Why energy efficiency needs to have priority as part of the Energiewende

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> The Energiewende debate is an opportunity to rethink and reprioritise delivery of the best value investments for renewing the German energy system. The current process would benefit from a broader strategic review of the most pragmatic way of delivering the original Energiekonzept's long-term multiple objectives of greenhouse gas emissions (GHG) reduction, primary energy demand cuts and increased renewable generation.

> Rising energy costs are a significant concern for Germany. In 2011, €81.2 billion – equal to 3.2% of German GDP – was spent on fossil fuel imports; this is an increase of 50% on 2000 levels. Global rises in demand for energy, especially gas and oil, from emerging economies and economies in transition, notably China mean this trend is unlikely to be reversed.

> These rising costs place a burden on industry – but they also place a burden on households, as people are forced to allocate an ever bigger proportion of their income to energy bills. In a 2011 survey, Germany ranked nine out of 15 European countries for the proportion of the population who say they are unable to afford to adequately heat their home. Against the backdrop of global trends, this makes successful delivery of the Energiekonzept's goals all the more important.

> E3G analysis shows that regardless of the technology pathway selected to decarbonise the German power sector through the Energiewende, increased energy efficiency will be crucial to keeping electricity costs down to acceptable levels. The Energiewende debate needs to be reframed to consider how placing a higher priority on energy efficiency can help deliver a decarbonised power sector in an affordable manner and, in so doing, help consumers manage the impact of rising electricity costs.

> However, rising electricity costs are only part of the issue for households. Over 70% of the energy consumed in homes is actually used for heating - with only 26% is used for electricity. This results in 64% of households' annual energy costs being allocated to providing heating and hot water, 13% for cooking and 23% to lighting and other electrical services. At the end of 2012, 18.9 million properties (49% of existing homes) were heated by natural gas, with heating oil fueling around 12 million homes. Reducing dependency on fossil fuel imports therefore should be a key priority for the German

Government, as it will also reduce the exposure of consumers to volatile and rising fossil fuel prices across the energy system.

> Despite the fact shale gas is now touted by many as a 'third way' to start to decarbonise European economies at affordable cost, it may well not be a cheap option for Europe. Detailed analysis of the economic case underpinning the US 'Shale Gas Revolution' indicates it will be difficult to replicate because Europe lacks both the infrastructure and the legal framework, in the form of property rights, needed to stimulate demand and facilitate investment. In addition, the social and environmental risks are not fully understood - and the simple facts of the different European geology and a more densely populated landmass in Europe will further challenge its ability to deliver at scale.

> Successful delivery of the Energiewende will therefore require a stronger focus on increasing building efficiency and demand side options. Refocusing Energiewende priorities toward delivering such demand side solutions will not only reduce GHGs, it can also generate savings on energy bills by decreasing energy use in residential buildings by more than 70%. It will also offer greater value to the economy through a number of side benefits. These include: avoided supply-side investment in conventional generation and distribution networks; substantial and diverse job creation potential – KfW's promoted investment created more than 250,000 jobs in 2011; new sources of tax revenue for the Government – the 2011 KfW Energy Efficient Construction and Refurbishment programme produced €3 billion in benefits to public budgets; and opportunities to drive growth. It will also increase living standards, by enabling greater numbers of German households access to warm dry homes, that in turn provides health benefits.

1. Energy trends: Why rising energy costs should concern everyone

Since 2000, household energy costs have been rising. The majority of household energy is sourced from natural gas and heating oil, with oil being used to heat 12 million homes. The price of heating oil more than tripled over the last two decades; the price of natural gas has doubled; and the price of electricity rose by about 75% (see Figure 1). These changes mean that every year households must allocate an ever bigger share of their income to energy costs. This is a particular concern for households with lower incomes. In 2008, the date of the most recent German survey, 13.8% of German households were described as being in 'energy poverty', that is they spend more than 10% of their income on energy1. In a more recent UK study of 15 European countries conducted in 2011, Germany ranked nine out of 15 for the proportion of the population who say they are unable to afford to adequately heat their home[2].

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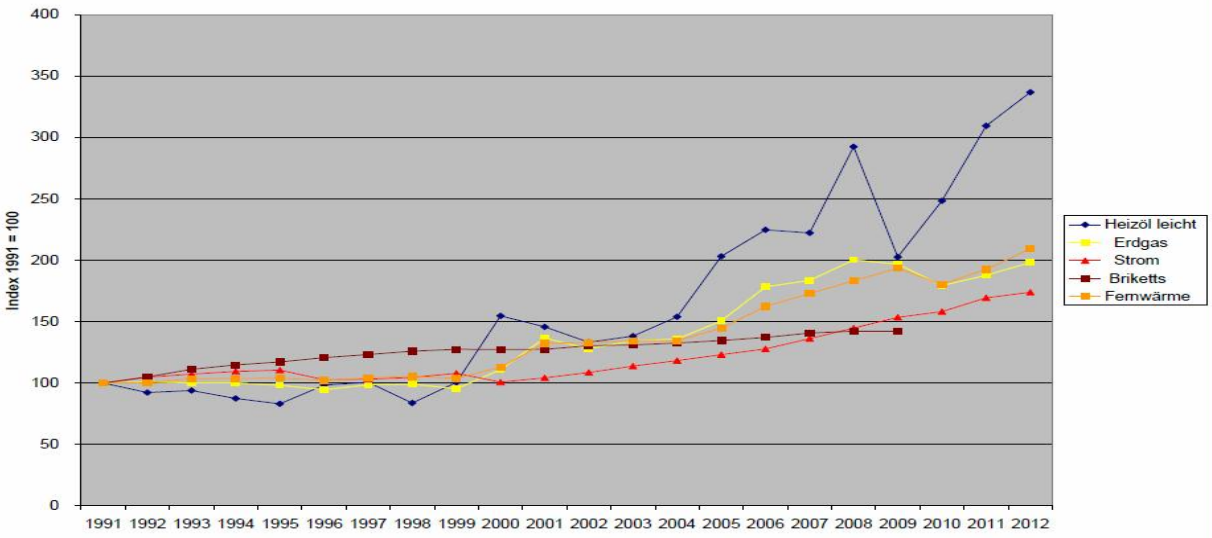
[1] Deutscher Bundestag (2012) *Energiearmut erkennen und Lösungen anbieten*, Antwort der Bundesregierung auf die Kleine Anfrage der Abgeordneten Bärbel Höhn, Markus Kurth, Daniela Wagner, weiterer Abgeordneter und der Fraktion BÜNDNIS 90/DIE GRÜNEN, Drucksache 17/10582 17. Wahlperiode 30.08.2012

[2] The rationale in this report was to compare the UK with countries in Europe that are both fairly prosperous, and have 'full' heating seasons, ie that usually need to heat their homes throughout the winter. The purpose of this is to avoid including countries that are either significantly less prosperous than the UK, or have warm climates, or both. The basis for the selection of 'prosperous' European countries is the 2012 Legatum Prosperity Index, selecting European countries that rank as having 'high prosperity' according to the index. The basis for choosing countries with 'full' heating seasons is to use the average annual heating degree days for each country as collated by Eurostat. Appropriate thresholds for heating degree days - to characterise different climate zones according to

Figure 1: Development of energy prices for private households



Source: BMWi (2013)[3]

1a. The need to widen the Energiewende discussion

The Energiewende is focused on decarbonising Germany's power sector and so naturally it follows that most of the public discourse on rising energy costs is focused on the costs of electricity. The voice of business has been prominent in these discussions. There has been less focus on the impact on households: for them rising electricity costs are an issue but rising heating costs are likely to be an even bigger concern. This is because electricity accounts for less than one-third of households' overall energy consumption (26% in 2011); the rest (>70%) is used to heat homes[4]. A breakdown of household energy bills is shown in Figure 2. According to the most recently available data (2010), 64% of the annual households' energy costs were for heating and hot water, 13% for cooking and 23% to lighting and other electrical services[5].

The narrow focus of the current energy debate therefore needs to be widened to take into account the broader social impacts of rising energy costs in Germany. The current focus on electricity ignores the broader opportunities to both reduce carbon emissions and tackle increasing energy poverty issues.

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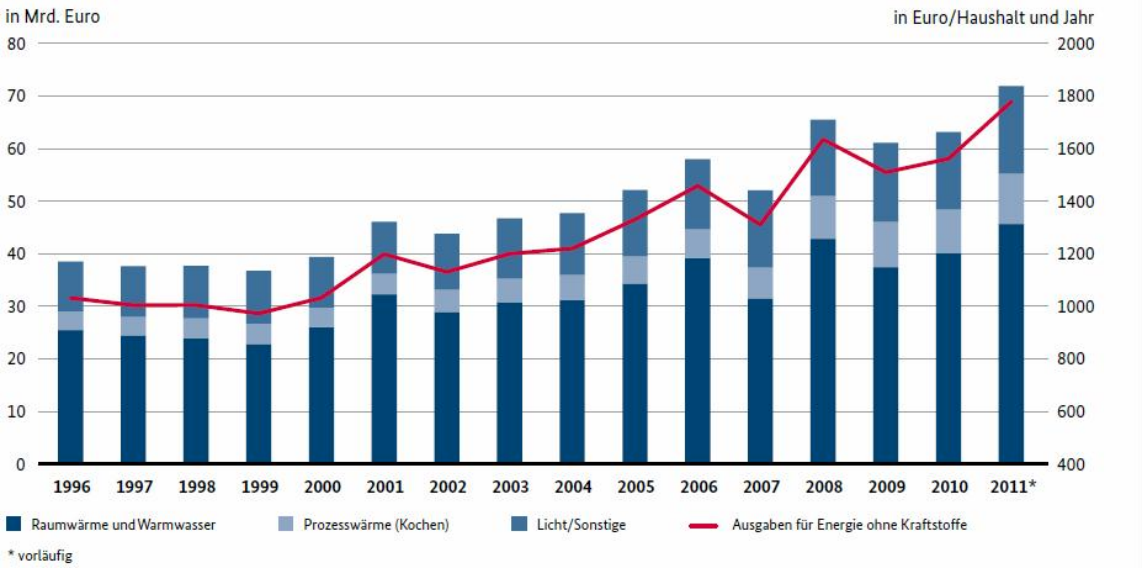
heating need – have been developed by the International Energy Agency in support of the G8 Gleneagles Plan of Action for Climate Change. See EBR and ACE (2013) *The Cold Man of Europe,* Energy Bill Revolution and Association for the Conservation of Energy, http://www.energybillrevolution.org/wp-content/uploads/2013/03/ACE-and-EBR-fact-file-2013-03-Cold-man-of-Europe.pdf

[3] BMWi (2013), *Energiedaten – ausgewählte Grafiken*, Bundesministerium für Wirtschaft und Technologie http://www.bmwi.de/DE/Themen/Energie/Energiedaten/gesamtausgabe.html

[4] Umweltbundesamt (2013) *Energieverbrauch der privaten Haushalte,* http://www.umweltbundesamt-daten-zur-umwelt.de/umweltdaten/public/theme.do?nodeIdent=3526

[5] The data show that in 2010, 64% of expenditures was on heating and hot water; 13% on cooking; 23% on other including lighting. See Deutscher Bundestag (2012) *Energiearmut erkennen und Lösungen anbieten*, Antwort der Bundesregierung auf die Kleine Anfrage der Abgeordneten Bärbel Höhn, Markus Kurth, Daniela Wagner, weiterer Abgeordneter und der Fraktion BÜNDNIS 90/DIE GRÜNEN, Drucksache 17/10582 17. Wahlperiode 30.08.2012

Figure 2: Energy bills for private households in billions Euros between 1996 and 2011 depending on purpose

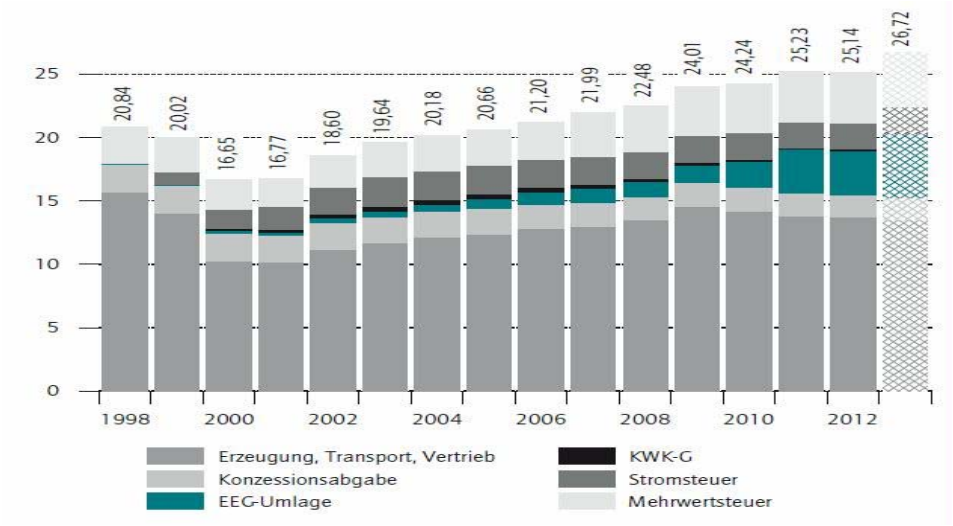


Source: BMWi (2013)[6]

1b. Is it the need to tackle climate change or broader energy trends driving electricity prices up?

For an average German household with a yearly consumption of 3,500 kWh, electricity prices have increased by more than 30% since 2002.

Figure 3: Development and composition of the household electricity bill in real term - €ct/kWh in 2011 prices



Source: DIW (2012)[7]

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[6] BMWi (2013) *Energie in Deutschland - Trends und Hintergründe zur Energieversorgung*, Bundesministerium für Wirtschaft und Technologie, http://www.bmwi.de/Dateien/Energieportal/PDF/energie-in-deutschland,property=pdf,bereich=bmwi2012,sprache=de,rwb=true.pdf

[7] K. Neuhoff, S. Bach, J. Diekmann, M. Beznoska and T. El-Laboudy (2012) *Steigende EEG-Umlage: Unerwünschte Verteilungseffekte können vermindert werden*, DIW Wochenbericht Nr. 41/2012

Claims in the press that 'Ökostrom'[8] – i.e. electricity from renewable sources – is the main cause for rising energy prices are misleading. They disregard the impact of rising fossil fuel prices (in particular of gas and of heating oil to heat homes) and omit to note that since 2000 power generation and distribution costs have contributed at least as much to the increase in electricity as the renewable levy (see Figure 3). In 2010, the renewable levy accounted for only 8.8% of total electricity costs, whereas power generation and distribution costs accounted for 55% of costs[9].

Moreover, the costs of the renewable levy are spread unevenly in the economy. Energy-intensive industries, despite being a major electricity consumer, are exempt from it. These costs become then socialised, with households carrying much of the burdens through increased electricity costs[10]. In 2012, the exemptions for energy-intensive industries amounted to about €13 billion, 33% higher than in 2005[11]. This current approach to allocating costs has created perverse incentives to business, some of which deliberately leave machines to run unproductively over the weekend in order to meet the thresholds set by law to obtain exemptions [12.] As well as increasing carbon emissions, this adds a further, and unnecessary, cost burden on households.

Increasing energy prices obviously disproportionally affects the poorest member of society most. Between 2000 and 2013 households in the lowest income group of society experienced the highest increase in electricity costs and in 2013 the lowest 5% have to dedicate 6.1% of their available income to electricity alone[13]. In 2013, electricity costs are expected to increase on average by 38% on 2000 levels[14].

Even if the Energiewende were abandoned, this trend is likely to continue because of rising global energy demand[15]. The US shale gas revolution, whilst proving a short term supply relief, will not solve longer terms issues over access to affordable energy (discussed further later). This indicates that in addition to the current focus on decarbonising the energy sector,

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[8] Die Welt (2012) *Ökostrom belastet Verbraucher noch lange* http://www.welt.de/print/die_welt/wirtschaft/article111173925/Oekostrom-belastet-Verbraucher-noch-lange.html;
Der Spiegel Online (2013) *Ökostrom kostet Verbraucher so viel wie nie* http://www.spiegel.de/wirtschaft/service/erneuerbare-energien-oekostrom-kostet-verbraucher-17-milliarden-euro-a-876029.html

[9] T. Traber, C. Kemfert, J. Diekmann (2011) *German Electricity Prices: Only Modest Increase Due to Renewable Energy expected*, DIW Berlin Weekly Report No. 6/2011.

[10] In 2012, 778 industries were exempting and about 2000 firms applied for exemptions for 2013. According to first estimates, more than 1500 firms currently do not pay for Ökostrom. See Der Spiegel Online (2013) *Milliardengeschenk: Regierung befreit 1550 Firmen von Energiewende-Kosten* http://www.spiegel.de/wirtschaft/unternehmen/energiewende-regierung-befreit-1550-firmen-von-kosten-a-874321.html

[11] Küchler, S. (2013) Ausnahmeregelungen für die Industrie bei Energie-und Strompreisen, Forum ökologisch-soziale Marktwirtschaft, available on http://www.foes.de/pdf/2013-09-Industrieausnahmen-2005-2014.pdf

[12] Bayerische Rundfunk (2012) *Öko-Paradox: Geld sparen mit Stromverschwendung* http://blog.br.de/quer/oko-paradox-geld-sparen-mit-stromverschwendung-13092012.html

[13] K. Neuhoff, S. Bach, J. Diekmann, M. Beznoska and T. El-Laboudy (2012) *Steigende EEG-Umlage: Unerwünschte Verteilungseffekte können vermindert werden*, DIW Wochenbericht Nr. 41/2012

[14] Ibid

[15] US National Intelligence Council (2012) *Global Trends 2030: Alternative Worlds*, http://www.dni.gov/index.php/about/organization/national-intelligence-council-global-trends

there must be an enhanced focus on enabling householders to use fewer units of energy to provide existing energy services. Otherwise the social burden will increase.

Current policies must be ramped up significantly. While long-term scenarios developed for the Ministry of Environment (BMU) looking at how to deliver 80% GHGs reduction by 2050 assume a reduction of final electricity demand of 10% by 2030 on a 2010 level (central scenario)[16], data shows that between 1990 and 2010 final electricity demand increased by 14% (households' electricity demand increased by 17%). This casts doubt on whether current policies are sufficient to reduce electricity demand[17].

1c. What is driving heating costs up?

Although total heating demand per square meter has decreased in Germany by 8% over the past 15 years, heating costs are still on the rise. Between 1996 and 2010 average overall heating bills for households increased by more than 30% (Figure 2)[18]. This is primarily due to underlying fossil fuel price dynamics that the Energiewende, as currently framed, cannot address. Thus a greater focus must be placed on delivering energy efficiency and managing energy demand in buildings.

At the end of 2012, 18.9 million properties (49% of existing homes) were heated by natural gas[19], with heating oil being used in around 12 million homes[20]. Looking at overall trends, demand for heating oil has decreased 28% since 2000, and is being replaced by heat pumps, district heating and switching to gas[21].

Because Germany lacks domestic gas and oil resources – 89% of natural gas was imported in 2012 - it is largely dependent on gas and oil imports to meet its heating demand[22]. As noted earlier, the cost of heating oil more than tripled over the last two decades and the price of natural gas has doubled due to rising demand and rising extraction costs (Figure 4)[23]. Since

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[16] J. Nitsch, T. Pregger, Y. Scholz, T. Naegler, D. Heide, D. L. de Tena, F. Trieb, K. Nienhaus (DLR) N. Gerhardt, T. Trost, A. von Oehsen, R. Schwinn, C. Pape, H. Hahn, M. Wickert, M. Sterner (IWES) B. Wenzel (IFNE) (2012) *Long-term scenarios and strategies for the deployment of renewable energies in Germany in view of European and global developments,* Deutsches Zentrum für Luft- und Raumfahrt (DLR), Stuttgart, Fraunhofer Institut für Windenergie und Energiesystemtechnik (IWES), Kasse, Ingenieurbüro für neue Energien (IFNE), Teltow.

[17] AGEB (2013) *Energieverbrauch in Deutschland im Jahr 2012*, Arbeitsgemeinschaft Energiebilanzen e. V.

[18] Ibid

[19] Ibid

[20] S. Bukold (2013), *Verheizt? Heizöl im deutschen Wärmemarkt - Preisrisiken und Alternativen*, Kurzstudie im Auftrag der Bundestagsfraktion Bündnis 90/Die Grünen

[21] Gas continues to dominate the market of new heaters with a market share of 50% in 2012. See Ibid

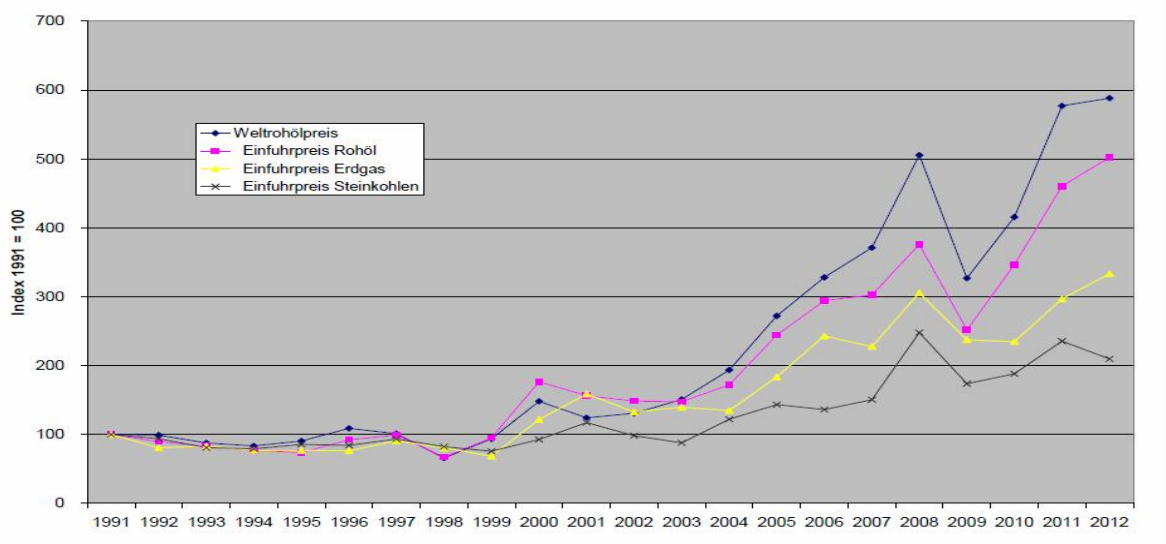
[22] AGEB (2013) *Energieverbrauch in Deutschland im Jahr 2012*, Arbeitsgemeinschaft Energiebilanzen e. V.

[23] Over the past 10 years, the oil price has risen from $25 a barrel in 2002 to $110 in 2012. This was due to rising demand from emerging economies, increasing cost and complexity of projects as exploration and drilling occurs in more remote and hostile locations and the cost structure of the industry changing as more is charged for drilling licences. Over the past decade, the world's top seven international oil and gas companies have increased their capital expenditure by 255%, with the whole oil industry allocating $550 billion in 2011. Despite this outlay, in 2012, the European majors managed a replacement ratio of just 92%.[23] See S. Pfeifer and G. Chazan (2013) *Energy: More buck, less bang*, Financial Times http://www.ft.com/cms/s/0/022fa468-a1c3-11e2-ad0c-00144feabdc0.html#ixzz2QW2jc7cw; M. T. Klare (2012) *The race for what's left – The global scramble for the world's last resources*, Metropolitan Books, New York City

gas and heating oil are responsible for 60% (in 2010) of German households' final energy demand [24], focusing on improving the efficiency of the building stock would substantially reduce Germany's exposure to fossil fuel price risk, while improving the lives of millions of people.

Figure 4: Development of import prices of oil, gas and coal for Germany

Over the last 15 years, the import price of oil (the purple line) and gas (the yellow line) have drastically increased. Oil price was subject to a 5-fold increase and gas prise to a 3-fold increase. As modern history has showed, oil price spikes can generate systemic economic shocks with wide economic and social repercussions such as in the 1970s. It is important to notice that in the case of Germany, gas prices are coupled to the price of oil so when oil prices increase so do gas prices[25].



Source: BMWi (2013)

Although it is difficult to predict how oil and gas prices will develop, future prospects of cheap fossil fuels seem an unlikely outcome. Some are arguing that shale gas offers an attractive and cheap alternative to conventional oil and gas and renewable energy. This is largely based on stories about the US 'Shale Gas Revolution'. However, the facts have been mis-represented and there is now considerable doubt that the underlying economics of projects are attractive, even if support could be obtained for this industry to develop in the EU.

Energy efficiency offers a pragmatic and feasible approach to reducing the managing energy costs for the German economy – and for households in particular. Driving forward more ambitious policies should therefore be a new priority for the Government. Everyone should have access to affordable energy and to warm dry homes. There is increasing evidence showing the impacts of inadequately heated homes on health and quality of life, particularly

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[24] AGEB (2012) *Auswertungstabellen zur Energiebilanz für die Bundesrepublik Deutschland 1990 bis 2011*, Arbeitsgemeinschaft Energiebilanzen e. V.

[25] This so-called 'indexation' determines the price of gas based on the competition between natural gas and substitute energy sources. In the German heating market the major substitute of natural gas is heating oil so that oil prices become the major drivers of the price of gas. See Frontier Economics/EWI (2010) *Energiekosten in Deutschland -Entwicklungen, Ursachen und internationaler Vergleich*, Endbericht für das Bundesministerium für Wirtschaft und Technologie

for children, the elderly and those living with disabilities[26]. In a modern and affluent society this should be unacceptable.

2. Delivering the Energiewende

2a. Technology choices

In 2010, the German Government proposed an ambitious plan (Das Energiekonzept) to transform Germany in a low-carbon economy by 2050. This sets out to: reduce GHGs emission by 80% compared to 1990 levels; increase the share of renewable electricity to at least 80%; cut primary energy consumption by 50% on 2008-levels; and cut electricity consumption by 25% compared to 2008 levels[27].

The Energiewende builds on the Energiekonzept, which was revised following the nuclear disaster of Fukushima in 2011 to include the aim of phasing out nuclear power by 2022. In March 2011 the seven oldest nuclear powers were shut down and the German Government together with opposition parties decided to accelerate the transition[28]. However, while the Energiekonzept sets out a clear political direction, it lacks a broader strategic approach that demonstrates how the multiple objectives will be met. The Energiewende, in turn, has generated further questions about how these outcomes will be achieved and turned the debate into one focused on narrow technology choices. In essence: coal is pitted against nuclear, each of which carries different risks and open up new opportunities.

Now is the right time to take a step back and undertake a broader strategic review of the options available. The scale and urgency of the investment challenge at hand means there should be a focus on policy and technology choices that minimise the risk of non-delivery of the Energiekonzept's original goals and achieve them in the most cost-effective and timely fashion. Failure to do so will put at risk the delivery of a secure, timely and affordable decarbonisation of Germany's energy infrastructure.

2b. Energy efficiency is key to managing costs

Recent E3G analysis shows that managing energy demand is key to reducing the costs of the Energiewende and risks around successful delivery. The study investigated alternative policy approaches to delivering power sector decarbonisation in Germany in line with the targets proposed by the 2010 Energiekonzept [29]. The objective of the study was to understand the

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[26] See EBR and ACE (2013) *Families and fuel poverty,* Energy Bill Revolution and Association for the Conservation of Energy, http://www.energybillrevolution.org/wp-content/uploads/2013/02/ACE-and-EBR-fact-file-2013-02-Families-and-fuel-poverty-final.pdf

[27] BMU (2011) *The Federal Government's energy concept of 2010 and the transformation of the energy system of 2011,* Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit

[28] Ibid

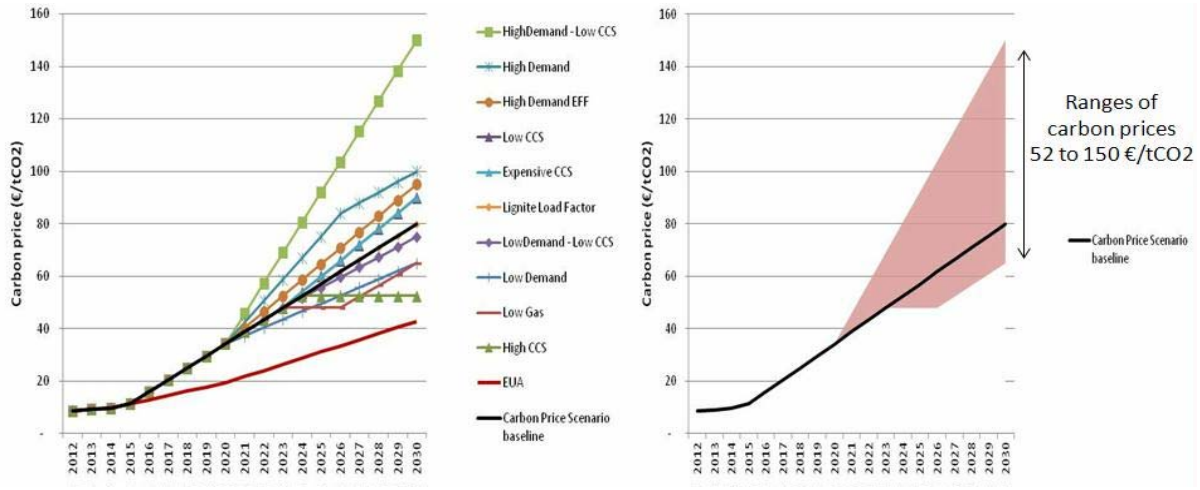
[29] For the full analysis including risk managing power sector decarbonisation in the UK and Poland see E3G (2013) *Risk Managing European Power Sector Decarbonisation*, Third Generation Environmentalism http://www.e3g.org/showcase/risk-managing-power-sector-decarbonisation

underlying risk landscape of two competing policy approaches which underpin two different scenarios. The 'Technology Support Scenario' assumed continuous support for renewables post-2020, while the 'Carbon Price Scenario' used a variable carbon price as the only driver of decarbonisation (support for renewables ends in 2015).

Results showed that electricity demand was consistently the most critical uncertainty affecting carbon price development as well as the costs and risks of policy delivery. Delivering electrical efficiency emerges as a key 'risk reducer'.

In the Carbon Price Scenario, where future choices are driven only by the carbon price, failure to deploy energy efficiency at scale led to a need for very high carbon prices in order to quickly meet decarbonisation targets (Figure 5). For example, the carbon price required in 2030 to attract sufficient renewable energy to compensate for energy efficiency failures would be 100 €/tCO2. In the absence of carbon capture and storage (CCS) technology being deployed onto the system, the carbon price required would amount to 150 €/tCO2.

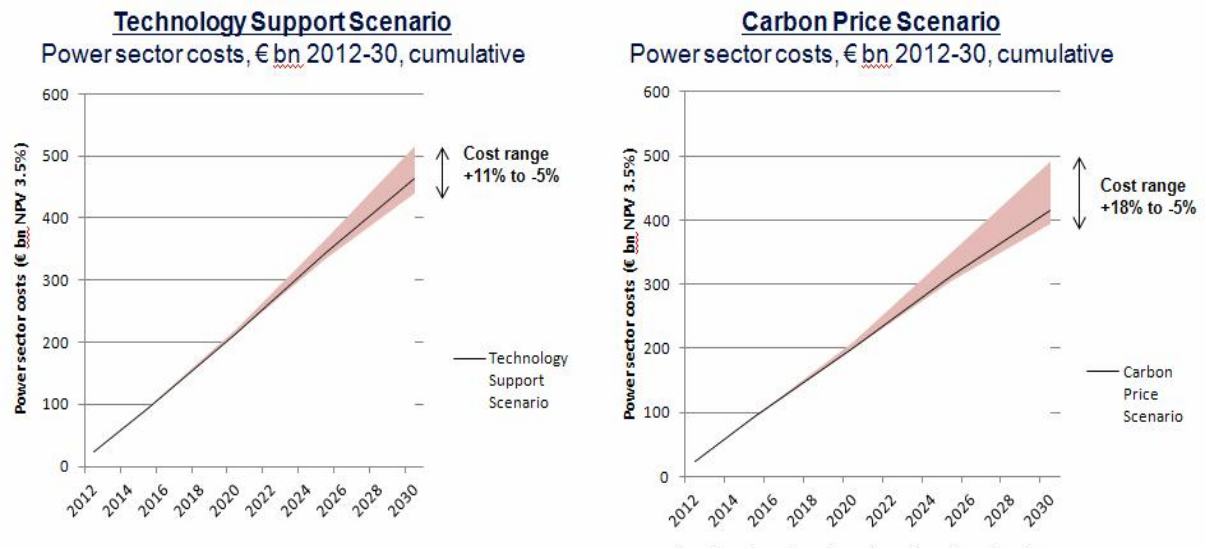
Figure 5: Range of carbon prices required to meet decarbonisation target by 2030 under different scenario assumption



Source: E3G (2013)

Figure 6 shows that in both the Carbon Price Scenario and the Technology Support Scenario power sector decarbonisation costs are significantly increased when electricity efficiency fails to be delivered. Within the scenarios, the technology pathways leading to the highest cost difference from central assumptions were those that failed to deliver energy demand reductions (+18% for the Carbon Price Scenario and +11% for Technology Support Scenario).

Figure 6: Total power sector costs cumulative in € bn 2012-2030

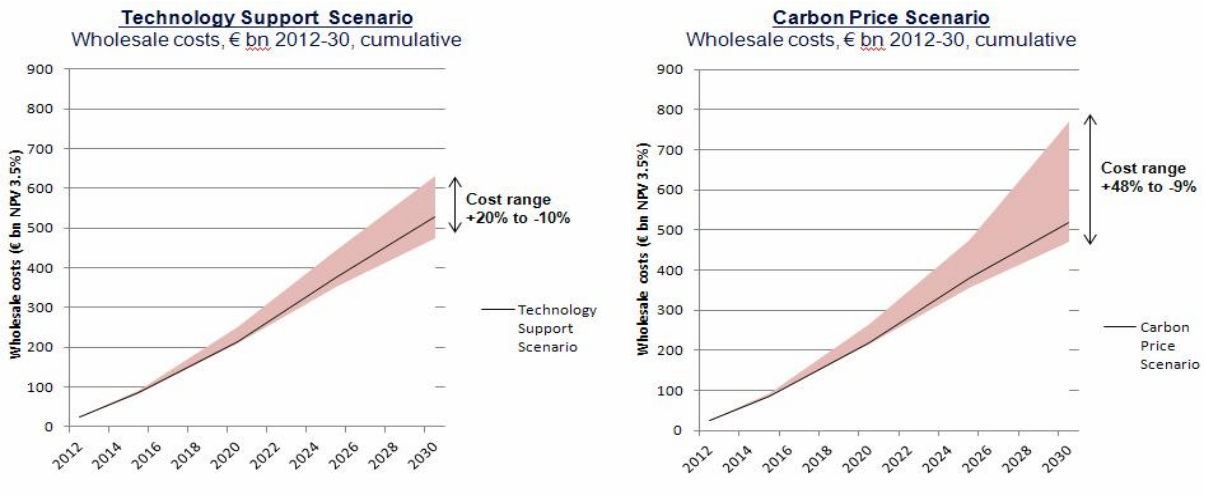


Source: E3G (2013)

In comparison, the trajectories that lead to the least cost delivery of policy objectives (-5% for both scenarios relative to baseline) were those that maximised energy efficiency. Increasing efforts to lower energy demand would make power sector costs more resilient to future shocks and uncertainties.

Costs to consumers are also exposed to high price risks. Figure 7 shows that in the Carbon Price Scenario wholesale costs would be 48% higher in 2030 than central assumption if energy efficiency fails to be delivered. This corresponds to a cumulative cost increase of more than €200 billion between 2012 and 2030 compared to baseline. In the Technology Support Scenario, costs would be 20% higher than baseline and cumulative costs would amount to less than €100 billion between 2012 and 2030 compared to baseline.

Figure 7: Total wholesale costs cumulative in € bn 2012-2030



Source: E3G (2013)

Given that the future is uncertain, effective decarbonisation strategies will need to identify key delivery risks and develop plans to manage these risks effectively. Under all technology pathways, the analysis shows energy demand reduction will be key to managing delivery but also to ensuring that increases in power costs are kept to acceptable levels. This will ensure that consumers and businesses stay onside with the Energiewende. Increased energy efficiency deployment can act to reduce price risk, increase system stability, reduce supply-side market distortions from capacity markets and improve the likelihood that decarbonisation targets are delivered.

2c. But won't shale gas solve our problems?

In many European discussions, shale gas is now touted as a 'third way' to start to decarbonise economies at affordable cost. This is driven by a surge in the production of shale gas in North America in recent years. Currently shale gas accounts for 40% of US natural gas production. However, a closer examination of the headlines indicates that shale gas may well not be a cheap 'third way' for Europe that some claim.

One immediate concern is that the shale gas industry is substantively underpinned by Government subsidies[30]. These subsidies could perhaps be justified on the basis of job creation: however there is no evidence that the number of jobs created in shale gas is any larger than those that could be created in other parts of the economy as a result of a similar subsidy regime[31]. In addition two-thirds of current volumes of gas are sourced from only three sites that are now showing steeply decline recovery rates and decreasingly attractive economics[32]. In 2012 the capital costs of maintaining production in more than 7,000 wells was US$42 billion per year. In comparison, the value of shale gas produced in 2012 was only US$32.5 billion[33].

There are also issues with oversupply which drove prices below production costs: in 2011, US supply for natural gas exceeded demand by a factor of four[34]. It is the need to recover costs that is driving the export of shale gas to more lucrative overseas markets. In November 2012, the number of permits granted by the US Department of Energy for shale gas export

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[30] Corporations exploiting shale enjoy significant tax exemptions from the Clean Air Act, the Clean Water Act, the Clean Drinking Water Act, as well as the Superfund Act, which requires cleanup of hazardous substances. See Ellen Cantarow (2013) *Fracking ourselves to death in Pennsylvania*, grist Magazine http://grist.org/climate-energy/fracking-ourselves-to-death-in-pennsylvania/

[31] There are strong voices especially from within the industry claiming that shale development led to a vast numbers of job creation. These studies often contain unrealistic multipliers about indirect jobs. Data available from the US Bureau of Labor Statistics, however, show that since 2003 direct industry jobs for onshore and offshore oil and gas have accounted for less than 1/20 of 1% of the overall US labour market. See Deborah Rogers (2013) *Shale and Wall Street: Was the decline in natural gas prices orchestrated?*, Energy Policy Forum

[32] J. David Hughes (2013) *Drill, Baby, Drill – Can unconventional fuels usher in a new era of energy abundance?*, Post Carbon Institute

[33] Ibid

[34] Despite poor recovery rate, production continued at high rate in order to meet financial analysts' targets of production growth for share appreciation and to meet debt service. This process led to an overproduction of natural gas which resulted in prices lower than the cost of production. See Deborah Rogers (2013) *Shale and Wall Street: Was the decline in natural gas prices orchestrated?*, Energy Policy Forum

had grown by 18 and shale gas committed for export accounted for about 60% of current US consumption[35].

The economics of shale gas in Europe are further thrown into question because of the different geology and a more densely populated landmass in Europe than the US. Shale wells are smaller, deeper and have a high clay content that makes fracking more difficult[36]. This was one of the drivers behind Exxon Mobil Corporation abandoning shale drilling in Poland in 2012[37]. In a densely populated Europe, disruptions caused by shale gas developments will struggle to find public acceptance[38]. In the UK recent attempts to undertake shale gas drilling met with fierce local opposition[39]; in Bulgaria in 2012 a mass protest movement against shale gas led to a moratorium on exploration[40].

Some have argued that shale gas in Germany represents an opportunity to enhance energy security, increase competitiveness, and foster technology research and development[41]. This seems unlikely. As well as concerns about the economic viability of shale gas, there are growing social and environmental concerns associated with shale drilling and extraction and the environmental risks are not yet fully understood[42]. This is contributing to public scepticism.

3. Moving forward: delivering an affordable Energiewende

The key challenges to delivering the Energiewende are managing time constraints and ensuring manageable costs for businesses and for consumers. In 2012, Federal Minister of the Environment Peter Altmaier stated the Energiewende could cost up to €1 trillion by 2040[43]. The statistic is startling but it also fails to take into account the fossil fuel import

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[35] Ibid

[36] Paul Stvens (2012) *Shale and a Renewed Dash for Gas in the UK?,* Chatham House http://www.chathamhouse.org/media/comment/view/187991

[37] The Wall Street Journal (2012) *Exxon Ends Drilling for Poland Shale Gas*, http://online.wsj.com/article/SB10001424052702303836404577474532500852896.html

[38] Paul Stvens (2012) *Shale and a Renewed Dash for Gas in the UK?,* Chatham House http://www.chathamhouse.org/media/comment/view/187991

[39] BBC (2013) *Balcombe oil: Drill site fracking protests continue* http://www.bbc.co.uk/news/uk-england-sussex-23475958

[40] In June 2012 the Bulgarian Government had granted a permit to the US firm Chevron to prospect across 4,400 sq km around Novi Pazar. In January 2013 parliament withdraw the permit issued to Chevron, and also decided to ban exploration due to environmental concerns thus becoming the second state after France to ban shale gas exploration. See Mirel Bran (2013) *Bulgaria becomes second state to impose ban on shale-gas exploration*, The Guardian http://www.guardian.co.uk/world/2012/feb/14/bulgaria-bans-shale-gas-exploration

[41] Wirschaftswoche (2013) *Oettinger: Deutschland soll Fracking erproben* http://www.wiwo.de/politik/deutschland/schiefergas-foerderung-oettinger-deutschland-soll-fracking-erproben/8252290.html; BDI (2013) *Fracking - Stärkung für den Technologiestandort* http://www.bdi.eu/163_13067.htm; Reuters (2013) *Industrie für Prüfung von Schiefergas-Förderung in Deutschland* http://de.reuters.com/article/domesticNews/idDEBEE91101H20130202

[42] Richard Schiffman (2013) *What the frack do we know? Not much, it turns out*, grist Magazine http://grist.org/climate-energy/is-your-drinking-water-fracked-who-the-hell-knows/

[43] FAZ (2013) *Energiewende könnte bis zu einer Billion Euro kosten*, Frankfurter Allgemeine Zeitung http://www.faz.net/aktuell/wirtschaft/wirtschaftspolitik/energiepolitik/umweltminister-altmaier-energiewende-koennte-bis-zu-einer-billion-euro-kosten-12086525.html

savings the Energiewende could deliver for the German economy. In 2011, Germany spent €81.2 billion on fossil fuel imports, 20% more than in 2010 and 50% more than in 2000[44]. This is equivalent to 3.2% of German GDP[45]. Neither does it take into account the impact an increased role that energy efficiency could play in driving costs down below this headline figure.

Other newspaper headlines, such as 'Green electricity still not competitive by 2050' or 'Coal and gas power stations must stay', fail to critically question the assumptions behind future scenarios and add to confusion[46]. These numbers do not include the costs that Germany has to bear anyway in order to replace old coal and nuclear capacity, modernise and expand the existing grid, and import fossil fuels. Nor do they take into account falling technology costs. For example, the costs of photovoltaic technology fell 50% in the period 2008-2011, and average operational and maintenance contracts for onshore wind farms fell by nearly 40 percent during 2008-2012 due to tight competition and better turbine performance[47]. Given that the future is uncertain and policy and technology choices depend on political will, these estimates are not conducive to an honest, evidence-based debate.

3a. To deliver affordable electricity, demand side reforms are needed

Increasing the profile of energy efficiency would be a first step to tangibly reducing costs of the Energiewende. While the political focus in Germany continues to be on supply side solutions, opportunities to cut waste and manage electricity resources through focusing on demand side opportunities will continue to be lost. Yet despite the undoubted huge potential, energy efficiency continues to rank at the lower end of the spectrum of realised sustainable energy investment opportunities.

It is critical that the Energiewende process drives the best value for investments across the German energy system. Within the debate about the future of the power sector this should include a focused discussion on the role of demand side resources (including demand management, demand response and distributed generation – referred to as D3) in reducing costs. To date, demand management and response programs have been limited to a few of the largest industrial and commercial consumers, and distributed generation capacity remains far below its potential. By contrast, demand side resources play an active role in a

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[44] UFE (2012) *Jährliche Ausgaben Deutschlands für den Import fossiler Energieträger von 2000 bis 2011 und Prognosen bis 2050*, http://www.unendlich-viel-energie.de/uploads/media/Energieausgaben_Deutschland_aug12_linie.pdf

[45] Destatis (2012) *Bruttoinlandsprodukt 2011 für Deutschland*, Statistisches Bundesamt https://www.destatis.de/DE/PresseService/Presse/Pressekonferenzen/2012/BIP2011/Pressebroschuere_BIP2011.pdf?__blob=publicationFile

[46] DENA (2012) *Integration der erneuerbaren Energien in den deutsch-europäischen Strommarkt*, German Energy Agency, http://www.dena.de/fileadmin/user_upload/Presse/Meldungen/2012/Endbericht_Integration_EE.pdf; Die Welt (2012) *Ökostrom soll selbst 2050 noch nicht marktfähig sein,* http://www.welt.de/wirtschaft/energie/article108744622/Oekostrom-soll-selbst-2050-noch-nicht-marktfaehig-sein.html; Handelsblatt (2012) *Kohle- und Gaskraftwerke müssen bleiben,* http://www.handelsblatt.com/politik/deutschland/trotz-energiewende-kohle-und-gaskraftwerke-muessen-bleiben-/7041060.html

[47] Bloomberg New Energy Finance (2012) *Wind farm operation and maintenance costs plummet*, Press Release

number of US electricity markets, with proven results. D3 resources within the New England capacity market covering six states, for example, saved customers as much as USD $290 million per year[48].

In the UK, the Department of Energy and Climate Change (DECC) evaluation of demand response trials targeted at domestic consumers found clear benefits including savings on electricity bills of 7% to 10%. According to estimates from the UK energy regulator Ofgem, demand response could yield up to £11.9 billion in savings over the next decade including: £1.5 billion to £6.2 billion in avoided wholesale electricity costs; £1.3 billion to £5.4 billion in avoided capital costs for new generation; and £140 million to £280 million in avoided capital costs for networks. Embedding approximately one-quarter of UK peak demand on local grids through decentralised generation would deliver economic benefits of roughly £13 billion over the same period[49].

In Germany demand side management can play a similar role by enabling Germany to cost effectively meet its low carbon infrastructure challenge and to improving security of supply. For example, industrial processes in Baden-Württemberg and Bavaria could shift more than 1 GW of their electricity demand for a period between 30 minutes and 2 hours to a later time[50]. This flexibility, achieved through technology and control systems available today, avoids bottlenecks in the grid and reduces the need for new capacity and storage by effectively managing and reducing demand during critical peak times. Pilots of critical peak pricing tariffs in California have led to a drop in peak demand of 27% to 44%, avoiding the need for high cost back up generation.

The German government should therefore consider indicating an explicit preference for the exploitation of demand side opportunities. This should be in the form of a requirement to ensure fair and equivalent treatment between supply, infrastructure and demand services. With renewables likely to provide an increasing share of Germany's electricity requirements in future, balancing will be an increasingly important component of ensuring secure electricity supplies are delivered. Resources with highly flexible capabilities will be required, including demand response technologies that have the fast, long-sustaining, reversible and flexible ramping and load following characteristics[51].

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[48] Power Markets, Systems Benefits and Key Design Issues: Powerpoint presentation by Rich Cowart, Regulatory Assistance Project & Chris Neme, Energy Futures Group

[49] E3G (2011) Driving lower energy bills and security of supply. See http://www.e3g.org/library/search&keywords=Driving+lower+energy+bills+and+security+of+supply/

[50] Agora (2013) *Lastmanagement als Beitrag zur Deckung des Spitzenlastbedarfs in Süddeutschland,* Agora Energiewende

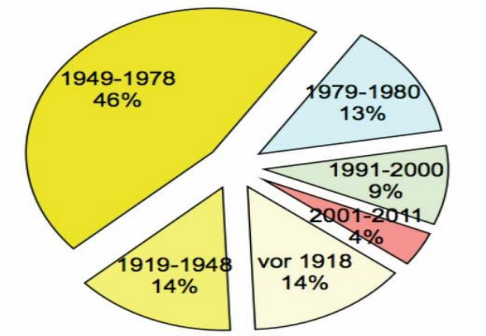
[51] RAP (2012) *Beyond Capacity Markets: Delivering Capability Resources to Europe's Decarbonised Power System*, Regulatory Assistance Project, http://www.raponline.org/featured-work/beyond-capacity-markets-delivering-capability-resources-to-europes-decarbonised-power and RAP (2012) *Making Germany's "Energiewende" (Energy Transition) a Reality,* Regulatory Assistance Project, http://www.raponline.org/featured-work/making-germanys-energiewende-energy-transition-a

3b. Beyond the Energiewende: protecting consumers

Some progress is being made with increasing the energy efficiency of buildings. Over the past 20 years, annual decreases of 1.5% in heating used per square metre have been achieved. The KfW House Programme is 'best in class' globally in terms of programmes aimed to driving uptake of energy efficiency measures in homes. To date it has led to the refurbishment of more than 3 million German homes between 2006 and 2013[52]. However, increasing in living space (up 27% between 1990 and 2011) has offset the gains made and reduced the energy saving impact of policies introduced to date. In addition, Germany currently has over 41 million homes, so the average rate of refurbishment achieved to date (around 430,000 homes per year) must be substantively increased[53].

One of the biggest challenges Germany faces – in common with other European countries – is how to increase the retrofitting of older properties. Currently around 46% of the existing German building stock was built before 1978 – and so before the first Heat Insulation Act in 1977, which set out for the first time a requirement to insulate buildings. It indicates that the majority of homes still need to be refurbished and that deep retrofits (that move beyond just low cost measures such as cavity wall and loft insulation) are required. In turn this will require a step-change in how energy efficiency refurbishments are delivered and uptake by households achieved.

Figure 10: Age classes of the building stock in %



Source: S. Bukold (2013)

A 2013 project undertaken by the German Energy Agency shows that deep retrofitting is possible: energy savings averaging 76% were achieved in the 63 residential properties included in the porject[54]. In addition, work is now underway – through the Finanzforum Energieeffizienz in Gebäuden (effin) initiative – to develop a series of mechanisms to help drive and finance greater uptake of energy efficiency measures in buildings. Ongoing workshops and conferences bring together key experts and decision-makers from strategic and product management, sales and marketing, as well as real estate and financial analysts with the aim of developing new ad hoc financial approaches that unlock business potential, stimulate energy efficiency investment and provide the capital needed. This process is due

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[52] KfW Interview

[53] Destatis (2013) *Zensus 2011 – Gebäude und Wohnungen in Deutschland*, Statistisches Bundesamt, https://www.destatis.de/DE/PresseService/Presse/Pressekonferenzen/2013/Zensus2011/gwz_zensus2011.pdf?__blob=publicationFile

[54] Energy use fell from 223 kWh to 54 kWh per square meter annually

to present conclusions on implementation and diffusion between mid and the end of 2014. Within that process three areas of discussion will have critical importance:

- Creating demand at scale in both the owner-occupied and rented sectors – the role of both financial incentives, innovative financing mechanisms such as on-bill financing and regulations should all be considered.
- Reducing transaction costs through streamlining the customer experience.
- Ensuring a scaled source of affordable finance is available to back loans that move beyond just public finance sources.

One of the often-cited reasons for not doing more to promote energy efficiency in buildings is that it is 'too expensive'. This highlights the gap between the strong social and economic rationale for undertaking refurbishments and the actual financial and other costs to consumers. It is they who must choose between energy efficiency upgrades and other calls on their income and savings - and who also bear other costs such as the personal cost of the time required to organise the financing and then delivery energy efficiency upgrades.

It also gives rise to the question: 'too expensive compared to what'? Taking a step back and looking at the broader societal benefits of energy efficiency in the context of other infrastructure investments that can be made - including power generation - energy efficiency starts to look relatively cheap. It is for this reason energy efficiency should be given a higher political priority. Greater thought must be given within the Energiewende debate to how a level playing field can be created to enable demand side and supply side measures to be part of the energy solution for Germany.

3c. The broader public policy rationale for doing more on energy efficiency

The positive social and economic impacts of energy efficiency are compelling. Each is briefly addressed here.

Links between energy efficiency and GDP - There are two main linkages between energy efficiency and GDP: increased investment and increased consumption. The implementation of energy efficiency improvements increases investment, which is a component of GDP. GDP is also generated by the impact of energy efficiency improvements on increased consumption − known as the rebound effect[55]. KfW analysis shows that energy efficiency

55 The rebound effect can be separated into direct, indirect and economy-wide effects. The direct rebound effect occurs if energy efficiency improvements lead to a reduction in the price of energy, which incentivises higher consumption of energy and therefore increases GDP. The indirect rebound effect occurs if the savings from lower energy bills, produced by energy efficiency improvements, is spent on non-energy goods and services that generate additional GDP but require additional energy to be produced. The economy-wide rebound effect occurs if energy efficiency improvements are made throughout the economy, improving productivity, reducing price levels and stimulating an increase in aggregate demand and therefore GDP. T. B. Barker and T. Foxon (2008) The Macroeconomic Rebound Effect and the UK Economy, UKERC Research Report, www.ukerc.ac.uk/support/tiki-download_file.php?fileId=157

investment could increase German GDP by 0.4% per annum by 2050[56]; the OECD calculates that the European Union's GDP is 0.7% higher in 2035 if the energy efficiency measures suggested by the International Energy Agency materialises in all sectors[57]. Empirical data show that UK's energy efficiency policies between 2000 and 2010 produced additional real annual GDP (i.e. annual GDP adjusted for inflation) that was 0.1% above that for a hypothetical reference scenario in which no energy efficiency policies had been implemented[58]. Studies show that 40% of the additional GDP was generated through investment while 60% resulted from the rebound effect[59]. It is important to note that the rebound effect will have an impact on the net carbon savings that result from energy efficiency improvements.

Employment creation - Energy efficiency improvements can be implemented wherever energy is consumed in the production process. This can include energy efficiency improvements to major infrastructure, residential and commercial buildings, equipment used in residential and corporate buildings, and transport required for logistical purposes. Installation of energy efficiency improvements tends to be implemented on a localised basis, by engineering, construction and installation companies. This provides substantial and diverse job creation potential[60].

The creation of a new energy efficiency improvement installation sector also offers a new source of tax revenue for governments including revenue from taxes on sales, wages and salaries, company profits, and indirect taxation such as value-added tax (VAT) on construction and installation services. In total, the 2011 KfW Energy Efficient Construction and Refurbishment programme produced €3 billion in benefits to public budgets. Estimates that include promoted investment and avoided expenditure on unemployment calculate benefits to public budgets in the amount of €10 billion[61]. In 2010, the Federal Government received €5 in tax revenue for every €1 of public funds spent on the KfW House Programme.

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56 KfW (2013) Die energieeffiziente Sanierung lohnt sich - Ein Gespräch mit KfW-Chefvolkswirt Zeuner und KfW-Direktor Kalischer, KfW Bankengruppe

57 OECD (2013) Economic impact of IEA Efficiency World Scenario, Organisation for Economic Co-operation and Development

58 T. B. Barker and T. Foxon (2008) The Macroeconomic Rebound Effect and the UK Economy, UKERC Research Report, www.ukerc.ac.uk/support/tiki-download_file.php?fileId=157. Cambridge Econometrics constructed a hypothetical reference scenario for the period 2000–2010 that excluded the impact of energy and carbon savings from the climate change agreements during this period but included the impact of the Climate Change Levy, Fuel Duty escalator to 1999, and the delivery of the 10% renewable electricity generation target by 2010. This reference scenario is similar to the baseline scenario used in the 2000 UK Climate Change Programme, the difference being that the impacts of the UK and EU Emissions Trading Schemes were included in the reference scenario.

59 Ibid

60 In some cases jobs related to implementing energy efficiency improvements are more labour intensive – i.e. less productive – than alternatives and this might reduce whole economy output. However, many jobs in this sector involve the deployment of innovative technologies – including high-tech industrial process technology; district heating and combined heat and power systems; smart meters and smart grid; advanced heat pumps; laser measurement technologies; and infrared technologies to asses thermal loss from buildings – that enhance productivity and so should be encouraged through investment in technological innovation.

61 KfW (2013) Impact on public budgets of the KfW promotional programmes „Energy-efficient construction", „Energy-efficient refurbishment" and „Energy-efficient infrastructure" in 2011, KfW Bankengruppe

The Programme achieved returns of 12.5% on investment, which enabled KfW Bankengruppe to offer 1% subsidies on their loan interest rates[62].

In 2011 investment in new construction and refurbishment activity worth €8.9 billion were induced (in the sense of having been directly initiated) through KfW funds, whereas investment promoted through the provision of KfW funds was markedly higher at €18.6 billion. Overall, 121,000 jobs (both direct and indirect) were generated by induced investment; 253,000 jobs were generated by promoted investment[63].

Improved living standards - Energy efficiency improvements, combined where needed with training and information on how to manage energy use can stabilise or even reduce household energy bills, resulting in an increase in disposable incomes. Higher disposable incomes are in turn associated with higher living standards, especially for those that are unable to warm their homes affordably.

In a world where resource scarcity and carbon prices will drive up energy costs, energy efficiency will offset rising prices that would otherwise exacerbate energy poverty. Without a focus on addressing energy poverty at its core − by improving the thermal performance of homes − increasing numbers of households will fall into energy poverty. This is turn will lead to a deterioration in health that will negatively impact the overall productivity of the labour force and therefore economic growth[64].

The final threat of rising energy poverty is that it raises state welfare costs because the Governments must provide financial transfers for vulnerable or energy poor groups. For example, in the UK €1.5 billion is spent each year on winter fuel payments to help the vulnerable and fuel poor meet their energy bills. In Germany, poor households receive a payment supplement to help with extra energy costs during extreme weather[65]. Until 2009, Hungary had similar government-funded programmes to assist the fuel-poor[66]. In Spain, the government subsidises electricity to ensure that it is affordable for consumers − however, this has resulted in the Spanish Government accumulating a €15 billion public debt, which is owed to Spanish energy companies[67]. It is more efficient to use this funding to tackle energy poverty at its core – through addressing the thermal performance of buildings – than to

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62 KfW (2011) KfW Programmes: Energy-efficient Construction and Refurbishment. Public budgets benefit up to fivefold from "promotional euros", KfW Bankengruppe, Press Release No. 092, http://www.kfw.de/kfw/en/KfW_Group/Press/Latest_News/ PressArchiv/PDF/2011/092_E_Juelich-Studie.pdf

63 KfW (2013) Impact on public budgets of the KfW promotional programmes „Energy-efficient construction", „Energy-efficient refurbishment" and „Energy-efficient infrastructure" in 2011, KfW Bankengruppe

64 M. Levine *et al.* (2007) *Residential and commercial buildings*, quoted in D. *Arena et al.* (2011:38) *Employment Impacts of a Large-Scale Deep Building Energy Retrofit Programme in Hungary*, http://3csep.ceu.hu/sites/default/files/field_attachment/ project/node-6234/employment-impactsof energyefficiencyretrofits.pdf

65 A. Power & M. Zulauf (2011) *Cutting Carbon Costs: Learning from Germany's Energy Saving Program*, The Brookings Institute

66 D. Arena *et al.* (2010) *Employment Impacts of a Large-Scale Deep Building Energy Retrofit Programme in Hungary,* Budapest: Central European University, http://3csep.ceu.hu/sites/default/ files/field_attachment/project/node-6234/employment-impactsofenergyefficiencyretrofits.pdf

67 S. Davies & I. Holmes (2011) *European Perspectives on the Challenges of Financing Low Carbon Investment: Spain*, http://www.e3g.org/docs/E3G_European_Perspectives_on_the_Challenges_of_Financing_Low_Carbon_Investment_Estonia.pdf

undertake financial transfer that will only ever be a temporary and increasingly ineffective 'fix'.

4. Concluding thoughts

The public discourse on the Energiewende has increasingly become a debate about how much we are prepared to pay for environmental outcomes: it pitches nuclear against coal. Yet there is another way to manage increased costs: through a focus on increasing the role of energy efficiency and other demand side options in the Energiewende. While energy efficiency and demand side solutions are cheaper that supply side solutions, they are not free. Greater government interventions are needed to drive this sector forward and enable it to play a meaningful role in reducing GHGs emissions, enabling an increase in the share of renewable electricity to at least 80%, cutting primary energy consumption and cutting electricity consumption.

Energy efficiency will be particularly important for keeping the German public onside with delivery of the Energiewende. In 2012, 93% of the public identified renewable energies as being important or extremely important for the delivery of the Energiewende and two-thirds said they are willing to pay more to make it happen[68]. However, one-third is sceptical at best around the value to the German economy of increased costs. A greater focus on energy efficiency is the only way to reconcile these two positions and ensure strong public support.

However, the debate must be broadened out from its current focus only on electricity to include heating as well. A proper strategic review is needed of the options available to Government. It will be critical that demand side options be viewed in the context of other infrastructure investments that can be made - and steps taken to enable demand side and supply side measures to be part of the energy solution for Germany. Only in this way can a fairer and more competitive society be delivered: one where affordable electricity and warm dry homes are available for all.

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[68] Germanwatch (2012) *Deutsche bereit, für Energiewende höhere Kosten zu schultern,* http://germanwatch.org/de/6224