Previous GHG mitigation options in Japan and discussion toward 2 degree C target

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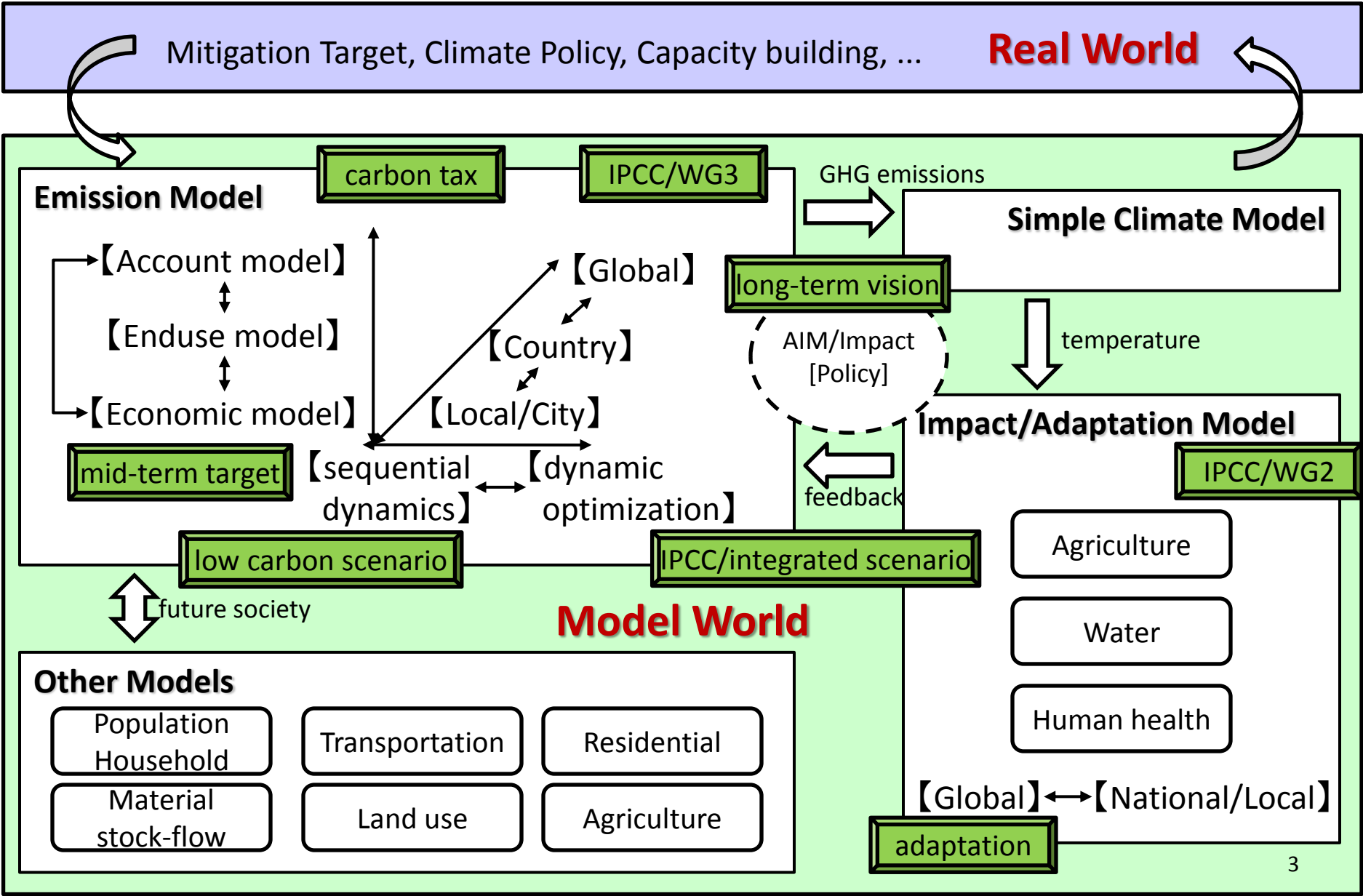
Asia-Pacific Integrated Model (AIM)

Asia-Pacific Integrated Model (AIM) is an integrated assessment model to assess mitigation options to reduce GHG emissions and impact/adaptation to avoid severe climate change damages.
The various types of models have been developed since 1990, and nowadays the research field is extended to sustainable development with Asian researchers.
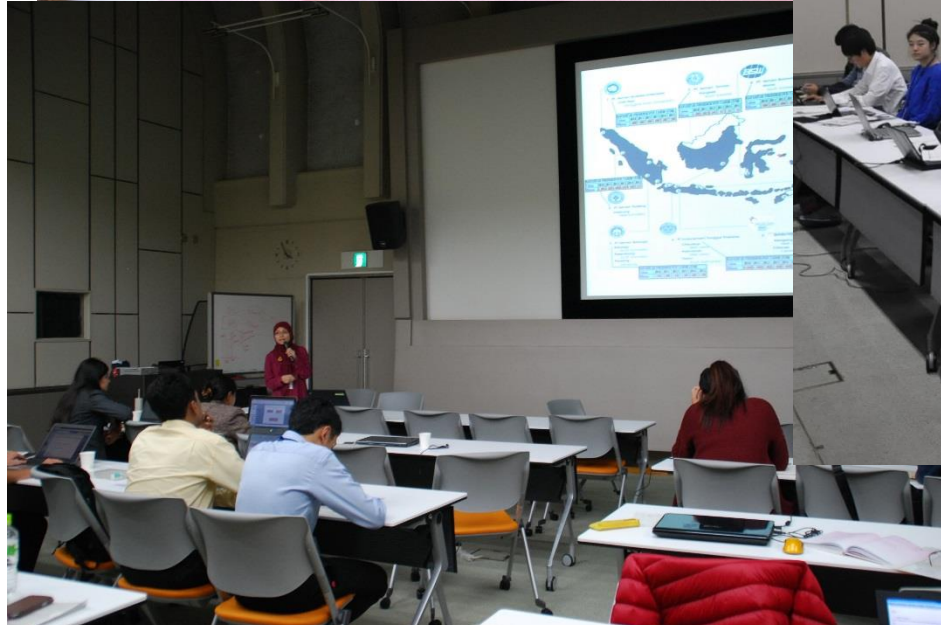http://www-iam.nies.go.jp/aim/

Contents of Present AIM

Mitigation Target, Climate Policy, Capacity building, ...   **Real World**

Emission Model

carbon tax   IPCC/WG3   GHG emissions

【Account model】   【Global】
【Enduse model】   【Country】   long-term vision
【Economic model】   【Local/City】   AIM/Impact [Policy]

Simple Climate Model

temperature

mid-term target   【sequential dynamics】   【dynamic optimization】

Impact/Adaptation Model

feedback   IPCC/WG2

low carbon scenario   IPCC/integrated scenario   Agriculture

future society   **Model World**   Water

Other Models   Human health

| Population Household | Transportation | Residential |
| Material stock-flow | Land use | Agriculture |

【Global】↔【National/Local】

adaptation

3

Capacity building related to AIM
Training Workshop at NIES, Oct 27-Nov 7, 2014

Brief history of climate policy in Japan and AIM (1)

- 1997; Toward UNFCCC COP3, Japan technology model (AIM/Enduse) model was used to assess the mitigation target in Japan.
  - GHG mitigation target in Japan: -6% compared to 1990 level
- 2008-2009; Based on three types of models (global technology model, Japan technology model and Japan economy model), options of Japan's middle-term target (2020 target) on GHG reduction were calculated at the Cabinet Office.
  - Role of model was to provide 6 options as GHG mitigation target. (Final decision was done by policymakers.)
  - GHG mitigation target in Japan: -15% compared to 2005 level (-7% to 1990 level)
- 2009-2011; By using Japan technology model and Japan economy model, the possibility of "**25% reduction in 2020 compared to 1990 level**" was assessed at the Central Environment Council.
  - Role of model was to show how to achieve the -25% target.
 - http://funtoshare.env.go.jp/roadmap/index_en.html

Brief history of climate policy in Japan and AIM (2)

➢Great East Japan Earthquake and Fukushima Dai-ichi Nuclear Power Plant Accident in 2011

- 2011-2012; By using Japan technology model and Japan economy model, mitigation target was revised to "5-9% reduction in 2020 compared to 1990 level" at the Energy and Environment Council.
  - Role of model was to show the GHG reduction based on various assumptions.
  - http://www.cas.go.jp/jp/seisaku/npu/policy09/sentakushi/english/index.html
- Present; The new mitigation target in 2020 was decided to be **"-3.8% compared to 2005 (+3.1% to 1990 level)"** on November 15, 2013.
  - Assumption: No nuclear power in 2020.
- By March 2015; Post-2020 GHG mitigation target (INDC: intended nationally determined contribution)?

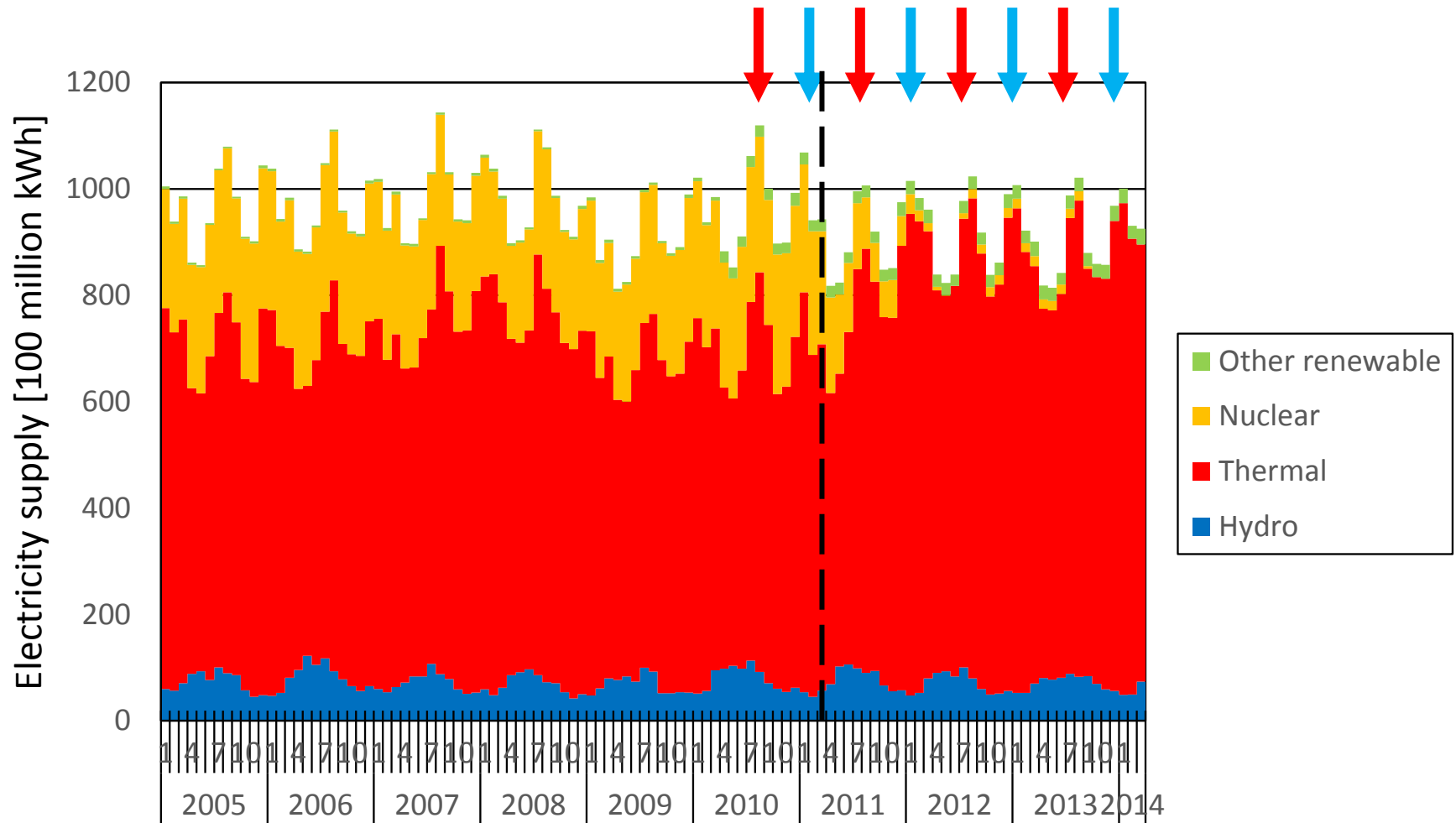# History of Japan's GHG mitigation target

GHG emissions in Japan

http://www-gio.nies.go.jp/index-j.html
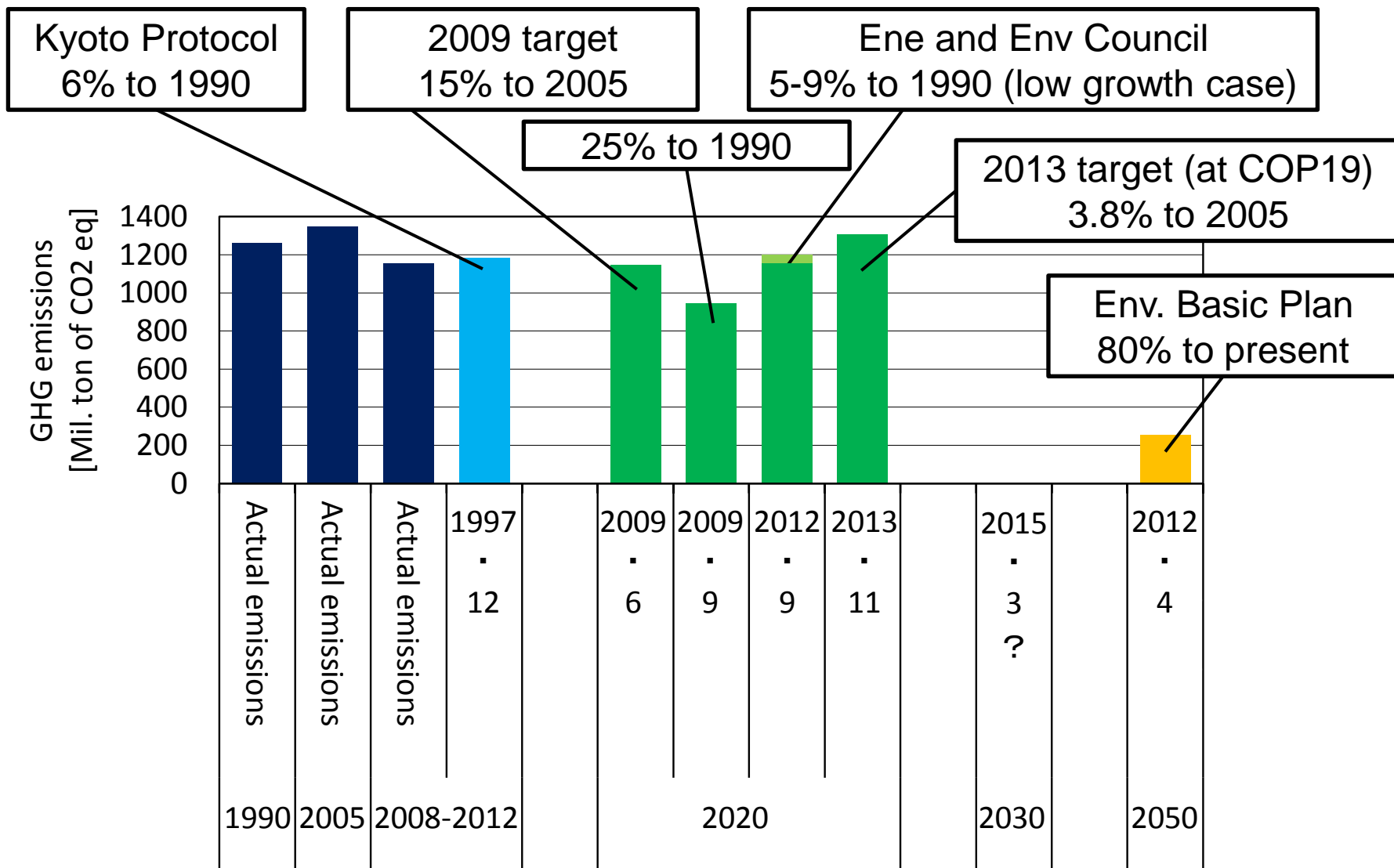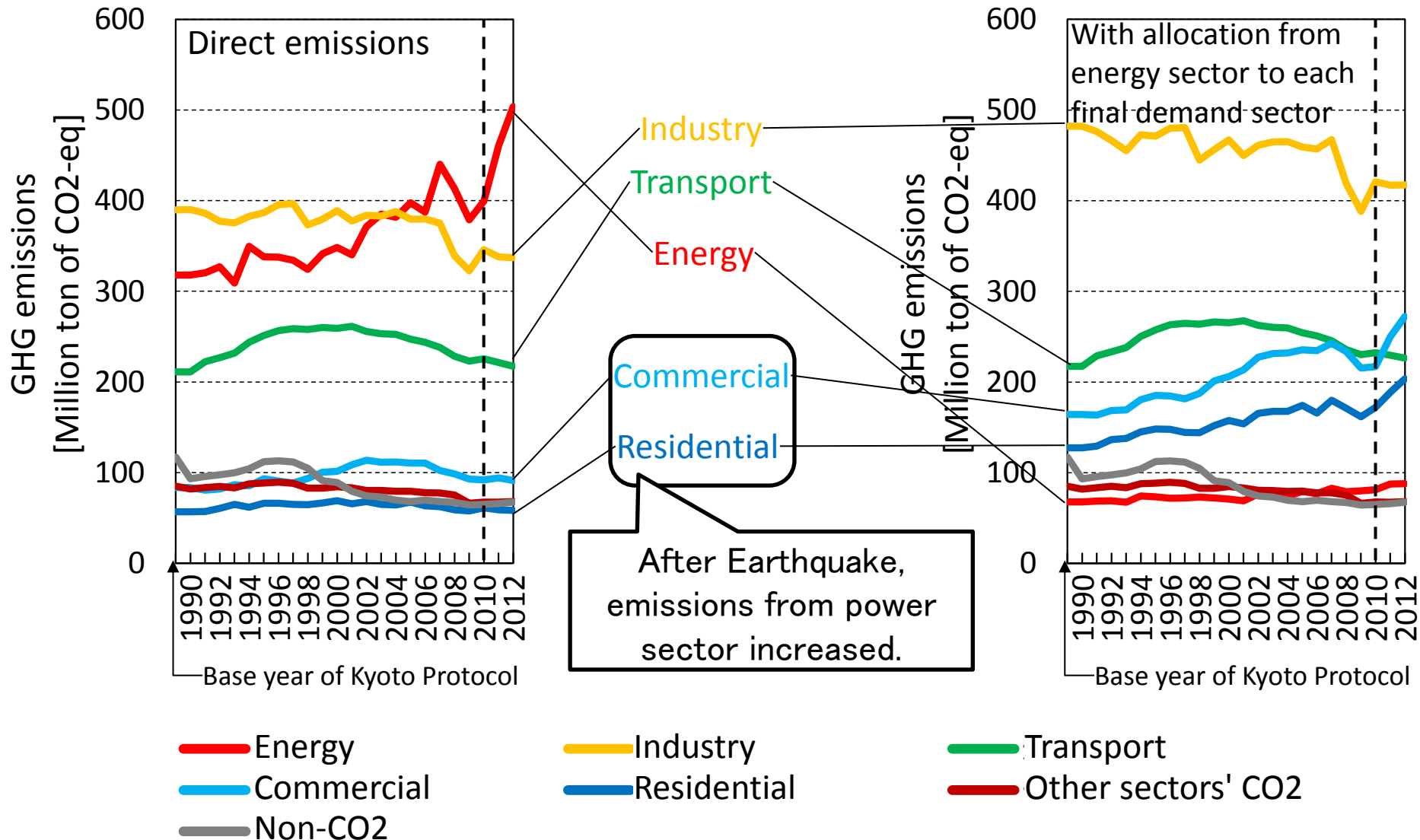
Monthly electricity supply before or after earthquake

After the earthquake, peaks of electricity supply in summer（↓）and winter（↓）were cut continuously compared with those before the earthquake because of the energy saving activities.

http://www.enecho.meti.go.jp/statistics/electric_power/ep002/

Features of AIM's approach to estimate GHG emission mitigation target in Japan

- Bottom-up approach: Enduse model
  - Based on a set of macro frame such as future population and GDP, energy demand, GHG reduction and related technology options are estimated. Calculation of technology selection and energy demand to minimize total annual cost (both initial capital cost and running cost).

- Top-down approach: Computable general equilibrium model
  - Based on the technology options, economic impact of mitigation policy is assessed. Calculation of economic activity to maximize household welfare and industry profits.

◆ Actually, at the policy discussion, only the flame works of the Enduse model is used, because some countermeasures are not selected from cost minimization viewpoint.
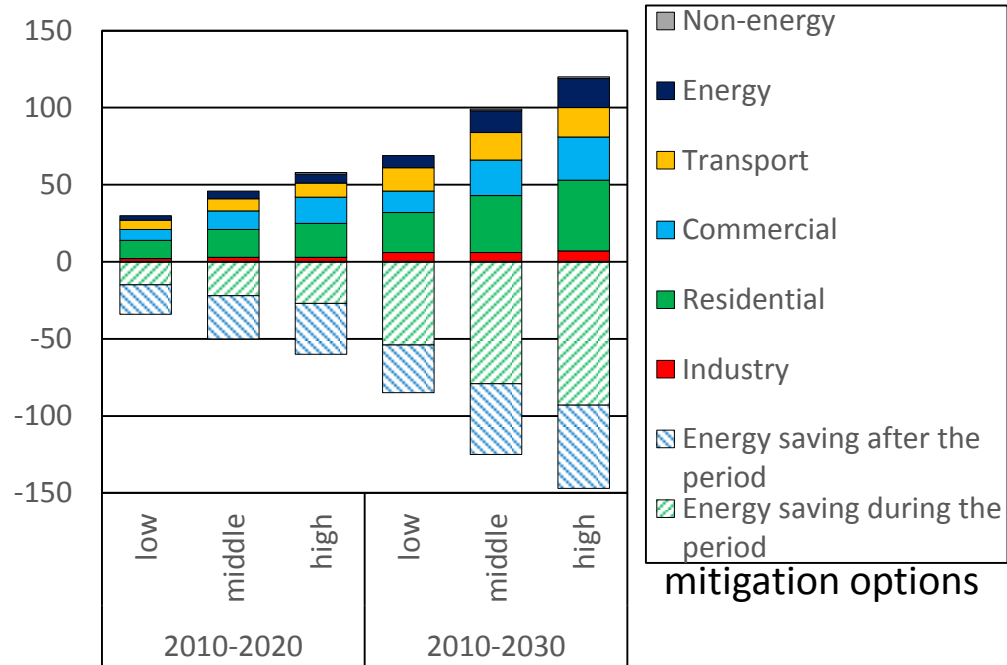
Results of AIM/Enduse as of June 2012
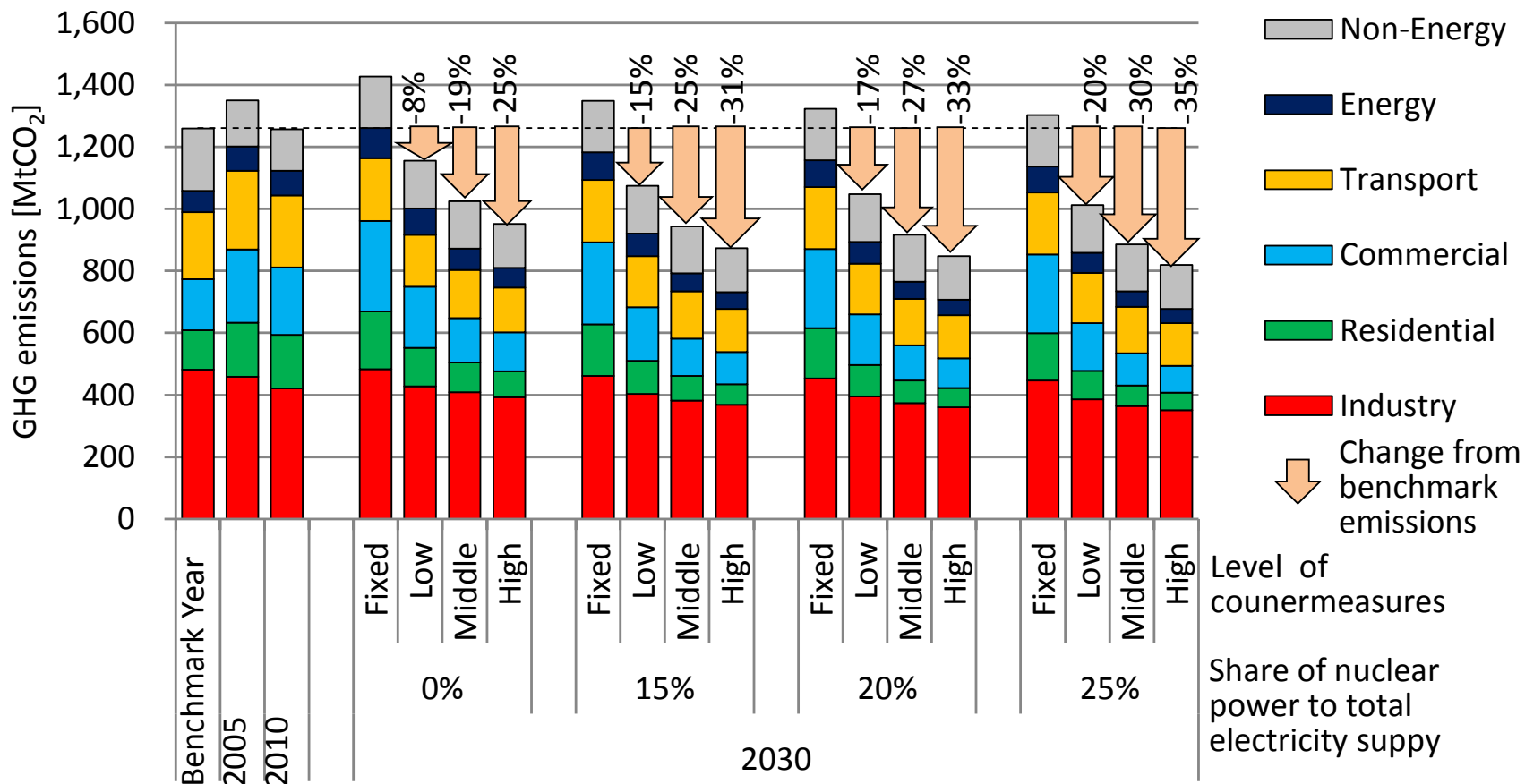
Sectoral GHG emissions in Japan in 2030 (low-economic-growth scenario)

Results of AIM/Enduse as of June 2012

Investment options to reduce GHG emissions

Industry	Energy intensive industries
	Industrial furnace, boiler, etc
Residential	High insulation house
	High efficient & solar water heater
	High efficient appliances & HEMS
Commercial	Energy efficient building
	High efficient & solar water heater
	High efficient appliances
Transportation	Next generation vehicles
	Low fuel consumption
Energy	PV
	Wind power
	Small scale hydro & geo-thermal
	Biomass power
	power system stabilization
	Gas pipelines
	CCS
Others (Non-Energy)	Agriculture
	Waste
	F-gas

mitigation options

Cumulative additional investment and saved energy costs by 2020 and 2030 (unit: tri. yen)
discount rate: 3%/year

Low carbon society will need the new investment.
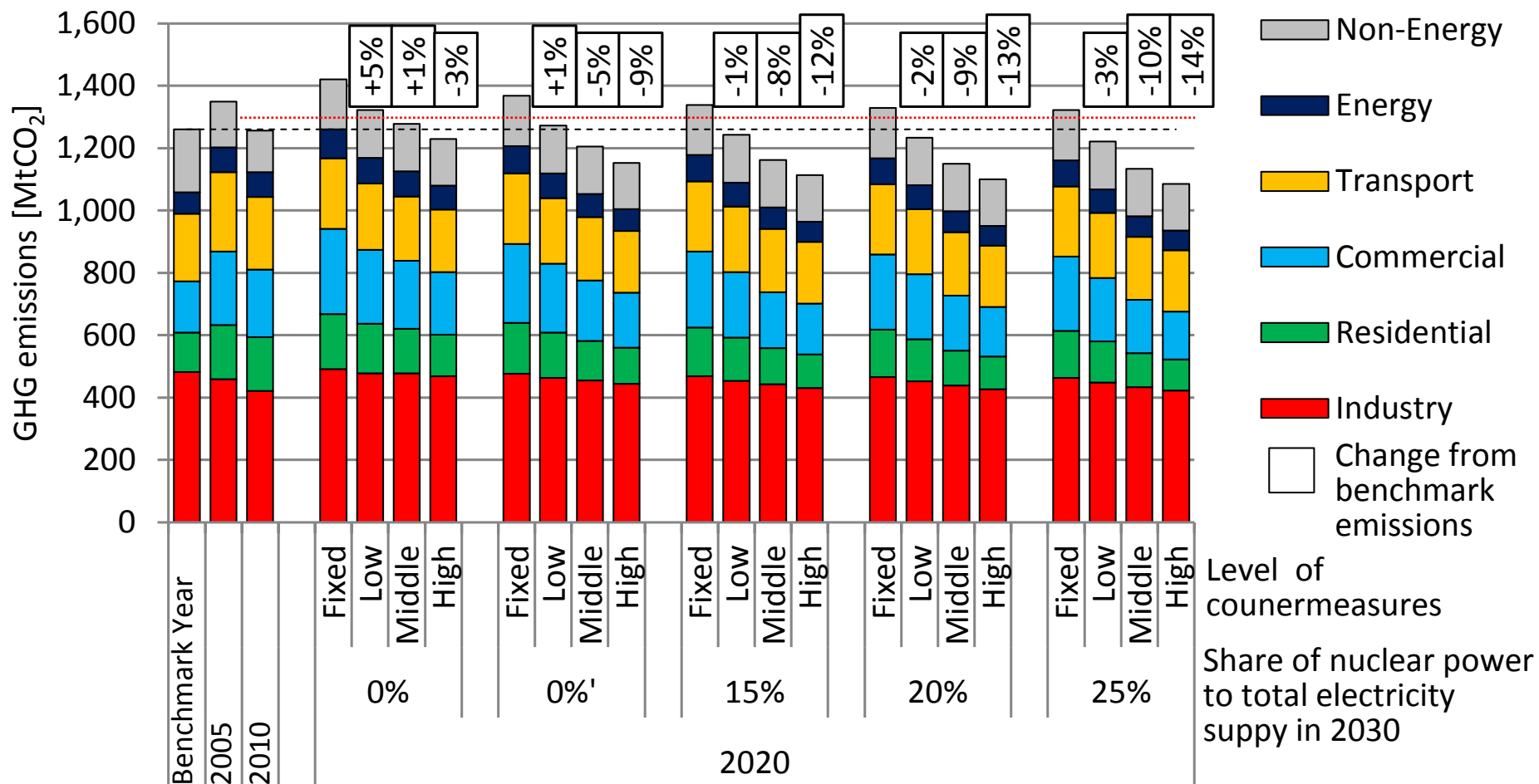
Results of AIM/CGE as of June 2012
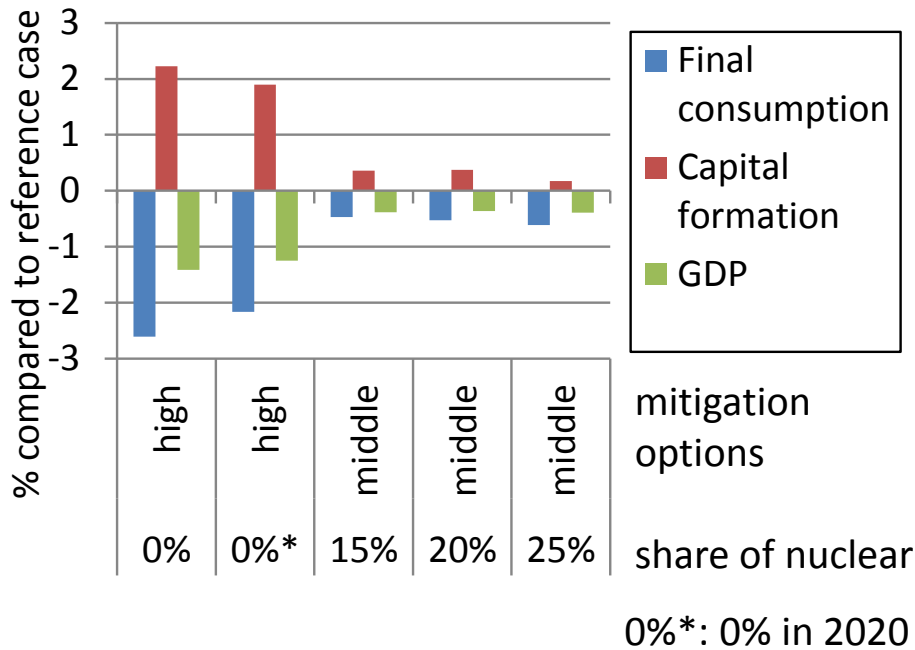
Additional investment to GHG mitigation will contribute to a domestic demand increase.
As a result, the GDP loss will be mitigated.

Macro economic impact compared to reference case in 2030, Low growth case

GHG reduction potential and present mitigation target
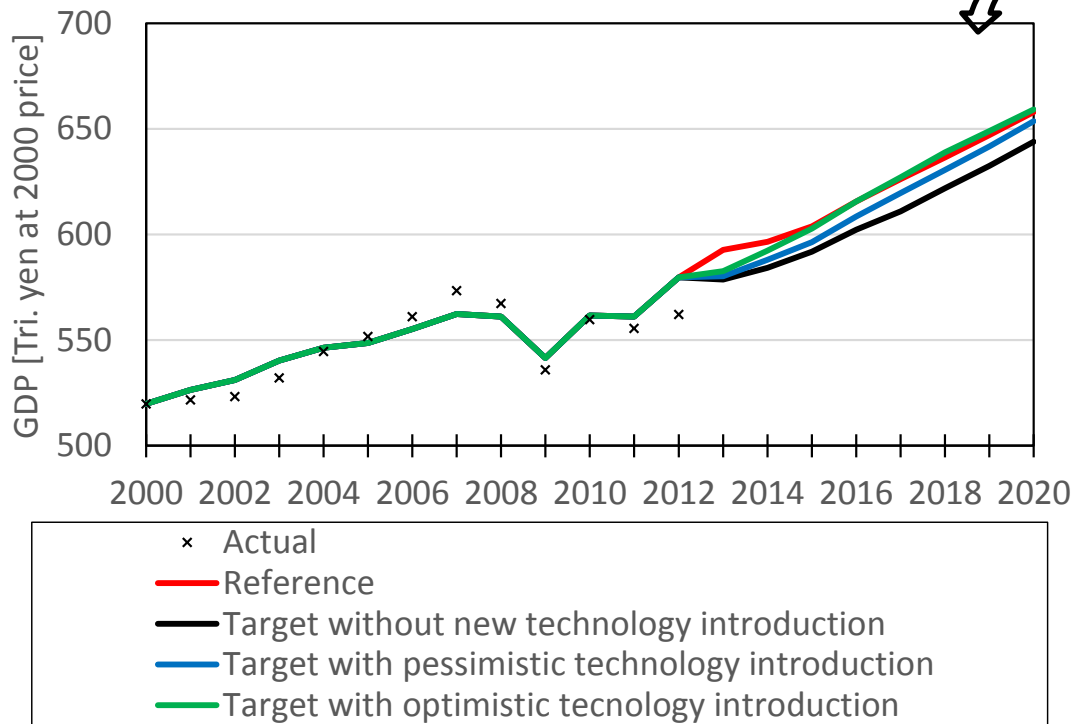## Results from AIM/Enduse model

Share of nuclear power is set to be gradually shifted to the numbers in this figure between 2010 and 2030. "0%" is assumed to be 0% in 2020 and after

.... Present GHG mitigation target (-3.8% to 2005 level = +3.1% to 1990 level)

Sectoral GHG emissions in Japan in 2030 (high-economic-growth scenario)

Economic impact of present mitigation target
Results of AIM/CGE coupled with technology selection

Technology options to reduce GHG emissions

Industry	Energy intensive industries
	Industrial furnace, boiler, etc
Residential	High insulation house
	High efficient & solar water heater
	High efficient appliances & HEMS
Commercial	Energy efficient building
	High efficient & solar water heater
	High efficient appliances
Transportation	Next generation vehicles
	Low fuel consumption
Energy	PV
	Wind power
	Small scale hydro & geo-thermal
	Biomass power
	power system stabilization
	Gas pipelines
	CCS
Non-CO2	Agriculture
	Waste
	F-gas

Legend:
- × Actual
- Reference
- Target without new technology introduction
- Target with pessimistic technology introduction
- Target with optimistic tecnology introduction

GDP change due to the present mitigation target in Japan

Introduction of countermeasures from long-term perspective is important.

Deep Decarbonization Pathways Project (DDPP)

Objectives

- The Deep Decarbonization Pathways Project (DDPP) is a collaborative initiative to understand and show how **individual countries** can transition to a low-carbon economy and how the world can meet the internationally agreed target of limiting the increase in global mean surface temperature to less than **2 degrees Celsius (°C)**.
- Staying within the 2°C limit:
  - The commitment of the Parties to the UNFCCC since COP16 in Cancun, which COP21 in Paris needs to operationalize
  - The upper limit to maintain our ability to adapt to climate change

Organization

- The Deep Decarbonization Pathways Project (DDPP) is convened under the auspices of the **Sustainable Development Solutions Network** (SDSN) and the **Institute for Sustainable Development and International Relations** (IDDRI).
- Currently, the DDPP comprises **15 Country Research Teams** composed of leading researchers and research institutions from countries representing 70% of global GHG emissions and different stages of development: Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Japan, Mexico, Russia, South Africa, South Korea, the UK, and the USA.
- The Country Research Teams are acting independently of their national governments.
- Several **Partner Organizations** contribute to the analysis and outreach of the DDPP, including the German Development Institute (GDI), the International Energy Agency (IEA), the International Institute for Applied Systems Analysis (IIASA), and the World Business Council on Sustainable Development (WBCSD).

3 "pillars" of deep decarbonization of energy systems

- Energy efficiency
- Low carbon electricity
- Fuel switching

- Within the three pillars that are common to all countries, individual DDPs show a wide variety of different approaches based on national circumstances.

Result of DDPP Japan

- How to realize the drastic GHG emission reduction in Japan (80% reduction in 2050 compared to 1990 level)
- http://www.unsdsn.org/what-we-do/deep-decarbonization-pathways/
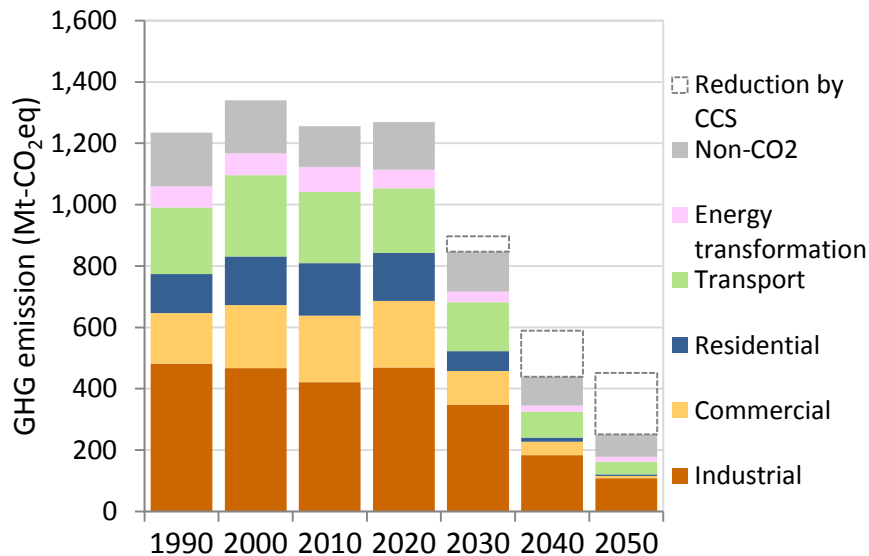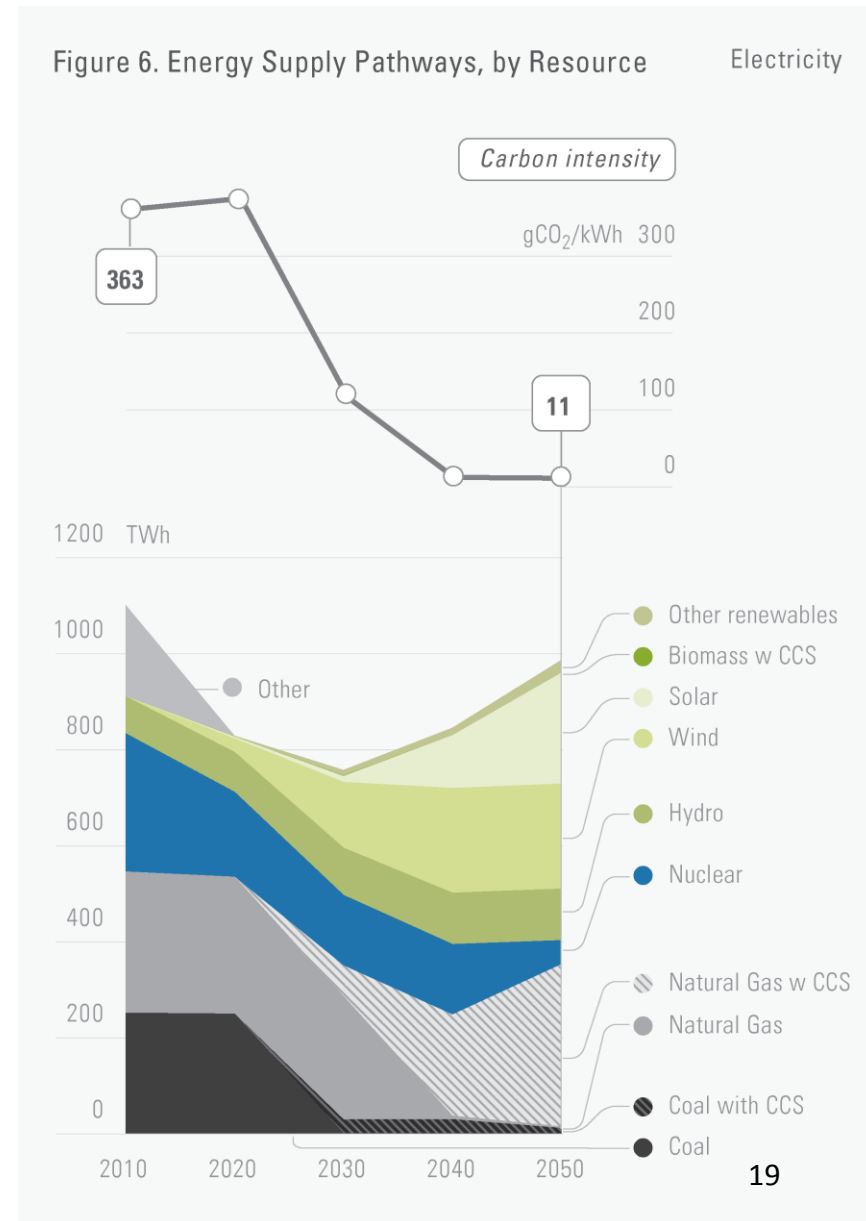

GHG emissions in Japan

DDPP seminar introducing Japan's results was held on October 7 in Tokyo.

In 2014, technology feasibility was assessed.
In 2015, economic aspects will be reported.

Power sector

- The nuclear power is assumed to be phased out gradually and electricity generation from coal without CCS is entirely phased out by 2050.

- Renewable energy is developed over the mid to long terms and reaches approximately 59% of total electricity generation through large-scale deployments of solar PV and wind power.

- In addition, natural gas (equipped with CCS) is developed to ensure balancing of the network and reaches about a third of total electricity generation in 2050.

- Carbon intensity of electricity falls to nearly zero in 2050.

Figure 6. Energy Supply Pathways, by Resource — Electricity

Carbon intensity

gCO₂/kWh

363

11

TWh

Other renewables
Biomass w CCS
Solar
Wind
Hydro
Nuclear
Natural Gas w CCS
Natural Gas
Coal with CCS
Coal

Other

Summary of this presentation

- History of GHG mitigation policy in Japan and contribution of AIM (Asia-Pacific Integrated Model).
  - Enduse model: reduction potential and technologies
  - CGE model: economic impacts
- Now we are discussing the new post-2020 mitigation target (INDC) for COP21.
- Contribution to DDPP toward the mitigation target in 2050.