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German Wind Energy Association

RESEARCH

The full costs of power generation

A comparison of subsidies and societal cost of renewable and conventional energy sources

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GREENPEACE ENERGY

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Abridgement
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Preface

What are the full costs of power generation? The question is decisive in the debate about our future energy supply, but German power bills only provide part of the answer. While they do separately list the “EEG surcharge” to cover the cost of renewables, a lot of the costs of conventional energy are not included. Society nonetheless has to pay for these “hidden” costs elsewhere. As our study clearly shows based on verifiable statistics, if the hidden costs of conventional energy were added to German power bills, they would exceed the EEG surcharge by a wide margin.

In other words, the last argument that proponents of conventional energy are holding onto so dearly has been refuted. In the end, nuclear and coal are not only dangerous and dirty, but also more expensive than hydro and wind power. From now on, “renewables are less expensive” can serve as the basis for debates about our energy future.

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1. Summary of results

A number of quite different components come together to make up the price of electricity. For instance, German retail power rates not only include the actual cost of power generation – which makes up around a third of the price for an average household – but also a number of charges and taxes, such as grid fees, the electricity tax, value-added tax, and the "concession fee," which power providers pay to communities for the right to install and operate power lines on public land.

In addition, the retail rate also includes the "EEG surcharge," which covers the cost of feed-in tariffs paid for renewable energy. In this way, power consumers directly and transparently cover the cost of the energy transition towards a larger share of renewables. In 2012, the EEG surcharge was 3.59 cents per kilowatt-hour for private households and other consumers not partly exempted (called "non-privileged consumers"). Having this surcharge as a separate item makes it look like renewables are the only power generation not competitive with less expensive conventional energy on free markets.

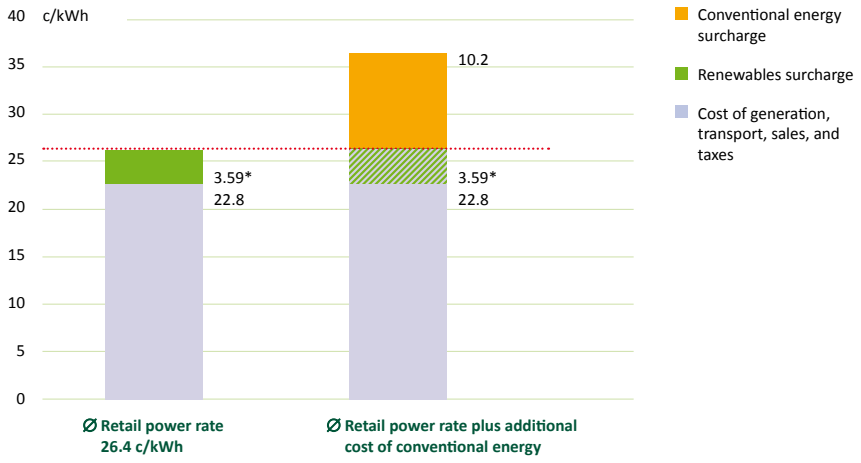
Yet, conventional energy – nuclear power, hard coal, and lignite – have been receiving considerable state subsidies for decades as financial contributions and tax incentives along with other favorable treatment. The main difference from the cost of renewables is that a lot of these costs for conventional power are not separately reported in power prices and paid in power bills; instead, they are part of the governmental budget. Based on an analysis of literature, data, interviews, and our own methodological investigations, this study systematically compares the direct and indirect state subsidies for renewable and conventional energy from 1970 to 2012. Specific subsidy values (in c/kWh) are calculated based on the absolute volume of the subsidy in a given year relative to that energy source's share of power supply to allow the subsidies to be compared across energy sources.

Furthermore, fossil and nuclear energy has considerable downstream costs, such as impacts on the environment and climate – and nuclear power entails risks that are also only included on power bills to a minor extent (called "external costs"). These two cost items – state subsidies and external costs – are often not directly linked to the price of conventional energy, but they nonetheless have to be paid either as taxes or as the societal cost of climate change and pollution. The resulting price of a kilowatt-hour of wind power for society in 2012 is 8.1 cents, compared to 7.6 cents for hydropower. In contrast, the total cost of power from lignite and hard coal add up to 15.6 and 14.8 cents, respectively, with nuclear power reaching at least 16.4 cents per kilowatt-hour. The cost of electricity from natural gas is 9.0 cents.

The additional cost of conventional energy – more than 40 billion euros in 2012 alone – is thus much greater than the cost of feed-in tariffs, for which the differential cost passed on to consumers is expected to be 13 billion euros in 2012. If subsidies from state budgets for and external costs of conventional energy were passed on to consumers the way the cost of renewables is passed on as the EEG surcharge, this "conventional energy surcharge" would be around 10.2 cents per kilowatt-hour in 2012 (see Figure 1).

Clearly, the EEG surcharge of 3.59 c/kWh in 2012 was a far less expensive option, and it will continue to be even if it increases significantly; at the same time, it paves the way for a future energy supply that is friendlier to the climate and environment. It is a common misconception that renewables are driving up the cost of electricity; in fact, they offset energy sources with a much higher price tag for taxpayers and society. If power providers had to pass on the additional cost of conventional power in their bills, renewables would already be competitive to a large extent.

FIGURE 1:
The power price, EEG surcharge, and additional cost of conventional energy technologies in 2012



* Renewables surcharge without liquidity reserve and rectification 2011: 3.31 c/kWh

2. The full costs of power generation

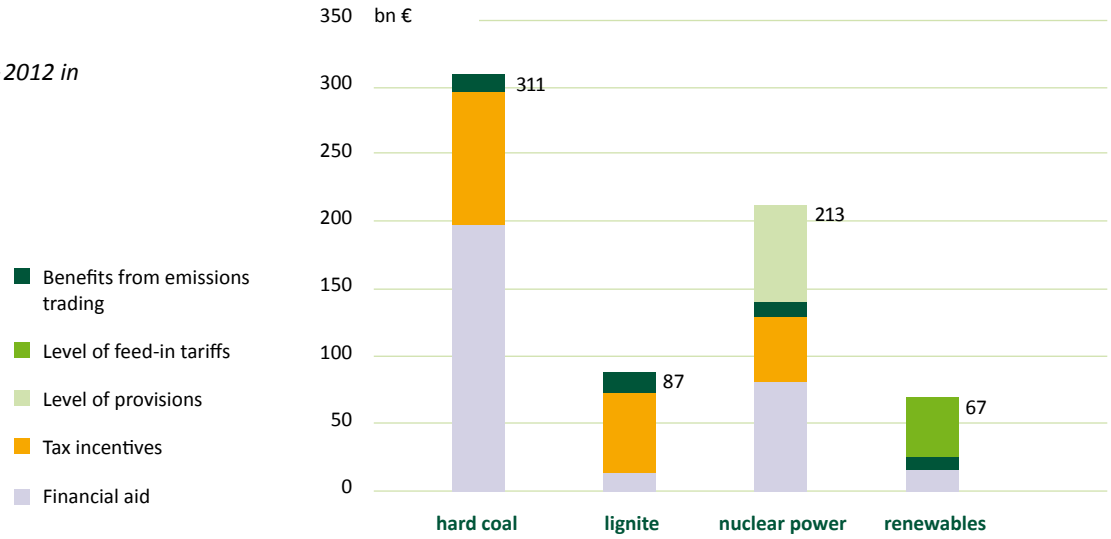
This study systematically compares state subsidies for nuclear, hard coal, and lignite with those for renewables. What is the cost of these subsidies in terms of the specific amount of energy produced by each source? And what gets subsidized more – conventional energy technologies or renewables? What is less expensive for consumers and taxpayers – nuclear and coal power or renewables? This analysis focuses on these questions. It summarizes the findings of a number of other studies focusing on state subsidies for power from nuclear, hard coal and lignite, natural gas, and renewables; in addition, the external costs of nuclear power were calculated as a part of the What Power Really Costs (Was Strom wirklich kostet) project from April 2011.[1] The data sources, methodological assumptions, and estimates are explained and documented in detail there. In other words, this edition is a completely revised, expanded version of the eponymous study from last year. The data sources were updated and the methodology further developed, so the findings cannot be directly compared.

2.1 Total state subsidies from 1970–2012

In order to systematically compare state subsidies for different energy sources, the term "subsidy" is used in its widest sense here; in addition to direct state aid and tax benefits, other forms of subsidies that are not a part of state budgets are included here, such as the value of allowances from emissions trading, provisions set aside for nuclear power, and feed-in tariffs for renewables. This comprehensive review provides a somewhat complete picture of state benefits – and the resulting costs for society – of each energy source. For a list of the benefits provided for a specific energy source, see the overview tables in the Annex.

Overall, hard coal was found to have benefited the most from state benefits at a total of 311 billion euros (real prices 2012), followed by nuclear at around 213 billion euros and lignite at 87 billion euros. Renewables have only been

FIGURE 2 :
State support 1970 – 2012 in bn € (real prices)



1 State subsidies for nuclear 1950–2012 | State subsidies for lignite from 1950–2012 | State subsidies for renewables from 1950–2012 | State subsidies for natural gas from 2005–2012 | External cost of nuclear power

supported significantly since the middle/end of the 1990s, so total support comes in at around 67 billion euros, far below what has been given to nuclear and hard coal.

Feed-in tariffs for renewables are reported transparently and explicitly on power bills, but state incentives for nuclear and coal power are sometimes a part of rules that increase the price of power (such as emissions trading) and sometimes a part of governmental budgets. In both cases, consumers cannot directly see the full cost in their power bills. The overall impression is then that renewables are driving up the price of power because of the cost of feed-in tariffs, whereas conventional energy is perceived to be an affordable source of power. This study finds that these impressions are misleading because nuclear and coal power receive considerable state support that is not clearly reported as an item in the composition of power prices.

2.2 Subsidies for electricity

The state subsidies determined for the various energy sources raise questions about the actual cost of nuclear, lignite, hard coal, and renewable power. What is the cost of these subsidies for society in terms of the specific amount of energy produced by each source? To answer this question, we first had to determine what parts of the subsidies can be attributed to power generation; after all, some of these energy sources are not used to generate power, but rather to create fuel or heat. For instance, only 90 billion euros of the 159 billion (real prices 2012) for the hard coal mining sector pertains to power generation. In addition, financial aid was not included if it pertained to German reunification (such as expenses for the decommissioning and dismantling of nuclear power plants in the former East Germany). The overview tables in the Annex provide further information about the share of individual subsidy types in the financial volume; for documentation of more details, see the individual studies. Wherever information and data could not be unequivocally attributed to specific purposes, the amount was estimated based on that energy source's share of power generation in total primary energy consumption. Starting in 2007, full data are available for natural gas, so that it is also included here.

FIGURE 3:
Cumulative state subsidies from 1970–2012 in billions of euros (real prices), share of power consumption

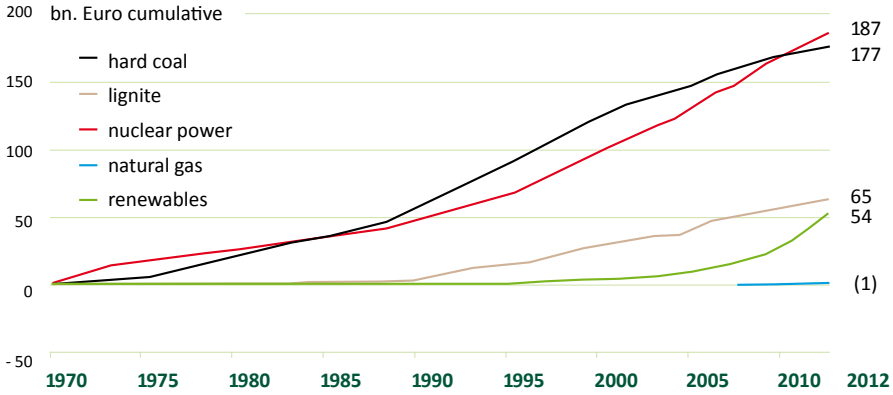


Figure 3 shows how state subsidies increased over time. Despite its increase since 2008, (cumulative) support for renewables (around 54 billion euros) falls far short of the state subsidies for the electricity sector from 1970–2012, with lignite coming in at 65 billion, hard coal at 177 billion, and nuclear at 187 billion. Relative to other conventional sources of energy, natural gas makes do with relatively little subsidies, but no proper analysis is possible cause of the relatively short time span of available data.

2.3 Comparison of specific subsidies in c/kWh for 5 energy sources

Furthermore, the various energy sources can only be compared based on a common denominator. In the comparison of the subsidies for electricity from nuclear, natural gas, hard and lignite, and renewables, the total volume of subsidies is therefore stated in relation to the amount of power generated, with the subsidy then reported in cents per kilowatt-hour. Some of this funding is not directly the result of power generation; a lot of state expenses pertain to future power generation (such as research) or concern future costs of past power generation (the search for a final repository for nuclear waste). Nonetheless, by stating the volume of subsidies in relation to the amount of power generated, we can more exactly compare subsidy levels.

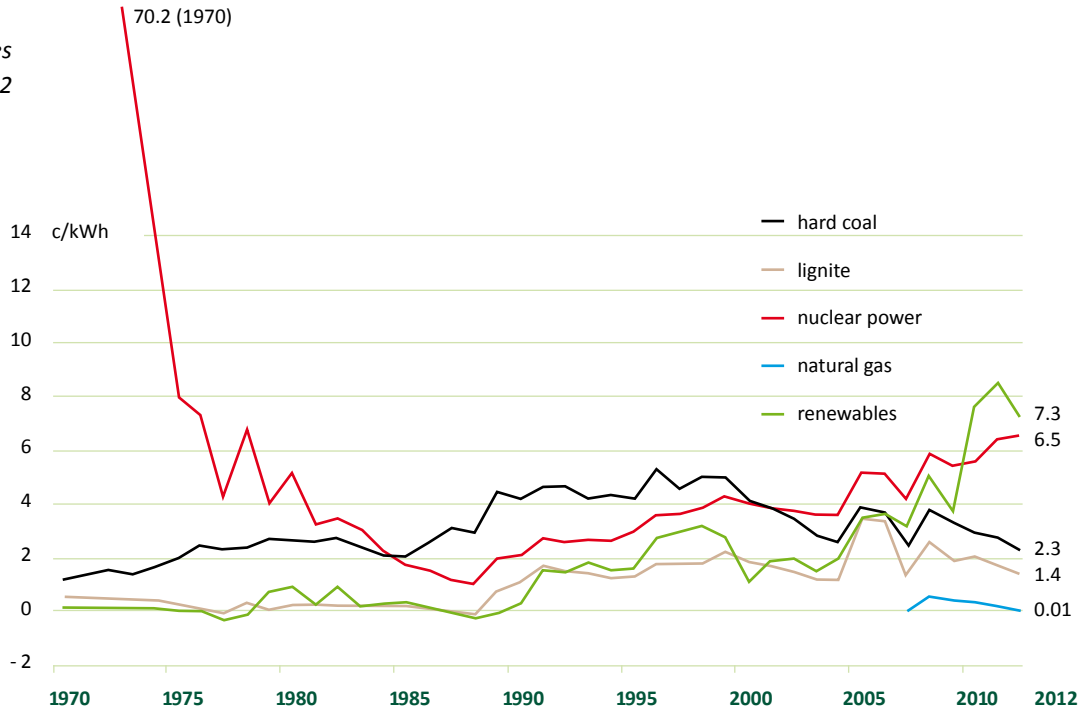
From 1970–2012, renewable power received 3.4 c/kWh of financial support on the average. During the same timeframe, power from lignite received the equivalent of 1.3 c/kWh, compared to 3.3 c/kWh for hard coal. Nuclear received the most support at 4.0 c/kWh. From 2007-2012, natural gas received state subsidies worth 0.3 c/kWh.

Not until 2007 do renewables reach a level of support higher than hard coal, and they do not surpass nuclear power until 2010, when support reaches 7.6 c/kWh.[2] That year, renewables became the energy source that received the greatest amount of funding per kilowatt-hour within a year for the first time. This change cannot and should not, however, be taken as an indication that renewables cost too much or that conventional power is cheaper. Rather, state subsidies over a long period of time made conventional energy affordable; with renewables, the goal is to quickly grow the sector so that it makes up 100 percent of our energy supply. Current discussions about the cost of subsidies for renewables – especially the debate about feed-in tariffs in Germany – have also taken place for conventional energy in different ways over the past few decades and sometimes been even more heated. At the beginning of the 1970s, support for nuclear exceeded 60 c/kWh in order to get the technology going; a relatively large amount was spent on research, but the technology was not yet producing much power.

From today's perspective, most of this early support – especially for nuclear – now appears as sunk costs that do not directly influence the current competitiveness of the technology concerned. If the owners of nuclear plants had, however, been required to cover a significant part of these costs themselves, the technology would never have seen the light of day. Nuclear would not have its current market

2 The level of these subsidies for renewable energy should not be confused with the EEG surcharge, which is relative to the total amount of power consumed regardless of how the power was generated. In contrast, the specific figures used here are directly related to the respective amount of power generated from this source (here, power from renewables).

FIGURE 4:
Specific subsidies from 1970–2012 in c/kWh.



position without generous subsidies in the past. Almost all of these subsidies are at least indirectly relevant for nuclear power's market launch and competitive advantages. Evolutionary economics teaches us that a development path that we started down in the past hampers and may even prevent innovations. In other words, established technologies enjoy a number of benefits that prevent innovations from being launched on the market ("path dependency"). Over the past 50 years, there would have been more opportunities much earlier for environmentally friendly energy if power grids had not been set up for central station power plants and research had not focused so much on nuclear power.

In addition, state subsidies for renewables support sustainable, environmentally friendly technologies that are intended to replace risky technologies that, like nuclear and coal power, detrimentally impact the environment and the climate. The initial investments pay off because the annual reductions in feed-in tariffs for new renewable installations lead to lower power prices. The Renewable Energy Act, which specifies German feed-in tariffs, is designed in its current design as a limited-term instrument to get renewables going with gradually reduced feed-in tariffs. In contrast, coal power and, in particular, nuclear power have tremendous future costs that can hardly be determined today but will continue to be payable even after the plants are switched off. For instance, any final repository for radioactive waste will have to remain in protected operation for a million years, and groundwater will have to be pumped out of underground hard coal mines for eternity. In other words, conventional energy will probably have to continue to be financed even when it no longer provides us with any of our electricity.

2.4 The cost of power generation to society in 2012

Most of these subsidies for renewables are directly reported in German power bills as the EEG surcharge, making these costs transparent for consumers. In contrast, state subsidies for nuclear and coal power are "hidden costs" not directly listed in consumer power prices. Instead, they generally place a burden on state budgets, meaning that taxpayers indirectly cover these costs. In addition, conventional energy has an impact on the environment and the climate, leading to external costs in the form of greenhouse gas emissions and pollution – not to mention the risk of nuclear accidents, all of which leads to costs that society has to pay. This study then uses these findings to calculate the costs to society for each source of energy's state subsidies in 2012. The cost of state subsidies in governmental budgets are added to the power price along with the external costs of power from nuclear, coal, and renewables.

2.4.1 The sales price of electricity

The first cost item in the power price for society is the purchase price of electricity itself. Here, a distinction is made between renewables and conventional energy. Renewable electricity is largely paid for with feed-in tariffs per kilowatt-hour of power as specified in Germany's Renewable Energy Act. The specific rates paid depend on the kind of technology used. In 2012, the average feed-in tariff was 8.8 c/kWh for wind power (onshore); 8.5 c/kWh for hydropower; and 36.5 c/kWh for photovoltaics (PV); the figures include older installations that still receive higher rates than are paid today, especially in the case of photovoltaics. (See page 12 for the lower rates that apply today.) Power from conventional energy is traded directly between buyers and sellers (OTC electricity) and on the EEX power exchange. Prices in OTC deals are not publicly accessible, though they are generally based on the exchange price; therefore, this study assumes that the average power price on the exchange is the sales price. A kilowatt-hour of electricity sold (and consumed) on the exchange in 2012 had an average price of 5.4 cents to date.

2.4.2 State subsidies that affect budgets

The subsidies that directly affect governmental budgets and are passed on to taxpayers are filtered out. To determine the additional cost of state subsidies, only A. financial aid and B. tax benefits were taken into account. Nuclear has received the most support at 2.0 c/kWh, followed by hard coal at 1.9 c/kWh and lignite at 1.0 c/kWh. Renewables even have a negative subsidy level of -0.5 c/kWh when their net cost to society is calculated. In other words, more was charged for renewables than would need to be if the charge were based on the amount of energy provided and external costs. Here, feed-in tariffs are not included because they are not an item in governmental budgets. The same tax effect holds true for natural gas (0.2 c/kWh).

2.4.3 External costs

The external cost of coal, natural gas, and renewables is based on the findings of a recent study conducted by Fraunhofer ISI for the German Environmental Ministry. The German Environmental Agency also uses this data for the 2012 edition of its method conventions on external costs. Fraunhofer ISI finds that the external cost of power production from hard coal is 8.9 c/kWh; 10.7 c/kWh from lignite; 4.9 c/kWh from natural gas; 0.3 c/kWh from wind; 0.2 c/kWh from water; and 1.2 c/kWh from photovoltaics.

But neither Fraunhofer ISI nor the German Environmental Agency's method conventions list a separate figure for the external cost of nuclear power. The estimates available elsewhere vary greatly, mainly because of assumptions about the probability and extent of the costs of a nuclear accident in which radioactive material is released. Estimates of the external cost of nuclear power range from 0.1 c/kWh to 320 c/kWh, thus diverging by a factor of 3,200. The authors do not believe that a sound "best guess" can be filtered out of that broad spectrum. Rather, a shorter spectrum is indicated for the external cost of nuclear, not a specific point. The lower end of the spectrum is based on the German Environmental Agency's method conventions for external costs, which categorizes nuclear at the level of the worst fossil fuel (lignite) at 10.7 c/kWh.

The upper limit of the spectrum is based on a broad review of literature and expert opinions, which produced a new calculation of the damage expected from a catastrophic nuclear accident. Purely in terms of damage, the spectrum now seems to reach 34 c/kWh based on realistic assumptions and methods when the risk aversion factor of nuclear power is taken into account. The study conducted by Green Budget Germany entitled "External costs of nuclear" (Externe Kosten der Atomenergie) provides details on the methodology and assumptions for the probability of severe accidents, the resulting costs, and the specific parameters used.

Some external costs are already internalized by emissions trading and energy taxes. The value of internalization from these two instruments is therefore deducted in calculating costs for society. **The sum of these three components thus reflects the cost of power generation to society.**

2.4.4 Conclusion

The resulting price of a kilowatt-hour of wind power for society in 2012 is 8.1 cents, compared to 7.6 cents for hydropower. In contrast, the total cost of power from lignite and hard coal add up to 15.6 and 14.8 cents, respectively, with nuclear power reaching at least 16.4 cents per kilowatt-hour. If the upper value from the spectrum of external costs is used (34.3 c/kWh), the cost of nuclear power to society reaches 42.2 c/kWh. The cost of electricity from natural gas is 9.0 cents. The resulting price of a kilowatt-hour of wind power for society in 2012 is 8.1 cents, compared to 7.6 cents for hydropower. In contrast, the total cost of power from lignite and hard coal add up to 15.6 and 14.8 cents, respectively, with nuclear power reaching at least 16.4 cents per kilowatt-hour. If the upper value from the spectrum of external costs is used (34.3 c/kWh), the cost of nuclear power to society reaches 42.2 c/kWh. The cost of electricity from natural gas is 9.0 cents.

Clearly, a few types of renewable power are already much cheaper than conventional electricity once we include not only the power price, but also the cost of state subsidies, the impact on the environment and climate, and nuclear risks – a factor that should be taken into account in the discussion about affordable power and the debate about our future energy supply.

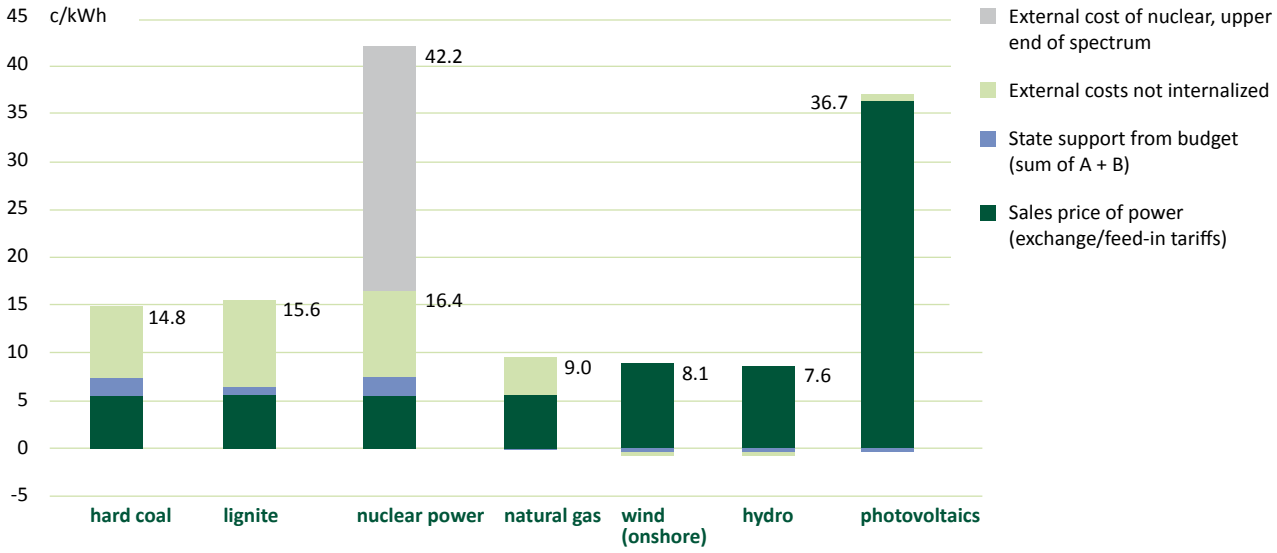


FIGURE 5:
A comparison of power generation costs to society in 2012

The relatively high figure for photovoltaics should also be seen in the context of the initial support for nuclear power. In the early years of nuclear energy, support for this technology exceeded 60 c/kWh, even more than was ever paid for photovoltaics. The great potential for lower PV prices also needs to be taken into account. Already, the feed-in tariffs paid for newly installed PV arrays is far below the average rate used here of 36.5 c/kWh; for instance, in October 2012 feed-in tariffs for PV ranged from 12.6 to 18.2 c/kWh.

2.5 The surcharge for conventional energy

The surcharge for conventional energy as shown above, conventional energy in particular leads to costs from state subsidies and pollution, neither of which have been part of power prices up to now. In contrast, the EEG surcharge clearly shows what renewable power costs as an item in power bills. **If the cost of subsidies for and the environmental/climate impacts of electricity from nuclear, coal, and natural gas were listed as a "conventional energy surcharge," it would raise the retail power rate considerably.**

The extent of the surcharge depends largely upon which consumers take part in the distribution of these cost. For instance, costs could be equally spread across the country's net power consumption (around 540 TWh per year, scenario 1). In comparison, if the surcharge were only spread across the somewhat limited group of power consumers who currently pay the surcharge for renewables (roughly 387 TWh per year, scenario 2), the conventional energy surcharge would be even higher. The table on the next page provides an overview of the cost items and amount of the surcharge in the two scenarios.

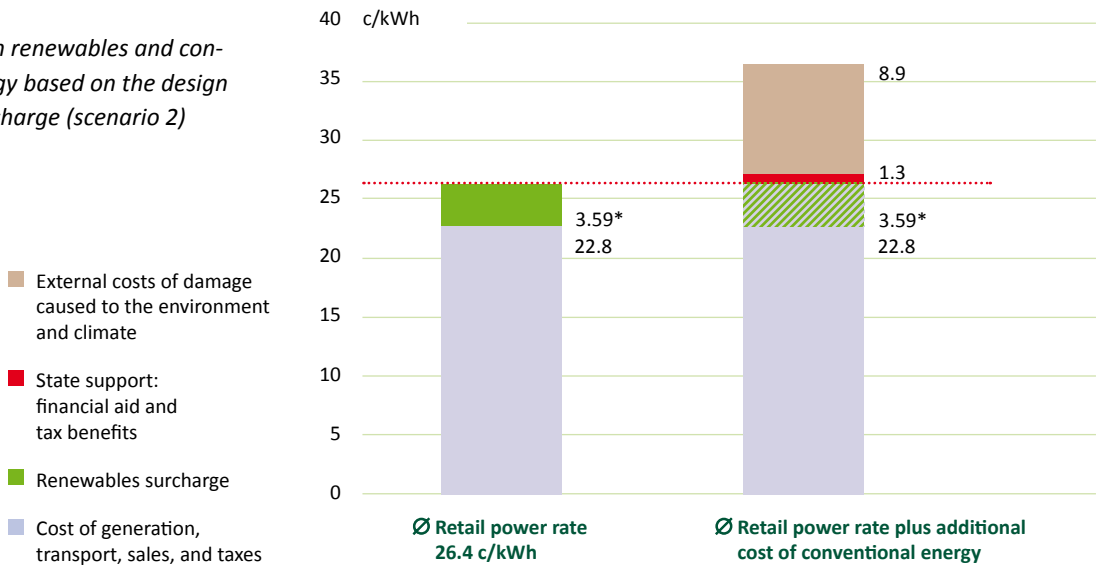
Some 40 billion euros in state subsidies came from governmental budgets and non-internalized external costs of conventional energy in 2012 – twice as much as the differential cost of German feed-in tariffs, which are paid for with the renewables surcharge.[3]

If the additional cost of conventional energy were added to power prices on the basis of net power consumption, the conventional energy surcharge would increase the price by 7.5 c/kWh. The EEG surcharge would be much lower at 2.4 c/kWh if spread across all net power consumption than under the current rules, which completely exempt power generated and consumed directly. The surcharge for conventional energy would be greater if certain types of power consumption were exempt from the full surcharge as with the renewables surcharge. In the second scenario, costs are spread across 387 TWh, as is done with the renewables surcharge. Here, the conventional energy surcharge goes up to 10.2 c/kWh, thus putting it far above the level of the EEG surcharge even if it increases.

Figure 6 shows the resulting surcharge by individual cost item for the average household power rate in 2012. **Instead of paying 26 cents for a kilowatt-hour in 2012, private households would have to pay 37 cents on the average if subsidies and the cost of environmental impacts were factored into the price of conventional power.**

This comparison shows that the EEG surcharge for renewables (3.59 c/kWh in 2012) is actually a far more affordable way of producing a future power supply that is friendly to the climate and environment – even assuming that it increases considerably. It is a common misconception that renewables are driving up the cost of electricity; in fact, they offset energy sources with a much higher price tag for taxpayers and society.

FIGURE 6:
Surcharge from renewables and conventional energy based on the design of the EEG surcharge (scenario 2)



* Renewables surcharge without liquidity reserve and rectification 2011: 3.31 c/kWh

3 As shown above, the figures for state subsidies from governmental budgets and external cost devoted to renewables can be excluded because no state funding has to be added to the price; furthermore, the electricity tax and the cost effect of emissions trading on power prices have already internalized the low external cost of renewables (see page 10).

3. Annex

TABLE 1: Composition and volume of state subsidies and external costs of conventional energy compared to German feed-in tariffs 2012

	Sum of costs passed on	Variant 1: surcharge on net power consumption*	Variant 2: EEG method (surcharge for non-privileged consumers)**
Volume of power for cost distribution		**541 TWh**	**387 TWh**
State support: financial aid and tax incentives			
nuclear power	2.0 Mrd. €	0.4 c/kWh	0.5 c/kWh
hard coal	2.1 Mrd. €	0.4 c/kWh	0.5 c/kWh
lignite	1.3 Mrd. €	0.2 c/kWh	0.3 c/kWh
natural gas	-0.2 Mrd. €	-0.04 c/kWh	-0.05 c/kWh
External costs not internalized			
nuclear power (min)	9.0 Mrd. €	1.7 c/kWh	2.3 c/kWh
hard coal	10.3 Mrd. €	1.9 c/kWh	2.6 c/kWh
lignite	12.6 Mrd. €	2.3 c/kWh	3.2 c/kWh
natural gas	3.2 Mrd. €	0.6 c/kWh	0.8 c/kWh
∑ Conventional energy surcharge, theoretically added to power price Level of EEG	40.3 Mrd. €	**7.5 c/kWh**	**10.2 c/kWh**
∑ Level of EEG, contained in power price	13.0 Mrd. €	**2.4 c/kWh**	**3.3 c/kWh*** **

* Assumed to be as in 2011 (according to BDEW) | ** For conventional energy, it is assumed that the surcharge would not be passed on to privileged consumers, who currently only pay around 0.3 percent of the total cost of the renewables surcharge. | *** This figure only slightly deviates from the actual renewables surcharge of 3.59 c/kWh because only the forecast for differential costs in 2012 is taken into account without the cost of liquidity reserves and the overdraft from 2011

TABLE 2: State subsidies for nuclear 1970 – 2012

	All figures in billions of euros	Total support 1970 –2012		Support / Share of power generation*	
		Nominal	real (prices 2012)	real 1970 –2012	in 2012
A.	**Financial aid**	**52.0**	**80.8**	**54.8**	**1.0**
A.1.	Research Germany	27.7	51.1	45.9	0.5
	of which: search for final repository	0.4	0.5	0.5	0.1
A.2.	Expenditures at state level	5.0	5.5	5.5	0
A.3.	Guarantees	0.1	> 0.1**	0.1	0
A.4.	Euratom + Phare (German share)	2.7	3.4	0	0
A.5.	Decommissioning of GDR nuclear plants	3.0	3.3	0	0
A.6.	Wismut re-cultivation	5.7	7.1	0	0
A.7.	Morsleben	1.4	1.5	0.9	0.3
A.8.	Asse	0.6	0.7	0.7	0.1
A.9	Chernobyl	0.5	0.6	0	0
A.10	Contributions to international organizations	5.2	7.4	1.0	0.03
B.	**Tax benefits**	**40.0**	**48.4**	**48.4**	**1.0**
B.1	Tax benefits from energy tax. net	40.0	48.4	48.4	1.0
C.	**State regulatory framework outside of budget**	**71.2**	**84.0**	**84.0**	**4.5**
C.1.	Emissions trading	10.8	11.6	11.6	0.5
C.2.	financial benefit of provisions	60.4	72.3	72.3	4.0
A. + B.	**Sum 1: Budget support**	**92.0**	**129.2**	**103.2**	**2.0**
	Average in cents per kilowatt-hour			2.2	2.0
A. + B. + C	**Sum 2: Budget support + benefits from emissi-ons trading + provisions**	**163.1**	**213.2**	**187.1**	**6.5**
	Average in cents per kilowatt-hour			4.0	6.5

* The calculation of specific support in cents per kilowatt-hour only includes expenses attributable to power generation in Germany (for instance, payments made related to the GDR are not included)

** Cannot be adjusted for inflation because the source used only provides a cumulative figure, not individual years.

TABLE 3: State subsidies for hard coal 1970 – 2012

	All figures in billion euros	Total support 1970 – 2012		Support / share of power generation*	
		nominal	real (prices 2012)	real 1970 – 2012	in 2012
A.	**Financial aid**	**135.8**	**197.4**	**112.1**	**1.1**
A.1.	Research into mining and power plants	3.5	6.3	3.6	0
A.2.	Research and pilot projects on CCS, national**	0.2	0.2	0.1	0.01
A.3.	Research and pilot projects on CCS, German share of EU**	0.1	0.2	0.1	0.02
A.4.	Sales aid	113.9	159.0	90.3	0.93
A.5.	Modernization aid	5.8	12.2	6.9	0
A.6.	Social assistance	8.9	13.0	7.4	0.09
A.7.	Decommissioning aid	3.5	6.6	3.8	0
B.	**Tax benefits**	**72.4**	**100.3**	**57.0**	**1.0**
B.1.	Tax benefits from energy tax, net	58.0	75.6	42.9	0.96
B.2.	Exemption from mining royalties	10.6	16.9	9.6	0.06
B.3.	Exemption from water levy (since 1995)	0.07	0.08	0.0	0.00
B.4.	Sales aid	0.4	1.2	0.7	0
B.5.	Modernization aid	0.7	1.8	1.0	0
B.6.	Social assistance	2.7	4.8	2.7	0
C.	**State rules outside of budget**	**12.4**	**13.4**	**8.2**	**0.4**
C.1.	Emissions trading	12.4	13.4	8.2	0.4
A. + B.	**Sum 1: Budget support**	**208.2**	**297.8**	**169.1**	**2.1**
	Average in cents per kilowatt-hour			3.1	1.9
A. + B. + C.1.	**Sum 2: Budget support + benefits from emissions trading**	**220.7**	**311.2**	**177.3**	**2.5**
	Average in cents per kilowatt-hour			3.3	2.3

* In line with the share of power generation in primary energy consumption for hard coal, without historic burden State support for hard coal 1970 – 2012

** Only share of hard coal (estimate)

TABLE 4: State subsidies for lignite 1970 – 2012

	All figures in billion euros	Total support 1970 – 2012		Support / share of power generation*	
		nominal	real (prices 2012)	real 1970 – 2012	in 2012
A.	**Financial aid**	**9.5**	**11.7**	**0.08**	**0.01**
A.1.	Research and development	0.01	0.02	0.02	0.00
A.2.	Research and pilot projects on CCS, national**	0.04	0.04	0.03	0.00
A.3.	Research and pilot projects on CCS, German share of EU**	0.04	0.04	0.03	0.01
A.4.	Brownfield sites / Brownfields recycling	9.43	11.64	0	0
B.	**Tax benefits**	**48.3**	**61.3**	**51.4**	**1.3**
B.1.	Tax benefits from energy tax, net	42.8	54.3	45.5	1.0
B.2.	Exemption from mining royalties	4.8	6.2	5.2	0.3
B.3.	Exemption from water levy (since 1995)	0.7	0.8	0.7	0.0
C.	**State rules outside of budget**	**13.4**	**14.5**	**13.2**	**0.6**
C.1.	Emissions trading	13.4	14.5	13.2	0.6
A. + B.	**Sum 1: Budget support**	**57.8**	**73.0**	**51.5**	**1.3**
	Average in cents per kilowatt-hour			1.0	1.0
A. + B. + C.1.	**Sum 2: Budget support + benefits from emissions trading**	**71.2**	**87.5**	**64.7**	**1.9**
	Average in cents per kilowatt-hour			1.3	1.4

* In line with the share of power generation in primary energy consumption for hard coal, without historic burden of former GDR mines (A.4))

** Only share of hard coal (esti of former GDR mines (A.4))

TABLE 5: State subsidies for natural gas 1970 – 2012

	All figures in billion euros	Total support 1970 – 2012		Support / share of power generation*	
		nominal	real (prices 2012)	real 2007 – 2012	in 2012
A.	**Financial aid**	**0.032**	**0.034**	**0.006**	**0.001**
A.1.	Research and development	0.032	0.034	0.006	0.001
B.	**Tax benefits**	**3.61**	**3.82**	**- 0.84**	**- 0.20**
B.1.	Tax benefits from energy tax, net	6.15	6.49	- 0.33	- 0.13
B.2.	Exemption from royalties*	- 2.54	-2.67	- 0.50	- 0.07
C.	**State rules outside of budget**	**4.1**	**4.3**	**2.2**	**0.01**
C.1.	Emissions trading	4.1	4.3	2.2	0.01
A. + B.	**Sum 1: Budget support**	**3.6**	**3.9**	**- 0.8**	**- 0.2**
	Average in cents per kilowatt-hour			- 0.2	- 0.2
A. + B. + C.1.	**Sum 2: Budget support + benefits from emissions trading**	**7.8**	**8.2**	**1.3**	**- 0.2**
	Average in cents per kilowatt-hour			0.3	0.01

* Figure is negative because the actual levy was greater than 10 percent of the market value (the method applied for coal)

TABLE 6: State subsidies for renewables 1970 – 2012

	All figures in billion euros	Support for both power and heat		Support as a share of power generation	
		nominal	real (prices 2012)	real 1970 – 2012	in 2012
A.	**Financial aid**	**13.6**	**15.9**	**9.5**	**0.6**
A.1.	Research and development	3.6	4.7	4.6	0.2
A.2.	Aid programs, federal and state	8.3	9.3	4.4	0.3
A.3.	EU programs	1.7	1.9	0.5	0.013
A.4.	Contributions to international organizations	0.02	0.02	0.009	0.002
B.	**Tax benefits**	**- 1.0**	**- 2.8**	**- 9.2**	**- 1.2**
B.1.	Tax benefits from energy tax, net (since 1970)	- 1.0	- 2.8	- 9.2	- 1.2
C.	**State rules outside of budget**	**50.3**	**53.3**	**53.3**	**11.1**
C.1.	Emissions trading	7.4	7.8	7.8	0.8
C.2.	Feed-in tariffs (since 1991)	64.3	68.5	68.5	13.0
C.3.	Compensation for disconnected EEG systems	0.04	0.04	0.04	0.01
C.4.	Backup and balancing energy	1.6	1.7	1.7	0
C.5.	Merit order effect	-22.9	- 24.7	- 24.7	- 2.7
A. + B.	**Sum 1: Budget support**	**12.6**	**13.2**	**0.3**	**- 0.7**
	Average in cents per kilowatt-hour			0.02	- 0.5
A. + B. + C.	**Sum 2: Budget support + EEG + benefits from emissions trading**	**62.9**	**66.5**	**53.6**	**10.4**
	Average in cents per kilowatt-hour			3.4	7.3

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