"How Can ASEAN Innovate to Accelerate Its Energy Transition?“

Retno Gumilang DEWI

Center for Research on Energy Policy

INSTITUT TEKNOLOGI BANDUNG

ASEAN Center for Energy (ACE)

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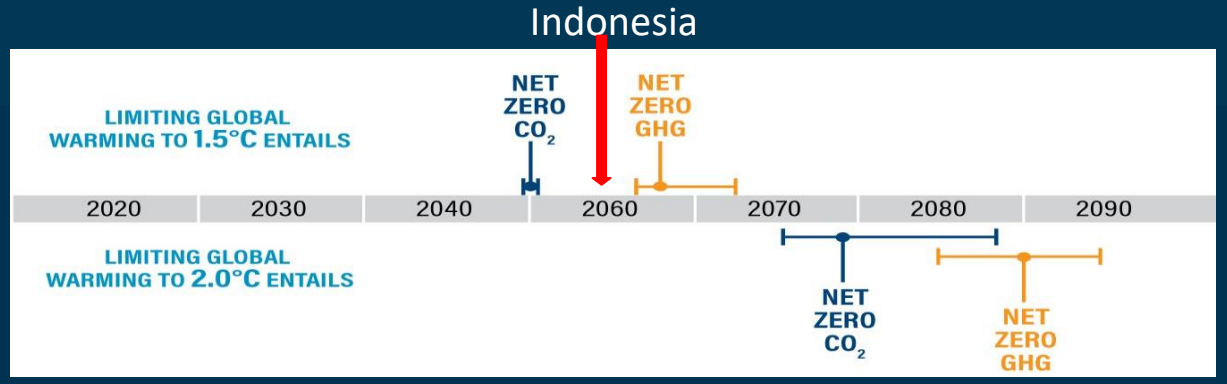
The energy transition in Indonesia

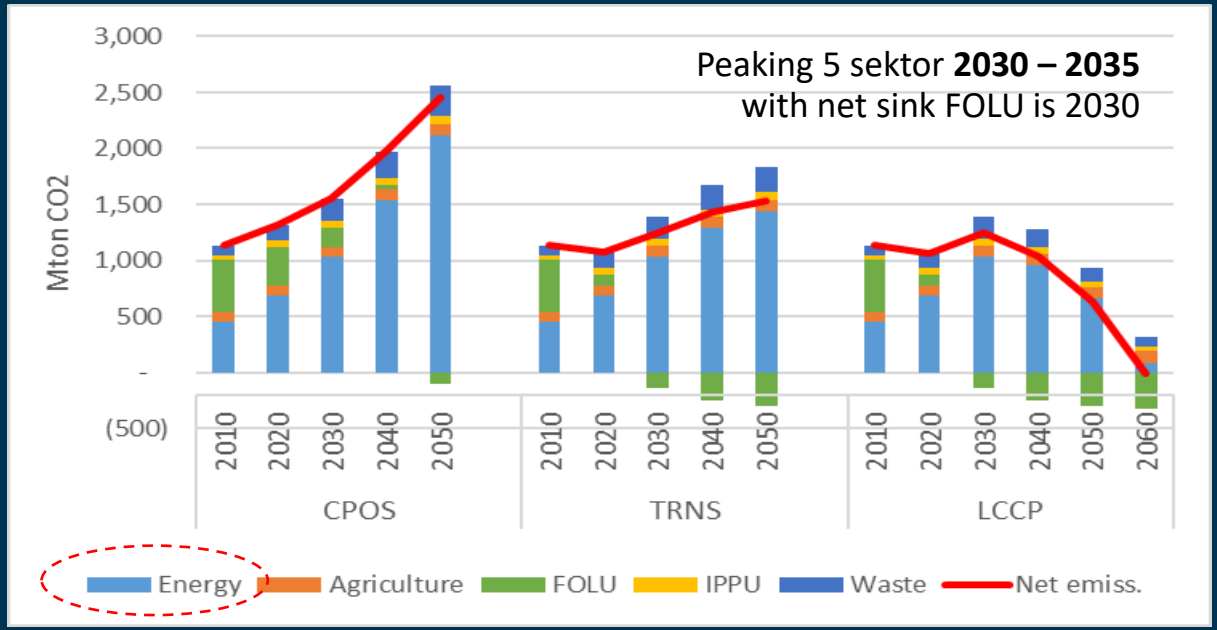
- Shifting the global economy onto renewable sources of energy is the key to combatting climate change, while improving quality of life. To do this, national energy systems must **transition** first, and fast changes.
- Indonesia’s energy face a situation of giddiness in deciding a transition that requires a much larger use of renewable energy, as the country is basically a fossil fuels one (issues to stranded assets) but in the other side it is demanded to contribute a bigger role in efforts to mitigate global climate change (deep-decarbonization toward NZE)
- Energy Indonesia faces a situation of uncertainty in deciding a transition that requires a much larger use of renewable energy, while the country's development relies on fossil fuels but on the other hand is required to contribute more in efforts to mitigate global climate change.
- *How does ITB play its role in driving the energy transition in Indonesia, the largest country in the region with a very complex energy challenge?*

Global Timeline To Reach Net-Zero Emissions

Indonesia NZE

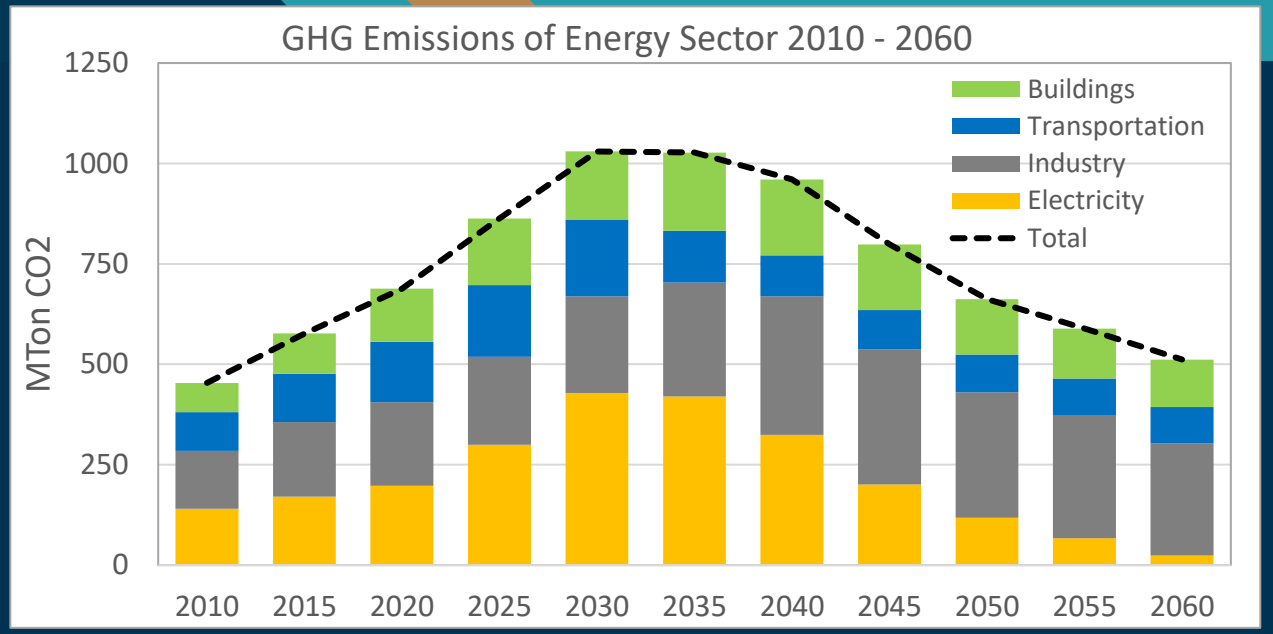


Source: IPCC Special Report on Global Warming of 1.5°



Source: Indonesia LTS LCCR, Indonesia MoEF (2021)

CPOS (Current Policy)
TRNS (Transition)
LCCP (Low Carbon Scenario Compatible with Paris Agreement Target)

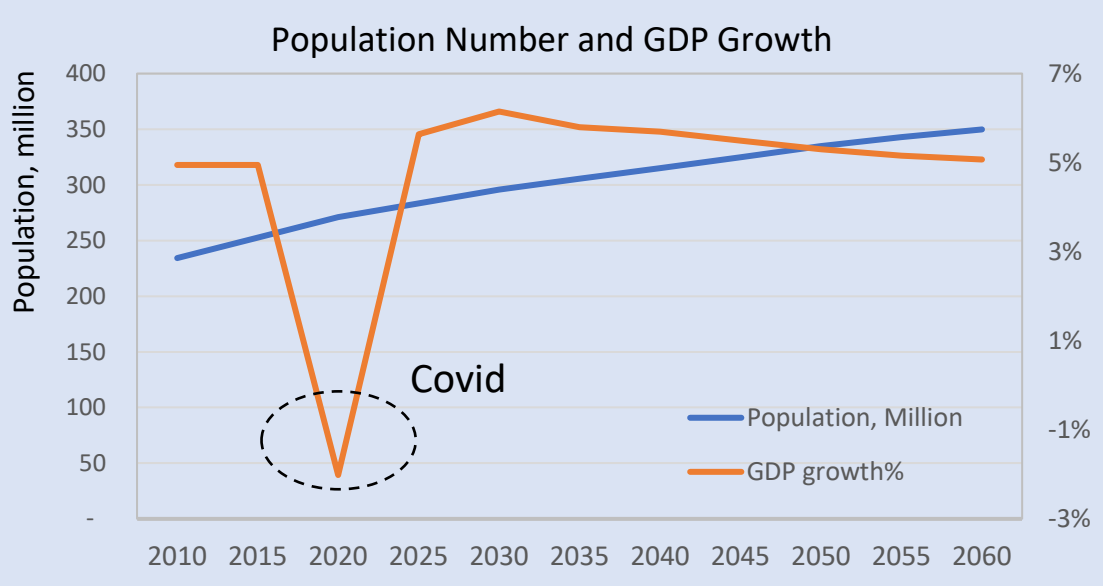


Aiming for +2°C target, Indonesia has the opportunity to transition its energy system by steeply reduce the carbon-intensity in all sectors of the economy.

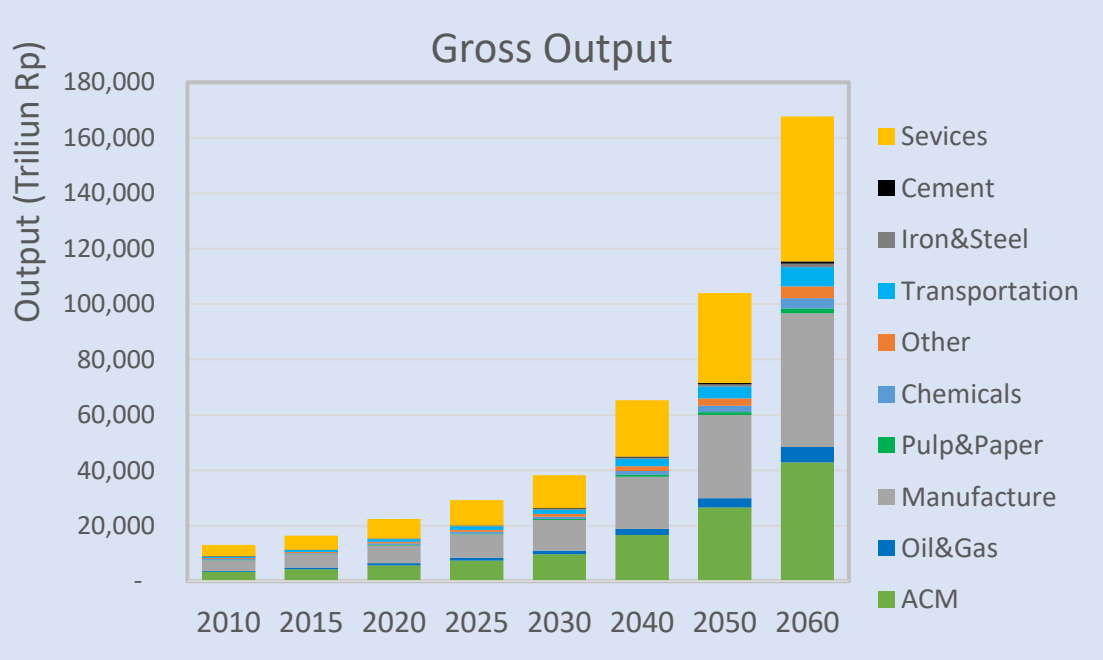
This transition is known as Deep-Decarbonization

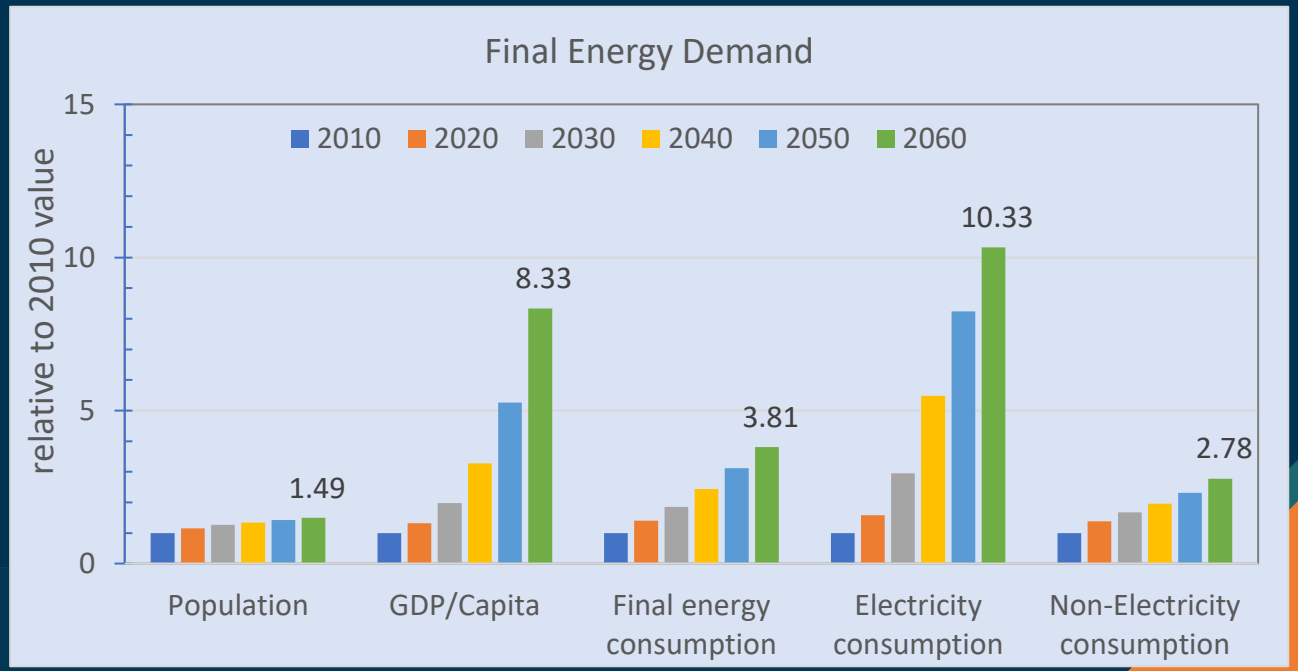
The need for negative CO_2 emissions technology. BECCS (biomass energy and CCS/CCUS)

Projection of Socio - Economy



- Pandemic scenario requires an economic growth of 5.64% (2021-2025) and 6.15%/year (2026-2030) to become a developed country in 2043
- After pandemic of achieving 6% growth will only bring Indonesia into a developed country (apart from the middle income trap) in 2043, the implication is a significant increased of energy use.

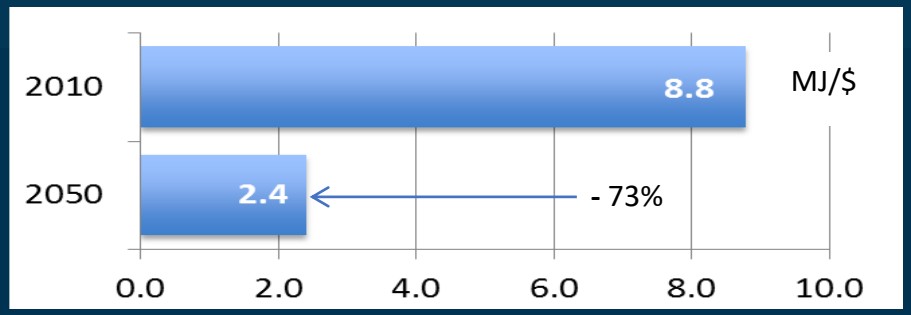




Pillars of Decarbonization

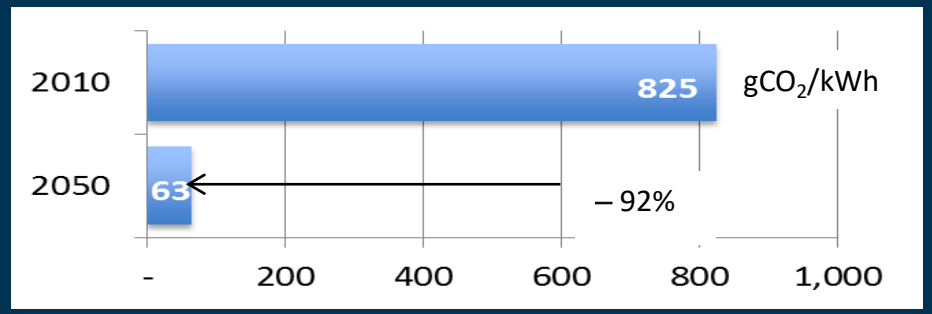
Pillar 1.
Energy Efficiency

Energy intensity of GDP



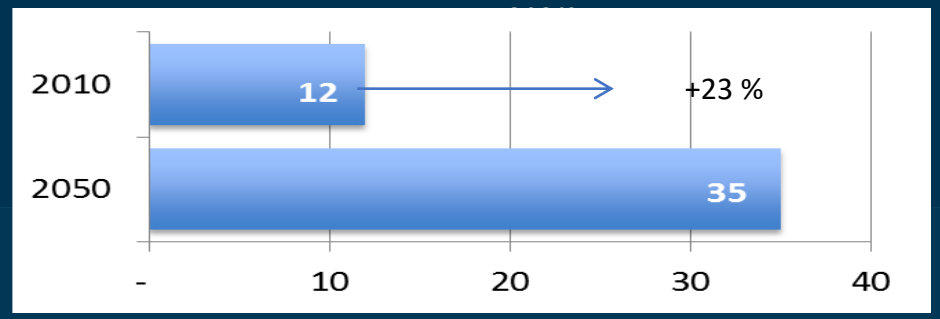
Pillar 2.
Decarbonization of Electricity

Elect. emission intensity



Pillar 3.
Electrification of end-uses

% of electricity in final



Pillar 1.
Aggressive efficiency improvement in demand side (labelling, energy management) and supply side (power decarbonization) would drastically decrease energy intensity of GDP (Energy per GDP)

Pillar 2.
Decarbonization of electricity: provision of clean/green/low and zero carbon emissions energy. Use of low carbon emitting fuels and CCS would significantly electricity emission intensity (gCO2/kWh)

Pillar 3.
Electrification of end uses (EV electric car and substitution of fossil fuel-based energy systems to electricity) will reduce fossil fuel combustions and reduce emission (as long as the power generation is deeply decarbonized)

Deep-decarbonization and Challenges of the implementation

- Development of Biofuels (fame biodiesel, bio-hydrocarbons, bioethanol, palm oil gasoline, etc.), for transportation while considering the provision of sustainable (plantation) raw materials
- Non-renewable power uses more efficient fossil fuels, i.e. IGCC, ultra-supercritical, gas combine cycle, etc., integrated with renewable energy (biomass co-firing) and CCS/CCUS (carbon capture and storage) – CCS/CCUS financing can consider Carbon Pricing and the benefits of CCUS as EOR
- Aggressive development of renewable energy in power plants: geothermal, hydro, biomass, solar PV (+roof top)
- Aggressive decarbonization in the power generation sector will reduce the Carbon Foot Print of electricity from the grid network which in turn will reduce the carbon foot print of products related to the use of electricity from the grid, thereby reducing barriers to exports of Indonesian products to countries that are implementing a carbon foot print. print as NTBs (non-trade barriers).
- In the industrial sector, more efficient use of energy and lower carbon emissions will encourage improvements in the carbon foot print of the products produced

- Renewable energy development:
  - power generation technology that is already established and has been mastered (bio-fuels based, hydro, wind, geothermal (needs exploration and exploitation innovation)
  - What needs to be continuously developed: Biofuels – based on agricultural waste and algae, solar PV, Biomass (co-firing, gasification, Organic Rankine Cycle)
  - Waste-fueled power plants – PLTSa/RDF (refuse derived fuels)
  - Solar PV, Wind power, Ocean Current, Nuclear.
- The development of renewable energy needs to consider:
  - Availability is intermittent, it requires energy storage (battery) and/or a hybrid system (renewable combined with conventional/fossil energy); pump storage for hydropower, etc
  - To encourage the development of renewable energy, necessary to have the right pricing policy (gradually eliminate the total energy subsidy), divert subsidies to encourage the development of renewable energy through research funding and temporary price subsidies, implementation of feed-in tariffs.

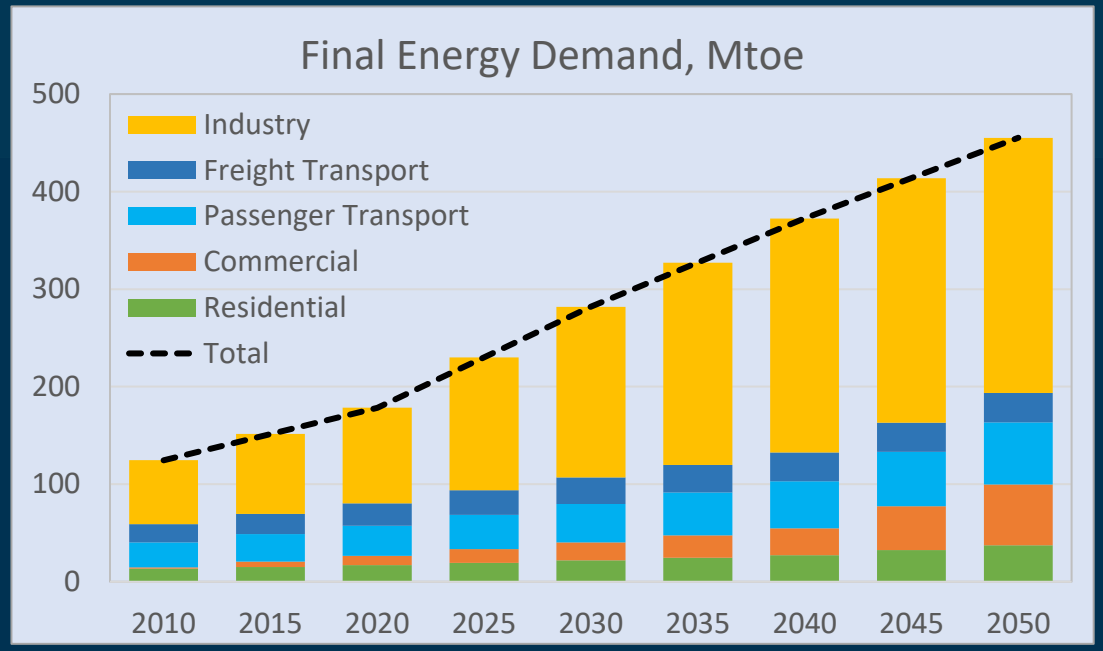
Deep-decarbonization and Challenges of the implementation

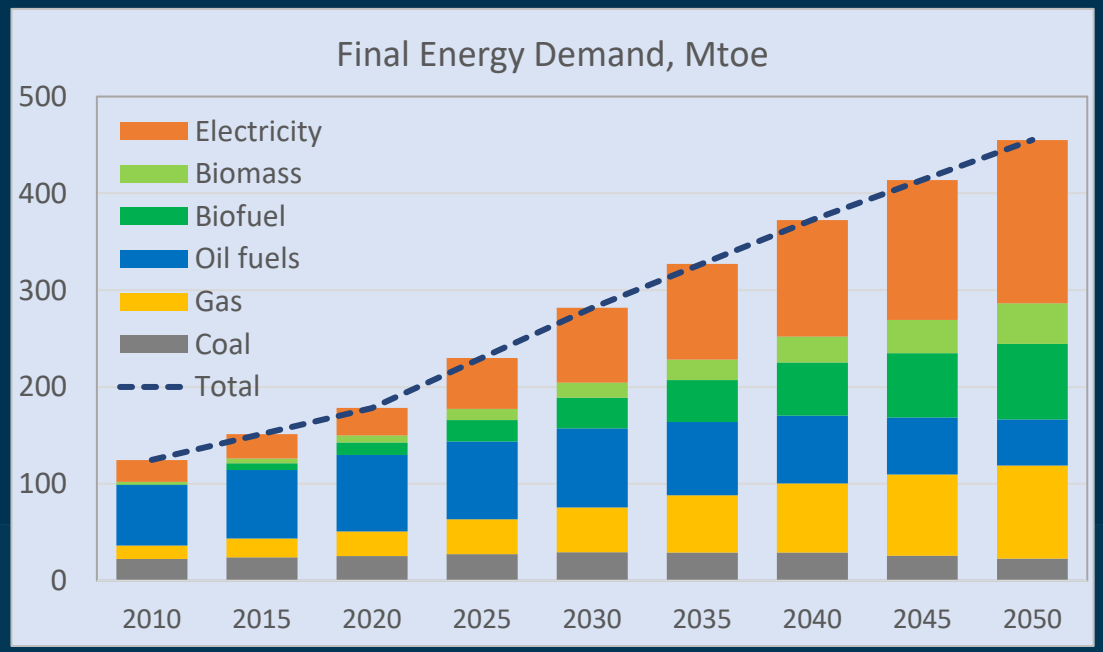
The implementation of deep-decarbonization will face many challenges among other:

- Need to develop local capacity in renewable technologies such geothermal, solar PV, wind power, bioenergy (biofuels and other biomass base)
- Need to reduce coal use significantly. It could affect negatively to Indonesian coal industry (related to stranded assets).
- The negative impact could be lessen by keep using coal but with high efficiency system, equipped with CCS/CCUS, and co-firing with biomass and CCS Technology (BECCS) as negative carbon technology

Road map and strategy for implementation

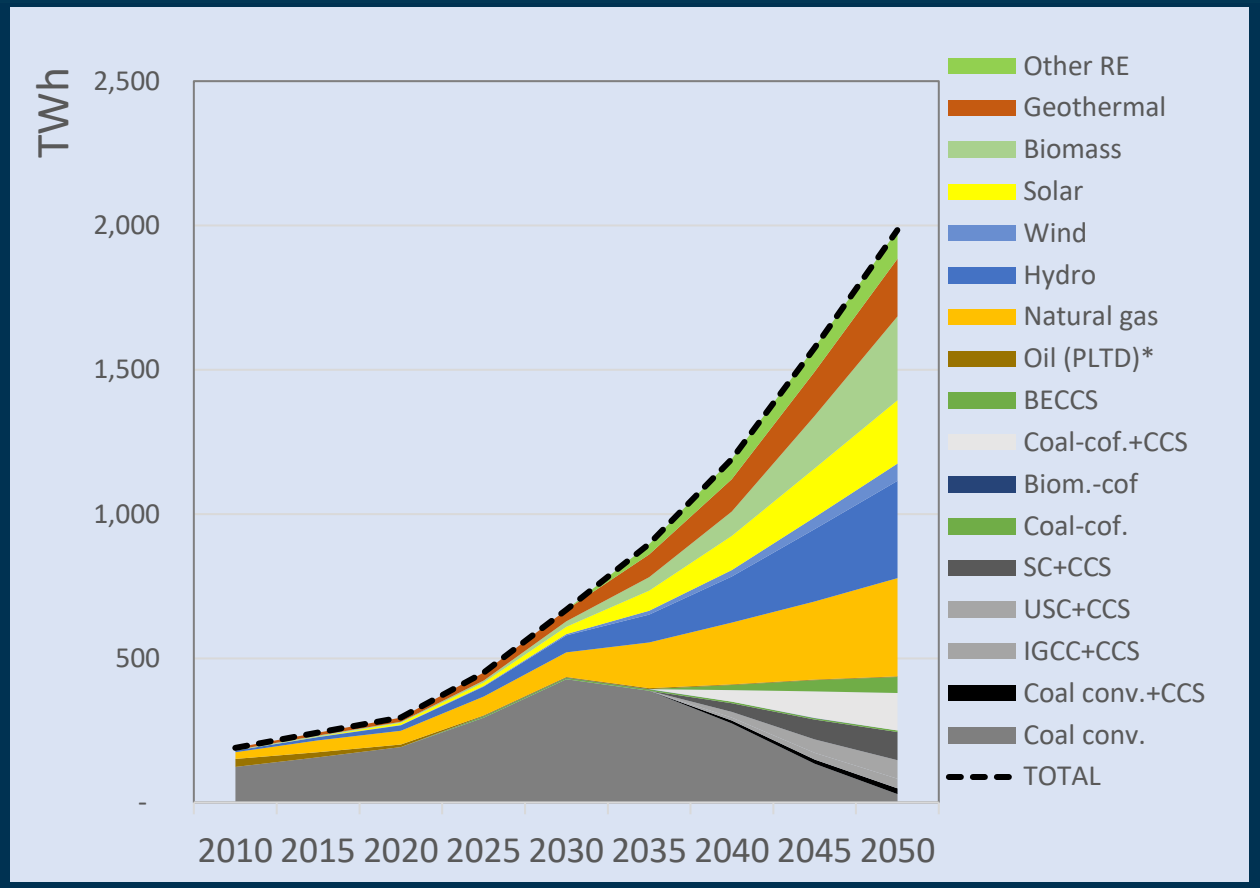
Energy Sector Development Challenges in Indonesia

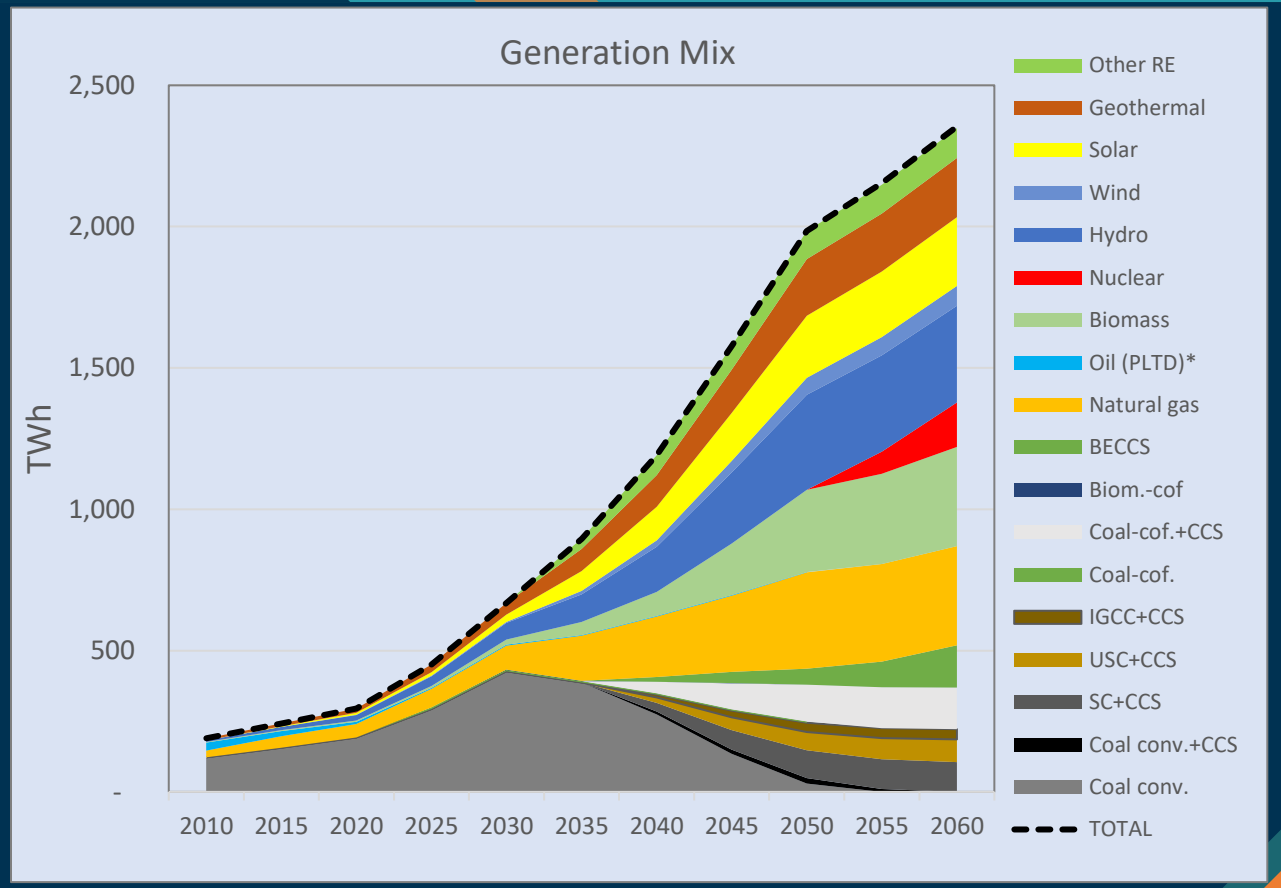




- High economic growth: increasing energy demand and trend (trajectory) of changing energy technology (fuels to electricity)
- Energy Security and Resilience
  - support economic development (get out of middle income trap)
  - meet the energy demand of modern society with high 'HDI'
- National Energy Policy:
  - Moving away from Oil (depleted & import dependency)
  - The use of strategic assets (gas, coal) – saves of stranded assets
  - Improved energy efficiency (management) and conservation
  - Development of new energy (nuclear, H_2, ammonia, CBM, shale gas) and renewable energy (green H_2, wind, hydro, geothermal, solar PV, biomass-biofuels)
- Current technology: increasing energy consumption and the GHG, on the one hand global commitment to addressing climate change to achieving the targets of the Paris Agreement
- The need for 'pollution-free' air quality (especially in urban areas)
- Energy distribution challenges for archipelagic countries and Electricity Supply Challenges

Power Generation Mix





	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060
*Biofuel content in PLTD	0%	0%	30%	30%	50%	50%	50%	50%	50%	50%	50%
Population, Million	234	248	271	285	296	306	315	325	335	343	350
kWh/cap/year	810	959	1,088	1,589	2,258	2,932	3,780	4,854	**5,923**	6,279	6,724

Terimakasih

gelangdewi@gmail.com