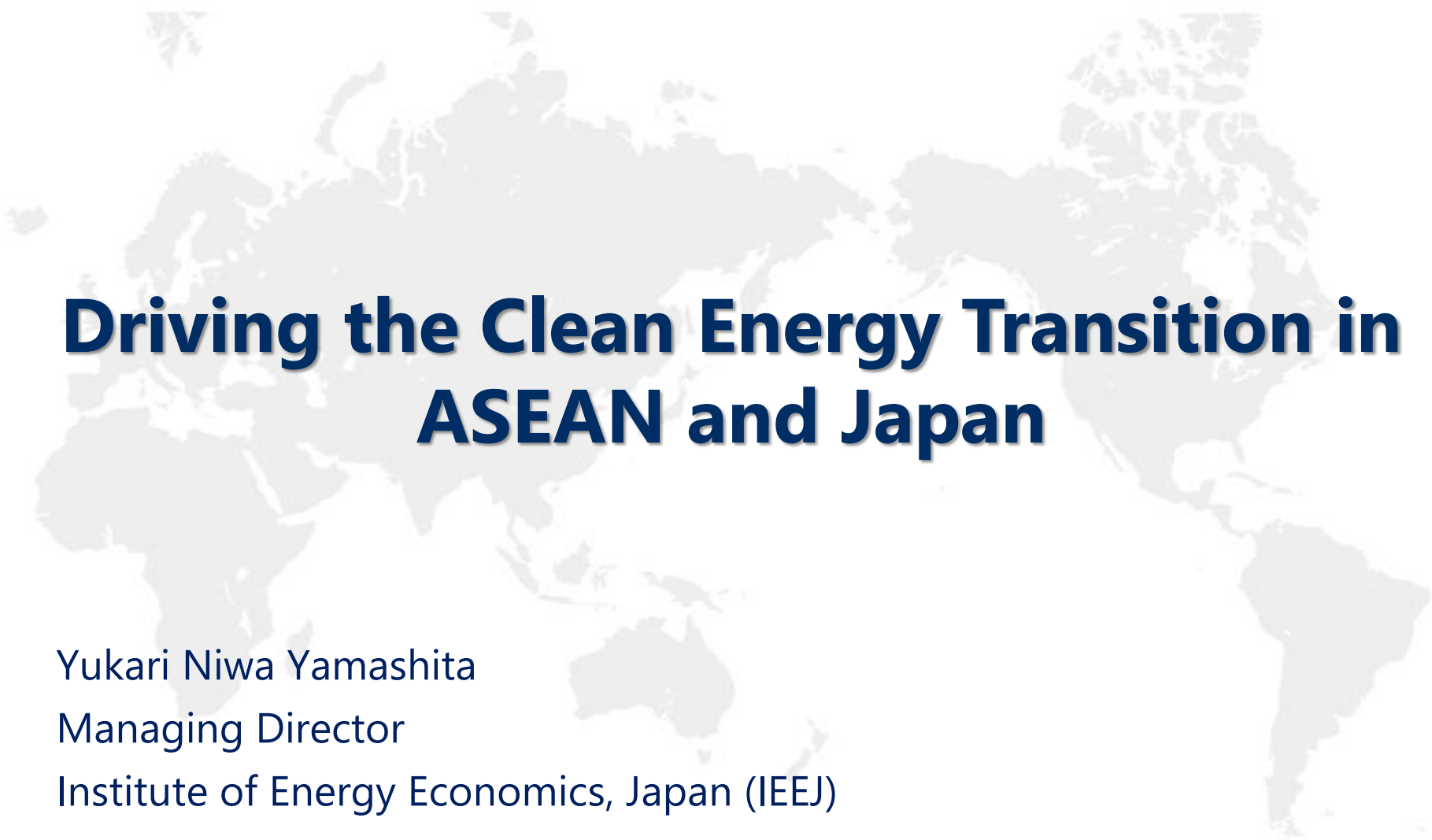


A light gray world map is centered in the background of the slide, showing the outlines of continents and major landmasses.

Driving the Clean Energy Transition in ASEAN and Japan

Yukari Niwa Yamashita
Managing Director
Institute of Energy Economics, Japan (IEEJ)

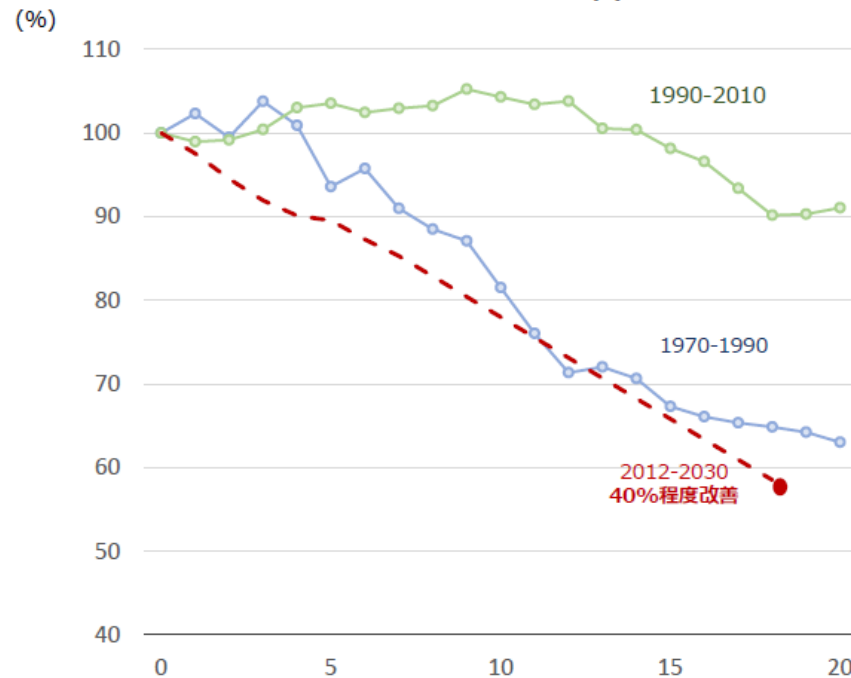
- Japan's 6th Basic Energy Strategy (main points)
- IEEJ's Outlook 2022
 - Where we stand in meeting Carbon Neutral by 2050?
 - What to expect towards 2050?
 - Some challenges



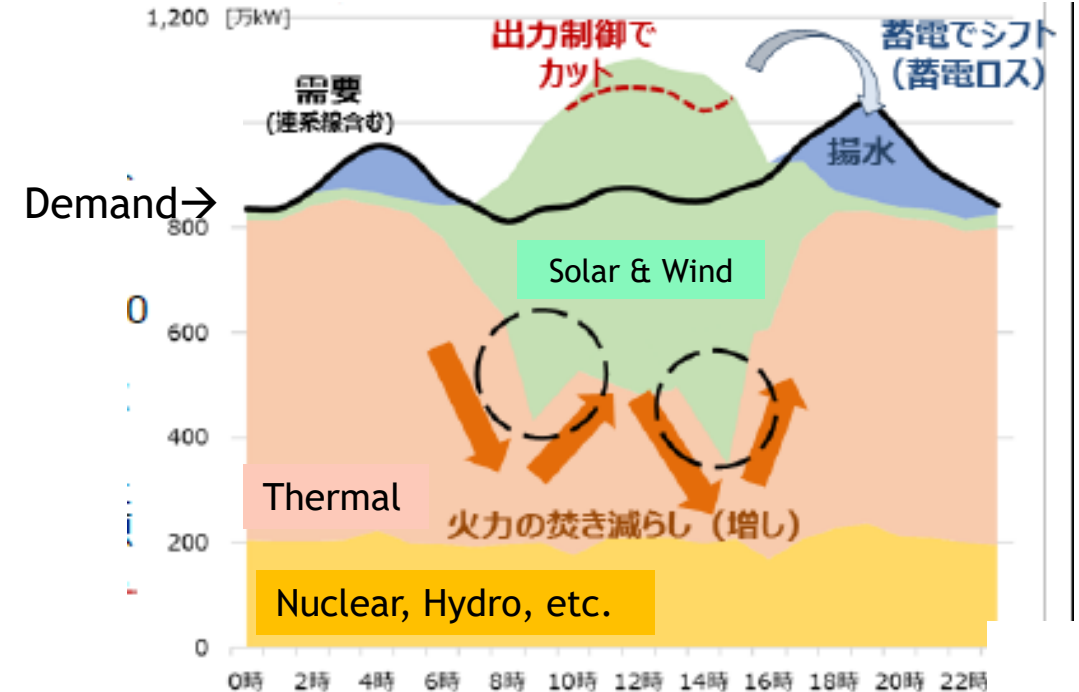
Japan: Basic Approach towards 2030 with 2050 CN target

- Deeper Energy Efficiency Improvement and Energy Saving
- Electrify as many sectors and usages as possible
- Decarbonization of power generation
- Fuel switching (shift away from coal & oil to gas)

Energy Efficiency Improvement

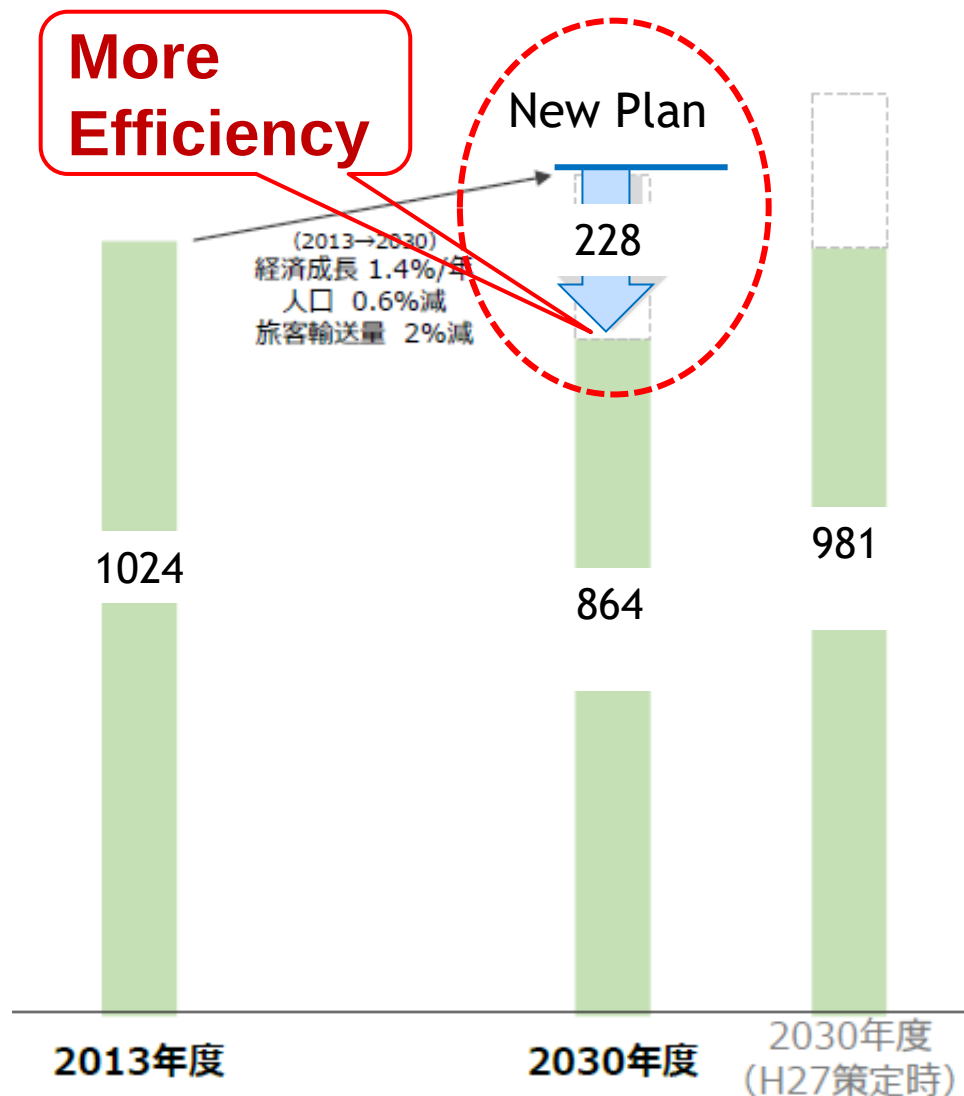


Load Curve Management

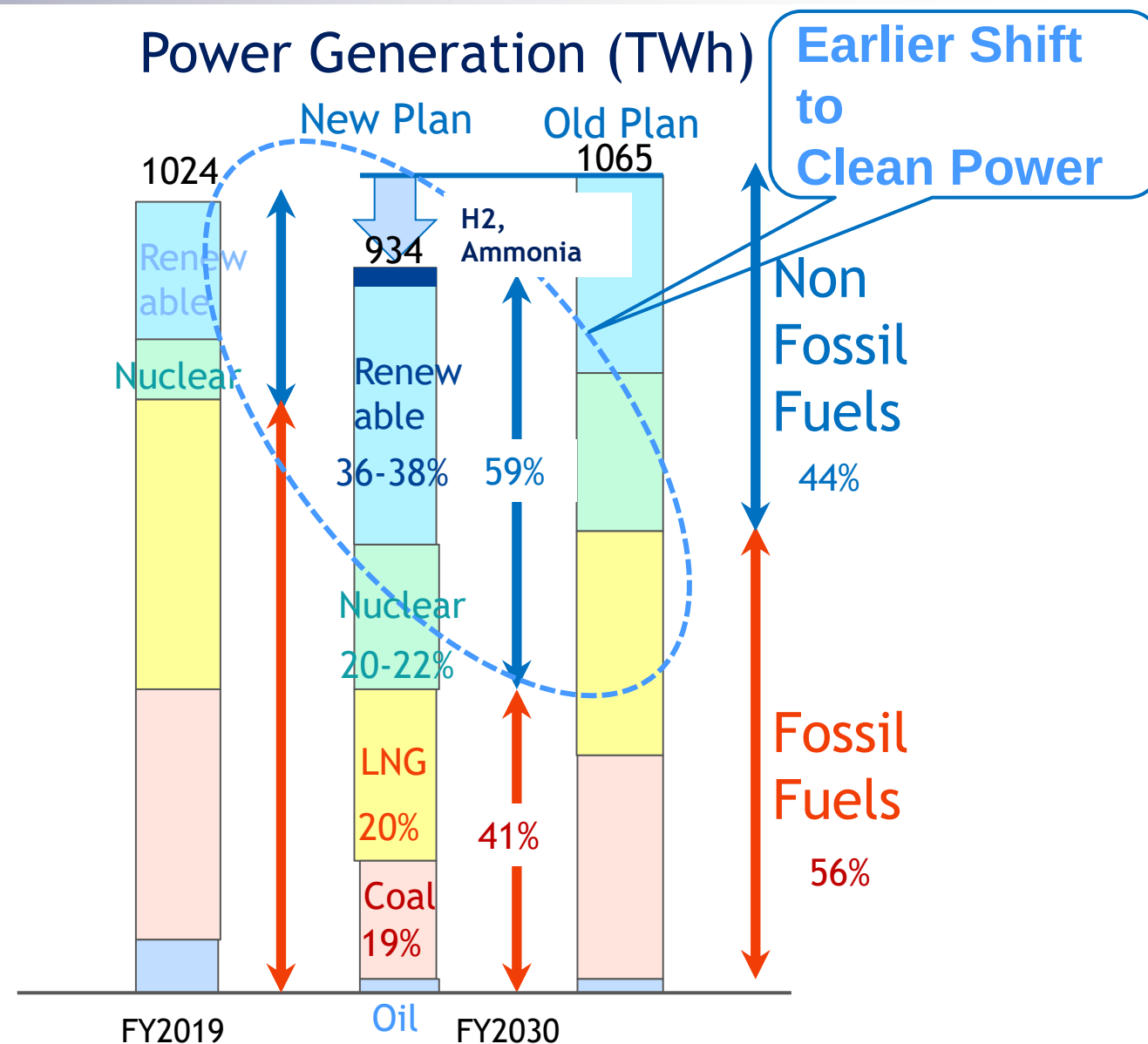


Energy Mix (Power Demand and Generation)

Power Demand (TWh)

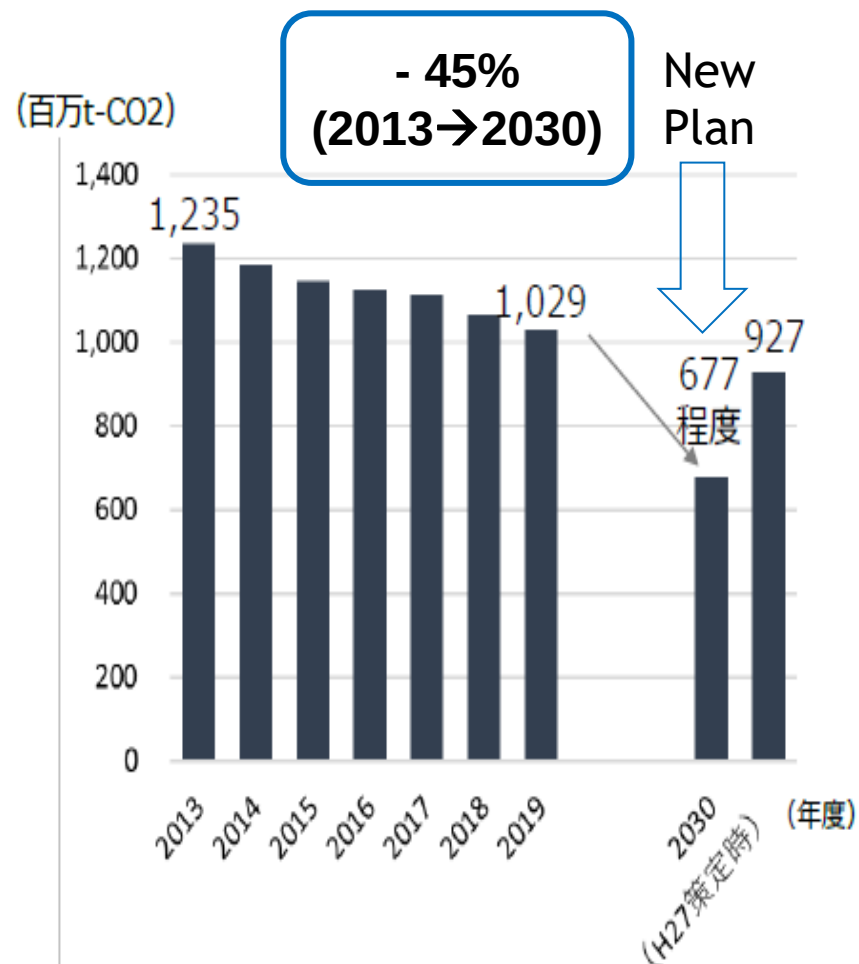


Power Generation (TWh)

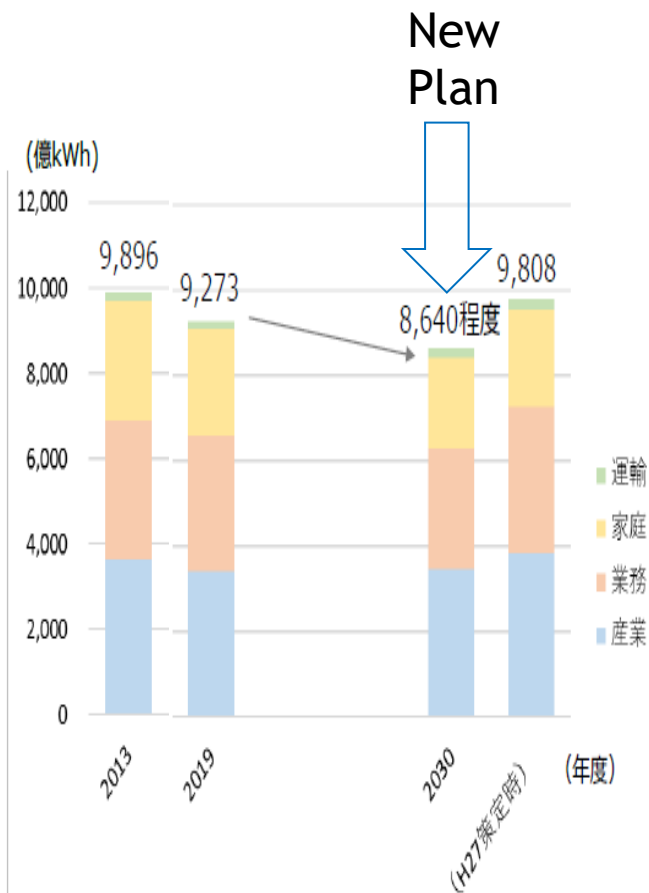


2030: 45% CO₂ Reduction from 2013

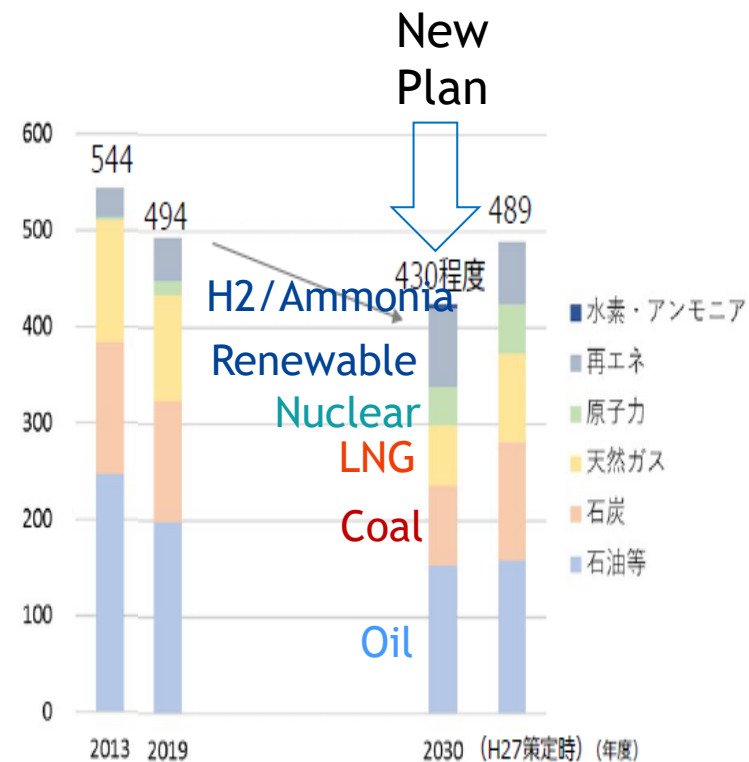
Energy-Related CO₂ Emission



Power Demand



Primary Energy Demand



Japan: Challenges Remain for Meeting 2030 Target

- Deeper Energy Efficiency Improvement and Energy Saving
- Electrify as many sectors and usages as possible
- Decarbonization of power generation
- Fuel switching (shift away from coal & oil to gas)

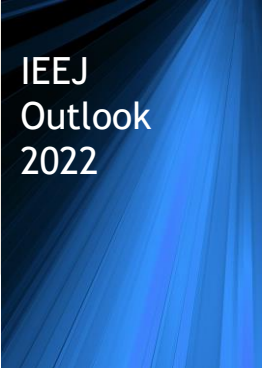


- Need more tools to utilize energy saving potential
- Transport and industrial sectors remain difficult to electrify
- Nuclear re-start is slow while plants are aging
- Accommodating increasing VRE is a challenge (batteries, fluctuation, reserve, etc.)
- Too much dependence on one energy source (=natural gas) causes traditional energy security concern

Scenario exercises for 2050 include yet to be innovated technologies

A light beige world map serves as the background for the slide, showing the outlines of continents and major landmasses.

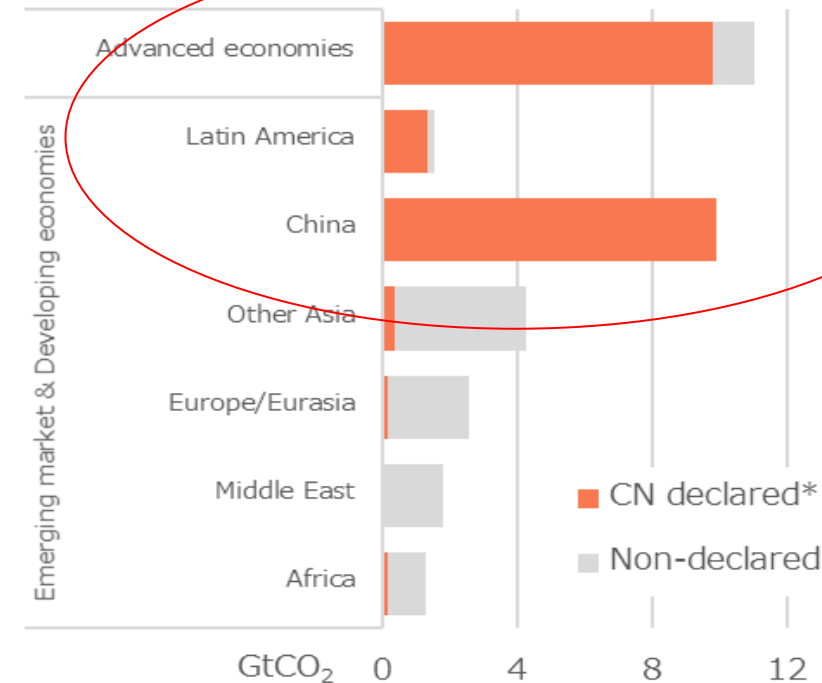
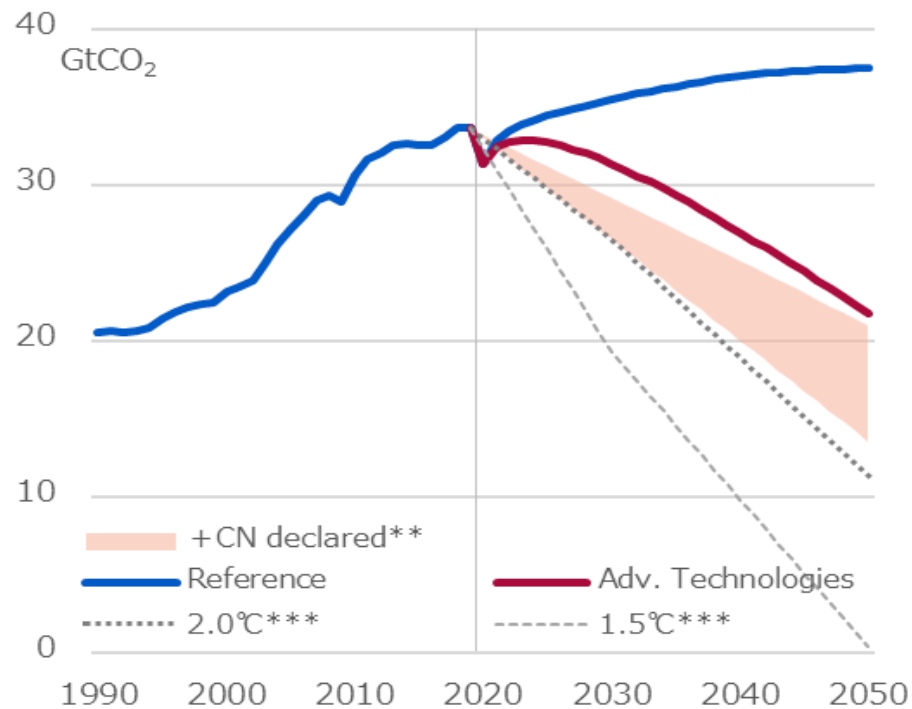
IEEJ Outlook 2021

A small image of the IEEJ Outlook 2022 book cover, which has a dark blue background with light blue diagonal lines.

IEEJ
Outlook
2022

Emitters of two-thirds of the emissions declare CN, but...

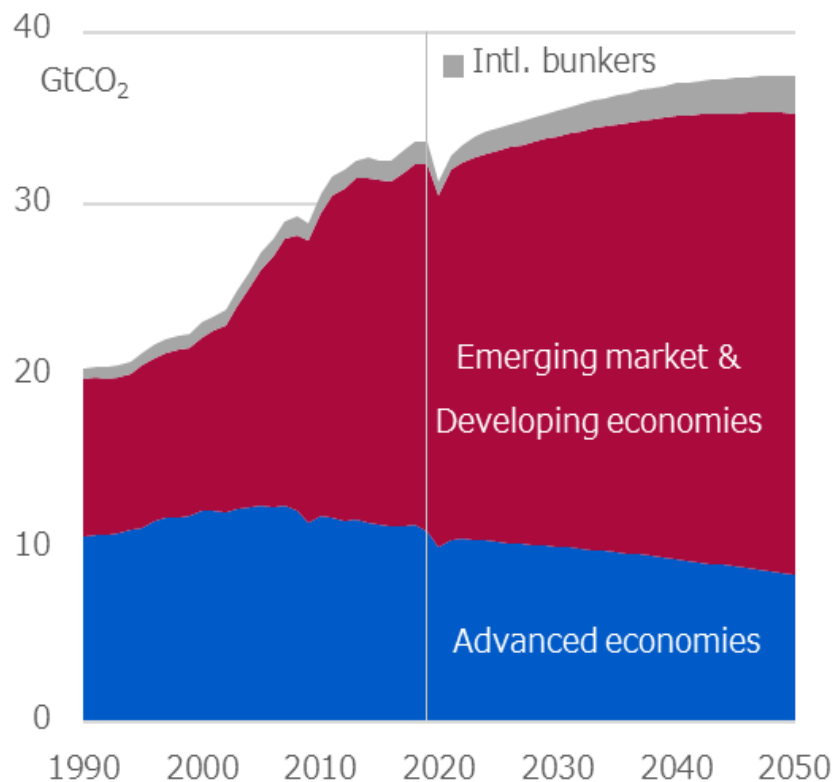
❖ Energy-related CO₂ emissions (global) ❖ Breakdown of CO₂ Emissions (2019)



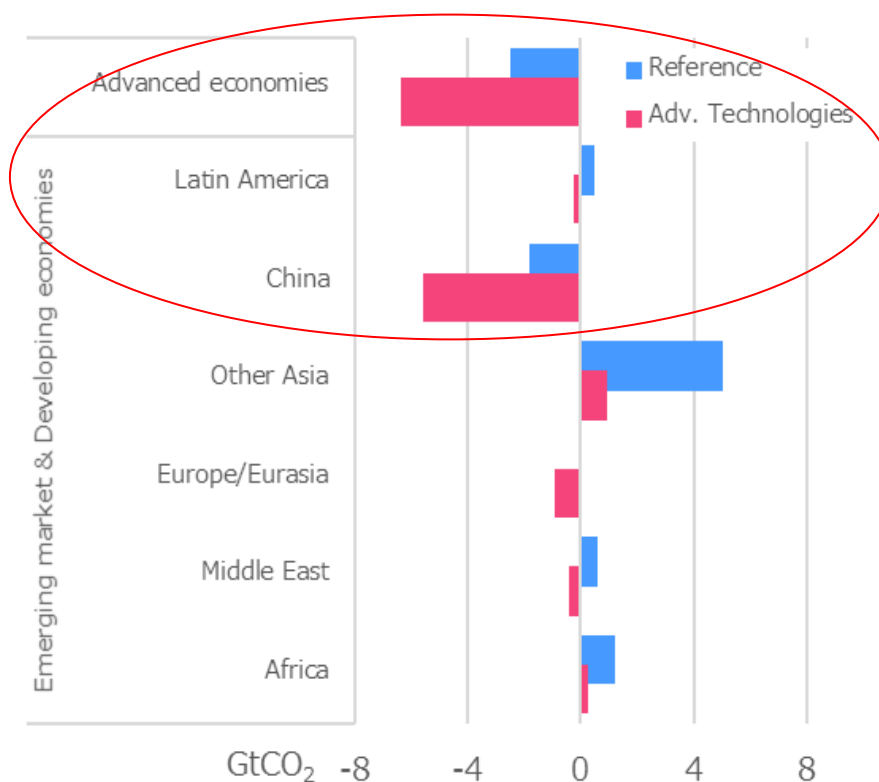
* United States, Brazil, South Korea, Poland, China and Climate Ambitions Alliance (121 countries). ** When the CN-stated countries achieve zero emissions in 2050 based on the emissions in the Reference / Advanced Technologies scenarios (For China, that announced 2060 CN, the emissions as of 2050 by linear interpolation between today and 2060). *** Average paths referred to the IPCC "Global Warming of 1.5°C".

Emissions in countries that have not declared CN increase and They Need More Energy

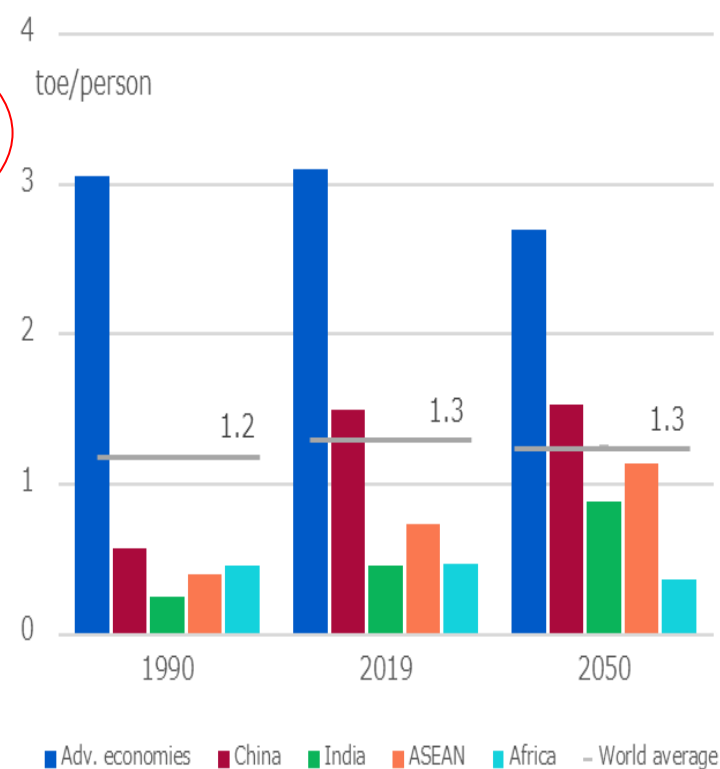
❖ Energy-related CO₂ emissions (Reference)



❖ Changes in emissions (2019-2050)

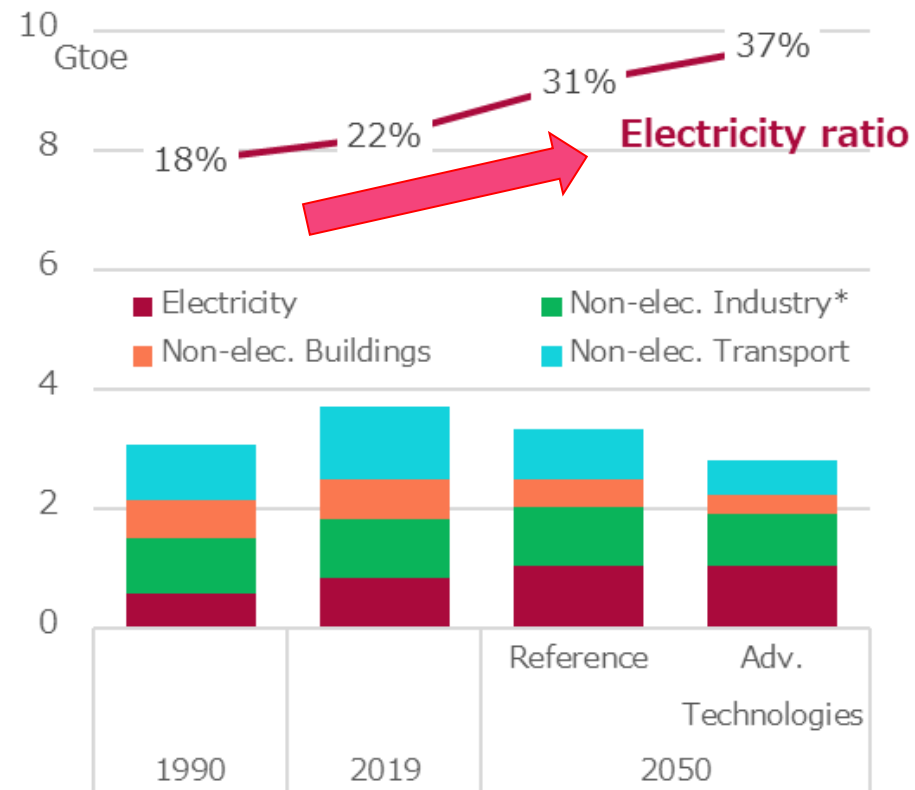


❖ Energy consumption per capita

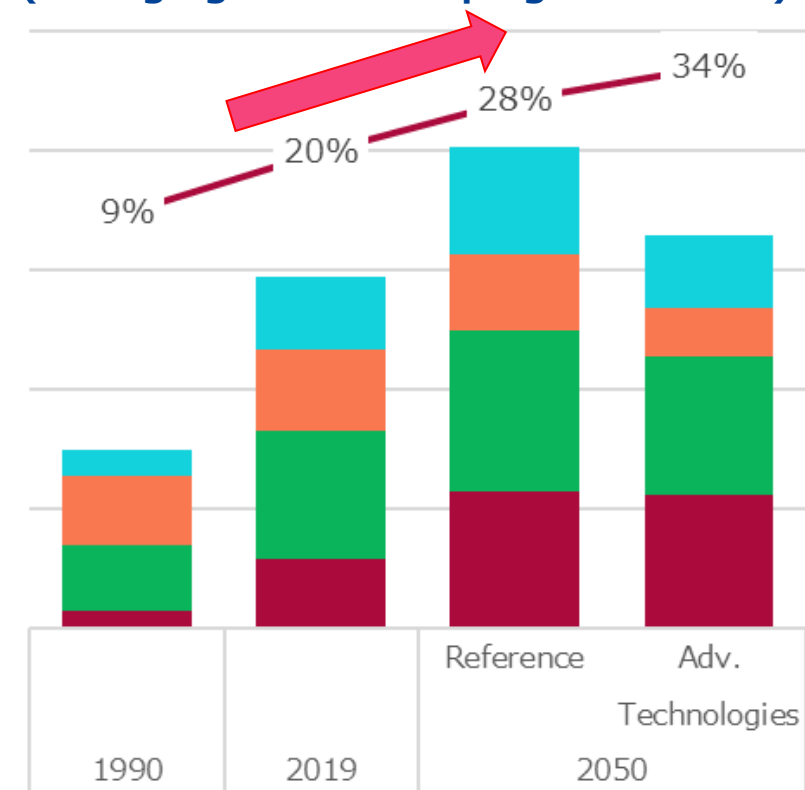


Power demand is certain to grow

❖ Final Energy Consumption (Advanced Economies)



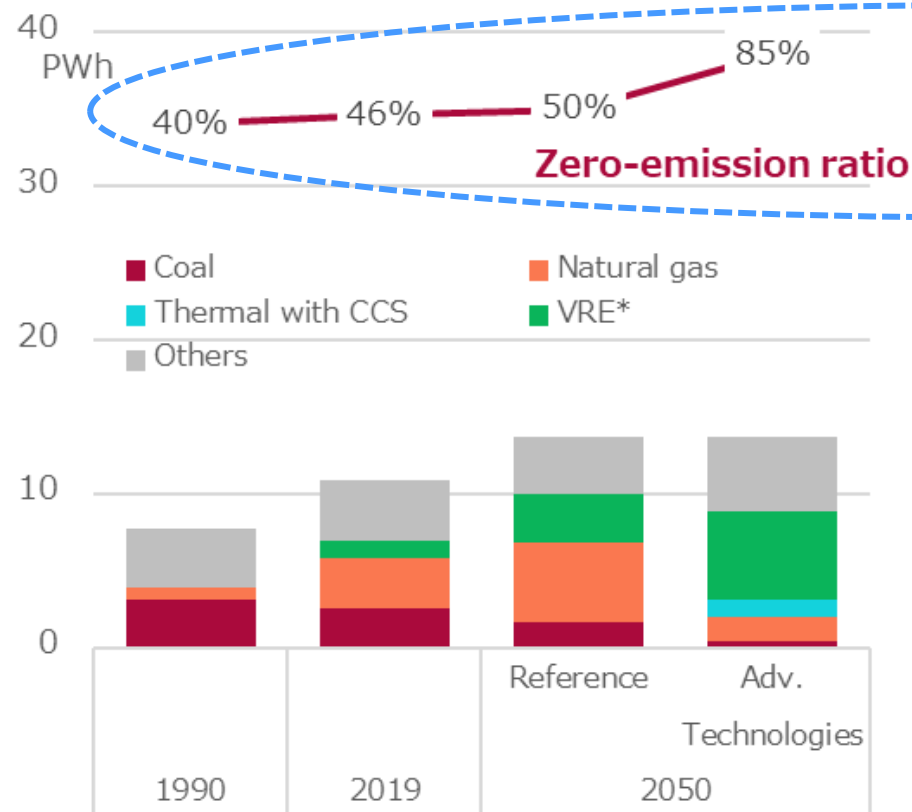
❖ Final Energy Consumption (Emerging and Developing Economies)



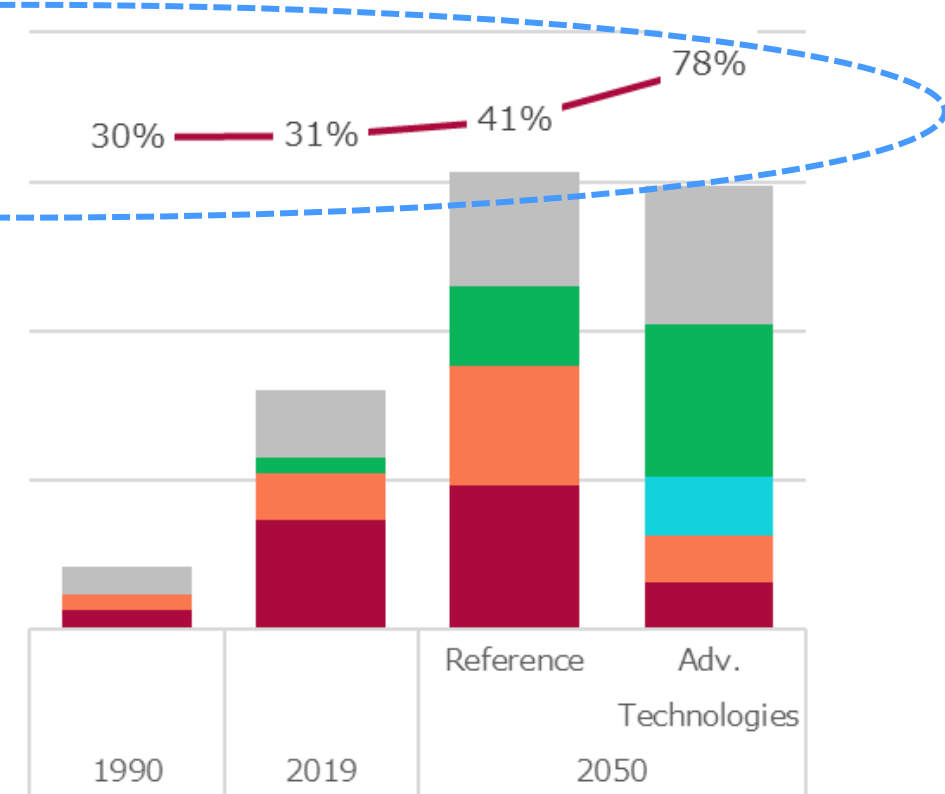
* Industry includes agriculture, forestry and fisheries and non-energy sector.

Decarbonization of the power sector is progressing

❖ Power Generation Mix (advanced economies)



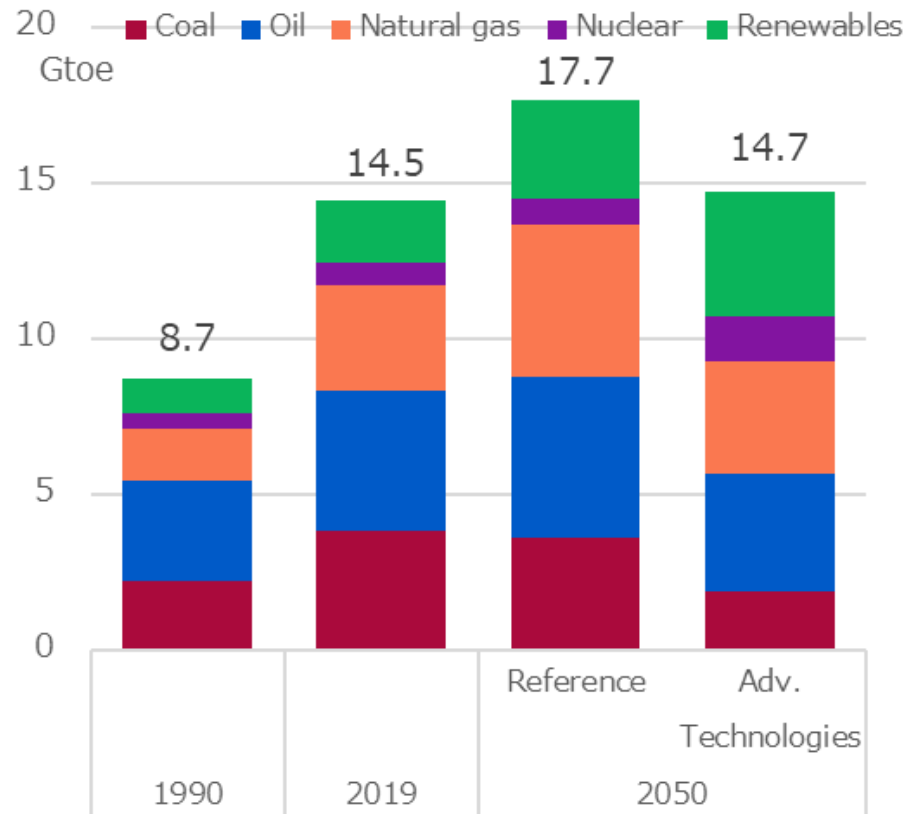
❖ Power Generation Mix (Emerging and Developing Economies)



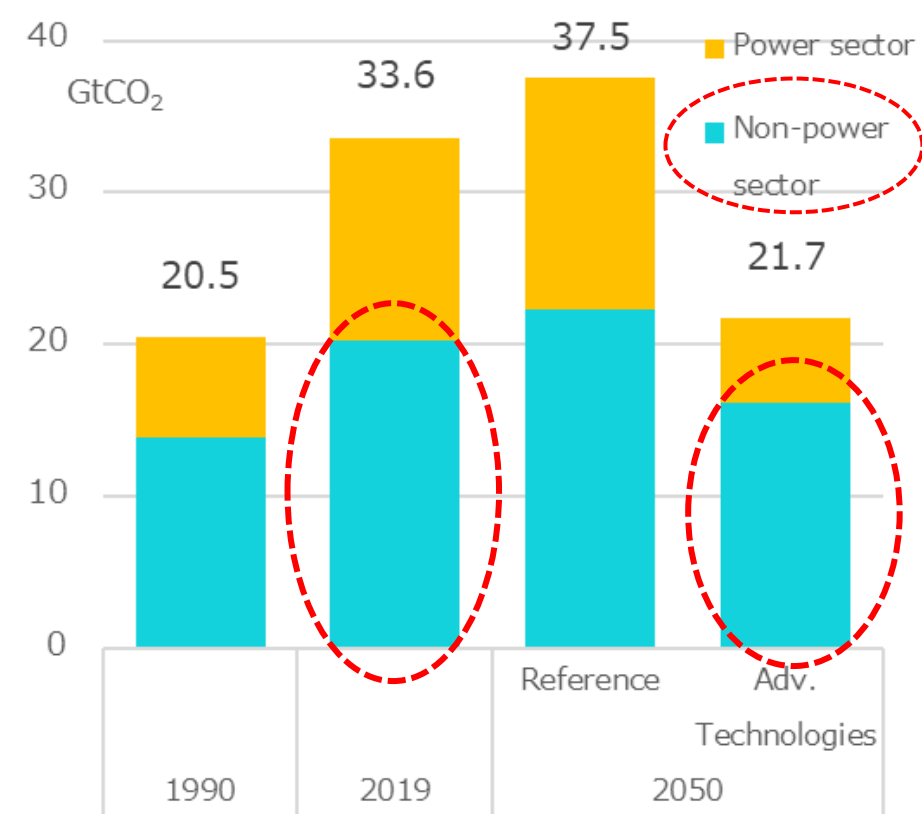
* VRE (Variable Renewable Energy): photovoltaic power, wind power, etc.

Decarbonization of non-power generation sector is difficult

❖ Primary energy demand

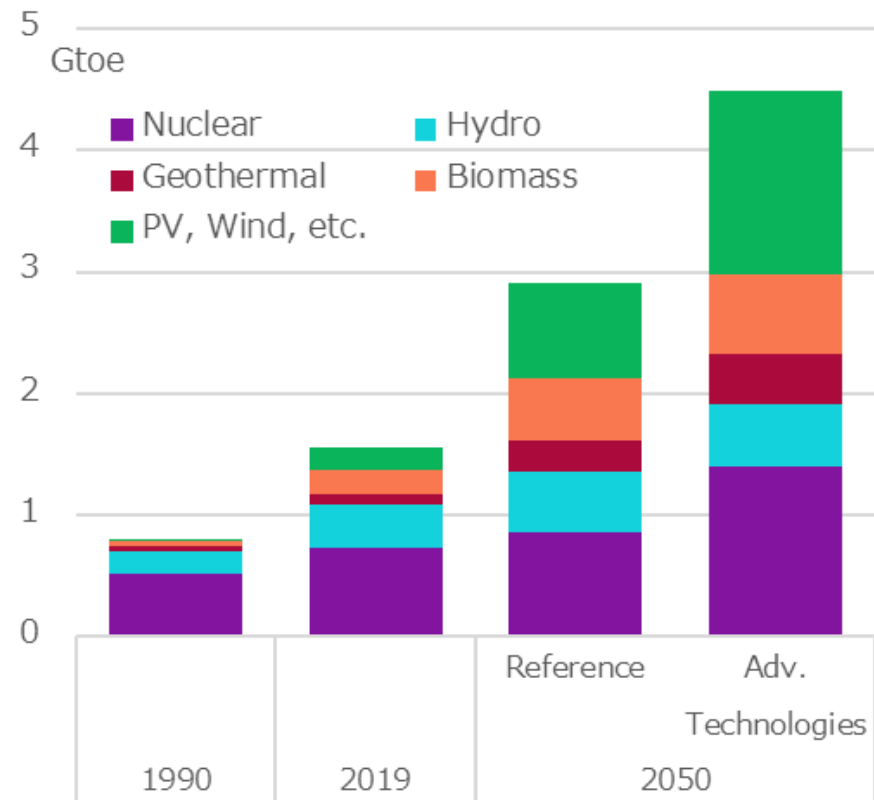


❖ Energy-related CO₂ emissions

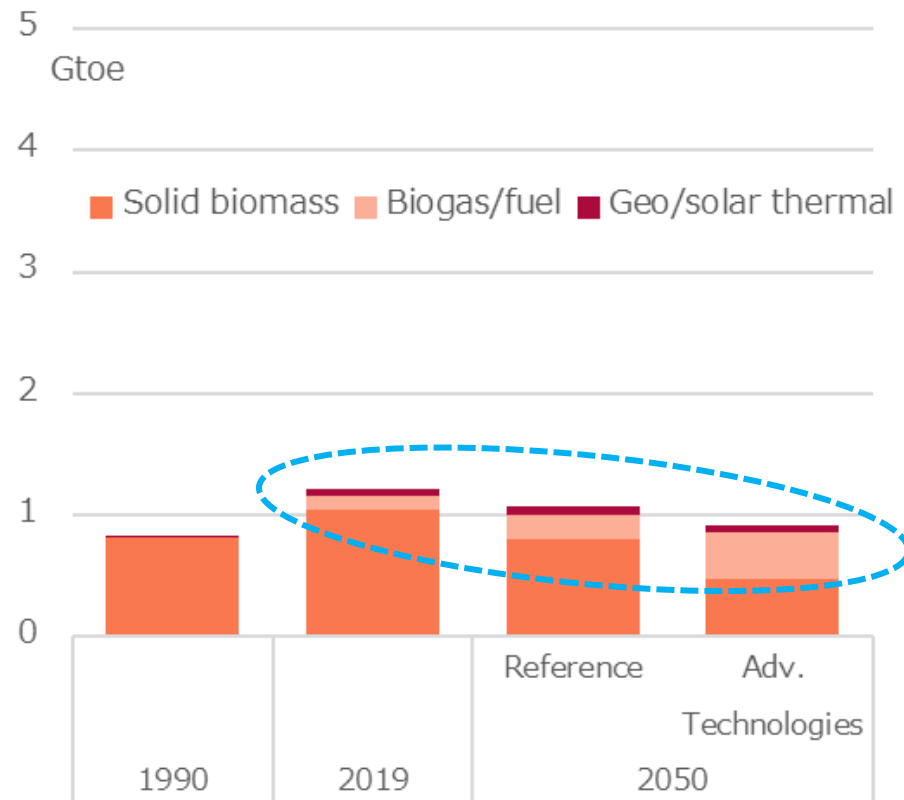


The introduction of non-fossil energy in non-power sectors is a challenge

❖ Non-fossil energy in the power generation sector

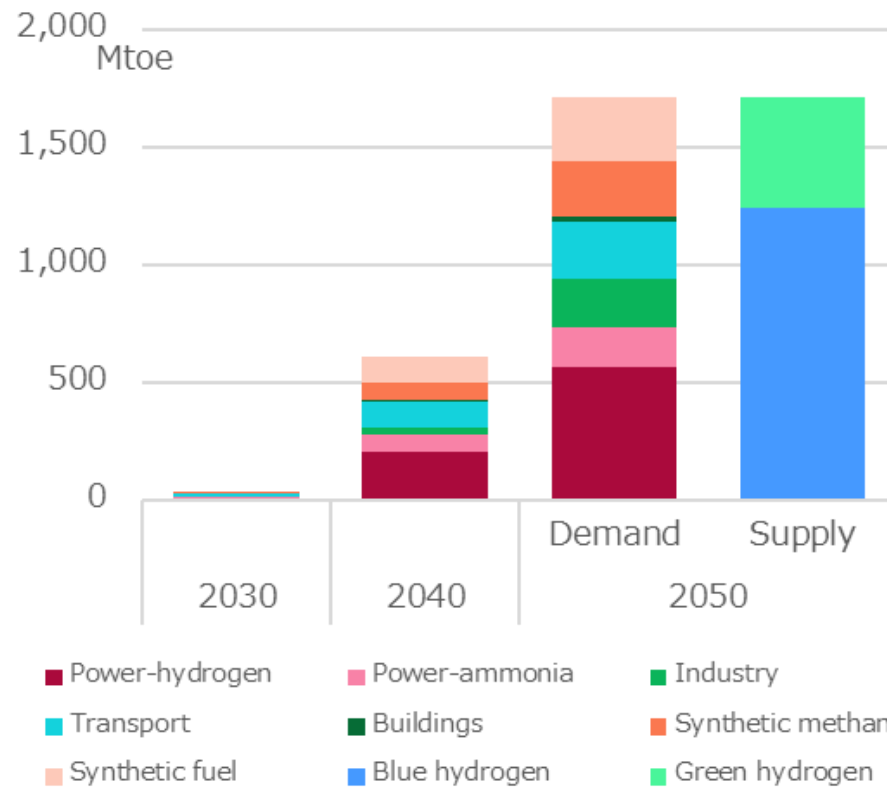


❖ Non-fossil energy in the non-power generation sector

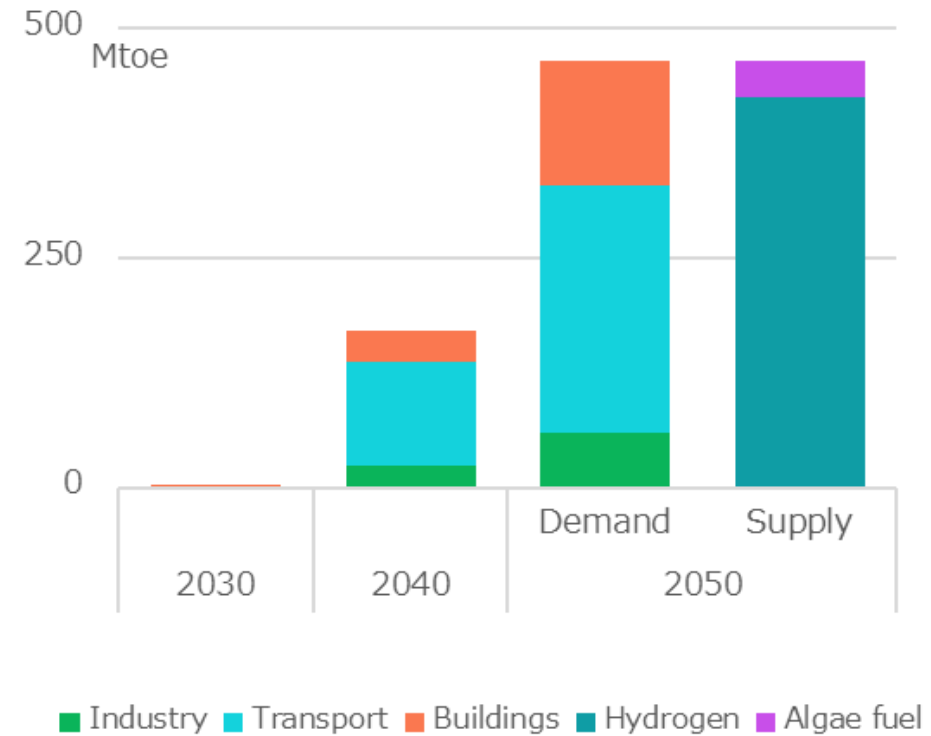


Utilize clean hydrogen/ammonia

❖ Supply and demand of hydrogen/ammonia

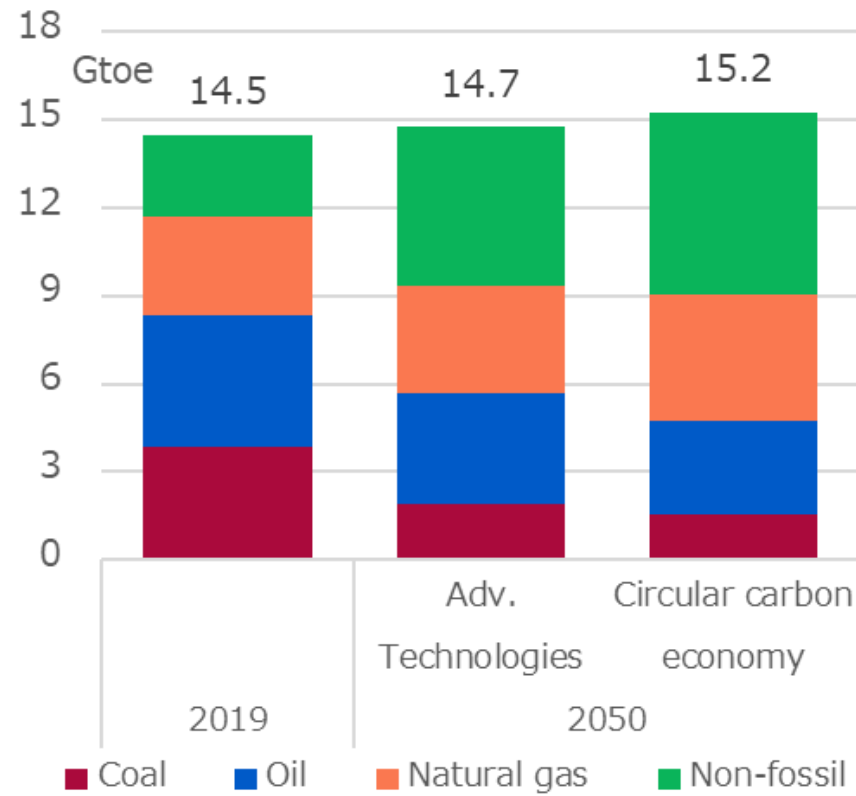


❖ Supply and demand of synthetic methane/fuel

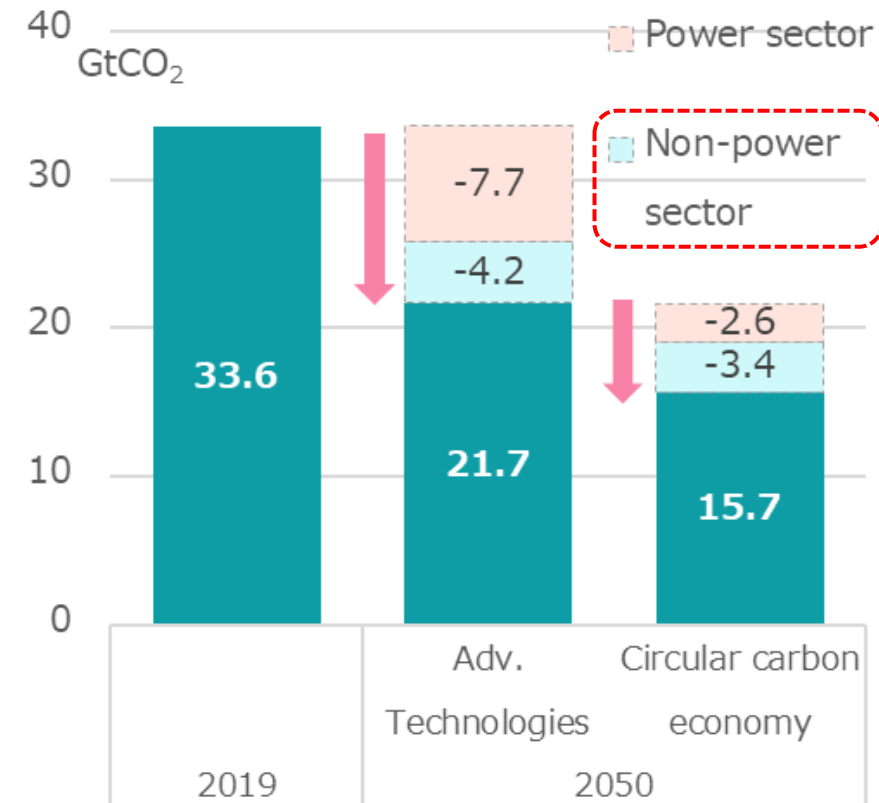


Reduce CO₂ emissions without reducing fossil fuels

❖ Primary energy demand

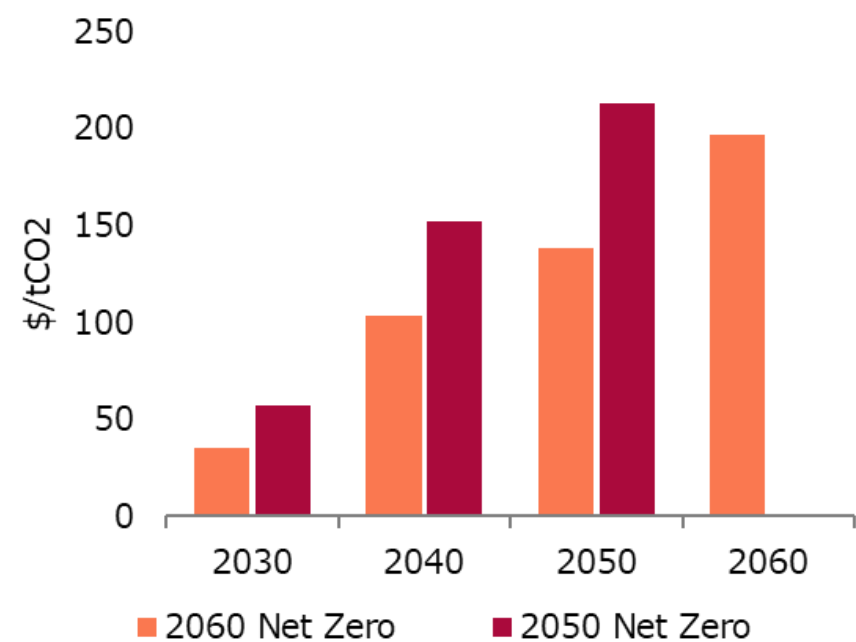


❖ Energy-related CO₂ emissions



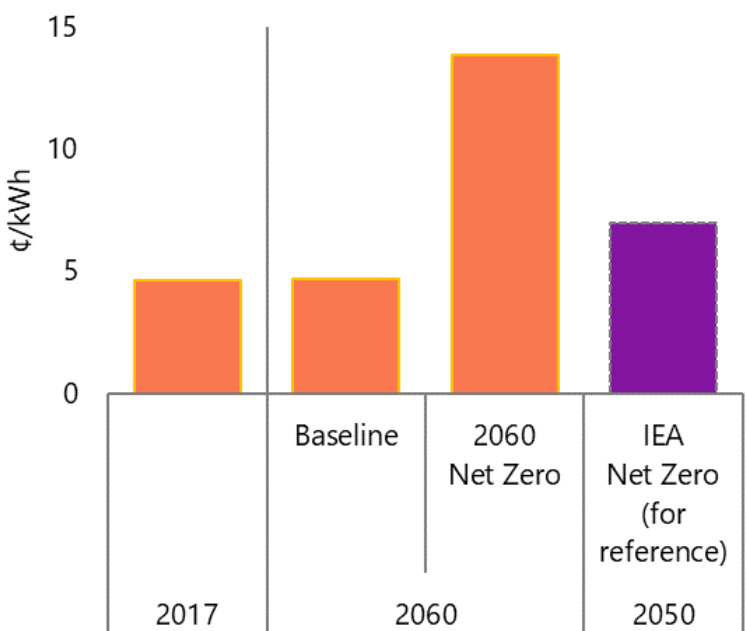
Economic burden for the developing world (in the case of ASEAN)

❖ Average CO₂ reduction cost in ASEAN



Source : IEEJ; IEA

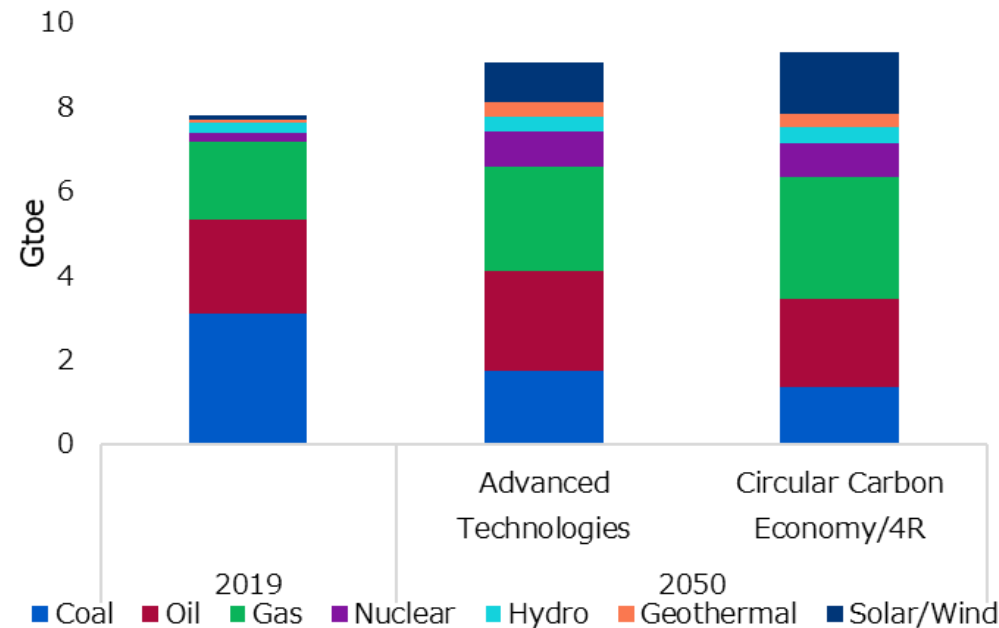
❖ Electricity price in ASEAN



Note : Figure of IEA Net Zero is based on the estimated increased rate of electricity price in the world (+50%)
Source: IEEJ; IEA

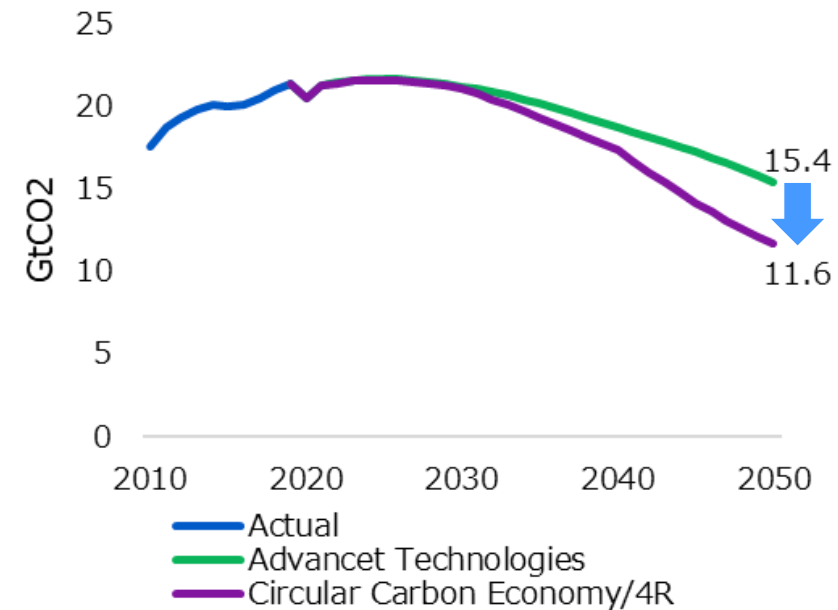
Use of decarbonized fossil fuels in the developing world

❖ Primary energy supply of developing countries



Source: IEEJ

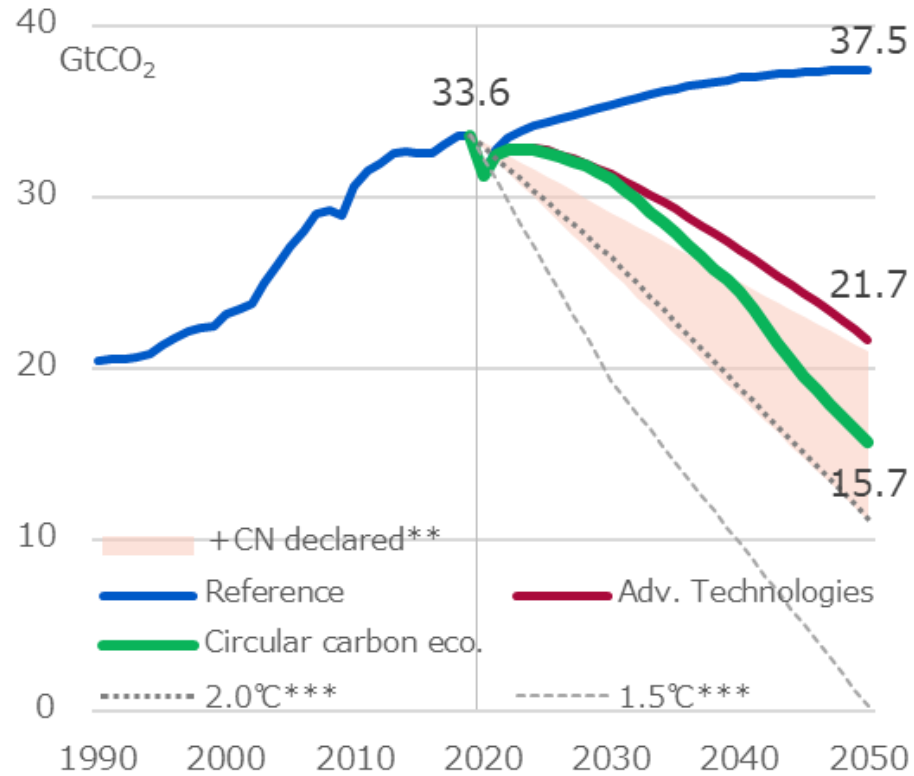
❖ CO₂ emissions of developing countries



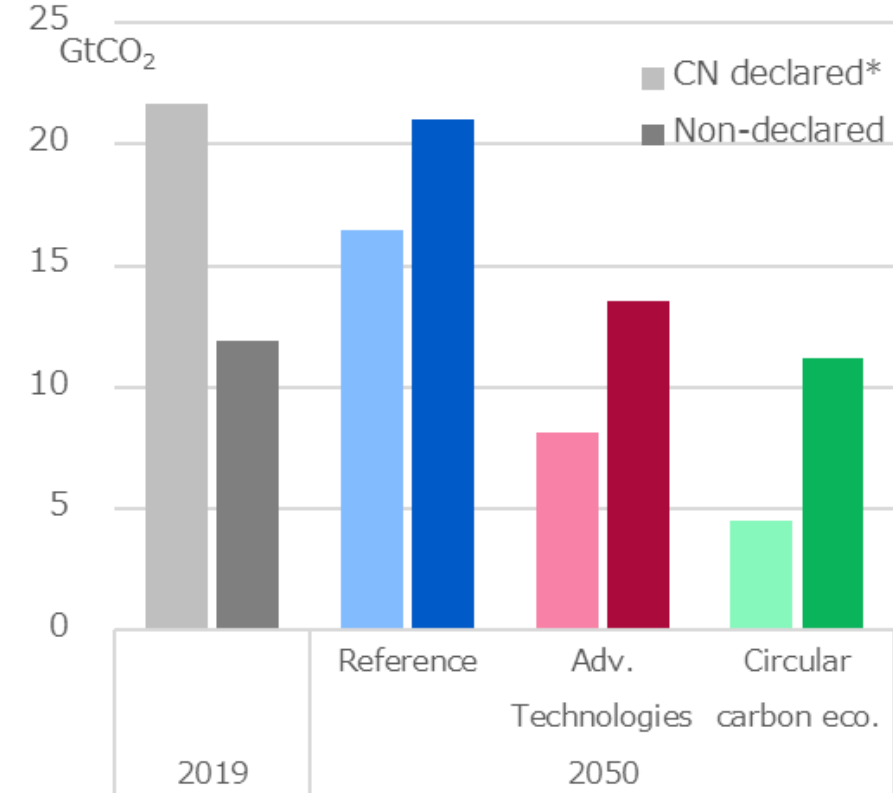
Source: IEEJ

There remain many challenges for CN in the world

❖ Global energy-related CO₂ emissions



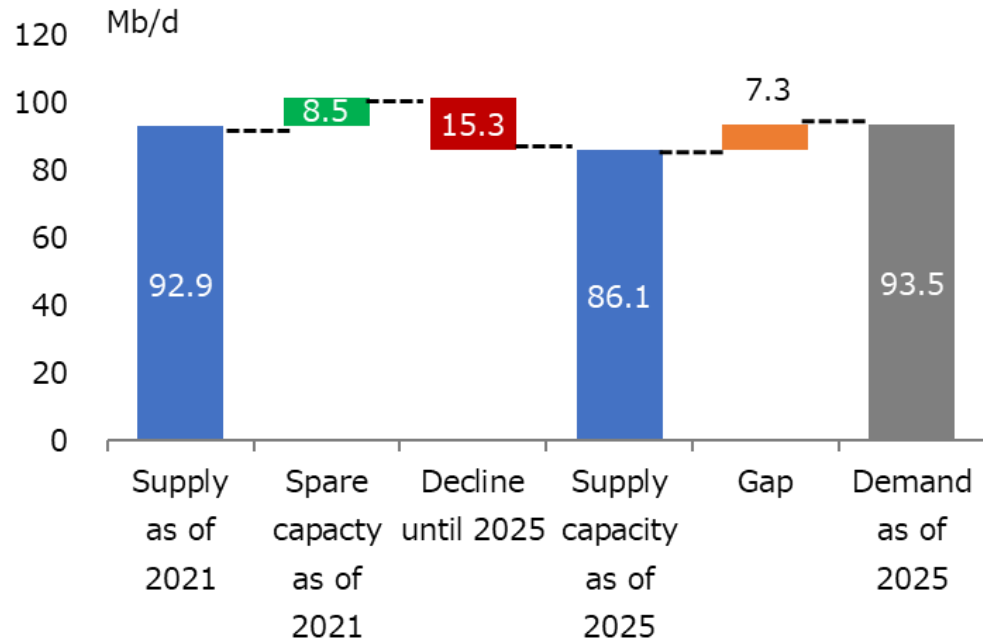
❖ CO₂ emissions by region



* United States, Brazil, South Korea, Poland, China and Climate Ambitions Alliance (121 countries). ** When the CN-stated countries achieve zero emissions in 2050 based on the emissions in the REF / CCE scenarios (For China, that announced 2060 CN, the emissions as of 2050 by linear interpolation between today and 2060). *** Average paths referred to the IPCC "Global Warming of 1.5°C".

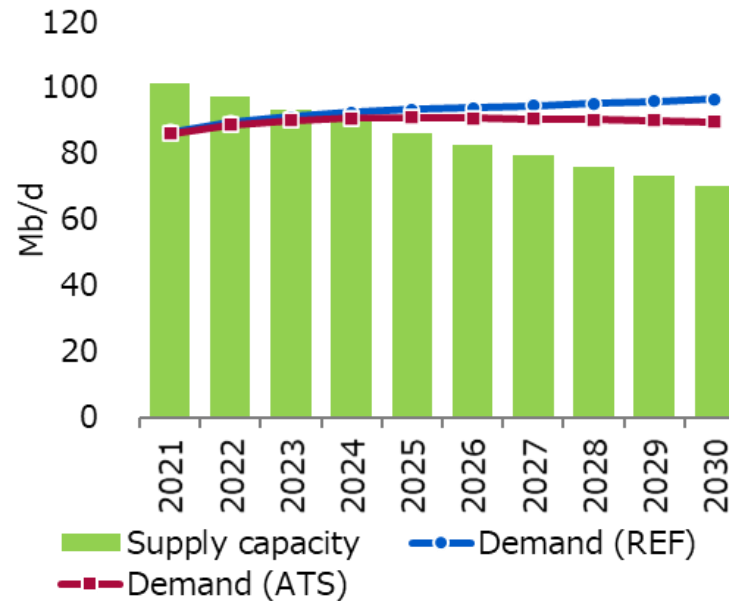
What if investments in oil markets stop?

World oil demand and supply capacity as of 2025 if investment stops



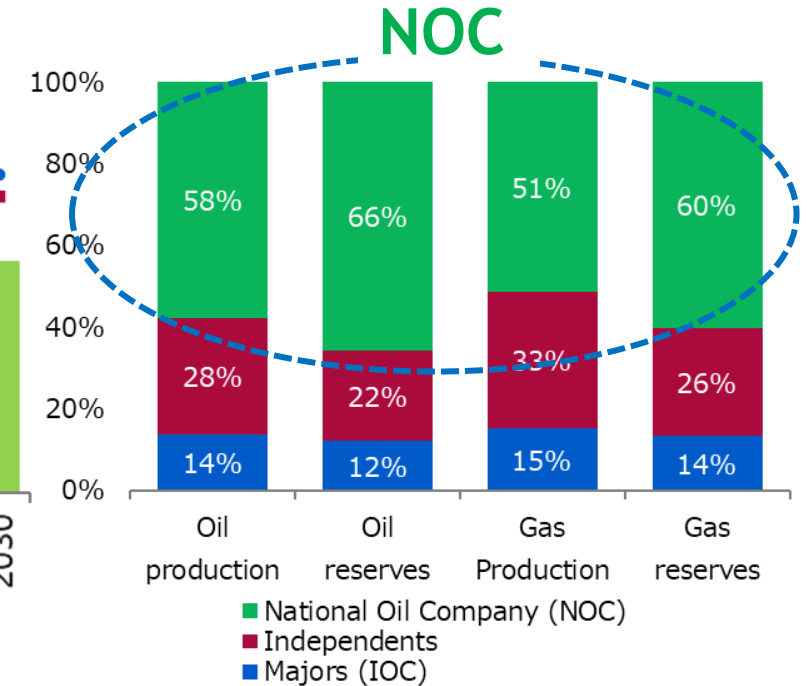
Note: Bio fuels are excluded. Supply capacity is assumed to decline by 4% annually.
Source : IEA; IEEJ estimate

World oil demand and supply capacity if investment stops



Note: Demand excludes bio fuels.
Sources: IEA, IEEJ estimates

Share of IOC and NOC in the world oil and gas supply in 2018



Source: IEA, Oil and Gas Industry in Energy Transitions

Summary

- CO₂ emissions would increase **in countries that have not expressed carbon neutrality (CN)**, such as India, ASEAN, Africa, and others.
- Electricity demand will increase. The **stability and security of electricity supply must be improved.**
- CO₂ reduction in the power generation sector is likely to proceed, but emission reductions in the non-power generation sectors will not progress much. **Decarbonization in the non-power generation sector is key to achieve CN.**
- In order to decarbonize the non-power generation sector, **clean hydrogen/ammonia and synthetic methane/fuels using these materials will be required.**
- Even with a shift from fossil fuel trade **to hydrogen/ammonia trade**, the importance of **trade relations between Asia and the Middle East remains unchanged.**
- In order to achieve a world-wide CN, it is important **to promote and share decarbonization technologies under international cooperation.**

A light beige world map is centered in the background of the slide, showing the outlines of continents and major landmasses.

Thank you
for your attention!

Questions?

For IEEJ Outlook2022, visit our website:

<https://eneken.ieej.or.jp/en/whatsnew/439.html>

PANEL DISCUSSION

INTRODUCTION BY JUNKO OGAWA

- **Prof. Jun Arima**

Professor, University of Tokyo

Senior Policy Fellow for Energy and Environment

The Economic Research Institute for ASEAN and East Asia (ERIA)

- **Dr. Neil D'Souza**

Principal Consultant, Argus Media

- **Mr. Suwanto**

Power, Fossil Fuel, Alternative Energy and Storage (PFS) Officer

ASEAN Centre for Energy (ACE)

- **Mr. Matthew Yeo**

Managing Director

Resources, Energy Transition Lead, Southeast Asia, Accenture

Potential Questions to the Panel

- What challenges are common between ASEAN and Japan in energy transition?
- What is the biggest challenge for ASEAN or any member country of ASEAN in energy transition?
- What do you think is the most needed to address these challenges?
- How do you define a well managed “transition” for ASEAN?
- How ASEAN and Japan collaborate in achieving Net Zero?