Impact of electricity market reform on CO2 emissions by states and its implication in the U.S

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Overview

Electricity market reform has been initiated in worldwide aiming mainly to secure a stable supply of electricity, suppress electricity rates, and provide greater choice to consumers and increase competition amongst business operators. In the U.S., the electricity market system started in 1990s. Since 1992, US electricity market has promoted to liberalize the market for independent electricity suppliers aiming to decrease the dependence of the U.S. on foreign oil and to enhance energy security by promoting energy efficiency and clean energy development. On the other hand, as global momentum of climate change, in 2015 the world agreed to make efforts to reduce GHG emissions to limit rising temperatures below 2 degrees Celsius in Paris Agreement under the international climate change negotiation of the United Nations Framework Convention on Climate Change (UNFCCC). To achieve the goal, nations are required to effectively reduce CO_2 emissions. One of the measures to reduce CO_2 emissions is a market system reform of electricity with a transition of electricity system from conventional energy use to low carbon electricity and promote energy efficiency. Electricity market system in the U.S. differs by states and regions. This raises the following questions; what are the main impacts of electricity market reform at the state level?; does deregulation of electricity market make impacts on reducing CO_2 emissions?; what other factors can impact on reducing CO_2 emissions?; and which electricity market system is more effective to reduce CO_2 emissions?

This paper assesses the impact of electricity market reform including deregulation of electricity market and transmission restructuring (establishment of Independent System Operators (ISOs) and Regional Transmission Organizations (RTOs)) on CO_2 emissions and energy efficiency at the state level. Examining the impacts of historical electricity market reform in U.S. on CO_2 emissions and energy efficiency is useful for countries that are currently planning the electricity market reform to understand the impact of electricity market reform and effective system that can promote renewable energy, energy efficiency and reduction of CO_2 emissions. The structure of this paper is following: after the instruction section, in the second section, it looks at a trend of CO_2 emissions and the overall structure and function of electricity market reform in the U.S by states. The methodology of the study is explained in the section three. The result and implication from the study is demonstrated in section four. The conclusion and policy recommendation for electricity market reform comes in the last section.

Methods

Fixed Panel data analysis: 50 states comparison.

Using the fixed panel data analysis, this paper examines the following variables of impacts on CO_2 emissions and energy efficiency: deregulation of electricity market; transmission restructuring (ISO/RTO including focusing on PJM interconnection that is one of the biggest and successful transmission organization); and renewable policy (renewable portfolio standard (RPS)). The research question is what combination of policies will impact on increasing renewables, improving energy efficiency and reducing CO_2 emissions.

Results

First, electricity market reforms had the potential to promote independent power producer (IPP) and to change the energy mix at the state level. When the reforms contribute to increase the usage of renewables, the elevated renewable usage diminishes the level of per capita CO_2 emissions.

Second, deregulation of electricity market itself is unlikely to do much to contribute to increasing renewbales and reducing CO_2, but it contributed to improvement of energy efficiency.

Conclusions

Since the implementation of electricity market reform in U.S, more than a decade has passed. The result of the market reform and its impact on enhancing renewable and energy efficiency differs by states. This study found that electricity market reform has promoted energy efficiency while renewable policy such as RPS contributed to the reduction of CO_2 emissions. The PJM interconnection, one of the RTOs, contributed to energy efficiency, which has introduced demand response system, and also to increasing renewables with increasing flexibility of balancing demand and supply and increasing access to various energy mix. It also found that the ISOs and RTOs can integrate variable energy resources through their organized markets and regional infrastructure planning processes, and also RTOs like PJM which covers the large geographic areas across states can integrate wind and solar generation by reducing the magnitude of variability-related challenges.

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