RESPONSIVE ADJUSTMENT OF FEED-IN TARIFFS TO DYNAMIC PV TECHNOLOGY DEVELOPMENT

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Overview
This paper reviews the experience with the adjustments of the feed-in tariff for new solar photovoltaics (PV) installations in Germany, so as to deliver the annual deployment target level in the presence of dynamic PV system price developments. The National Renewable Energy Action Plan of the German government targets the installation of 52 GW of PV power generation capacity in Germany by 2020, with annual targets of 3.5 GW. However, in both 2010 and 2011 yearly PV deployment was around 7.5 GW. As PV system prices declined rapidly over the last years, the German government implemented automatic mechanisms to adjust the support level for new installations in response to deployment volumes. This paper develops an analytic model to simulate weekly installations of PV systems ≤30 kW (35% market share in 2010) based on project profitability and duration. The model accurately replicates observed market developments, and can be used to compare different policy designs. To illustrate this, the competing proposals that had been discussed in 2011 are simulated. A robust choice must perform well against multiple scenarios for future PV system prices. The analysis shows that adjustment schemes with more frequent tariff reductions would have reached deployment targets in 2011 more effectively.

Methods
The deployment effectiveness of a feed-in tariff scheme is analyzed using a simple model based on only three factors impacting deployment:
(i) Deployment increases proportionately with project profitability.
(ii) Profit expectations of investors decrease every year.
(iii) In periods prior to a feed-in tariff reduction, project implementation accelerates to still receive the higher tariff.

During the political discussions in 2011, three options for the design of the adjustment mechanisms were brought forward by different political parties. These are discussed based on the calibrated model, so as to explore the implications of different design choices. Moreover, the designs are tested against different potential system price scenarios.

Results
Despite the differences between the individual feed-in tariff adjustments since 2009, the market responded in a similar manner in all cases. In periods prior to feed-in tariff reductions, the numbers of installations peaked as investors aimed to still qualify for the higher tariff level. In this regard, larger projects are usually more responsive to changing support schemes.

The analytic model introduced in this paper is able to simulate the evolution of new PV installations and feed-in tariffs on the basis of observed PV system prices. Model results show that demand responds very quickly to declining system prices. The larger profitability leads to increasing installation numbers. The demand peaks result from accelerated projects which are completed in the last week before a feed-in tariff reduction.

Within the scenarios assessed, the current feed-in tariff design is the least effective in reaching the German annual installation target, as it is not able to adjust quickly enough to compensate for rapidly changing system prices. Alternative design options with more frequent adjustment mechanisms would follow these price evolutions more closely and thereby match deployment target levels more effectively.

Conclusions
The model is used to analyze various policy design options in different PV system price scenarios. Simulation results show that: (i) the feed-in tariff adjustment mechanism implemented in 2011 is not effective in reaching the German annual installations target; (ii) constant tariff reductions on a quarterly basis would have better matched target levels in 2011, but face the challenge of predicting future price reductions; (iii) a flexible adjustment mechanism with more frequent tariff reductions would reach target levels most effectively.

The experience of the last years shows that demand behaves according to simple rules. Based on these rules, individual feed-in tariff adjustment proposals can be tested to identify mechanisms that are robust to different PV system price developments. Moreover, the adjustment frequency of the feed-in tariff has to be increased to better correspond to the short project durations of small-scale systems.

References

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