Optimising the Floor Price and Balancing Payment in Renewable Energy Feed-In Tariff (REFIT) Scheme

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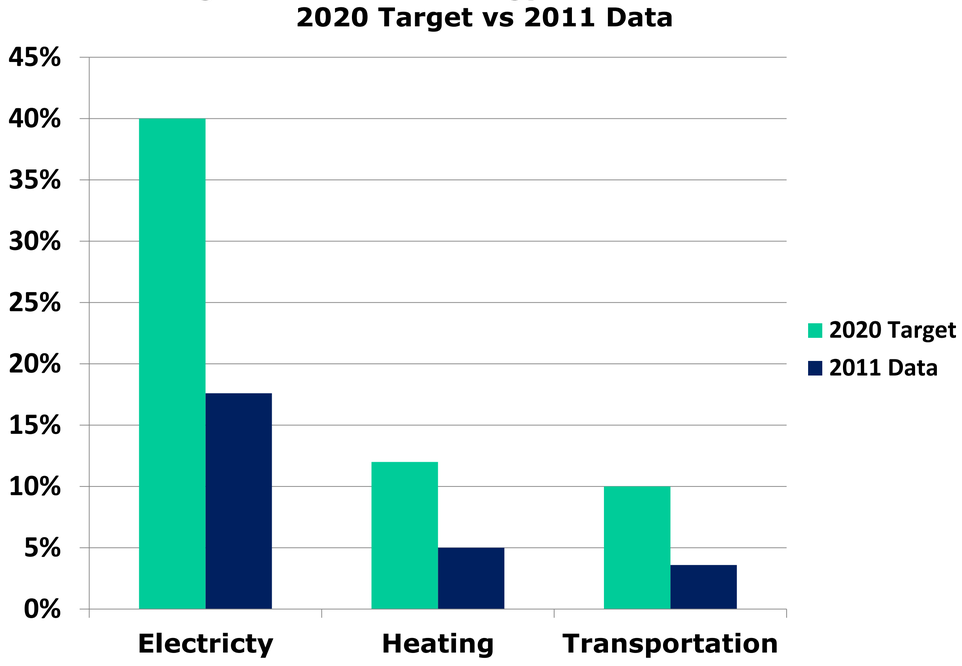
Introduction

Ireland has binding legal obligations to ensure that 16% of all energy consumed in Ireland is from renewable sources by 2020 (DCENR).

Fig. 1: Renewable Energy Share in Ireland: 2020 Target vs 2011 Data



In order to incentivise investment in renewable energy, Renewable Energy Feed in Tariff (REFIT) has been introduced.

REFIT has gone through revisions. REFIT 1 (1380MW), REFIT 2 (55 MW) and REFIT 3 (2MW). Our focus is on REFIT 1 because most of the wind farms are registered under this scheme.

The Problem

First to calculate the past and (estimates of) the future annual return for investments in wind energy based on the available data. Then use the data to optimise the REFIT guaranteed price.

$$\begin{cases} \text{minimize } K(i) \quad (\text{for } \; i = 1, \dots, N) \\ \text{Subject to:} \\ \sum_{i=1}^{N} \mathrm{W(i)}.\max(P(i), K(i)) \geq C_0 + \sum_{i=1}^{N} r(i)\, C_M(i) + \sum_{i=1}^{N} r(i) p(i) C_0 \end{cases}$$

where $K(i)$ is the REFIT price in time step i, $P(i)$ the Single Market Price (SMP), C_0 the capital cost, N total number of time steps, $C_M(i)$ the maintenance cost and $r(i)$ the interest rate and $p(i)$ the expected profit.

Methodology

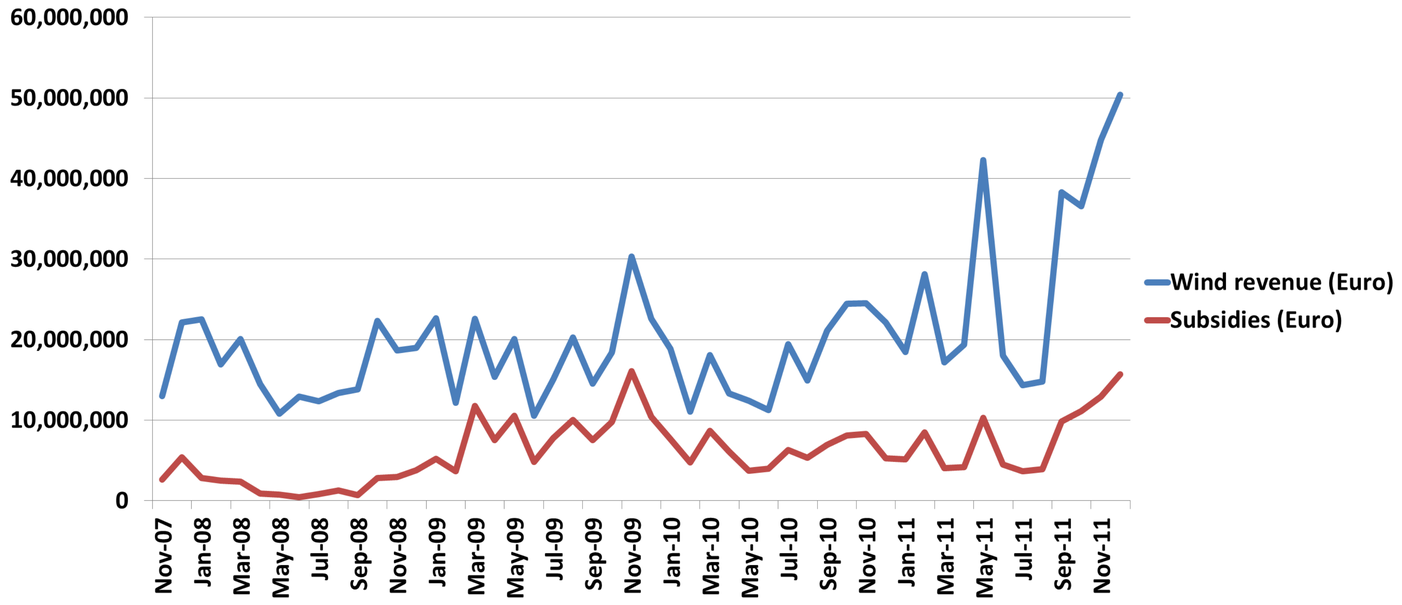


Fig. 2: Total Revenue of Wind Power Generation and the REFIT share (Nov. 2007-Dec. 2011)
data from Eirgird.ie and SEM-O.com

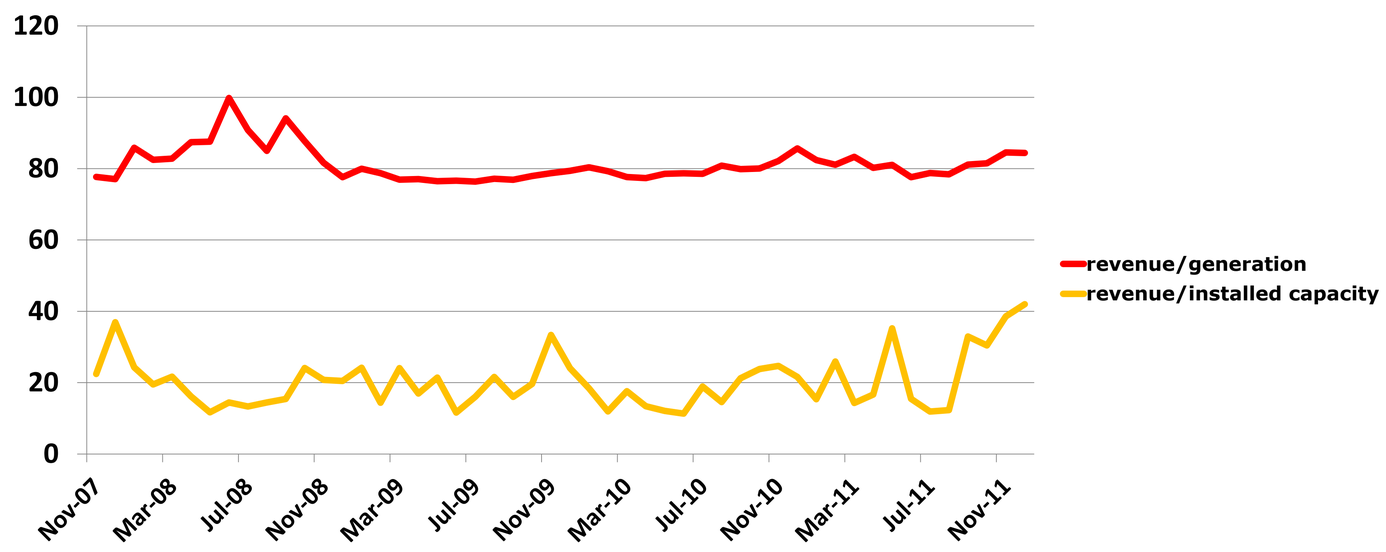


Fig. 3: Total revenue per MWh of wind Generation and per MWh of installed capacity (Nov. 2007 - Dec. 2011)
data from Eirgird.ie and SEM-O.com

- Between Nov 2007 and Dec 2011, in total 12,466,347 MWh of electricity was generated by wind energy. In this time period, €1,011,073,123 has been paid for wind power generation, of which €304,201,690 (30.08%) has been subsidies paid because of REFIT scheme.
- In this time period, on average, €81.26 is paid per MWh of wind generated electricity and €20.40 per MWh of installed capacity.
- There has been an average annual income of €178,695 per MW installed wind generation capacity.
- Assuming the capital cost of wind farms to be € 1 - 1.22 million per MW, the net return in the period of Nov.2007 – Dec 2011 has been 12.5% - 15.7% of capital cost each year.

Future Work

Since 2010, all new wind farms can only apply for REFIT 2. REFIT 2 is different from REFIT 1 in the balancing payment element. The effects of increasing share of REFIT 2 should also be considered for estimating future revenues.

Acknowledgement

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