ENERGY SYSTEM TRANSFORMATIONS FOR THE LONG TERM MITIGATION TARGET IN JAPAN

Diego SILVA HERRAN[1], Shinichiro FUJIMORI[2,3,4] and Mikiko KAINUMA[1, 4]

[1]Institute for Global Environmental Strategies, [2]Kyoto University, [3]National Institute for Environmental Studies,

[4]International Institute for Applied Systems Analysis

We analyse the transformations in the Japanese energy system to realize 80% emission reduction by 2050, comparing the role of uncertain nuclear power deployment to other key uncertainties with a CGE model.

Keywords: Energy system, mitigation target, Japan

INTRODUCTION

Achieving long term climate mitigation targets for Japan requires deep transformations in the energy system, in particular in the power generation sector. Decarbonization of this sector is unclear due to the uncertain nuclear policy after the 2011 Great East Japan Earthquake. However, many other uncertainties need to be considered, namely the availability of carbon capture and storage (CCS), the cost reductions for renewable energy technologies to be scaled up, the improvement of energy efficiency, and the cost of fossil fuels. This study analyses the transformations in the Japanese energy system to realize 80% emission reduction by 2050, comparing the role of uncertain nuclear power deployment to other key uncertainties by means of a computable general equilibrium (CGE) model.

METHOD

We assess a set of scenarios (listed in Table 1) with different assumptions for the availability of key technologies, and uncertainties related to the energy demand and energy security. The Asia-Pacific Integrated Assessment Model CGE (AIM/CGE) model covers the whole economic activities and a full set of GHGs and air pollutants, with a detailed description of the energy sector, the agricultural sector and the land use activities (Fujimori et al., 2017; Fujimori et al., 2012).

Table 1 Scenarios considered in the analysis.

Scenario name	Description
Reference	Without mitigation policies.
Default_NDC80	Reference but with mitigation targets.
Nuc_H_NDC80	Default_NDC80 with high level of nuclear power supply.
Nuc_L_NDC80	Default_NDC80, with low level of nuclear power supply.
Nuc_no_NDC80	Default_NDC80, with no nuclear power supply.
NoCCS_NDC80	Default_NDC80, with no CCS.
RE_CostRed_L_NDC80	Default_NDC80, with low level of renewable energy cost reduction.
AEEI_L_NDC80	Default_NDC80, with low level of energy efficiency improvement.
PrFossil_L_NDC80	Default_NDC80, with low prices of fossil fuels.

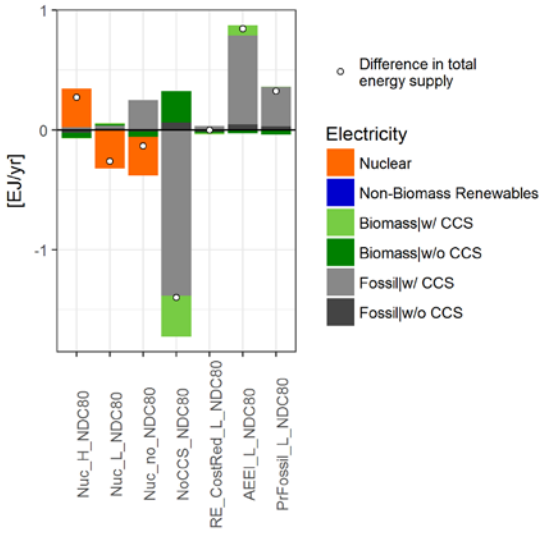

Figure 1 Changes in electricity supply by major sources compared to the *Default_NDC80* scenario.

RESULTS AND DISCUSSION

The analysis showed that mitigation targets can be achieved for Japan under several alternative scenarios for nuclear power deployment from a macroeconomic modeling perspective, including early phase out. Lack of CCS brought the largest impacts on the energy system and the macroeconomy. Also, uncertain nuclear supply had a secondary impact on the energy system, as it can be substituted with other sources (mainly natural gas) and measures (reduction of energy consumption) to achieve long-term mitigation targets with lower GDP losses. In addition to scaling up low carbon energy technologies, energy consumption reductions, along with higher shares of electricity in final energy supply, had an important role in achieving mitigation targets.

References

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