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German Electricity Prices: Only Modest Increase Due to Renewable Energy expected

Consumer prices for electricity in Germany have risen considerably in recent years. These price increases are partially attributable to a strong rise in the apportionment for the promotion of renewable electricity in accordance with the German Renewable Energy Sources Act (EEG). The EEG apportionment and associated VAT currently account for approximately one-sixth of household spending on electricity. Yet the increasing generation of power from renewables leads to decreased wholesale electricity prices. As a result, the net burden on the consumer – given effective competition – is lower than the apportionment.

According to modelling calculations performed by the German Institute for Economic Research (DIW), inflation-adjusted wholesale prices for electricity will only increase by 11% between 2010 and 2020 to 4.9 euro cents per kilowatt-hour (kWh), despite increasing fuel and CO_2 certificate prices. In the absence of expanded deployment of renewable energy, a higher price increase of 20% can be expected. Although electricity generation from renewable sources is forecasted to more than double by 2020, the EEG apportionment borne by consumers will in real terms only be 3.64 euro cents per kWh, and thus only slightly higher than it is today. The main reason for this low growth is the fact that the tariffs for new installations are digressive, falling year by year. In addition, tariffs are diminished in real terms by price inflation. Our modelling calculations assume that legislators will take action against the recent overinvestment in the solar electricity sector. Thanks to a significant fall in the cost of photovoltaic (PV) systems, the reduction of PV tariffs can be placed on an accelerated timetable. Over the long term, the overall level of support provided under the EEG should be reduced. For the further deployment of renewable energy it is necessary to expand Germany's power grid in addition to the availability of energy storage facilities. Steps must also be taken to increase competition in electricity markets.

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Consumer and producer (i.e. wholesale) prices for electricity in Germany have experienced divergent developments in recent years. The electricity prices paid by households fell between 1991 and 1998 in real terms. Since then, they have risen continuously (Figure 1).[1] In the first half of 2010 households paid on average 23.75 cents per kWh (nominal price, including VAT). Industrial consumers pay

1 Due to methodological changes, Eurostat data on consumer prices from 2007 onward have limited comparability to previous years.

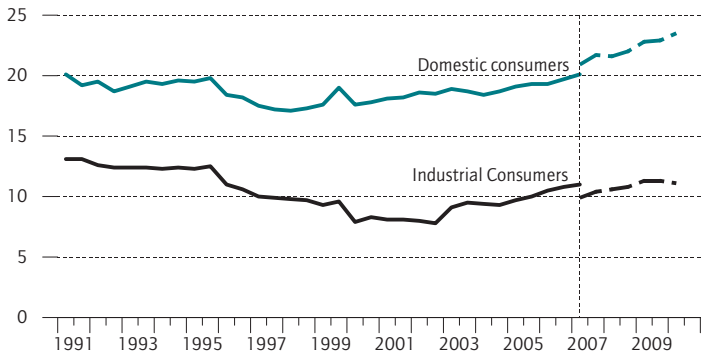
JEL Classification:
D4, Q2, Q4

Keywords:
Electricity markets,
Renewable energy,
Energy policy

Figure 1

Consumer Electricity Prices in Germany, 1991–2010

In euro cents per kWh (real, Euro 2009), including taxes; industry prices without VAT



Prices at six-month intervals.
Selected typical consumer groups according to Eurostat data (based on new methods since 2007):
"Domestic Consumption Dc" (old): Annual consumption of 3500 kWh.
"Domestic Consumption DC" (new): Annual consumption of 2500 to 5000 kWh.
"Industrial Consumption Ie" (old): Annual consumption of 2000 MWh; maximum demand of 500 kW; power usage of 4000 hrs.
"Industrial Consumption IC" (new): Annual consumption of 500 to 2,000 MWh.

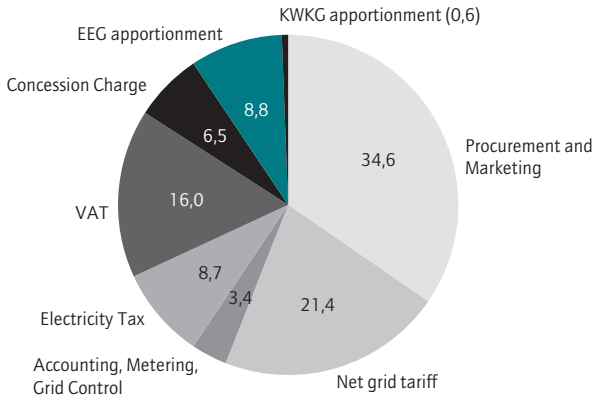
Sources: Eurostat; Destatis; calculations by DIW. **DIW** Berlin 2011

Over the past decade consumer prices for electricity in Germany have risen considerably in real terms.

Figure 2

Breakdown of Household Electricity Bill

In percent (as of 1 April 2010)



Source: Federal Network Agency: Monitoringbericht 2010. Bonn, November 2010. **DIW** Berlin 2011

Taxes, fees, and apportionments made up 40% of the household electricity bill in Germany in 2010.

considerably lower prices for electricity. Industrial electricity prices fell in real terms considerably until 2000 and have been rising thereafter. Electricity prices in Germany are considerably higher than the European average, particularly for households, but also for industrial consumers.[2]

Regulatory requirements are responsible for a large share of the price paid by consumers for electricity (Figure 2). Approximately 40% of the price paid by households in 2010 was attributable to the electricity tax, VAT, concession fees, as well as charges due to the Renewable Energy Sources Act (EEG) and the Act on Combined Heat and Power Generation (KWKG). In 2010, the EEG apportionment was 2.05 euro cents per kWh, and represented 8.8% of the consumer price for electricity.

The EEG apportionment was sharply increased in 2011 to 3.53 euro cents per kWh, and now comprises 14% of the electricity price paid by households. Including VAT, the apportionment currently stands at 4.2 euro cents per kWh, thus representing one-sixth of the household electricity bill. The increase of 1.5 euro cents per kWh over the year prior includes a retroactive increase for 2010 of 0.29 euro cents per kWh (excluding VAT). Furthermore, in determining the apportionment for 2011, Germany's transmission system operators (TSO) have made calculatory assumptions – particularly with regard to solar electricity trends and direct selling as a consequence of the so-called green electricity privilege– which tend to overestimate the shortfall in revenues, and, as a consequence, the apportionment necessary for 2011.[3]

By contrast, producer prices for electricity contain neither the aforementioned regulatory taxes and fees, nor network costs and accounting charges. Wholesale electricity trading now takes place to large extent on exchanges such as the EEX in Leipzig (spot and forward trading). The average day-ahead spot market prices for electricity during specific hours fluctuate considerably. Short-term price changes are primarily attributable to varying demand and increasingly to variation in wind and photovoltaic power generation. Moreover, prices tend to vary considerably over time, e.g. from quarter to quarter (Figure 3). Such fluctuations primarily result from changes in fuel and CO_2 certificate prices. Over the last five years the average spot market price for electricity has varied between 30

2 For more on electricity price trends and costs, see Frontier Economics, EWI: Energiekosten in Deutschland – Entwicklungen, Ursachen und internationaler Vergleich (Project 43/09). Final Report of the Federal Ministry for Economics and Technology, August 2010.

3 50Hertz Transmission GmbH, Amprion GmbH, EnBW Transportnetze AG, TenneT TSO GmbH: Prognose der EEG-Umlage nach AusglMechV. Prognosekonzept und Berechnung der ÜNB, 15 October 2010. Leipziger Institut für Energetik GmbH (IE): Jahresprognose 2011 zur deutschlandweiten Stromerzeugung aus regenerativen Kraftwerken. Prognose der Stromeinspeisung und der Vergütung im Rahmen des Erneuerbare-Energien-Gesetzes für 2011. Endbericht im Auftrag der Übertragungsnetzbetreiber (ÜNB). Leipzig, 30 September 2010.

and 70 euro per MWh (3 to 7 euro cents per kWh). In 2010 the average price for electricity was 44 euro per MWh (4.4 euro cents per kWh). Thus, the wholesale price for electricity in 2010 was 19% of the price paid by households.

In order to estimate the future impact of promoted renewable energy on electricity prices, the following interrelationships are thus significant, and were taken into account in our modelling calculations:

- Wholesale prices are influenced by the expanded use of renewables.
- The EEG apportionment depends on the growthof renewables, the feed-in tariffs, and the wholesale prices.
- Consumer prices depend on wholesale prices as well as EEG apportionment.

Electricity generation from renewables to more than double by 2020

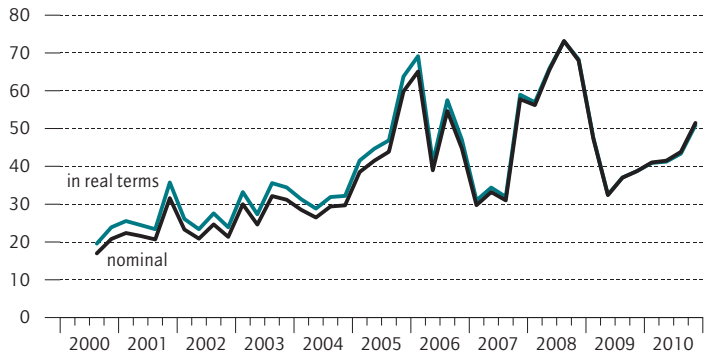
According to EU Directive 2009/28/EC on the Promotion of the Use of Energy from Renewable Sources, at least 18% of Germany's gross final energy consumption must come from renewables by 2020. In the EEG 2009 a binding target of at least 30% was set for the electricity sector. The energy plan adopted by the German government in September 2010 sets the goal of obtaining a green energy share in the electricity sector of at least 35% by 2020.[4] Germany's National Renewable Energy Action Plan even foresees a renewable energy share of 38.6% by 2020.[5] Thus, the share of electricity generated from renewable sources will more than double between 2010 and 2020.

Our modelling calculations are based on an expansion of renewables in accordance with a scenario of the German Federal Ministry for Environmental Protection, under which the annual electricity generation from EEG power plants will increase to some 217 TWh by 2020.[6] If this goal is reached, the share of electricity generated from renewables would represent 40% of electricity consumption in 2020.

Figure 3

Quarterly Average EPEX Spot Market Prices for Electricity, 2000–2010

In euro per MWh, nominal and real (Euro 2009)



Sources: EEX; Destatis; calculations by DIW. **DIW** Berlin 2011

Over the last five years the average spot market price for electricity has varied between 30 and 70 euros per MWh (3 to 7 euro cents per kWh).

Rising Fuel Costs Drive Spot Prices

Wholesale prices for electricity are driven by several factors. Key price determinants include the supply of power generated from renewable sources, electricity demand, the generation capacity of conventional power plants, and, in particular, fuel and CO_2 prices.

As a result of the global economic crisis in 2008–9, fossil fuel prices fell sharply. In 2010 fuel prices rose again, and remained volatile. This was particularly true of crude oil prices, which have a considerable influence over market developments for other fuels.

In its most recent World Energy Outlook, the International Energy Agency (IEA) foresees under current policies an additional increase in real crude oil prices from around 80 USD per barrel in 2010 to around 110 USD per barrel in 2020.[7] While the price differential in Europe between crude oil and natural gas is expected to remain relatively constant, the IEA believes global hard coal prices will rise somewhat slower, as there will be no shortage of easily accessible coal reserves over the mid-term. The fuel prices that underlie our electricity price calculations for 2020 are for the most part based on IEA figures. The following megawatt-hour prices are expected for individual fuel types in 2020: crude oil: 55.30 euro, natural gas: 35.40 euro, hard coal:

4 BMWi, BMU: Energiekonzept, für eine umweltschonende, zuverlässige und bezahlbare Energieversorgung. Berlin, 28 September 2010. By 2050 it is even foreseen that 80% of electricity will come from renewables.

5 Federal Republic of Germany: Nationaler Aktionsplan für erneuerbare Energie gemäß der Richtlinie 2009/28/EG zur Förderung der Nutzung von Energie aus erneuerbaren Quellen. Berlin, August 2010.

6 Wenzel, B., Nitsch, J.: Entwicklung der EEG-Vergütungen, EEG-Differenzkosten und der EEG-Umlage bis zum Jahr 2030 auf Basis des Leitszenario 2010. Study on behalf of the German Federal Ministry of Environmental Protection. June 2010.

7 OECD/IEA: 2010 World Energy Outlook. Paris, November 2010, p. 69 ff. The U.S. Energy Information Administration (EIA) arrives at similar conclusions, see EIA: 2010 International Energy Outlook, July 2010.

Table

Net Capacity of Conventional German Power Plants in 2020

In Megawatt

	Baseline scenario	Comparative scenario	Difference
Hydro	3465	3465	0
Nuclear	16912	16912	0
Lignite	14605	17465	2860
Hard Coal	23989	33239	9250
Gas/Oil	20087	20087	0
Total	79058	91 168	12 110

Source: Calculations by DIW. **DIW** Berlin 2011

Coal-fired power generation capacity is 12,110 megawatts higher in the fictitious scenario (which foresees no further growth in renewables) than in the baseline scenario.

10.10 euro, lignite: 4.20 euro. These figures presuppose a USD:EUR exchange rate of 1.25 to 1.

Considerable price increases are also to be expected in the market for CO_2 emission allowances as a result of the continuous emission cap reduction by 1.74% per annum. We assume a CO_2 price of 25 euro per allowance (ton of CO_2) in 2020.

While energy efficiency increases in the electricity sector are uncertain, additional demand for electricity will be created through the expanded use of electric vehicles and other technologies such as heat pumps. We therefore assume conservatively that electricity demand will remain constant.

The generation capacity of conventional power plants that we can expect in 2020 depends on the current inventory of power plants, the rate at which they are shut down due to ageing, as well as the rate at which new plants are constructed. In this regard, the recent decision to extend the operational life of Germany's nuclear power plants by 8 to 14 years is of considerably importance. According to our assumptions, the planned expansion of renewable energy generation will also be accompanied by the completion of all currently planned natural-gas power plants as well as all currently approved coal-burning power plants (see Baseline Scenario in Table).

According to the German Environmental Ministry's guideline scenario, wind energy in particular will be significantly expanded, reaching a production potential of 108 TWh in 2020. Due to the strong expansion in photovoltaic capacity witnessed in 2010 (an estimated 7.5 GW of capacity was added, in contrast to the guideline scenario's foreseen addition of 6.5 GW), we assume that the expansion of PV capacity will be 5 GW in 2011, slightly higher than the guideline scenario's forecast. From 2012 onward, 3.5 GW of photovoltaic capacity will be added annually. Thus, at the end of 2020 an installed capacity of 53.8 GW will be reached. It will therefore be possible to generate 47 TWh of solar electricity in 2020 (assuming 910 full load hours per year).

Based on these assumptions, DIW's ESYMMETRY electricity market model (Box 1) simulates an average inflation-adjusted electricity price of 49.3 euro per megawatt-hour in 2020. This corresponds to a real increase of 11% over the average EEX wholesale price in 2010. This increase is first and foremost attributable to rising fuel and CO_2 prices.

Box 1

Electricity market simulation using the ESYMMETRY model

The ESYMMETRY simulation model was developed at the German Institute for Economic Research (DIW) to analyze short-term adjustments in the electricity market in light of fluctuations in demand and power generation from wind and solar. The model simulates electricity-market price developments at one-hour intervals while taking imperfect competition into account. Thanks to detailed data – particularly on the power plants of Germany's four largest electricity suppliers – it is possible to realistically simulate power-plant operation under market conditions. Previously the model was used to analyze the electricity price effects of wind energy.[1]

1 See Thure Traber, Claudia Kemfert (2011): Gone with the Wind? Electricity Market Prices and Incentives to Invest in Thermal Power Plants under Increasing Wind Energy Supply, Energy Economics, 33, S. 249-256.

Renewable Energy Reduces Wholesale Prices

Fuel prices and the further expansion of renewable energy will have a strong impact on electricity wholesale prices. In order to quantify how these factors impact wholesale price, we investigate a hypothetical scenario under which renewable energy is not expanded any further. In contrast to the baseline scenario, in this comparative scenario we instead assumed that all plans to construct fossil fuel-driven power plants will be realized. The net installed capacity of conventional power plants is thus 12.1 GW

higher than in the baseline scenario (see Table). In this fictive case, the smaller supply of electricity from renewables leads to higher electricity prices in the year 2020. Our modelling calculations predict a wholesale price of 52.5 euro per megawatt-hour. In the baseline scenario, by contrast, our calculations yield a lower price of 49.3 euro. In this way, the additional electricity generation supported by the EEG between 2010 and 2020 leads to a price reduction of 3.2 euro per megawatt-hour.[8]

Only a small increase in the EEG apportionment by 2020…

Besides wholesale prices, the expansion of renewable power plants, and the tariffs for EEG electricity are key determinants of the EEG apportionment which must be borne by consumers. The feed-in tariffs for new plants fall from year to year based on the digression rates defined in the EEG. While the digression rates for most supported technologies have remained predominantly the same in recent years, they have been repeatedly adjusted for photovoltaic systems due to the unexpected sharp decline in PV system prices as well as the associated overheating of the market. In order to reduce the high uncertainty surrounding the rate at which capacity is added, the digression stipulated by the current EEG is calculated based on the capacity added in the previous year. Beginning in 2012, if the "target corridor" of 2.5 to 3.5 GW of additional capacity was exceeded in the previous year, the tariff digression is to be increased from 9% by 3 percentage points, and by additional 3 percentage points for each excessive GW of added capacity, until an maximum digression of 21% is reached. By contrast, if less than 2.5 GW of capacity is added, the digression decreases. For the capacity expansion assumed in our calculations, this means a digression of 13% beginning in 2012 and of 9% per year in the following years.

Furthermore, we assume that the amount of privileged electricity consumption of power-intensive companies will not be increased (Box 2) and that there will be no major burdens from the so-called green electricity privilege (Box 3).

Under these conditions, we estimate an EEG apportionment in 2020 of 3.64 euro cents per kWh (at 2010 prices), which is only slightly higher than it is today. Broken down into individual technologies, it turns out that photovoltaic will account for 1.7 euro cents per kWh, or 47% of the apportionment (see Figure 4). Photovoltaic power will then contribute almost a quarter of the electricity generation promoted by the EEG.

… While Net Burden to Consumers is lower than EEG Apportionment

Given sufficient competition in the end user markets for electricity, the reduction of wholesale prices by 0.32 euro cents per kWh in 2020 resulting from the additional renewable energy supply will at least partially be passed through to consumers. The net burden to consumers is thus lower than the EEG apportionment. Furthermore, the EEG may even lead to a discharge of electricity-intensive companies.

Political Implications

In the public debate, it is frequently argued that the economic burden associated with the promotion of renewable energy support is too high, particularly in light of recent increases in electricity prices. For this reason, some have even called for the complete abolishment of the EEG. Yet our model calculations show that the burden imposed on Germany's economy by renewable energy support will not be excessive in the future. It turns out that the burden borne by electricity consumers will furthermore not increase substantially if appropriate measures are considered.

It is essential that renewable electricity generation continues to be promoted under the EEG. Otherwise, it would not be possible to achieve the targets. However, tariffs should continue to be set digressively and adjusted in case of changing market conditions. For example, the reduction of photovoltaic tariffs should be accelerated due to the considerable drop in system costs that has occurred in recent years. Installation operators should not be provided with excessive tariffs. Furthermore, efforts should be made to lead photovoltaic capacity expansion to the targeted growth rate of 2.5 to 3.5 GW per annum.[9]

In this connection, the German Environmental Minister and the German Solar Industry Association have jointly proposed an accelerated timetable for the reduction of PV tariffs. The proposal suggests

8 The electricity-price reducing effects associated with lower CO_2 prices as a result of the expansion of renewable energy have not been taken into consideration. Our estimates can thus be viewed as conservative.

9 The German Advisory Council on the Environment (SRU) considers this target rate to be too high and has recommended limiting annual capacity expansion on a "first-come, first-served" basis. The Council has refrained, however, from identifying the capacity expansion rate that should be achieved. See The German Advisory Council on the Environment (SRU): Wege zur 100 Prozent erneuerbaren Stromversorgung, January 2011.

Box 2

Improving the EEG Special Equalisation Scheme

The special equalisation scheme contained in Sections 41 to 44 of the German Renewable Energy Sources Act (EEG) provides advantages to power-intensive manufacturing companies and rail operators at the expense of other electricity consumers. The redistributive effect resulting from this scheme has become much stronger in recent years; the magnitude of the effect in 2010 has been estimated at 1.1 billion euro.[1] As a consequence of rising EEG differential costs, the redistributive effect resulting from current rules will continue to grow stronger. According to preliminary estimates, the magnitude of the redistribution in 2011 could reach 2.1 billion euro.[2] The burden falling on non-privileged consumers (companies which do not benefit from Sections 41 to 44, as well as households) will thus increase. Approximately one-sixth of power consumption is privileged under the EEG (apart from the special economic circumstances in 2009). The burden of financing green power promotion is correspondingly higher for other consumers.

The special equalisation scheme was devised to avert negative competitive effects of the EEG. Although not the whole additional burden directly leads to competitive disadvantage – crucial in this regard is whether or not competitors are also subject to similar policies – special treatment remains justified, particularly in light of the strong rise in the EEG apportionment in 2011. Yet it is against this very backdrop that the special equalisation scheme should be reconsidered.

The rules currently in place are not ideal. For example, companies with an annual power consumption of at least 100 GWh and electricity costs in relation to gross value added of 20% or more only make a contribution of 0.05 euro cents per kWh. When one takes the lower electricity prices induced by increased renewable power generation into account, such companies are even likely to profit on the whole from the EEG. The charge exemption granted to such companies is thus unnecessarily high. In the case of other manufacturing companies that receive exemption under the EEG (i.e. companies with an annual consumption of at least 10 GWh and electricity costs equalling at least 15% of gross value added), full charges are levied only on 10% of electricity consumption. This arrangement also applies to rail operators. For this group of privileged consumers, as well, the charge exemption is unnecessarily high. Companies falling just below the defined consumption threshold receive no exemption whatsoever and, like Germany's households, bear the full EEG apportionment, including the additional costs resulting from the exemptions provided to power-intensive firms.

The following guidelines should be observed when revising the special equalisation scheme:

- The reduced charge of 0.05 cents per kWh should be considerably increased (for example, to 0.5 euro cents per kWh).
- Absolute annual power consumption is only appropriate to a limited extent as a criterion for determining charge thresholds. The threshold of 100 GWh should be abolished so that companies with higher power consumption levels are also required to pay full charges on a defined percentage of their power consumption (deductible).
- Relative electricity costs are an economically sound criterion for determining the level of exemption that should be granted. The deductible could have a variable structure that depends on relative electricity costs. This would avoid large exemption discrepancies based on marginal differences in power consumption. In the case of low relative electricity costs, a larger deductible is justified.
- If legislators intend to make additional companies eligible for exemption, then an additional threshold, such as relative electricity costs of 10 to 15%, should be applied. These companies should be required to pay full charges on a higher percentage of their consumption, e.g. 30 or 40%.
- The broad inclusion of all rail operators in the special equalisation scheme should be reconsidered under competitive and environmental considerations.
- On the whole, a revision of the equalisation scheme should reduce the burden placed on all other consumers, such as households.

1 ISI, GWS, IZES, DIW: Einzel- und gesamtwirtschaftliche Analyse von Kosten- und Nutzenwirkungen des Ausbaus Erneuerbarer Energien im deutschen Strom- und Wärmemarkt: Kurzupdate der quantifizierten Kosten- und Nutzenwirkungen für 2009. Study undertaken on behalf of the German Environmental Ministry (BMU), May 2010.

2 BMU: Informationen zur Anwendung von § 40 ff. EEG (Besondere Ausgleichsregelung) für das Jahr 2011. Publication date: 15 December 2010.

Box 3

Abolishment of the EEG Green Electricity Privilege

In order to promote the market integration of electricity from renewable resources, in accordance with Sec. 37 of the German Renewable Energy Act (EEG), electricity suppliers are exempted from the EEG apportionment if at least 50% of the total volume of electricity they sell to end consumers qualifies for EEG tariffs. This so-called "green electricity privilege" was devised first and foremost to promote the direct selling of electricity from low cost installations. This provision, however, increases the specific additional costs for the remaining EEG electricity. With increasing EEG apportionment, the direct selling of electricity (in accordance with Sec. 17 of the EEG) becomes increasingly attractive in combination with the green electricity privilege. Assuming an energy supplier has a 50% green electricity share and the current EEG apportionment of 3.53 euro cents applies, the total advantage is equal to 7 euro cents per kWh. The total revenue – including a market price of around 5 euro cents per kWh – is thus 12 euro cents per kWh, a figure which in many cases is considerably higher than the EEG tariff, even when one subtracts approximately 20% for selling costs.

According to estimates prepared by the Leipzig Institute for Energy, there is already in 2011 a direct selling potential resulting from these incentives of approximately 37 TWh, approximately a third of which (12.3 TWh) will be directly sold.[1] This, in turn, is expected to reduce non-privileged final consumption – which is ultimately the basis for the EEG apportionment – by a total of approximately 24.6 TWh, or 6 percent. The forecasted additional burden from the green electricity privilege was taken into account as the EEG apportionment was calculated for 2011.[2] In coming years this burden would increase even further.

Due to the sharp rise in the EEG apportionment, the magnitude of benefit granted through the green electricity privilege is considerably higher than intended. The magnitude of benefit has set excessively strong incentives for suppliers to take advantage of the provisions for direct selling. At the same time, considerable volumes of renewable and non-renewable electricity are freed from charges. This, in turn, induces further increases in the apportionment to be paid by non-privileged electricity consumers. The green electricity privilege should thus be abolished in its current form.[3] To support market integration of renewables, it would be better to institute a bonus or market premium model for direct selling. According to a recent proposal made by the German Environmental Ministry, the charge exemption for companies that use the green electricity privilege should be limited to 2 euro cents per kWh.[4] After all, this proposal would reduce the burden placed on other consumers by the green electricity privilege.

1 Leipziger Institut für Energetik GmbH (IE): Jahresprognose 2011 zur deutschlandweiten Stromerzeugung aus regenerativen Kraftwerken. Prognose der Stromeinspeisung und der Vergütung im Rahmen des Erneuerbare-Energien-Gesetzes für 2011. Endbericht im Auftrag der Übertragungsnetzbetreiber (ÜNB). Leipzig, 30 September 2010.

2 50Hertz Transmission GmbH, Amprion GmbH, EnBW Transportnetze AG, TenneT TSO GmbH: Prognose der EEG-Umlage nach AusglMechV. Prognosekonzept und Berechnung der ÜNB. Publication date: 15 October 2010.

3 Georg Erdmann, Manfred Fischedick, Christian von Hirschhausen, Olav Hohmeyer, Eberhard Jochem, Claudia Kemfert, Felix Matthes, Martin Pehnt, Mario Ragwitz, Jürgen Schmid: Dringender Appell zur Rettung des Erneuerbare-Energien-Gesetzes seitens deutscher Energiewissenschaftler. DIW Press Release of 15 December 2010.

4 Environment Minister Röttgen: Solar power support must be adjusted to market developments. BMU Press Release No. 008/11. Berlin, 20 Jan. 2011.

introducing the variable portion of the digression rate already in mid-2011, instead of in the beginning of 2012.[10] According to this proposal, the tariff reduction would be between 0 and 15%, depending on the capacity expansion realized in the months of March to May 2011. This measure, however, would reduce excess support for photovoltaic only conditionally and probably to a limited extent. Thus, the reduction would potentially be insufficient to slow down capacity expansion. As an alternative, legislators could non-conditionally reduce the PV tariff at mid-year by 12%, thereby reacting more forcefully to current market developments.

10 Environment Minister Röttgen: solar power support must be adjusted to market developments. BMU Press Release No. 008/11. Berlin, 20 Jan. 2011.

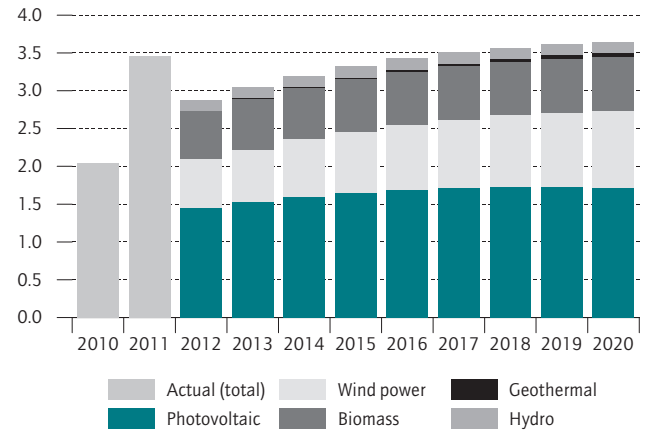
Moreover, circumventing the feared negative consequences of the green electricity privilege can help to prevent a further increase in the overall EEG apportionment (Box 3). Similarly, as adjustments are made to the EEG in 2012, care should be taken to ensure that the burden on consumers resulting from the charge exemption granted to power-intensive firms at least does not increase (Box 2).

For the further expansion of renewable energy it is also necessary to ensure sufficient power-grid connectivity to neighboring EU states. Likewise, within Germany the power grid needs to be expanded and improved. In its most recent network study, the German Energy Agency (DENA) estimates that up to 3,500 kilometers of additional

Figure 4

EEG Apportionment in 2010 and 2011, Forecast to 2020

In euro cent per kWh (real, Euro 2010)



Sources: Transmission network operators (ÜNB) for 2010 and 2011; calculations by DIW for 2012 to 2020.

DIW Berlin 2011

In 2020 EEG reallocation charges in real terms will only be slightly higher than they are today.

power lines are needed in Germany, an investment expected to cost up to 25 billion euro.[11] In the first network study released by DENA, it was shown that at least 850 kilometres of new power lines are required. Unfortunately, the power grid has for various reasons not been sufficiently expanded thus far. Existing market structures have not delivered adequate incentives for network expansion. Four large energy suppliers in Germany continue to possess nearly 75% of all conventional power plant capacity and also own most of the power grid. Only recently has the market been shaken up by new suppliers, particularly in the area of renewables. Furthermore, two providers have sold their grid assets – more or less willingly. Regulatory authorities have for some time criticized the lack of competition at various stages of the value chain in the electricity market.[12] Insufficient competition can hinder power grid expansion, among other negative effects.

In addition to the expansion of Germany's power grid, it will be necessary in the future to make greater use of energy storage facilities in order to compensate for fluctuations in wind and solar power generation. Thus, regulatory authorities should not only devote attention to the expansion of the power grid, but also to the construction of new electricity storage facilities. Furthermore, the EEG should be modified to create incentives for both, greater market integration as well as demand-driven feeding-in of more flexible renewable energy such as electricity from biogas.

It is also important to bolster competition in non-regulated segments of the electricity market by mitigating the dominance of Germany's four large energy suppliers and by ensuring sufficient market transparency. Moreover, the integration of electricity markets in Europe should be encouraged. Finally, in order to support competition, consumers need to make greater use of their right to switch energy supplier.

Conclusion

The consumer electricity price increases witnessed in Germany are in recent years partially attributable to a strong rise in the green electricity apportionment under the German Renewable Energy Act (EEG). In 2011, the EEG apportionment amounted to 3.53 euro cents per kWh, including associated VAT this accounts for approximately one-sixth of household spending on electricity.

In simulating the electricity market, we assumed in accordance with the German Environmental Ministry's guideline scenario that electricity generation from renewable energy will more than double between 2010 and 2020. In our calculations we also took into account the rapid expansion of photovoltaic capacity in 2010 and 2011. According to our findings, the inflation-adjusted wholesale price for electricity will only increase by 11% between 2010 and 2020 to 4.9 euro cents per kWh, despite increasing fuel and CO_2 certificate prices. The EEG apportionment will be 3.6 euro cents per kWh in 2020, thus only somewhat higher in real terms than they are today. The main reason for this stabilisation of the apportionment is the fact that the feed-in tariffs granted to new installations are digressive. Furthermore, the feed-in tariffs will be diminished in real terms by price inflation.

Increasing power generation from renewable energy reduces wholesale electricity prices. To the contrary, assuming no further expansion in renewables and an increased coal power plant capacity, the inflation-adjusted wholesale price for electricity would increase to 5.3 euro cents per kWh by 2020. In our baseline scenario that includes further deployment of renewables, the wholesale price is by 0.3 euro

11 See German Energy Agency: Dena-Netzstudie II: Integration erneuerbarer Energien in die deutsche Stromversorgung im Zeitraum 2015–2020 mit Ausblick 2025. Berlin 2010.

12 See Bundeskartellamt: Sektoruntersuchung Stromerzeugung und Stromgroßhandel. Bericht gemäß § 32e Abs. 3 GWB. Bonn, January 2011. Federal Network Agency: Monitoringbericht 2010. Bonn, November 2010. See also Federal Network Agency: Bundesnetzagentur nimmt Stellung zur Erhöhung der EEG-Umlage. Press Release, 15 November 2010.

cents per kWh lower. The net burden to consumers is thus lower than the EEG apportionment.

The support granted under the EEG must be maintained if renewable energy development targets are to be fulfilled. Yet legislators must also take action at present to counter market overheating in the photovoltaic sector and to reduce windfall gains induced by the support system. Furthermore, the so-called green electricity privilege should be modified in order to prevent the apportionment from rising too high. Similarly, revision of special rules for power-intensive companies should not lead to an additional burden being placed on other electricity consumers.

Over the long term, the overall support level provided under the EEG should be reduced. For the further expansion of renewable energy it is additionally necessary to expand Germany's power grid and construct new energy storage facilities. Finally, steps must also be taken to establish more competition in electricity markets.

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