Assessing the key factors in achieving emission reduction goals in Japan using TIMES-Japan techno-economic framework

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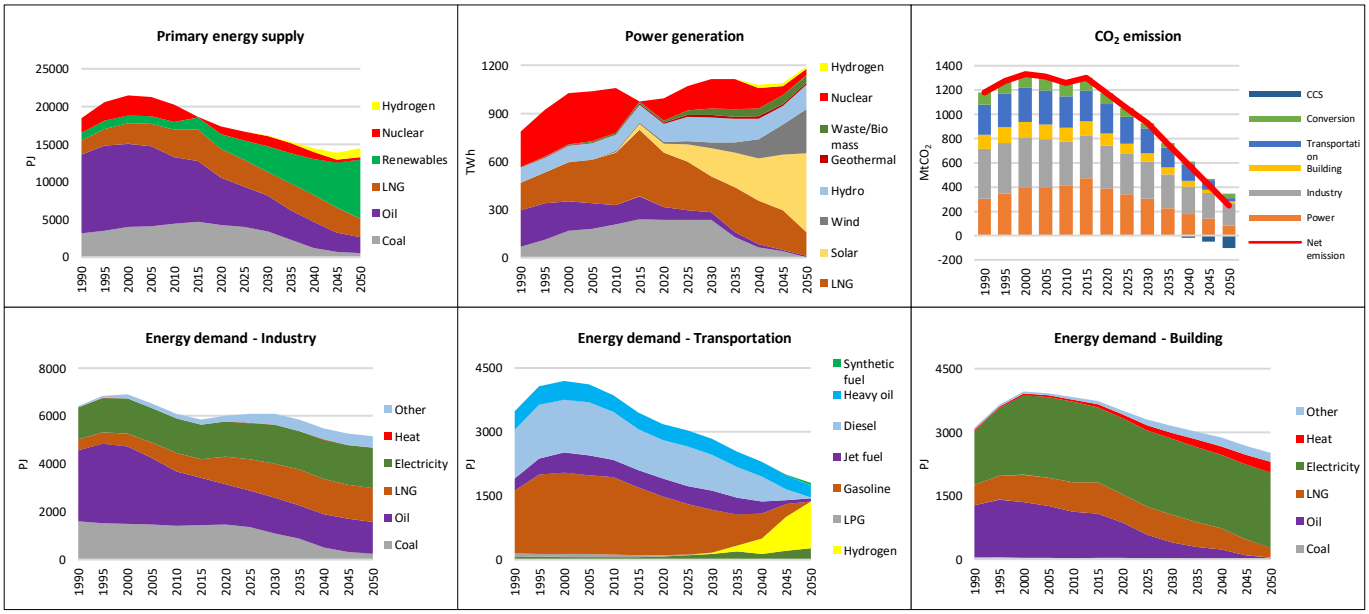
In order to achieve the IPCC 2.0 goals, developed countries have committed to reducing their emissions considerably during the upcoming decades. In order to achieve the ambitious target of an 80% CO_2 emission reduction in Japan by 2050 (compared to 2013 levels), various low-carbon sources on the supply 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. The contribution of carbon capture and storage (CCS) in achieving the emission reduction targets is studied in various scenarios. Results of the analysis reveals the significant importance of hydrogen import on the supply side and electrification of steel-making furnaces on the demand side for obtaining "feasible" scenarios. The minimum amount of 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 proper policies.

Summary of important factors in 3 groups of scenarios

	Group 1		Group 2		Group 3	
Limit on hydrogen import	No		No		Yes	
Limit on electric arc furnaces	No		Yes		No	
	Max CCS	Min CCS	Max CCS	Min CCS	Max CCS	Min CCS
Stored CO_2 in 2050 ($MtCO_2$)	129	5	158	144	131	67
Hydrogen energy in 2050 (PJ)	1,262	2,744	2,572	2,740	1,145	1,278
Average annual energy system cost (billion USD)	646.0	654.4	666.8	668.8	643.9	645.1



Main results of calculations for one of the scenarios: energy supply, demand, and emission (1990 – 2050)