

# The management of wind power output under a feed-in tariff model: the role of TSO

Céline Hiroux<sup>†</sup>, Florent Maupas<sup>‡</sup>

## ABSTRACT

### 1. Overview

For more than five years wind power has been boosted in Europe especially in countries such as Germany, Spain or Denmark. Each of these countries is using or used a feed-in tariff model as support mechanism to foster the development of renewable technologies. Support mechanisms have been widely studied in researcher community notably on questions relating to their compared efficiency regarding the installed capacity, the technological learning or their impacts on local industry and employment. Nonetheless, few of them analyse the impact of support mechanisms on the system operation.

The starting point of this paper focuses on one of the support mechanisms which is the feed-in tariff model, as the one widely used in Europe. The feed-in tariff requires that each kWh produced by a wind turbine and fed into the grid has to be purchased by a “final obliged party”, commonly the end users, at a fixed price. The dispatch priority is the other key feature when applying a feed-in tariff. In case of liberalised electricity markets, this power purchase obligation has to be born by other actors, which are called “delegated obliged party”. One of these potential “delegated obliged parties” is the transmission system operator, which is responsible of the general balance of the electric system. The main question of our paper concerns the ability of the TSO to manage this new task and the possibility for the TSO to behave strategically when balancing the wind power output produced under a feed-in tariff.

### 2. Methods

We first demonstrate that under a feed-in tariff model, neither the final obliged party nor the wind power producer can deal with the volume risk. Instead, the TSO becomes a “delegated obliged party” and manages this new task. For doing that, the TSO develops exchange schedules to pass on end-users (or suppliers) the true amount of wind power energy they have to purchase under the feed-in laws. This exchange schedule between TSO and final obliged parties has to imply (i) a mutualisation of priority production purchase costs, (ii) an internalisation of uncertainties due to priority production in order to deliver an ex-ante known quantity before the gate closure and (iii) the non-discrimination of buyers so that they equally contribute to the priority production purchase proportionally to their consumption.

Some options are available to define the exchange schedule in accordance to these characteristics. Depending on the chosen option, the shape of the exchange schedule is to be different.

---

<sup>†</sup> Céline Hiroux is Ph.D student at the University Paris XI, in ADIS Research Centre. Her dissertation is granted by both EDF and Atomic Energy Commission (mailto: [celhiroux@yahoo.fr](mailto:celhiroux@yahoo.fr))

<sup>‡</sup> Florent Maupas is Ph.D Student at both Supelec and University Paris XI, ADIS Research Centre. (mailto: [florent.maupas@supelec.fr](mailto:florent.maupas@supelec.fr))

### 3. Results

We show that an inadequacy between the exchange schedule and the realised wind power output requires the TSO to balance the schedules before the gate closure. In fact, if the choice of the shape of the exchange schedule is not arbitrary, it could have consequences on costs and benefits for the TSO due to the balancing realised before the gate closure.

In the case of the TSO is responsible for the volume risk of wind power, he will act as the other market participant. He will be able to participate to energy markets (forward and balancing). If we assume that the TSO is not a simple market participant but it is a much more informed participant, we could assume that this information asymmetry could leave some place for opportunistic behaviour.

### 4. Conclusions

We conclude that the management of wind power output under a feed-in tariff imposes to a “delegated obliged party” to deal with the volume risk of the wind power. The TSO in order to manage this task develops new tools called “exchange schedule”. An inadequacy between the exchange schedule and the realised wind power output requires the TSO to balance the schedules before the gate closure on energy markets. When realising this balance, the TSO as a much more informed market participant may adopt different strategies which could impact his costs and rents.

### Bibliography

- Ackermann, T, Andersson G, Soder, L, 2001, “Overview of government and market driven programs for the promotion of renewable power generation”, *Renewable Energy* 22 (2001), 197-204
- Bathurst, Graeme N., Weatherill, Strbac G, 2002 “Trading wind generation in short term energy markets”, in *IEEE transactions on power systems*, vol 17. NO. 3
- Dinica, V, 2003, *Sustained Diffusion of renewable energy*, Twente University Press, 2003
- Doherty, R, O'Malley, M, “Quantifying reserve demands due to increasing wind power penetration”. Presentation at *IEEE Bologna PowerTech conference, Bologna. 23-26 June 2003*.
- Garcia-Cebrian, L.I, 2002, “The influence of Subsidies on the production process: the case of Wind Energy in Spain”, in *The Electricity Journal*, May 2002
- Huber, C; Ragwitz, M 2004, “Feed-In Systems in Germany and Spain and a comparison”, Working Paper, Fraunhofer Institute Systems and Innovation Research, 2004
- Mitchell, C, Bauknecht, D, Connor, P-M, “Effectiveness through risk reduction: a comparison of the renewable obligation in England and Wales and the feed-in system in Germany”, *Energy Policy, Article in press*
- Neuhoff, K; Butler, L, 2004, “Comparison of Feed-In Tariff, Quota and Auction Mechanisms to support Wind Power Development”, *Cambridge Working Papers in Economics CWPE 0503, CMI Working Paper 70*
- Sacharowitz, S, 2003 “Managing Large Amounts of Wind Generated Power Feed In – Every Day Challenges for a German TSO and Approaches for Improvements”