UTokyo
Green
Transformation

Climate Change - People's Responses

University-wide Sustainability (GX) Literacy Education

Graduate School of Frontier Sciences
Sustainable Society Design Center

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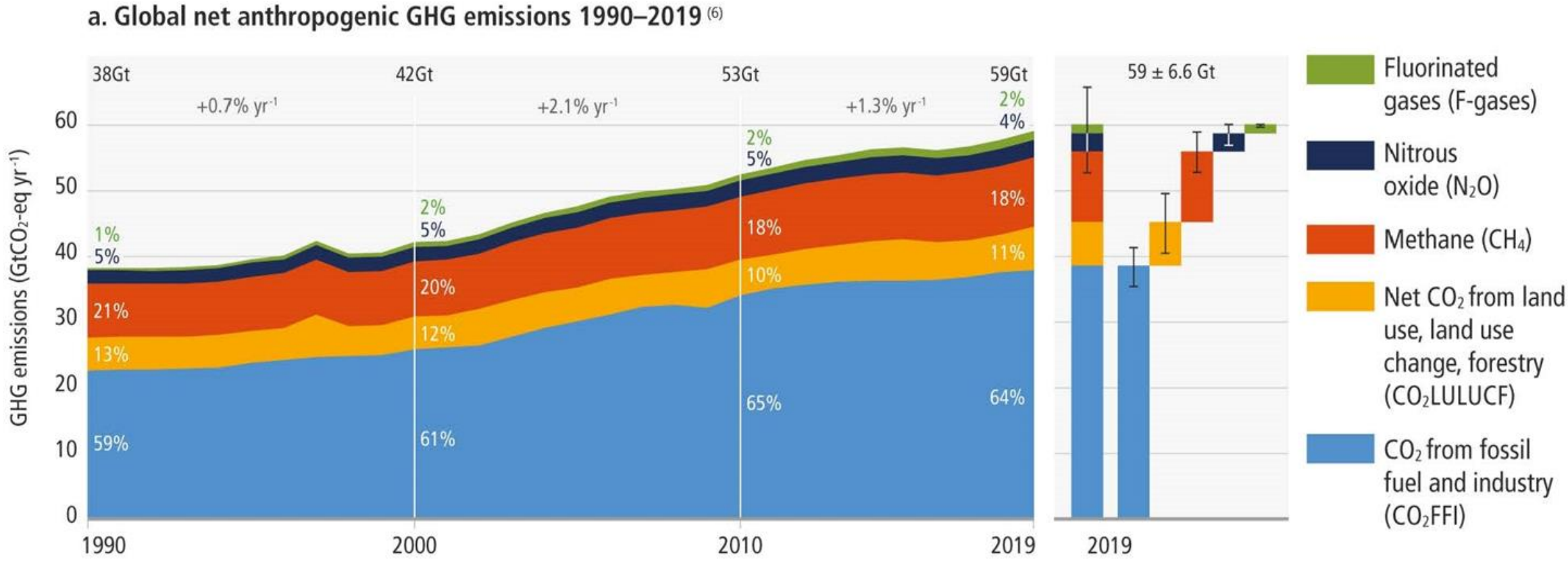
Three Responses to Global Warming/Climate Change

Mitigation	Adaptation	Loss and Damage
Measures taken to reduce greenhouse gas emissions with the aim of limiting further global warming in the future. Such measures include "decarbonization," "carbon neutrality," "emissions reduction," and "global warming countermeasures."	Measures that can be taken to minimize damage from the climate change effects of warming that have already occurred. Such as withdrawing from flood-prone areas, cultivating varieties better suited to warmer climates, etc.	Assistance to people and countries affected by climate change that has already occurred and that adaptation measures have not been able to prevent. Insurance schemes, funds to support developing countries, etc.

To reduce emissions to zero, we need to understand which type of gas is coming from where

Global net anthropogenic emissions have continued to rise across all major groups of greenhouse gases.



1992
United Nations Framework Convention on Climate Change

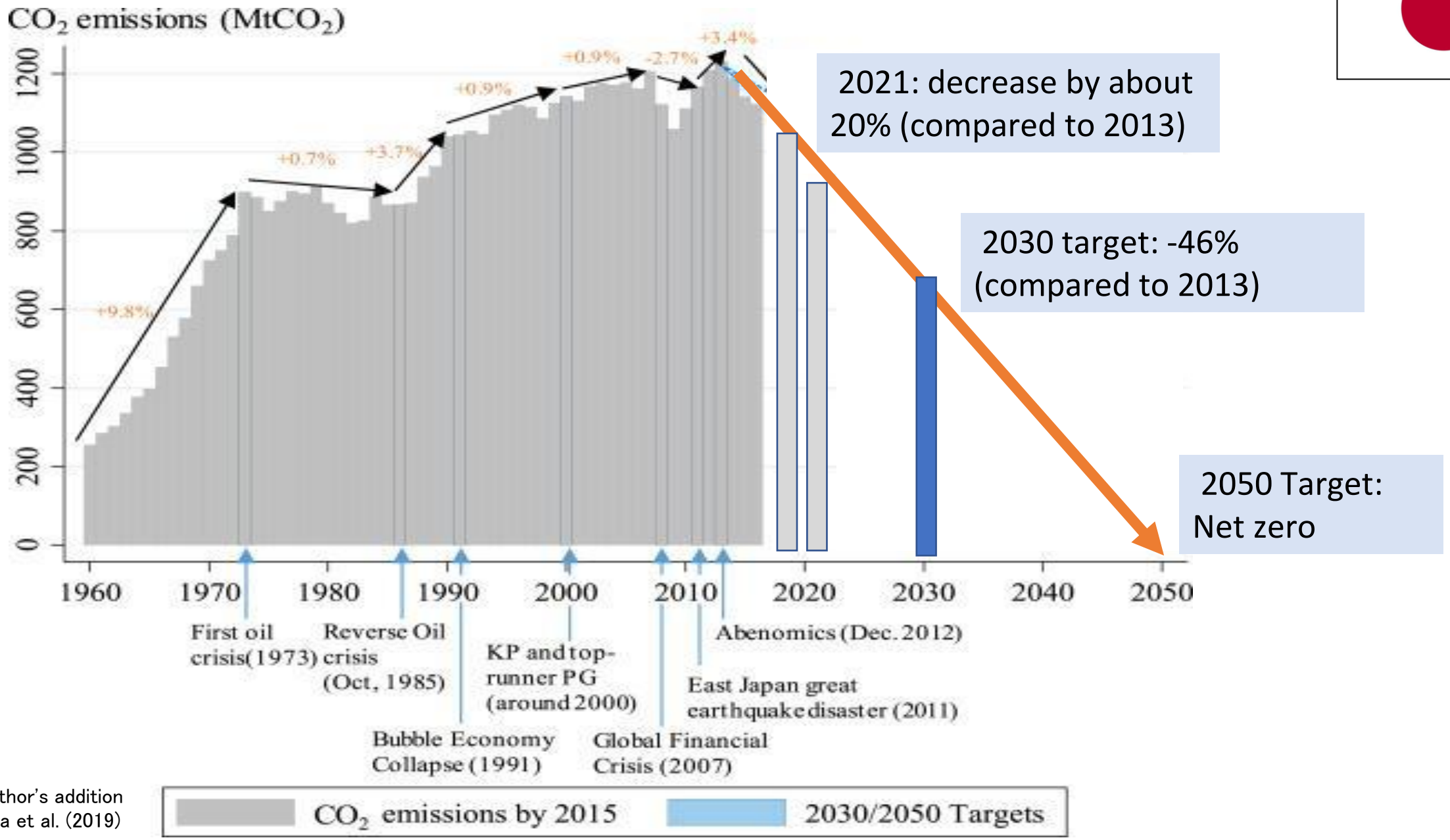
1997
Kyoto Protocol

2015
Paris Agreement

COP: Conference of the Parties to the United Nations Framework Convention on Climate Change, held annually, where important decisions are made

Source: IPCC (2023) with author's additions.

Japan



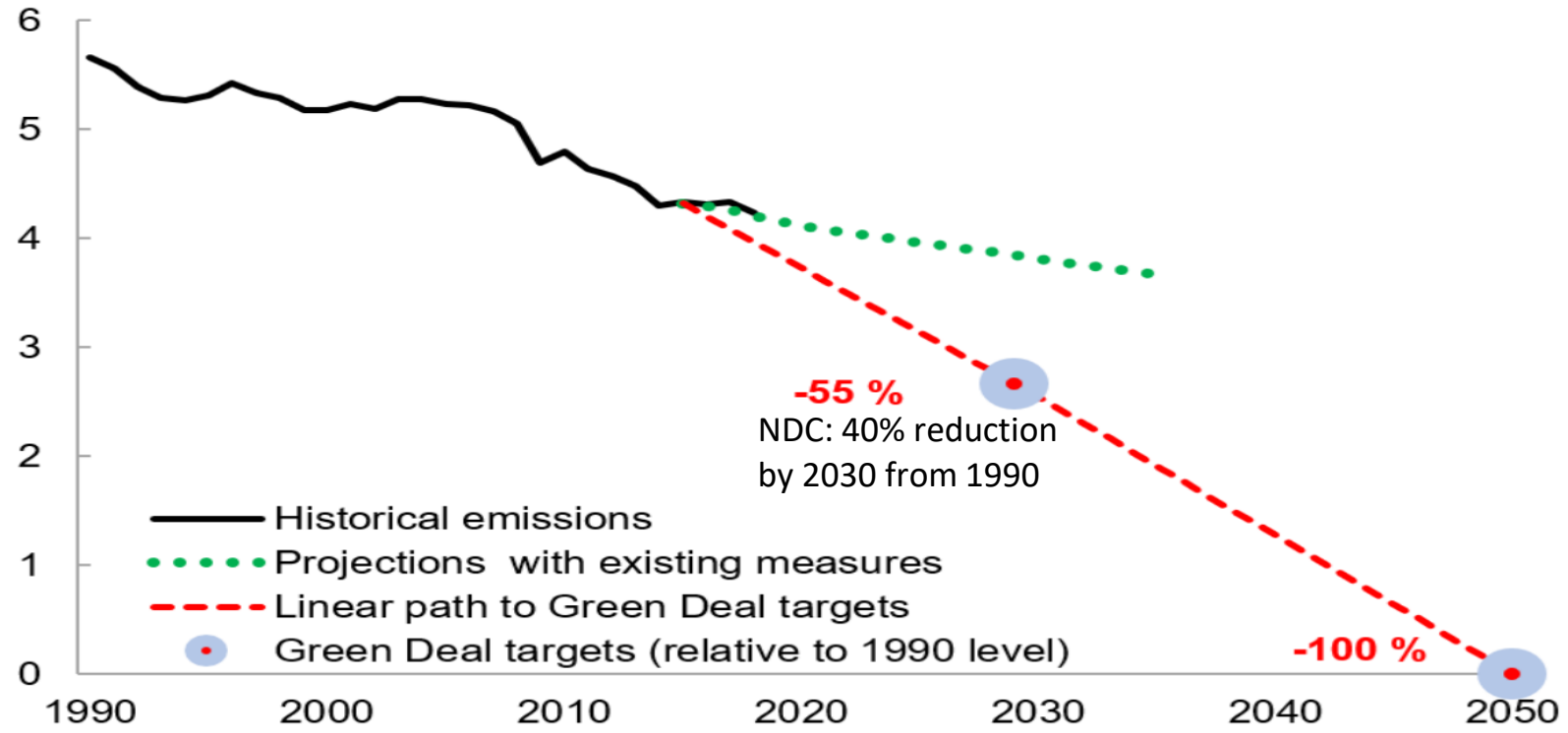
Source: author's addition to Kuriyama et al. (2019)

Europe Union (EU)

New EU targets

The European Union proposes an ambitious reduction of emissions.

(millions of kilotons of CO_2 equivalents)



Sources: United Nations Framework Convention on Climate Change; and European Environment Agency.

Source: IMF.(2022)

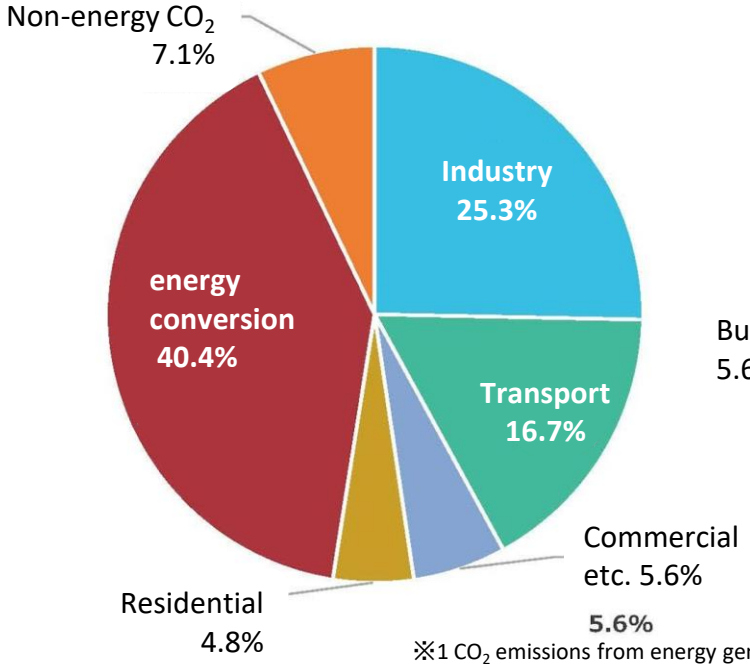
INTERNATIONAL MONETARY FUND

Breakdown of emissions in Japan

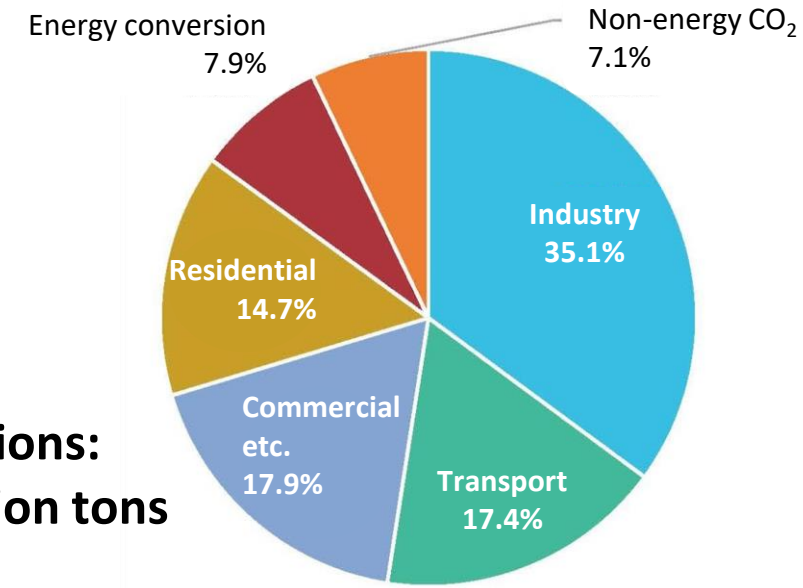
CO_2 emissions by sector

- In terms of CO_2 emissions in FY2021 before electricity and heat allocation※1, emissions from the energy conversion sector (40.4%) were the largest, followed by the industrial sector (25.3%) and the transportation sector (16.7%).
- In terms of CO_2 emissions in FY2021 after allocation of electricity and heat ※2, emissions from the industrial sector (35.15%) were the largest, followed by the commercial and other sector (17.9%) and the transportation sector (17.4%).

【before electricity and heat allocation】



【after allocation of electricity and heat】



CO_2 emissions:
1,064 million tons

※1 CO_2 emissions from energy generation associated with electricity and heat generation are allocated to producer sectors as emissions from electricity and heat producers.
※2 CO_2 emissions from energy generation associated with electricity and heat generation allocated to consumer sectors based on the amount of electricity and heat consumed.

Source: Ministry of the Environment (2023)

How to reduce carbon dioxide 1. Energy decarbonization

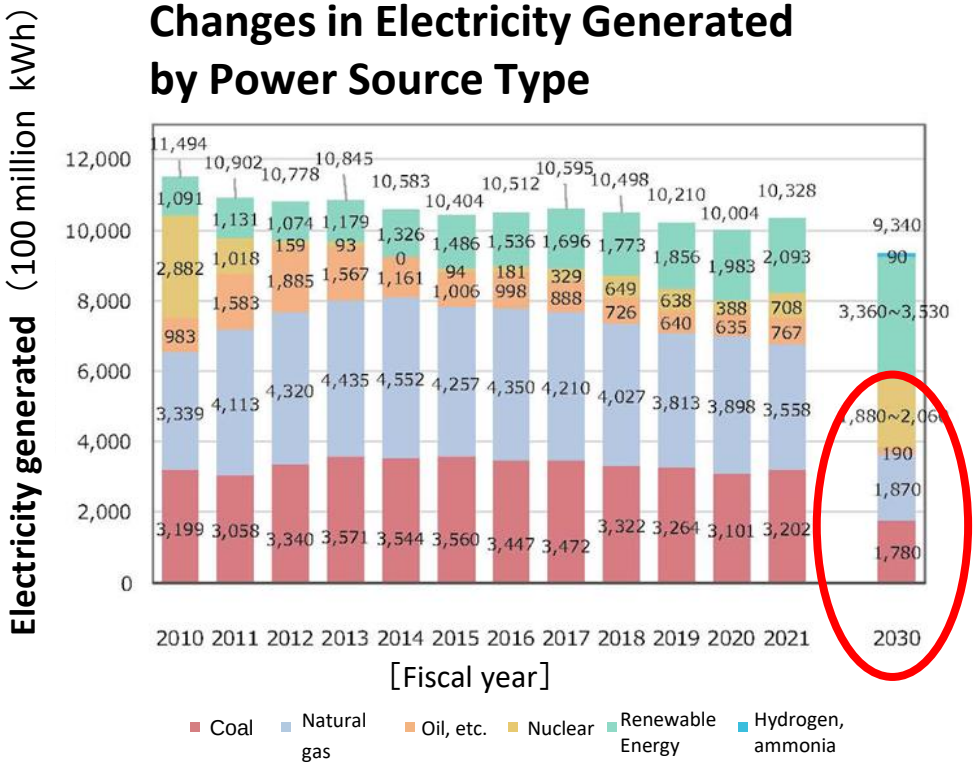
1. Decarbonize electricity

2. Switch from coal (industry), gasoline (transportation), kerosene (home heating), etc., to electricity.

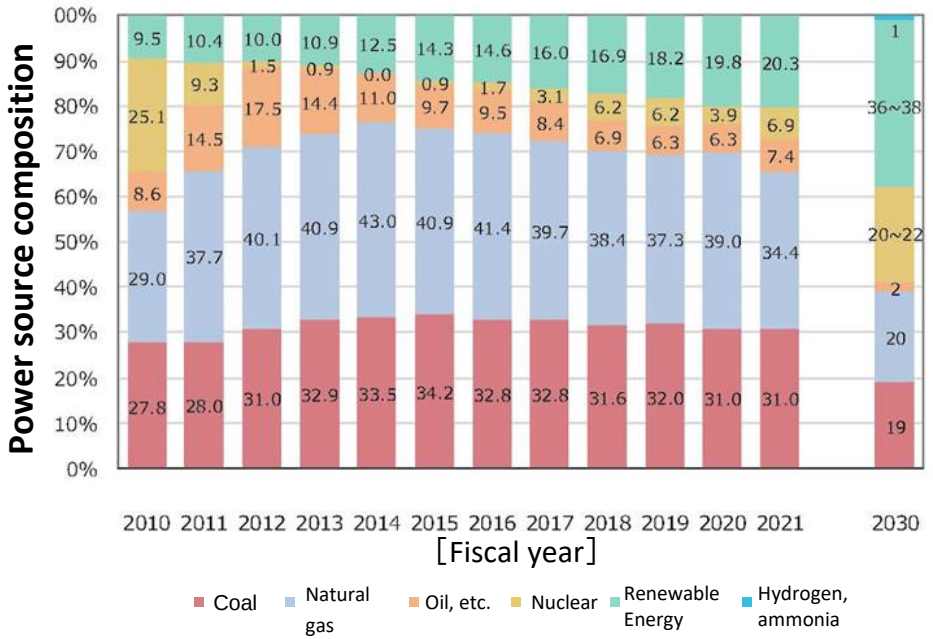
(For reference) Changes in Power Generation Mix in Comprehensive Energy Statistics

The share of renewable energies (including hydropower) in the power generation mix in FY2021 is 20.3%, up 0.4 percentage points from the previous year. The share of renewable energies (including hydroelectric power) in the power source composition in FY2021 is 20.3%, up 0.4 percentage points from the previous year. Nuclear power accounted for 6.9%, up 3.0 points from the previous year. Thermal power (excluding biomass) was 72.9%, down 3.4 points from the previous year.

Changes in Electricity Generated by Power Source Type



Trends in Power Source Composition



Source: Prepared based on actual energy supply and demand data and the outlook for energy supply and demand in FY2030 (related data) (Agency for Natural Resources and Energy)

The above figures cover all power generation facilities in Japan, including commercial and private power generation facilities.

Source: Ministry of the Environment (2023)

2. Do not waste energy and things

1. When there is a surplus of solar or wind power (surplus electricity), it can be stored and used for hydrogen production.

2. Energy conservation. Improved energy efficiency.

3. Creating a town that is convenient without the use of automobiles

3. Absorption by afforestation, etc.

1. Use timber to plant trees on vacant lots.

2. Other technologies such as carbon capture and sequestration (CCS), in which carbon dioxide is directly adsorbed and injected into the ground, are also being developed.

Emissions will not decrease on their own!

We know what we need to do to reduce emissions. But they are not decreasing. Why?

Technology does not just come into being on its own. It is essential to have consumers who are willing to buy the technology if it is available and people who insist that it is necessary. Technological innovation can only be promoted with the support of society.

Almost every academic discipline in the world is conducting research on climate change. It is important to have a dialogue between different disciplines rather than categorizing them as "science" or “social sciences / humanities."

Engineering (energy engineering, systems engineering, urban engineering, etc.)

New technology development - e.g.

- More efficient and versatile renewable energy generation

  Examples: solar (perovskite), wind (offshore), etc.
- Storage, transmission, and demand-side measures to match supply with demand
- Hydrogen production from clean energy sources and practical application of hydrogen
- Steelmaking in electric arc furnaces, cement production that captures carbon dioxide, etc.
- DX (digital use) improving energy use efficiency.
- Thermally efficient buildings, urban planning that does not rely on car use

...etc. etc.

Forest Ecology, Agronomy

- Monitoring carbon dioxide emissions from deforestation
- Impact of large forest fires on greenhouse gas emissions
- Plantation technology adapted to the local climate
- Interrelationships between climate change and biodiversity
- Nitrous oxide and methane reduction methods from agriculture and dairy farming
- Forest conservation measures and carbon dioxide credit estimation methodology

...etc. etc.

Environmental law (national and international)

- The legal framework and legislative theory on emission reductions
- Interconnectedness of laws and regulations established for different purposes, such as global warming countermeasures, energy policy, industrial policy, etc.
- Climate litigation (rapidly increasing overseas in recent years)
- Effectiveness of international treaties such as the Paris Agreement
- Carbon tariffs and their relationship to the WTO (free trade)
- Climate refugees and human rights
- Voluntary initiatives and rulemaking by industrial sector

...etc. etc.

Environmental economics (public goods, externalities, finance)

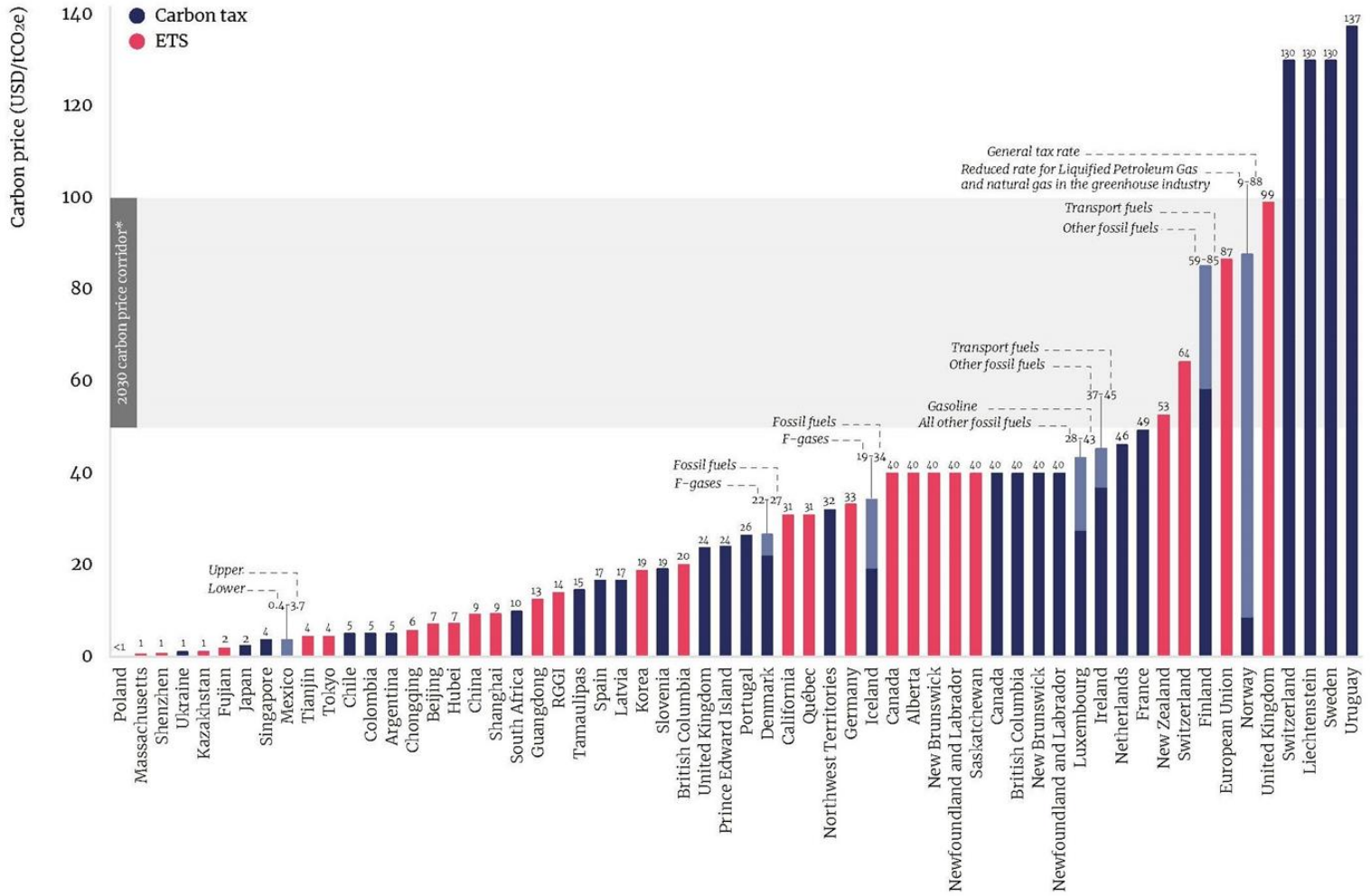
- Carbon pricing as a method of internalizing externalities
- Theory of carbon tax rates, and consideration of where tax revenues are to be returned.
- Emissions trading schemes and tariffs
- Diffusion of renewable energy and consumer preferences
- Inclusive wealth as an alternative to GDP
- Carbon footprint (e.g., CO_2 emissions from transportation of goods) and product pricing
- Net zero finance, sustainable finance and ESG investment
- Climate risk disclosures such as TCFD

...etc. etc.

Carbon pricing (carbon tax and emissions trading scheme)

FIGURE 6

Carbon prices as of April 1, 2022



Nominal prices on April 1, 2022 are shown for illustrative purpose only. Prices are not necessarily comparable between CPIs because of (for example) differences in the sectors covered and allocation methods applied, specific exemptions, and compensation methods.

*The 2030 carbon price corridor is based on the recommendations in the report of the High-Level Commission on Carbon Prices.

**Several jurisdictions apply different carbon tax rates to different sectors or fuels. In these cases, we have indicated the range of tax rates applied, with the dark blue shading showing the lower rate and the combined dark blue and light blue shading representing the higher rate.

Source: World Bank (2023)

Environmental sociology and environmental ethics (people's perceptions, behavior, community)

- International comparison of climate change awareness surveys
- Gap analysis between awareness and behavior change
- Deliberation such as climate citizen assemblies
- Media and information gap due to different languages
- The ability of the younger generation (Generation Z) to accept the situation as their own.
- Relationship with intergenerational and intra-generational ethics, loss and damage, etc.

...etc. etc.

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Everyone,
take part in the first step to change society!