AN INTERPROVINCIAL COOPERATIVE GAME MODEL FOR POWER-SAVING AND CARBON-REDUCING IN CHINA

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Overview

The world is facing great challenges of climate change and environmental pollution. On November 30, 2015, President Jinping Xi promised to the world that China would reduce total carbon emission and carbon emission intensity. China is facing severe situation of carbon reduction. In recent years, a lot of provinces have being suffered serious haze weather in China, and the situation of reducing air pollution is severe. The special energy structure of China determines that effective power administration is critical to energy saving, emission reduction, and carbon reducing. However, the current administration mechanism for energy saving and carbon reducing, which check the achievement effect of each province individually, is not beneficial to optimization of energy and resource distribution, and cannot encourage power saving and carbon reducing of each province. It is vital for China to build mechanism of interprovincial collaborative management for power-saving and carbon-reducing.
The paper is organised as follows: After the introduction the second section constructs an interprovincial cooperative game model for power-saving and carbon-reducing(ICGM) that consists of two parts. The third section is the case study on interprovincial union of Shanghai–Sichuan–Shanxi-Gansu in China. In section four we conduct sensitive anlysis to test parameter's effects on benefit improvement of power consumption and carbon reduction.

Methods

we construct an interprovincial cooperative game model for power-saving and carbon-reducing(ICGM) that consists of two parts: (1) an optimization model that calculates the optimal quantities of power consumption and power production for each participating province to meet the joint energy-saving goal and carbon-reducing goal; and (2) a model that distribute the economic benefit of the cooperation (i.e., benefit by power usage and carbon ruducing) among the provinces in the cooperation based on the Shapley value method.

Results

We applied the ICGM to the case of interprovincial union of Shanghai–Sichuan–Shanxi-Gansu in China. The results, based on the data from 2001–2014, show that cooperation can significantly improve benefit of power usage and carbon reduction of each province in the union.

Conclusions

ICGM can significantly promote power saving and carbon reducing much better by check the performance of the cooperation union instead of each province individually than the current administration mechanism. Shaplye value method is a reasonable benefit allocation method for power consumption benefit and carbon reducing benefit in interprovincial cooperation union.

References

Andrews-SpeedP. China's ongoing energy efficiency drive: Origins, progress and prospects [J]. Energy Policy, 2009, 37:1331-1344.
Bertoldi P., Huld T., Tradable Certificates for Renewable Electricity and Energy Savings[J]. Energy Policy, 2006, 34(2): 212-222.
Carf D., Schilirò D. A coopetitive model for the green economy[J]. Economic Modelling, 2012, 29:1215-1219.
Child R., Langniss O., Klink J.,et al. Interactions of white certificates with other policy instruments in Europe[J]. Energy Efficiency, 2008, 1(4): 283-295.
Halkos G. E. Implementing optimal sulphur abatement strategies in Europe [J].Water Air and Soil Pollution,1996,

8(1-4):329-344.
Halkos G. E. Sulphur abatement policy: implications of cost differentials [J]. Energy Policy, 1993, 1:1035-1043.
Jia N.X., Yokoyama R. Profit allocation of independent power producers based on cooperative game theory[J]. International Journal of Electric Power and Energy Systems, 2003,25(8):633-641.
Krupp C. M., Patricia S. P. Market response to antidumping laws: some evidence from the U.S. chemical industry[J]. Canadian Journal of Economics.1996, 29(1):200-218.
Lo K., WangM. Y. Energy conservation in China's Twelfth Five-Year Plan period: Continuation or paradigm shift?[J].Renewable and Sustainable Energy Reviews, 2013, 18: 499-507.
Long R., LanY. Study on regulation design about energy-saving and emission-reduction based on game theory [J]. Procedia Earth and Planetary Science, 2009,1:1641-1646.
Mu S., Niu J. An analysis of the Effect of Government-Enterprise Game in the Government–leading Industrial Energy Saving Model[J].EnergyProcedia, 2011, 5:633-637.
Mundaca L. Markets for energy efficiency: Exploring the implications of an EU-wide 'Tradable White Certificate' scheme[J]. Energy Economics, 2008, 30(6): 3016-3043.
MundacaL, Neij L. A multi-criteria evaluation framework for tradable white certificate schemes[J]. Energy Policy,2009,37(11): 4557–4573.
Nasiri F., Zaccour G. An exploratory game-theoretic analysis of biomass electricity generation supply chain[J].Energy Policy,2009,37(11): 4514-4522.