

Exploring Japan's mid- and long-term mitigation pathways and challenges: A pilot model intercomparison study

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This study presents results of a pilot study on Japan's mid- and long-term climate policy goals with six integrated assessment models. Our analysis shows that in a deep decarbonization scenario with domestic 80% emissions reduction, the inter-model range of marginal abatement cost is wider and higher for Japan than for the USA (EMF 24) and EU (EMF 28). Partial equilibrium models suggest difficulty of decarbonizing the industry sector as opposed to the transport sector found in other major model intercomparison studies. The present result has an implication for Asian countries where industry is an important emission source.

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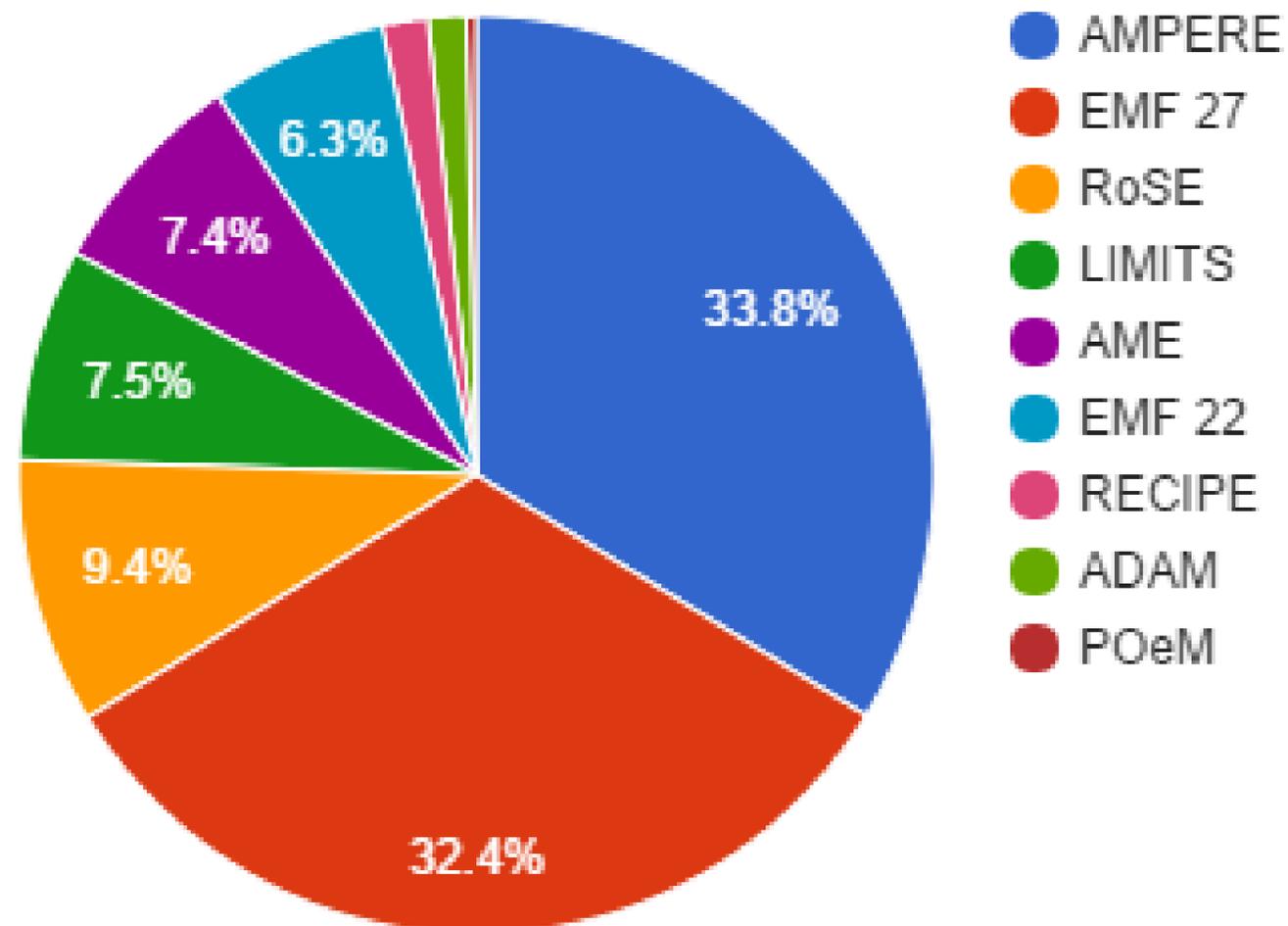
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Introduction (1)

- The 2015 Paris Agreement obliges each party to submit its nationally determined contribution (NDC) every five years. Because of the bottom-up nature of the Paris Agreement, it is vital to critically examine submitted contributions from each member state.
- Under its NDC, Japan intends to reduce its greenhouse gas emissions by 26% by FY2030 from the FY2013 levels. In addition, it "aims to reduce greenhouse gas emissions by 80% by 2050 as its long-term goal, while pursuing the global warming countermeasures and the economic growth at the same time."
- And yet, only few studies systematically explored the economic and environmental implications of these national policies, taking into account inter-model uncertainty (Akimoto et al. 2015). An analysis with multiple models is vitally needed to fully explore the uncertainty of cost implications. In fact, Japan has historically lacked model intercomparison studies (except for Hanaoka & Kainuma 2012).
- This study attempts to fill the gap by with model intercomparison

Introduction (2)

- Connection between NDC and IPCC
- Model intercomparison is a defacto standard for IPCC-level studies
 - Contributions of studies to IPCC AR5 WG3 Chapter 6 (global scenarios)



Past major (academic) modeling exercises in Japan, US, and EU

Policy events	Study	Country/region	Type of work	Outcome and note
COP15 (2009)	Committee on mid-term target	Japan	Part of policymaking process (with townhall meetings and surveys)	Documents for expert committee Book (Fukui 2009 (ed.)) (in Japanese) Individual papers
	EMF 22 (US)	USA	Academic	<i>Energy Economics</i> special issue (Fawcett et al. 2009)
	EMF 22 (EU)	Europe	Academic	<i>Energy Economics</i> special issue (Böhringer et al. 2009)
COP21 (2015)	N/A	Japan	(no MIP)	Analysis by individual modeling groups
	EMF 24	USA	Academic	<i>Energy Journal</i> special issue (Fawcett et al. 2014; Clarke et al. 2014)
	EMF 28	Europe	Academic	<i>Climate Change Economics</i> special issue (Weyant et al. 2013; Knopf et al. 2013)

No academic work from Japan (aside from some individual contributions)

=> Not reference to Japan's modeling effort from abroad or IPCC

Design of the *pilot* study: 6 models and 2 scenarios

Model	Institute	Solution concept	Intertemporal treatment	Regional coverage
AIM/CGE	NIES	General equilibrium	Myopic	Global
AIM/Enduse [Japan]	NIES	Partial equilibrium	Myopic	Japan
DNE21	UTokyo	Partial equilibrium	Intertemporal	Global
DNE21+	RITE	Partial equilibrium	Intertemporal	Global
IEEJ (based on MARKAL)	IEEJ	Partial equilibrium	Intertemporal	Japan
TIMES-Japan	IAE	Partial equilibrium	Intertemporal	Japan

Scenario	Description
Ref	A reference scenario, which is left to the individual modeling group's choice.
NDC+2050	A mitigation scenario, which combines the 2030 NDC goal (26% reduction relative to 2013 levels) and the 2050 goal (80% reduction)

Conclusions

Major findings

- The range of marginal cost of abatement from models is wider and higher for Japan
- Industry is hard to decarbonize, possibly reflecting Japan's unique situation of Japan

Some research questions for the next step

- Flexibility mechanisms? "Backstop" technology? (CDR such as BECCS, DAC, etc.)

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