ASSESSING THE IMPACT OF RENEWABLE SUPPORT POLICIES – MODELLING INVESTORS AND INVESTMENT DECISIONS

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Overview

One key issue for renewable energy policy design is the estimation of possible impacts of specific support mechanisms such as FITs or quota systems. To forecast the impact of different promotion schemes one has to be able to predict future investment in renewable energies. Most models which are aiming on modelling investments in the energy sector focus on the assessment of the profitability of possible investments. This means capital demand is modelled but since every profitable investment is realized there is no consideration of capital availability and capital supply among the different investor groups. Every investment decision in reality is linked with a matching of capital supply and demand. Thus to model investment decisions in renewable energies it is necessary to model both aspects. In the proposed model, capital demand is described as function of the profitability of different renewable energy investments and the associated risk. The corresponding capital supply is dependent on the development of the financial resources of the investors and their requested return on investments. The model is used to assess the future development of renewable energies in Germany under different support schemes and allows to compute key figures like renewable energy production, installed capacity, investment volume and height of the renewable surcharge.

Methods

As on other markets, capital supply is expected to be an increasing function of the price of capital, i. e. the interest rate or expected return on investment. A parsimonius yet realistic model is needed to describe the investment behavior of different investor groups dependent on the profitability of the investment alternatives. Therefore a piecewise linear capital supply function is designed. It is characterized by three key parameters: the minimum profitability required for any investment (the so-called hurdle rate), the maximum available capital and the level of profitability necessary to make full use of the available capital. Because investors are heterogeneous the capital supply represented by the investment function has to be modelled separately for the different investor groups considered (e.g. private households, farmers, insurance companies).

Capital demand for renewable investments is conversely a decreasing function of the price of capital, because under a given regulation and market environment only few projects will achieve high returns on investment. In order to achieve again a parsimonius, manageable model, the profitability of an investment is assessed by the risk-adjusted internal rate of return (IRR). With growing investments in renewable energies best sites are already employed. Any further investment can only be taken in a site with less full load hours or respectively higher investment costs leading in any case to a lower IRR. Therefore functions similar to cost potential curves are implemented for most of the 18 included investment alternatives. For each investment alternative the IRR is calculated taking into account detailed information on the revenues depending on the policy support mechanism and market environment as well as technical and application characteristics like full-load hours and possible self consumption. The corresponding cost are derived using CAPEX, OPEX, depreciation time, physical lifetime etc.

The introduced modelling of capital supply and demand leads to an equilibrium solution, which may be computed in a dynamic recursive manner for a sequence of future years.

Results

The impact of support schemes in energy markets can be measured in various dimensions. When it comes to the promotion of renewable energies key impacts are the annual electricity generation, necessary investments and the costs to society (measured notably through the height of the renewable surcharge for electricity consumers). The developed model is used to forecast the development of renewable energies in Germany until 2030 with a focus on these key impacts. By modelling different support schemes it is possible to compare the influence of these promotion schemes on the electricity market. Preliminary results cover the German feed-in tariff EEG 2012, a renewable energy premium and a renewable energy quota scheme. For the EEG 2012, there are also some sensitivity analyses on the influence of several input parameter like central bank interest rates on the results

The highest investment in renewable energies is observed with the conventional feed-in tariff. Because of a missing adjustment of regulation we see an overachievement of the German goals. Under the considered premium scheme, similar to the EEG 2014, the support level adjusts as a f unction of the growth of renewable energies. Therefore only a temporary overachievement of policy goals is observed in this scheme and the amount of investment is lower. The quota is the mechanism with the lowest investment volume due to the fact that there is no overshooting of pre-established targets (as with the planned reform of the EEG 2017) and no technology-specific support. This is accompanied by a similar ranking in social costs of policies. In our calculations the capital resources in all three mechanisms are sufficient to realise all profitable investments.

Conclusions

The developed model is a usefull tool to forecast the investments in renewable energies by different investor groups depending on the policy support mechanism and the development of the market environment. The capital demand and supply is modelled which implies the advantage of a possible shortcoming of capital in the market. Among other things this allows a consideration of risk which is crutial when comparing the impact of different support policies. Furthermore the model is able to indicate impacts of different support policies on the development of renewable energies. In later work further support policies, investor groups or technologies could be implemented.

While no absolute statements can be made based on previous calculations the results indicate that cost-efficiency of the promotion of renewable energies is strongly supported by technology-unspecific promotion which is adjusted as a result of the observed growth of renewable energies. Sensitivity analyses demonstrate a high robustness of the model results against variation of single input parameter like central bank interest rates.