# The German *Energiewende* under pressure

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## 1. Background and purpose of the study

The European Union has initiated a process aimed at a complete restructuring of the energy system. In Germany, meanwhile, the intention is gradually to replace both $CO_2$-emitting coal-fired power plants and nuclear power plants with low-carbon and renewable energy sources. The resulting greener power mix is to be complemented by enhanced energy efficiency in the building and transport sectors. This fundamental restructuring of the German energy system – commonly referred to as the *Energiewende* – has become a societal consensus. Germany has thus embarked on what will inevitably be a lengthy process, and yet it is a process that already appears to be in jeopardy. Debates about the right way of implementing the *Energiewende*, as well as possible course corrections, have only just begun.

In the aftermath of the Fukushima disaster an upbeat tone prevailed between roughly spring 2011 and spring 2012. Since then, this optimism has been extinguished by the pessimism of the naysayers. Insofar as politicians have allowed themselves to be forced into backward steps and political U-turns, the national *Energiewende* has become subject to perverse policy shifts and uncertainty. A forward-looking energy policy has – according to Kemfert (2013: 8) – turned into a battlefield on which opposing forces argue vociferously and block further action, while Rosenkranz (2012: 101) describes the German *Energiewende* as 'the obstructed project of a century'. Politicians, lobbyists and environmentalists wage war, a war that is about power and influence, cash and profits; stakeholders defend their vested rights and interests. At the centre of the media debate is the cost of the German *Energiewende*, specifically the cost of rolling out renewable energy technologies in the power generation sector. But in the view of Lovins (2013:1), many of the media contributions concerning the *Energiewende* amount to a 'disinformation campaign'.

The aim of this study is to separate facts from fiction in the cost debate and to figure out whether we really are at a 'turning point' in German energy policy. Are backward steps now being taken in terms of implementation of the German *Energiewende*? Are there signs that green objectives and social concerns are being played off against each other? Who are the boosters and who are the blockers and what are their respective arguments?

Development of the chapter will be as follows: first, the author describes the policy framework of the German *Energiewende* and explains which controversial topics arise when energy policy is translated into practice; the second section deals with the difficulties entailed in any attempt to assess the costs of the German *Energiewende*; in the third section the focus is on the benefits of the German *Energiewende*: fourthly, the power price debate is examined in terms of the validity of the arguments often put forward in politics and the media; fifthly, the citizen- and community-driven *Energiewende* is shown to be a democratic and decentralized complement to the policy goals which entails changing actors and diverging interests and stakes; the study ends with a summary of the main points and conclusions.

## 2. The German *Energiewende* – what exactly are we talking about?

What exactly are we talking about when we use the term *Energiewende* in relation to Germany? In 1985, Hennicke, Kohler and Seifried (1985) wrote a book entitled The German *Energiewende* is possible. The year of publication indicates that making the *Energiewende* happen has been a long-haul project. Others prefer to say that the *Energiewende* started in the years 1999/2000 with the 100,000 solar rooftops power programme, the Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz, EEG), and the nuclear consensus on limiting the average service life of the German nuclear power plants (Ruchser 2012). Basically, the 'German can-do attitude' (Morris and Pehnt 2012: 7) is based on the experience of the last two decades in which renewables matured more quickly than expected.

In 2007, the European Union initiated a process aimed at a complete restructuring of the energy system. The '20-20-20 targets' require the EU member states as a whole, by 2020, to:

1. Reduce greenhouse gas emissions by at least 20% compared to 1990,
2. Reduce energy demand by around 20% compared to a 'business-as-usual' development, and
3. Increase the share of renewable energy in overall energy consumption to 20% (European Commission 2007).

With the introduction of the 'Energy Concept' in September 2010, the German Federal Government set itself ambitious targets for energy and climate policy (Bundesregierung 2010). The Energy Concept entails plans to cut greenhouse gas emissions by 40% by 2020, and by at least 80% by 2050. Renewables are to be expanded to form the mainstay of energy supply, the aim being to increase their share in gross final energy consumption from roughly 10% in 2010 to 60% in 2050. In electricity supply, the share of renewables is to grow to as much as 80% by 2050. At the same time, the government seeks to reduce energy consumption over the long term. Compared to 2008 levels, the aim is to achieve a 50% reduction in primary energy consumption by 2050. On average, this is expected to require a 2.1% annual increase in energy productivity relative to final energy consumption. Furthermore, the annual rate of energy retrofits for buildings is to be doubled from current levels, from one to two percent of existing buildings per year.

Table 1 presents the goals of the Federal Government's Energy Concept (2010) as cornerstones of the *Energiewende*.

Following the Fukushima nuclear power plant disaster, the German Government decided to speed up the phase-out of nuclear energy. Accordingly, the last nuclear power plant will be shut down by the end of 2022. The Federal Government laid the foundations for the energy system to undergo a fundamental transition in 2011 by adopting a comprehensive legislative package known as the 'Energy Package' (Bundesregierung 2011). The following box (Box 1) summarizes the main targets and regulations of the policy framework.

The German energy transition after Fukushima represents a policy-driven, sustainability-oriented restructuring of both the supply and demand-side components of the entire energy system by 2050. In this study, we focus on the period since the Fukushima catastrophe. Basically, the German energy transition, post-Fukushima, has two pillars: the Energy Concept of the German Federal Government (2010), which sets

Table 1 **Targets of the *Energiewende***

| | 2011 | 2020 | 2050 | | |
|---|---|---|---|---|---|
| Greenhouse gas emissions | | | **2030** | **2040** | **2050** |
| Greenhouse gas emissions (compared with 1990) | -26.4% | -40% | -55% | -70% | -80% to -95% |
| Efficiency | | | | | |
| Primary energy consumption (compared with 2008) | -6.0% | -20% | -50% | | |
| Energy productivity (final energy consumption) | 2.0% per annum (2008-2011) | | 2.1% (2008-2050) | | |
| Gross electricity consumption (compared with 2008) | -2.1% | -10% | -25% | | |
| Share of electricity generation from combined heat and power | 15.4% (2010) | 25% | – | | |
| Buildings | | | | | |
| Heat requirement | No data | -20% | – | | |
| Primary energy requirement | No data | – | Around -80% | | |
| Rate of modernisation | Approx. 1% per annum | Doubling levels to 2% per annum | | | |
| Transport | | | | | |
| Final energy consumption (compared with 2005) | Approx. -0.5% | -10% | -40% | | |
| Number of electric vehicles | Approx. 6.600 | 1 million | 6 million | – | |
| Renewable energies | | | | | |
| Share in gross electricity consumption | 20.3% | at least 35% | at least 50% | at least 65% | at least 80% |
| Share in gross final energy consumption | 12.1% | 18% | 30% | 45% | 60% |

Source: BMWI and BMU 2012: 3.

ambitious targets for energy and climate policy, and the Energy Package, a comprehensive legislative framework for its implementation including a timetable for nuclear phase-out (2011).

This new direction in energy policy implies numerous controversial topics. The following questions encompass the most significant aspects and challenges of the short- and medium-term energy policy:

— Costs of the *Energiewende*: How much? For how long? Who pays?
— What are the short- and medium-term impacts on the economy?

— How to secure power supply while integrating intermittent power into the power system?
— Power is not the only focus of the *Energiewende*: how are system transformations of heat and transport sector to be designed?
— Redressing the supply-side bias: how to foster energy (and resource) efficiency on the demand side?
— How to find the right balance between decentralized power generation (e.g. from photovoltaics) and centralized power generation (e.g. from solar thermal power plants and offshore wind power plants)?
— How to guarantee citizens' participation and democratization?
— How to bring about lifestyle changes to foster sustainable consumption and production?

Box 1 **Main targets and regulations of the 'energy package' – six laws and one ordinance (2011):**

1. Act to restructure the legal framework for the promotion of electricity generation from renewable energy sources
2. Act on measures to accelerate the expansion of the electricity grid
3. Act to restructure provisions of the energy industry act
4. Act amending the Act to establish a special energy and climate fund
5. Fourth Ordinance amending the Ordinance on the award of public-sector contracts
6. 13th Act to amend the atomic energy Act
7. Act to strengthen climate-friendly measures in towns and municipalities

Source: BMWI and BMU 2012: 5.

Generally speaking, all major political parties endorse the *Energiewende*. However, aspects including the speed of the *Energiewende* transition are hotly debated. In the media, a reductionist approach is often taken to the whole subject of the *Energiewende*. Germany's energy transition is not only about switching from nuclear and coal to renewables in power generation. Most public attention has focused on the electricity sector. Costs and power prices are at the heart of the debate and, in both the media and politics, social considerations and environmental needs are played off against each other in order to thwart progress of the German *Energiewende*.

## 3. The costs of the *Energiewende* – ambitious but feasible

How much will the German energy transition cost? For some time now, the costs of the German energy transition have been a subject of heated dispute in politics and the media. At the level of public opinion it is the short-term costs of the *Energiewende* that are causing particular outcry and on which debate focuses almost exclusively. The former Federal minister of the Environment Peter Altmeier referred to costs of the *Energiewende* as amounting to 1000 billion euros, thereby triggering a tremendous media echo (FAZ 2013).

In monetary terms there can be no precise answer to the 'cost question', because any exact determination of this aspect is hampered by a range of factors. For instance, future economic and technological developments cannot be predicted with certainty. However, it is possible to assess the costs of the energy transition on the basis of some plausible assumptions about these developments. In any such effort to assess costs, their components and the calculation methods must be set out precisely. Figures must be transparent. To this end, it is necessary to define the terms 'costs' and '*Energiewende*'.

A first distinction in speaking of 'costs' relates to the question of whether it is the absolute or the differential costs of the *Energiewende* that are being assessed. Differential costs would appear more appropriate in this respect, for these are costs that are incurred *additionally* compared to a business-as-usual development of the energy system. The additional costs are the decisive aspect, since the remaining costs would be incurred in any case in meeting the demand for energy.

In a next step, (differential) costs can be separated out into market costs and external costs. External costs comprise costs induced by environmental pollution and borne not by the polluter but by society as a whole. A macroeconomic assessment requires the inclusion of such external costs (or avoided external costs). Nor must the economic benefits of the *Energiewende* be neglected.

Finally, it is important to specify both the period of time which is under consideration – short-term or long-term – and the discounting rate that is to be taken as a basis for the assessment.

Different studies have assessed the differential costs of a forceful energy transition by 2050, for example:

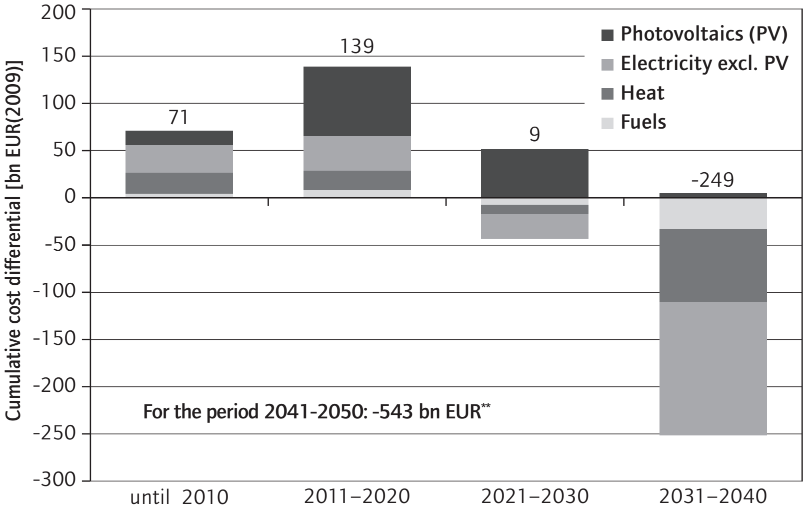
— Fraunhofer Institute for Wind Energy and Energy System Technologies (Gerhardt *et al*. 2014), commissioned by the German Federal Ministry of the Environment;
— German Aerospace Centre; the Fraunhofer Institute for Wind Energy and Energy System Technologies; Engineering Consultants for New Energies (DLR *et al*. 2012) commissioned by the Federal Ministry for the Environment;
— Fraunhofer Institute for Solar Energy Systems on 100% power supply based on regenerative energy sources (Henning and Palzer 2012);
— Prognos and Öko-Institut on behalf of the WWF (Öko-Institut, Prognos AG and Ziesing 2012);
— German Advisory Council on the Environment (SRU 2011).

These studies all present robust assessments of the additional costs that would be entailed by the *Energiewende* or by some of its components.

According to the Federal Ministry of the Environment findings, the additional costs that society would have to bear in the short term in order to implement the *Energiewende* could reach their peak at 20 billion euros per year by the end of this decade. Figure 1 shows, in ten-year stages, the estimated differential costs of the *Energiewende* including all sectors – power, heat and transport – according to the study's 'Scenario 2011 A'. The differential costs of the expansion of renewables, compared to a fossil-fuel path, are expected to become negative at some point between 2025 and 2035 – depending on the assumptions about future fossil-fuel price increases. In this study, only market costs have been assessed.

By 2010, the renewables roll-out amounted to 71 billion euro with 44 billion euro accruing to the power supply. If the subsequent 10-year blocks are added, the result is that by 2020 the cumulated differential costs will have increased to 210 billion euro. By 2030, these costs are shown to rise only slightly to 219 billion euros, whereafter the cumulated differential costs will decrease. By the middle of the century, regenerative energy supply will have saved some 570 billion euros of potential additional expenditure that would have been incurred by continuing the (fictive) business-as-usual fossil-fuel path.

Figure 1 **Cumulated system analytical differential cost of total regenerative energy supply in the scenario 2011A (in ten-year blocks)***



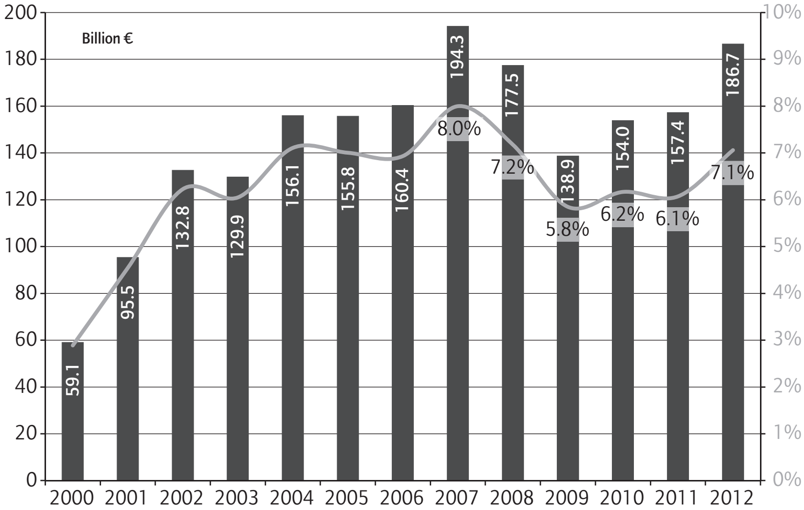

Note: * Compared with a fossil energy system, assuming a future increase in fossil fuel prices in line with price path scenario 2011A.
** No breakdown by energy source available.
Source: BMU 2012c: 63.

As for the additional yearly cost burden: 12.4 billion euros is what the *Energiewende* could have cost in 2010 (DLR *et al.* 2012). In absolute numbers this seems to be an enormous amount of money. In relative terms these yearly additional costs correspond to only 0.8% of the private consumption in Germany which amounted to 1,435.09 billion euros in 2010 (Destatis 2014). It can be assumed that this is an acceptable price. The differential costs could reach their maximum level in 2015 with 15.5 billion euros, and in the medium-to-long term these costs are expected to become negative, i.e. costs will be saved compared to a pathway that continued to rely on fossil fuels.

Can Germany afford a transitional reduction of private consumption by 0.8%? Is this really a significant welfare loss? Is it really a cost explosion that might even initiate the deindustrialization of Germany? Is Germany even on the edge of deindustrialization?

Figure 2 shows that Germany has been realizing very considerable balance of payment surpluses amounting to 7.1% of its GDP in 2012, and

Figure 2 **Balance of payments surplus of Germany (billion EUR, left scale; % of GDP, right scale)**




Source: Rosenkranz *et al*. 2013: 6.

faces growing criticism from other member states because such prolonged trade imbalances are regarded as detrimental to economic stability.

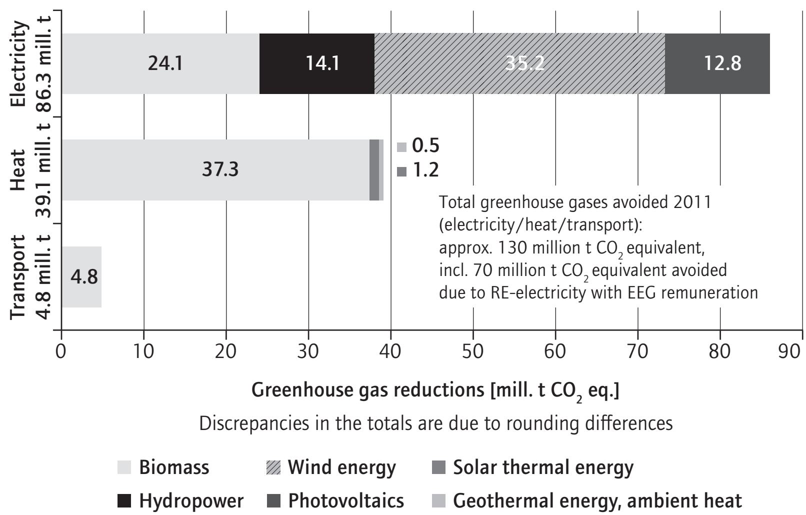
To sum up, the costs of the *Energiewende* can be assessed only approximately. Even if studies state concrete amounts, it should be stressed that these rely on a host of uncertain assumptions. The figures themselves are therefore also uncertain. To decide what are acceptable financial burdens in the context of transformation of the energy system is a question of values. Ascertainment of these values within Germany society is the result of an ongoing political and societal process. The *Energiewende* will not come free of charge – not initially at least – but it is economically feasible.

## 4. Investments or costs? The benefits of the German Energiewende

The costs of the energy transition cannot be viewed in isolation from the (significant) benefits of the *Energiewende*. It is important to realize that the non-monetary costs of energy consumption do not appear on consumers' electricity, gas and oil bills. Yet avoidance of external costs is a central benefit of the *Energiewende*. In addition to this, the *Energiewende* is a long-term investment programme; it contributes to technological innovation and boosts the 'green economy'. In this chapter five types of benefit that result from fostering the massive roll-out of renewable energies are highlighted: a contribution to greenhouse gas reductions; savings in fossil fuel imports; energy technology price decreases; job creation and investments triggered by renewable energy sources.

The expansion of renewable energy is expected to make a major contribution to meeting Germany's climate target of cutting greenhouse gas emissions by between 80 and 85 percent by 2050 relative to 1990. In 2011 the quantity of greenhouse gases avoided through the use of renewable energy amounted to 130 million tonnes of CO2 equivalent (BMU 2012b: 26). Of this, 86.3 million tonnes were due to renewables in the electricity sector, including 70 million tonnes attributable to electricity subject to remuneration under the Renewable Energy Sources Act (EEG). Emissions avoided due to renewables amounted to 39.1 million tonnes in the heat sector and 4.8 million tonnes CO2 equivalent in the transport fuel sector (see Figure 3).

Figure 3 **Greenhouse gas emissions avoided by the use of renewable energy sources in Germany in 2011**




Source: BMU 2012b: 27.

Germany is gradually reducing its above-average dependence on energy imports. At present the country needs to import 97 percent of its oil and 89 percent of its gas (BMU 2013: 29). Renewable energy sources help mitigate energy import risks such as quantity and price risks, thereby contributing to improved energy supply security. Savings in fossil fuel imports are an indicator of increasing energy security. Table 2 shows that in 2012 renewables replaced imports to a total value of 10 billion euros.

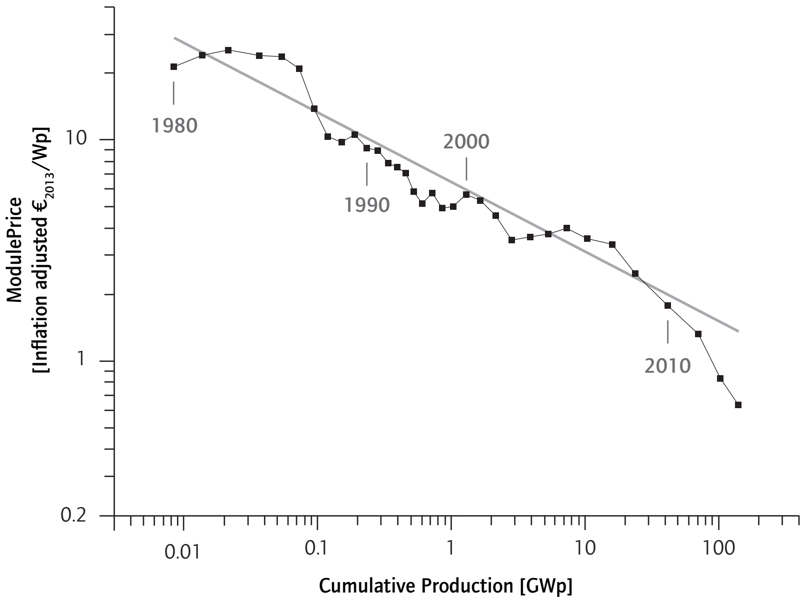
Table 2 **Savings in fossil fuel imports in Germany due to renewable energies (bn. €)**

| | Electricity | Heat | Transport | Total |
|---|---|---|---|---|
| 2009 | 2.1 | 3.1 | 0.9 | 6.1[2] |
| 2010 | 2.5 | 3.3 | 0.8 | 6.6[2] |
| 2011 | 2.5 | 3.3 | 0.8 | 7.1[2] |
| 2012 | 3.9 | 4.9 | 1.2 | 10.0[2] |

Source: BMU 2013.
Notes: [1]Excluding imported lignite for heating purposes. [2] Gross figures.

The long-term effect of different solar power subsidy schemes in Germany decreased prices for a typical 3 to 10 kWp photovoltaic rooftop-system from around 14,000 euros per kilowatt-peak (output power achieved under Standard Test Conditions) in 1990 to 1,600 euros per kilowatt-peak by the end of 2012. This is a price reduction of 89% over a period of 22 years and is equivalent to a compound average annual price reduction rate of 9.4% (Fraunhofer ISE 2013b: 9). The Experience Curve – also called Learning Curve – shows that in the last 30 years module prices decreased by about 20% with each doubling of the cumulative module production (see Figure 4). Cost reductions result, inter alia, from economies of scale and progress in research.

Figure 4 **Price learning curve (all bulk PV technologies)**

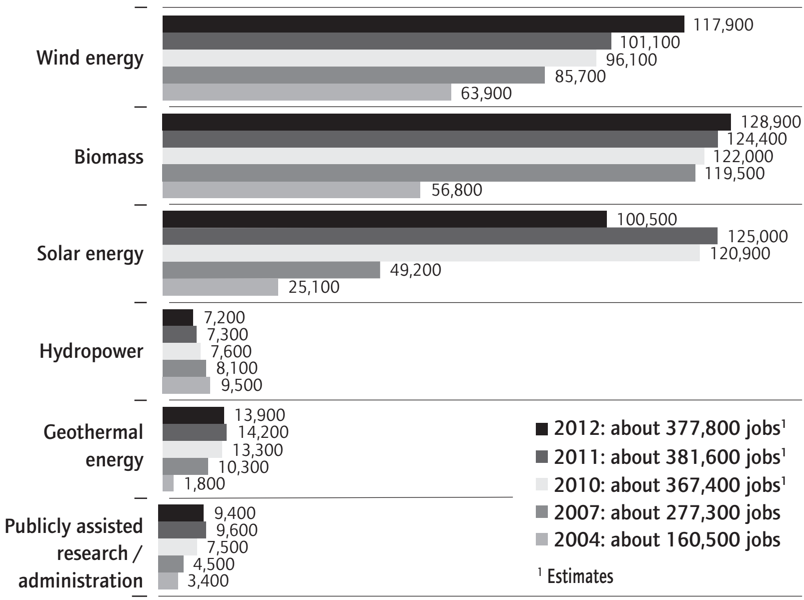



Source: Fraunhofer ISE 2014: 40.

The energy transition is Germany's largest post-war infrastructure project. It serves to strengthen its economy and to create new jobs. With the energy transition, Germany aims not only to keep its industrial base but also to make it fit for a greener future.

Figure 5 below shows that the transformation of the energy system creates and secures jobs and drives sustainable growth. In the renewables sector, 377,800 new jobs had been created by 2012.

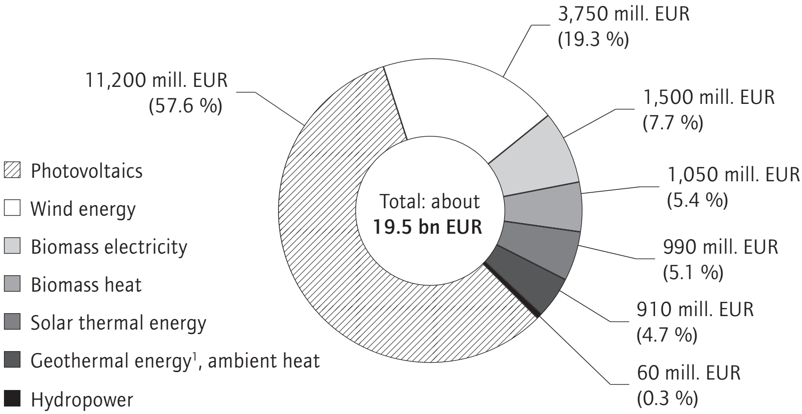
Figure 5 **Development of jobs in the renewable energy sector**




Source: BMU 2013: 32.

Investments in renewable energy technologies dropped for the second consecutive year in 2012 to 19.5 billion euros, see Figure 6 (BMU 2013: 30). This downward trend is due, however, to declining prices for photovoltaic systems and is a step towards a balanced investment structure. Investments in renewable energy technologies continue to be an important economic factor. In particular, revenues from plant operation showed a 9-percent rise on the previous year to 14.8 billion euros. Revenues accrue continuously over the entire life of an installation, which is usually around 20 years.

Figure 6 **Investments in construction of renewable energy installations in Germany, 2012**



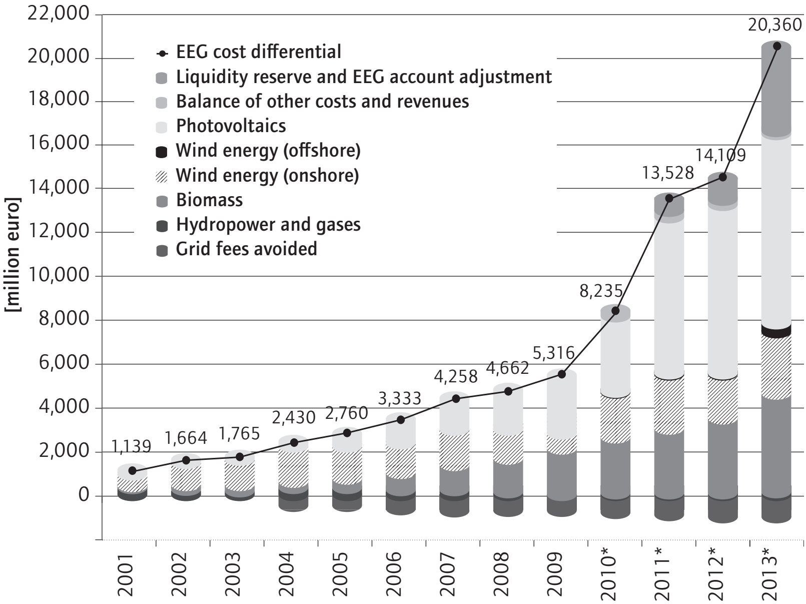

Source: BMU 2013: 30.
Note: [1] Large installations and heat pumps.

It is mainly a question of investment in new installations, and, to a small extent, of an expansion of refurbishment of installations, such as the reactivitation of old hydropower plants. The figures include not only investments by energy supply companies, but also investments by industry, trade, commerce and private households.

## 5. The power price debate

The large-scale deployment of renewable energy technologies in the electricity sector is at the heart of the German energy transition. The German Renewable Energy Sources Act introduced two key policies in the year 2000: first, a fixed 20-year power purchase contract (i.e. feed-in tariff) offered to most newly built power plants using renewable energy sources (such plants also enjoy priority grid access), and, second, a stipulation that this support offered to electricity generation from renewable energy sources is to be paid not by taxpayers but rather by electricity consumers. The transmission grid operators are obliged to take the electricity produced by the renewable energy power plants and sell it on the electricity exchange. The differential costs are the difference between the payments made to the operators of the plants and the revenues received by the transmission grid operators by selling the electricity on the exchange. The differential costs are spread over the (non-privileged) final consumers. Figure 7 shows the development of the differential costs which have risen to just over 20 billion euros in 2013.

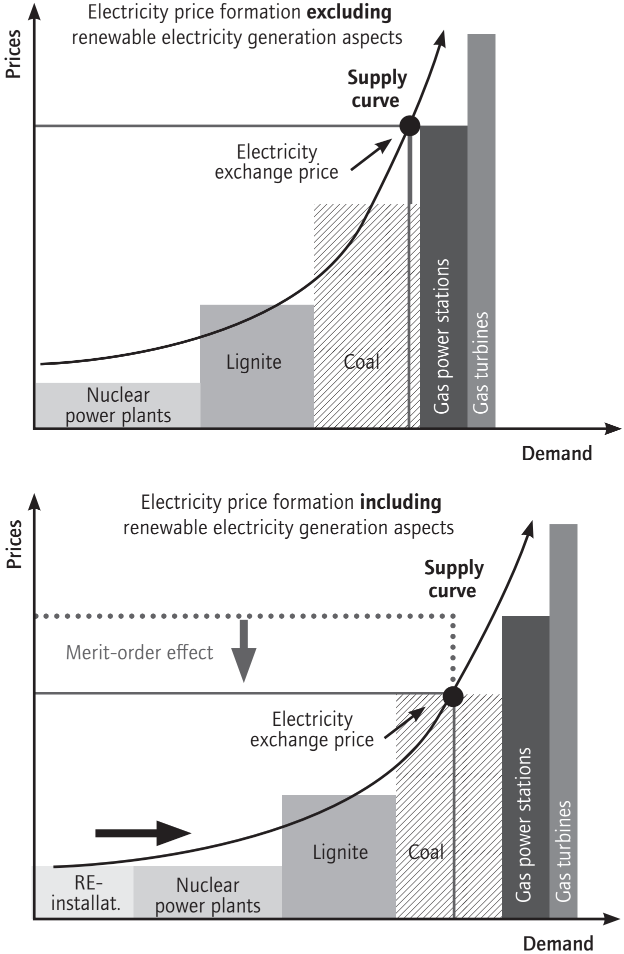
Figure 7 **Development of EEG differential costs from 2001 to 2013**




Source: BMU 2013: 37.

While renewable power has raised the retail rate of power by 5.28 cents per kilowatt hour in 2013 in Germany, it has lowered wholesale prices. The so-called 'merit-order effect' plays an essential role when analysing the effects of the German Renewable Energy Sources Act (EEG) on the electricity price for final consumers. Merit-order effect means that the electricity generated by renewable energy sources has a price-curbing effect on power exchange prices. This is due to the fact that renewables displace power stations with higher variable costs in line with their merit order, which is the priority of use on the basis of the short-term marginal costs (see Figure 8). In this way, renewables reduce electricity wholesale prices. By way of example, solar power in particular is generated in the early afternoon at a time of peak consumption. Normally, even the most expensive generators such as gas-fired power plants are switched on during such hours (merit-order effect), but less expensive solar power largely offsets this costly peak demand power in Germany (Morris and Pehnt 2012).

Figure 8 **Simplified description of the Merit-order effect**

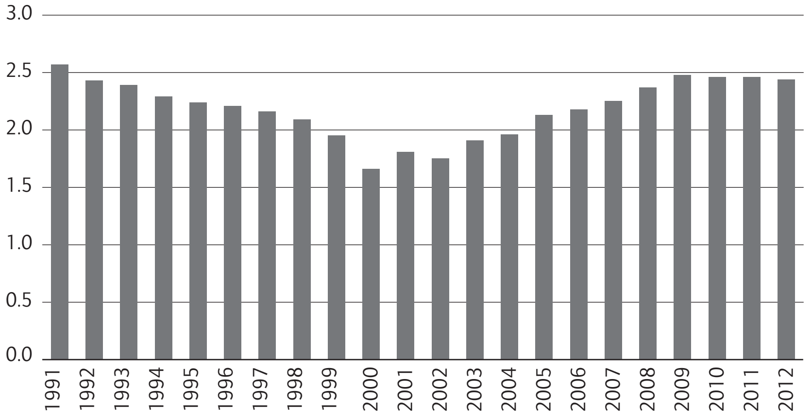



Source: BMU 2013: 40.

To assess whether the energy supply is affordable, the possible burdens caused by energy costs on individual households and enterprises as well as the aggregated effect of energy costs on the economy as a whole need to be taken into account (Löschel *et al.* 2012). Affordability is often debated with regard to the burden-sharing, i.e. the prices paid by individual end-users. However, this distracts from system cost developments. The aggregated burden on the economy caused by energy costs permits a statement of how far there is a high-energy cost burden to society as a whole.

The Expert Commission for the Assessment of the first monitoring report on the *Energiewende* concludes that, seen from an aggregated perspective, the power price increase is not as dramatic as it is often publicly depicted to be (Löschel *et al.* 2012: 101). Figure 9 shows the development of the power prices as a share of gross national product. In 1991 the aggregated power bill of all private and commercial end-users in Germany amounted to 2.6% of gross domestic product (GDP). Twenty years later the share is almost identical at 2.5%.

Figure 9 **Share of power costs as measured by gross domestic product (%)**




Source: BMWI 2014: 109.

However, power prices for private households as well as for the commercial sector and for a large share of medium-sized businesses have been rising faster than power prices for large-sized and energy-intensive businesses. The opponents of the *Energiewende* blame this price rise on the energy transition and especially on the roll-out of renewable energy technologies, thus 'inspiring the absurd election-season fiction that renewables have made electricity a luxury good and tipped Germany's poor into energy penury' (Lovins 2013: 1). As a matter of fact, power prices for an average German household, for commercial enterprises and manufacturers, as well as for a large share of medium-sized businesses, have, since the start of the millennium, virtually doubled. It is noteworthy though, that the rise began long before the roll-out of renewable energy technologies gained momentum and long before the cost allocation of the feed-in law could noticeably be reflected in end-users' power bills (see Figure 10).

Indicators for energy costs are drawn on especially in discussing the social aspects of the *Energiewende*. Recent increases in power costs have placed low-income households under pressure and, over the next few years, power prices are expected to increase a little more.

TNS Infratest conducted a survey for the Renewable Energies Agency, the results of which show that German citizens consider the *Energiewende* to be worth its price (Wunderlich and Vohrer 2012). Power prices are not the biggest issue for German households; rather, heating costs represent the lion's share of energy costs. The problem of some low-income households having trouble in paying their energy bills is much more of a general poverty problem; it is not the energy prices that are the cause of the poverty. The German government is sponsoring energy audits to help people to conserve power and energy for heating. Some authors point to the fact that the *Energiewende* is expected to lead to lower energy prices in the longer term, thus helping to reduce energy poverty: 'The energy transition itself is a way of keeping energy poverty in check' (Morris & Pehnt 2012: 9).

The renewable energy surcharge is just one of several cost components that have been on the rise in the last few years. The lion's share is still the costs for generation, transportation and distribution of power as Figure 10 also shows. For the record, the increase in the support for renewable energy accounts for less than half of the total increase in the average household electricity price over the 2000-2013 period.

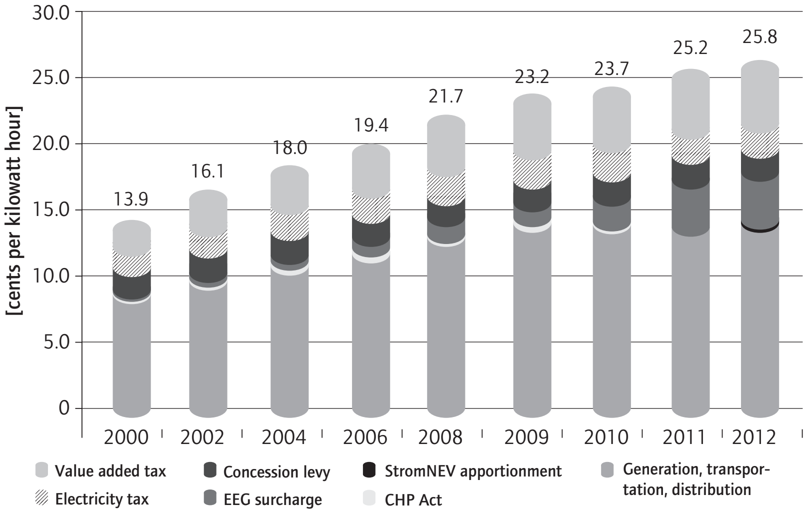
The power price index of the energy association of the German industry (VIK) for medium voltage clients in industry and commerce – which is deemed to be an important indicator of the general power price development in the German economy – has been in steady decline since mid-2011 (VIK 2014).

The general trend of declining industry power prices at the power exchange can be attributed, in the main, to the following two factors:

— The low price level of the certificates of the European Union Emissions Trading System (EU ETS)

— The steady increase in electricity generation from renewable energy sources, which has led to lower prices due to the merit-order effect. It is estimated that this effect has led to a decline in wholesale electricity prices of approximately 10 euro/MWh.

Figure 10 **Power price development and cost components for private households (annual consumption of 3.500 kWh)**




Source: BMU 2013: 39.

Depending on their respective power procurement strategy, energy-intensive enterprises can currently achieve prices of 40 euros/MWh and less at the power exchange (Matthes 2013). Compensating payments for the $CO_2$ costs of the EU ETS, which are included in the wholesale power price, reduce the actual price that energy-intensive companies need to pay for their electricity by approximately 3 euros/MWh. Thus power procurement costs fall significantly below 40 euros/MWh. Energy-intensive industry is, to a large extent, exempted from having to pay for its own $CO_2$ emissions, as emission certificates are allocated to such firms free of charge.

Since 2007, the average cost share of all types of energy cost in the industry sector has remained virtually unchanged, amounting to 2% of the gross production value. Nearly 90% of the 36,000 industrial companies in Germany can be assigned to sectors in which the total energy costs are on average less than 3% of gross production value (BMU 2011). In other words, for a vast majority of manufacturing companies the power costs are not a decisive factor of economic success or failure. Even considerable cost increases in a two-digit range are only marginally reflected in these companies' balance sheets.

Berlin has always granted privileges in order to protect energy-intensive industries against actual or perceived competitive disadvantages on the world market. The development of exemptions from the renewable power surcharge is shown in Table 3.

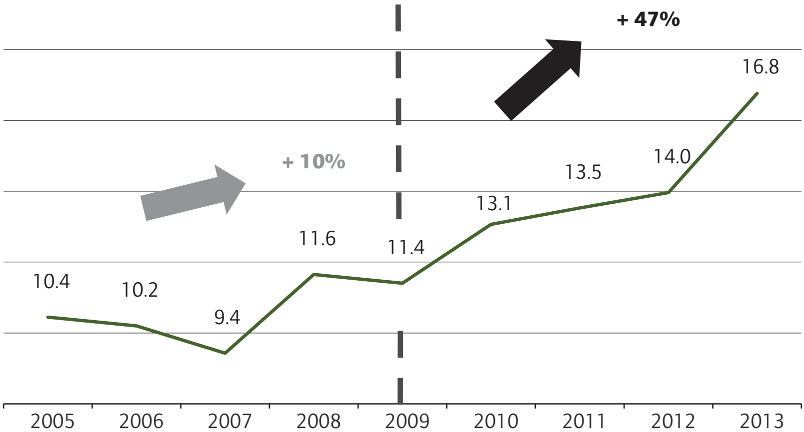
Table 3 **Increasing exemptions from the renewable energy surcharge**

| | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|
| Number of enterprises that made an application | 650 | 813 | 2,055 | 2,384 |
| Exempted amount of power in GWh | 75,974 | 85,402 | 95,557 | registered: 119,539 |
| Exemptions in billion euro | 2.74 | 2.72 | 4.0 | 5.1 |
| Share of exemptions in total surcharge | 0.6 | 0.63 | 1.04 | 1.35 |

Source: BMU 2013b: 11.

In terms of power price, German industry has traditionally benefited from generous privileges of various kinds. In 2013, the total electricity-related privileges granted added up to a record sum of 16.8 billion euros. By contrast, the sum of the differential costs caused by the Renewable Energy Sources Act (allocated among end-users) amounted to 20.4 billion euros in 2012. The list of the privileges and exemptions is long and difficult to analyse. It affects all kinds of cost factors comprising the total power price. It includes costs of power generation and transport, the power tax, use-of-system charges/transmission fees (to the network operator) and concession fees (to the municipality). Another group of privileges are granted in regard to the Renewable Energy Sources Act allocation, the so-called co-generation allocation (to support highly efficient power plants that make use of both the power generated and the heat that accrues during this process). Additionally, there are exemptions from the allocation in accordance with §19, section 2, of the electricity network charges ordinance and, last but not least, since 2013 from the offshore liability levy. Under the last government coalition consisting of the Christian Union (CDU and CSU) and the Liberals (FDP), the total

Figure 11 **Total financial exemptions with regard to the power price of the industry sector (Billion €)**




Source: Rosenkranz *et al.* 2013: 22.

power price exemptions of the industry sector reached their highest level yet at 16.8 billion euros in 2013 as Figure 11 shows.

Summing up, the renewables surcharge is not a relevant factor for measuring the costs of the *Energiewende*. The surcharge has increased in recent years. One reason for the increase in the surcharge in recent years is a declining wholesale price at the power exchange. And a key reason why this wholesale price is declining is that the European Union emissions trading system remains ineffective. Another reason why the surcharge has increased in recent years is that the number of exempted enterprises has been increasing considerably. Critics of renewables try to inflate the FiT surcharge into a big issue, perhaps because, in reality, there are no big issues: the consensus supporting Germany's renewables policy is broad, deep, and durable (Lovins 2013).

## 6. Changing actors in the German energy market

The debate on the costs of the *Energiewende* also raises the question of who is actively promoting this reform and who is benefitting from it?

Over the past two years alone German wholesale power prices have fallen by about 30% to near eight-year lows, placing big utilities that have underinvested in renewables under severe profit pressure (The Economist 2013). Germany's biggest utility, E.ON, has seen its share price fall by three-quarters from its peak, while the company's income from conventional power generation (fossil fuels and nuclear) has fallen by more than one third since 2010. At the second-largest utility, RWE, recurrent net income has also fallen by a third since 2010. Electricity generation from solar and wind power plants with marginal generation costs of zero or almost zero is replacing on the power market, in particular, the expensive electricity generation from gas-fired power plants. Even the higher revenues for peak load power hardly cover the plants' operational costs. Accordingly, under current conditions old hard coal-fired power plants no longer make any money (Matthes *et al.* 2012). Lignite-fired power plants alone are still profitable. The fuel is cheap and the environmental damage caused by lignite does not need to be fully taken into account by operators. In the future, the kinds of power plants needed are those that can quickly ramp up their power generation and thus complement the fluctuating power generation by wind and solar. Gas and coal will continue to play a role over the short to medium term; however, the total fossil generation system will need to downsize. Representatives of the 'ancien régime', i.e. the ologopoly comprising the big four German power companies as well as the industrial beneficiaries of the market structure, have little interest in supporting the transition to a renewables-based energy system because this transition dissolves the old, centralized market structure (Gawel *et al.* 2012).

By and large, however, utilities have been slow to invest in renewables, especially in solar energy. For example, utilities own no more than 7% of the capacity of renewable energy technologies in Germany. Utilities may eventually become more serious about renewable energy, but at the moment they appear to be slow in altering their generating practices. Instead, they are responding to their woes by shifting away from power generation and towards 'downstream activities, such as trading and offering customers advice on how best to use energy.

The German energy transition is driven mainly by citizens and communities. By 2011, more than half of total investments in renewables have been made by small investors (Trend:research and Leuphana University 2013). Large corporations, on the other hand, have so far invested relatively little. The switch to renewables has greatly strengthened small and medium-sized businesses, and it has empowered local communities and their citizens to generate their own renewable energy. Across Germany a rural energy revolution is underway.

## 7. Summary of main points and conclusions

Regarded from the standpoint of its goals, the German 'Energiewende concept' appears to represent the only project of its kind in the world. However, it entails challenges and – in the short to medium term – additional costs. For this reason, it is increasingly important that the adjustments to the *Energiewende* that are continually needed should be properly designed and implemented. In this way the project's long-term advantages will be enabled to take their full effect.

The power price increases of the past years are due not only to the rapid deployment of renewable energy technologies but also to rising fossil fuel prices and industry exemptions from the FiT surcharge. The upward trend of these costs is expected to continue in the coming years. Renewable energy deployment will cause additional costs over approximately the next two decades, but will lead subsequently to significant cost savings.

The costs of the *Energiewende* should not be equated with the FiT surcharge. In order to obtain a meaningful figure for the support costs of renewables in the power sector, the extent of the merit-order induced price decline at the power exchange must be subtracted from the costs of the surcharge ('net surcharge').

Even if the focus on the supposedly too high costs of renewables may be a ploy used by opponents of the *Energiewende*, there is need for action to design the support policy of renewables more efficiently. The German Renewable Energy Sources Act has already proved adaptive over the past 14 years and will certainly require further reform in the years to come. However, a fundamental revision would jeopardize the swift transition to a future electricity and energy system based mainly on renewable energy sources.

Regarding the efficiency goals of the Federal Government in the buildings sector, action taken to date has been insufficient. In connection with the urgently required tax relief for modernising the insulation of buildings, a narrow-minded quarrel between Federal Government and the German Länder has broken out. Energy efficiency is an important pillar of the *Energiewende*. To date, Germany has made some progress and has implemented a broad sweep of programmes across all sectors. Nonetheless, there remains much to be done if Germany wishes to meet its 2020 efficiency and greenhouse gas mitigation targets. Pace and intensity must increase in order to achieve improvements in energy efficiency in the buildings sector.

The main recommendations are the following:

— Correct any apparent but undesired developments – especially the excessive exemptions for industry and the overloading of the FiT remuneration with cost components that have nothing to do with supporting technologies using renewable energy sources

— Reform the Renewable Energy Sources Act, preserving a high level of investment security which has been a key element of the law's success in the past

— Support for renewables should preferably be provided in a manner that makes it economically worthwhile for power plant operators to contribute to a secure supply of electricity and that helps to limit the required extension of the power grid

— End the political blockade with regard to energy efficiency and help curb the use of energy

— Strengthen and foster the idea of 'citizen energy' and design the *Energiewende* in a way that continues to allow citizens to invest in and benefit from it

— Secure the energy supply in the transition period through mechanisms and revenues that keep 'system-relevant' power plants on-grid.

The German energy transition is here to stay. Contrary to public discussion, the primary future challenges do not consist in capping electricity prices or abandoning feed-in support schemes, but rather in coordinating the variety of actors as well as appropriately matching the different system elements, such as grids, technologies, energy sectors, demand and supply side. The major challenges relating to the German energy transition go, in the main, beyond the current policy-driven and short-term discussion of energy prices. Germany might well indeed surprise the world by going even further and arriving even faster.

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