Energy 77 (2014) 422–433

Contents lists available at ScienceDirect

Energy

journal homepage: www.elsevier.com/locate/energy

A valuation of wind power projects in Germany using real regulatory options

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ARTICLE INFO

Article history:
Received 6 August 2013
Received in revised form
9 September 2014
Accepted 10 September 2014
Available online 14 October 2014

JEL codes:
c63
H43
H54
H71
L51
L94
L98

Keywords:
Real regulatory options
Renewable energy
Project valuation

ABSTRACT

This study evaluates a proposed investment in wind power generation using real options from the regulatory framework applicable to the German market (Europe's largest producer of renewable energy). For this evaluation, we have modelled the primary uncertainties affecting the project and we have incorporated the uncertainties arising from public support for renewable energy. These mechanisms generate RROs (real regulatory options) – not in the hands of the project's promoter – that affect the net present value of the project. The inclusion of these mechanisms enriches and improves the valuation methodology of such projects. The comparative analysis of the case study, using other countries, reinforces the idea that the existing RROs depreciate the net present value of renewable generation projects. We believe that the methodology we propose in our paper can help policy makers to improve their policies to promote renewable energy.

1. Introduction

The European Parliament and the Council Directive 2009/28/EC on 23 April 2009 related to the promotion of the use of energy from renewable sources, set as general objectives to achieve a 20% share of energy from renewable sources in gross final energy consumption in the EU (European Union) in each Member State by 2020.

To achieve this goal, the development of renewable energy in Europe is needing the support of Public Administrations of different countries.

Due to this fact, the member states of the European Union have developed various schemes of public support for renewable energy projects.

Sometimes these public support schemes designed in the respective regulatory frameworks, contain RRO's (real regulatory options), which can increase or decrease the value of the projects from the developer's point of view.

In addition, these regulatory real options can simultaneously modify the amounts in the form of public subsidies granted by the Administration to renewable energy projects, either as limits on the amount of subsidized electricity from renewable sources, or as limits to the sale price of renewable energy.

The methodology presented in this paper aims to help private developers of renewable energy projects, as it allows them to better assessment of investment projects to include the value of the real regulatory options.

Furthermore, this paper can also help politicians of the Public Administrations of the states in the design of schemes of public support for renewable energy, since the methodology presented, on the one hand allows them to quantify the economic value of the public aid granted to the different renewable energy technologies, and on the other hand it allows them to analyse whether these quantities can be assumed or not by taxpayers.

In this article, we value a wind farm in one of the most important countries in the world for the development of renewable energy, Germany, incorporating the effect of the existing real options

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http://dx.doi.org/10.1016/j.energy.2014.09.027
0360-5442/

that result from the country's regulatory framework (real regulatory options – RROs).

There is a gap in the literature on the assessment of projects regarding the role of real options that do not depend entirely on the project promoter (in our case, the regulatory options) and yet affect the value of the project. This article attempts to explore this situation.

Specifically, this study presents the following objectives:

1. Identify real options in the existing legal framework regulating the production of electric renewable energy in Germany.
2. Determine the value of the existing real options. Obtain a measure of global valuation for the investment projects given the real options derived from the government-assigned grants.
3. Analyse whether the real options existent within the legal framework benefit the project promoter or the administration.
4. Analyse whether there is a differential contribution from the RRO to the renewable generation projects with respect to studies in other European countries.

This article is structured as follows. In Section 2, we examine the state of the art in renewable project valuation with real options. Section 3 analyses Germany's regulatory framework for renewable power generation projects. In section four, we present the valuation methodology. The fifth section establishes the characteristics of the project to be evaluated. Section 6 identifies and analyses the real options contained in the German regulatory framework. Sections 7 and 8 present the results for the German case and offer a comparative study with other European countries that have these types of option. Lastly, Section 9 presents the conclusions.

2. State of art

Various methods for valuing investment projects under uncertainty have questioned the appropriateness of particular classical models that are widely used in the evaluation of investments (Net Present Value, Internal Rate of Return and Payback Period). Since the end of last century, many authors have questioned the use of these models for assessing the viability of projects under uncertainty [1–3]. To fill the gap in the traditional methods, studies arose using options valuation methodology, applying this methodology to projects investing in real assets (Real Options Approach) [3].

In fact, traditional valuation methods do not need to be replaced, but should be supplemented with techniques to more accurately assess and adjust to reality projects that generate uncertainties in some of their parameters [3–5].

Within the scope of Real Options, investment projects can be measured as a collection of CALL and PUT Options, representing the different types of opportunities or options that exist in the project [6]. Therefore, the fundamental point when evaluating projects using real options is to identify the options that arise in the project evaluation horizon [7].

Within the specific field of the valuation of power generation projects, the real options methodology has been used extensively for both conventional generation [8–14] and for generation with renewable sources [15–22].

However, the studies mentioned above and other similar contributions emphasise project valuation that considers the role of the real options property of the project developer but that ignores the impact of the real options held by the administration regulatory authority for specific projects. Clearly, the regulation affects the valuation of generation projects from renewable sources [23–27]. Furthermore, regulatory support for renewable energy should be analysed from an efficiency perspective, considering the costs and benefits of such actions [28]. In turn, the regulatory policy on renewable energy can generate different scenarios that affect not only the mix of production [29], but also to the financial return obtained by the promoters [30]. Therefore, models incorporating valuation of investment projects in renewable energy, based on real options that consider the different regulatory policies, could be very useful for both Administration and investors. However, until now, the few contributions addressing the role of the regulator in the valuation of investments using real options focus on the general aspects of the environmental policies [17] or the valuation of generic renewable sources [31]. The first focuses on the use of the real options approach to estimate the net present value of expected future supply from renewable electric technologies in U.S. while the second deals with the importance of real options in the development of regulatory policies on renewable energies in Taiwan, using real options to estimate the value of wind generation by modifying the Feed In Tariff policies. The first definition of the term RRO and the first assessment of these options can be found in Ref. [32], which analyses the impact of RRO in specific renewable generation projects in three small European countries (Denmark, Finland and Portugal). However, this study did not assess the influence of the RRO in the renewable generation projects of the leading producer in Europe (Germany) to analyse whether any differential behaviour existed in the role that public subsidies play in the assessment of renewable generation projects between Germany and the countries in their study.

3. The legal framework to support wind energy in Germany

Support for renewable energy in Germany is provided by the EEG (renewable energy sources act (Erneuerbare Energien Gesetz)) [33]. This scheme of support for renewable energy is regulated by the EEG, which came into force on 1 April 2000.

EEG promotes renewable energy through economic incentives that grid operators must pay for renewable energy fed into the power grid.

According to Section 1 of the Act, the purpose of the law is to facilitate the sustainable development of energy supply, particularly for the sake of protecting the climate and the environment, to reduce the costs of energy supply to the national economy (also by incorporating external long-term effects), to conserve fossil fuels and to promote the further development of technologies for the generation of electricity from renewable energy sources.

Until January 2012 the support measures for renewable energy included only feed in tariffs schemes. However, in June 2011, the German Bundestag passed a new amendment to the Renewable Energy Sources Act (EEG), which came into effect on 1 January 2012. In parallel to the existing fixed feed-in tariffs, this amendment introduces a market premium (feed in premium scheme) that allows power producers to sell electricity from renewable sources on the electricity market [34].

The Act on Granting Priority to Renewable Energy Sources establishes (Section 20), reductions in Tariffs and Bonuses that the tariffs and bonuses will decrease by 1.5 percent on 1 January each year for electricity generated by wind energy from on-shore installations from the year 2013 onwards.

The tariffs will each be paid for a period of 20 calendar years and for the year in which the installation was commissioned.

According EEG Act (Section 29 (1)), the tariff paid for electricity from wind-powered installations shall amount to 4.87 euro cents per kilowatt-hour (This is considered as basic tariff). This tariff is added as a bonus to the initial tariff described below.

A tariff of 8.93 cents per kilowatt-hour will be paid in the first five years after the installation is commissioned (Known as initial tariff). This period will be extended by two months for each 0.75 percent of the reference yield by which the yield of the installation falls short of 150 percent of the reference yield. The