Comparing Feed-In Tariffs and Renewable Obligation Certificates - The Case of Repowering Wind Farms

Tim Mennel[1], Teresa Romano[2], Sara Scatasta[3]

[1]DNV KEMA Energy & Sustainability, Bonn, +49 228 44690 54, tim.mennel@dnvkema.com
[2]Politecnico di Milano, teresa.romano@coleurope.eu
[3] Chair of Development Policy, University of Hohenheim, Germany, scatasta@uni-hohenheim.de

(1) Overview

The promotion of renewable energy is at the top of the political agenda in many developed countries. Environmental and energy security concerns lead governments to adopt support programs to increase the share of renewable energy in total energy consumption. Two main policy instruments emerge: renewable energy quotas and feed-in-tariffs. Under a quota system, such as Britain's Renewable Obligation Certificates (ROC), each producer of electricity has to certify that a fixed quota of his electricity stems from renewable energy sources. Certificates are tradable, their price is capped. Feed-in-tariffs (FIT), applied e.g. in Germany, guarantee a certain price for electricity produced from renewable energy plants for a limited time horizon. Both instruments aim at encouraging investment into renewable energy production. This paper compares the two instruments with respect to their ex-ante effectiveness in promoting the adoption of innovative technologies, applying the model framework to the case of repowering wind farms.

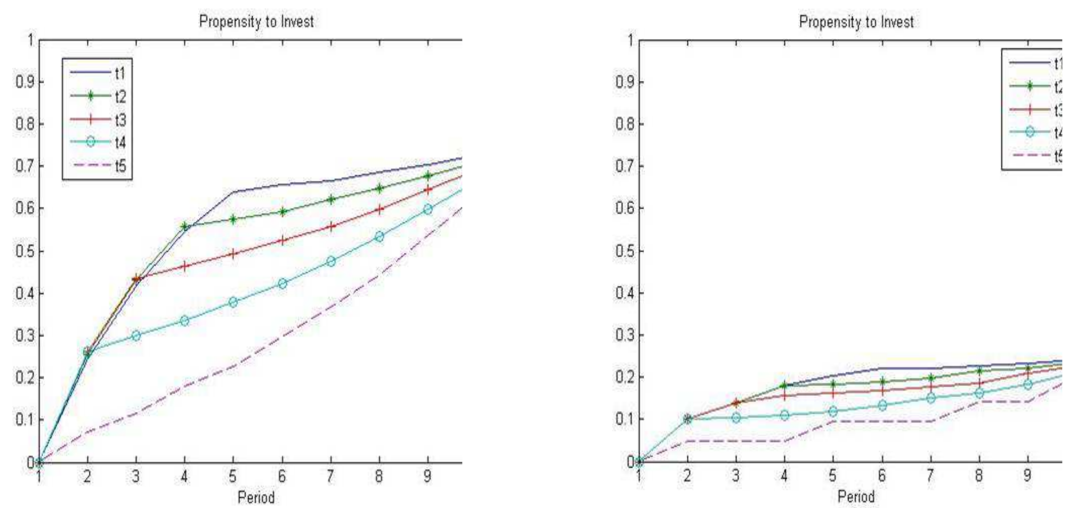
(2) Methods

The conventional modelling framework for large investment decisions is net present value (NPV). Implicitly, the NPV approach is also used in existing studies on renewable energy policy, such as Butler and Neuhoff (2005). Because NPV is based on future cash flows, it fails to account for the value of flexibility, i.e. the value of the option to postpone investments to a later point in time. The value of this option is particularly relevant for investment decisions that are taken under a high degree of uncertainty about key economic variables, such as prices or quantity demanded. Real option theory studies investment decisions under uncertainty and irreversibility (cf. Dixit and Pindyck 1994). This framework has been applied to investment decisions in energy economics (cf. e.g. Hlouskova et. al. 2005), in particular to investments into renewable energy plants: They are usually taken under uncertainty, mainly of prices and of the pace of technological change, and involve irreversibility, as most costs in building a (renewable) power plant are sunk after its construction. In our model, we adopt a real option framework. Two sources of uncertainty are depicted: uncertainty with respect to prices of investment (capital), and uncertainty with respect to electricity prices. In contrast, technological progress of wind farms is deterministic. The model is calibrated on German data for wind plants. In our analysis we introduce the variable propensity to invest as a way to measure the likeliness of an owner to repower his wind park with a new technology.

(3) Results

The analysis shows differences between the two policy instruments, as depicted in Figure 1: Our general result is that the owner is more likely to adopt a new technology FITs than under ROC. Furthermore our results show how the propensity to invest varies with the age of the plant and state of technology. However, even a small positive variation in electricity price volatility increases the propensity to invest under ROCs. In contrast, we find that increases in capital cost volatility do not affect the likelihood to repower wind farms under either policy.

Figure 1: Benchmark case: Propensity to invest unter FITs (a) and ROCs (b).



(4) Conclusions

The analysis of the model highlights one aspect in the comparison between the two main support instruments for renewable energy: the effect of price uncertainty on the willingness to adopt new technologies. For the case of repowering wind farms the results show that the certainty provided by Feed-in-Tariffs promotes innovative investment. This adds a new and important aspect to a debate over Feed-in-Tariffs versus Quota Systems that often focuses on the cost of their technology specific versus technology neutral nature. Future research should focus on a joint analysis of both aspects.

References

1. Butler, L. and K. Neuhoff (2004) “Comparison of Feed-in-Tariff, Quota and Action Mechanisms to Support Wind Power Development”, CMI Working Paper 70
2. Dixit, A.K., and R.S. Pindyck (1994) “Investment under uncertainty”, Princeton University Press
3. Hlouskova, J., Kossmeier, S., Obersteiner, M. and A. Schnabl (2005) “Real options and the value of generation capacity in the German electricity market”, Review of Financial Economics 14