

Clean Energy Transition in ASEAN Region

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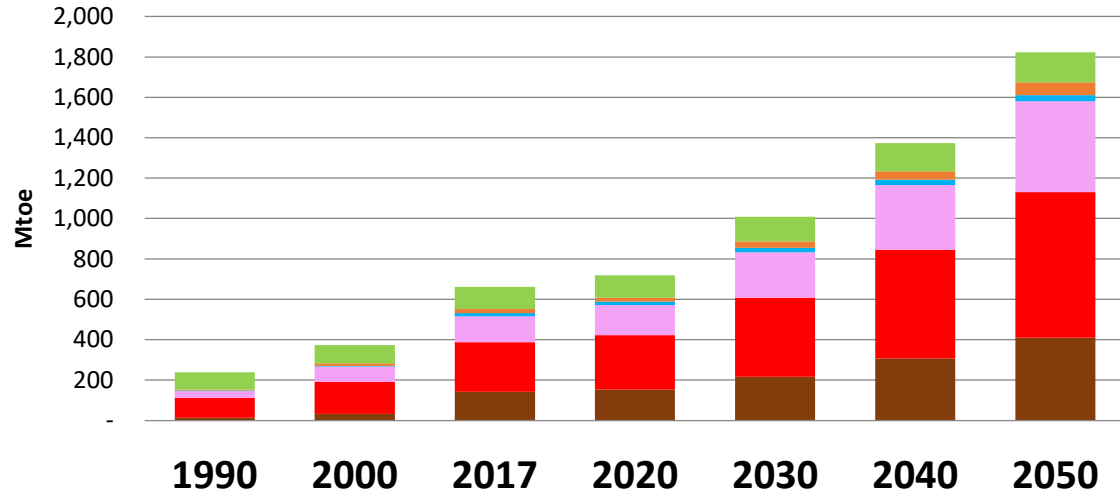
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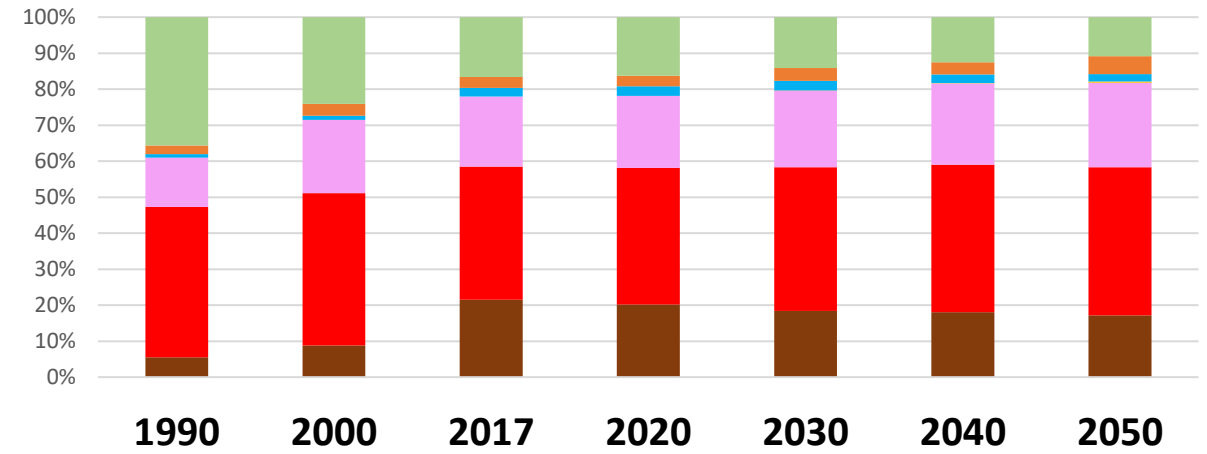
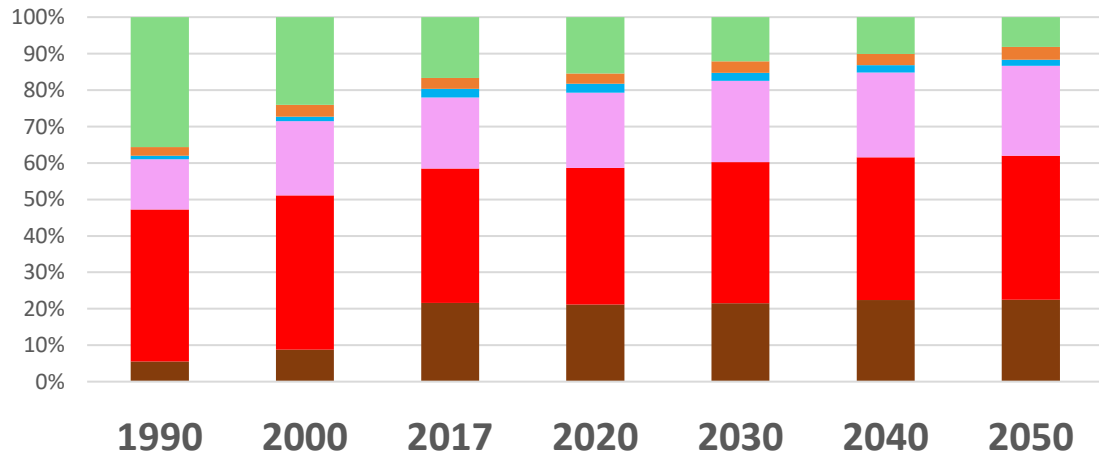
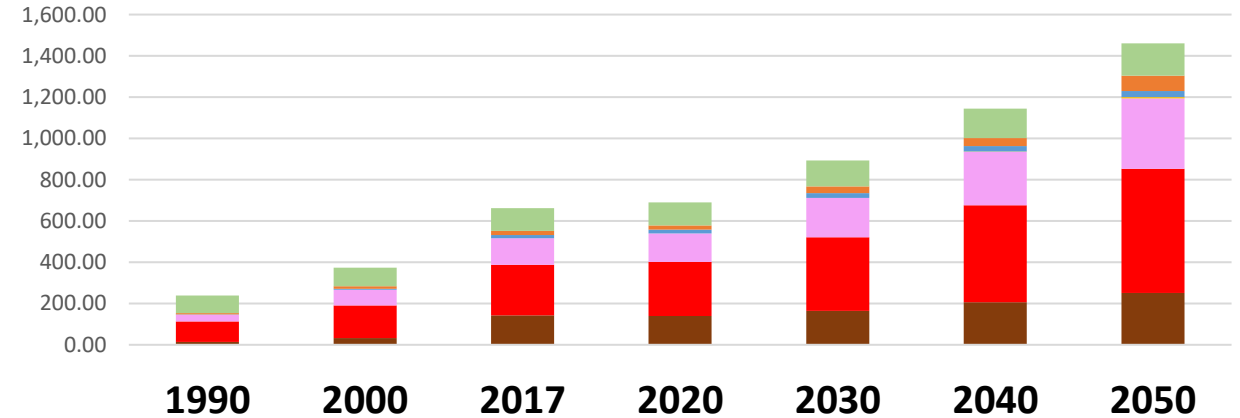
Outlook of Fuel Mix in ASEAN in BAU and APS (TPES)

◆ Fossil fuel will continue to play dominant role in ASEAN energy mix even in the Alternative Policy Scenario

Total Primary Energy Supply in BAU



Total Primary Energy Supply in Alternative Policy Scenario (APS)

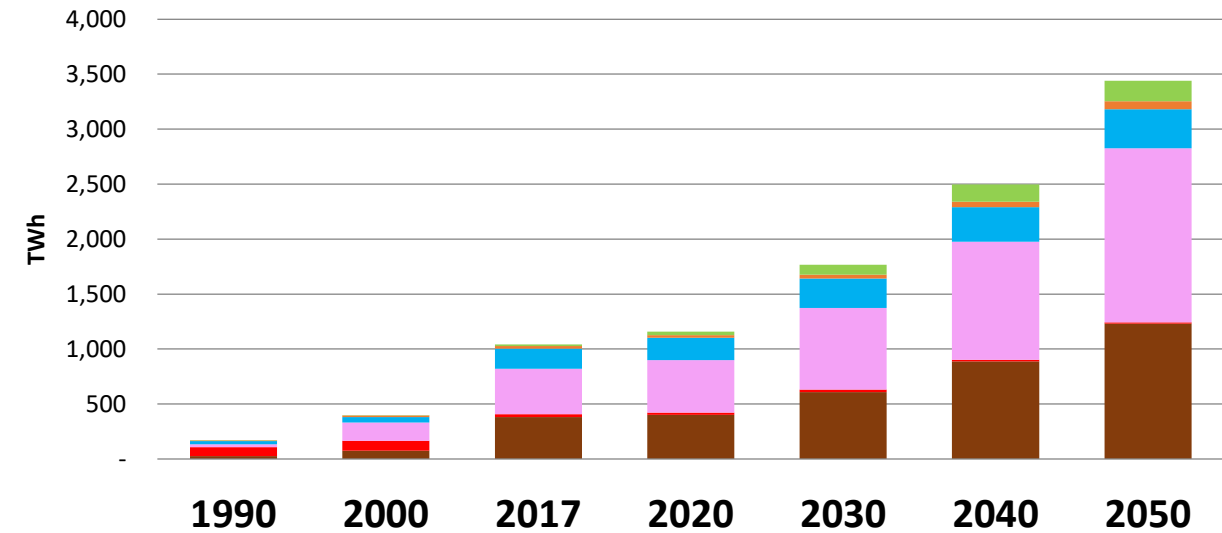


■ Coal ■ Oil ■ Natural gas ■ Nuclear ■ Hydro ■ Geothermal ■ Others

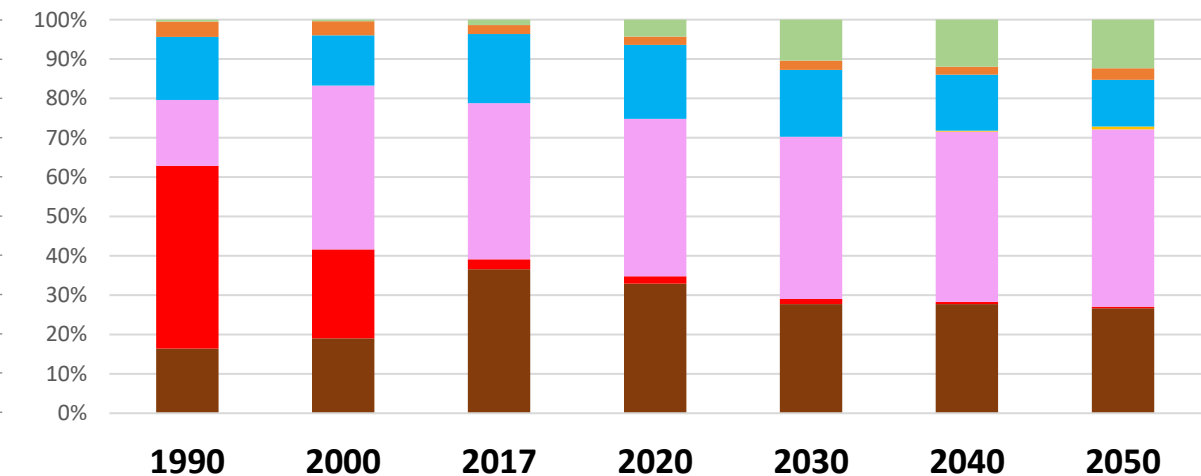
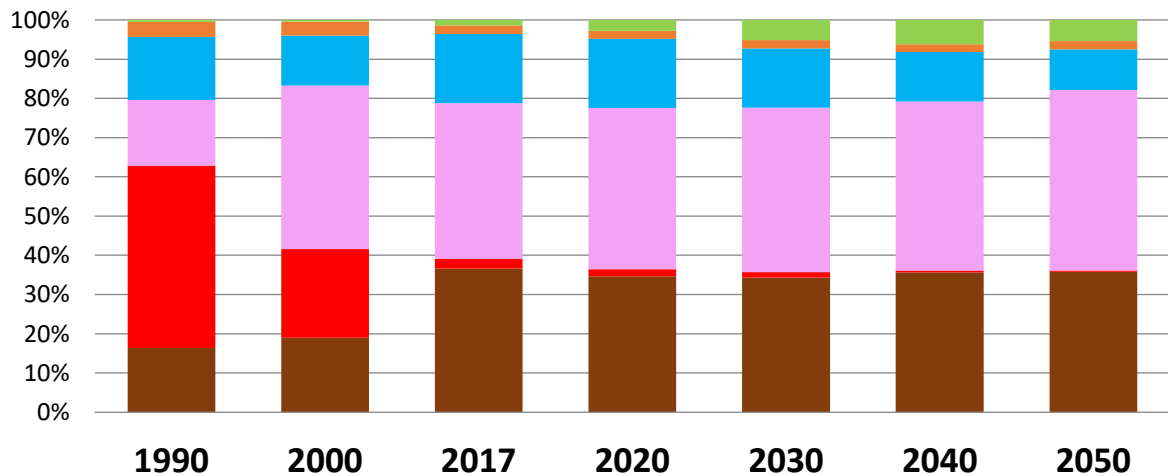
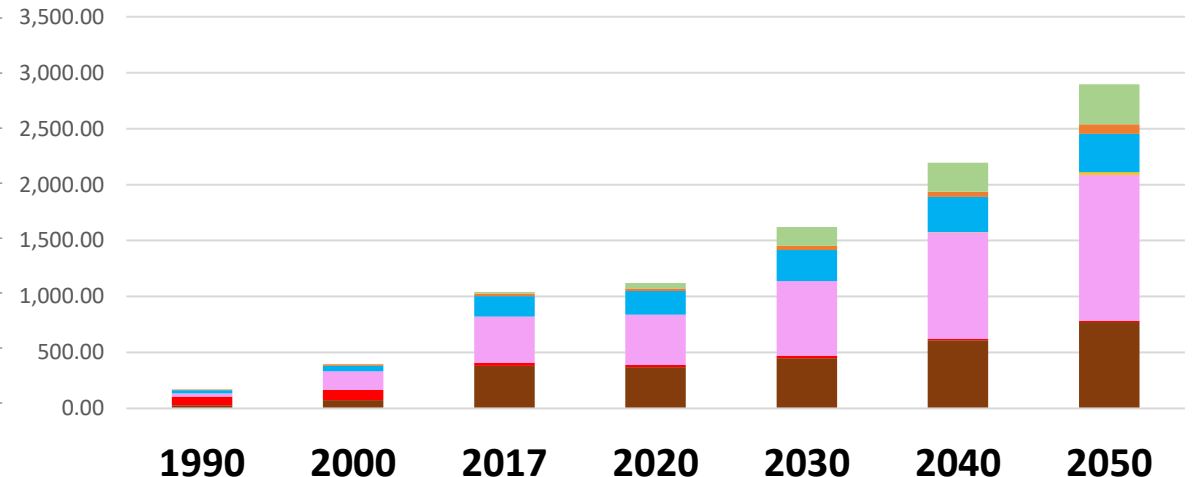
Outlook of Fuel Mix in ASEAN in BAU and APS (Power Generation)

◆ Fossil fuel will continue to play dominant role in ASEAN power mix even in the Alternative Policy Scenario

Fuel Mix for Power Generation in BAU



Fuel Mix for Power Generation in APS

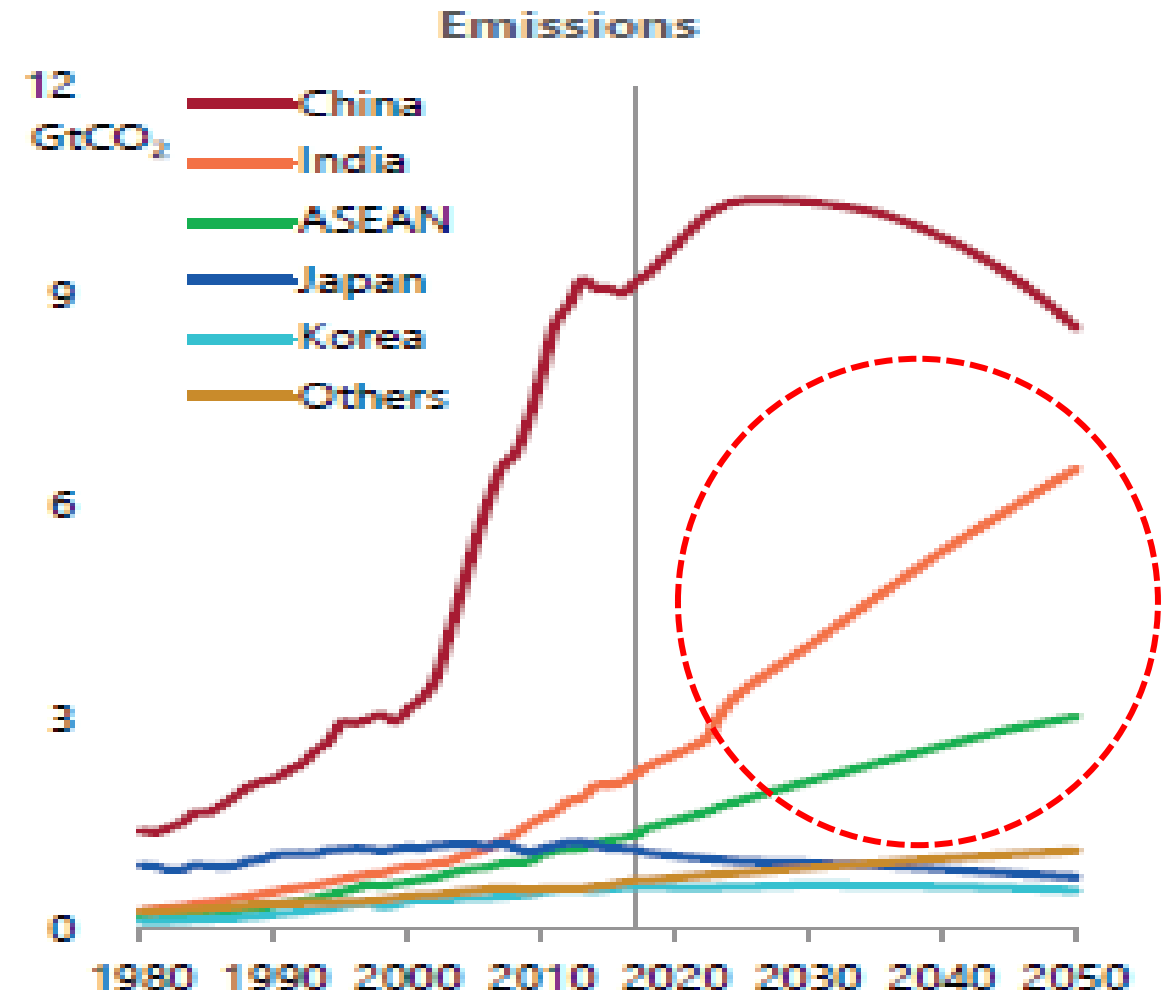
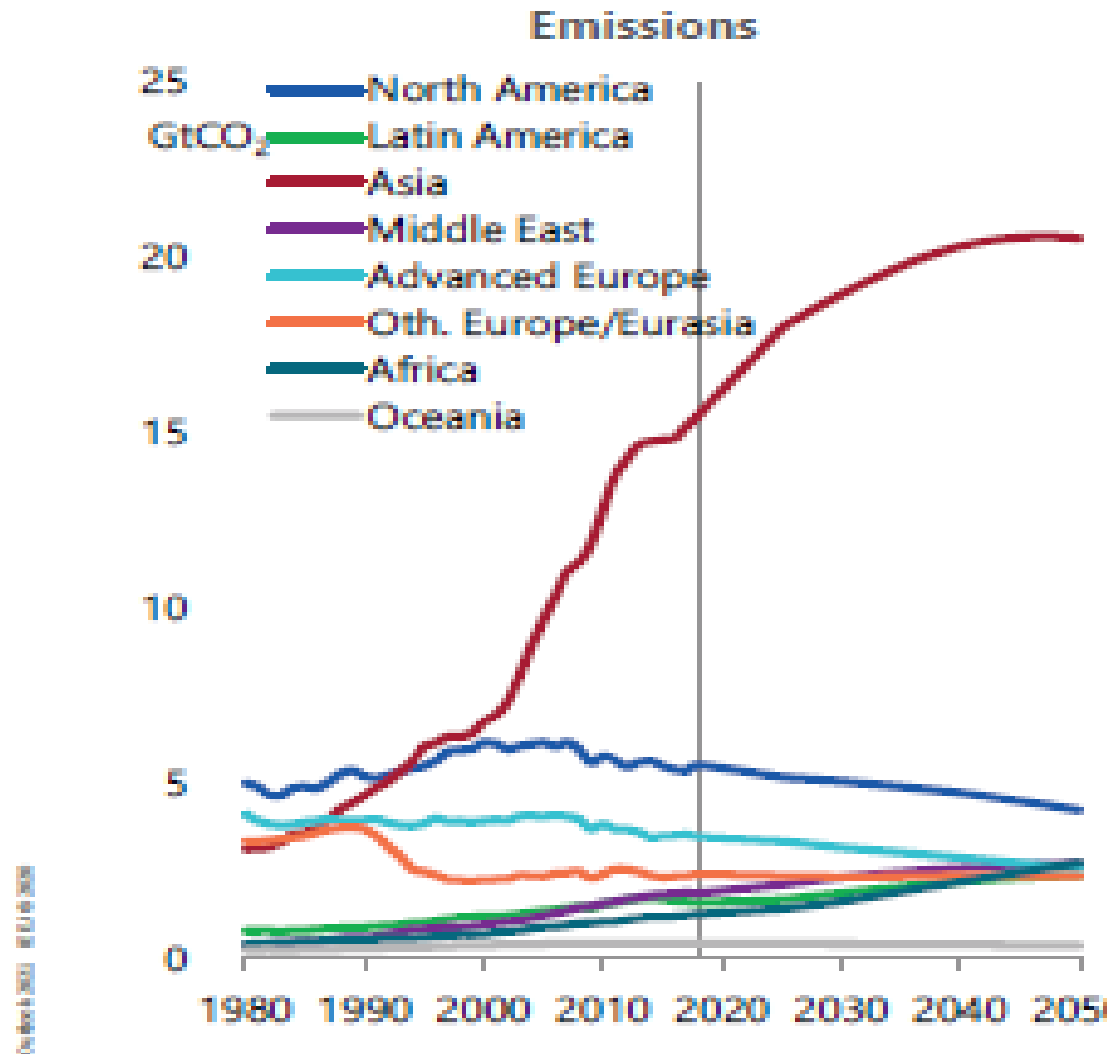


Source : ERIA Energy Outlook and Saving Potential of East Asia Summit Countries 2019-20

■ Coal ■ Oil ■ Natural gas ■ Nuclear ■ Hydro ■ Geothermal ■ Others

CO2 Emissions Trends Not Compatible with PA

Asian region holds the key in global endeavor towards decarbonization



Source: IEEJ Asia and World Energy Outlook 2020 part of COVID-19.

ASEAN Low Carbon Energy Transition Scenario (1)

■ Background

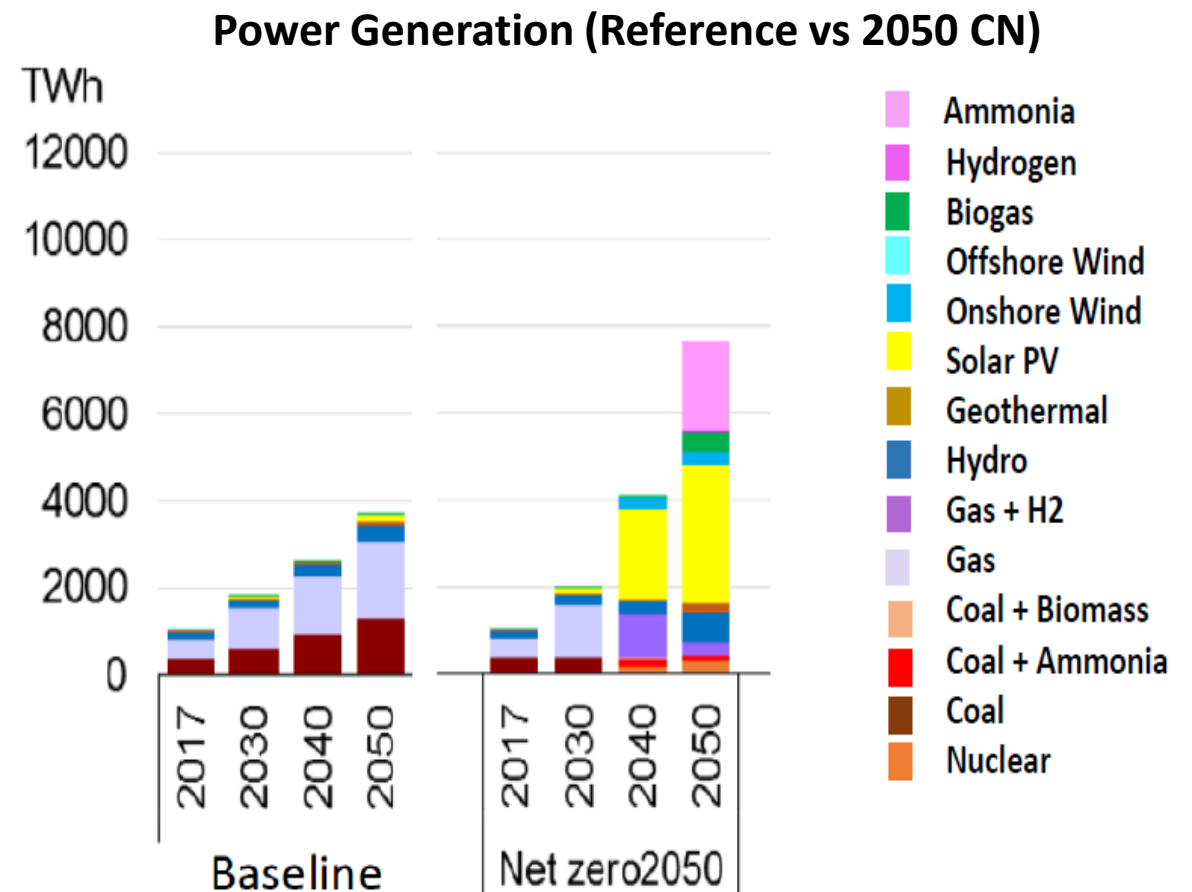
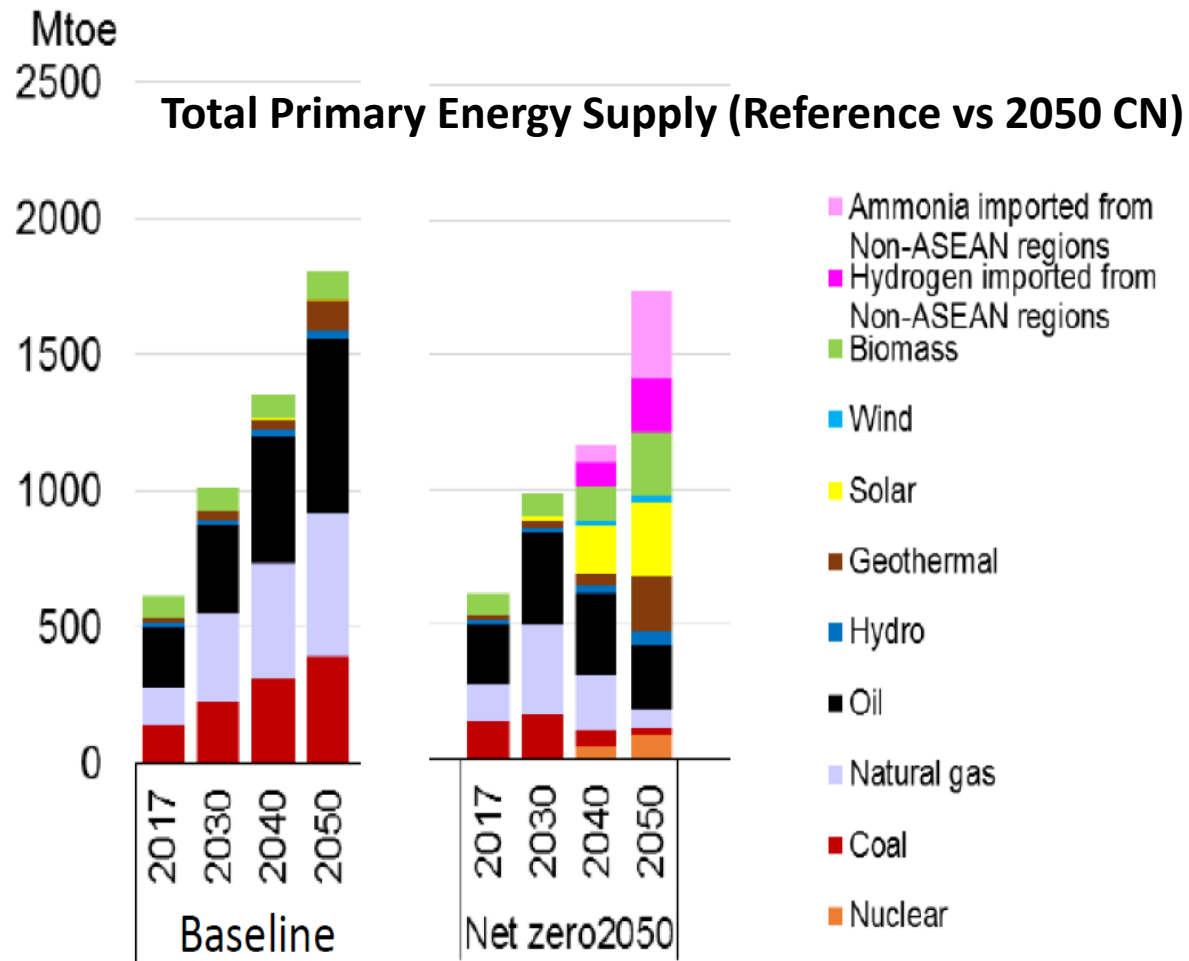
- ◆ Global trend to announce carbon neutrality goals
- ◆ Provide inputs to each ASEAN Member State for drawing her own carbon neutrality roadmap reflecting national specific circumstances

■ Methodology

- ◆ Institute of Energy Economics of Japan New Earth model for simulating cost-optimal deployment of energy technologies under technical cost constraints, encompassing the total energy system including energy transformation and end-use sectors
- ◆ Low carbon technologies (solar PV, onshore and offshore wind, hydro, geothermal, biomass, nuclear, CCUS, hydrogen, ammonia, DACCS and BECCS) based on various assumptions
 - Carbon pricing
 - Cost reduction of various technologies (RE, battery, CCUS, hydrogen etc)
 - RE potential (solar, wind and hydro)
 - ASEAN Power Grid development
 - Hydrogen imports from non-ASEAN region
 - Annual CO2 storage capacity etc

ASEAN Low Carbon Energy Transition Scenario (2)

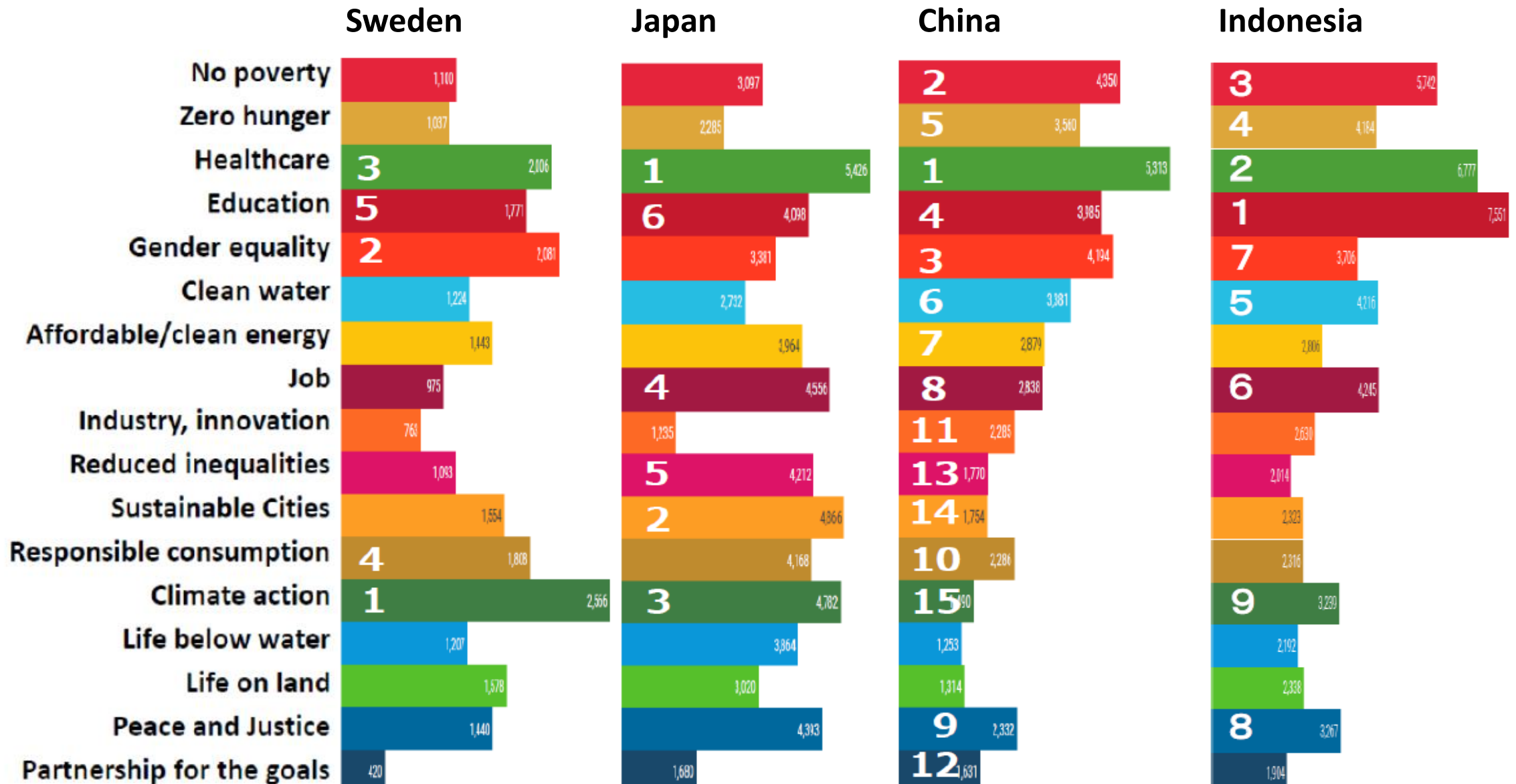
- ◆ In the 2050 ASEAN Carbon Neutrality Scenario, the share of fossil fuel substantially lower (86% → 19%), while non-fossil energy (Ammonia, Hydrogen, Biomass, Wind, Solar, Geothermal and Nuclear) much higher (14% → 81%).
- ◆ Renewables become the main power source in the 2050 CN, accounting for 59% in 2050.
- ◆ Hydrogen and ammonia, including co-firing, could also be a part of the power generation mix.



ASEAN Law Carbon Energy Transition Scenario (3)

- **Energy saving and electrification in end-use sectors, combined with low-carbon power supply, would be core strategies for decarbonizing ASEAN energy systems.**
 - Not only VRE, but also other carbon-free technologies (hydro, geothermal, biomass, and nuclear) can contribute to carbon neutrality.
 - CO₂-free hydrogen supply, CCS, and negative emission technologies are also important.
- **During transition periods, various kinds of “low-carbon” technologies can reduce CO₂ emissions effectively.**
 - Power sector: fuel switching from coal to natural gas, deployment of more efficient turbines, co-firing with hydrogen or ammonia, fossil-fuel power with CCS.
 - Affordable technologies in the mid-term. More expensive technologies required in the last stage of complete carbon neutrality.
- **Cost reduction and international cooperation necessary for affordable decarbonization**
 - Technology innovation and scale merits are essential for cost reduction.
 - Regional cooperation (e.g., international power grid in the Mekong region, establishment of hydrogen/ammonia value chain) would contribute to more efficient deployment of low carbon technologies.
 - Future research & development, in cooperation with advanced economies, is crucial for achieving carbon neutrality in the long term.
- **Cost optimization scenario could be utilized as an input for each country’s consideration of its unique transition pathway**

Different Priority among 17 SDGs



Source: United Nations My World 2030 (Jan 2020)

ASEAN Law Carbon Energy Transition Challenges

- Availability, accessibility and affordability of energy supply is the most fundamental requirement for the ASEAN countries
- The ASEAN region will continuously depend on fossil fuels even under the Alternative Policy Scenario
- The Paris Agreement sets ambitious 1.5-2.0 degree goals. As the Parties to the Paris Agreement, ASEAN countries need to pursue low carbon energy transition pathways aiming at carbon neutrality in the second half of this century.
- Priorities among 17 SDGs are different across countries
- Pathways towards carbon neutrality could be diverse among countries. One size does not fit all. Each country's specific national circumstances must be taken into account and decarbonization pathways needs to ensure other policy objectives, namely, availability, accessibility and affordability.
- Given high priority on poverty eradication, affordability strongly matters. Technology optimal approach would be needed for minimizing cost.