

Feed-in Tariff Contract Schemes in Oligopoly

Luciana Barbosa^a, Artur Rodrigues^b, and Alberto Sardinha^a

^aINESC-ID and Instituto Superior Técnico, Universidade de Lisboa

^bNIPE and School of Economics and Management, University of Minho

June 26, 2018

Abstract

This paper presents a model to analyze three different types of feed-in tariff (FIT) contracts within an oligopolistic market structure. The FIT contracts are the minimum price guarantee, the premium price and the fixed price. The derivation uses an asymmetric Stackelberg model and a real options valuation model. With the model, we can find several interesting properties. First, we can identify the optimal time to deploy a renewable energy project. Second, we can find the value of FIT that maximizes the social welfare for each FIT design. Third, we can analyze the impact of the value of the FIT remuneration, volatility and duration of the contract on the investment threshold and the social welfare for each FIT design.

JEL Classification: L94, Q42, C72

Keywords: Asymmetric Stackelberg Equilibrium, Real Options, Feed-in tariff

1. Introduction

Creating incentives for renewable energy generation have been on the agenda of many governments for over 20 years. The aim of these incentives is to increase the production of renewable energy, which may lead to a more sustainable environment, reduce climate changes and increase the social welfare.

Policymakers have an important role in creating incentives for renewable energy generation. These incentives have a direct impact on the investment decision of a renewable energy project. According to Couture & Gagnon (2010), feed-in tariff (FIT) is the most popular incentive for stimulating new renewable energy projects. The key features of a FIT is the long duration of the contract (e.g., 20 years) and the price-based incentive.

Couture & Gagnon (2010) classify FIT policies into two groups according to the price-based incentive. Within the first group, the remuneration is independent from the electricity market price and is typically known as market-independent FIT. In the second group, a premium payment is added to the electricity market price, thus creating a premium-price policy or market-dependent FIT. Market-independent FITs are very popular policy schemes in many jurisdictions, because they create a lower risk investment condition. While market-dependent FITs present greater risks to investors, they also have embedded options that provide managerial flexibilities and may provide slightly higher income to investors.

This article presents an asymmetric Stackelberg model and a real options valuation model to analyze three FIT contracts within an oligopoly. The FIT contracts are the minimum price

guarantee (Barbosa, Ferrão, Rodrigues & Sardinha 2018), the premium price and a fixed price. The three policy designs have been presented in the work from Couture & Gagnon (2010). In addition, our model assumes that the FIT contracts have a finite duration, which is a more realistic assumption. We also analyze the impact of the value of the remuneration, the duration of the contract and the volatility on the investment threshold and social welfare.

References

Barbosa, Luciana, Paulo Ferrão, Artur Rodrigues & Alberto Sardinha (2018), ‘Feed-in tariffs with minimum price guarantees and regulatory uncertainty’, *Energy Economics* **72**, 517–541.

Couture, Toby & Yves Gagnon (2010), ‘An analysis of feed-in tariff remuneration models: Implications for renewable energy investment’, *Energy Policy* **38**(2), 955–965.