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Agenda

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Almost a reform: the new German support scheme for renewable electricity

After protracted negotiations with the European Commission and an intense national debate, the German renewable energy law has come into force (EEG 2014). It comes at a time when the German large-scale transition to renewable electricity production (the *Energiewende*) is beset by rising costs and fading popular support. What are the principal features of the EEG 2014?

Generation from renewable energy sources now accounts for a quarter of Germany's total electricity generation. Prior to the EEG 2014, German energy legislation sought to promote the development of niche technologies. In contrast, this latest reform aims to stabilise the pace at which new renewable generation capacities are being built and to contain the costs of subsidies. All generators in central Europe, including conventional electricity generators, will be affected, as the new law has implications for the future shape of electricity markets beyond Germany.

The EEG 2014: what's new?

The investment in renewable electricity generation continues to be promoted by a system of guaranteed fixed feed-in tariffs (FiTs). Network operators are required to sell the electricity fed in by small generators on the electricity spot market, while large generators sell their output directly. Because FiTs are higher than spot prices, the difference must be financed by a 'surcharge' (with the effect of a tax) borne by the end-consumer. Eligible electricity-intensive firms are exempt from the surcharge, which increases the cost burden for the remaining consumers (see the box overleaf).

Rising costs and no CO_2 reduction

Adjusting the FiTs upwards or downwards affects the electricity surcharge in three ways. First, there is a direct price effect. Higher or lower tariffs translate into higher or lower surcharges, all else being equal. Second, there is a volume effect. Experience suggests that increasing or decreasing tariffs is an effective way to control capacity additions. The third effect is seen in the merit order. Increasing renewable electricity output volumes reduces the residual demand on the wholesale electricity markets left to be supplied by conventional generation. This reduces the wholesale price in the short run and increases the spread between the market price and the FiT, such that the surcharge rises. On balance, these effects should result in higher end-user prices.

Due to the merit-order effect, environmentally friendly and highly efficient combined-cycle gas-turbine (CCGT) units with higher marginal costs than coal or lignite units are dispatched less frequently. Conversely, German (European) mid-merit hard coal- or lignite-fired units operate at ever-higher annual load factors. This has been much criticised given the inconsistency with the original decarbonisation premise of the EEG regime. Instead of directly targeting the reduction of CO_2 emissions via high carbon prices, the EEG promotes some new technologies with low emissions but fails to make use of the opportunities to reallocate conventional capacity.

The rising surcharge has previously been accompanied by increasing exemptions for energy-intensive industries, which accelerated the surcharge increase. Figure 1 overleaf shows that the total support has reached a substantial volume of €21.7bn.

Less generous FiTs but unchanged support periods

FiTs guarantee a 20-year fixed price per kWh of electricity. The 'degression' rate means that a unit that is commissioned, say, one year later receives a lower FiT (but, again, constant over 20 years).

Although this remains the principle under the EEG 2014, the system has been amended by the 'market premium approach' (see below). This means that, except for some small-scale technologies (e.g. small hydro power),

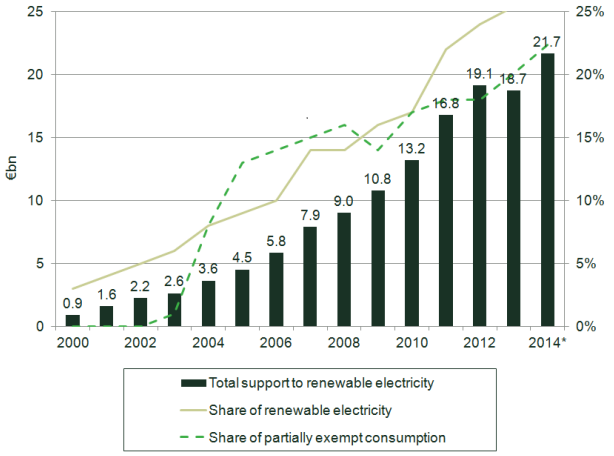
renewable generators no longer receive fixed payments under the FiT regime. Instead, generators have to sell their electricity on the electricity market and receive a market premium in addition to their market revenues. FiTs are, however, still meaningful, as they are the reference for the market premium. Table 1 overleaf shows FiT levels and structures under the EEG 2014 compared with the EEG 2012.

FiT levels for new plants decrease at a specified rate. This degression is intended to reflect declining investment and operating costs for new capacity, due to technological progress and learning effects. Once a plant has been built, the FiTs remain fixed for 20 years.[1] The rate of degression is lower under the new EEG, which reflects policymakers' assumption that solar and wind power are mature technologies whose CAPEX and OPEX are not likely to decline significantly. Degression rates are adjusted to ensure that capacity additions remain within certain volume caps and floors (see below).

Two different FiTs apply for wind power. By default, a high tariff is applicable in the first five years of operation. Wind plants at less favourable locations can command this high FiT for a longer period to compensate for lower revenues. The low FiTs (in brackets in Table 1) then apply for the remaining (shorter) support period.

As can be seen from Table 1, wind FiTs have mostly increased slightly, while solar FiTs are much lower under the EEG 2014, even taking into account the degression of old tariffs. Hydro power and biomass are supported with various FiTs, but, due to geographical circumstances and environmental concerns, neither of these is likely to have a significant impact on electricity generation.[2]

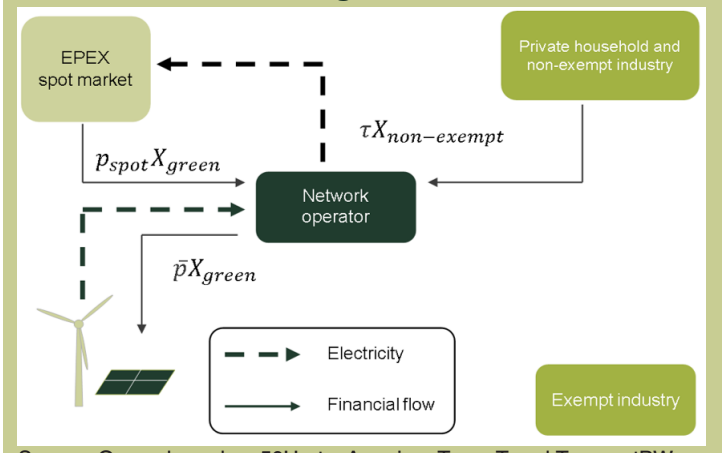
Figure 1 Financial support and renewable electricity generation



Note: * Forecast data for total support and share of exempt consumption in 2013 and 2014 based on 50Hertz, Amprion, TenneT and TransnetBW (2014), 'EEG-Umlage 2014'.

Source: Oxera, based on Bundesministerium für Wirtschaft und Energie (2014), 'Zeitreihen zur Entwicklung der Erneuerbare Energien in Deutschland', Table 5. EEG surcharge from BDEW (2014), 'Erneuerbare Energien und das EEG: Zahlen, Fakten, Grafiken'.

How the EEG surcharge is calculated



Source: Oxera, based on 50Hertz, Amprion, TenneT and TransnetBW (2013), 'Prognose der EEG-Umlage 2014 nach AusglMechV. Prognosekonzept und Berechnung der Übertragungsnetzbetreiber. Stand 15.10.2013'.

According to (unchanged) secondary legislation,[1] the EEG surcharge is determined as follows:

$$\tau = \frac{1.1\left[\overbrace{\bar{p}X_{green}}^{support} - \overbrace{p_{spot}X_{green}}^{market\ \ revenue} + c\right] + \Delta}{X_{non-exempt}}$$

where $\bar{p}$ is the volume-weighted guaranteed fixed FiT;[2] p_{spot} is the PHELIX price for baseload-year futures at the European energy exchange EPEX for the particular year; X_{green} is the volume (in kWh) of renewable electricity generation fed into the grids; and $X_{non-exempt}$ is the electricity volume (in kWh) of consumption by non-exempt end-users.[3] Additional costs c comprise interest costs and administrative costs. The surcharge is a year-ahead planned value, so electricity generation and consumption outputs are year-ahead estimates. The estimates are provided by the four German electricity transmission network operators. A factor of 1.1 is applied to create a 10% liquidity buffer to hedge for unforeseen developments.[4] Because the formula is based on planned values, it includes the term Δ to true up deviations of planned versus actual volumes and prices.

The total annual cost of support is €21.3bn in 2014. The respective surcharge τ amounts to 6.24 cent/kWh for non-privileged end-users:

$$\tau = \frac{1.1[€21.3\ 10^9 - €2.2\ 10^9 + €4.2\ 10^8] + €2.2\ 10^9}{3.779\ 10^{11}\ kWh} = €0.0624/kWh$$

Note: [1] See 50Hertz, Amprion, TenneT and TransnetBW (2013), 'Prognose der EEG-Umlage 2014 nach AusglMechV. Prognosekonzept und Berechnung der Übertragungsnetzbetreiber. Stand 15.10.2013'.
[2] FiTs are differentiated according to technology, so $\bar{p}$ denotes the volume-weighted average of technology-specific FiTs. In addition, FiT levels depend on the time (year) of commissioning. The quantity $\bar{p}X_{green}$ takes this into account. For ease of notation, this is omitted here.
[3] Since large industrial consumers are partially exempt from paying the surcharge, this volume is computed to represent the consumption necessary to generate equivalent revenues based on estimated consumption brackets. [4] A minor part of the additional costs, c, is not included in the amount that is used to determine the liquidity buffer. This is omitted here for ease of notation.

Table 1 FiTs for 2014 and 2012

	Nominal FiTs (€ cents/kWh)		
	EEG 2012	EEG 2014	Provisions
	2012 tariff	2014 tariff	
Solar power			
0–10kW	19.50	13.15	If the target of new capacity is exceeded, FiTs will be reduced by up to 2.8% per month. Large-scale greenfield solar power plants are not subject to the FiT regime
10–40kW	18.50	12.80	
40kW–1MW	16.50	11.49	
1–10MW	13.50	9.23	
Degression p.a.	–11.8%	–5.8%	
Wind power			
Onshore	8.93 (4.87)	8.90 (4.95)	Producers can command the higher FiT for a period of five years. If the actual yield is comparatively low, the high FiT applies for a longer period
Degression p.a.	–1.5%	–1.6%	
Offshore	15.00 (3.50)	15.40 (3.90)	
Degression p.a.	–7.0%	–3.2%	
Hydro power			
Max./min.	12.70/3.40	12.52/3.50	FiTs are differentiated according to size to reflect economies of scale
Degression p.a.	–1.0%	–0.5%	
Biomass			
Max./min.	14.30/6.00	13.66/5.85	FiTs are differentiated according to size to reflect economies of scale
Degression p.a.	–2.0%	–2.0%	

Source: Oxera, based on EEG 2014 of 21 July 2014 and EEG 2012 of 20 December 2012.

As can be seen in Table 1, depending on the technology and unit size, FiTs for new units will generally be lower than 13 cent/kWh (apart from offshore wind in the early years). This is still high relative to the wholesale electricity prices, but lower than the 15 cent/kWh paid on average to existing capacities as of 2014.[3] Because large-scale plants, which are generally supported with lower FiTs, make up the bulk of newly added capacity, the cost of newly installed renewable electricity is likely to be around 10 cent/kWh, on average, in 2014. Thus, high FiTs for small plants do not greatly influence average costs.

The tariff discrimination is intended to support the respective technologies. The EEG 2014 shows that the German government has successfully advocated technology-specific support and pushed back the European Commission's economic efficiency argument for promoting least-cost technologies.[4]

Control of capacity additions is a new factor under the EEG 2014

The EEG 2014 sets out two main objectives with regard to renewable electricity supply.[5] First, it specifies that the share of renewable electricity should be 40–45% by 2020, and 55–60% by 2035. Second, the legislation establishes technology-specific annual growth targets for newly added capacity. For instance, the target for solar power and onshore wind is 2.5GW per year, while it is only 100MW per year for biomass. Furthermore, the government aims to encourage investment in 6.5GW of offshore wind capacity by 2020, and 15GW by 2030.

To ensure that these annual capacity targets are met, the government has put in place an automatic capacity growth mechanism by adjusting the FiTs ('breathing caps'). Any deviation of the actual from the target capacity will trigger an automatic adjustment of the degression rate to encourage or discourage future investment, as necessary.[6]

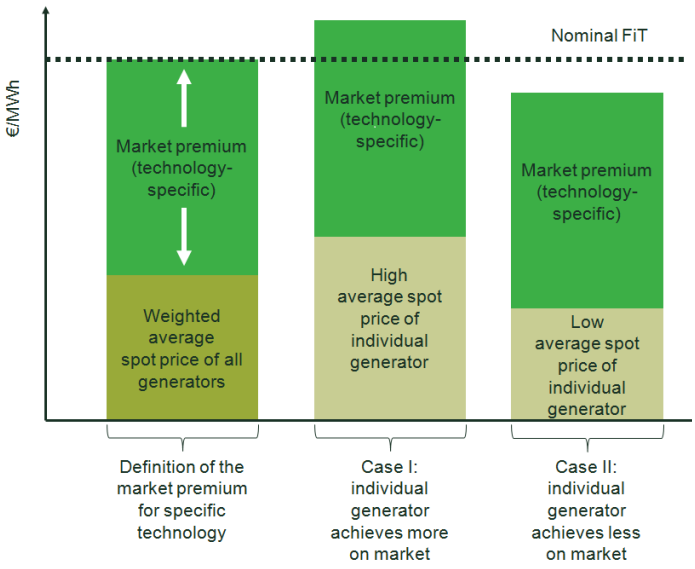
The breathing mechanism and degression rates have been designed on the basis of the perceived future CAPEX and OPEX cost of the technologies.[7] It is unclear whether the caps will have to be revised if, for instance, the per-kW cost for solar modules suddenly drops (or increases).

Incentives for direct marketing of renewable electricity

By 2017, the large- and medium-scale renewable generators will be obliged to sell their electricity output directly on the wholesale or retail markets. Instead of a fixed FiT, they will receive whatever they raise for their electricity on the spot market plus the market premium. The premium is the average difference between spot market prices and FiTs for that technology. It is calculated monthly as the nominal FiT less the technology-specific volume-weighted average spot market price in that month.[8]

For example, solar power plants usually produce most of their electricity at midday when the spot price is high, so the solar volume-weighted average price is slightly higher than the plain average spot price. On average, the group of all producers using a certain technology receives a price that corresponds to its nominal FiT. Depending on the individual producer-specific feed-in profile, the producer will receive a price that is higher or lower than the group average (see Figure 2).

Figure 2 The market premium model



Source: Oxera, based on www.netztransparenz.de and EEG 2014, Appendix 1.

The market premium model therefore does not significantly reduce the total financial support required to fund the EEG regime.[9]

The market premium has two objectives. First, renewable generators are supposed to familiarise themselves with wholesale market workings in terms of volume nominations, price forecasting, exchange trading, etc. This is to facilitate the integration of renewable and conventional generation markets. Second, the market premium is supposed to provide an incentive to control the dispatching of renewable energy such that electricity is mainly fed in at times of high demand, and not at times of low or even negative prices. For example, the market premium creates an incentive to schedule planned maintenance work at weekends or during other periods of low demand.

From fixed FiTs towards competitive tenders

In compliance with the reformed EU state aid guidelines on energy and environmental protection,[10] the EEG 2014 support for renewable generation will be determined in competitive tendering procedures beginning no later than 2017.[11]

The applicable rules are not yet specified, with the exception of open-air photovoltaic installations. This technology is identified in the EEG 2014 as the pilot technology for gaining experience with optimal auction and tender rules from 2015. In this respect, the Federal Economics Ministry has issued a draft framework under which up to 600MW of solar capacity per year will be tendered in two or three tranches from 2015.[12] The stated objective is to determine least-cost FiTs on a competitive basis, rather than by government decision. All other features of the German support scheme will be maintained. The federal energy network regulator (*Bundesnetzagentur*) will base the competitive tendering on economic and legal criteria that are currently subject to consultation.

The pilot tendering for solar will be on a national scale. The EEG 2014 also stipulates that at least 5% of annual capacity will be tendered at the European level in future. This is made conditional on cooperative agreements with the respective countries, the physical feasibility of imports, and reciprocity principles.

Revised exemptions for energy-intensive industries

After intensive consultation with the European Commission, the German government altered the exemption criteria. Under EEG 2014, eligible industrial electricity users pay the full surcharge for the first GWh and 15% of the surcharge for any additional electricity. In compliance with the 'cap' and 'super cap' of the EU state aid rules, the amount of support is capped at 4% of the gross value added, or at 0.5% for companies with an electricity intensity of 20% or more.

The majority of exempt firms are large, even in comparison to firms within the same narrowly defined four-digit industry branch classification.[13] While at the international level these exemptions may protect large German manufacturers from competitive disadvantages arising from the high domestic cost of electricity, the exemption may create competitive distortions at the intra-industry level.

Under the EEG 2014, the rules have become more stringent and fewer firms are eligible for an exemption. Despite this, the total volume of exempt electricity is expected to remain constant, at around €5bn per year.

Own consumption

New generation that serves to supply own-consumption has to contribute to the surcharge in future. A reduced 40% surcharge is levied on such generation, and also on combined heat and power. A de minimis rule applies for new small generation units with a maximum capacity of 10kW, whose first 10MWh of output is exempt from the surcharge. The roof-top photovoltaic installations on private homes will qualify for the latter exemption.

Auto-consumption of (self-generated) electricity remains exempt from the surcharge if the installation existed before the EEG 2014.

The example of the wind industry

It was apparent from the protracted debate over the EEG 2014 that the feed-in levels would follow a downward trend over time. This significantly affects the behaviour of renewable investors as they rationally try to front-load investments, as the example of the wind industry demonstrates.

In the first half of 2014, 650 new wind turbines were built, with a total capacity of 1.723MW—a 66% increase over the previous year. Only around 100 turbines with 64MW capacity were decommissioned in the same period. For the whole of 2014, the German wind association, BWE (Bundesverband WindEnergie e.V.), expects capacity additions totalling 3,300–3,700MW, representing an all-time record.[14] Furthermore, in 2015, early-mover effects are expected as investors fear that the tendering procedures that are supposed to be introduced in 2017 will produce lower tariffs than the government-fixed FiTs. In 2015, therefore, BWE expects the annual corridor target of 2,500MW to be met.

BWE's outlook post-2015 is less optimistic. The wind industry fears that the pilot tendering procedures for photovoltaic generation will not fit the purposes of wind generators. BWE argues that wind generation projects typically require much longer planning and implementation horizons, and the industry sees the danger of strongly fluctuating construction activities. It also fears that the reduction of FiTs for more favourable locations will make replacement and expansion investments no longer economically viable for such sites.

Concluding remarks

The EEG 2014 contains no panacea for the many issues that have to be addressed following Germany's *Energiewende*. However, it introduces elements to control the quantity of renewable new builds, and the first step towards competitive tendering. It also goes one step further in attempting to integrate renewables into the markets by making direct marketing obligatory. However, the choice of technology and the amount of new generation are still determined by politics and not by the interplay between innovation, entrepreneurship and market demand.[15]

The breathing cap mechanism is new and should, in principle, ensure that added capacity remains within policy targets, and thus provides a backstop in the event of FiTs being set too high.

Introducing competitive tendering is a step in the right direction. This is because tendering is an economic mechanism which, if implemented properly, makes sure that the end-consumer pays only what is necessary for the provision of the desired renewable electricity, and that it is not supported more than is necessary.

While the EEG 2014 makes direct marketing mandatory for all producers, effective FiTs are still much higher than wholesale prices, so it looks like the renewable industry will depend on support for some time. From an environmental perspective, it can be argued that these subsidies may be justified because renewable sources have lower external costs (pollution, CO_2) than conventional sources of generation.

The EEG 2014 remains focused on setting technology-specific FiTs, which may mitigate the grid stability issues associated with the intermittency of renewable generation. The renewable mix that emerges may generate a more balanced supply of electricity than one single source. On the other hand, this approach forgoes the opportunity to promote the least-cost technology.

The transition to the EEG 2014 may not be smooth. We currently see a front-loading of renewable investments because investors understandably expect lower renewable support in the future.

Industry exemptions are now in line with EU state aid rules, but distributional concerns remain. Due to the 1GWh threshold, small-scale businesses are exposed to a high burden relative to large firms, even if they depend on electricity in a similar manner.

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[1] Offshore FiTs feature a profile over a 20-year period.

[2] For the impact of biomass power on groundwater quality, see Aue, C. (2014), 'Auswirkungen des Energiepflanzenanbaus auf das Grundwasser', *Korrespondenz Wasserwirtschaft*, **7**:2, pp. 113–6.

[3] Compare Bundesministerium für Wirtschaft und Energie (2014), 'Gesetz zur grundlegenden Reform des Erneuerbare-Energien-Gesetzes und zur Änderung weiterer Bestimmungen des Energiewirtschaftsrechts' (EEG 2014), Art. 38–49, *Bundesgesetzblatt*, **1**:33, 21 July.

[4] Kraus, M. (2013), 'Energy market reform in Germany: What can we expect?', *Agenda*, September.

[5] Deutscher Bundestag (2014), 'Gesetzentwurf der Bundesregierung. Entwurf eines Gesetzes zur grundlegenden Reform des Erneuerbare-Energien-Gesetzes und zur Änderung weiterer Bestimmungen des Energiewirtschaftsrechts', Bundestagsdrucksache 18/1304, pp. 131–3.

[6] EEG 2014, Art. 26–31. See in particular Sections 2 and 3 of Article 29. For example, the FiT for solar energy is reduced by up to 2.9% each month, which amounts to around 29% per year.

[7] CMS Hasche Sigle (2014), 'Energiewirtschaftsrecht. Die Novelle des Erneuerbare-Energien-Gesetzes (EEG) 2014'.

[8] Computed using the EPEX spot price for Germany/Austria. See Section 2.2.2.1 of Appendix 1, EEG 2014.

[9] Energy Brainpool (2013), 'Auswirkungen der verpflichtenden Direktvermarktung für EEG-Neuanlagen. Kurzstudie im Auftrag des Bundesverbands Erneuerbare Energien e.V.', 19 July.

[10] European Commission (2014), 'Guidelines on State aid for environmental protection and energy 2014-2020', Communication from the Commission, C(2014) 2322, 9 April.

[11] European Commission (2013), 'Staatliche Beihilfe SA.33995 (2013/C) (ex 2013/NN) – Deutschland. Förderung der Stromerzeugung aus erneuerbaren Energien und Begrenzung der EEG-Umlage für energieintensive Unternehmen', Letter to the Member State, C(2013) 4424 final, 18 December, para. 109.

[12] Bundesministerium für Wirtschaft und Energie (undated), 'Eckpunkte für ein Ausschreibungsdesign für Photovoltaik-Freiflächenanlagen'.

[13] Source: Oxera calculations, based on Bundesamt für Wirtschaft und Ausfuhrkontrolle (2014), 'Statistische Auswertungen zur "Besonderen Ausgleichsregelung" des Bundesamtes für Wirtschaft und Ausfuhrkontrolle (BAFA)', and Bureau van Dijk (2014), 'Amadeus Financials', accessed on 9 May 2014.

[14] Bundesverband WindEnergie (2014), 'Windenergie an Land – Halbjahresstatistik 2014 für Deutschland: Starker Ausbau der Windenergie an Land', 29 July.

[15] Other technologies, such as nuclear and coal, are also strongly driven by government subsidies.

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