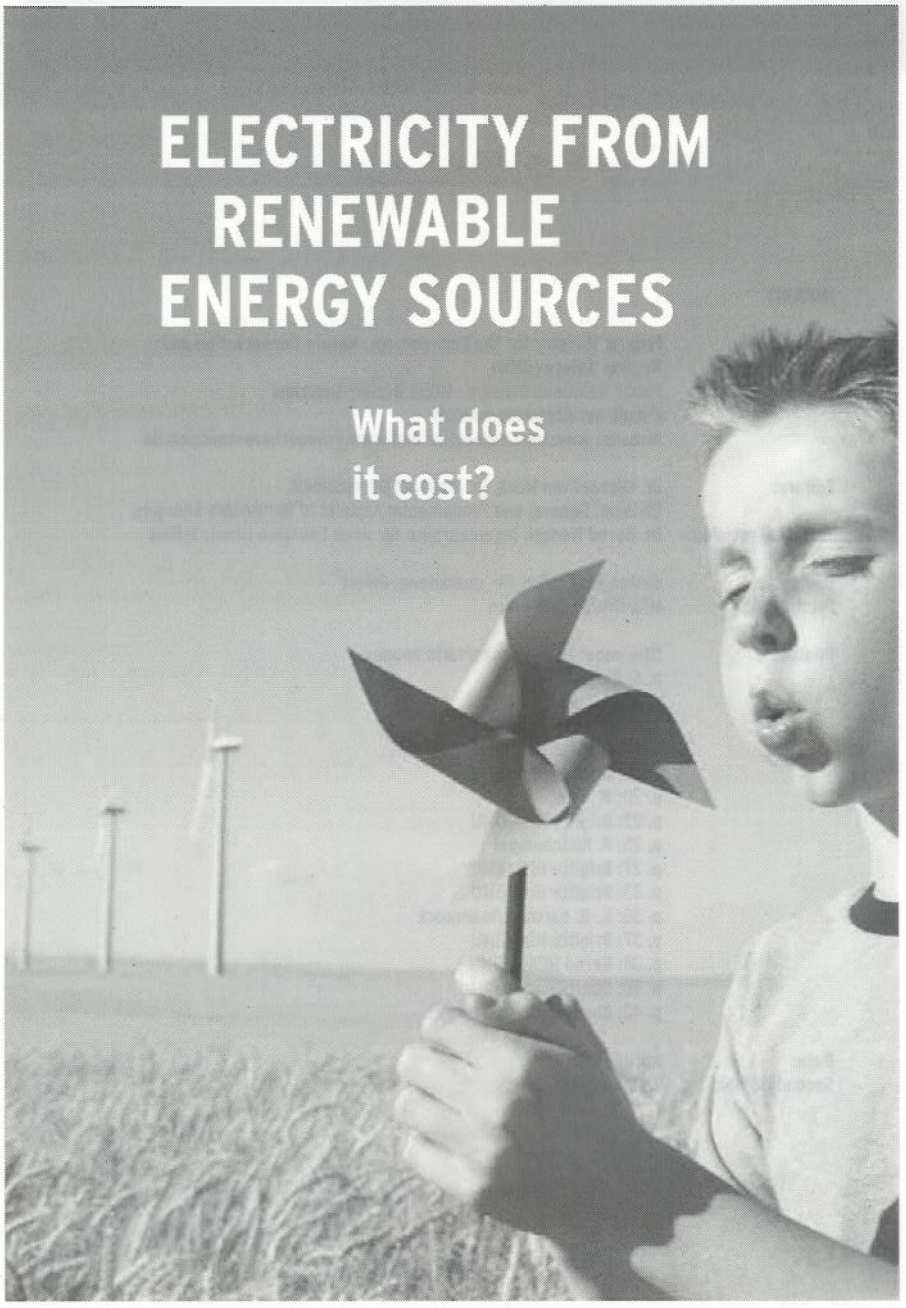
Greenpeace 25/3

Cost of FiT:
External costs: £4bn
Reduced fuel imports = £1bn
Jobs: 278,000

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

ELECTRICITY FROM RENEWABLE ENERGY SOURCES

What does it cost?



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Published by:	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) Public Relations Division · 11055 Berlin · Germany E-mail: service@bmu.bund.de Website: www.bmu.de/english and www.erneuerbare-energien.de
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Design:	design_idee, büro_für_gestaltung, Erfurt
Printing:	MKL-Druck, Ostbevern
Photos:	title page: Tetra images/vario images p. 6: Ridder/f1 online p. 13: J. Eckel p. 15: D. Gust/gustfoto p. 17: Brigitte Hiss/BMU p. 19: Brigitte Hiss/BMU p. 20: W. Otto p. 22: Brigitte Hiss/BMU p. 25: R. Kleinhempel p. 27: Brigitte Hiss/BMU p. 33: Brigitte Hiss/BMU p. 36: K.-B. Karwasz/teamwork p. 37: Brigitte Hiss/BMU p. 38: Bernd Müller/BMU p. 40: Oberhäuser/BMU p. 42: ChristianeEisler/transit
Date:	April 2009
Second edition:	7.500 copies

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INTRODUCTION

What impact do renewable energy sources have on electricity prices, which have been rising for years? This brochure provides answers to this question and explains the situation on the German electricity market.

The central factor is the success of the German Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz – EEG). The Act has made a major contribution to the fact that around 15 percent of the electricity produced in Germany comes from renewable energy sources. This is a substantial increase on previous years. In the electricity sector alone, the Act succeeded in reducing our CO_2 emissions in 2008 by about 75 million tonnes. Together with the heat and motor fuel sectors, total savings of CO_2 due to renewables in 2008 came to nearly 115 million tonnes.

The proportion of household electricity prices due to the EEG is currently about 5%, and this is not likely to show any marked increase in the future. In view of the central role that renewable energies

play in efforts to mitigate climate change, this is an appropriate contribution: The Federal Government's recently reaffirmed intention to expand renewable energy in the electricity sector (at least 30 percent of electricity consumption by 2020, and steadily increasing thereafter) is an important precondition for ensuring that Germany can achieve its ambitious climate change mitigation targets.

But we should not forget that renewable energy sources also have considerable economic benefits. They increase competition on the electricity market, reduce situations of dependency and the economic risks of rising raw material prices, and they stimulate innovation, investment and employment. Today renewable energy sources are already providing jobs for some 280,000 people in Germany – which is a rise of about 120,000 jobs in only four years.

Investment in renewable energies paves the way for Germany's energy future. Together with improved energy efficiency it lays the foundation for sustainable, secure and affordable energy supplies.

ELECTRICITY FROM RENEWABLE ENERGY SOURCES – TOO EXPENSIVE?

"We regret to announce that owing to cost increases arising from the promotion of renewable energies and third-party electricity price rises we are forced to raise our own electricity prices with effect from the beginning of next year." This tends to be the message of the letters that electricity suppliers send their customers towards the end of the year and of official statements by the electricity industry. And it frequently creates the impression that electricity from renewable energies is a major source of the price rises we have been seeing for years now in the electricity sector.

But is this really the case? What items go to make up the price of electricity? What share is due to the Renewable Energy Sources Act (EEG)? And above all: are renewable energies really the main reason for soaring electricity prices? This brochure sets out to explain and inform, and to throw light on the bewildering confusion of physical laws, specific energy-sector conditions and environmental aspects. And, to come straight to the point: it makes it clear that renewable energies are by no means the main factor responsible for electricity price rises.

WHAT DOES ELECTRICITY COST? INFORMATION ON THE ELECTRICITY INDUSTRY

A variety of components go to make up the price of electricity. Before we explain them in more detail on the following pages, the table below offers an initial overview of the individual price components and the factors that cause them. Among other things, the table shows that the costs of promoting renewable energies under the Renewable Energy Sources Act (EEG) are not public taxes or charges. The EEG surcharge does not go to the state, but to the operators of EEG plants. The EEG merely establishes a framework for the private-sector relations between EEG plant operators and the grid operators and/or electricity suppliers.

goes to / Revenue from:	Energy suppliers	Plant operators under EEG/KWKG	Federal authorities	Länder	Cities and municipalities	Pension insurance
Power generation	■					
Transport	■					
Distribution	■					
Measurement	■					
EEG surcharge		■				
KWKG surcharge		■				
Concession charge					■	
Electricity tax			■			■
VAT			■	■	■	■

The electricity sector distinguishes two groups of customers: those who pay the general household rate, and customers with special terms. Both the absolute level of electricity prices and the relative importance of the cost components listed above show considerable variations between general household-rate (tariff) customers and special-contract (non-tariff) customers.

Relief for non-tariff customers

The **Renewable Energy Sources Act (EEG)** contains a special compensation provision for particularly energy-intensive enterprises in the production sector and for railways. They can apply to take a much reduced quantity of EEG electricity; based on an EEG levy of only 0.05 cent per kilowatt-hour.

The **Heat-and-power Cogeneration Act (KWKG)** also lays down a much reduced surcharge as compensation for energy-intensive enterprises. For final consumers with an annual electricity consumption of more than 100,000 kilowatt-hours (kWh) per delivery point it is a maximum of 0.05 cent per kilowatt-hour for the portion that exceeds the 100,000 kWh threshold. If electricity costs accounted for more than 4% of sales revenue in the preceding calendar year, the surcharge for the quantity exceeding 100,000 kWh is reduced to as little as 0.025 cent per kilowatt-hour.

Revenue from the **Electricity Tax Act** is largely paid into the state pension scheme, where it helps to stabilise the level of contributions. This reduces the burden on business that is due to the employer's contribution to the pension scheme. Without the electricity tax the present contribution rate (19.9% since 2007/1/1) would today be 1.7 points higher, at 21.6%. However, electricity-intensive operations in the production sector often derive little benefit from this reduction in the employer's contribution, since their personnel costs only account for a small proportion of total costs by comparison with other industries. In such cases the following compensation arrangement applies: if the electricity tax, after deduction of a minimum amount of €512.50, exceeds the saving on pension contributions, the company has to bear only 5% of the remaining additional cost.

In the case of the **concession charge**, non-tariff customers basically pay a reduced rate of 0.11 cent per kilowatt-hour. What is more, this charge does not apply at all if the mean annual electricity price paid by the non-tariff customer is less than the average price (see above). However, towns and municipalities may also set higher threshold prices and thereby deliberately exempt businesses from paying the concession charge.

The Grid Access Fees Ordinance (*Entgeltverordnung für den Zugang zum Stromnetz – Strom-NEV*) permits a reduction of up to 50% compared with normal grid fees if the customer's annual power consumption is over 10 GWh and the total annual operating hours come to more than 7,500 hours, i.e. the customer's demand for electricity is very high and steady.

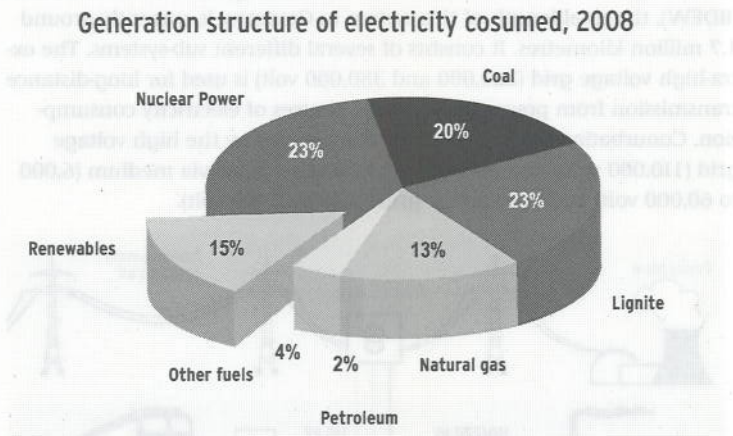
PRICE COMPONENTS OF HOUSEHOLD ELECTRICITY

The EEG is only one of eight price components that go to make up the price of household electricity. These components can essentially be classified in two categories: electricity generation (including transport and marketing), and taxes and charges. The KWKG and EEG surcharges which are shown separately in the following explanation belong to the electricity generation category.

Electricity generation and transmission

1. Electricity generation

In Germany electricity is mainly generated in large power plants using finite energy sources such as coal and lignite, uranium ore, and gas and heating oil. In 2008 the growing share due to renewable energy was already as high as 14.8%, after only 6.3% in the year 2000.



Data: Arbeitsgemeinschaft Energiebilanzen, AGEE Stat, presentation by ifne, figures rounded

The specific generation costs for electricity produced from fossil fuels are heavily dependent on the price of the fuel and the price of CO_2 emission rights. Whereas the production cost of electricity from the largely depreciated nuclear power plants costs only about 2.5 cent per kWh,[3] the figure for coal-fired or gas-fired power plants is considerably higher.

3 Electricité de France (EdF) expects a newly constructed EPR (European pressurised reactor) nuclear power plant in France to result in generation costs of 5.5 cent per kWh. The capital cost of an EPR is between €4 and €5 billion.

Depending on the type of power plant, electricity production costs can currently range up to 7 cent per kilowatt-hour. For comparison: payments to all EEG plants in 2008 probably averaged an 12 cent per kilowatt-hour (average production costs). A distinction must be made between electricity production costs and the market price which is determined on the Energy Exchange. This may be considerably higher or lower than production costs, because prices there are strongly influenced by the relationship between supply and demand (cf. diagram below).

2. Electricity transmission

Once generated, the electricity has to be transmitted from where it is produced to where it is consumed – with the aid of a multi-branched grid. This is operated by the distribution and transmission system operators (TSOs). The construction and maintenance of these grids involve corresponding costs.

According to the Federal Association of the Energy and Water Industries (BDEW), the total length of this system in Germany is currently around 1.7 million kilometres. It consists of several different sub-systems. The extra-high voltage grid (220,000 and 380,000 volt) is used for long-distance transmission from power plants to the centres of electricity consumption. Conurbations and large regions are served by the high voltage grid (110,000 volt). Regional distribution takes place via medium (6,000 to 60,000 volt) and low voltage grids (230 and 400 volt).

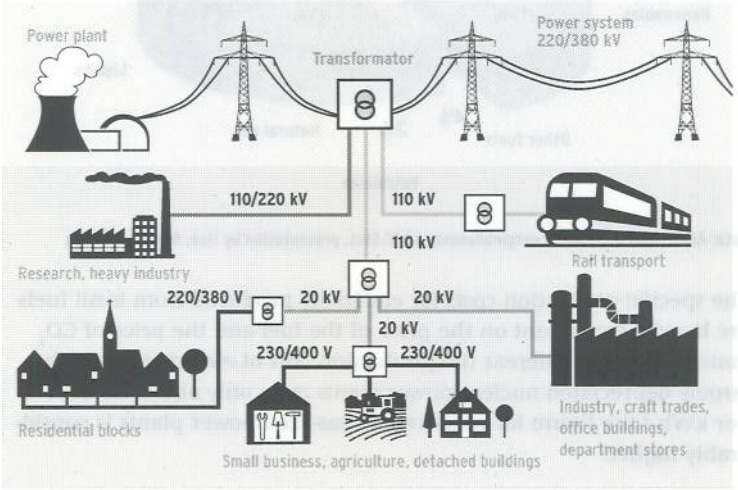


Diagram: after Federal Association of the Energy and Water Industries (BDEW)

In Germany the supra-regional extra-high voltage grid, also known as the transmission grid, is run by only four transmission system operators: E.ON Netz, RWE Transport-Netze Strom, Vattenfall Europe Transmission and EnBW Transportnetze. These grid operators – despite legal unbundling – are linked via their group with power plant operators and are therefore also known as integrated companies. The integrated companies provide over 80% of domestic electricity generating capacity and also hold numerous interests in regional providers and municipal utilities.

The average grid fees for tariff customers have fallen considerably as a result of network regulation, and stood at only 5.92 cent per kilowatt-hour in 2008 (2007: 6.34 cent per kilowatt-hour) according to the Federal Network Agency, though in individual cases they may display marked upward or downward variations depending on the grid operator. They thus account for about one third of the total price of a kilowatt-hour of household electricity. The share of the total price accounted for by grid fees has fallen from nearly 40% to around 27%.[4]

The grid fees also include the cost of constantly matching the electricity supply to actual demand, i.e. providing „regulated energy". This adjustment process ensures that at any given time the amount of electricity produced in the electricity system matches the amount consumed, and that the frequency of the alternating current remains constant at 50 hertz. The regulated energy is produced by power plants kept specially for this purpose. Over defined periods of time (seconds, minutes, hours) they smooth out the fluctuations that are constantly occurring in the electricity grids. However, no plausible evidence has yet been produced of the additional input for regulated energy that the grid opera-

4 Monitoring report 2008 by the Federal Network Agency (Bundesnetzagentur für Elektrizität, Gas, Telekommunikation, Post und Eisenbahnen) (figures: July 2008).

tors constantly claim to be necessary as a result of large fluctuations in feed-in of wind power, particularly since no extra control energy input for renewable energy is identifiable from publicly accessible grid operator data.[5]

However, the task of distributing EEG power to the electricity suppliers as uniform band power gives rise to energy balancing costs for transmission system operators, because the fluctuating input from wind systems in particular has to be smoothed out compared with the fixed band power. The resulting expenditure – also known as EEG-upgrading – is included in the grid fees. The Federal Network Agency forecasts a figure of €570 million for 2007.[6] Since this forecasts is based on cost information from the transmission system operators, who do not

Control zones of German transmission service operators

Source: Federal Association of the Energy and Water Industries (BDEW)

5 LDB-Beratungsgesellschaft: Angemessenheit der Netznutzungsentgelte der Übertragungsnetzbetreiber im Auftrag des Bundesverbandes neuer Energieanbieter und des Verbandes der industriellen Energie- und Kraftwirtschaft (2005).
6 See Footnote 4.

procure EEG balancing energy on a transparent basis, the Federal Network Agency has presented a key point paper with detailed proposals for opening up the EEG upgrading market segment. If these proposals are implemented, transparent cost data would become available.

3. Marketing and metering

It is not only the generation and transmission of electricity that cause costs. These factors – as in other companies – are joined by additional expenditure on selling the electricity in the market (marketing costs). The final stage in the consumption cycle is the cost of metering – for ascertaining and communicating the amount of electricity consumed. The two cost components together come to around 0.5 to 1 cent per kilowatt-hour.

Under the Measurement Sector Deregulation Act, which entered into force on 9 September 2008 and the supplementary Measurement Access Ordinance, connection users can now entrust third parties with electricity metering. One of the aims is the introduction of modern meters which show actual energy consumption and actual usage times (smart meters). Such meters are compulsory for new connections from 2010 onwards, and such units will also be offered when meters are replaced. The intention is to facilitate energy and cost savings in combination with tariffs providing incentives to save electricity which will be available from 2011 onwards.

4. Electricity tax

The electricity tax is part of the *Ecological Tax Reform*, which has been in force since 1999. It is intended to provide incentives to save energy, make efficient use of energy and use renewable energies. Tax surcharges on the use of heating oil, petrol, diesel, natural gas, liquefied gas and electricity increase the price of these fuels. This internalises external costs[7] that have not so far been taken into account in economic decisions about the use of energy. Since revenue from the Ecological Tax Reform is largely used to reduce and stabilise the rate of contributions to the state pension scheme, this reduces the burden on the production factor "labour" and raises the cost of "use of energy" instead. The benefits accrue not only to the environment, but also to employers in the form of reduced personnel costs and to employees through increased net income.

Internal consumption of electricity from plants with a nominal capacity of up to 2,000 kilowatts is exempted from electricity tax, since such plants are usually operated as efficient heat-and-power cogeneration plants and help to strengthen decentralised electricity generation.[8]

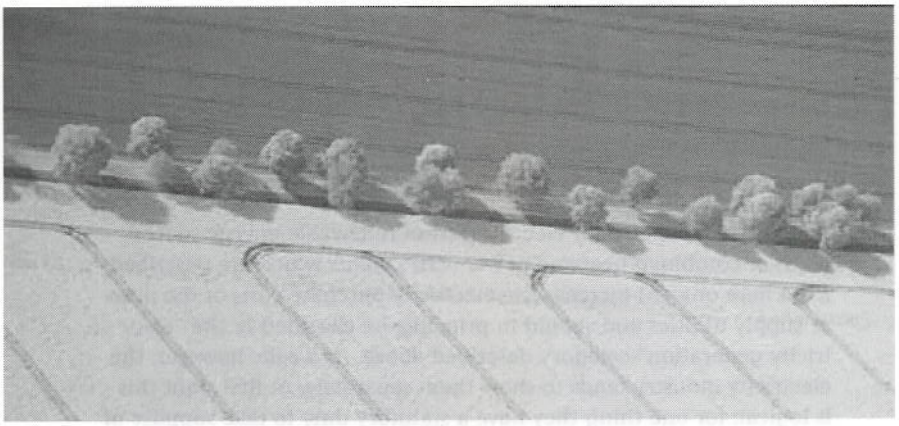
An electricity tax of 2.05 cent per kilowatt-hour for household-rate power has been in force since the fifth and latest stage of the reform in 2003. Ninety percent of the revenue goes straight to the state pension scheme, where it helps to keep down the level of contributions. Electricity tax is also levied on electricity from renewable energy sources.[9] This was justified on fiscal grounds when the Ecological Tax Reform was introduced in 1998, but still encounters a certain amount of criticism, especially since it runs contrary to one of the aims of the Ecological Tax Reform, namely to promote increased use of renewable energies.

	1998	1999	2000	2001	2002	since 2003
Electricity tax (cent per kWh)	-	1.02	1.28	1.54	1.80	2.05

7 For explanations, see box on "External costs of electricity generation" on page 35.

8 Electricity from power grids or lines fed entirely with electricity from renewable energies is exempt from the tax in unlimited quantities. The exception here is electricity from hydro-power plants with a capacity of over 10,000 kilowatts.

9 The resulting tax revenue is estimated at €910 million for 2007. Part of it is used – especially via the "market incentives programme" – to promote renewable energies.



5. Value-added tax

Unlike all electricity price components listed so far, sales tax (*Umsatzsteuer – USt*) – also known as value-added tax – makes a major contribution to financing general government expenditure. The energy supply utilities charge it at the rate of 19% on the net electricity price (including all charges, apportionments and electricity tax) and pay it to the tax authorities. As a "tax on consumer spending", value-added tax is only intended to be borne by final consumers of electricity. Since businesses are usually entitled to deduct input VAT, it is only a transitory item for them.

The revenue from value-added tax, as a "community tax", goes to the federal authorities (including the state pension scheme), the regional authorities (*Länder*) and – to a small extent – the local authorities. Value-added tax on electricity is levied on all other cost components mentioned here.

6. Concession charges

Concession charges are private-sector fees that electricity suppliers – like water or gas suppliers – have to pay to local authorities so that they can build or operate largely on or under public roads. The basis for this is the Concession Charges Ordinance (*Konzessionsabgabenverordnung*), which gives local authorities a certain freedom as to how they apply it. Depending on population, municipalities can levy between 1.32 and 2.39 cent per kilowatt-hour as "road rental". It is possible to waive the concession charge, and in some cases this is actually done. Non-tariff customers in any case pay reduced rates or no charges at all (see box on "Relief for non-tariff customers" on page 10).

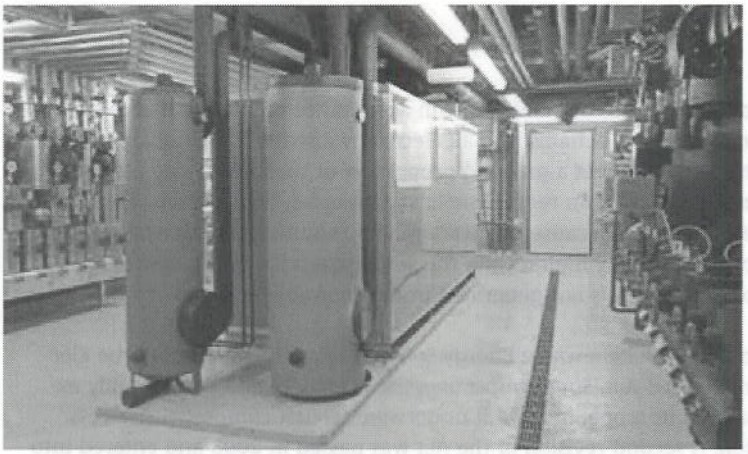
Promotion of combined heat-and-power and renewable energy sources

The cost components for electricity from renewable energy sources (EEG) or combined heat-and-power (CHP) plants which are described from here onward increase the electricity purchase costs of the power supply utilities and should in principle be classified in the "electricity generation" category described above. As a rule, however, the electricity industry tends to show them separately. At first sight this is logical: for one thing they have a statutory duty to take supplies of electricity from EEG or KWKG sources, while for another, suppliers of such electricity are largely in competition with the classic electricity industry. For the latter it therefore makes sense to show the EEG and KWKG surcharges separately as "government motivated price factors".

At the same time, however, other electricity price components that are also due to state intervention are not shown separately. One prominent example is the substantial price-boosting impact of the CO_2 emissions trading system introduced throughout Europe (see box on "Emissions Trading", page 24). In view of the largely free allocation of emission rights, this has in recent years made it possible for power suppliers to net additional "windfall" profits running into the millions.

7. Heat-and-power Cogeneration Act (KWKG)

Between 45 and 70% of the energy used to generate electricity is currently lost in conventional power plants in the form of unused "waste" heat. This is not the case with cogeneration of heat-and-power (CHP): the simultaneous use of heat-and-power increases utilisation of the fuel in energy generation to up to 90%, the heat being used, for example, in industrial processes or in district or local heating networks. Thus cogeneration of heat-and-power ensures much lower energy consumption and much reduced emissions of climate-relevant carbon dioxide (CO_2). Accordingly, the German government – as an addition to the climate agreement of 2000 – reached agreement with German industry on the Heat-and-power Cogeneration Act (*Kraft-Wärme-Kopplungs-Gesetz – KWKG*), which was last revised in 2008 and entered into force on 1 January 2009. It sets out to raise the CHP share of electricity to 25% by 2020. To this end grid operators are to accept the electricity on a priority basis – as in the Renewable Energy Sources Act –and feed it into the grid. The electricity not used or marketed by the plant operator itself is to be paid for by the grid operator at the usual market



price (only for plants up to 2 MWel) plus a CHP surcharge laid down in the Act[10]. The equalisation of burdens between grid operators ultimately results in higher grid fees (see box on "Relief for non-tariff customers" on page 10).[11]

According to the most recent annual statement (2007), the grid operators paid a total Cogeneration Act surcharge of €648 million to operators of Cogeneration Act plants, which generated a total of around 46,813 GWh[12] of electricity. For all non-privileged customers ("Final consumer group A") this increased grid fees in 2007 by 0.25 cent per kilowatt-hour. A figure of 0.20 cent per kilowatt-hour has been forecast for 2008.

8. Renewable Energy Sources Act (EEG)

The „Act on priority for renewable energy sources" (Renewable Energy Sources Act – EEG) obliges grid operators to give priority to taking electricity generated from renewable energy sources, feeding it into the electricity grid, and paying the relevant statutory minimum rates to the plant operators. These minimum rates are based on the individual generation costs and show a gradual decrease, i.e. they take account of differences in productivity advances in the various sectors and in potential cost reductions over time. Electricity from renewable

10 The market price is based on the CHP Index of the Leipzig electricity exchange EEX. The CHP surcharges are 5.11 cent per kWh for the component up to 50 kW, 2.1 cent per kWh for the component from 51 kW to 2 MW, and 1.5 cent per kWh above that. The subsidy is limited to 4 years (industry) or 6 years or a maximum of 30,000 full-load operating hours.

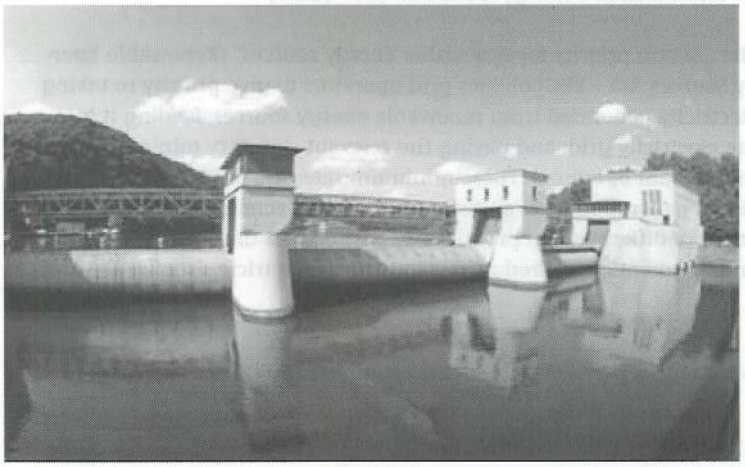
11 This is a major difference from the Renewable Energy Sources Act, which does not impose a surcharge on the grid operators' grid fees, but requires that every power supplier must buy a defined quota of EEG electricity at the average price from the transmission system operator, which increases the cost of externally purchased electricity.

12 Gigawatt-hour (GWh) = one million kilowatt-hours (kWh).

sources is passed on uniformly in accordance with a defined burden equalisation mechanism to all electricity distribution companies, who thus have to meet a growing proportion of their electricity purchase requirements from renewable energy sources. They thereby incur additional costs, because the average EEG remuneration that they have to pay is usually higher than the wholesale price of the electricity – most of which is not generated from renewable energies.

In 2000 the Renewable Energy Sources Act (*EEG*) superseded the Electricity Feed Act (*Stromeinspeisungsgesetz*) of 1990 and considerably expanded its scope. In 2004 it underwent its first comprehensive revision. A second revision of the Act was passed in 2008 and entered into force on 1 January 2009. In this process, the majority of tariffs were brought into line with the current market situation and arrangements were included for better market and system integration of the electricity from renewable sources. Moreover, the expansion target for electricity from renewable sources was considerably increased: By 2020 it is to account for at least 30% of German electricity generation. But even after that, the expansion of renewable energy is to continue; a scientific study for the Federal Environment Ministry[13] expects a share of around 50% for the year 2030.

The aim that the German government is pursuing in the EEG is to ensure harnessing of the vast potential of wind, water, biomass, sun and geothermal energy for electricity generation and advance the establishment of sustainable electricity generation in Germany.



13 Lead study 2008: Further development of the 'Strategy to increase the use of renewable energies' within the context of the current climate protection goals of Germany and Europe. Commissioned by the Federal Environment Ministry.

According to Section 1, the Renewable Energy Sources Act pursues the following additional aims:

- sustainable development of energy supply, particularly for the sake of protecting our climate, nature and the environment;
- reducing the external costs of energy supply;
- improving security of supply through reduced dependence on energy imports while simultaneously making a contribution to reducing conflicts about fossil fuels;
- technological development in the field of renewable energy sources.

Cost impacts of the EEG

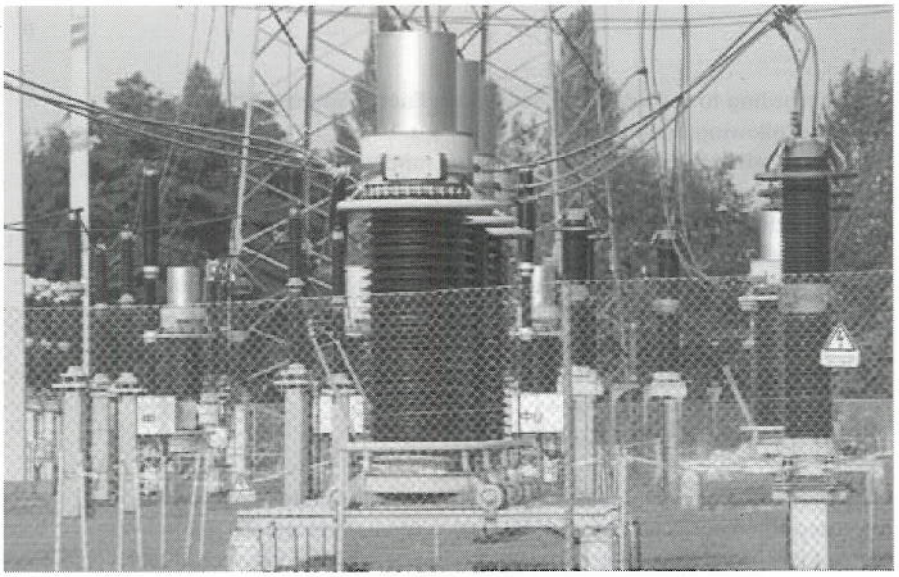
According to provisional calculations by the Working Group on Renewable Energy Statistics (AGEE Stat), a total of around 91 billion kWh of electricity from renewable sources was generated last year (2008) and fed into the grid.[14] This is about 15% of gross power consumption. Of this figure, about 71 billion kWh was subject to remuneration in accordance with the EEG.[15] The average remuneration for the entire EEG electricity mix in this period was probably around 12 cent per kilowatt-hour. The sum total of EEG remuneration to plant operators was around €8.8 billion.

What additional costs – known in the EEG as differential costs – were actually incurred by electricity consumers depends above all on two factors: firstly, what additional costs are incurred by electricity suppliers as a result of their obligation to take EEG power, and secondly, whether they pass on these additional costs in full to their customers.

As far as procurement of electricity by electricity suppliers is concerned, the compulsory purchases of electricity from renewables replace purchases of conventional electricity, which means the effective additional cost is the result of the difference between the average EEG remuneration and the purchase price of conventional electricity. Since all electricity suppliers have individual procurement terms and their purchase prices are a central business secret, the latter are not publicly available. To calculate the average EEG costs in Germany, as in this brochure, it is therefore necessary to estimate an average purchase price across all electricity suppliers as an approximation. Where electricity suppliers base their calculations of the EEG surcharge on differ-

14 Development of renewable energy sources in Germany in 2008 – as of April 2009.

15 The difference is primarily due to electricity generated by hydro-power, which has been produced economically in large hydro-power plants for about 100 years and is therefore not the subject of remuneration under the EEG.



ent individual electricity procurement costs, this can in practice lead to deviations from the average EEG surcharge mentioned in this brochure. However, according to Section 15 of the EEG 2004 which remained in force until the end of 2008, electricity suppliers are obliged on request to substantiate the calculation of a specific EEG surcharge imposed.

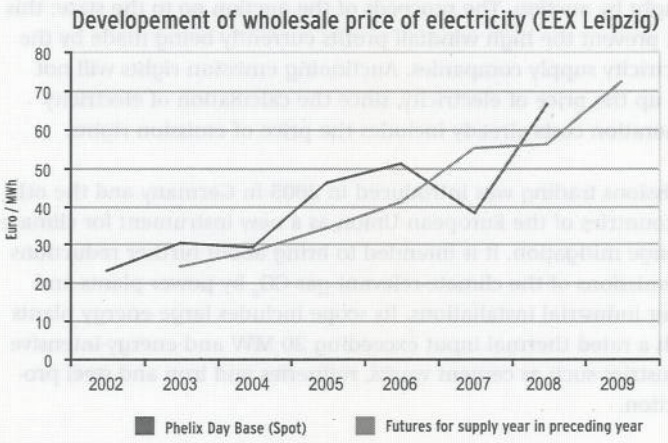
Whether the higher procurement costs ultimately have an impact on final consumer prices depends on the extent to which the electricity suppliers are willing or able to pass on their additional procurement costs to the customer in their electricity prices. Since there is still relatively little competition on the electricity market for household customers, they can be assumed to pass these costs on in full.

What is the average purchase price of conventionally generated electricity?

The market price for EEG electricity is taken to be the purchase price of the conventionally generated electricity that it replaces. This purchase price is determined among other things in wholesale electricity trading on the Leipzig electricity exchange EEX. This price also has a major lead function for purchase prices outside the exchange (i.e. direct transactions between electricity producers and purchasers/end customers). The following diagram shows the development of electricity prices on the EEX spot and futures markets.[16]

16 The spot market relates to short-term electricity supply contracts for the next day.

The wholesale price is no longer based – as it was before the deregulation of the electricity market – on actual generation costs, but on the prices that can be obtained on the market, i.e. on the relationship between supply and demand. One clear trend is the marked rise in EEX prices since 2002. The trend of futures prices, i.e. price hedging before the actual year of delivery (front year), shows a continuous upward movement. In 2007 the prices for 2008 were about 230% above the prices for 2003 in 2002. The price trend on the spot market shows similar tendencies, though with the difference that in 2007 they were below the previous year's prices, mainly because of the barely relevant prices for CO_2 emission rights at the end of the first trading period.[17]



Source: EEX, calculations by ifne

The average electricity purchase price of all electricity suppliers can be determined approximately by means of the EEX price. Depending on the approach adopted, i.e. use of futures and/or spot market prices, there are understandable differences in the results. A scientific study commissioned by the Federal Environment Ministry recommends combining the two prices: if the spot market and futures prices for base load electricity are weighted in accordance with their trading volume, the procurement price for 2008 works out at around 5.7 cent per kilowatt-hour.[18]

17 In 2007 the price of CO_2 emission rights was only marginally above €0 per t CO_2.
18 Starting in 2009, a new calculation procedure regulated in Section 54 of the Renewable Energy Sources Act will apply; this is based entirely on futures.

Emissions trading

As a result of emissions trading, CO_2 emission rights now have a market price that businesses have to include in their calculations. Operators of electricity generating plants therefore take this price into account – despite largely free allocation to date – when calculating their electricity generation costs. They can also sell the rights if they no longer need them as a result of CO_2 savings (reduced requirements). The extent to which this valuation raises electricity prices depends largely on the current price of emission rights and the competition situation on the electricity market. Starting in 2013, emission rights for the product "electricity" will have to be bought by auction. The proceeds of the auction go to the state; this will prevent the high windfall profits currently being made by the electricity supply companies. Auctioning emission rights will not put up the price of electricity, since the calculation of electricity generation costs already includes the price of emission rights.

Emissions trading was introduced in 2005 in Germany and the other countries of the European Union as a new instrument for climate change mitigation. It is intended to bring about further reductions in emissions of the climate-relevant gas CO_2 by power plants and other industrial installations. Its scope includes large energy plants with a rated thermal input exceeding 20 MW and energy-intensive industries such as cement works, refineries and iron and steel production.

If originators of CO_2 emissions do not have enough emission rights available, they can for example buy additional rights or reduce their CO_2 emissions by installing climate-friendly technologies. The number of emission rights is limited. Emission rights can only be bought if CO_2 emissions are reduced elsewhere. In this way the CO_2 savings take place where they have the most favourable impact on costs. Emission rights are traded on stock exchanges and other trading centres.

Analyses have shown that renewable energies have had a price-curbing impact on the EEX spot market prices in recent years, because their additional supply gives rise to a shift in the demand curve. This applies particularly to the supply of electricity from wind energy, which is sometimes very considerable. According to scientific studies for the Federal Environment Ministry, renewable energies reduced the spot market price by an average of 0.78 cent per kilowatt-hour in 2006.[19]

Using the example of 2008, the following table shows what effect different assumptions about the market value of EEG electricity have on the size of the EEG differential costs for the electricity industry and end customers.

		2008	
Assumption about procurement price of conventionally generated electricity [cent per kWh]		Extra cost of EEG* (billion euro)	Calculated EEG surcharge for private households (cent per kWh)
5.5	BDEW (basic-future-price)	4.6	1.1
5.7	BMU expertise Electricity purchase costs Electricity suppliers	4.5	1.1
11.5	BMU plus inclusion of external costs[20]	0.4	0.1

* **Data basis in each case: EEG electricity quantity 71 billion kWh, average EEG payment: 12 cent/kWh, most recent consumption 495 billion kWh. Electricity purchases by companies privileged under Section 16: 76 billion kWh, external costs 5.8 cent per kWh; figures rounded.**

19 Cf. Sensfuß/Ragwitz/Genoese: The merit-order-effect: A detailed analysis of the price effect of renewable electricity generation on spot market prices in Germany. Fraunhofer Institute Systems and Innovation Research, Working Paper 07/2007

20 See box on "External costs of electricity generation" on page 35.

WHAT DOES THE EEG COST ELECTRICITY CUSTOMERS?

A "reference household" with an annual electricity consumption of 3,500 kilowatt-hours is often used to make it possible to compare the electricity costs of tariff customers over a period of several years. In fact, individual electricity consumption depends on a large number of factors such as number of persons, usage habits, or age and number of electrical appliances. For example, household electricity consumption can range from nearly 2,000 kWh for a 1-person household to 6,000 kWh for households with 5 or more persons.[21] Households that are well equipped with efficient appliances and make sparing use of energy may nevertheless keep their annual consumption down to as little as 2,000 kWh for 4 persons. By the way: Do you know how much electricity you use every year?

Cost trends

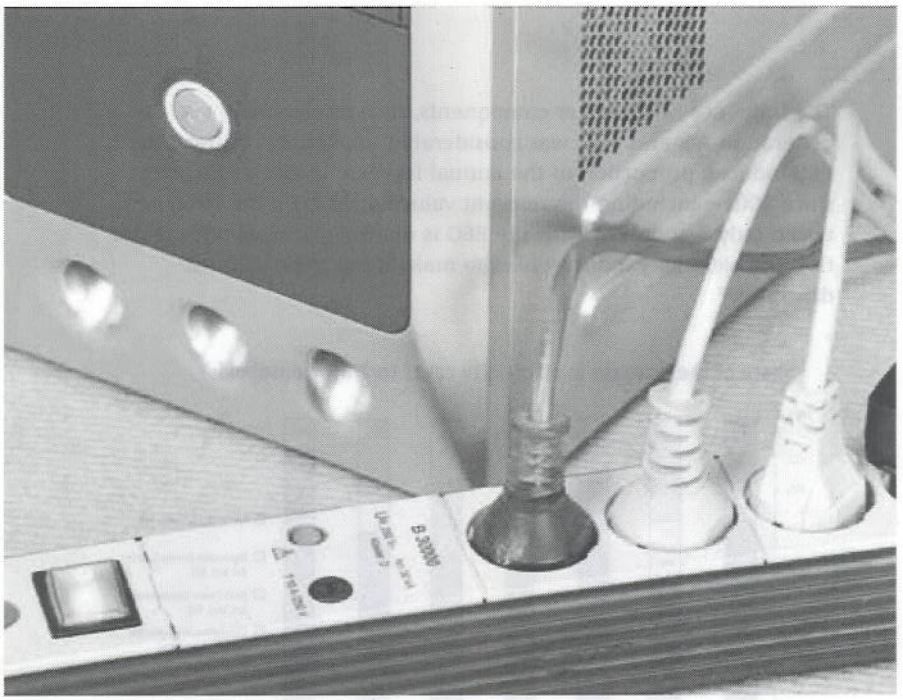
The following table shows how average monthly electricity costs for the reference household mentioned above have developed over the last seven years. The figures are based on information from the Federal Association of the Energy and Water Industries (BDEW). Only the EEG levy since 2005 is calculated rather differently than by the BDEW, in line with the assumptions explained above regarding the procurement price of conventionally generated electricity.

	2000	2002	2004	2006	2007	2008	2009
Electricity bill €/month (3,500 kWh/a)	**40,67**	**46,99**	**52,48**	**56,63**	**60,26**	**62,93**	**65,97**
Generation, transmission, marketing	25,15	28,32	31,56	34,53	35,70	38,01	40,48
Renewable Energy Sources Act (EEG)*	0,58	1,02	1,58	2,20	2,90	3,10	3,10
Heat-Power Cogeneation Act (KWKG)**	0,38	0,73	0,91	0,90	0,85	0,58	0,67
Concession charge***	5,22	5,22	5,22	5,22	5,22	5,22	5,22
Electricity tax (eco-tax)	3,73	5,22	5,97	5,97	5,97	5,97	5,97
Value-added tax	5,61	6,48	7,24	7,81	9,62	10,05	10,53
Electricity bill at 2005 prices	43,87	49,00	53,28	55,74	58,00	59,03	61,31

* Figures from 2005 onward: BMU calculations on the basis of applicable wholesale prices.
** From 2002 on the basis of the new Heat-and-power Cogeneration Act, which has been in force since 1 April 2002. Increase due to reduction in burden on manufacturing industry.
*** Great regional differences: 1.32 to 2.39 cent per kilowatt-hour from 2002 onward, depending on community size; some municipalities dispense with this income.

Sources: Bundesverband der Energie- und Wasserwirtschaft (BDEW); calculations by ifne

21 Forsa/EWI: Erhebung des Energieverbrauchs der privaten Haushalte für das Jahr 2005. Forschungsprojekt Nr. 15/06 im Auftrag des Bundesministeriums für Wirtschaft und Technologie 2008.



In 2008 the EEG surcharge, at about 1.1 cent per kilowatt-hour, only accounted for a bare 5% of the total household electricity price.

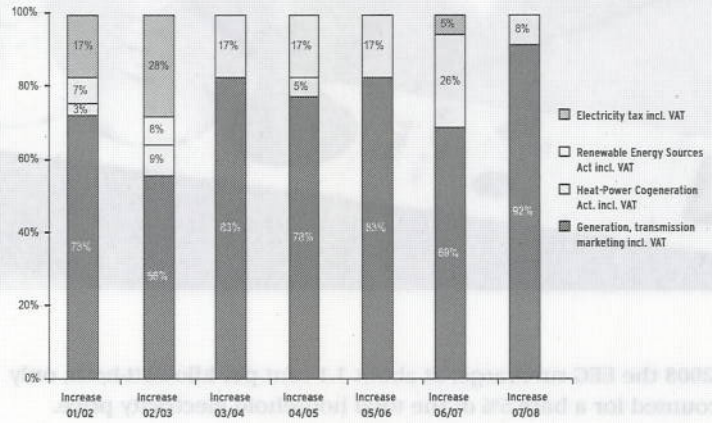
In individual cases there are naturally considerable variations in the size of the EEG surcharge, depending on electricity consumption. On the basis of the above mentioned spectrum for individual household or user types, the average EEG levy for 2008 mostly gives rise to household costs of between about €2 and €6 per month.

WHY ARE ELECTRICITY PRICES RISING DESPITE COMPETITION?

The table on page 26 also shows that there has been a steady increase in the price of electricity for households in recent years. This is primarily due to the price components for generation, transport and marketing which are attributable to the electricity industry. Including the relevant value-added tax, their share of the annual electricity price rises came to between 56 and 92%. A large part of the sizeable overall increase in monthly electricity bills from 2006 to 2007 was due to the increase in value-added tax from 16 to 19%.

The influence of the other components, such as electricity tax, Co-generation Act and EEG, was considerably smaller. By contrast, the EEG-induced proportion of the annual increase in electricity prices since 2001 – including the relevant value-added tax – has been between only 7 and 27%. Thus the EEG is not the principal price factor that the electricity industry likes to make it out to be (cf. next diagram).[22]

Share of the increase in electricity costs (private households)



Special effects in 2007 due to increase in VAT from 16 to 19 percent.
Data: Federal Association of the Energy and Water Industries (BDEW), AGEE-Stat, calculations by ifne

But why have costs in the field of electricity generation and transport been rising continuously for several years?

Little competition in the electricity generation sector

Electricity and its price have a special history compared with other goods and services. Until 1998 the supply of electrical energy was governed by an Energy Management Act dating from 1937, the basic features of which were thus over 60 years old at that time. Germany was divided into supply districts with in which the individual supplier had a duty to supply (demarcation agreements), but also enjoyed a monopoly. To prevent the supplier from demanding exorbitant monopoly prices from the customer, electricity prices were subject to approval. This situation, which had been established for decades, changed when an EU directive of 19 July 1997 obliged the Member States to gradually open the electricity markets. This directive was

22 2007 increase of Electricity tax is caused just by raise of rate of taxation VAT.

transposed into German law in the new Energy Management Act (Energiewirtschaftsgesetz – EnWG) of 1998. The new Energy Management Act abolished the district monopolies and basically permitted free competition.

The revision of the Energy Management Act (EnWG) in 2005 created a new regulatory framework for the energy industry. The natural monopoly in the electricity grid sector is now subject to regulation. Since the revised version entered into force, the grid fees have been approved by the Federal Network Agency and the regulatory authorities of the federal Länder. From 2009 onward the system of grid fee approval will be replaced by incentive-based regulation, which is intended to bring about a steady increase in the efficiency of grid operation and a reduction in grid fees. Grid operators are obliged to provide grid connections and system access to anyone, and to expand grids to cater for needs. Separation of the generation, transport and marketing sectors within an integrated energy supply enterprise is subject to rules for unbundling of grid operation.

Since 1998, however, there has been increasing concentration in the electricity supply sector, with the four major integrated companies acquiring interests in municipal utilities and regional suppliers. Today, grid fees are a central competition factor. In its 2008 monitoring report, the Federal Network Agency therefore stated:

"Base in particular on the overwhelming market share of these two companies [RWE and E.ON; Editor's note: see also end of sentence] in the generated net capacity of electricity, the federal electricity markets that supply large industrial customers, municipal utilities and energy traders with electricity are dominated by an oligopoly with a dominant position and no competition, which according to the findings of the Federal Cartel Office currently consists of RWE and E.ON." [23]

In the annual report 2007 it had already been noted that:

"The competition situation on the electricity markets upstream and downstream of the grid sector did not improve significantly in 2006 either. The trend towards greater market concentration ... is therefore continuing."
"The players active on the demand side are a small number of major customers, sourcing-optimised redistributors and the major electricity supply companies themselves. The four biggest electricity supply companies together account for an overwhelming share of the trading offers."[24]

23 Monitoringbericht 2008 der Bundesnetzagentur für Elektrizität, Gas, Telekommunikation, Post und Eisenbahnen, page 13.
24 Monitoringbericht 2007 der Bundesnetzagentur für Elektrizität, Gas, Telekommunikation, Post und Eisenbahnen, page 11.

The monopoly commission set up by the German government has also been examining competition on the electricity market for several years now, and in 2007 it presented a special report. Although this notes progress on some fronts, it reaches the following overall conclusion:

"The analysis of the German electricity and gas market shows that on the markets for grid-based energy supplies in the Federal Republic of Germany one still cannot speak of a functioning market."[25]

The reasons given are:

- Concentration of electricity generation on a small number of companies.
- Numerous horizontal and vertical linkages between the market-controlling transmission system operators themselves and between the TSOs and downstream municipal utilities.
- High barriers to market access for new companies.
- Small number of final consumers changing suppliers.
- Participation by the four integrated companies in municipal utilities and other redistributors.

Similar statements for Germany and the EU were also made in the report by the EU Competition Commission in February 2006.[26] In September 2007 the EU Commission made suggestions for a third single market package with a view to advancing deregulation of the markets.

Thus more competition on the electricity generation market calls for more suppliers and above all for sufficient generating capacity, since capacity shortages would inevitably result in higher prices. Renewable energy sources make a great contribution to the provision of new and environmentally sound generating capacity.

25 Sondergutachten der Monopolkommission gemäß § 62 Abs. 1 des Energiewirtschaftsgesetzes. Strom und Gas 2007: Wettbewerbsdefizite und zögerliche Regulierung. page 14. Bundesdrucksache 16/7087.

26 DG Competition report on energy sector inquiry (SEC(2006)1724).

What is green power?

Electricity from renewable energy sources is also known as *green power*. However, this does not mean that the green power sold under various product names by electricity suppliers is the same as EEG electricity.

Electricity remunerated under the EEG is expressly not allowed to be marketed as green power. This is prohibited by the "double marketing ban" in Section 56 of the Renewable Energy Sources Act. In other words, green power must have been produced in generating plants not subject to remuneration under the EEG, which may also mean abroad.

Since the term *green power* is not clearly defined or even protected, there are many products of widely varying quality on sale on the electricity market. For this reason a number of organisations offer certifications that claim to say something about the quality of the green power (e.g. "Grüner Strom Label gold/silber" or "OK-Power"). The Federal Environment Agency is currently drawing up certification standards for awarding the "Blue Angel" for green power.

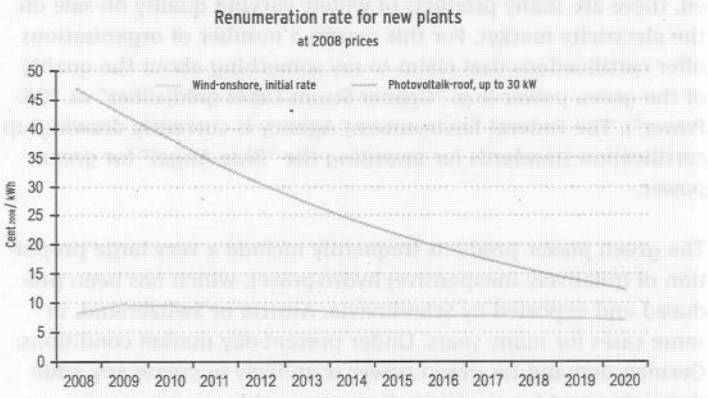
The green power products frequently include a very large proportion of (relatively inexpensive) hydro-power, which has been produced and exported by Scandinavia, Austria or Switzerland, in some cases for many years. Under present-day market conditions, German demand for green power is unlikely to create any additional demand for electricity from renewable energy sources.

Anyone who wants to pursue environmental and especially climate protection objectives with their choice of electricity should therefore make sure that their decision does indeed contribute to the building of new plants for generation of electricity from renewable energy sources, thereby creating incentives to shift the present electricity mix in the direction of more renewables.

Against this background, consumers are well advised to obtain information about the kind of certification and the underlying requirements before they consider changing to a green power tariff. This is easily done by Internet.

Further development

The ongoing dynamic expansion of electricity generation from renewable energy sources, especially in the young and innovative fields of offshore wind energy, solar energy or biomass, will initially result in a further rise in the costs of the Renewable Energy Sources Act in the years ahead – though with a downward drift: for example, the decreasing rates for payments under the EEG will make their effects felt (see diagram below). Moreover, the fact that the price of conventionally produced electricity will in all probability continue to rise (e.g. as a result of targeted reductions in CO_2 emission rights, price increases for natural gas and coal, decline in power plant generating capacity) will ensure a gradual reduction in the cost differential for power from renewable energy sources.



Source: EEG 2004, EEG 2009, calculations by ifne; average inflation rate 2% p.a.

According to estimates made for the BMU, the monthly EEG surcharge for the "reference household" mentioned above (3,500 kWh per a) could show a further increase to more than €4 by 2015.[27] This would mean monthly EEG costs of over €2 for a single-person household.

27 Price basis 2008. Cf. Ausbau erneuerbarer Energien im Strombereich bis zum Jahr 2030. www.erneuerbare-energien.de/inhalt/42785/40870/

After that, the decreasing cost of renewables due to the declining rates of remuneration, coupled with continuing price rises for conventional power, will result in a continuing marked reduction in the size of the EEG surcharge. On this basis it will be only around 60 cent per month in 2030 for an reference household with 3,500 kWh per a, or around 30 cent per month for a single-person household.

For the moment, however, no further increase in EEG differential costs is to be expected for 2009, in view of the recent marked increases in EEX spot market prices.

WHY EEG COSTS ARE ONLY HALF THE TRUTH

The public debate about the cost of renewable energy generally focuses on the additional procurement costs of the electricity suppliers and the – resulting – EEG surcharge for final consumers. This issue has been discussed in detail in this brochure. For a sound economic assessment of renewable energy sources and the EEG, however, it is not enough to confine one's view to these operating cost factors.

For one thing, it fails to take account of other costs attributable to renewable energy sources. These include, for example, the additional cost for basic and balancing energy that is needed because of the fluctuating input of electricity from photovoltaic and especially wind energy systems. Other factors are grid expansion due to the integration of power from renewables, and administrative costs incurred by grid operators for implementation of the EEG. These additional cost factors are difficult to quantify. They have been estimated to total between €300 million and €600 million for 2006,[28] the dominant share of which is due to basic and balancing energy.

On the other hand, the expansion of renewables also involves a number of beneficial effects that are not reflected in the operating cost factors so far considered. On an overall view they considerably improve the economic bottom line for renewables.

Apart from the reducing effect of the EEG on wholesale electricity prices, the external costs of electricity generation from fossil fuels that are avoided by using renewable energy sources are particularly important from a macro-economic point of view (see box on "External costs of electricity generation" on page 35): If these costs were allocated in strict accordance with the "polluter pays" principle, the price of electricity from non-renewable energy sources would be much higher. There would be a corresponding reduction in the EEG surcharge and the additional cost of EEG power procurement. In this connection a scientific study for the BMU came to the conclusion that the external costs saved by EEG electricity, at €4 billion in 2008, were more or less equal to the additional procurement costs for the EEG.

Electricity generation from renewable energy sources also results in a significant reduction in imports of coal and natural gas into Germany. In 2007 this reduced Germany's bill for fuel imports, after allowing for biomass imports, by about €1.0 billion.

28 Fachgespräch zum "Merit-Order-Effekt" im Auftrag des Bundesministeriums für Umwelt, Naturschutz und Reaktorsicherheit Berlin am 07.09.2007. Abgestimmtes Thesenpapier. Available from www.erneuerbare-energien.de.

External costs of electricity generation

The concept of external costs is a firmly established part of economic theory. External costs arise, for example, where electricity generation causes damage that electricity producers do not have to include as costs in their electricity prices. Examples include damage arising from global climate change, harmful effects on health, or damage to materials due to acid and soot. On a broader view, external costs also arise where access to energy resources is secured by political and military means.

External costs may be included in electricity prices if relevant provisions require the originators to take technical or organisational measures that cause additional costs ("internalisation"). Examples include stricter limit values for sulphur dioxide, nitrogen oxides and particulates in the case of power plants in the 1980s and 1990s, and also electricity tax or emission rights for carbon dioxide (see box about "Emissions trading" on page 24). Calculating external costs is a complex task, and the results vary widely depending on the choice of parameters. There are therefore considerable fluctuations in the figures quoted in studies.

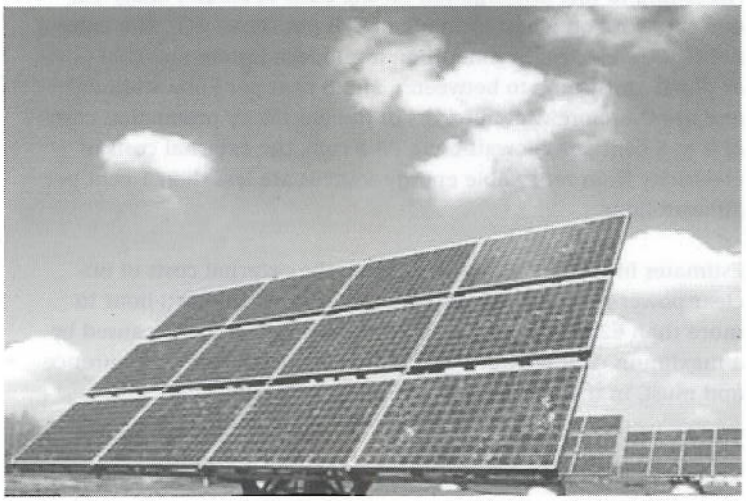
The expected costs of damage due to climate change account for the largest share of the external costs of electricity generation. A study conducted for the Federal Environment Ministry (DLR/FhG-ISI 2006) comes to the following conclusion: These costs are very likely to be over €15 per tonne of carbon dioxide (CO_2), and could, on plausible assumptions, work out at up to €300 per tonne CO_2. According to this investigation on the basis of studies analysed, one can work on a best estimate of €70 per tonne CO_2. The external costs of electricity generation in modern lignite and coal power plants thus come to between 6 and 8 cent per kilowatt-hour, and are therefore well in excess of the electricity production costs of 2 to 5 cent per kilowatt-hour. As a rule, the external costs of electricity from renewable energy sources are less than 1 cent per kilowatt-hour.

Estimates in various studies regarding the external costs of nuclear power range from less than one cent per kilowatt-hour to more than €2 per kilowatt-hour. The immense damage caused by a maximum credible nuclear accident is not covered by insurance and must, in the worst case, be borne by society.

One must also remember the positive effects of renewable energy on growth and employment: In 2008 it was already providing employment for some 278,000 people in the electricity, heating and motor fuel markets in Germany. More than half of these jobs are attributable to the EEG.

The basis for this positive trend is the rise in domestic sales of renewable energy (2008: about €29 billion) that has been in progress for years and – to an increasing extent – the export success of the German renewables sector. The latter is profiting considerably from the fact that the EEG and research promotion measures in particular have set in motion a technological development that has given Germany a leading position on the world market in various fields in the renewables sector. Today wind turbines or biomass power plants "Made in Germany" are already very successful internationally and still have considerable growth potential, because renewable energy markets worldwide are booming. The fact that the EEG itself is increasingly proving to be an export hit both reflects this trend and is one of its main driving forces.

The Renewable Energy Sources Act (EEG) as an instrument with fixed feed payments that can be predicted for long periods is a method of promoting and organising renewable energy which is considerably more efficient and cost-effective than other approaches such as quotas and bonus models. This has several times been confirmed by the European Commission. Moreover, the EEG stimulates competition on the electricity market: it creates distributed generating structures with considerably more actors, thereby reducing imbalances of market power.



RENEWABLE ENERGY – GREAT BENEFITS, DEPENDABLE PRICES

Renewables have long since emerged from their much ridiculed niche existence and established a firm place in the energy mix. Their further expansion is certain now that the European Union has laid down ambitious and binding targets. These state that by 2020 renewables are to account for as much as 20% of Europe's energy consumption. For Germany this means a share of 18%.

These targets focus attention not only on the electricity sector, but also on the use of renewable energy sources in heat production and in the transport sector. This includes the revised EEG 2009 and the new Renewable Energy Sources Heat Act, and also numerous other measures to improve energy efficiency and reduce energy consumption.

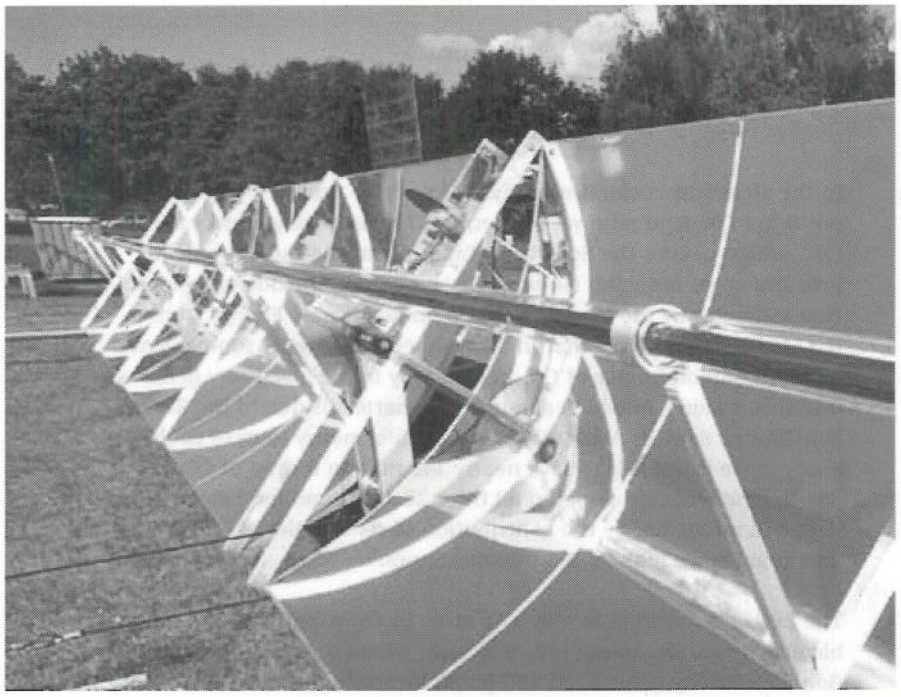
In the electricity sector, Germany is already in a particularly good position to expand renewable energies. This is largely thanks to the EEG, which next to the Ecological Tax is by far the most successful instrument for reducing climate-relevant carbon dioxide emissions. First estimates by the Working Group on Renewable Energy statistics (AGEE-Stat) indicate that in 2008 renewable energy sources saved some 75 million tonnes of CO_2 in Germany in the electricity generation sector alone, of which about three quarters is due to the Renewable Energy Sources Act. By 2020 renewable energy sources could already make it possible to save nearly 140 million tonnes of CO_2 in the electricity sector alone; in all three sectors together – electricity, heat and motor fuels – the contribution of renewables to CO_2 reduction could be as high as 190 million tonnes.[29]

The EEG will continue to play a key role in the expansion of renewable energy sources in the future as well: whereas the cost of conventional electricity generation will go on increasing as a result of rising fuel prices and the need to construct new power plants, most of the feed-in remuneration payments laid down in the EEG will go down every year. Thus renewable energy sources will steadily become more economic. The revision of the EEG in 2009 also embodies incentives for better integration of renewables in the electricity system and for separate marketing of electricity generated from renewables. This too will further improve the profitability of electricity generation from renewables.

The expansion of renewable energy sources creates the basic requirements for sustainable and technologically viable energy supply at reasonable prices in the long term. It will conserve the basis for the life of future generations and put new and especially environment-friendly technologies in place on the world market.

Good prospects for the future!

29 As in the Federal Environment Ministry's Lead Study 2008, cf. Footnote 13.

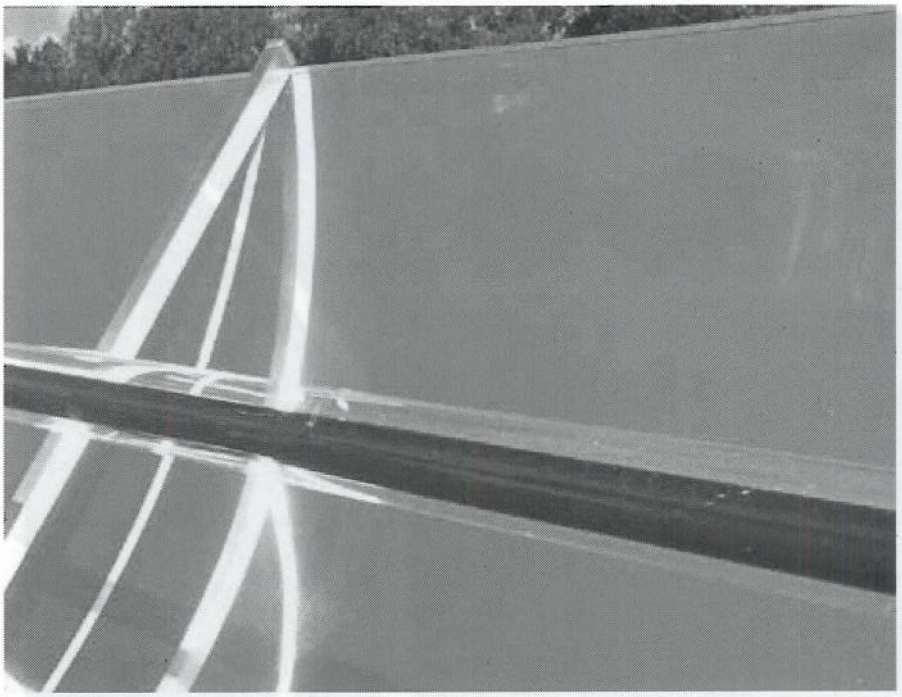


SUGGESTIONS FOR FURTHER READING

- **Publications by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety**
  - Renewable energy sources in figures – National and international development.
  - Wirtschaftsförderung durch erneuerbare Energien – Was bringt uns das? (german only).
  - Renewable Energies Act: The Renewable Energy Sources Act. – Renewable Energy Sources Act Progress Report 2007.

- **DLR/FhG-ISI (2006):** Externe Kosten der Stromerzeugung aus erneuerbaren Energien im Vergleich zur Stromerzeugung aus fossilen Energieträgern. Report commissioned by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

- **Nitsch, Joachim (2008):** Lead study 2008: Further development of the 'Strategy to increase the use of renewable energies' within the context of the current climate protection goals of Germany and Europe. Study commissioned by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

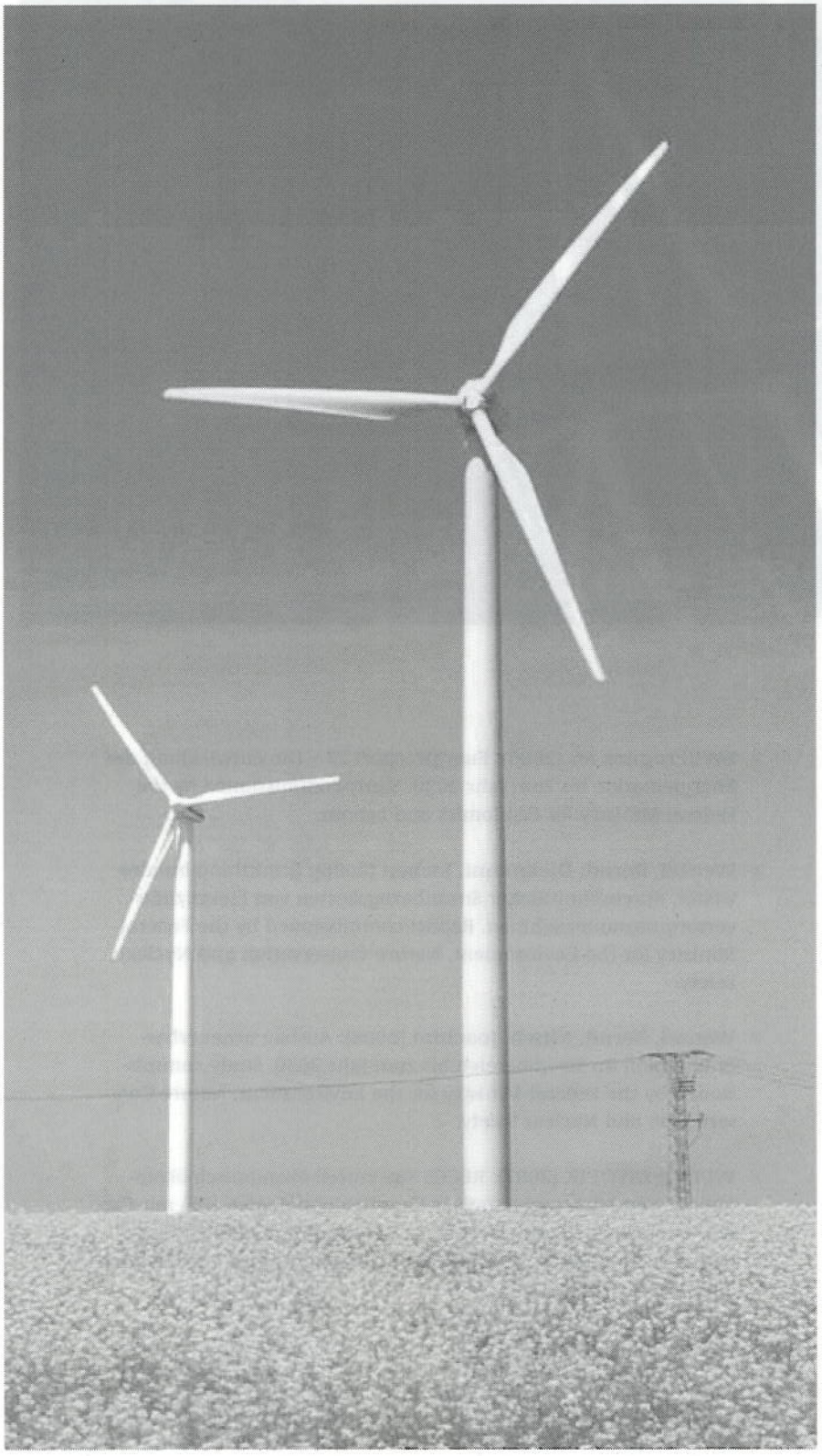


- **EWI/Prognos AG (2005):** Energiereport IV – Die Entwicklung der Energiemärkte bis zum Jahr 2030. Study commissioned by the Federal Ministry for Economics and Labour.

- **Wenzel, Bernd; Diekmann, Jochen (2006):** Ermittlung bundesweiter, durchschnittlicher Strombezugskosten von Elektrizitätsversorgungsunternehmen. Report commissioned by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

- **Wenzel, Bernd; Nitsch, Joachim (2008):** Ausbau erneuerbarer Energien im Strombereich bis zum Jahr 2030. Study commissioned by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

- **WI/DLR/ZSW/PIK (2007):** RECCS Strukturell-ökonomisch-ökologischer Vergleich regenerativer Energietechnologien (RE) mit Carbon Capture and Storage (CCS). Research project commissioned by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.



INFORMATION ABOUT RENEWABLE ENERGY ON THE INTERNET

This list shows only a small selection of information available on the Internet that is closely related to the topics in this publication.

- bundesrecht.juris.de/eeg_2009: Renewable Energy Ressources Act in german. English version of the Renewable Energy Sources Act: http://www.erneuerbare-energien.de/files/pdfs/allgemein/application/pdf/eeg_2009_en.pdf.
- www.bdew.de: Federal Association of the Energy and Water Industries *(Bundesverband der Energie- und Wasserwirtschaft)*, EEG data.
- www.bine.info: Informationabout energy conservation an renewable energies (german only).
- www.bmu.de: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety *(Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit)*.
- www.co2online.de: Project sponsor of the climate protection campaign, comprehensive information portal on efficient exploitation of energy and utilisation of renewable energy sources (german only).
- www.dena.de/themen/thema-reg: German Energy Agency *(Deutsche Energieagentur)*.
- www.eex.de: European Energy Exchange.
- www.energiefoerderung.info: Development programme database.
- www.erneuerbare-energien.de: Federal Environment Ministry's information portal on renewable energy sources.
- www.externe.info: EU research findings on external costs from the ExternE project.
- www.klima-sucht-schutz.de/oekostromrechner.0.html: Comparative calculator for green power tariffs.
- www.unendlich-viel-energie.de: Information campaign on renewable energy sources.

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