Energy Systems Analysis under Deep-decarbonization Constraints

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Short Biography

Hadi Farabi-Asl is a Researcher in Research Institute for Humanity and Nature (RIHN) in Kyoto, Japan. He is a member of Supply Chain project in RIHN, aiming to assess the environmental impacts of the global supply chains with quantitate methods.
Before joining RIHN, Hadi was a Postdoctoral Research Associate in International Institute for Carbon-Neutral Energy Research (I²CNER), Kyushu University. His research in Energy Analysis Division (EAD) of I²CNER, was related to modeling the energy systems in national and global scales, considering deep-decarbonization targets. He has a background in Mechanical Engineering. Results of his studies are published in journal papers and presented in conferences, including an award-winning paper in 4th International Conference of Grand Renewable Energy in Yokohama, Japan.

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Abstract

Low-carbon transitions of energy systems are required globally under the Paris Agreement for the United Nations Framework of Convention of Climate Change (UNFCCC). It important to understand how transitions in supply and demand structure of energy system help to realize the low-carbon energy system? On the other hand, quantitative analyses are necessary for the policy recommendations.
In order to achieve the ambitious target of an 80% CO_2 emission reduction in Japan by 2050 (compared to 2013 levels), various low-carbon sources on the supply side, and efficient technologies on the demand side of the energy system must be deployed at a reasonable cost. In this study, we investigate the possibility of achieving the emission reduction targets in Japan using the TIMES-Japan framework, which employs a least cost optimization approach. Results of the analysis reveals the significant importance of hydrogen import on the supply side at the same time with renewable power generation, and electrification of steel-making furnaces on the demand side for obtaining feasible scenarios. The minimum amount of carbon capture and storage (CCS) capacity is calculated for each scenario and the results vary between 5 and 150 million tons of CO_2 by 2050. Based on the results of our analysis, a moderate scenario is proposed to engender desirable future actions.

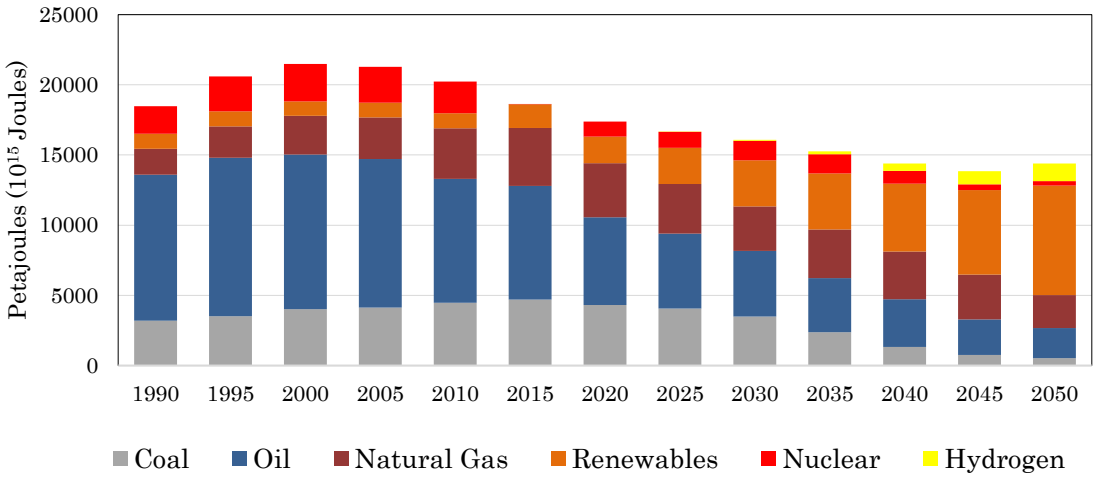

Fig. 1 Primary energy in Japan (1990 – 2050) in one of the scenarios of study

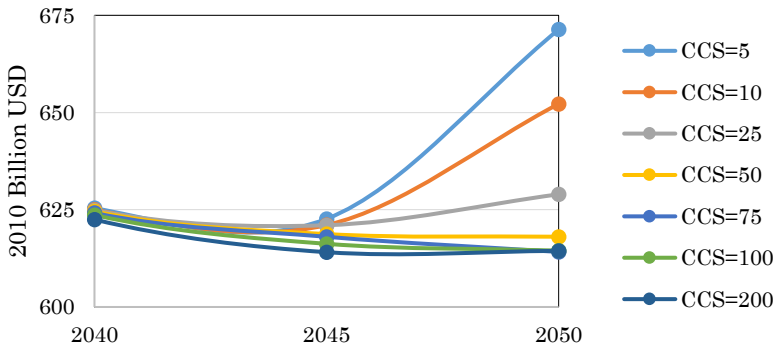

Fig. 2 Relationship between energy system cost and CCS capacity (million tons of CO_2) in a group of scenarios