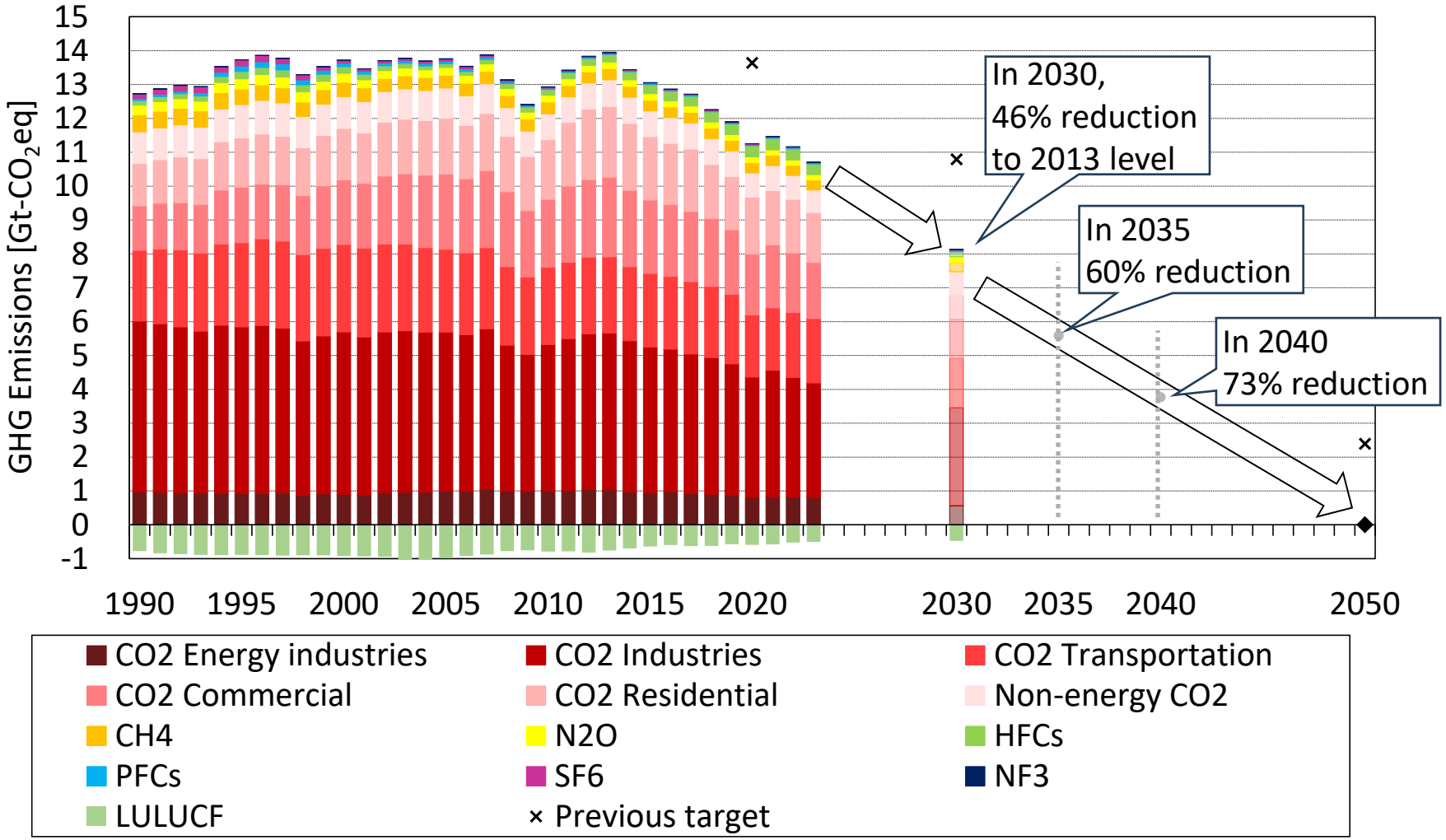
Introduction of Session 6
Roadmap toward Net-Zero GHG Emissions in Japan

Toshihiko MASUI
National Institute for Environmental Studies

The 31st AIM International Workshop
Ohyama Memorial Hall, NIES
July 23, 2025

Past GHG emissions and NDC in Japan



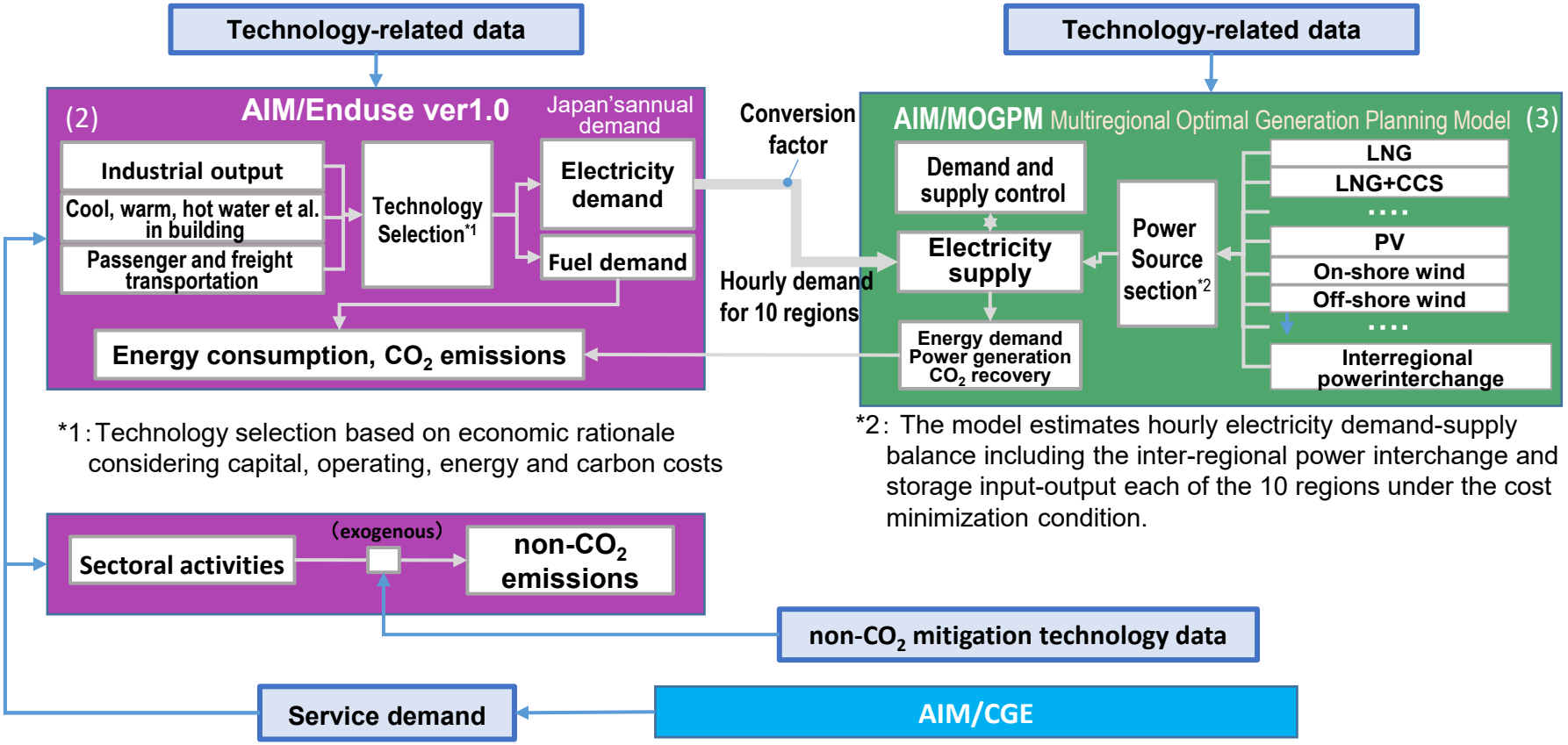
Source:

Historical data: Greenhouse Gas Inventory Office of Japan, Japan's National Greenhouse Gas Emissions
(Data for 2023 are tentative.)

Target: Japan's Nationally Determined Contribution (NDC) and Long-Term Strategy under the Paris Agreement

In order to assess net-zero GHG roadmap of Japan, AIM/CGE, AIM/Enduse and AIM/MOGPM were used.

- An applied general equilibrium model is used to establish a macro-frame for the future, given the economic growth rate and population assumptions (1). Next, future energy demand is estimated using an energy demand model (2). The annual electricity demand estimated in (2) is expanded to hourly demand by region, and the generation facility configuration and supply configuration are estimated using a cost-optimized power supply model that can take into account coincidence constraints and inter-regional interconnection line constraints (3). The results are fed back into the energy demand model to calculate Japan's overall energy supply and demand and CO_2 emissions.



*1 : Technology selection based on economic rationale considering capital, operating, energy and carbon costs

*2 : The model estimates hourly electricity demand-supply balance including the inter-regional power interchange and storage input-output each of the 10 regions under the cost minimization condition.

Three basic scenarios in this analysis

- In this analysis, we assumed three scenarios and estimated emission pathways to 2050 for each: A) the "Decarbonization Technology Progress Scenario", which assumes that although efficiency improvements and renewable energy deployment will continue, the implementation of innovative technologies will not fully develop after 2030; B) In addition to A), "Innovative Technology Deployment Scenario," which assumes that large-scale deployment of innovative decarbonization technologies will progress after 2030; and C) In addition to B), a "Social Transformation Scenario," which incorporates reduced demand for goods and transportation due to social transformation.

A) "Decarbonization Technology Progress Scenario" (Technology Progress)

Energy efficiency and renewable energy technologies are deployed as planned until 2030, and continue to deploy at the same rate after 2030. On the other hand, innovative decarbonization technologies that are expected to be deployed at an accelerated pace and on a large scale after 2030 are assumed to be deployed at a slower pace.

<GHG net-zero scenario>

B) "Innovative Technology Deployment Scenario" (Innovative Technology)

A scenario in which innovative decarbonization technologies that are expected to be deployed at an accelerated pace and on a large scale after 2030 are fully deployed, and net zero GHG emissions are achieved in 2050.

C) "Social Transformation Scenario" (Social Transformation)

In addition to B, this scenario incorporates a reduction in demand for goods and transportation while maintaining or improving people's utility, etc., as a result of social transformation, such as the development of digitalization and the circular economy. Net zero GHG emissions in 2050.

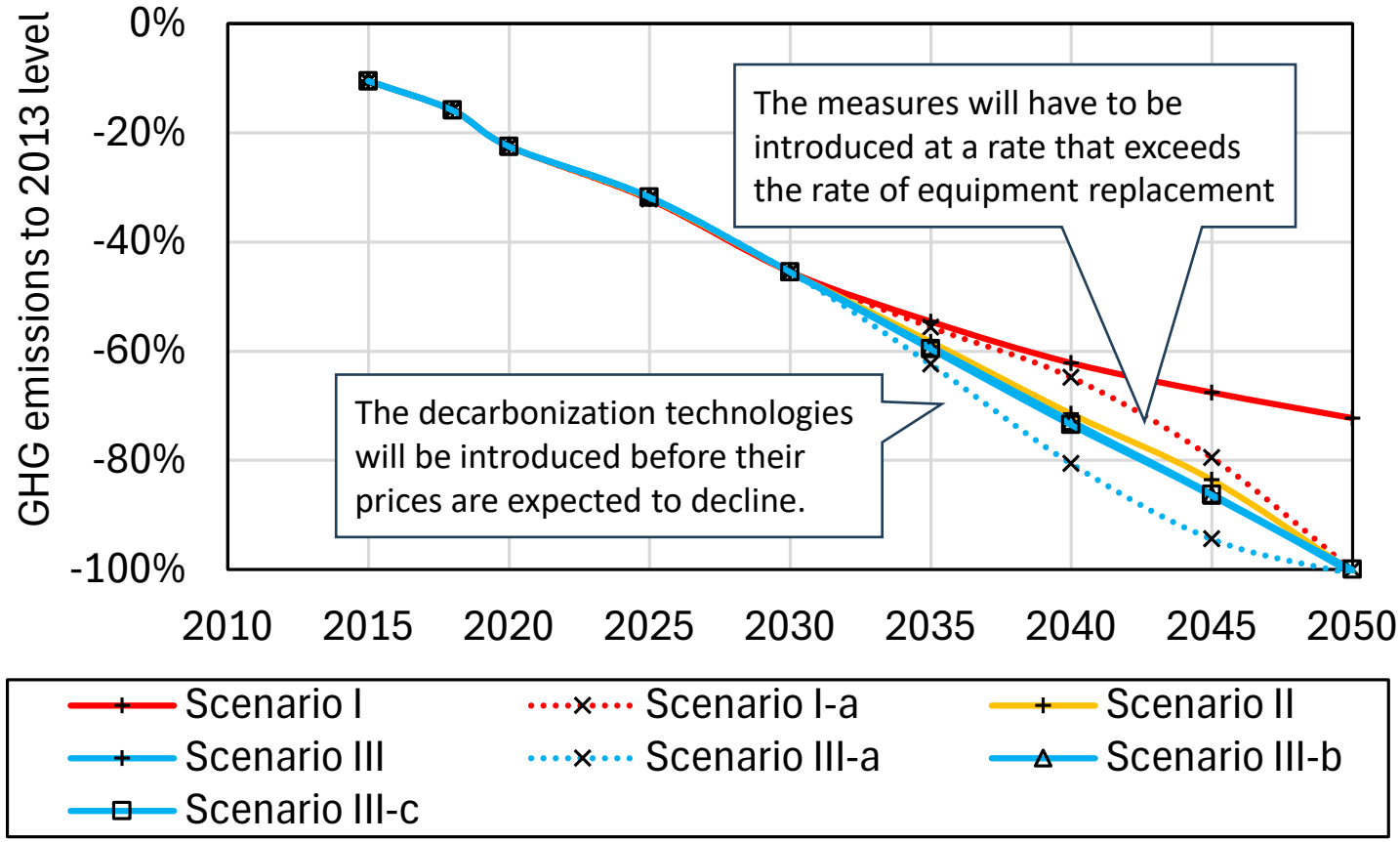
Innovative decarbonization technologies for large-scale deployment beyond 2030

- Expanded use of synfuels (hydrogen, synthetic fuels, ammonia) and biofuels
- Further deployment of PV and offshore wind power
- Further electrification of freight vehicles
- Further proliferation of HP equipment
- CCUS implementation in power generation and industry
- Negative emission technologies

Assumed social transformation

- Efficient use of materials: Sharing, long life, recycling, resource-saving design, etc.
- Reduction of business and commuting travel: ICT to substitute for travel demand, etc.
- Reduction of freight transportation: Efficient use of materials to reduce freight transportation, etc.

Assessment of GHG Emission pathways using AIM



AIM Team also assessed energy demand, power supply by technology, additional investment costs, and energy self-sufficiency to achieve the above pathways.

Session 6

Emissions Scenario Analysis for Consideration of Japan's Reduction Target using the AIM Model

Mr. Go Hibino (NIES)

Power Supply and Demand for Decarbonized Society

Dr. Shuichi Ashina (NIES)

Analysis of Regional GHG Reductions Consistent with Japan's GHG Reduction Targets

Dr. Yuko Kanamori and Dr. Kei Gomi (NIES)

Discussion of National Analyses based on AIM Including Discussion of the Next 5-Year Plan of NIES (carbon neutral, circular economy and nature positive)

- ✓ Analysis on Japan is only one example. From the Asian perspectives, what is needed?
- ✓ Communication to stakeholders