Title:

Analyzing the impact of climate change on energy-economy-carbon nexus system under uncertainty – A case study of China

Abstract:

Damage caused by global warming is happening far faster than experts predicted or anticipated. As the damage brought by climate change becomes a reality, more and more countries and international institutions have realized that it is imperative to take actions to tackle climate change. In this study, a multi-GCM ensemble simulation and optimization approach is developed for analyzing the impact of climate change on China's energy-economy-carbon nexus system under multiple uncertainties through integrating techniques of multiple global climate models, support-vector-regression, Monte Carlo simulation, and interval chance-constrained programming within a general framework. The developed approach can tackle multiple uncertainties existed in global climate models, random carbon dioxide emission, and complex optimization process. Results disclose that the national electricity demand would increase by 58.6% in the next 30 years under the consideration of climate change. In order to cope with climate change as well as facilitate energy sustainable development, fossil fuel would be gradually replaced by renewable energy (i.e. the share of electricity generated from renewable energy would raise by 27 % in 2050). Compared to the peak value in 2030, carbon dioxide emission would reduce by 15% in 2050 (i.e. most reduction coming from coal-fired power generation). A number of wind-power and solar-power projects are expected to be implemented due to their abundant potential markets. Results also reveal that multiple uncertainties existing in factors related to climate change, economy and environmental policy (e.g., multi-GCM, carbon dioxide emission, energy demand, fuel price, and production cost) have obvious impacts on the national energy management and planning schemes.