The distribution of renewable energy policy cost amongst households in Germany – and the role of energy efficiency policies

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Abstract

We explore historical trends of household electricity prices and consumption in Germany and show that, whilst prices have risen, consumption has largely remained stable in the last 16 years, indicating that the average household was not able to compensate higher prices by reducing the amount of electricity consumed. Data from the German Income and Expenditure Survey (EVS) is applied to the EEG surcharge to show its effect on different household types. We show that those groups with the largest consumption of electricity often face the smallest relative burden due to the EEG surcharge, as they can compensate with their relatively large income. Groups with little discretionary income, such as low-income households, the unemployed and single parents face the highest relative burden, although the amounts they consume are not large in absolute terms.

In light of our findings, we review the provisions relating to energy expenditures in the German social security system. We then go on to examine the main energy efficiency policies that are implemented and planned in Germany relating to buildings and electricity consumption/appliances. Results indicate that those policies do have the potential to reduce the burden imposed by the EEG surcharge. Furthermore, the combined effect of the EEG surcharge and those policies turns out to be nearly proportional. On the one hand, this shows that energy efficiency measures are not only relevant climate and energy policy instruments, but can also serve distributional goals. On the other hand, we highlight that the result regarding their positive distributional effects only holds if indeed these measures are taken up also by low-income households. Therefore, it is crucial to monitor the beneficiaries of energy efficiency measures in the evaluation of these policies and if necessary design more targeted approaches.

Introduction

The distribution of costs on the household level are, at the time of writing, quite prominently discussed in the context of the German Energy Transition ("Energiewende") and specifically the surcharge for renewable energy ('EEG surcharge'). This debate has gained ample political traction, also in the context of energy/fuel poverty – and to date has lacked a comprehensive presentation of the underlying issues. Moreover, as Tews (2013) points out, it has solely focussed on the costs of energy and climate policy and neglected their benefits, such as the merit-order effect of renewables or the cost saving potential of energy efficiency measures, which are also part of the German Energiewende. In fact, the German Energy Concept ("Energiekonzept") (Deutsche Bundesregierung 2010/2011) outlines ambitious goals for energy savings across the German economy: 20 % of primary energy saved by 2020 as compared to 2008, rising to 50 % in 2050. Sub-goals for buildings, electricity and transport are also inscribed. In fact, with the publication of its National Action Plan on Energy Efficiency (NAPE; BMWi 2014), the German government has reinforced its commitment to achieving these goals. Many of the changes necessary will have to take place at the household level and have the potential to lower energy expenditure of households and therefore may be able to alleviate the costs imposed by renewable energy support policy.

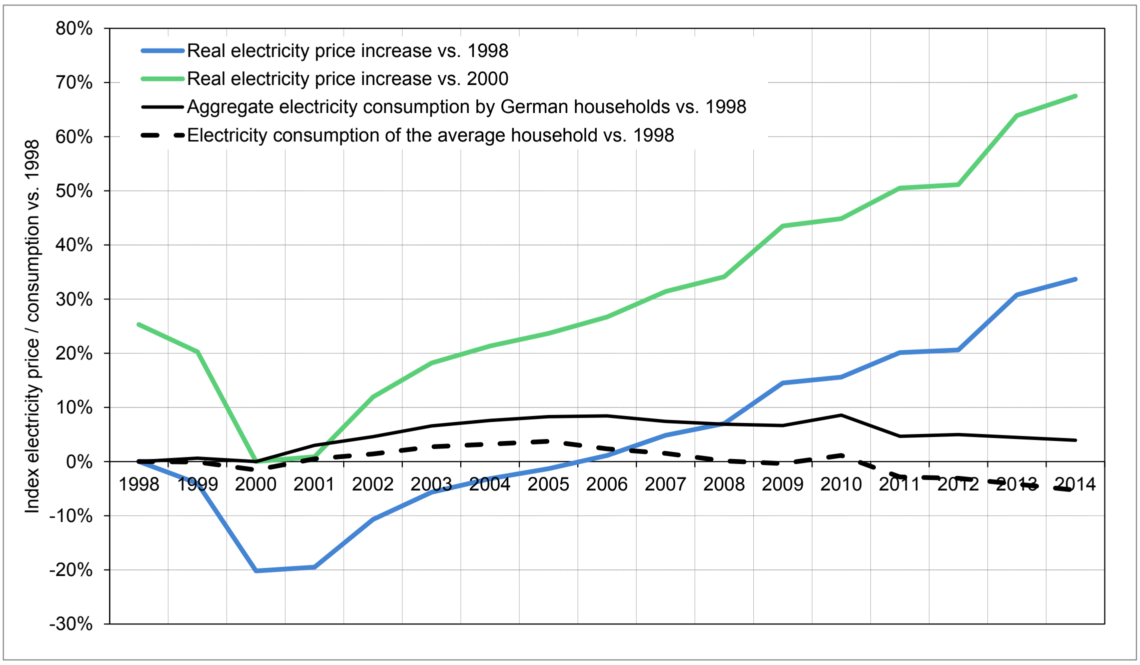

Figure 1. Household electricity prices and consumption. Source: BDEW (2014); BMWi (2013); Eurostat Harmonised Consumer Price Index (HCPI) Germany; own estimation and illustration. Notes: Electricity price for a 3-person household with yearly consumption of 3,500 kWh; consumption values interpolated between 2012 and 2014 (using average growth rates 2008–2012).

The remainder of this paper is structured as follows. We first give an overview of the developments of electricity prices, consumption and expenditures by households in Germany. Since electricity prices have risen considerably, whilst consumption has stayed nearly constant, expenditures have risen as a consequence. In a next step, data from the German Income and Expenditure Survey (EVS) is used to investigate how the EEG surcharge is distributed amongst households. In order to be able to more comprehensively assess the situation of low-income households, the provisions enshrined in the German social security system regarding energy expenditure are set out in the next section. We then go on to analyse the most important existing energy saving and efficiency policies in Germany, as well as the new policies from the National Action Plan on Energy Efficiency (NAPE; BMWi 2014) and examine their potential to compensate for the additional burden imposed on households by the EEG surcharge. In the last section we sum up and conclude.

Development of household electricity prices and energy expenditure

Following electricity market liberalisation in 1998, household electricity prices first dropped before starting to rise again in 2001. At the same time, electricity consumption has merely budged since 1998. Figure 1 shows both the growth rate for aggregate consumption by all households in Germany and consumption for the average German household (aggregate consumption divided by number of households). The reason that growth rates differ lies in the fact that the number of individual households has grown by 10 % since 1998.

The fact that electricity prices have grown substantially, whilst consumption has stayed fairly flat, is an indication that electricity price increases could not be mitigated by the average household through efficiency gains – or that those efficiency gains only compensated for the additional demand caused by new and larger appliances (cf. rebound effect). As a result, the average expenditure of households for electricity has risen considerably in recent years.

When investigating electricity price developments since 1998, results are highly dependent on the choice of base year that increases are compared against. When comparing price increases against 1998, prices rose by 34 % during the last 16 years, whereas if current prices are compared to 2000, the increase amounts to 68 %.

Households have not only increased their average expenditure for electricity but also their expenditure for heating purposes (Figure 2) which further underlines the fact that efficiency gains and/or an absolute reduction in energy consumption were not large enough to offset fuel price rises for the average household.

For the average household, total household energy expenditure represents about 8 % of net household income (as compared to 20 % for rent and 10 % for food). Figure 3 displays the share of net income an average household spent on household energy in 2014[1] and its different components. The largest share (2.3 %) is spent on electricity, followed by gasoline (2.1 %), gas (1.2 %) and heating oil (1 %).[2] Looking further into the past Neuhoff et al. (2013) find that in 1986 an average household spent about 2.3 % of its total consumption expenditures on electricity – exactly the same as in 2014, indicating that current expenditures are not necessarily very high in a long-term view.

1. Please see next section for extrapolation routine.

2. These are average numbers. An individual household in most cases uses either gas or oil for heating purposes.

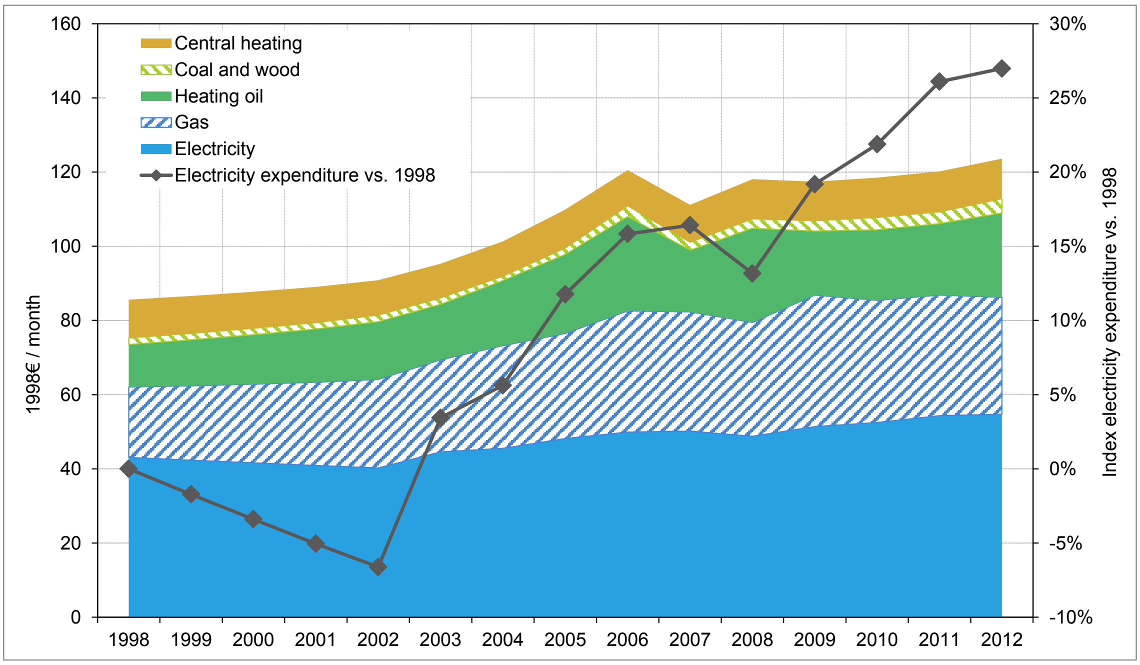

Figure 2. Average monthly expenditure for energy by German households. Sources: Destatis/Research Data Centre (FDZ): German Income and Expenditure Survey (EVS) & Continuous Household Budget Surveys (LWR) summary tables; Eurostat HCPI Germany; own estimation and illustration. Note: Values interpolated between 1998 and 2001, due to unavailability of consistent data.

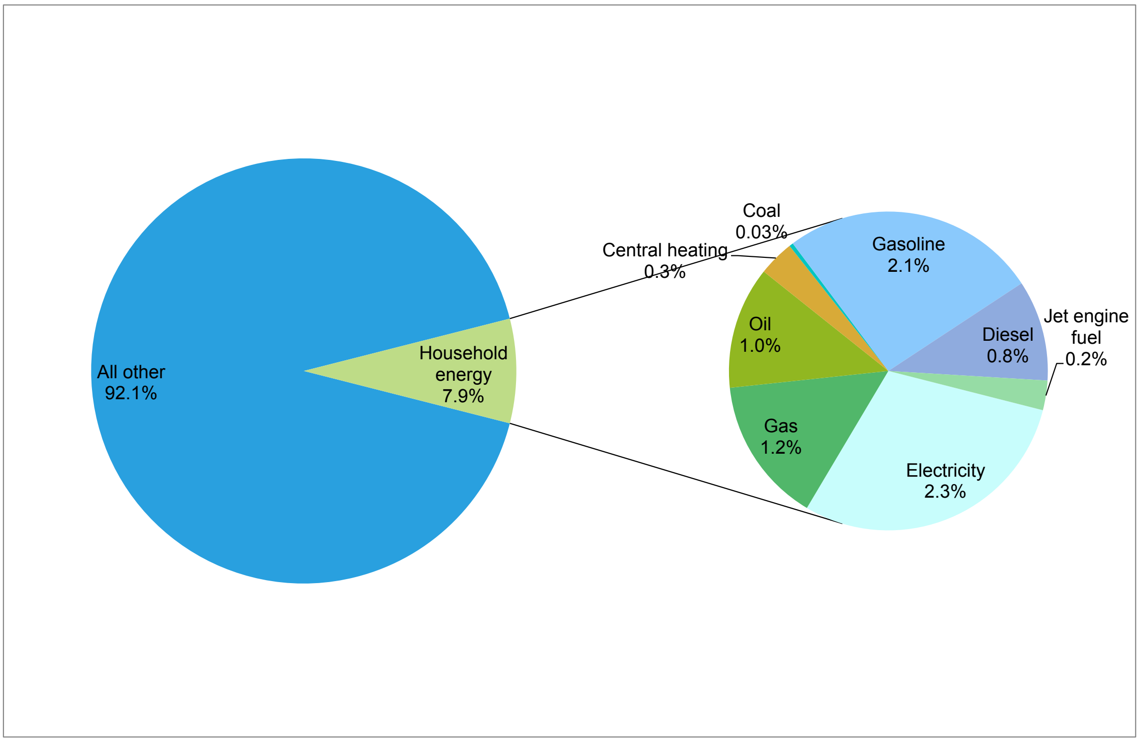

Figure 3. Make-up of average expenditure on household energy in 2014.
Source: Destatis/Research Data Centre (FDZ): EVS 2008 (80 % scientific use file) extrapolated to 2014; own estimation and illustration.

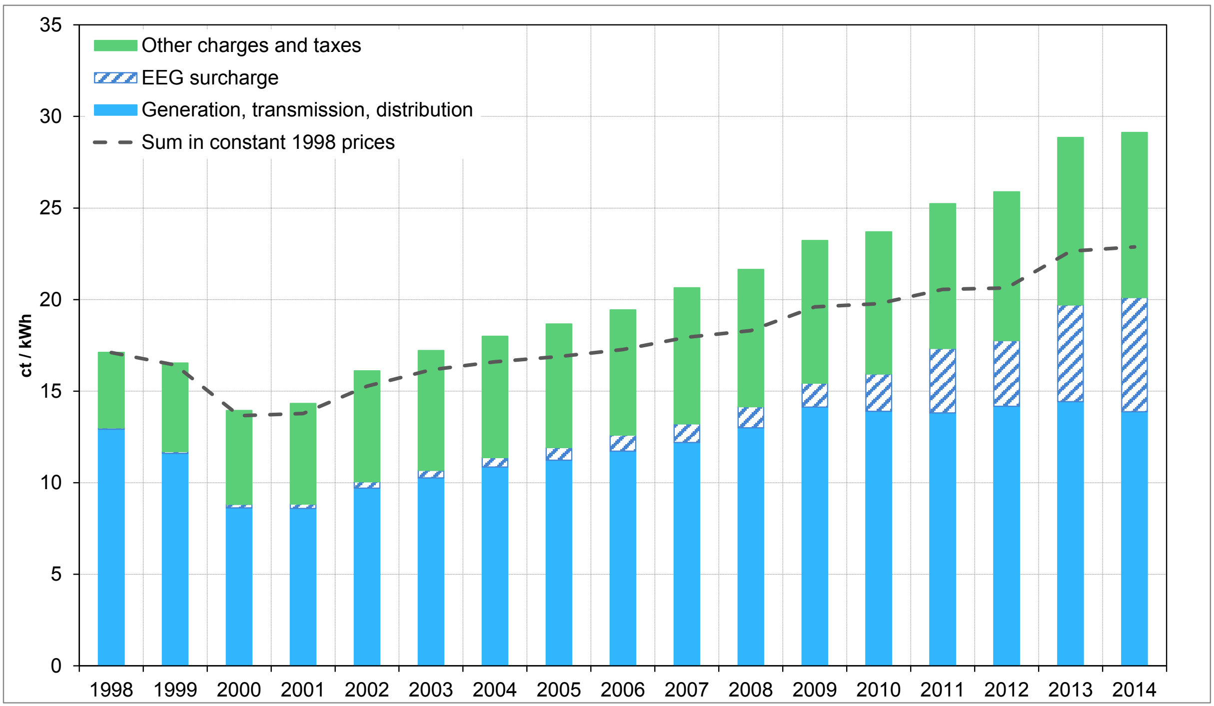

Figure 4. Household electricity price components. Sources: Öko-Institut (2012); BDEW (2014); own illustration.

Furthermore, it is important to note that that the share of fees and charges in household electricity prices has risen considerably – in particular due to the rising EEG surcharge (Figure 4). These components are determined politically and their level depends, in part, on decisions made with regards to exempting industry from contributing to the cost of a number of schemes. Similar developments with regards to the policy costs contained in electricity prices are also observed in other jurisdictions (cf. Chawla & Pollitt 2013 for the UK).

Due to the high share of policy costs embodied in electricity prices and the resulting increase in household expenditure, there is an expectation that government takes responsibility for these increases and introduces measures to address potentially undesired impacts – in contrast to price changes that are attributed to market developments (Elkins 2005). In order to reduce electricity expenditure by households or certain household groups, the government has different options, including influencing price components, such as the EEG surcharge, reducing the amount consumed by households or channelling money through the social security system. Those options will be further discussed below.

Impact of the EEG surcharge on the income distribution amongst German households

Data from the German Income and Expenditure Survey (EVS) is used to map the distributional effects of the EEG surcharge on German households. The EVS is an administrative data source and contains detailed information on income sources and expenditure patterns of households, as well as information on other household characteristics, such as social status and age of the household members. The survey is published every five years and households are observed for one quarter reporting individual income and household level expenditures. Currently, the most recent available survey is the one held in 2008 which provides the basis for our analysis.

To get a more recent picture, household incomes in the EVS are extrapolated based on information up to 2011 available from the German socio-economic panel (SOEP). The extrapolation is conducted by cluster, i.e. combining different household characteristics such as age of household members, social status of main income earner, size of household, and extrapolating for each of these combinations (=cluster). Subsequently, incomes are further extrapolated to the year 2014 with a fixed factor derived from the national accounts (VGR) which reflects nominal GDP growth between 2011 and 2013. We further assume 2 % growth between 2013 and 2014. In addition, the grossing-up factors are adjusted via the method of "static ageing" to reflect household structures in 2014. This implies that extrapolation to the whole German population correspond to the year 2014. Information on static ageing for 2014 stems from the national accounts and the micro census published by the German Statistical Office.

In order to calculate the physical amounts of energy consumed, we use energy prices for the year 2008 to derive energy quantities from the information on expenditure as detailed in the EVS. Energy prices are taken from the second modelling round of the "Climate Protection Scenario 2050 (Klimaschutzszenario 2050)".[3] For electricity and natural gas we use a combination of base price and variable price to adjust for the share of fixed costs. Moreover, we adjust for a quantity based rate structure following the method used in Neuhoff et al. (2013), which also takes account of costs for night-storage heating. Quantities for energy consumption derived using this

3. Ongoing project for the Federal Environment Ministry (BMUB) by Öko-Institut, Fraunhofer ISI, dezentec.

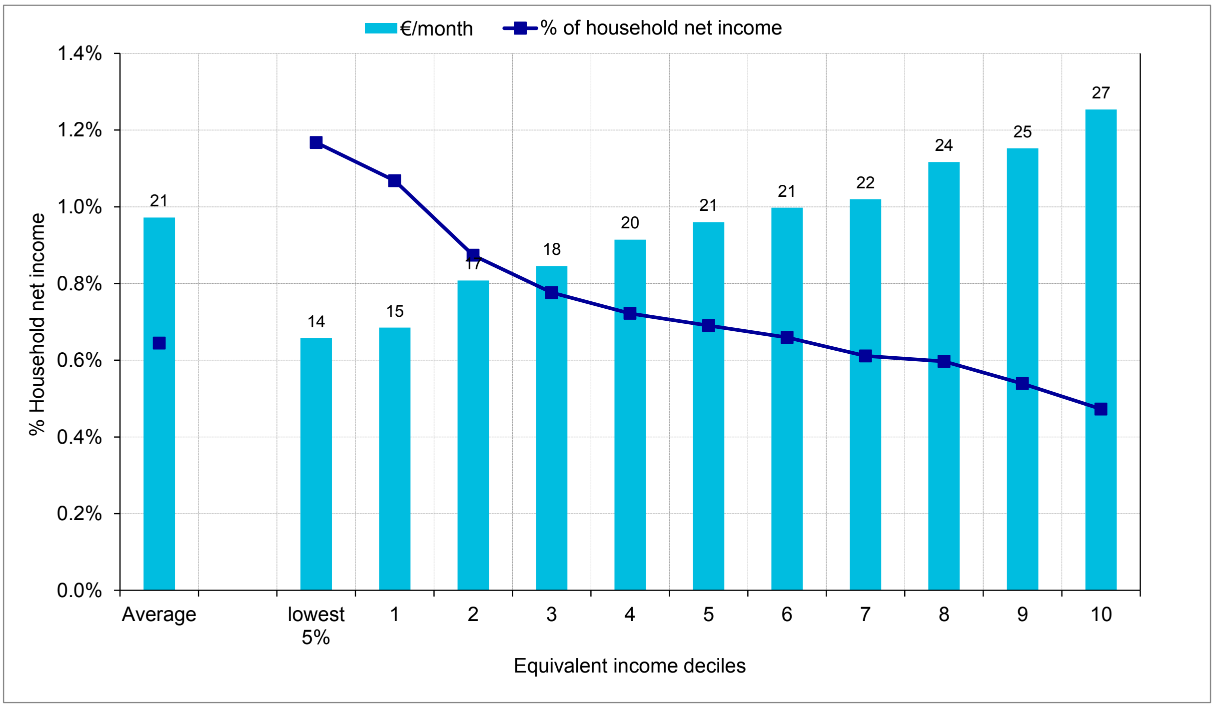

Figure 5. Impact of the EEG surcharge on German households by income group (new OECD equivalence scale). Source: Destatis/Research Data Centre (FDZ): EVS 2008 (80 % scientific use file) extrapolated to 2014; own estimation and illustration.

approach are in aggregation consistent with household energy consumption reported by the national energy balance.[4] We considered also extrapolating the information on energy consumption of households. However, the additional or guiding information needed for this task is not as straightforward as for household income. We therefore decided to not extrapolate consumption of energy and assume that the amounts consumed in 2008 are a good proxy for 2014 values. This assumption is supported by the trend in electricity consumption shown in Figure 1. Furthermore, we also expect this assumption to be valid because of two countervailing effects: On the one hand, the extrapolation of (real) income should increase energy demand (income effect), on the other hand expected increase in energy prices should result in a drop of demand (substitution effect).

For the analysis of the distributional effects of renewable energy policy, we use the EEG surcharge as of 2014 of 6.24 ct/kWh, which represents the highest surcharge so far (in 2015, the surcharge is reduced to 6.17 ct/kWh). Households also have to pay value-added tax (VAT) on top of the total electricity price – and therefore also on the EEG surcharge. The EEG surcharge of 6.24 ct/kWh in 2014 is therefore multiplied with 1.19 to arrive at a total additional burden of 7.43 ct/kWh.

Figure 5 displays how the EEG surcharge in 2014 is distributed amongst households falling into different equivalent income groups[5]. It becomes clear that households with higher incomes face a higher absolute burden, rising from €14/month for the lowest income group to €27/month for the highest income group. However, when looking at the share of their net income spent on the EEG surcharge, the picture is reversed. While the lowest income group spends 1.2 % of their net income, households in the highest income group spend, on average, 0.5 % of their net income. Therefore, the effect is clearly regressive. This is not a novel result and has been confirmed many times in the literature (Chawla & Pollitt 2013; Grösche & Schröder 2014; Neuhoff et al. 2013; Tews 2013).[6]

Other distributional dimensions may be of interest, which could allow developing more targeted policy instruments. Looking at the distributional effects by sorting households into groups according to the social status of their main income earner (Figure 6) confirms that absolute and relative burden are often distributed differently – or even diametrically opposed. In this case, the highest relative burden lies with the unemployed (1.2 % of net household income) and students (1.1 %), whilst the largest absolute burden can be found in the group of self-employed and workers. Naturally, this result also has to do with the fact how income is distributed amongst those groups. However, other factors – such as behaviour regarding electricity usage or the type of water heater used – also play a role (cf. Chawla & Pollitt (2013) who discuss so-called 'winter fuel payments' that are distributed to households with seniors in the UK).

Finally, looking at the distributional effects of the EEG surcharge by household type (Figure 7) shows that single parents are particularly affected, followed by single women. This analysis indicates that targeted policies may indeed be necessary to counteract rising electricity expenses as a result of the EEG

4. http://www.ag-energiebilanzen.de

5. The new OECD scale is used to construct equivalent income weights (main income earner = 1, additional household member older than 14 = 0.5, younger than 14 = 0.3).

6. Note that this is a static analysis. If one took into account reactions by households or by the wider economy, these effects may be alleviated or exacerbated.

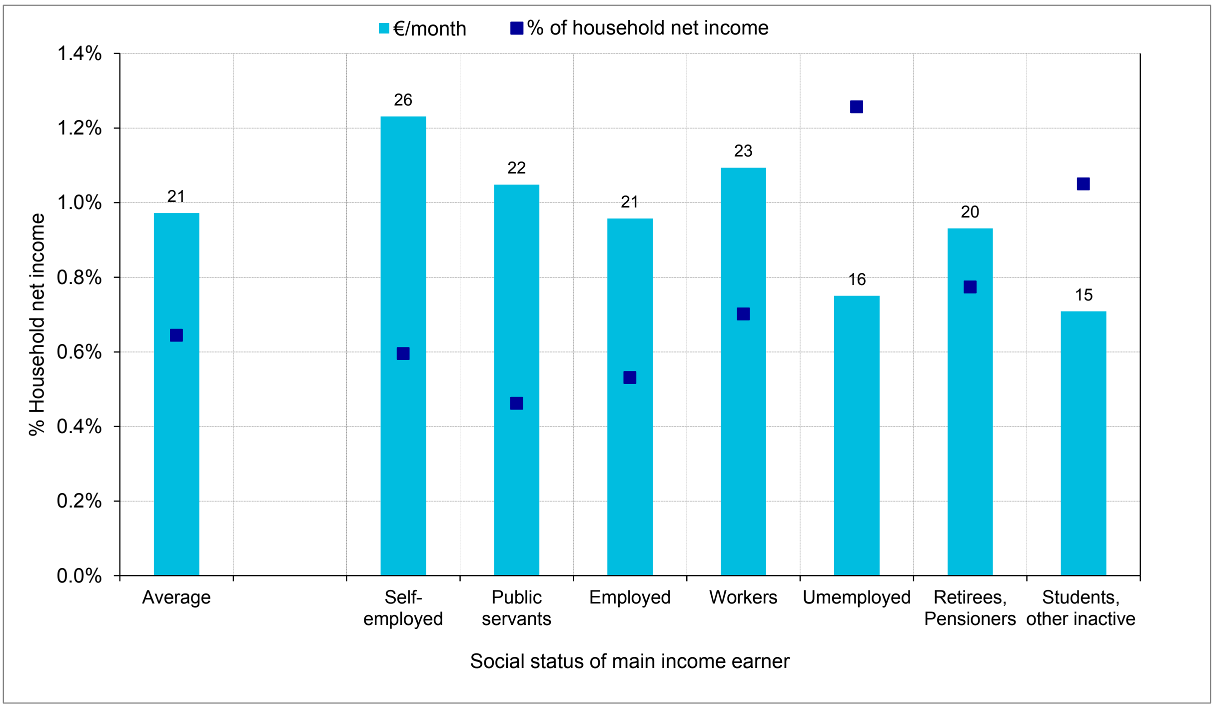

Figure 6. Impact of the EEG surcharge on German households by social status of main income earner. Source: Destatis/Research Data Centre (FDZ): EVS 2008 (80 % scientific use file) extrapolated to 2014; own estimation and illustration.

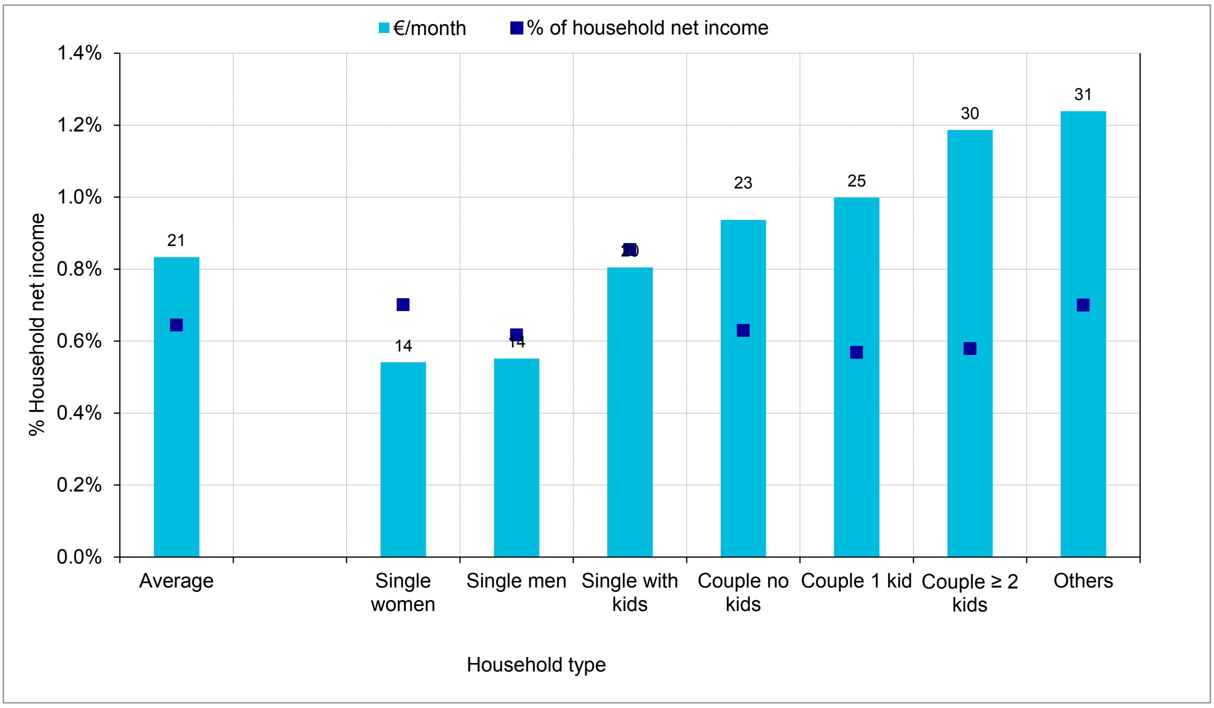

Figure 7. Impact of the EEG surcharge on German households by household type. Source: Destatis/Research Data Centre (FDZ): EVS 2008 (80 % scientific use file) extrapolated to 2014; own estimation and illustration.

surcharge. At which point these impacts become a problem for households and when and how policy makers should react has been a point of discussion. In this context the definition of a threshold of 'fuel poverty' is discussed. It could be used as a baseline against which developments and policies are compared. However, the definition of such a threshold is difficult and subject to debate both in Germany (Heindl 2013) and abroad (Tyszler et al. 2013) – in particular, because results as to who is identified as 'fuel-poor' vary wildly depending on the measure chosen. Methods that have been proposed to calculate the threshold range include a fixed share of expenditure spent on energy, deviations from average energy expenditures, but also self-assessment ('feeling cold indicator', cf. Tyszler et al. 2013) or regional identification.

There are also financial benefits that accrue to households generating electricity in PV panels on their roof (or through investing in a large-scale renewables project). Grösche and Schröder (2014) also take this dimension into account and find that the aggregate effect of the surcharge and the income from renewables generation is regressive – no matter which of the different inequality measures is applied. This is due to the fact that high-income households are more likely to own PV panels (for example because they own rather than rent a house and therefore have the possibility to decide to put PV panels on their roof). Doing so in the early years of the EEG guaranteed a large return on investment due to the high support rates. The authors furthermore isolate the two effects and show that the effect of the surcharge on the income distribution is much larger than the effect of the income from PV panels. Finally, they comment on the overall magnitude of the effect, which seems rather small for the average household to date, but is already problematic for those households at the bottom of the income distribution. This is due to the fact that those households do not have 'discretionary income', i.e. income that is not allocated to cover recurring costs, which they could shift between different consumption goods.

Assistance to low-income households in Germany

Persons that become unemployed in Germany first receive one type of unemployment benefit for one year (Arbeitslosengeld I – ALG I), followed by general unemployment benefits (Arbeitslosengeld II – ALG II) in the following years – or directly go into ALG II if they have contributed to the unemployment insurance scheme for less than one year. Everyone aged between 16 and 67 years is entitled to receiving ALG II (SGB II 2011; SGB III 2011). While ALG I represents a share of previous earnings (67 % of net earnings with dependents, 60 % otherwise), ALG II does not depend on previous earnings, but is calculated using information on the expenditure of low-income households from the German Income and Expenditure Survey (EVS).

Figure 8 gives an overview over the structure of ALG II. It consist of a basic allowance which, in 2014, is set at €391/month for a single adult without dependents. Rent and heating costs are paid for directly and mainly financed by local governments. Finally, there is a provision for additional needs, such as if water is heated using electricity. All three components contain energy expenditures. The basic allowance for single adults of €391/month includes €32.68 for the composite item of electricity expenses and maintenance expenses for the home. This rate is based on the expenditures of the 15 % single households with the lowest income that do not exclusively receive social security benefits. Comparing this to the estimated burden of the EEG surcharge for an average single household in 2014 of €14/month (Figure 7) reveals that it is equal to nearly 40 % of this assistance rate.

Since the EVS is only conducted every five years, rates are adjusted on a yearly basis using a weighted average of the relevant consumer price index (70 %) and wage increases (30 %). However, these adjustments take place with a delay of up to 1.5 years compared to when the price increases actually happened (Neuhoff et al. 2013). Especially for the EEG surcharge that has evolved very dynamically during the past years, this delay seems problematic. In fact, Schleicher (2009) shows that the development of the support rates has historically been slower than the development in energy prices. Due to the inelasticity of electricity demand, this has led to a situation where a significant amount of households receiving social assistance are not able to cover their electricity costs through the fraction of the support rate intended for this use and have to generally substitute by reducing expenditures for other goods (Tews 2013).[7] Furthermore, anecdotal evidence suggests that it may be harder for low-income households to reduce their electricity costs by switching suppliers, since it is harder for households receiving social benefits to opt-out of the usually quite expensive basic tariff offered by electricity retailers in Germany, as they may have a bad credit record making it impossible for them to switch to a cheaper supplier (Der Spiegel 2012).

In 2013, about 35 % of persons living in Germany received government transfers.[8] Retirees represent the largest group at 20.6 million. In the context of this analysis, they are, however, of limited interest, since their benefits do not include special provisions for energy expenditure. There exist cases, however, where retirement benefits are smaller than the minimum allowance. In this case, these persons receive additional assistance through social welfare benefits. Social welfare benefits are also paid in other cases where persons do not qualify for ALG II but need assistance. This applies to 0.34 million persons in total. If their work income is not high enough to cover a person's basic needs, they receive a share of ALG II ('Aufstocker'). Unemployment benefits in the first year were paid to 0.94 million persons in 2013, while general unemployment benefits (ALG II) were paid to 6.16 million. In total, there were 80.59 million persons living in Germany in 2013.

The other side of the coin: Energy saving and efficiency policies

In this section, we consider all major existing and planned energy efficiency policies in the buildings and electricity/appliances sector in Germany in order to check to what extent they may be able to alleviate the burden imposed by the EEG surcharge. Both policies at the federal level and the effects of EU Directives on German households are investigated. Although the EEG surcharge only affects electricity costs, we also take into account legislation targeting energy efficiency of new and existing residential buildings. These policies reduce fuel costs in buildings and can thus substantially contribute to the reduction of overall energy costs for households. We furthermore check how the impacts of these policies are distributed amongst different household types. We both include policies legislated before the release of the National Action Plan on Energy Efficiency (NAPE; BMWi 2014) in December 2014 and those policies included in the Plan. For each of the policies, we only consider the part that is applicable to households (e.g. in the

7. See also Sutherland, H.; Hancock, R.; Hills, J. & Zantomio, F. (2008) for a general discussion on the way in which indexation rules influence the distribution of income in the UK.

8. German Census; Statistik der Bundesagentur für Arbeit, http://statistik.arbeitsagentur.de; Statistik der Deutschen Rentenversicherung, http://www.deutsche-rentenversicherung.de.

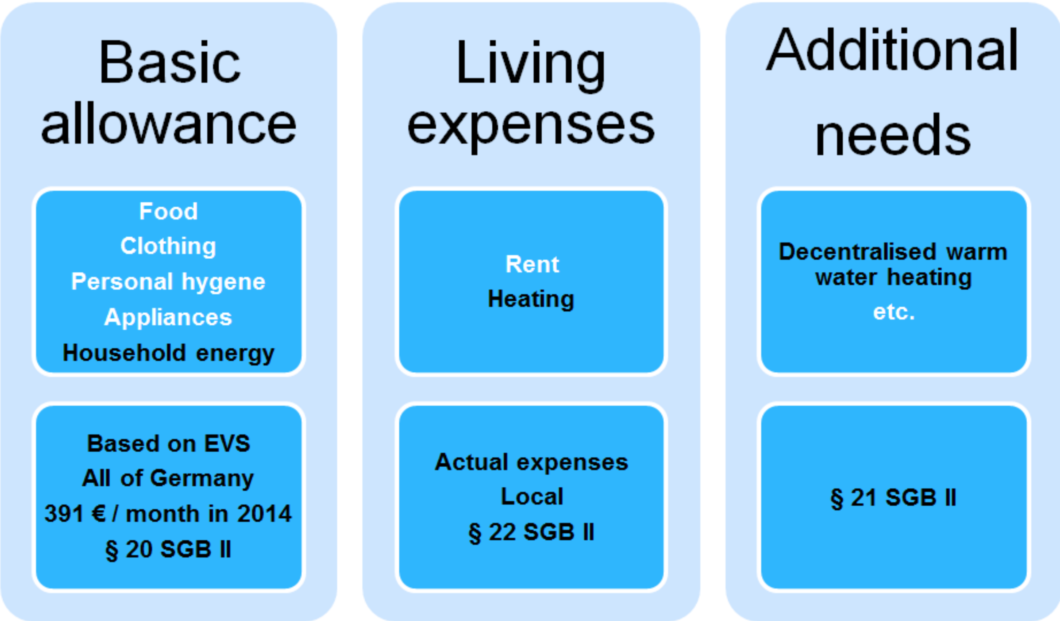

Figure 8. Components of ALG II support. Source: SGB II (2011); own illustration.

buildings sector, only those energy savings and investments affecting residential buildings).

In the buildings sector, we consider the existing Energy saving legislation (EnEV 2013) and its further development planned for 2019. The legislation sets minimum efficiency standards for the renovation of existing, as well as for the construction of new buildings. Another important measure in the building sector is the loans and subsidies available from the KfW (Kreditanstalt für Wiederaufbau). These loans and subsidies are accessible for the renovation of existing or construction of new buildings adhering to certain efficiency standards. The NAPE also sets out a number of new policies to be implemented. In particular, tax incentives for energy-efficient renovations that surpass the standards set out in the EnEV, several consulting programs and a national energy-efficiency label for old heating installations.

In the electricity/appliances sector, we consider the two EU Directives on Ecodesign (2009/125/EC) and Labelling (2010/30/EU) of appliances and the installation of smart meters as inscribed in the Energy Efficiency Directive (2012/27/EU) that is currently passed into German law. The NAPE contains additional measures, such as the Top Runner Initiative, which would – at the national level – strengthen the incentives for efficient product design and adequate information on efficient appliances. Furthermore, the NAPE envisages the setting up of competitive tenders for the reduction of electricity consumption in all sectors of the economy. In this context, funds that support the achievement of these reductions would be tendered competitively and bid for by parties representing a program to carry out these reductions. We consider the part of this program that is expected to lead to reductions of electricity consumption at the household level.

Finally, we investigate an instrument directly targeted at low-income households, namely the Electricity Saving Check ("Stromsparcheck"). Under this program, households that receive government transfers are eligible for energy consulting and ad-hoc measures, such as the replacement of inefficient lightbulbs. A part of the program also provides subsidies for the replacement of old fridges. An extension of this program is planned.

Table 1 shows the policy instruments considered in this analysis and associated saving potentials and annualised investment costs at the household level expected in the year 2020. The energy saving potentials and the resulting energy cost savings and annualised investment costs for each of the energy efficiency policies are mainly based on calculations carried out for the accompanying, scientific study on the NAPE (Fraunhofer ISI et al. 2014) and on additional calculations made by the authors in an ongoing study on behalf of the Federal Environment Ministry.[9] The calculations are based on the following methodological approach:

- For already existing or further developed policies (as e.g. the KfW programmes, the Energy saving legislation for buildings or the Top Runner Initiative), the energy savings up to 2020 were estimated based on available program evaluations and calculations made for the 3rd German National Energy Efficiency Action Plan (NEEAP) submitted under the EU Energy Efficiency Directive (2012/32/EC) and the German projection report submitted in accordance with Decision 280/2004/EC (Deutsche Bundesregierung 2013).
- For new measures in the NAPE (especially the competitive tenders for electricity savings), the calculations were based on energy saving potentials calculated by Fraunhofer ISI et al. (2012) and assumptions about the extent to which the specific policy instrument addresses these potentials.

9. Fraunhofer ISI, Öko-Institut, Ecofys, IREES: Entwicklung eines Konzepts für das Erreichen der nationalen Energieeinsparziele bis 2020 und bis 2050 auch unter Berücksichtigung relevanter EU-Vorgaben im Kontext einer ganzheitlichen Klima- und Energiepolitik ("Aktionsplan Energieeffizienz"). Ongoing research project on behalf of the Federal Environment Ministry (BMUB).

Table 1. Main implemented and planned efficiency policies in Germany: Saving potentials and investments in 2020.

Category	Policy instrument	Energy saving potential (TWh)	Annualised investment cost (M€)
Existing policies buildings	Energy saving legislation (EnEV 2013) KfW Energy-efficient renovations KfW Energy-efficient construction	-37.2	4 144
Existing policies electricity / appliances	EU Ecodesign EU Labelling Smart Meter	-19.2	1 044
Electricity Saving Check (low-income households)	Existing check Extension	-0.2	4
NAPE policies buildings	Further development of Energy saving legislation Tax incentives for energy-efficient renovations Quality assurance and optimising of energy consulting Heating check National energy-efficiency label for old heating installations	-14.4	2 110
NAPE policies electricity / appliances	Further development of national Top Runner Initiative Competitive tenders (electricity)	-6.1	314

Sources: BMWi 2014; Fraunhofer ISI/IFAM, Ifeu, Prognos & Ringel 2014; Fraunhofer ISI, Öko-Institut, Ecofys, IREES (2015, ongoing project).

- The resulting energy cost savings were calculated by multiplying the achieved energy savings for electricity and each fuel type with energy prices taken from the second modelling round of the "Climate Protection Scenario 2050 (Klimaschutzszenario 2050)".[10]
- The additional investment costs induced by the policies were again calculated based on information from existing program evaluations, as well as from Fraunhofer ISI et al. (2012) which also includes assumptions on investment costs of energy saving measures induced by the relevant policies. Further investment cost calculations – in particular for existing policies in the buildings sector – stem from the ongoing study for the Federal Environment Ministry.[9]

Similarly to the analysis of the EEG surcharge, energy cost savings and annualised investment costs are distributed amongst households in order to investigate who is most affected. We apply assumptions as follows:

- All building measures affect owner-occupiers and renters equally, as owners will carry out those measures and pass the cost forward to their tenants. Investment costs are distributed according to square meters of the dwelling in question.[11]
- All measures relating to appliances lead to the same relative reduction in electricity consumption for all households. Investment costs are distributed according to the electricity saved (i.e. each kWh saved requires the same amount of investment). Savings and investments related to the Electricity Saving Check are distributed to households that receive social transfers above a threshold value of €100/month for general transfers ("Grundsicherung") and €50/month for transfers relating to living costs ("Wohngeld").

Table 2 shows results for the direct monetary benefits, i.e. savings on fuel and electricity costs that households belonging to different income groups generate under the respective policies. In general, higher income groups have larger savings in absolute terms, which corresponds to the fact that those households consume more at an absolute level and that relative reductions are constant across households. Energy cost savings related to the Electricity Saving Check benefit mostly households in the lower income groups, as they are specifically targeted by this policy. In total, households are expected to save an average €27/month in 2020.[12]

However, there are also investment costs associated with these measures induced by these policies at the household level. As Table 3 shows, investment costs average €16/month in 2020 and are particularly high for measures relating to buildings. Table 4 sums up those direct (monetary) effects and shows the net effects (in % of household net income). It becomes clear that in case of measures related to buildings the investment costs are nearly on par with the savings achieved through reduced consumption of energy. In case of measures related to electricity/appliances, savings of energy costs surpass investment costs. This in turn has the effect that the distributional effect of these measures is progressive, since energy costs represent a higher share of expenditure for low-income households. The net effect of the Electricity Saving Check is

10. Ongoing project for the Federal Environment Ministry (BMUB) by Öko-Institut, Fraunhofer ISI, dezentec.

11. Please note that this analysis considers annualised investment costs (as is routinely done in economic analysis) and therefore aims to give an overview of the impact across the whole lifetime of the measure rather than a snapshot of actual costs in a given year.

12. Please see ISI/IFAM, Ifeu, Prognos & Ringel (2014) on the fact that overlap between the potentials addressed by those policies was minimised and it is therefore possible to sum up individual effects to get an overview of the combined effect of all policies.

Table 2. Savings due to efficiency policies in 2020 for households of different income groups (€/month).

Deciles of household net equivalent income	Household net equivalent income		Saved energy costs					Total
	Decile average	Highest income in decile	Existing policies buildings	Existing policies elec. / appl.	Electricity Saving Check	New policies buildings	New policies elec. / appl.	
	€/month		€/month					
Lowest 5 %	686	855	5.1	7.7	0.5	1.6	2.5	17.4
1st decile	812	1 043	5.3	7.8	0.4	1.7	2.5	17.8
2nd decile	1 193	1 329	6.9	9.6	0.2	2.3	3.1	22.0
3rd decile	1 441	1 552	7.6	10.2	0.1	2.5	3.3	23.7
4th decile	1 659	1 771	8.2	10.7	0.1	2.7	3.4	25.1
5th decile	1 883	1 994	8.7	11.2	0.0	3.0	3.6	26.4
6th decile	2 116	2 244	9.2	11.9	0.0	3.1	3.8	28.0
7th decile	2 396	2 564	9.4	12.2	0.0	3.2	3.9	28.7
8th decile	2 773	3 021	10.3	12.6	0.0	3.5	4.0	30.4
9th decile	3 386	3 854	10.9	13.3	0.0	3.7	4.2	32.1
10th decile	5 385	.	11.6	14.0	0.0	4.0	4.5	34.0
Average	2 252	.	8.7	11.2	0.1	2.9	3.6	26.5

Source: Destatis/Research Data Centre (FDZ): EVS 2008 (80 % scientific use file) extrapolated to 2014; own estimation and illustration.

Table 3. Investment for efficiency policies in 2020 for households of different income groups (€/month).

Deciles of household net equivalent income	Household net equivalent income		Annualised investment cost					Total
	Decile average	Highest income in decile	Existing policies buildings	Existing policies elec. / appl.	Electricity Saving Check	New policies buildings	New policies elec. / appl.	
	€/month		€/month					
Lowest 5 %	686	855	5.3	1.5	0.0	2.7	0.4	9.9
1st decile	812	1 043	5.5	1.5	0.0	2.8	0.5	10.3
2nd decile	1 193	1 329	6.9	1.8	0.0	3.5	0.6	12.8
3rd decile	1 441	1 552	7.4	2.0	0.0	3.8	0.6	13.7
4th decile	1 659	1 771	8.0	2.1	0.0	4.1	0.6	14.8
5th decile	1 883	1 994	8.5	2.1	0.0	4.3	0.6	15.7
6th decile	2 116	2 244	8.9	2.3	0.0	4.5	0.7	16.4
7th decile	2 396	2 564	9.4	2.3	0.0	4.8	0.7	17.2
8th decile	2 773	3 021	10.0	2.4	0.0	5.1	0.7	18.3
9th decile	3 386	3 854	10.7	2.6	0.0	5.5	0.8	19.5
10th decile	5 385	.	11.3	2.7	0.0	5.8	0.8	20.6
Average	2 252	.	8.5	2.2	0.0	4.4	0.6	15.7

Source: Destatis/Research Data Centre (FDZ): EVS 2008 (80 % scientific use file) extrapolated to 2014; own estimation and illustration.

also distributed progressively, as the savings are concentrated in the low-income groups. [13]

It has to be noted that the estimated effects crucially depend on the assumptions taken with regards to which income groups actually carry out those measures. In the context of this analysis, we have applied assumptions that should be checked and verified going forward. We believe that the assumption that policies in the building sector affect owner-occupiers and tenants equally holds. However, it may be necessary to account for the fact that low-income owners are less likely to carry out efficiency measures that require investment. Since in the electricity/appliances sector, the measure with the highest potential by far is the Ecodesign Directive, it should also have a comparable impact (in relative terms) on both low- and high-income households. However, we would

13. We also investigated the distribution of the net effect for households with a different social status of their main income earner and different household types. The unemployed, students and retirees and pensioners receive the largest direct net benefit (in % of household net income) from the investigated efficiency policies. This is not surprising, since these are also the groups that include a fairly large share of low-income households. We also find that single parents receive the largest direct benefit, followed by "other" households and couples without kids.

Table 4. Net effect of efficiency policies in 2020 for households of different income groups (% of household income).

Deciles of household net equivalent income	Household net equivalent income		Total effect (investment - savings)					Total
	Decile average	Highest income in decile	Existing policies buildings	Existing policies elec. / appl.	Electricity Saving Check	New policies buildings	New policies elec. / appl.	
	€/month		% of household net income					
Lowest 5 %	686	855	0.03	-0.73	-0.05	0.12	-0.24	-0.87
1st decile	812	1 043	0.02	-0.60	-0.04	0.10	-0.20	-0.72
2nd decile	1 193	1 329	0.00	-0.45	-0.01	0.07	-0.14	-0.53
3rd decile	1 441	1 552	-0.01	-0.39	0.00	0.06	-0.13	-0.47
4th decile	1 659	1 771	-0.01	-0.34	0.00	0.05	-0.11	-0.41
5th decile	1 883	1 994	-0.01	-0.31	0.00	0.05	-0.10	-0.37
6th decile	2 116	2 244	-0.01	-0.30	0.00	0.04	-0.10	-0.36
7th decile	2 396	2 564	0.00	-0.27	0.00	0.04	-0.09	-0.31
8th decile	2 773	3 021	-0.01	-0.24	0.00	0.04	-0.08	-0.28
9th decile	3 386	3 854	0.00	-0.20	0.00	0.03	-0.07	-0.24
10th decile	5 385	.	0.00	-0.14	0.00	0.02	-0.05	-0.17
Average	2 252	.	0.00	-0.27	0.00	0.04	-0.09	-0.32

Source: Destatis/Research Data Centre (FDZ): EVS 2008 (80 % scientific use file) extrapolated to 2014; own estimation and illustration. Note: Negative values indicate net savings.

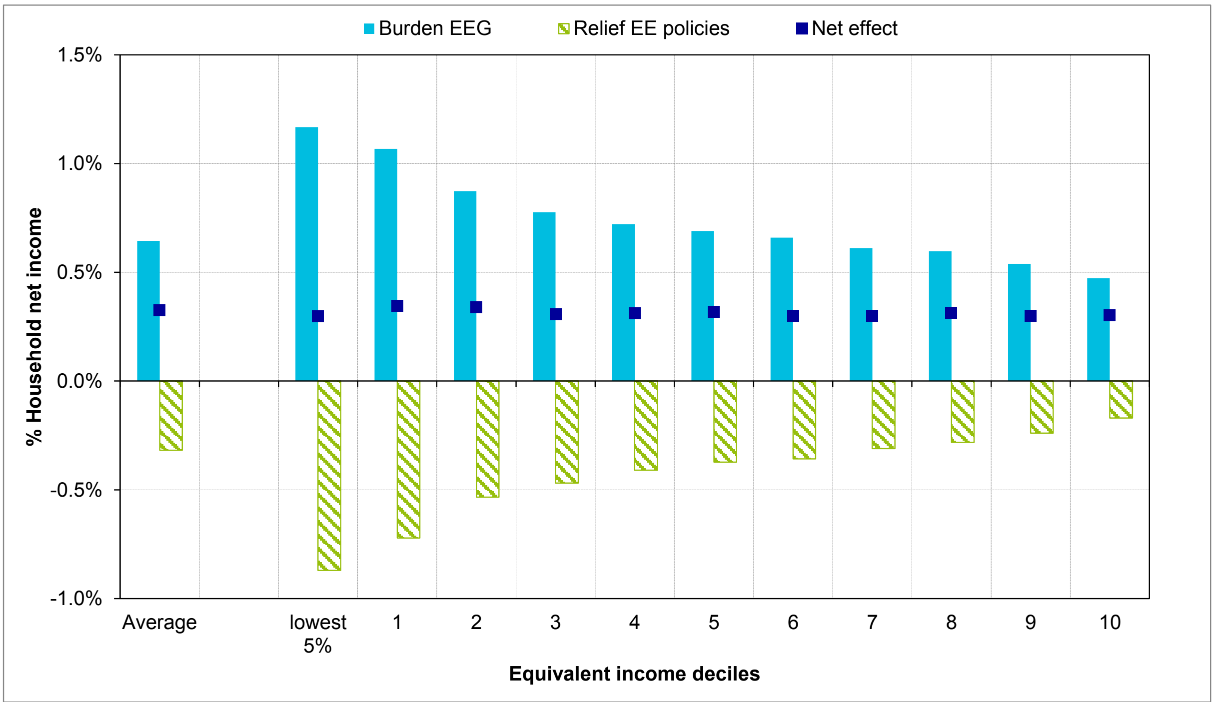

Figure 9. Effect of the EEG surcharge vs. efficiency policies. Source: Destatis/Research Data Centre (FDZ): EVS 2008 (80 % scientific use file) extrapolated to 2014; own estimation and illustration. Note: Negative values indicate net savings.

like to stress that it is important to check who really carries out those measures during the course of the evaluation of these policies. In this context, Tews (2013) notes that energy efficiency policies that rely mainly on providing information, rather than investment subsidies (e.g. for new appliances) have the potential to worsen rather than alleviate regressive effects. It is therefore crucial to continue to build an evidence base on the beneficiaries of these policies that would allow further refining the present analysis. Information on who carries out these measures and analyses of the effects thereof are crucial ingredients in designing targeted policy instruments, if those were needed.

We have found that energy efficiency policies that are currently legislated or planned in Germany have the potential to lower the (monetary) burden imposed by the EEG surcharge. We have furthermore found that if households across all income groups carry out the measures associated with those policies, they have the potential to also lower the regressive effect imposed by the EEG surcharge. In fact, when comparing the effects of the EEG surcharge to those of the efficiency policies (Figure 9), the burden of the combined policies (in % of household income) is distributed more or less proportionally. As stated above, this only holds true if indeed the assumptions on which households carry out the measures that are made in this paper are correct.

Discussion

The analysis in this paper has shown that household expenditure for electricity has been growing in the past years. This is an effect of rising electricity prices coupled with relatively constant consumption of electricity. Taxes and charges – in particular the EEG surcharge – represent a large share of household electricity prices today. The impact of the EEG surcharge on households is non-negligible. It is, however, crucial to distinguish between different groups of households, as effects vary considerably between the different groups. The impact of the EEG surcharge in 2014, for example ranges from 0.5 % of net household income for the highest income group to 1.2 % for the lowest income group. Furthermore, it has been shown that the unemployed, students, single parents and single women are particularly affected.

On the other hand, the German Energy Concept ("Energiekonzept") also contains ambitious energy saving goals. In order to check whether policies in this field have the potential to lower the burden imposed by the EEG surcharge, we have investigated all relevant existing or planned energy efficiency policies related to buildings and electricity/appliances. The results indicate that those policies have the potential to substantially alleviate the burden imposed by the EEG surcharge by about 50 % for the average household because they reduce overall household energy costs. Whilst for measures in the buildings sector, required investments are more or less on par with the saved energy costs, measures in the area of electricity consumption/appliances achieve net savings at the household level. Therefore, an assessment of the distributional effects of the German Energiewende should take into account both the additional costs (as, for example, imposed by the EEG surcharge), but also the (monetary) benefits related to energy efficiency and saving policies.[14]

We have shown that the burden imposed by the EEG surcharge is distributed regressively amongst households. The distributional effects of energy saving and efficiency polices we investigated on the other hand, shows a progressive pattern, leading to a situation where the total effect of EEG surcharge and current and planned energy efficiency policies is distributed roughly proportionally amongst households.

We have stressed that the distributional effects of the policies investigated crucially depend on which households carry out those measures. We have explained the choice for the assumptions we have taken in this context, but have argued that it is important to continue to build an evidence base with regards to the beneficiaries of these policies in order to carry out more refined analyses. Evaluations of the existing and planned policy programs discussed should take into account these issues, since a one-sided involvement of high-income households may indeed increase rather than alleviate regressivity of the Energiewende policies at the household level.

14. Note that we do not account for additional benefits (e.g. health, biodiversity) related to the reduction of CO_2-emissions, which would increase the overall benefits for all households.

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