



Economic analysis of the profitability of existing wind parks in Portugal



Ivonne Peña^{a,b,1}, Inês Lima Azevedo^{c,*}, Luís António Fialho Marcelino Ferreira^{d,2}

^a Department of Engineering and Public Policy, Carnegie Mellon University, PA, United States

^b Instituto Superior Técnico, Lisboa, Portugal

^c Center for Climate and Energy Decision Making (CEDM), Carnegie Mellon University, PA, United States

^d Department of Electrical Engineering, Coordinator of Energy Scientific Area, Instituto Superior Técnico, Portugal

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ABSTRACT

Discussions on the appropriate policy design and level of incentive to promote renewable energy adoption and meet the 20/20/20 goals have spurred recently in the European Union. These discussions are also ongoing in Portugal, namely in what concerns the level and duration of feed-in tariffs that should be provided to independent power producers. This, in turn, raises the question of whether the past feed-in tariff levels were well designed to achieve the goals of a larger penetration of renewables in the Portuguese grid. The policies to induce wind adoption have led to a growth in wind installed capacity and share of electricity generated by wind in Portugal, but questions arise on their cost-effectiveness and whether alternative policy designs would have led to the same goal. In this work, we estimate profits made by wind independent power producers for wind parks that were connected in Portugal between 1992 and 2010, and conclude that the feed-in tariffs have overcompensated some wind power producers. We also discuss the recent changes in feed-in tariff legislation published in February 2013 and estimate the expected costs of the introduced changes.

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1. Introduction

Global wind power increased by 200 GW in the past five years. Just in 2013, the industry grew by 12.5%, due mostly to an increase in installed capacity in China and in Canada (GWEC 2014). Around the world, several countries so far have or had renewable tariff schemes. However, the design and implementation of such schemes vary substantially across countries both in terms of design and amount (Mendonça, 2007; Mendonça et al., 2009). For example, in Spain, a renewable electricity producer could choose between receiving a fixed price or a bonus on top of the spot electricity market price; in Denmark the tariff would correspond to a bonus on top of the electricity market price; and in Germany the incentive included a fix base tariff to which a bonus could be added (BMU 2011).

Portugal, too, has implemented mechanisms to incentivize the production of electricity from renewable sources. Today, wind accounts roughly for 20% of electricity generation. Wind power has been added to the grid since the late 1980s: since 1988 Portugal has a feed-in tariff (FIT) system, i.e., a guaranteed price for electricity generated from several renewable energy sources (Diário da República, 1988), including wind. The wind FIT scheme in Portugal was applied since the construction of the first wind park in 1992, and as of February 2013, FITs are guaranteed for the first 20 years of production or until the production of the wind park reaches 44 GWh per MW of installed capacity (Diário da República, 2013).

In Portugal, FIT values are defined according to a formula established by legislation. The amount is computed every month by the energy regulator (ERSE) for each independent power producer (IPP) according to several factors, such as inflation, avoided costs and environmental benefits.

The Portuguese wind policies and associated legislation have been changing over time, and so has the formula used to compute the monthly FITs provided to IPPs for wind and for other energy sources, and therefore the level of incentive that independent power producers obtained. Fig. 1 shows the four main laws where FIT formulas changed, as well as the reported average annual national FIT for wind over time.

As shown in Fig. 1, the annual national average FIT for wind (\$/MWh) decreased from 1992 to 1999 (all costs and benefits throughout the

* Corresponding author at: 5000 Forbes Avenue, Carnegie Mellon University, Department of Engineering and Public Policy, Baker Hall 129, Pittsburgh, PA 15213, United States. Tel.: +1 412 268 3754.

E-mail addresses: ipenacab@cmu.edu (I. Peña), iazevedo@cmu.edu (I. Lima Azevedo), lmf@ist.utl.pt (L.A.F.M. Ferreira).

¹ Address: 5000 Forbes Avenue, Carnegie Mellon University, Department of Engineering and Public Policy, Baker Hall 129, Pittsburgh, PA 15213, United States. Tel.: +1 412 515 9765.

² Address: Avenida Rovisco Pais 1, Instituto Superior Técnico, Torre Norte, Área Energia, Lisboa, Portugal 1049-001.

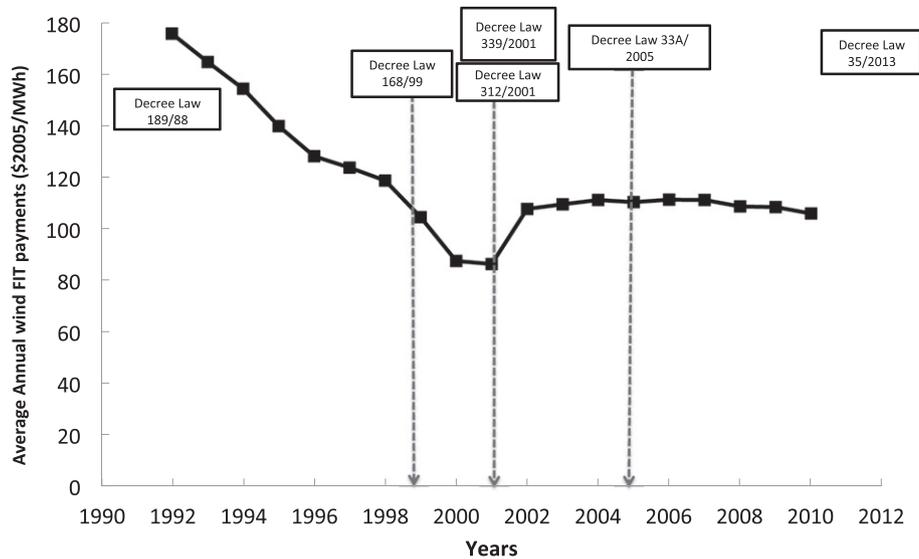


Fig. 1. Average annual wind FIT in Portugal over 1992–2010 (\$2005/MWh). Constructed using data from (ERSE, 2011).

paper are in dollars of year 2005. The euro-dollar exchange rate used was 1.24 euro/\$ for year 2005). In 1999, FIT values started to include environmental benefits that arise from avoided construction of additional fossil fuel power plants. Since 1999 until today, the FIT formula assumes that the carbon intensity of the Portuguese grid is of 370 g CO₂ per kWh (Diário da República, 1999) and that the externalities associated with CO₂ are valued at \$20 per metric ton of CO₂ (Diário da República, 2005).

In 2001, FIT started to differ by technology. Before 2001, a kilowatt-hour generated from solar energy received the same payment as a kilowatt-hour generated from wind energy (Diário da República, 2001). This change led to an increase in wind FIT of approximately 20%.³ Also in 2001, Decree-Law 312/2001 specified two public procedures for wind power producers to have connection rights: (1) a direct procedure in which parks individually ask for a connection license when the Directorate of Energy (called Direção Geral de Energia e Geologia, or DGEG, in Portuguese) establishes available connection points, and (2) a public tender in which specific criteria apply to grant connection licenses. About 3000 MW was granted up to 2005 under the 'direct procedure' specified in 2001, and 1900 MW was allocated between 2006 and 2008 according to the 'public tender procedure' that opened in 2005. In addition, Decree Law 339/2001 established that wind IPPs would pay 2.5% of the total revenue obtained from power generation to their respective municipality (Diário da República, 2001).

In 2005, the wind FIT was established for either 15 years or until producing 33 GWh per MW of capacity installed (Decree-Law 33A/2005). Oddly enough, the 2005 legislation also provided that all projects connected before 2005 had an additional 15-year period of FIT starting February 2005, regardless of the number of years they had been already operating and under the FIT mechanism. Therefore, according to Decree-Law 33A/2005, only by January 2020 will some wind parks be ending their FIT period.

The decree law in 2005 (33A/2005) established that after a 15-year period where IPPs are provided with a feed-in tariff, wind parks would start receiving the average annual spot electricity market price plus the value of green certificates⁴ those green certificates are available. If a

³ The FIT formula in 1999 and 2001 was the same except for a coefficient to differentiate renewable energy technologies. Assuming a capacity factor of 0.20, a given wind park would receive 23% more under the formula established in 2001 than under the formula established in 1999.

⁴ A green certificate is the name given in Europe to U.S. renewable energy certificates (RECs). In Portugal, these are certificates that are issued by the Grid Operator (REN) and can be traded in a separate market, leading to additional profits to renewable energy generators. Nevertheless, wind parks under the FIT system cannot trade green certificates.

green certificates scheme is not available when the FIT period ends, the FIT is to be extended for five additional years. Since 2012, wind IPPs, which are predominantly represented by the Portuguese Renewable Energy Agency (APREN), have been negotiating with the Energy Regulator (Entidade Reguladora dos Serviços Energéticos, or, ERSE, in Portuguese) a new remuneration scheme for the subsequent years. The motivation comes from the need to cut the National Electricity System (SEN) deficit, and is reinforced by the "Memorandum of understanding on specific economic conditionality" (MoU) issued by the Troika (European Commission, International Monetary Fund and European Central Bank), which expresses the need to limit the policy costs of renewables (EC, 2013a, 2013b; EC et al., 2013).

Recently, the Ministry of Economy and Employment called upon a redesign once again the FIT scheme and claimed that "not all the expenditures associated with the support of renewable energy generation technologies have been passed on to electricity consumers" (Diário da República, 2013), which could lead to an increase of the deficit of the National Electricity System (SEN) (Diário da República, 2013). Negotiations between the regulator and stakeholder groups resulted in the publication of a new legislation in 2013 that aims to reduce urgently part of the electricity system deficit. The 2013 legislation includes an annual payment to the regulator, and in exchange offers the opportunity to increase the period of the FIT payments. There are two levels of possible annual payments from the wind IPPs back to National Electricity System (SEN): a 'low payment' equal to \$6700/MW-installed and a 'high payment' equal to \$7500/MW-installed, either of which are paid annually for eight years. The 'low payment' offers a FIT extension of five years and the 'high payment' offers a FIT extension of seven years.⁵ This extension period starts in 2020 for old parks (connected on or before 2005). Parks connected after 2005 will keep receiving the current FIT of approximately \$105/MWh for 20 years or until the park produces 44 GWh of generation per MW of capacity installed – counted from the year of connection, instead of 15 years or 33 GWh, as previously established in 2005 legislation. Thus, the option to further extend the FIT for five or seven years in exchange of payments to the SEN is as well available to new wind parks, and the extension period starts counting between 2026 and 2029 depending on connection year (see Fig. 2 for details). The FIT offered for the additional period is designed to equal the level of spot electricity market prices. In any case, the levels of incentives are designed so wind power producers receive higher revenue than the

⁵ The terms 'low payment' and 'high payment' are not textual from the legislation, but are used by the authors to describe better its details.

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