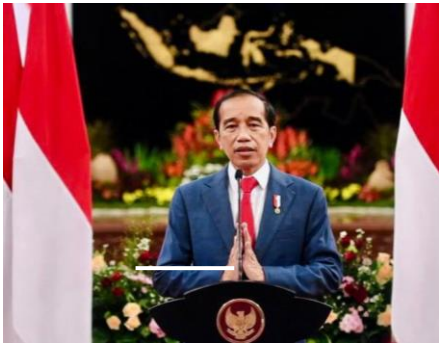
November 22<sup>nd</sup>, 2022



# ENERGY TRANSITION IN INDONESIA G20 PRESIDENCY



**Global commitment to keep global temperature rise below 2°C and seek to limit it to 1.5°C – COP26 and G20 2021 results**



## G20 Presidency

**“Recover Together, Recover Stronger”**

**The focus of Indonesia's G20 Presidency lies on 3 main issues:**

1. Inclusive Global Health
2. Digital-Based Economic Transformation
3. **Transition Towards Sustainable Energy**

## FRAMEWORK – ETWG G20 PRESIDENCY 2022

### DELIVERABLES:

### **BALI – COMPACT AND BALI ENERGY TRANSITION ROADMAP**

- *A non-binding agreement on the basic principles in accelerating the energy transition which will be the foundation and reference for G20 member countries in accelerating the energy transition implementation.*
- *The Energy Transition Mechanism, specifically for Indonesia, obtained a commitment from the Just Energy Transition Program of US\$20 billion*

**“Energy Transitions towards Sustainable Recovery and Productivity: Strengthen Global Cleaner Energy Systems and Just Transitions, by:**



**Securing Energy Accessibility**



**Advancing Smart and Clean Energy Technologies**



**Advancing Energy Financing**

# INDONESIA'S NRE POTENTIAL, ELECTRICITY CONSUMPTION & NRE MIX

The increasing electricity consumption should be in line with increased NRE utilization

## NRE POTENTIAL

ENERGY	POTENTIAL (GW)	UTILIZATION(*) (MW)
SOLAR	3.295	256.52
HYDRO	95	6,679
BIOENERGY	57	3,073
WIND	155	154.31
GEOTHERMAL	24	2,343
OCEAN	60	0
<b>TOTAL</b>	<b>3.686</b>	<b>12,505.83</b>

Notes: October 2022

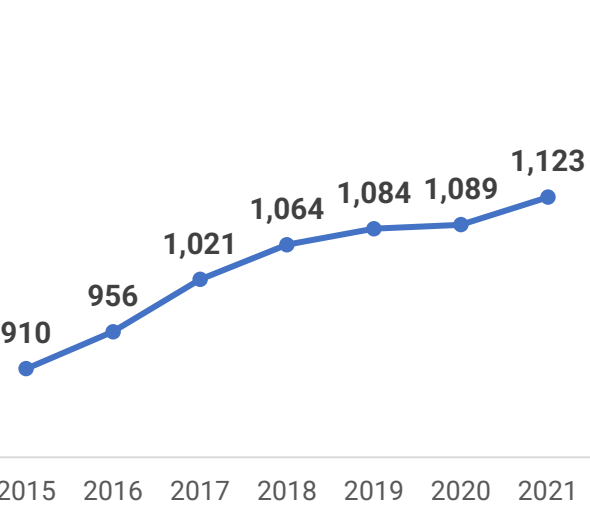
Nuclear: Uranium 89,483 tons - Thorium 143,234 tons

The current NRE utilization is 0.3% of the total potential. Indonesia has abundant, various, and spreading NRE resources:

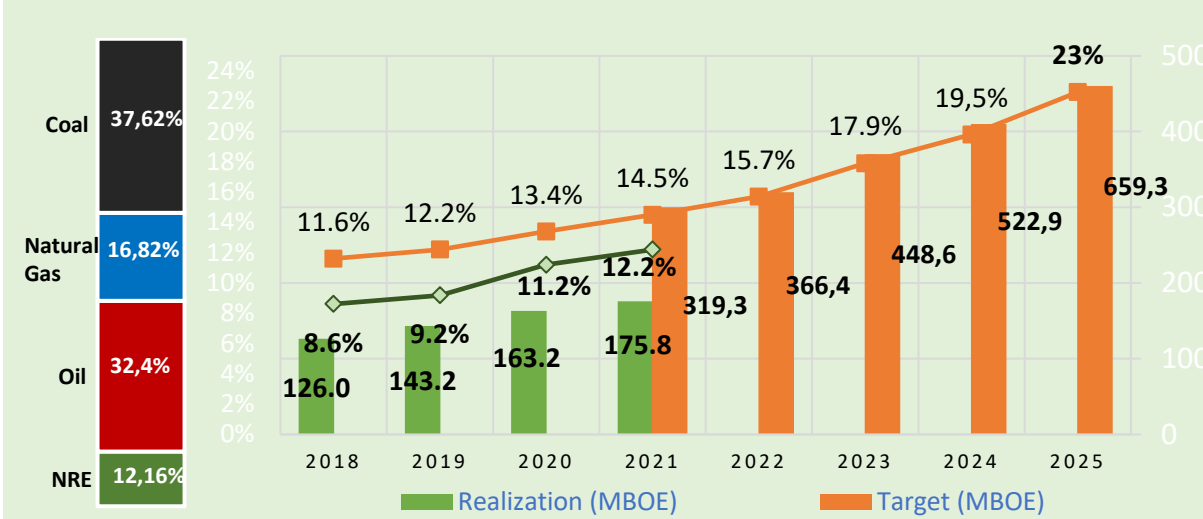
- Hydro potential spreads all over Indonesia's areas, particularly in North Kalimantan, NAD, North Sumatra and Papua.
- Solar potential spreads all over Indonesia's areas, particularly in East Nusa Tenggara, West Kalimantan and Riau which has higher radiation.
- Wind potential (>6 m/s) is particularly located in East Nusa Tenggara, South Kalimantan, West Java, NAD and Papua.
- Ocean energy potential spreads all over Indonesia's areas, particularly in Maluku, East Nusa Tenggara, West Nusa Tenggara and Bali.
- Geothermal potential spreads in ring of fire areas, including Sumatra, Java, Bali, Nusa Tenggara, Sulawesi, and Maluku.

## ELECTRICITY CONSUMPTION

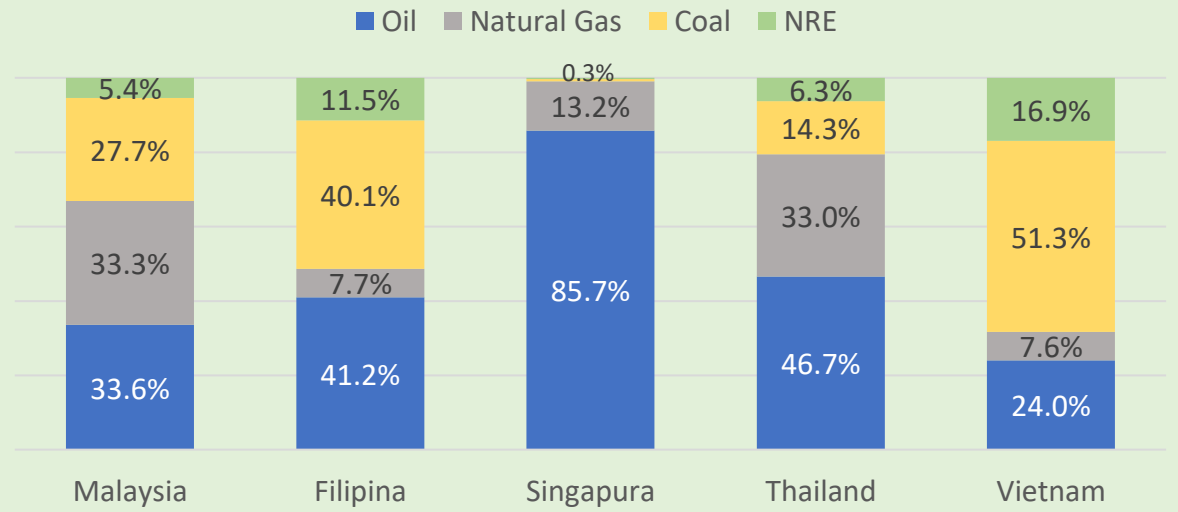
Unit: kWh/capita



## INDONESIA NRE MIX 2021



## ENERGY MIX ASEAN MEMBER COUNTRIES 2020\*



\*Source: BP Statistical Review of World Energy 2021

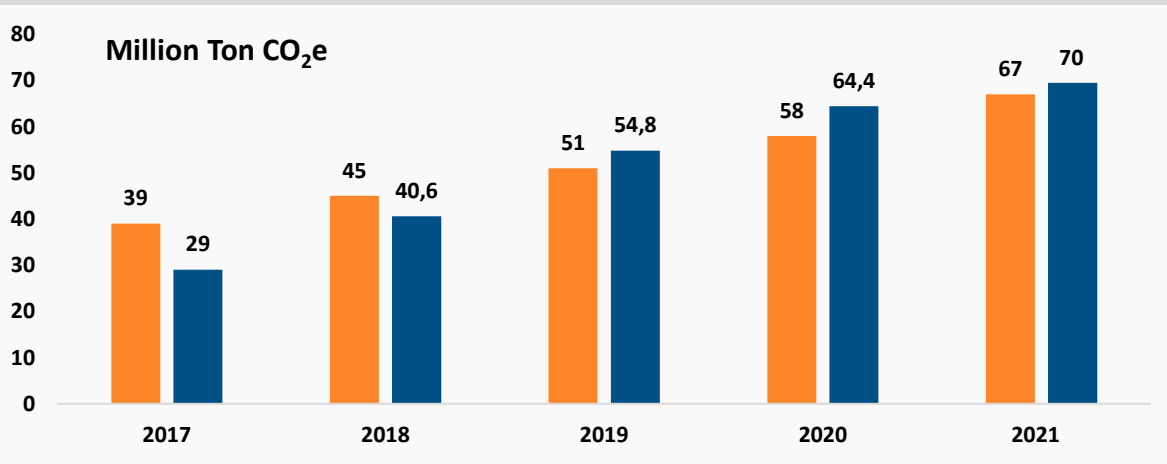
# EMISSION REDUCTION FROM ENERGY SECTOR

Reducing fossil energy consumption and long term NRE development

## NDC TARGET 2030

No	Sector	GHG Emission in 2010 (Million Ton CO <sub>2</sub> e)	GHG Emission in 2030					Reduction			
			BaU	CM1	CM1E	CM2	CM2E	CM1	CM1E	CM2	CM2E
1.	Energy	453.2	1,669	1,355	1,311	1,223	1,223	314	358	446	446
2.	Waste	88	296	67	256	256	253	11	40	40	43.5
3.	IPPU	36	70	110	63	66	61	3	7	3.25	9
4.	Agriculture	111	120	217	110	116	108	9	10	4	12
5.	Forestry	647	714	285	214	22	-15	497	500	692	729
<b>TOTAL</b>		<b>1,334</b>	<b>2,869</b>	<b>2,304</b>	<b>1,953</b>	<b>1,683</b>	<b>1,632</b>	<b>834</b>	<b>915</b>	<b>1,185</b>	<b>1,240</b>

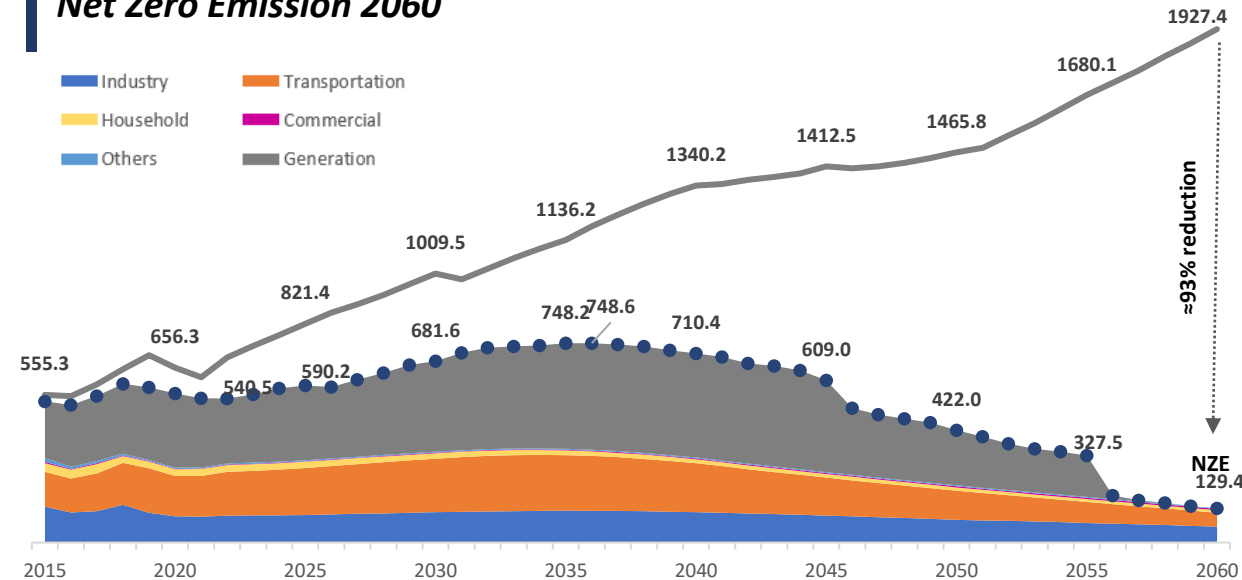
## MITIGATION REALIZATION



Notes: CM: Counter Measure; CM1: self effort; CM2: With International Assistance; IPPU: industrial processes and production use

Directorate General of New, Renewable Energy and Energy Conservation @2022

## Net Zero Emission 2060



## Implementation Strategies:

1. Gradual retirement of coal-fired PP.
2. NRE development acceleration, particularly Solar PV and Wind PP.
3. More efficient technology utilization.
4. Encouraging the use of electric vehicle and electric stoves.
5. The implementation of Smart Grid to overcome intermittency of VRE (Variable Renewable Energy).

# ENERGY TRANSITIONS ROADMAP TOWARDS NET ZERO EMISSION

- 1) The timeline for strategic achievement towards net zero emission for supply and demand on energy sector
- 2) The roadmap is a joint commitment between the Government and stakeholders to achieve NZE by 2060



2021 – 2025	2026 – 2030	2031 – 2035	2036 – 2040	2041 – 2050	2051 – 2060
<p><b>2025: Emission Reduction 231.2 Mio ton CO<sub>2</sub>e</b></p> <p><b>Supply:</b></p> <ul style="list-style-type: none"> <li>▪ <b>NRE Development</b> in accordance with RUPTL PT PLN (Persero) 2021-2030</li> <li>▪ Utilization of <b>Rooftop PV</b></li> <li>▪ <b>Waste to energy</b> development acceleration</li> <li>▪ Development of <b>small-scale biomass PP</b></li> <li>▪ <b>Cofiring</b> for existing CFPP</li> </ul> <p><b>Demand:</b></p> <ul style="list-style-type: none"> <li>▪ <b>Induction cooker</b> used by 8.1 million HH</li> <li>▪ 300 thousand <b>electric cars</b> and 1.3 million <b>electric motorcycles</b></li> <li>▪ Gas network for 5.2 million HH</li> <li>▪ Dimethyl ether to become substitute of LPG for HH</li> <li>▪ Mandatory <b>biodiesel 30%</b> by 2025</li> </ul>	<p><b>2030: Emission reduction 327.9 Mio ton CO<sub>2</sub></b></p> <p><b>Supply :</b></p> <ul style="list-style-type: none"> <li>▪ NRE Development in accordance with RUPTL PT PLN (Persero) 2021-2030</li> <li>▪ <b>Pump storage</b> from 2025</li> </ul> <p><b>Demand:</b></p> <ul style="list-style-type: none"> <li>▪ Induction cooker used by 18.1 million HH</li> <li>▪ 2 million electric cars and 13 million electric motorcycles</li> <li>▪ Gas network for 10.2 million HH</li> <li>▪ <b>Biofuels</b> in the industrial and transportation sectors reach 40%</li> <li>▪ Energy Management and MEPS for 11 equipment</li> </ul>	<p><b>2035: Emission reduction 388 Million ton CO<sub>2</sub></b></p> <p><b>Supply:</b></p> <ul style="list-style-type: none"> <li>▪ <b>Green Hydrogen</b> development starting 2031</li> <li>▪ <b>Massive Battery Energy Storage System (BESS)</b> in 2034</li> <li>▪ Installed capacity <b>geothermal PP</b> reach 11 GW in 2035</li> </ul> <p><b>Demand:</b></p> <ul style="list-style-type: none"> <li>▪ Induction cooker used by 28.2 million HH</li> <li>▪ 9.3 million electric cars and 51 million electric motorcycles</li> <li>▪ Gas network for 15.2 million HH</li> <li>▪ Biofuel use is maintained at 40%</li> </ul>	<p><b>2040: Emission reduction 629.4 Mio ton CO<sub>2</sub></b></p> <p><b>Supply:</b></p> <ul style="list-style-type: none"> <li>▪ <b>Nuclear</b> utilization for power generation starts from 2039</li> <li>▪ The development of <b>Variable Renewable Energy (VRE)</b>, especially <b>solar PV</b>, is more massive, followed by wind turbine PP on both onshore and offshore starting 2037.</li> </ul> <p><b>Demand:</b></p> <ul style="list-style-type: none"> <li>▪ Induction cooker used by 37.9 million HH</li> <li>▪ 23 million electric cars and 101 million electric motorcycles</li> <li>▪ Gas network for 20.2 million HH</li> <li>▪ Biofuel use is maintained at 40%</li> <li>▪ <b>CCS</b> for cement and steel industries from 2036</li> <li>▪ Low carbon for shipping</li> </ul>	<p><b>2050: Emission reduction 1,043.8 Mio ton CO<sub>2</sub></b></p> <p><b>Supply :</b></p> <ul style="list-style-type: none"> <li>▪ Green hydrogen to replace natural gas for high temperature heating processes starting from 2041</li> <li>▪ Primary energy utilization from NRE is higher than the fossil</li> </ul> <p><b>Demand:</b></p> <ul style="list-style-type: none"> <li>▪ Induction cooker used by 46.6 million HH</li> <li>▪ 50.2 million electric cars and 163 million electric motorcycles</li> <li>▪ Gas network for 22.7 million HH</li> <li>▪ Biofuel use is maintained at 40%</li> </ul>	<p><b>2060: Emission reduction 1.526 Million ton CO<sub>2</sub></b></p> <p><b>Supply :</b></p> <ul style="list-style-type: none"> <li>▪ Zero emissions from power sector and 129 million tons of carbon emission remains in the industrial and transportation sectors</li> <li>▪ <b>All electricity is generated by NRE</b></li> </ul> <p><b>Demand:</b></p> <ul style="list-style-type: none"> <li>▪ Induction cooker used by 54.3 million HH</li> <li>▪ 65 million <b>electric cars</b> and 175 million <b>electric motorcycles</b></li> <li>▪ Gas network for 22.7 million HH</li> <li>▪ Utilization of <b>CCS</b> in industry up to 13 million ton CO<sub>2</sub></li> <li>▪ Projected demand for <b>electricity consumption is 1,942 TWh or equal to 5,862 kWh/capita</b></li> </ul>

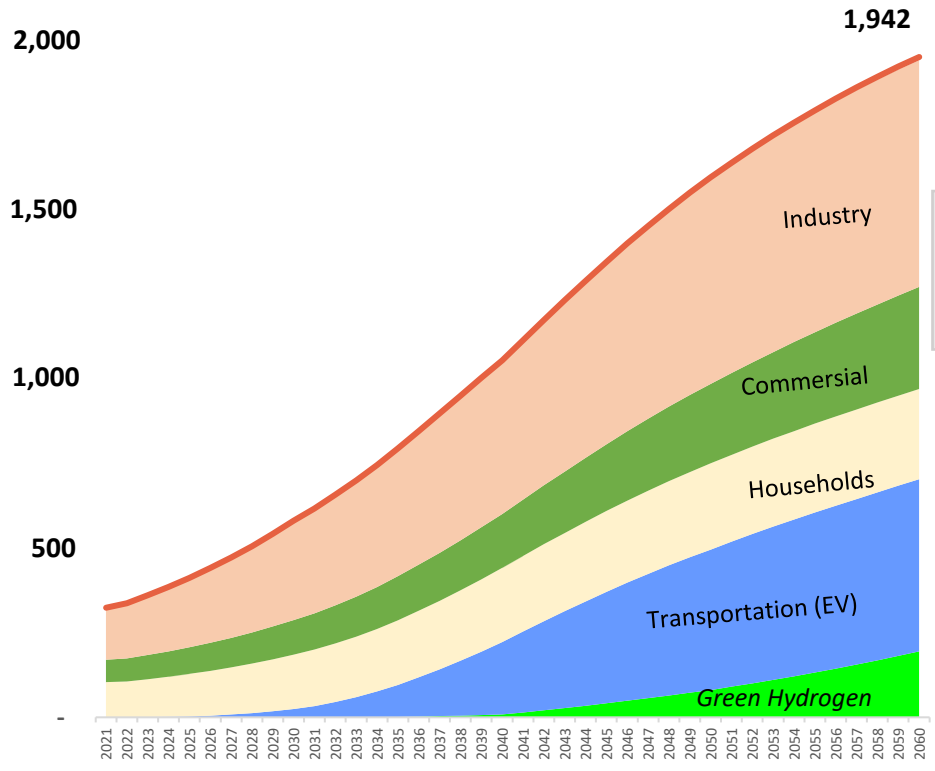
\*) CFPP age of PLN & PPU maximum 30 years dan IPP 25-30 years (based on PPA)



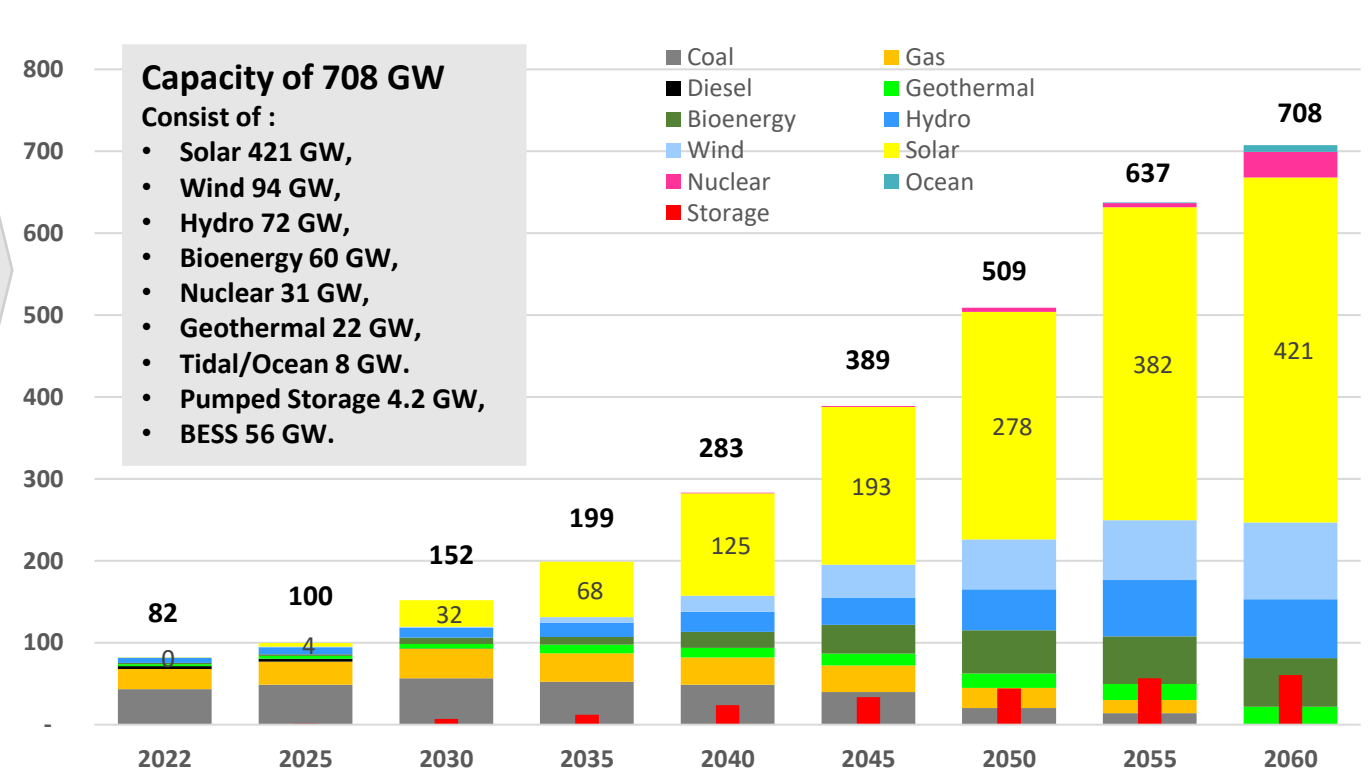
# POWER PLANT DEVELOPMENT TO ACHIEVE NET ZERO EMISSION

## NZE Power Plant Development Roadmap

Electricity Demand per Sector | TWh



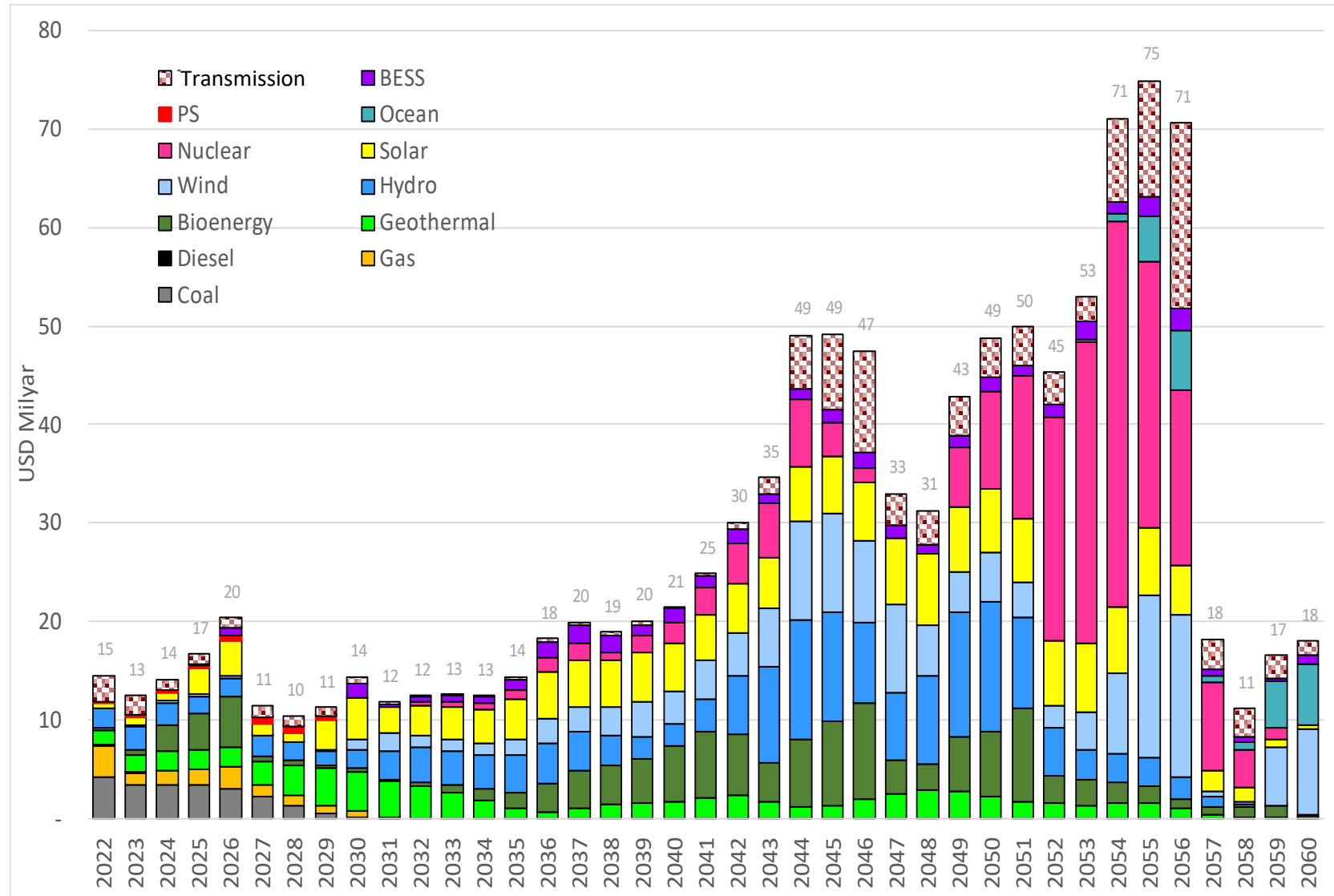
Capacity of Power Plant | GW



- Electricity demand is projected to reach 1,942 TWh by 2060 which dominated by industry and transportation sectors. **All electricity demand will be generated by 96% renewable energy PP and 4% new energy generator (nuclear)** with total capacity of 708 GW. Capacity of VRE PP is 77% from NRE total capacity equipped with storage technology such as Hydro PP pump storage and BESS.
- Pump storage enters the system in 2025, **Battery Energy Storage System (BESS) to be massively utilized in 2031.**

- **Total investment** for NZE Power Plant required : 1,108 billion USD or 28.5 billion USD p.a. up to 2060.
- Indonesia is planning to develop **super grid and smart grid technology**, considering Indonesia as an archipelagic country and need to provide energy access to local people. **Supergrid** will be commenced **after 2025**. The super grid is also intended to address mismatch between renewable energy resources and the location of high electricity demand area.

# INVESTMENT NEEDS FOR POWER GENERATION AND TRANSMISSION



**Notes:**

- The graphs shows that the investment needs is plan of disbursement per year (not referring to COD year)
- Fossil investment is only for committed project and will be phased out before 2060

ENERGY TYPE/ STORAGE	INVESTMENT (MILLION USD)	CAPACITY BY 2060 (GW)
<b>GENERATOR</b>	<b>954,386</b>	<b>708</b>
HYDRO	168,568	72
NUCLEAR	216,210	31
SOLAR	159,879	421
WIND	156,393	94
GEOHERMAL	71,270	22
OCEAN/TIDAL	24,205	8
BIO	122,347	60
COAL	21,693	-
GAS	13,614	-
OIL	207	-
<b>STORAGE</b>	<b>40,207</b>	<b>60.2</b>
BESS	37,218	56
PUMP STORAGE	2,989	4.2
<b>TOTAL</b>	<b>994,593</b>	<b>768</b>

**Total Investment Needed:**

- Power Generation: USD 994.6 billion
- Transmission: USD 113.4 miliar
- Total: 1,108 billion USD or 28.5 billion USD/year



# Thank You

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