

Original citation:

Kuzemko, Caroline, Mitchell, Catherine, Lockwood, Matthew and Hoggett, Richard. (2017) Policies, politics and demand side innovations : the untold story of Germany's energy transition. *Energy Research & Social Science*, 28 . pp. 58-67.

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Policies, Politics and Demand Side Innovations: the Untold Story of Germany's Energy Transition

By C. Kuzemko; C. Mitchell; M. Lockwood; R. Hoggett

1. Introduction

Many governments around the world have made specific commitments to sustainable energy transitions, often on the understanding that energy market decarbonisation is an essential element in meeting climate mitigation objectives. These new commitments have already resulted in a significant rise in governance strategies and policies designed ultimately to change how energy is produced and used. Many such policies have, however, been focused on the decarbonisation of energy *supply* whilst commitment to demand focused solutions has, arguably since the 1980s, taken a relative back seat (Warren 2014; Sorrell 2015). Certainly one of the greatest areas of change in how we produce and use energy thus far has been the marked development and deployment of renewable generation technologies. This is not to say that there has been no progress in demand side governance and innovations, but just to suggest that we remain some way off the kind of fundamental shift in the underlying design of energy systems, from the supply to the demand side, that some argue is required (ECC 2010; Warren 2014; DECC 2014; Rosenow et al 2016).

A fundamental shift to demand-focused markets is, of course, easier described than achieved in practice. This might not be too surprising if we consider that some demand innovations are relatively new, such as those associated with demand side response. At the same time demand innovations understood in the broadest sense, to explicitly include demand reduction, demand side response and distributed energy, have not been a high priority for energy policymakers. What this means, however, in academic and practical terms, is that much needs still to be learnt about demand governance. This paper is one contribution towards an improved understanding of demand governance, how it is developing in practice and how it inter-relates with market innovations.

As set out in Section 2, this task is approached through the lenses of recent scholarship on the politics and policy of energy system transitions, that sees governing for fundamental change as a highly political but also contingent process (Kern 2011; Andrews-Speed 2016; Fouquet 2016; Schmid et al 2016). There are three basic conceptual assumptions made. Firstly, that governance choices are important to the *nature* of any given sustainable energy transition, because they both enable and constrain technological, corporate and social innovations (Kuzemko et al 2016). Secondly, that demand governance does not take place within a vacuum and, as such, choices are contingent upon a range of other energy and political contexts (Andrews-Speed 2016; Lockwood et al 2016). Lastly, that profound, system-wide transitions involving multiple economic sectors and societal groups tend to take some time to complete (Fouquet 2016; Schmid et al 2016). Taken together what these assumptions amount to is an understanding that the politics of energy policymaking is unlikely to remain static given that systems, power relations and markets alter and change over time. In order, therefore, to understand how demand governance is developing in any given country analysis needs to not only encompass the broad range of demand strategies and policies in place, but also be sensitive to the precise ways in which political and market contexts may be changing over time.

This paper, in Section 3, focuses the analytical lens onto demand governance in one case study country, Germany, but across the three inter-related areas of demand innovations outlined above. The intention here is to analyse policies and strategies, how energy markets are changing as well as some of the implications of these changes for recent German energy

governance decisions and, indeed, for the *nature* of its transition. The analysis focuses on one country because of the level of detail that this will allow when building an understanding of demand governance, but also given assumptions here about the contingent nature of policy decision-making. Arguably, Germany makes for an interesting case study, partly because it is often held up as a leader in terms of sustainable energy governance (Mitchell et al 2006; Pahle & Steinbacher 2015; Schroeter et al 2016), and it will be interesting to see if, when refocusing the analytical lens onto demand governance, it still appears innovative. Secondly, Germany's energy markets have already changed quite substantially, indeed it is understood by some to already be in 'phase 2' of its sustainable energy transition (Kitzing & Mitchell 2015; Interview 9).ⁱ This means that Germany is further down the road than some countries, and that new policies and market changes have already had some clearly identifiable implications for how the politics of governing for demand innovations have progressed.

2. Theorising Demand Governance and Energy System Transition

Many demand strategies and policies date back to the late 1970s and early 1980s, when demand reduction was pursued by a number of countries in the aftermath of the oil shocks (Warren 2014; Sorrell 2015). Such policies were taken up on the basis of assumptions that reducing demand would result in lower dependence on energy imports, thereby contributing to the important energy governance objective of supply security. Times have, however, changed and although supply security remains important, energy policymakers are now devising policies that must respond to a broader and more complex range of objectives. At the same time energy markets are also changing quite rapidly.

Although many claim that demand innovations are central to delivering on the trilemma of energy objectives, relatively less is known about *how* to govern over time to best engender a broad array of demand innovations. Recent theorisations of governing for energy transitions have tended not to factor in the demand side in any great detail (Araújo 2014; Schaffer & Brun 2015; Andrews-Speed 2016; Schmid et al 2016; Kuzemko et al 2016). Energy demand focused analyses, on the other hand, have often been concerned with single categories, for example demand side response (Torriti et al 2014; Bayer 2015; Fell et al 2015), or demand reduction (Rosenow 2013; Mallaburn & Eyre 2014; Reid et al 2015; Sorrell 2015). These literatures arguably, therefore, tell us too little about complex processes of governing for multiple, but in some cases only emerging, demand innovations.

2.1 Extending Definitions of Demand Innovations

In this sub-section demand governance is broadly defined in order to take better account of the complexity and challenges faced in this fast emerging policy area. The need to understand this area better is based on arguments that a lasting move away from fossil fuel usage will be easier, less costly and less politically difficult if demand innovations are placed at the core of how markets operate (ECC 2010: 14-16). Inspiration is taken from recent non-academic research that has intentionally broadened out what is meant by demand innovations and their role within sustainable transitions (DECC 2014; Hinton & Thumim 2014; Rosenow et al 2016). In these reports demand side innovations are brought together under three, related categories: distributed energy, demand reduction and demand side response (DSR), sometimes referred to together as 'D3' (DECC 2014: 4; Hinton & Thumim 2014: 3).

From this literature we can see that each category has multiple roles to play within sustainable, secure and affordable energy systems. For example the *long-term* reduction of demand, including peak demand, is seen as especially relevant to the extent that this results in less expensive new generation and lower consumer costs (Warren 2014). Demand reduction and energy efficiency, together with active demand side response, can also ensure the most

efficient use of decarbonised generation capacity thereby also bringing down the overall costs of energy systems. Hence claims that reducing energy demand is the most promising, fastest, cheapest and safest means to mitigate climate change (Sorrell 2015: 74).

Distributed energy is defined as the production of heat or electrical power near the end of the distribution network, and other practices that can balance loads at a similarly local scale (Hinton & Thumin 2014: 3; DECC 2014: 4). It is argued that, wherever possible, using energy closer to where it is generated reduces the distance that electricity and heat need to travel across networks – thereby reducing system costs. Although distributed generation is a fast growing phenomenon in electricity markets in particular, as renewable technologies develop and are more widely diffused, this is by no means always matched by greater local consumption. Thinking about how to operationalise distributed energy brings to the fore difficult questions of how to localise practices that tend to have become centralised over time, such as markets, pricing and data availability (Goulden et al 2014). Another, less technical, claim about distributed energy it is more actively inclusive of consumers, who importantly are also citizens and voters. For example, German and Danish transitions have tended to include more community, household and municipal actor groups within renewable generation processes (Fuchs & Hinderer 2016; Schmid et al 2016). In this way some citizen groups become part of and invested in sustainable transitions, instead of a sustainable transition being something that is done to them.

Demand side response, including supporting consumers to undertake short-term shifting of load, also has a wide range of potential benefits. It can be used to lower peak demand, avoid investment in costly generation capacity, better enable local markets, and contribute to maintaining dynamic system stability (DECC 2014: 4; Koliou et al 2014: 245). Intelligent, ICT-based control of local networks can also make an important contribution, in particular in terms of balancing the increased quantities of distributed renewable generation being connected to distribution networks (Goulden et al 2014; Lockwood 2015). In the past market actors involved in demand response have tended to be large industrial companies, but there is now a growing political and market focus on the value that including medium and small sized consumers in demand response can offer and, hence, on demand aggregation (Torriti et al 2010).

Taken *as a whole*, therefore, embedding demand innovations from across each category can provide multiple social and technical functions within processes of sustainable energy system change. Indeed, some governance bodies have started to place particular emphasis on the need to not only govern simultaneously for the full range of innovations, but to also integrate policies across categories in order to achieve more demand-focused outcomes (DECC 2014: 5; IEA 2016).

2.2 Governance, Markets and Change

As mentioned in the introduction, governance is widely understood to be of central importance to how demand innovations emerge and become diffused, but arguably in a range of different ways. Economic historians and socio-technical transitions scholars have argued that governance can be important to *enabling* sustainable innovations (Markard et al 2012; Fouquet 2016). This can be achieved via different governance methods, for example by implementing sustainability objectives that set direction for market and political actors and/or devising policies and regulations that support niche technological innovations. Governance can, however, also constrain and delimit what kinds of changes are possible, for example if regulations act as barriers to entry to certain niche technologies.

Underpinning demand governance is an assumption that governance and markets dynamically inter-relate over time, or as some scholars put it, that there are both positive and negative feedback mechanisms between policies and markets (Lockwood et al 2016).

Feedback effects can arise from a range of different actor groups, including incumbent and new, more innovative energy actor groups (ibid: 11). At the same time, it is worth noting that although sustainable energy governance has emerged quite strongly over the past decade or so specific strategies, policies and regulations will themselves be open to contestation and change over time. The possibility of challenge and change to sustainable governance is important to bear in mind given that large-scale socio-technical transitions tend to take place across decades (Kitzing & Mitchell 2015; Fouquet 2016).

This means that there will be multiple *points in time* at which sustainable energy policies can be contested by new ideas about how to produce and use energy, and to what end. At each point policy decision-making can be informed by political factors, such as the nature of government in power at the time, but also by new debates about and reactions to energy policies (Hake et al 2015; Lauber & Jacobsson 2016). What is suggested here is that these debates will be informed in part by the experiences of those societal actor groups affected by how markets are changing (Lockwood 2014), including energy companies (Geels 2014). As such, the *precise ways* in which different sets of actor groups have been experiencing energy system change becomes highly relevant. For example, some companies who lose out as a result of transition have tended to put forward arguments to try to slow it down or to cast doubt upon sustainable energy narratives (Jacobsson & Lauber 2006; Geels 2014). At the same time, those whose interests are in the provision of sustainable, innovative products and services have argued for governance changes that, for example, place greater value on demand.

How different citizen groups, understood as voters, experience energy system change also has a bearing on the terms of political debate and on possible policy choices (Stefes 2010; Jacobs et al 2014; Schmid et al 2016). Citizens can experience transition via their role as consumers, for example when faced with higher energy prices, but also through changing employment opportunities, in the instance that new jobs become available in energy services and existing positions in fossil fuel companies disappear. However, as mentioned above, demand innovations can also offer some citizens a new set of opportunities to become active, or passive, participants in energy markets. Recent research shows that active citizen participation in all stages of development can improve the public acceptance of renewables, allowing for a more positive politics of distributed energy (Schmid et al 2016: 267). It is partly for these reasons that Stefes has argued that governance that successfully creates new markets, employment and other opportunities will tend to have self-reinforcing dynamics (2010).

What this conceptual approach suggests is not only that governance, market outcomes, how actor groups experience change and politics are inter-linked, and indeed co-constituted, but also that *how* they interact can be historically and contextually contingent (Lockwood et al 2016). These lenses have informed the methodological approach taken here, in particular the choice of studying one, single case study, as this is arguably more suited to eliciting more detailed, and contextually relevant information (Yin 2014: 13; Hennik et al 2011:10-11 and 17). This choice is also more suited to the objectives of this analysis, to extend understandings of the fast evolving but temporally contingent policy area of demand governance. In this way methodological decisions have been guided by the conceptual lenses applied and by the explanatory objectives of the research.

The analysis below is mixed methods as it draws on three principle sets of data: in-depth interviews, Federal energy policy and strategy documents, and recent expert and consultancy reports and surveys. In total 27 interviews were conducted during two research trips to Germany in 2014 and 2015, as well as over email and telephone.ⁱⁱ Federal government staff, government consultants and advisory groups, all policy experts in demand management, were interviewed in order to elicit information about: demand policies, how markets are

changing, newly emerging policy debates, and how these changes have been influencing governance choices. In order to gain further insights into how markets are changing, and how corporate groups are experiencing and responding to these changes, representatives from incumbent and challenger utilities were also interviewed.

All interviews took the form of extended face-to-face conversations and were loosely structured around a set of questions about demand policies, politics and how markets were changing. This less formal approach allowed for interviewees to offer their expertise unrestricted by too much pre-supposition on behalf of the interviewer. In addition, given the broad, complex and fast evolving nature of this policy area, this approach had the added advantage of allowing for the recording of information that may not have been anticipated. Analysis of Federal government energy strategy and policy documents took place both before the interviews, so that it was possible to enter into some detail during interviews, and after, as new policies emerged and to cross check information gleaned from interviews. Where necessary, particularly as policies changed, further clarification was sought from interviewees over email or telephone conversations and from consultancy and other expert sources.

3. Demand Governance in Germany

There is a considerable literature on German supply side sustainable energy governance, including studies that have sought to explain the socio-political contexts within which the *Energiewende* emerged (Jacobsson & Lauber 2006; Toke & Lauber 2007; Hake et al 2015; Lauber & Jacobsson 2016). We can glean much from these analyses about the quite unique contextual factors that helped to support and inform radical governance and market changes: the Chernobyl nuclear disaster; the Red-Green coalition government; the relative predominance of social market economy and re-municipalisation ideas; and the ability and willingness of Parliament to stand up to coalitions against sustainable energy change. What we also learn is that Germany is understood as having led the way in renewable policy, renewable energy growth, technological learning and innovation, and in unleashing new market entrants (Mitchell et al 2006; Schüppe 2014; Geels et al 2016; Schmid et al 2016; Lauber and Jacobsson 2016).

In this section the analytical lens is refocused onto the less researched demand side of Federal energy governance and markets. Each sub-section, on demand reduction, distributed energy and demand side response, sets out the most relevant policies and strategies, how markets are changing over time, and how related challenges emerge and influence new policy debates and decisions. What this section shows, in part, is that debates around consumer costs and decentralised energy systems have become pivotal to how energy policy debates are re-emerging. It also shows that there are multiple governance changes underway in response to what is being learnt about energy transitions and about demand innovations. All of this is important to altering the *manner in which* one of the highest profile sustainable energy transitions proceeds, and the role of demand innovations within it.

3.1 Demand Reduction: Governance and New Markets

What is particularly significant about German demand reduction governance is that it is rooted in comprehensive and aggressive medium and long-term demand targets, some of which are more ambitious, and longer term, than those set by the EU Energy Efficiency Directive. Specifically, *Energiewende* objectives are to reduce primary energy consumption by 20% by 2020 and 50% by 2050 - both compared to 2008 levels; and to reduce electricity consumption by 10% by 2020 and 25% by 2050 (BMUB 2013; Agora 2016). There are also policy sub-goals – for example of renovating existing building stock at a rate of 2% per annum and of an 80% reduction in primary energy consumption in the buildings sector by

2050 (BMUB 2013; Interviews 3 and 19). Indeed, the biggest share of potential CO₂ emissions reductions, 25-30 million tonnes, specified in Germany's Climate Action Plan 2014 is estimated to come from energy efficiency measures (Appunn 2014b).

In terms of policies and regulations in place, buildings efficiency policies have been extensively outlined elsewhere and so the intention here is not to re-describe them in detail (Schlomann & Eichhammer 2012; Rosenow 2013). What we can learn from this research, and was confirmed during interviews, is that the role of considerable KfW Banking Group grant and subsidised loan programmes has been a central tenet of buildings efficiency policy. One effect of this has been to make refurbishment loans more accessible and affordable and, see below, to facilitate greater investment (Rosenow 2013; Interviews 3, 17 and 19). Equally important to how buildings efficiency markets have developed has been the application of strict buildings standards, such as the Energy Conservation Ordinance (EnEV) (GBPN 2016). Regulatory standards have also been applied as incentives. One example is high efficiency mortgages whereby, if a building meets certain standards such as 'Passiv Haus', then the borrower can benefit from reduced interest rates on their loan (Interview 17).

What is also clear is that German energy demand has been falling. Indeed, according to the German Arbeitsgemeinschaft Energiebilanzen (AGEB), which monitors the Energiewende, primary energy consumption fell 9% between 2008 and 2014, whilst levels recorded in 2014 were the lowest since reunification in 1990 (BMW 2014b: 9). Demand for electricity has also been on a downward trend since 2007, falling by 4% between 2013 and 2014, while the economy grew by 1.4% (ibid). This, as well as recent figures on energy intensity, has led some to argue that Germany has managed to delink economic growth from energy demand growth (IEA 2014; Agora 2015d), and Germany also consistently tops international benchmarks on energy efficiency (Kallakuri et al 2016).

A far less widely discussed aspect of German energy efficiency governance is the degree to which efficiency policy is perceived as a way of creating new economic opportunities (BMW 2014a and 2014c). Policies aimed at promoting the manufacture of 'green' goods, such as energy efficiency technologies, and at training and re-skilling energy efficiency workforces are explicitly part of a wider green industrial policy (BMW 2014a: 2). This in practice marks a departure from the emphasis often placed on energy efficiency as offering opportunities to lower costs, for example in claims that energy efficiency measures save \$5.7 trillion in energy expenditure world wide (IEA 2015: foreword), and firmly onto economic growth and employment opportunities. New efficiency markets, which include the manufacture of efficiency products and the supply chains that support buildings refurbishment, are now well established in Germany. For example, German companies have large market shares in growing, worldwide efficiency markets, such as in condensing boiler technologies (BMW 2014c: 24). Indeed, in 2013 Germany had export volumes in the region of €3 billion for capital goods which help to protect the environment (BMW 2014a: 4).

There have also been some considerable market changes within construction industries. One claim is that strict buildings standards, such as the EnEV, and KfW loan schemes have led to high demand for renovations, for example \$17bn was invested in building energy efficiency markets in Germany in 2014 (IEA 2015: 75). This in turn means that, combined with skills training, a large percentage of the labour force employed in skilled crafts, or in the planning and consulting sector, are now involved in energy-efficient renovations (BMW 2014a: 30). Although much has already been made of new employment opportunities in renewable energy markets (Lauber & Jacobsson 2016: 148), employment in energy efficiency markets is now also in the many hundreds of thousands (IEA 2015: 81; Interview 2). In addition, Germany has one of the strongest energy service company (ESCO) markets in the world, partly due to the fact that there have been positive regulatory responses

to concerns raised by ESCOs that had previously experienced regulatory barriers to market entry (Bertoldi et al 2014: 79-81; Interview 3).

These market and employment opportunities are notable in that they have been an important part of how various corporate and social groups have been experiencing energy system change. There are some other market outcomes of energy efficiency policy that have had an influence on how people have experienced change. As discussed in more detail below, energy prices have been rising but it claimed that energy efficiency policies have gone some way to offset the overall impacts on consumers. For example, although prices per unit are high, overall energy costs per household are not, whilst welfare policies also help to shelter the most vulnerable (Thalman 2015; SDSN 2015). Indeed research shows that German homes are better insulated than those in many other countries (Praetorius et al 2009: 64), which means that an average German household in 2011 used less energy than households in the United States, Britain, France and Spain (Thalman 2015: 2). Efficiency has, therefore, made some contribution towards sheltering consumers from the worst effects of high prices thereby making the energy transition somewhat more palatable socially.

3.1.1 *Challenges, New Debates and Efficiency Strategies*

Despite these achievements a number of critical policy discourses have emerged, not least arguments that Germany will miss its 2020 primary energy demand reduction targets (Interviews 3, 4 and 17). Others focus more specifically on future electricity demand as there are estimates that it will rise, partly due to the electrification of transport implied in the 'Mobility Energiewende' that was announced in 2016 (Richardson 2016). Another critique is that the potential for heat savings still remains huge, given that approximately 85% of the energy consumed in buildings is now attributed to heating and hot water generation (BMWi 2014c: 23). Importantly, some commentators are also calling for primary energy demand reduction achievements, listed above, into question, or at least the degree to which these achievements can be attributable to policy. Some argue that improvements in industrial energy efficiency were not as good as superficial numbers suggest because of links between industry energy efficiency measurements and low capacity use during the 2008-10 economic crisis (Schlomann & Eichhammer 2013: 3). Others suggest that, temperature corrected, improvements in buildings efficiency are not so impressive given that temperatures have been rising (Rosenow 2013).

Taken together these debates and critiques have placed considerable pressure on policymakers. Indeed, by having ambitious demand reduction targets, German policymakers have left themselves directly open to challenge in the event that these are not met. There is something, no doubt, intentional here and interviewees noted that Energiewende targets directly drive changes to policy decision-making as missing them is not considered feasible for international reputational reasons (Steinbacher & Pahle 2015; Interviews 3, 5, 21 and 23). There are also domestic political considerations and here it is not insignificant that a wider range of commercial and other actor groups do now have an interest in seeing energy efficiency markets continue to flourish.

Certainly there has been direct governance response to criticism, including renewed assertions about energy efficiency innovations being a decisive factor in the success of the energy transition (BMWi 2014c: 2; BMWi 2014b: 4; BMWi 2016b), as well as new strategies and policies adopted with the specific aim of meeting Energiewende demand reduction targets. For example, in 2014 the new 'National Action Plan on Energy Efficiency' (NAPE) was enacted as part of the Climate Action Plan 2020 (SDSN 2015). Within NAPE there is an emphasis on near term incentives and establishing energy efficiency as a business sector that can thrive without the need for financial support (BMWi 2014b; Interview 3). NAPE marks some departure, however, from previous efficiency strategies in that it placed particular

emphasis on the new market-based tender system for medium-scale efficiency projects and on supplying information and advice (BMWi 2014b: 4).

Before long, however, NAPE was also facing criticism – namely that it was too focused on information campaigns, with not enough financial stimulus and too small a role for KfW grants and loans (SDSN 2015: 55), although funding available through energy efficiency programmes remains a relatively generous \$2bn per annum (IEA 2015: 129). There are further claims that progress in terms of turning NAPE measures into reality has been slow, and it is clear that some projects have not been passed or have been delayed (Amelang 2015: 2; Interview 5). Others claim that improvements in reality still lag behind high expectations, which in turn are fostered by strict targets (SDSN 2015: 56).

These debates have informed yet more discussion amongst policymakers and their advisors, most significantly the BMWi's Green Paper on Energy Efficiency published in October 2016 (BMWi 2016e). In this discussion document the principle of 'Efficiency First', which prioritises investments in customer-side efficiency resources, is accepted as a strategic planning principle (ibid: 14-15). In this government document the argument that strategic planning should be focused onto the demand, rather than supply side, of energy markets is rigorously emphasised. There have also been recent policy changes, specifically in the form of the 'Effizienzoffensive', the second large-scale efficiency strategy in less than a year and a half. Details of the strategy are, at the time of writing, still unclear but sources say that there will be generous stimulus, specifically that €17bn will be invested from 2016 to 2020 as part of the strategy (BMWi 2016b). Four new programmes will be launched, including an initiative to promote new, cross cutting technologies that enhance the efficiency of energy output or its use. This marks large-scale, planned investment in energy efficient technologies over the next five years. The new strategy also includes a comprehensive public awareness campaign, 'Deutschland Macht's Effizient', designed to contribute to a consciousness shift in German society toward energy demand efficiency but also to encourage the individualisation of responsibility (ibid). In this way the 'Effizienzoffensive' is consistent with green industrial policies, by directing more investment into supporting the manufacturing, use and export of efficiency technologies, but also with NAPE's focus on advice and information.

3.2 Distributed Energy: Governance, Citizen Energy and Local Markets

Germany stands out as a country where policymakers historically intended that the energy system become decentralised and recent pronouncements re-enforce that claim. According to the BMWi a decentralised energy system can lead to: efficient use of electricity and heat production; significantly lower transmission losses; energy security; job security and the regional accumulation of value (BMWi 2014: 20). This section argues, however, that German governance focus and market changes to date have been on distributed generation such that localised production *and* consumption, that could deliver the kinds of advantages outlined in section 2 above, remain on the fringes in Germany today.

It has been widely claimed that the 2000 energy policy, the Erneuerbare Energien Gesetz (EEG), provided the foundation necessary to promote a broad uptake of renewable technologies (Pescia et al 2015; Lauber & Jacobsson 2016). This is partly because EEG policies, such as priority access for renewable generation to the grid and the guaranteed return over a fixed time frame, enabled very low risk market conditions (Mitchell et al 2006). These conditions have been an important factor in making the cost of capital for renewables in Germany the lowest in Europe (Noothout et al 2016), and making renewable generation more accessible to a broader range of actors (Burger & Weinmann 2014: 49). Other governance decisions have been influential over how generation markets have changed. For example decisions that the KfW bank group should continue to focus on sustainability and that loans should be discounted have, in practice, provided affordable and accessible financial support

for new, small and medium sized sustainable market players (Fuchs 2014: 46). These decisions were no accident but reflected ideas behind policy design, for example about the need to create a reliable mass market in order to allow manufacturers of renewables to achieve economies of scale and reduce costs (Mike Ahearn, Chairman of First Solar in Mendonça et al 2010: xiv).

By 2012 citizens, classed as individual households, minority stakeholders and cooperatives, had taken advantage of low risk investment conditions in that they owned 47% of renewable generation capacity (Borchert 2015; Interview 21). It has arguably been important for how political debates about energy have developed that benefits of system change have accrued to these citizen groups. This is not just in terms of citizens making money from generating renewables, but also because of the policy, as in energy efficiency, of creating new markets and jobs (Interviews 3, 4, and 5). Growing economic opportunities and employment in renewable generation markets has, indeed, resulted in more organised renewable industry associations. These and other interest groups together form a considerable renewable lobby in Germany, which some claim has contributed to too much governance emphasis on generation over demand innovations (Interviews 1 and 3). However, recent analysis suggests that broadening out citizen involvement has also been positive as more widespread exposure to energy leads to greater desire to become involved and to increased acceptance of localised renewable generation (Jacobs et al 2014; Borchert 2015; Kalkbrenner & Roosen 2016). It should, however, be pointed out that there are also political issues here around the uneven distribution of benefits. Notably, although the benefits of Germany's energy system transition have been quite widely distributed, middle classes and farmers are over-represented in citizen ownership of renewables (Bardt & Niehues 2012: 250).

As such governance here, and the thinking behind it, has been more about distributed generation, the diffusion of generation technologies, and citizen buy-in to the *Energiewende*, and relatively less about creating fully distributed energy systems per se. Arguments are emerging about the need to localise energy markets as one route towards more use of energy close to where it is produced, as well as towards more community economic development (Klagge & Brocke 2012). These remain, however, more marginal to policy debates. Indeed, at the Federal level, in contrast to energy efficiency governance, there is no outright strategy or target in place. Policy emphasis has largely been on support for RD&D projects that, for example, work to establish energy 'internets' that can intelligently control and regulate local electricity systems (BMW 2016b). Some RD&D funds were invested in 6 'E-Energy' projects, including the Model City Mannheim (MoMa) project where the new IT system integrated electricity from renewables and CHP into local grids and market. Many policies aimed at localising energy, however, tend to be at the Land governance level where some municipalities have been taking back contracts to run generation and distribution assets (Hall et al 2016; Interview 3). And there is some expectation that growing re-municipalisation may provide useful building blocks for altering the scale at which markets operate (Hockenos 2013).

There is one Federal level policy, however, that has had some indirectly positive implications in enabling local energy. The Direct Marketing law, made compulsory as part of EEG 2.0, frees up generators of renewables from selling through the central EEG system, thereby allowing them to sell electricity directly to suppliers and/or on exchange (Julian 2014: 15; Interview 19). A number of the innovative suppliers are now entering this newly opened up market, including Grundgrün, with its new 'regional business model', as well Lichtblick, with its *SchwarmEnergie* virtual power plant concept. One interviewee noted that the BMW was preparing, in July 2016, to enable guarantees of origin (GOs) for EEG power plants on a *regional* basis, which would enable those interested to create regional offerings based on the GOs (Interview 25).

3.2.1 *Challenges and Debates: Distribution, Cost Efficiency and Recentralisation?*

Although Germany has its fair share of innovative companies offering new distributed energy services, there are many, including a number of experts interviewed, who claim that there are Federal governance obstacles here (Interviews 2, 3, 5, 6, 19, 21, 25 and 26). For example, the BMWi's report on the 6 E-Energy projects observed that although technologies have advanced market rules, especially around prequalification for balancing markets, need to be changed to better enable the emergence of local markets (BMWi 2014d: 28). As a result there are calls for a comprehensive market framework to govern local balancing markets, as well as growing interest in locational marginal pricing and balancing (Julian 2014: 15).

Another critical issue emerging in policy debates is the distribution grid, or more specifically distribution network operators (DNOs) and how they are regulated. This is a highly fragmented market in Germany and some DNOs have worked harder to, for example, integrate renewables than others. There are many that consider them, as an overall market segment, to have done as much to hinder distributed energy than to enable it (Interviews 19, 25 and 26). This, it is claimed, is a governance problem in that DNOs have not yet been sufficiently motivated through regulation, nor have many had sufficient expertise, to change and become 'smarter' or, indeed, more transparent (Clausen & Jahn 2015: 37).

There is considerable awareness of these debates within policymaking circles. The Federal network regulator, Bundesnetzagentur (BNetzA), has already identified an 'intelligence gap' in networks but considers that closing this gap will be a major challenge for DNOs (BNetzA 2011: 2). In November 2015 the Federal Cabinet adopted draft smart grid legislation, the Digitalisierungs Gesetz, which sets out plans on how to develop smart grids and a programme for adopting smart meters from 2017 onwards (BMWi 2015a). The draft Act also includes technical preconditions and data protection rules for the electricity sector to become digitised. There have also, however, been very long standing discussions over important new regulations to incentivise DNOs to emphasise smart grid improvements over capacity growth which, at the time of writing, had still not yet been concluded (BMWi 2015b: 15; Interviews 24 and 26).

As suggested above, some arguments have been put forward that there are governance obstacles to the emergence of local markets, but energy policy debates about rising energy costs have also had implications for distributed generation (Lauber & Jacobsson 2016: 148). Surveys show that German electricity prices have been consistently amongst the highest in Europe (Schüppe 2014), not least because the costs of EEG surcharges has risen most years since its inception due to high uptake (Pescia & Graichen 2015: 6). Indeed, annual EEG surcharge costs, at €23bn in 2014, are expected to continue to rise until 2023, whilst network costs are also on the rise (Pescia et al 2015: 6). The argument, see section 3.1 above, that the impact of these costs has been somewhat offset by energy efficiency measures does not always have the same degree of political traction.

What is also significant is that policy and system costs are not evenly distributed amongst consumers, in fact recent research points to a regressive and socially unbalanced distribution of costs amongst consumer groups (Bardt & Niehues 2012: 250). Surcharges, system costs and taxes now make up 70% of some customers' bills, such that sharp falls in electricity wholesale prices have made little difference to some household and small and medium sized enterprise (SMEs) consumers. The situation for these particular groups has been exacerbated by the policy of exempting 'self-consumers' and heavy energy users from various payments. At the same time, the number of exempted consumers has been growing steadily such that, by 2014, 10% of all customers were exempt from, or paid heavily reduced, surcharges, taxes and grid fees (Appunn 2014a; Interviews 3, 14 and 20). These exemptions, in turn, represent costs shifted to SME, household and non-exempted commercial users.

Indeed, in the first half of 2014, a heavy industrial user with maximum exemptions paid 4.14-4.64 cts€/kWh, whilst an average SME paid 15.56 cts€/kWh (Thalman 2015). These inequalities are exacerbated by the fact that renewable electricity is being sold in increasing amounts, at wholesale prices, across borders whilst the system and surcharge costs are picked up by German consumer groups (Interview 18; Morris 2016b).

Many businesses not exempt from surcharges, some of which are represented by the powerful Bundesverbandt der Deutschen Industrie (BDI), have entered strongly into energy cost debates (Interview 20). The European Commission opened an in-depth enquiry into compliance with EU state aid rules that centred on EEG exemptions, which has added extra pressure on the government to address subsidy cost issues (Lang & Lang 2015). In addition, cost distribution and energy price issues have found a degree of public purchase and this is important because of fears that if this aspect of the Energiewende is seen as being overtly unfair then the whole transition might be called into question (Bardt & Niehues 2012: 250). It is important here, however, to differentiate between consumer groups, even within consumer categories such as households. For example, some consumers are prepared to pay higher per unit prices in order to remain customers of municipal suppliers on the basis that profits are reinvested in local services (Interviews 19 and 21).

The political and policy debates about cost inequalities are, however, important within the context of recent surveys. These show that although 90% of those surveyed support Energiewende targets, only 45% think that the Energiewende is properly managed (Pescia et al 2015: 10). Targets themselves, therefore, seem not to be open to question within current debates but the *means of achieving them* increasingly are. It is also not insignificant that cost focused debates coincided with the return to power, in 2009, of a Conservative-Liberal coalition more ideologically predisposed to focusing on short-term economic costs and less likely to take into account arguments about external costs of electricity generation and use (Lauber & Jacobsson 2016: 148).

In 2014 it came as little surprise, therefore, when the Federal government responded to cost, and other, concerns by making significant changes to the EEG, referred to as EEG 2.0. EEG 2.0 stipulates that energy intensive industry and *new* self-consumers, over a certain size, must start to pay a proportion of grid fees, surcharges and taxes (Interviews 2, 3, 5, 6 and 19), albeit exemptions for heavy users remain significant. New rules also seek to slow down and/or regulate the rate of growth of renewables, in particular PV and onshore wind, by setting annual capacity corridors (Pescia et al 2015: 14). Most significantly the EEG 3.0, which was announced in June 2016, set out new auction rules that will, as of January 2017, apply to medium and large-scale renewable generation (Morris 2016b; Appunn 2016).ⁱⁱⁱ New PV generation below 750 kW in capacity will remain in the EEG system. At auction, bidders will have to put up a security deposit in order to show that their bid is serious. For onshore wind generators there will be another prerequisite: bidders will have to get their projects approved under the Federal Immission Control Act which is expected to be a costly process (Appun 2016).

One expectation is that the shift to auctions will reward incumbents and other large-scale corporations over those that are less professionalised, such as community energy groups (Jacobs et al 2014: 10; Lauber & Jacobsson 2016: 154; Interview 19). Overall EEG 2.0 and 3.0 changes are expected to reduce the security of investment for citizen groups thereby exposing them to greater revenue uncertainty, with potential implications for the cost of capital (Tisdale et al 2014; 2; Borchert 2015: 1). With regard to onshore wind, in particular, there is also a concern that planning permission will become more of an issue (Interview 19). Since these reforms there have been some shifts in PV markets. In 2014 total PV additions, at 1.9GW, came in below the bottom of the capacity corridor, partly because small scale PV, in particular, has been impacted by the partial removal of self-consumption exemptions (ibid).

Perhaps more significantly, another study has found that, when measured in terawatt hours, citizen ownership of renewable generation had fallen to only 25% in 2015 from 47% in 2012 (Morris 2016a).

There have been other governance and market changes that have potentially negative implications for the *distributed* nature of Germany's energy transition. One has to do with the growing focus on offshore wind generation, which some argue can be seen as an attempt to get the 'Big 4' utility companies more involved in the Energiewende (Interviews 3, 4, 5 and 10). Whatever the motivations, the new EEG rules are more favourable towards large-scale offshore wind and the rate of growth here has been considerable. As citizen ownership of renewable TWh's falls so has ownership by the energy industry gone up, to 40%, mainly as a result of the boom in offshore wind (Morris 2016a). New capacity targets for offshore wind, at 15 GW by 2030, are also seen as generous whilst the upper limit of the corridor for onshore wind, the lowest cost renewable choice, has been reduced to 2.8 GW per annum (ibid). Higher proportions of offshore wind also have higher system cost implications in terms of system reliability, 're-dispatch' costs, and because of the need to build out large-scale transmission to bring electricity onshore (Schlandt 2014; Interview 26). There is also a, some say associated, upward trend in distribution losses due to the changing locations of generation in relation to centres of demand - the opposite of what localising generation and consumption achieves (Interviews 3 and 19).

These policy changes, and their effects on markets, raise high-level questions about the nature of the Energiewende. Germany's current Energy Minister has claimed that the "...future energy system will be highly decentralised... millions of generators will be linked to customers via smart systems" (Baake 2014), whilst markets have moved in the opposite direction over the past few years. One important addition to this debate might be to consider whether and/or how value can be placed on having a distributed system (Interview 19).

3.3 Demand Side Response (DSR): Governance and (Lack of) Market Change

German electricity markets have been significantly altered by the growth of renewables – not least in terms of falling wholesale prices and increased intermittency. Until quite recently renewables had been quite well integrated into the German electricity system, partly because there had been overcapacity on the grid, but this is no longer the case placing greater emphasis on the need for flexibility of demand (Baake 2014; Interviews 4, 5, 17, 19 and 26). However, with a couple of notable exceptions (Jacobs et al 2014; Bayer 2015), DSR is the least well-analysed category of D3, perhaps reflecting the fact that governance in this area is comparatively less well developed. Indeed, what this sub-section tells us is that Germany lacks a joined-up strategy to enable greater load aggregation and response, whilst SME and consumer demand response remains largely untapped (BMWi 2014a: 24). Indeed, one estimate is that whilst in 2013 only about 2 to 3% of demand was flexible, over 50% of demand could in practice respond to supply (Agora 2013: 27).

In terms of storage Germany does have a reasonably well-developed track record of policy support (Interviews 14 and 17). Current policies focus on R&D into long-term, large-scale storage systems and on funding programmes to assist in the uptake of battery systems with solar PV (BMWi 2016c). The market for home batteries has, indeed, been expanding quite rapidly, costs have been falling, and there are some innovative companies, such as Lichtblick and Tesla, operating in this space (Interview 14). There are, however, some fears that EEG 2.0 reductions in self-consumption exemptions will make the overall package for 'PV plus battery' less attractive (Interview 19). With regard to large-scale storage the official Federal line at the moment is that it will not be needed in any widespread sense until 2035, or when renewables have reached 60% of gross electricity consumption (BMWi 2015e: 45; Deutsch & Graichen 2015: 1).

Smart meters are also not seen as a central flexibility platform in the short-to medium term. Although policy here has been a long time coming, and there is still some lack of detail regarding smart meter rules, a decision has been made to roll out a differentiated but compulsory smart meter installation programme (Bayer 2015: 35). Smart meter policymaking is made more complicated by consumer protection regulation, especially regarding data handling, which makes smart meters more expensive to install and too expensive to mandate a roll-out to all consumers (Interviews 1, 19 and 26; BMWi 2015b: 71). This potentially excludes a wide proportion of the population from compulsory access to smart meters – with implications for aggregators of small to medium size loads.

Given market integration needs there has, as mentioned above, been some considerable policy refocus onto demand side response and flexibility. Although there is no comprehensive strategy in place for encouraging demand response, there have been some ad hoc market rule changes made, for example the introduction of quarter hour products on the intra-day market (since 2011) (BMWi 2014a: 21). This change, from the previous one-hour unit, was designed to boost competition, improve routes to market for, and integration of, renewables, as well as allowing balancing responsible parties to adhere more closely to their schedules (ibid: 21).

The main markets where demand response can participate, however, are the reserve markets run by the four German transmission system operators (TSOs) (Bayer 2015: 58). Most of those involved in demand response on these markets remain large industrial companies, conventional power plants, and pumped storage plants (Jacobs et al 2014: 31). Arguments have emerged, however, that reserve market pre-qualification rules are overly strict, implying high up front costs (Koliou 2014: 250), and that rules governing terms for pre-qualification, size and availability are more suitable to flexible generation than demand (Bayer 2015: 58). Here too some regulatory changes have been made, which include lowering the minimum bid size and shortening tendering periods for primary and secondary balancing capacity (BMWi 2014a: 22). According to some analysts, though, rules remain too strict and this is continuing to put industrial demand response off participating (Agora 2013: 28; Koliou et al 2014: 250).

3.3.2 New Challenges and Debates

There are, however, more particular debates emerging with regard to the need to better involve small and medium size consumers in demand side response activities, in order to best optimise the system at lowest long-term cost (Agora 2013: 22). Here intermediary aggregators, and the market rules and incentives that effect their entry into and expansion within markets, are important. There are some very innovative companies already active in load aggregation and operating virtual (IT based) power plants in Germany, for example Grundgrün, Next Kraftwerke and Lichtblick (Koliou et al 2014; Schüppe 2014). Overall, however, aggregation of small and medium sized loads is seen to be just ‘at the door’ but not yet fully participating in markets (Interview 19). This is partly because here too business models, technology and IT developments appear to have outpaced governance innovations. As such these companies have been in conversation with policymakers, arguing that the regulatory landscape is too unclear and that it provides barriers to entry. In addition they argue that not enough value is placed on flexibility and aggregation in demand markets (Interviews 16 and 18), and no capacity market is planned.

One critical focus in these debates is on the absence of legal structures to define the rights and obligations of aggregators, or even a simple definition of an aggregator (BNetzA 2015: 4; BMWi 2015b: 68). The concern is that without legal definition aggregators must depend upon the available, recognised market roles of ‘balancing group partner’ (BRP) and/or ‘supplier’, and most end up registering as suppliers. This creates an unnecessary barrier to

market entry by placing demand aggregators in a position of either being in direct competition with incumbent suppliers or being required to negotiate balancing exposure remedies with them (BNetzA 2015: 14; Hogan & Weston 2014: 25; Interview 25). Furthermore, within the context of current unbundling rules, each market participant has a separate role and aggregators must make separate arrangements with each of them. As such, aggregators require individual contracts with balancing group managers; electricity traders; TSOs and DNOs, whilst there are still no standard rules or clear contractual obligations (Jacobs et al 2014: 35). In addition, important questions have also yet to be resolved regarding the legal role of consumers that provides demand response through an aggregator (Koliou et al 2014: 251).

Calls have therefore emerged for the establishment of ‘aggregator’ as an independent market role with its own rights and obligations, with the Swiss and French models having been presented as example solutions (BNetzA 2015: 16). These models provide legal status for aggregators but they also replace the requirement for a bilateral agreement with a fixed, standardised procedure that indemnifies the supplier and/or BRP (BNetzA 2015: 16). There has also been some discussion about whether German aggregators should be able to act as a BRP for reserve markets only, without having to become a BRP for wholesale markets as well (Interview 19). Others have argued for a separating out of the roles of electricity supplier and BRP on the basis that demand aggregation is a separate service provided to customers at their discretion (Hogan & Weston 2014: 25).

What is important to note here is that progress in terms of demand flexibility governance remains incremental, or in other words the German Federal government is not currently contemplating the kind of radical restructure of markets that, for example, is being planned in the New York Review of electricity markets (Mitchell 2015). There has indeed been some reluctance to produce new legislation. In response to aggregators’ concerns the BNetzA produced a position paper in 2015 which stated that, when it comes to the integration of new roles such as aggregator, competition must be protected and the interests of other market participants taken into consideration (BNetzA 2015: 16). The report concluded that ‘special treatment’ for aggregators did not seem justified.

Beyond the regulator’s response there is some recognition of the issues, in particular within the BMWi’s electricity market review process of 2014-15. The ‘Energy-only-Market 2.0’ white paper makes reference to aggregators’ concerns but solutions continue to be ad hoc and there remains a lack of any comprehensive set of new market rules. The BMWi does commit to clarifying rules for the aggregation of flexible electricity consumers (BMWi 2015b: 55), to evaluating the “rights and obligations of aggregators in the electricity markets”, and, to this end, to entering into dialogue with the relevant stakeholders along with the BNetzA (ibid: 68). As a first step, it is suggested that access for aggregators to the balancing energy markets is to be simplified and aggregators’ rights to access balancing groups will also be extended to minute and secondary balancing markets.

4. Observations and Conclusions

By taking an explicitly broad approach to defining demand innovations, and by focusing on what is happening in one country, this paper has managed to delve into some degree of detail about demand governance in practice. It is arguably by doing so across all D3 categories that the complexity of demand governance and dynamic interactions with changes in markets; political debates; and with other policy areas can be revealed. For example, the case of Germany suggests that ambitious, high profile demand objectives do more than just set direction for market actors, they can also act as a statement of intent that guides policymaking processes. German demand reduction governance also shows us that ambitious objectives both reflect domestic attitudes, whilst at the same time driving the high expectations that

underpin critique of government if it appears that they might be missed. However, what we also learn is that, in practice, even with a relatively high degree of political commitment the complexities involved in achieving demand reduction are considerable. This is partly because demand reduction policy has been contingent upon other governance areas, including buildings, industry and transport as decisions taken in each area have had implications for the others.

By extending the analysis to demand side response and distributed energy it has been possible to reveal yet more complexity but also some lack of governance innovation, and indeed regulations lagging behind market innovations. There is also some disconnect between not having a comprehensive strategy for distributed energy whilst, at the same time, claiming a ‘distributed energy future’. Indeed, recent energy governance and market changes appear to be re-orienting Germany’s energy system away from decentralisation, thereby also revealing the degree to which demand and renewable energy governance are inter-related. Analysis of demand side response governance reveals a similar lack of a comprehensive framework and the difficulties of placing a value on demand services in markets whilst applying only ad hoc changes to existing market structures. Taken together German demand governance has had multiple effects: enabled some demand innovations (efficiency markets), constrained others (demand side response), whilst at the same time influencing the near-term *nature* of the German transition process.

By analysing all three categories it has also been possible to reveal a lack of the kind of integration between demand policy areas that some transitions and energy policy analysts suggest is needed (IEA 2016). This is, perhaps, ironic given the observation above that Germany has, to some extent, already managed to integrate demand with policy areas outside energy. The BMWi’s 2015 white paper, however, does reveal some recognition of the need to better integrate demand governance in the claim that policymakers are considering greater coordination between incentives for efficiency and flexibility, as well as between efficiency and power market design (BMWi 2015: 88). This, however, falls short of the quite comprehensive overhauls of market rules currently planned and/or discussed in parts of the USA and Australia (Araújo & Bade 2016; ENA 2016; Mitchell 2016), whilst it appears that Swiss and French rules are more supportive of new aggregation business models and services. As such, although Germany has clearly achieved a great deal in energy efficiency terms demand governance, taken as a whole, is not yet particularly innovative. Those that emphasise the importance of involving citizens within energy markets (see ENA 2016), will be particularly disappointed by apparent moves away from citizen energy.

In conceptual terms, this analysis confirms that the ways in which citizens and corporate actor groups experience change is central to how policy debates are informed and to possibilities for governance change. Again, it has been important to be specific about actual challenges, debates and policy changes and to differentiate between actor groups. Some corporate actor groups, especially those frustrated by the lack of recognition for demand value, have been able to bring their learning and experiences to bear to help highlight failings in existing governance. At the same time, however, domestic debates about rising prices, and a government more sympathetic to near-term cost issues, led to the pull-back of support for distributed renewables. Governance, ultimately, has always needed to balance arguments about sustainable policy innovations with the interests of coalitions more interested in continuity but in Germany, on balance, this analysis shows that there has recently been a slight preference for market continuity. This tends to reinforce the notion that governance and politics, like transitions, are not static but dynamic making temporal considerations highly relevant (see Fouquet 2016). These observations tend also to reinforce arguments that governing for sustainable innovations needs to actively consider how to bring as much of society along with it as possible (Stefes 2010; Stirling 2014).

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Interviews

1. Academic and Government Advisor, June 2014 and September 2015
2. Academic and Government Advisor, June 2014
3. Academic and Government Advisor, June 2014, July and September 2015
4. Academic, June 2014 and July 2015
5. Academic and Government Advisor, June 2014 and July 2015
6. Academic and Government Advisor, June 2014
7. Academic, June 2014
8. Academic, June 2014
9. Energy sector consultant and government advisor, June 2014
10. Energy sector consultant, June 2014
11. Academic and Government Advisor, June 2014
12. Academic and Government Advisor, June 2014
13. Energy sector consultant, June 2014
14. Academic and Government Advisor, June 2014 and July 2015
15. Senior executive at Big 4 energy company, July 2015
16. Executive at Big 4 energy company, July 2015
17. Energy sector consultant and government advisor, July 2015
18. Senior executive at Big 4 energy company, July 2015

19. Consultant, Advisor and ex-independent company executive, July 2015 and September 2015
20. Senior executive at the Bundesverband der Deutschen Industrie (BDI), July 2015
21. Senior executive at ESCO, July 2015
22. Executive at Bundesnetzagentur, September 2015
23. Senior civil servant at BMWi, September 2015
24. Senior executive at Big 4 energy company, September 2015
25. Senior executive at innovative supply company/aggregator, September 2015
26. Energy sector consultant, September 2015
27. Energy sector consultant, June 2014

ⁱ 'Phase 2' is used here in the sense that some scholars and policy analysts understand energy transitions as going through a number of phases (between 3 and 5 depending on the analysis). Not many countries are considered to have already emerged out of 'Phase 1' yet, but Germany is one of those countries (Kitzing & Mitchell 2015).

ⁱⁱ Interviews are listed at the end of the bibliography according to numbers – i.e. interview 1, 2, 3 and so on. Some information about the identity of each interviewee is also listed, according to professional function.

ⁱⁱⁱ It is worth noting that EEG 3.0 has yet (at the time of writing in August 2016) to be approved by the Bundestag and the Bundesrat .