Chapter 29
The Economics of Renewable Energy Promotion Policies: A Case of Wind Power in Brazil

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ABSTRACT

Large-scale deployment of renewable energy technologies, such as wind power and solar energy, has been taking place in industrialized and developing economics mainly because of various fiscal and regulatory policies. An understanding of the economy-wide impacts of those policies is an important part of an overall analysis of them. Using a perfect foresight computable general equilibrium model, this study analyzes the economy-wide costs of achieving a 10 percent share of wind power in Brazil's electricity supply mix by 2030. The study finds that the expansion of wind power would increase GDP in Brazil. The study also finds that a production subsidy financed through increased value-added tax would be superior to a consumption mandate where electricity utilities are allowed to pass the increased electricity supply costs directly to consumers. These two policies would impact various production sectors differently to achieve the wind power expansion targets.

1. INTRODUCTION

Brazil is well-known for its hydropower resources. However, a large portion of the economic potential of hydropower has already been exploited and a further expansion is increasingly constrained by environmental sensitivity and the remoteness of much of the remaining resource (REN21, 2014). On the other hand, the country is also endowed with a large potential of wind energy, estimated to be 143 GW (Meisen & Hubert, 2010). Most of the potentials are identified in the northeast and southern parts of the country, especially across the states of Bahia, Rio Grande do Norte and Ceara. While Brazil is currently expanding its thermal power generation capacity (IEA, 2014), the rapidly increasing emissions of greenhouse gases (GHGs) from the power sector is a major challenge to meet its voluntary commitments for climate change mitigation. Therefore, the government is planning to expand wind power, and

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expects wind power to contribute 9% of the total electricity generation by 2021.[1] Moreover, wind power provides an excellent complementarity to hydropower in Brazil, as the high wind seasons coincide with low rainfall seasons.

In Latin America, Brazil is the leader in developing wind power generation capacity. The total installed capacity of wind power increased by more than 6 fold in just four years since 2010 (GWEC, 2014).[2] Brazil made the fourth largest addition of wind power capacity in the world in 2014 with 2,500 MW added in that year alone (REN21, 2015). With this addition, total installed wind power capacity in the country stands at 5,900 MW. Although almost half of the new capacity addition in 2014 was wind power, the total installed capacity of wind power accounts for a only small fraction of the total electricity generation capacity in the country, about 4% of the total electricity generation capacity available in the country by the end of 2014 (REN21, 2015).

A number of policies and programs have been introduced in Brazil to promote large-scale deployment of wind energy. The Programa de Incentivo às Fontes Alternativas de Energia Elétrica (or Incentive Program for Alternative Sources of Energy) introduced in 2004, was one of the first major initiatives. At present, existing policies aimed at wind power development include market (or purchase) guarantee, where the government procures wind power through competitive bidding (Franca, 2011); exemption of some taxes on wind power generation equipment; investment subsidies through grants and soft loans and wind power auctioning (IEA/IRENA, 2015). In addition, the government has launched specific programs to facilitate large-scale deployments of renewable energy, including wind power (REN21, 2015).

The promotion of renewable energy is essential from climate change mitigation and other environmental perspectives; it is also necessary as renewable energy is a vehicle for the development of sustainable energy systems in a long-run. However, it is equally important to ensure that a large-scale expansion of renewable energy is also consistent with short-term economic and social development goals. A large-scale deployment of renewable energy should not adversely affect the competitiveness of energy supply systems, especially in developing countries. Moreover, the economic and regulatory policies to stimulate renewable energy sources should not excessively cost to the final consumers as well as productive sectors. Despite the importance of these issues, relevant literature is limited.

This study analyzes the economic and environmental (mainly climate change mitigation) implications of a large-scale deployment of wind energy in Brazil to increase the share of wind power in the total electricity generation to 10% by 2030. We used a computable general equilibrium (CGE) model as an analytical tool because CGE models are the most appropriate tools for this type of ex-ante assessment of economy-wide impacts of a policy or an economic activity. Existing studies, such as Qi et al. (2014), Timilsina and Landis (2014) and Böhringer and Löschel (2006), have also employed CGE models for analyzing renewable energy promotional policies. We simulated two broad policy instruments: fiscal policy instruments and regulatory policy instruments, and compared them in terms of their economy-wide impacts. In our model, the fiscal policy instruments are represented by a production subsidy[3] and the regulatory measures are represented by a renewable energy consumption mandate.

The remainder of the chapter is structured as follows. In Section 2, a brief description of the computable general equilibrium model is presented followed by discussions of results from model simulations in Section 3. Section 4 concludes the chapter.