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Promoting the market and system integration of renewable energies through premium schemes—A case study of the German market premium

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HIGHLIGHTS

- Premium schemes are used to align renewable energy sources (RES) with market signals.
- We examine the effectiveness and efficiency of the German market premium scheme.
- Participation in direct marketing has increased, but so have support costs.
- For intermittent RES, incentives for demand-oriented production are insufficient.
- Efficiency gains from exposing RES to market risks entail several trade-offs.

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ABSTRACT

With the share of renewable energies within the electricity sector rising, improving their market and system integration is of increasing importance. By offering plant operators a premium on top of the electricity market price, premium schemes represent an option to increase the alignment of renewable electricity production with market signals, and have been implemented by several EU member states. This paper examines the case study of the German market premium scheme adopted in 2012. Building on an evaluation of early experiences, we discuss whether the market premium contributes to the aims of market and/or system integration (effectiveness), and what potential efficiency gains and additional costs of "administering integration" are associated with it (efficiency). While exposing renewables to price risks is not the scheme's purpose, it has successfully increased participation in direct marketing. However, risks of overcompensating producers for marketing and balancing costs are high, and the benefits of gradually leading plant operators towards the market are questionable. Incentives for demand-oriented production are established, but they seem insufficient particularly in the case of intermittent renewable energy sources. To conclude, we provide an outlook on alternative designs of premium schemes, and discuss whether they seem better suited for addressing the challenges ahead.

1. Introduction

Renewable energy sources (RES) are rapidly outgrowing their status as niche technologies, as member states strive to meet the EU Renewable Energy Directive's 2020 target and national long-term targets (Eclareon and Öko-Institut, 2012; ECN, 2011). In Germany, for example, the Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz, EEG) aims to increase the share of RES in electricity supply to at least 35% by 2020, rising up to 80% by 2050 (sec 1 (2) EEG 2012). However, substituting a centralised energy system based on large-scale, base-load power plants for a mix of predominantly small-scale, decentralised renewable energy technologies, in which intermittent energy sources like wind and photovoltaics (PV) play an important role, poses considerable challenges (BMU, 2011; Neubarth, 2011; Hiroux and Saguan, 2010). Both for grid stability and the economic efficiency of electricity provision, effective short- and long-term market signals to producers are important, because they provide incentives for demand-oriented and efficient deployment of existing plant

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capacities as well as for investments in increasing the flexibility of electricity production. At the same time, most RES technologies are not yet competitive at current market prices and still require public support, posing the question of how to align RES production with market signals, while providing adequate incentives for investment.

Technology-specific feed-in tariffs have proven to be a successful instrument for promoting the expansion of renewable energies (Haas et al., 2011; Mitchell et al., 2006; Ragwitz et al., 2007). However, in combination with priority purchase and transmission rules, publicly administered feed-in tariffs also shield renewable energy producers from both price- and quantity-related market signals (Brandstätt et al., 2011; Wustlich and Müller, 2011). For achieving a cost-effective mix of energy sources, renewable energy technologies cannot remain permanently detached from competition. The necessity to align investment and production decisions with scarcity signals gives rise to the *challenge of market integration*, i.e. the inclusion of RES in the allocative processes of the electricity market through an equilibrium electricity price valid for all energy technologies.[1]

Additionally, security of supply considerations require that grid stability is ensured at all times. However, electricity production which is independent from demand and, in the case of wind and solar power, also intermittent, imposes additional burdens on grid stability. At the same time, the balancing costs for other components of the energy system increase, reducing the system's overall cost efficiency. For example, with the rising share of RES in Germany's energy mix, an increase in regional grid congestions and voltage fluctuations can already be observed, necessitating short-notice interventions by Transmission System Operators (TSOs) (cf. Brandstätt et al., 2011; Borggrefe and Nüßler, 2009; TenneT, 2012; 50Hertz, 2012). Moreover, particularly in the case of wind power, the coincidence of high production levels with low demand can cause negative price spikes at the electricity exchange, which can involve significant economic costs (Brandstätt et al., 2011; Andor et al., 2010; Nicolosi, 2010). The rising importance of RES therefore brings about the additional *challenge of system integration*, i.e. renewables must accept responsibility for grid stability, provide balancing services, and align production with demand to a greater extent. Lastly, a fundamental question is how to design the *institutional transition* from a market introduction regime to a systemically integrated market price regime.

As a potential policy option for addressing these challenges, premium schemes which offer RES producers a premium on top of the electricity market price have been implemented by several EU member states in recent years (Eclareon and Öko-Institut, 2012; RES LEGAL, 2012). However, the design of such schemes varies considerably, as does as their importance within national policy mixes for renewable energy support (cf. Kitzing et al., 2012). As an example of a sliding premium scheme, this article examines the effectiveness and efficiency of the German market premium scheme, which was introduced in the 2012 amendment of the Renewable Energy Sources Act (EEG 2012). The aim of the so-called "Marktprämie" (market premium) is to provide market experience to renewable plant operators and incentives for demand-oriented electricity production (Fraunhofer-ISI et al., 2011). At the same time, the former feed-in tariff regime remains in place, because direct marketing may prove challenging for some RES plants (e.g. small-scale installations) (Fraunhofer-ISI et al., 2011). As an optional, i.e. parallel, component for integration, the market premium does not aim for a fundamental change in the renewable energy support system, but is intended to prepare the ground for a future transition to a market-based regime.

Building on an evaluation of early experiences, we discuss whether the German market premium scheme in its current design improves market and/or system integration. First, the design and objectives of the scheme are introduced, followed by an assessment of its performance along three dimensions: (1) uptake of the scheme and effects on participation in direct marketing; (2) the instrument's suitability to contribute to its objectives in principle (effectiveness); and (3) potential efficiency gains and additional costs of "administering integration" (efficiency). To conclude, we provide a brief outlook on alternative designs of premium schemes, and discuss whether they seem better suited for addressing the challenges ahead.

2. The market premium scheme in the Renewable Energy Sources Act 2012

2.1. Design of the German market premium scheme

Since 01.01.2012, when the Renewable Energy Sources Act 2012 (EEG 2012) came into force, RES plant operators can choose between receiving a fixed feed-in tariff (FIT) and a sliding market premium on a monthly basis (Lehnert, 2012; Wustlich and Müller, 2011). Alternatively, if certain requirements are fulfilled, electricity suppliers can directly market RES electricity and benefit from a reduction of their EEG surcharge (i.e. the surcharge suppliers pass on to their customers to finance the EEG feed-in tariffs) (sec 39 EEG 2012). Also, RES producers can choose to directly market their electricity without receiving any reimbursements, although they still benefit from priority transmission and grid access rules (sec 33a et seqq. EEG 2012). Whereas in the FIT scheme, TSOs are responsible for selling RES electricity on the spot market (cf. Bundesnetzagentur, 2010), plant operators choosing the premium scheme or other forms of direct marketing have to market their electricity themselves. In the market premium scheme, producers are paid the difference between the feed-in tariff a plant would be entitled to and the average market value of the electricity generated. Moreover, they receive a management premium intended to cover additional costs resulting from their direct participation in the market, e.g. balancing costs incurred when actual production deviates from forecasts, and costs for handling

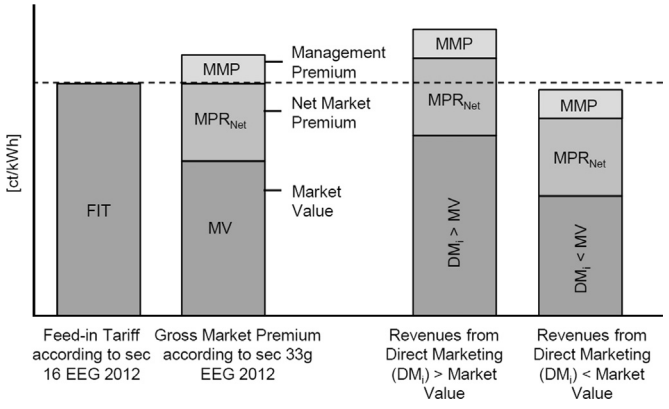

Fig. 1. Overview of the German market premium scheme.
Source: Own illustration, based on Lehnert, 2012; Wustlich and Müller, 2011; EEG 2012 annex 4 no. 1.

[1] For energy-only markets, we define the equilibrium price as the uniform marginal cost-based price resulting hourly at the electricity exchange from the balance between supply and demand. However, the challenge of market integration of RES remains relevant for alternative market designs, such as combinations of energy-only and capacity markets (cf. Kopp et al., 2012); in the latter, the equilibrium price would be capacity-related.