



Directorate General of Electricity
Ministry of Energy and Mineral Resources
REPUBLIC of INDONESIA

ELECTRICITY INFRASTRUCTURE INVESTMENT NEEDS TO SUPPORT THE ENERGY TRANSITION

Workshop Challenges on Energy Transition in Indonesia

Jakarta | 27 September 2022



ENERGY
TRANSITIONS

NET ZERO EMISSION (NZE) SCENARIO ENERGY SECTOR

Consolidated Energy Sector CO2 emissions 129 million tonnes by 2060, 0 for power generation*

Greenhouse gas emission levels to reach NZE by 2060 or sooner

Emission per Sector (million ton CO2e) – LCCP **)						
	2010	2020	2030	2040	2050	2060
Energy	453	688	1,030	960	572	87
Agriculture	84	88	94	98	102	101
FOLU	470	98	-140	-246	-304	-326
IPPU	35	55	62	55	50	45
Waste	89	139	198	170	120	87
Net emiss.	1,131	1,068	1,244	1,038	540	-6



Energy Sector Emission (million ton CO2e) - LCCP

	2010	2020	2030	2040	2050	2060
Electricity	140	198	428	324	28	-66
Industry	145	208	241	345	312	51
Transportation	96	151	191	102	94	62
Buildings	73	132	169	189	138	41
Total	453	688	1030	960	572	87

Energy Subsector	KLHK	NZE	Consolidation
Powerplants	-66	0	0
Industry	51	231	60 (dengan CCS)
Transportation	62	149	52
Households and other building	41	21	17
TOTAL	87	401	129

Notes:
 *) In the process of preparing and coordinating between ministries, international organizations, and bilateral countries
 **) Source: LTS-LCCR Ministry of Environment and Forestry

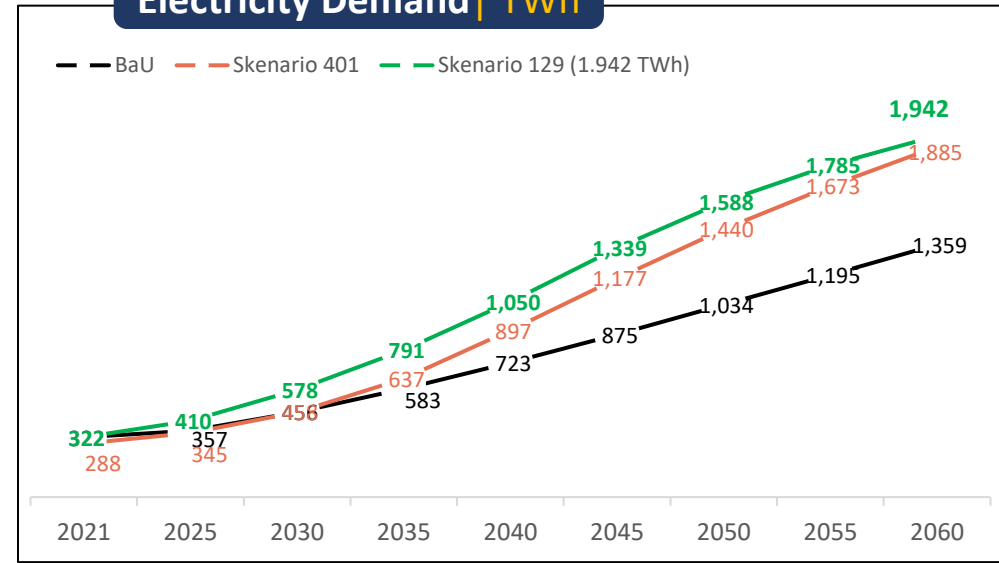
- Achieving lower total emissions in the consolidated scenario will need to be supported by international support (financing, studies, etc.)

ELECTRICITY DEMAND FORECASTING

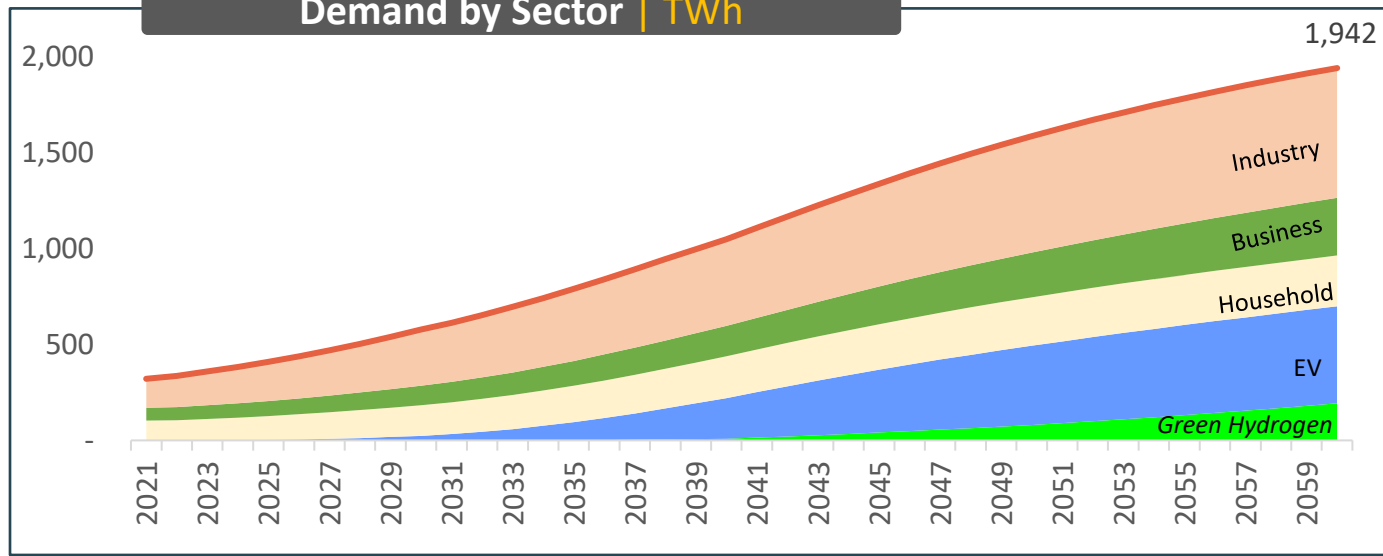
Long-term electricity demand is influenced by CO2 emission reduction targets

- Without the emission reduction scenario in the energy sector (BaU), the electricity demand will be around **1.359 TWh (4.101 kWh/capita)** in 2060;
- With the emission reduction scenario, the electricity demand will be higher. The reduction in emissions in the energy sector from 401 million tons to 129 million tons in 2060 has an impact on the increase in electricity demand from **1,885 TWh (5,308 kWh/capita)** to **1,942 TWh (5,862 kWh/capita)** in 2060;
- The demand for electricity in scenario 129 is higher because:
 - Electrification of industrial demand and acceleration of EV penetration;
 - Additional demand for green hydrogen production.

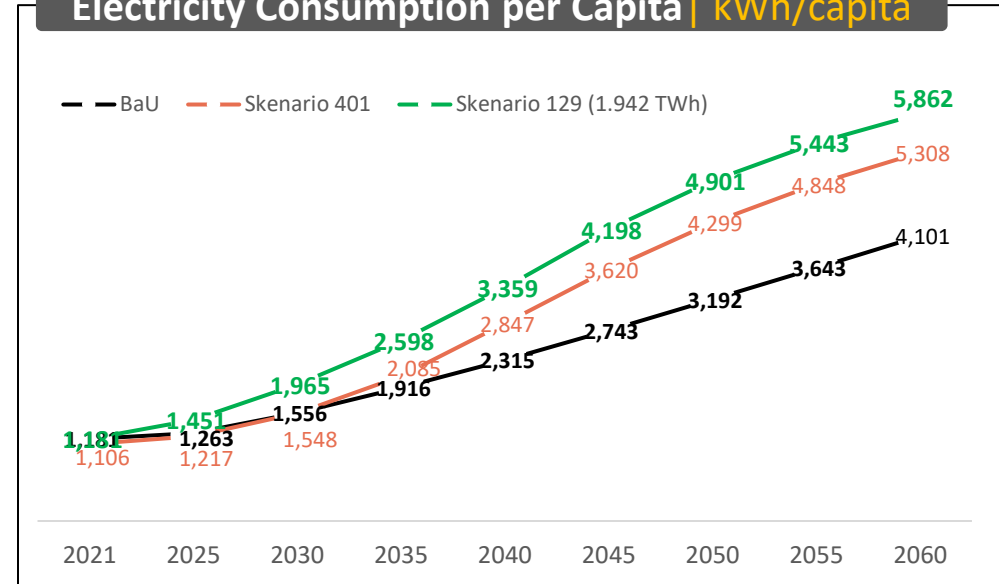
Electricity Demand | TWh



Demand by Sector | TWh

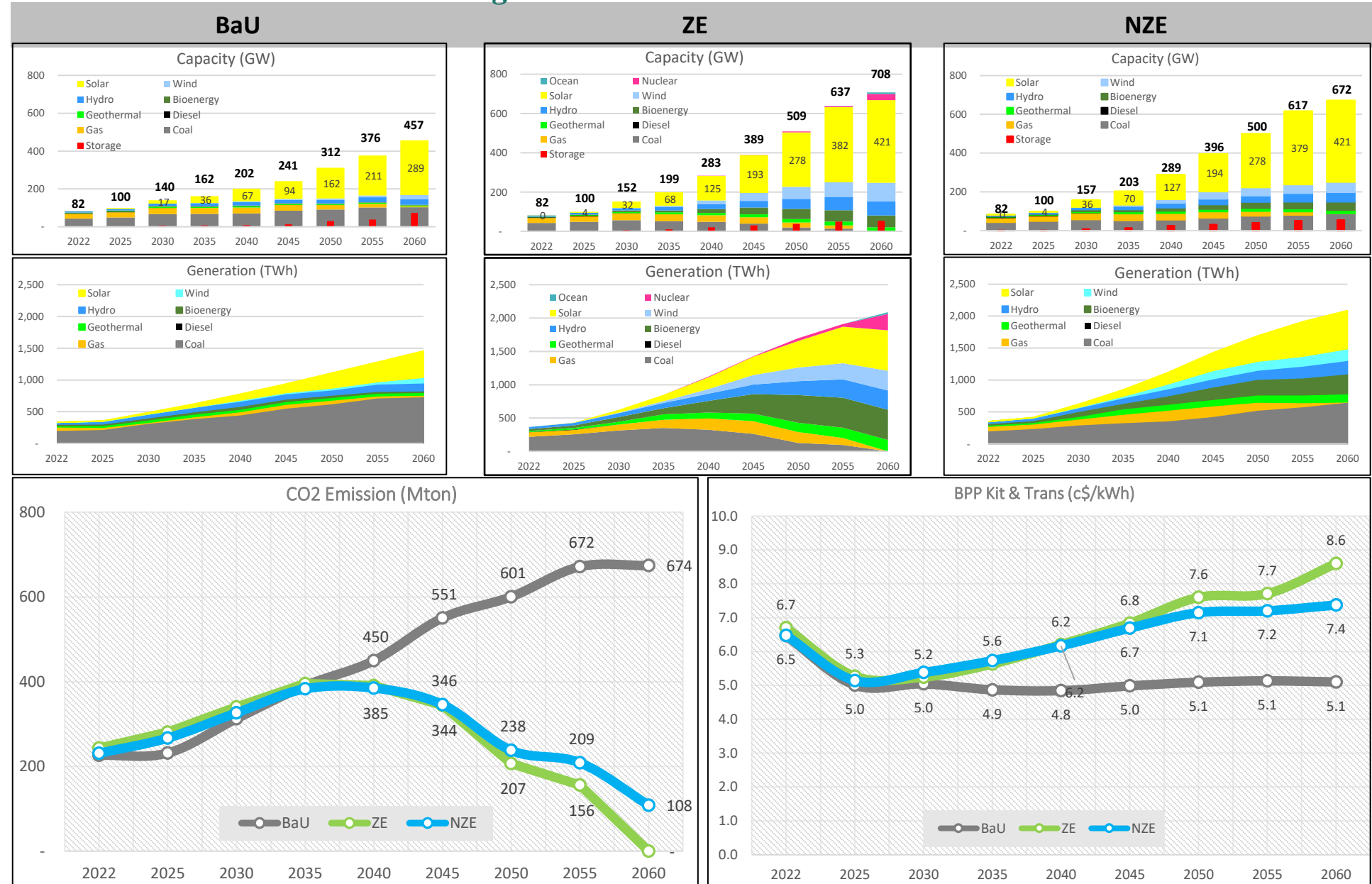


Electricity Consumption per Capita | kWh/capita



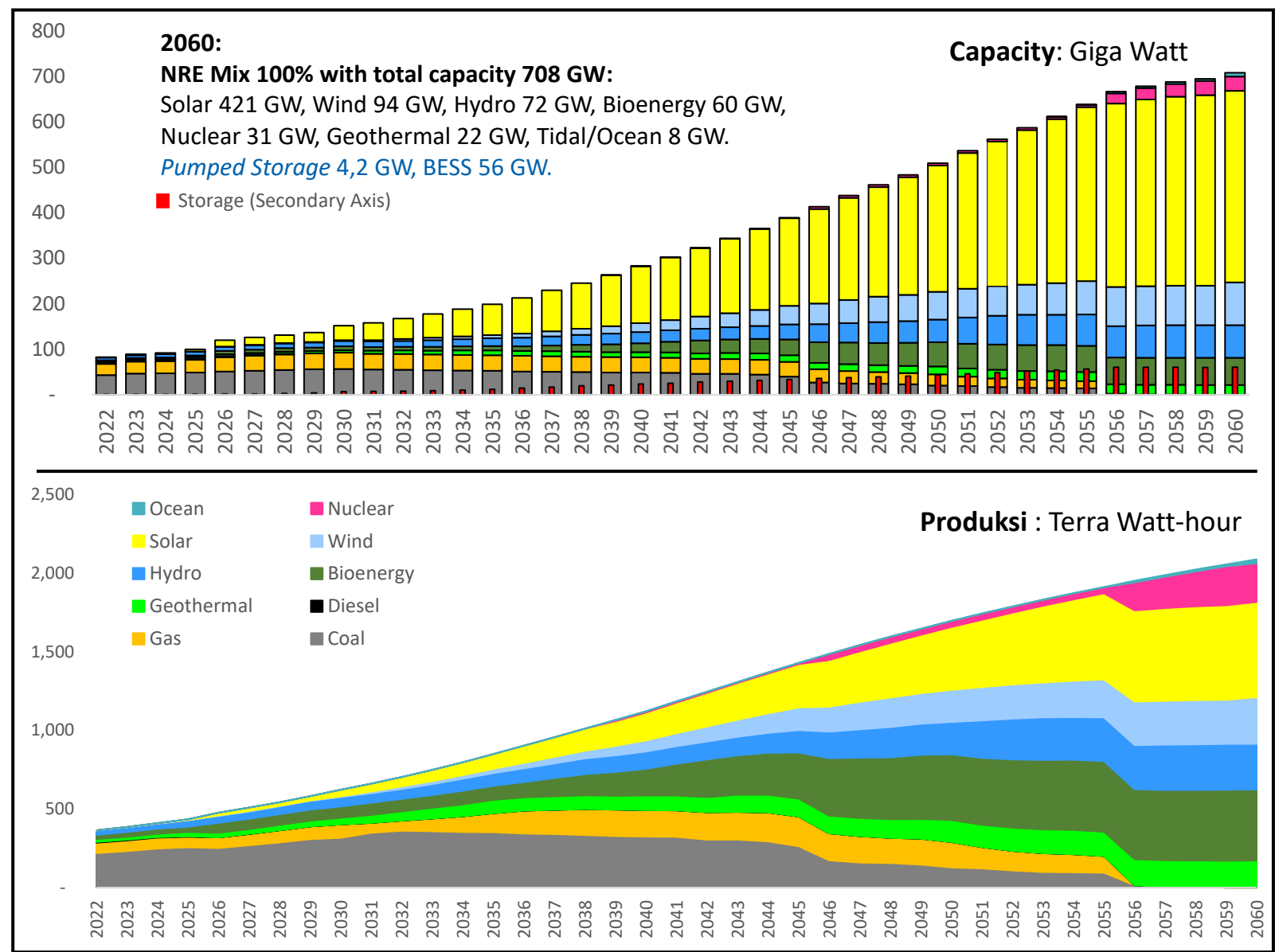
SCENARIOS FOR ELECTRICITY SUPPLY

Challenge towards NZE 2060: LCOE tend to higher



POWER GENERATION CAPACITY TOWARD ZERO EMISSION BEFORE 2060

Optimize the utilization of renewable energy development in power generation



Scenario: To achieve NZE in the energy sector where emissions for the generating sector must be 0 by 2060, the scenario chosen is the *Zero Emission (ZE)* scenario.

Coal/Gas: Additional Coal PP is only for projects that are already under contract and construction. IPP's Coal PP retired after the PPA ended. Combined Cycle PP retired after the age of 30 (remaining < 1 GW, PLTU: 2057, PLTGU: 2056).

RE: Additional generation after 2030 only from NRE. Starting in 2030 the development of Variable Renewable Energy (VRE) in the form of PLTS is increasingly massive, followed by PLTB both on shore and off shore starting in 2037.

Geothermal: The development is gradually maximized to 22 GW, through the development of the Advance Geothermal System and the development of other unconventional geothermal systems.

Hydro: will be optimized and transferred to the load centers in other islands. The other utilization is to create system balance in the increasing share of VRE.

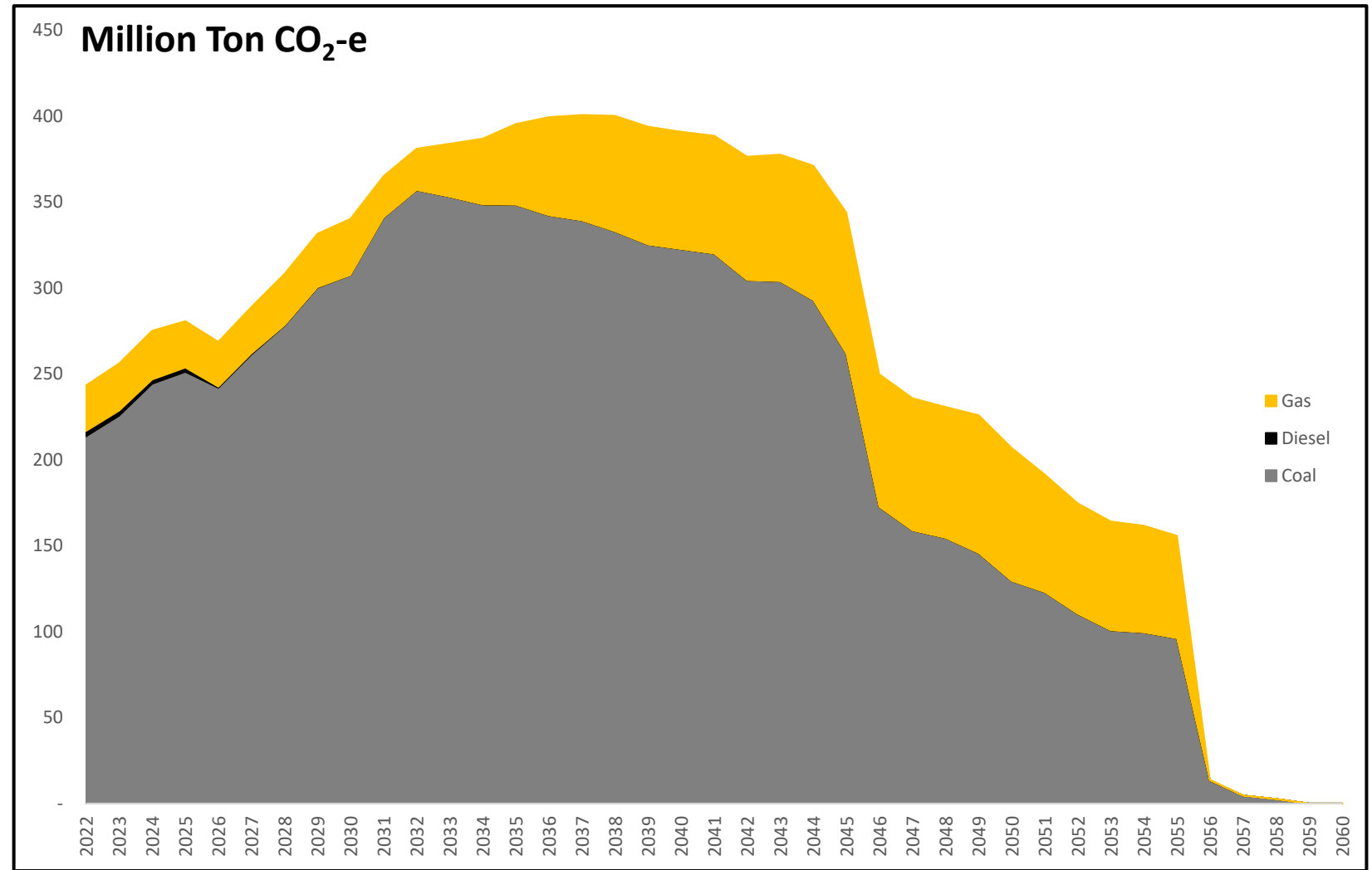
Nuclear: will be commercial in 2039 to increase power system reliability. The capacity will be increased up to 31 GW in 2060.

STORAGE: Pump storage starting in 2025, Battery Energy Storage System (BESS) will start to be massively developed in 2034. While Hydrogen produced from RE (Green Hydrogen) based electricity starting in 2031 where its use is intended for the non-generating sector.

PROJECTION OF POWER GENERATION CO₂ EMISSION

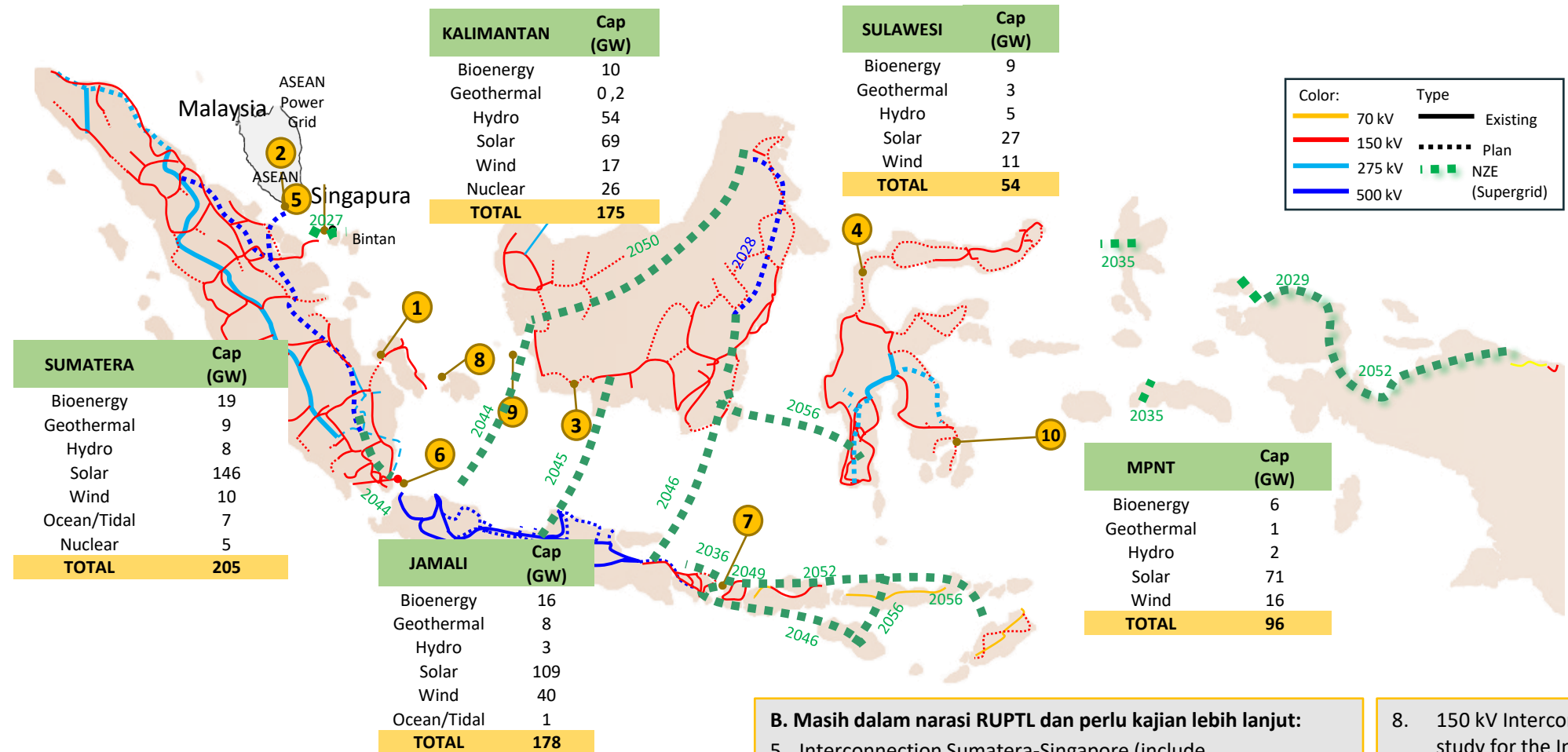
The power generation sector will achieve zero emission before 2060

1. Total Emission from power generation sector in 2022 around 243 Million ton CO₂.
2. Towards 2040, there will be power plant emission peak for 401 million ton CO₂-e.
3. Emission will sharply decrease by 2046 in line with the retirement of Coal PP and Combined Cycle PP.
4. Emission will significantly falling down after 2056, following the completion of fossil plant contract.
5. Emission on power plant will be zero before 2060.



SUPER GRID FOR RE SHARING RESOURCES

Super grid is a key factor to achieve Zero Emission in the power generation sector



Nasional	Kap @ 2060 (GW)
Bioenergy	60
Geothermal	22
Hydro	72
Solar	421
Wind	94
Ocean/Tidal	8
Nuclear	31
TOTAL	708

The invested interconnection will be decreased if REBID is implemented.

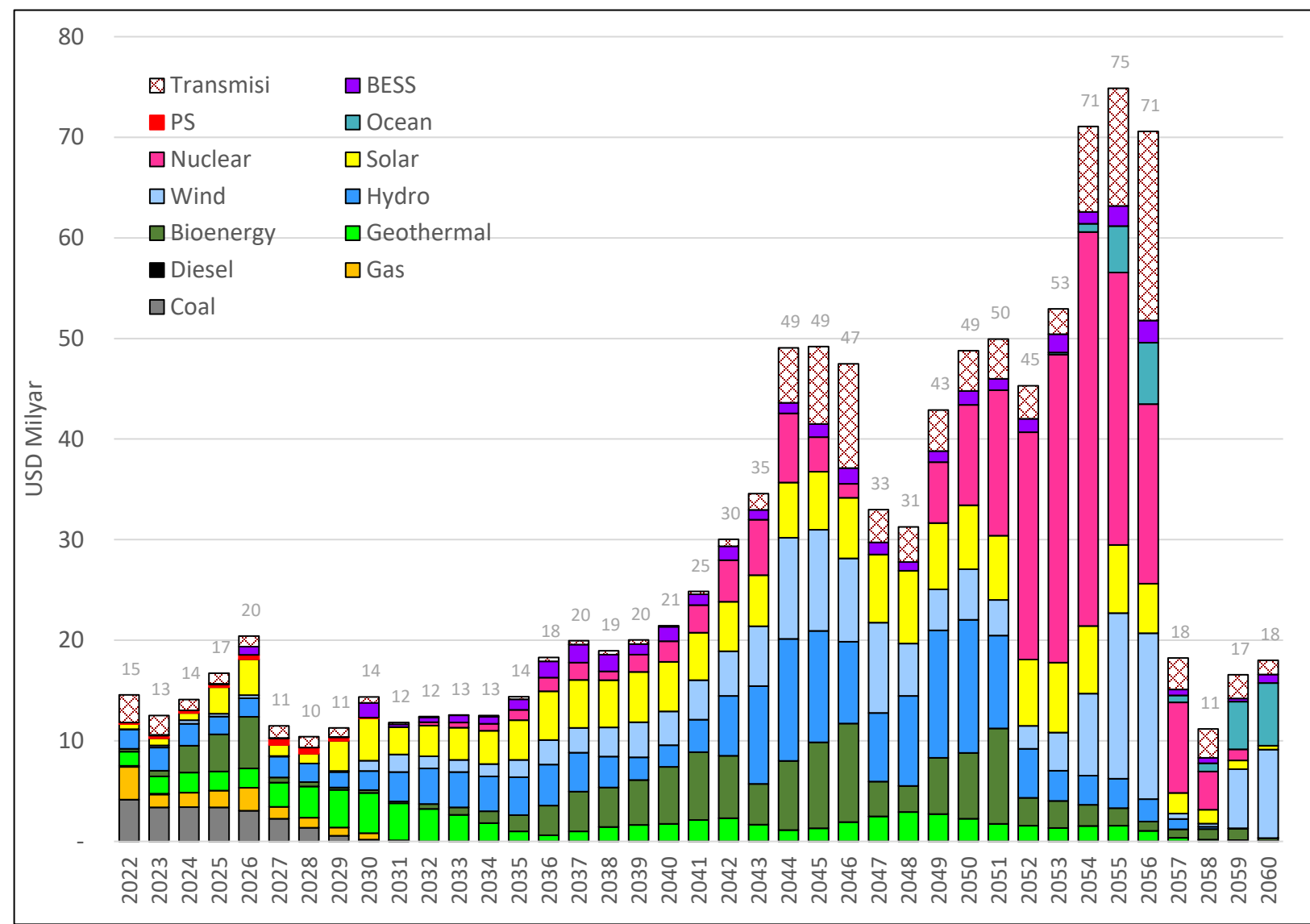
- A. Listed in RUPTL:**
- 150 kV Interconnection Sumatera-Bangka (2022);
 - 500 kV Interconnection Sumatera-Malaysia (2030), Supporting ASEAN Power Grid;
 - 150 kV Interconnection Kalimantan (2023);
 - 150 kV Interconnection Sulbagut-Sulbagsel (Tambu-Bangkir COD 2024).

- B. Masih dalam narasi RUPTL dan perlu kajian lebih lanjut:**
- Interconnection Sumatera-Singapore (include Interconnection Sumatera-Bintan), supporting ASEAN Power Grid;
 - 500 kV Interconnection Sumatera-Jawa;
 - 150 kV Interconnection Bali-Lombok (require further study for Interconnection Jawa-Nusa Tenggara);

- 150 kV Interconnection Bangka-Belitung (require further study for the Interconnection of Sumatera-Kalimantan);
- Interconnection Belitung-Kalimantan (require further study for the Supergrid Nusantara program);
- 150 kV Interconnection Baubau-Sulbagsel (require further study for the Bau-Bau Sulbagsel Interconnection System Reliability).

INVESTMENT REQUIREMENT TOWARD NZE 2060

The average annual investment is about 28 billion USD.



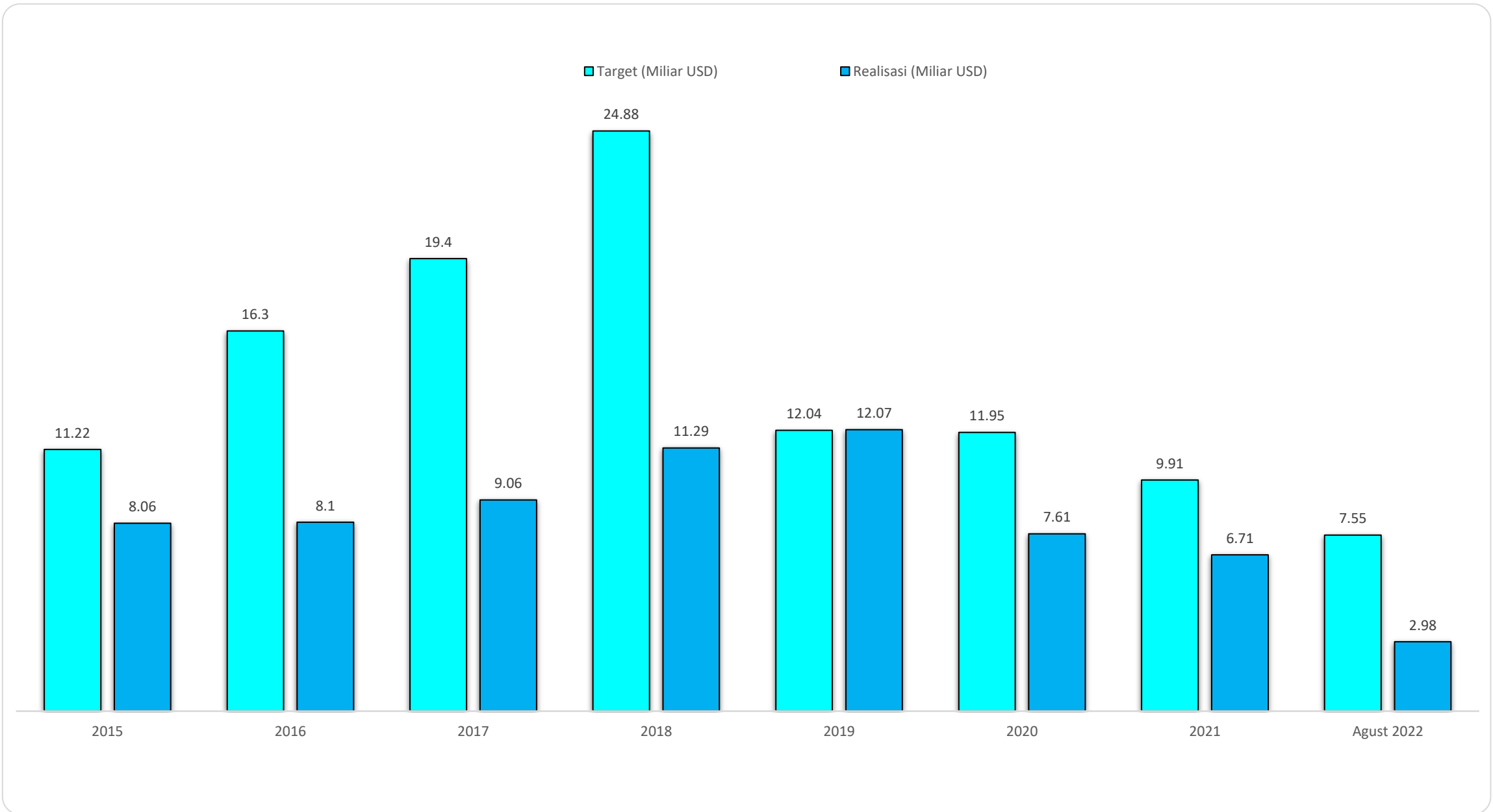
JENIS PEMBANGKIT/ STORAGE	KEBUTUHAN INVESTASI (JUTA USD)	KAPASITAS @ 2060 (GW)
COAL	21.963	_*
GAS	13.614	_*
DIESEL	207	_*
GEOHERMAL	71.270	22
BIOENERGY	122.347	60
HYDRO	168.568	72
WIND	156.393	94
SOLAR	159.879	421
NUCLEAR	216.210	31
OCEAN	24.205	8
PUMP STORAGE	2.989	4,2
BESS	37.218	56
TOTAL	994.593	768

Investment Needs:

- Powerplant: USD 995 Billion
- Transmission: USD 113 Billion
- Total: 1.108 Billion USD or 28 Billion USD/year


*Fossil investment is only for on-going projects

HISTORICAL ELECTRICITY INVESTMENT




Thank you

www.gatrik.esdm.go.id

 Direktorat Jenderal
Ketenagalistrikan

 @infogatrik

 @infogatrik

 Info Gatrik

