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The politics and economics of constructing, contesting and restricting socio-political space for renewables – The German Renewable Energy Act

Volkmar Lauber[a,*], Staffan Jacobsson[b]

[a] *Department of Political Science and Sociology, University of Salzburg, Rudolfskai 42, 5020 Salzburg, Austria*
[b] *Chalmers University of Technology, Sweden*

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ABSTRACT

This paper addresses the politics and economics of constructing, contesting and reducing the "socio-political space" for renewables connected to the German Renewable Energy Act (EEG). The political discourse is traced, revealing a gulf between "fit and conform" versus "stretch and transform" narratives. The former focus on short-term consumer costs, short learning periods and cost reductions from R&D rather than from market formation. The latter focus on total costs and acknowledge the need for lengthy learning periods and market formation to reduce costs. The version of the "fit and conform" narrative which recently became dominant, misrepresents the EEG surcharge, exaggerates the "burden" by ignoring external costs of fossil generation and doesn't consider inter-generational equity issues. This reflects the defensive reactions of a politically entrenched industry caught in a process of creative destruction, appealing to political actors such as the European Commission by invoking Europe's industrial competitiveness and (ideologically shared) technology-neutral policies.

* Corresponding author.
E-mail addresses: Volkmar.Lauber@sbg.ac.at (V. Lauber), Staffan.jacobsson@chalmers.se (S. Jacobsson).

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1. Introduction

Institutional[1] alignment is central to large-scale transformation processes (Freeman and Louca, 2002) and includes alterations in norms, beliefs and regulations. As an alignment enables access to resources and markets, firms and broader coalitions compete to gain influence over institutions (Van de Ven and Garud, 1989). "Battles" over the construction/restriction of a "socio-political space" for new technologies are, therefore, inherent in transformation processes involving potential path-breaking innovations (Smith and Raven, 2012). Constructing and maintaining such spaces involves a political process of building legitimacy, creating positive expectations and influencing regulations shielding the space and nurturing innovations. Maintaining and developing the space rests on empowering advocates "... to obtain more active protective measures, that assist in further nurturing, greater empowering, and eventually the institutionalisation of the innovation" (Smith and Raven, 2012, 1034).

Smith and Raven (2012, 1030) distinguish between two perspectives of empowering – "fit and conform (F&C)" and "stretch and transform (S&T)". The former "makes the niche innovation competitive with mainstream socio-technical practices in otherwise unchanged selection environments" whereas the latter "aims to undermine incumbent regimes and transmit niche-derived institutional reforms into re-structured regimes." These perspectives are supported by different discourses: F&C emphasises conventional selection criteria (e.g. cost-efficiency) and temporary shielding needs (Smith and Raven, 2012, p. 1033); S&T argues that the selection environment, i.e. the rules of the game, needs to be changed. Politics is most prominent in S&T processes and it requires power and collective action of political networks to influence institutional change, e.g. in the form of institutionalising environmental values.

In 2000, the German Renewable Energy Act (EEG) replaced the 1990 Feed-in Law as deployment support, leading to (a) large-scale deployment of renewable energy technologies; generation grew from 29 TWh in 1999 to 161 TWh in 2014 (AGEB, 2015) (b) distributed ownership; 1.3 million generators in 2012 and (c) a German industry employing well over 350,000 in 2011 (FME, 2012). This reflects the creation of a large "socio-political space" empowered by a clear S&T discourse. This law, and its 2004 amendment, were, however, contested by big utilities, energy-intensive industry, the Ministry of Economic Affairs, and Conservative and Liberal parties.[2] A brief pragmatic consensus between Conservatives and Social Democrats (2005–2009) ended when a Conservative-Liberal coalition returned to power in 2009, arguing the need to restrict the "excessive" deployment of renewables to make *Energiewende* [3] "affordable". By 2012–2013, many in the coalition questioned the whole structure of EEG.

The German debate on "affordability" spilled over to other countries, and the European Commission's (2013, p. 2) Green Paper on climate and energy policy for 2030 argued that a central consideration for future policies is "concerns of households about the affordability of energy and of businesses with respect to competitiveness". Another example is the head of the Committee on Industry in the Swedish Parliament, who explicitly linked the German price of electricity (for non-privileged customers) of about 28 eurocents to German wind power policy (Odell, 2014). Hence, EEG was contested since its start and with increasing ferocity at the same time as both IEA (2013a) and World Bank (2014) warned, in strong terms, of the risks of global warming.

This paper addresses the politics and economics of constructing, contesting and reducing the "socio-political space" for renewables connected to the 1990 Feed-in Law and the EEG with particular emphasis on the discourse and its impacts on institutions, i.e. the politics of empowerment.[4] We

[1] We are grateful to two reviewers and Sjoerd Bakker for useful comments on earlier drafts. Jacobsson's contribution was funded by Region Västra Götaland.

[2] In 2000, the adversaries included the European Commission (Lauber and Schenner, 2011).

[3] *Energiewende* is the German term for the transformation of the energy system based on a shift to renewable energy and energy efficiency, in use since 1980.

[4] The features of the 1990 Feed-in Law and EEG, e.g. priority access for renewables and unlimited purchasing obligation (Section 2) empower, of course, the niche actors to displace conventional generation. Deployment support is, therefore, not only linked to shielding and nurturing but also to empowerment. The deployment support also influences empowerment via its impact on the formation of advocacy coalitions which are strong enough to obtain more protective measures, strengthening

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use Smith and Raven's (2012) analytical categories to classify positions within the discourse, although with one minor modification. A F&C discourse may well be pursued by advocates of novel technologies, e.g. by pointing to scale advantages of large solar installations owned by utilities (Smith and Raven, 2012). Such a discourse needs to be framed in terms of conventional criteria rather than broader sustainability values since, as Smith and Raven (2012) point out, this type of empowerment makes the niche innovation competitive with *mainstream socio-technical practices;* that is, it is subordinated to an unchanged selection environment. This means, however, that a F&C discourse may equally well be pursued by advocates of incumbent technologies and industries, protecting their investments. Such a F&C discourse would put pressure on the new technology to conform to the current regime or industry structure by emphasising short-term cost competitiveness as selection criteria. In addition, a discursive emphasis on maintaining protective spaces for a quite limited period of time would be expected.[5] Indeed, as the infant industry debate informs us (Jacobsson and Alam, 1994) a F&C narrative may set tight limits to the protective space – it was argued that protection should be limited to industries which could become cost-competitive within eight years only (Balassa, 1975) which is far less than the length of the learning period for new technologies (Jacobsson, 1993).

In Section 2, we analyse the initial construction and expansion of a space, including the S&T rationale behind the EEG, and how controversy gave way to political consensus in 2005–2009. Section 3 analyses efforts to restrict this space as from 2009, ending with the dominance of the F&C discourse and an associated reduction in the protective space through EEG 2014. Given the strong F&C discursive emphasis on the cost "burden" of EEG, Section 4 critically addresses the cost discourse aiming to delegitimise this deployment policy by drawing on complementary literature in, e.g. economics of innovation. Section 5 provides elements of an explanation of the current (2014) dominance of F&C discourse while Section 6 concludes the paper.

2. Initial construction and expansion of a protective space

During the oil crises of the 1970s, German policy favoured coal and nuclear power. Renewable energy was a marginal feature of public policy, limited to the creation of a knowledge base by funding R&D. The big utilities were hostile to research on wind turbines. The Ministry of Economic Affairs (a stronghold of the Liberal Party and often a patron of the utilities) blocked market creation as it was expected to lead to permanent subsidies for non-competitive technologies.[6] Other ministries (Research and Technology, Environment) saw things less narrowly but had no say on market creation. Thus, renewable power policy was of a F&C type, limited to R&D.

In the late 1980s, many German MPs became increasingly frustrated by the Ministry of Economic Affairs' position. In 1988, two Conservative MPs submitted a members' bill for a feed-in tariff – a rebellion against the government coalition leaders. As the issue was popular, these leaders offered a deal: withdrawal of the bill in exchange for RD&D programmes involving market creation for 100 MW of wind power and 1.000 solar roofs (Jacobsson and Lauber, 2006). In 1990, another member's bill for a feed-in tariff passed parliament, largely ignored by electricity incumbents preoccupied with absorbing East German utilities. Thus, "by accident" the bill passed parliament and became the 1990 Feed-in Law (Kords, 1993; Jacobsson and Lauber, 2006; Laird and Stefes, 2009).

It provided for obligatory access to the grid and differentiated compensation per kWh (e.g. 90 percent of household consumer tariffs for wind and solar power) for decentralised renewable power plants not owned by government or utilities. Many thought the law would not make much difference given Germany's modest wind and solar resources. Yet, between 1990 and 1999, wind power generation increased by a factor of 78 (from 71 to 5.528 GWh) and solar power by a factor of 42 (from 1 to 42 GWh) (FME, 2012; Bergek and Jacobsson, 2003). With this growth, the feed-in law gathered

nurturing and empowerment further. Shielding, nurturing and empowerment are, therefore, three properties of protective spaces which are related in an iterative process where the initial shielding and nurturing empowers advocates to impact on institutions (Smith and Raven, 2012).

[5] The reasons for expecting such a discourse emphasis is that it would be consistent with short-term cost competitiveness as selection criterion and that it would provide a protection of incumbent technologies.

[6] Coal and nuclear were strongly subsidised (Kuechler and Meyer, 2012).

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political support from environmental and RE associations as well as from metalworkers, farmers, church groups and the influential investment goods industry association VDMA. The big utilities were taken aback and challenged the law in courts and before DG Competition but without success (Hirschl, 2008). Even though the European Commission and the German government (in a bill) supported the incumbents' demand for reduced feed-in tariffs (FIT), the German parliament rejected it (Jacobsson and Lauber, 2006). Hence, the Feed-in Law created an initial protective space for renewable electricity and a growing coalition supporting a change in the selection environment (S&T).

2.1. Market creation with a punch: EEG 2000

Since their beginnings in the 1970s, the Greens had advocated a radical reformation of energy policy in response to the nuclear power and, later, climate change problems. After Chernobyl, they committed themselves to the immediate shutdown of nuclear power whereas the Social Democrats argued for a gradual phase-out of nuclear power. When the two parties joined in a coalition (1998–2005), the Greens prevailed on providing generous and fixed feed-in tariffs, including effective PV support, which the Social Democrats accepted out of concern for the nascent wind turbine industry threatened by declining electricity prices which might result from recent liberalisation and which, via FIT set as percentages of household consumer tariffs, would risk making investments in wind turbines less attractive.[7]

The subsequent EEG 2000 was a major policy innovation with a clear S&T perspective, changing the rules of the game. The purpose of the law went far beyond creating small niches as its long-term goal was to replace nuclear and fossil generation. Nuclear – then about 30% of total generation – was to be phased out by around 2020. The medium-term goal was 12.5% market share of renewables by 2010 (Jacobsson and Lauber, 2006). The rationale behind the specifics of the law were summarised as follows (FME, 2000):[8]

> "...the cost of the production of renewable energy sources is still much higher than the production cost of conventional energy sources. This is largely due to the fact that the overwhelming share of the external costs associated with the generation of electricity from conventional energy sources is not reflected in the price; instead, these costs are borne by the general public and by future generations. In addition, conventional energy sources still benefit from substantial governmental subsidies which keep their price artificially low. Another reason for the higher costs is the structural discrimination of new technologies. Their lower market share does not allow economies of scale to become effective. Lower production volumes lead to higher unit cost and thus reduce competitiveness, which in turn prevents higher production volumes, like in a vicious circle. For this reason, the purpose of this Act is not only to protect the operation of existing installations but also to break this vicious circle and to stimulate a dynamic development in all fields of electricity generation from renewable energy sources."

Three S&T themes can be discerned. First, the main selection criterion should not be private cost of production (i.e. that of the utility) but the definition of cost should include negative externalities and subsidies (through the state budget). Second, the time-frame must be extended to future generations both in terms of costs (e.g. of climate change) and benefits in the form of learning processes that lower costs of new technologies. The time scale envisioned was revealed in the expectations that the law would be redundant after 2030 or 2040 when declining renewables' costs were expected to intersect with rising costs for fossil-based electricity. Third, market formation is seen as essential for reducing initially high costs. As will be evident in the remaining parts of Sections 2 and 3, this rationale became subject of a great controversy and the associated F&C discourse is critically addressed in Section 4.

The new rules of the game included unlimited obligation of utilities to purchase renewable power at fixed feed-in tariffs based on full-cost compensation guaranteed generally for 20 years, making a range of renewable power technologies profitable. Scheduled tariff reductions ("degression") would

[7] The Social Democrats also contained a strong "coal faction".
[8] There are no page numbers in the source.

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incentivise innovation and reduce costs, enabled by the development of a German capital goods industry. Cost to consumers was low at first, particularly when compared to the hundreds of billions of budget support for nuclear and coal, a point driven home by Scheer, a Social Democrat in the forefront of the struggle for renewable energy (Deutscher Bundestag, 1999).

However, the Conservatives and Liberals rejected the bill as overly expensive and failing to induce the necessary competition to bring down costs.[9] Some MPs argued that R&D was more important for improving competitiveness than market creation, which might lead to permanent subsidies (Deutscher Bundestag, 1999). The Liberals also argued that support should be smaller and come from the budget, not consumers. Thus, both opposition parties proposed a smaller protective space which deviated less from the current selection environment (F&C). Outside of parliament, only the Federation of German Industry (BDI) and utilities association VDEW condemned the bill for exorbitant costs. However, DG Energy and DG Competition opposed EEG as incompatible with state aid provisions and liberalisation. A gulf between the two perspectives was now clearly visible.

2.2. Fully including solar: market expansion under EEG 2004

In 2003, a special amendment extending cost-covering tariffs to solar PV was adopted unanimously by Bundestag parties. A comprehensive amendment (EEG 2004) increased the protective space further by improving compensation for small biomass and offshore wind, favouring traditionally Conservative and Liberal groups – landowners and electricity incumbents. The Conservative-Liberal opposition challenged, however, both the bill's duration (which it wanted to limit to three years, instead of two decades or more), and its target of 20% by 2020 with a clear F&C discourse. The Liberals demanded a technology-neutral quota system, unaware of its poor performance in the UK (Brunkhorst and Fell in Deutscher Bundestag, 2004).

Since 2000, the EEG advocacy coalition had undergone some changes. In 2002, renewables were transferred from Economic Affairs to the more supportive Environment Ministry. The EEG coalition also acquired support from the German Confederation of SMEs (representing about two-thirds of total employment) and the trade union of service workers. As usual, most big electricity incumbents – now reduced to four – rejected the feed-in system, with E.ON warning of grid destabilisation and increased blackout risks (Hirschl, 2008).[10] While Conservatives and Liberals voted against EEG 2004 in the *Bundestag* (lower house), six out of nine Conservative-ruled *Länder* supported it in the *Bundesrat* (upper house). The European Commission remained passive this time; EU directive 2001/77/EC left member states free to choose support schemes, and the Court's 2001 PreussenElektra decision held that the German Feed-in Law was not subject to state aid rules. The Commission accepted that this logic also applied to EEG. Hence, the EEG advocacy coalition was gaining strength to empower renewables further.

2.3. Brittle consensus on continued market expansion under EEG 2008

2005 saw a new coalition government – Conservatives and Social Democrats. With near equal strength, they agreed to continue previous policies regarding EEG and nuclear phase-out. Consensus seemed to spread on EEG and polarisation decreased between the Economic Affairs and Environment Ministries (Buschmann, 2011). The conservatives seemingly embraced EEG, their ecological wing (in combination with supportive agrarian and other interests) allied with the Social Democrats. Having rejected, in 2004, a renewable power target of 20% by 2020, in 2008 they supported one of "at least 30%" by the same date and further increase afterwards. Yet, Conservatives also demanded steeper scheduled tariff reductions and "direct marketing". Moreover, intense dissent came from the Conservatives' business wing on PV support (the technology furthest away from competitiveness, contributing heavily to EEG costs). Here it called for a 30% tariff cut, an annual cap of 600–700 MW (Deutscher Bundestag,

[9] Even though most Conservative MPs rejected the bill, several Conservative-led *Länder* (in the upper house of parliament) voted in its favour.

[10] EnBW broke ranks as it benefited from EEG 2004 via a new feed-in tariff for large hydro plants. The other incumbents were E.on, RWE and Vattenfall.

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2008; Siemer, 2008) and an emphasis on R&D. The business wing was outmanoeuvred by a coalition between the Conservative ecological wing and Social Democrats but was "looking for revenge" (Podewils, 2008) through a future alliance with the Liberals. S&T was no longer on a secure footing.

3. Reducing protective space

With the new Conservative-Liberal coalition (2009–2013), the gulf between S&T and F&C advocates re-emerged. From the beginning, the new government stressed the need to slow down deployment until renewable power was "affordable"; postponing nuclear phase-out would bridge the gap. According to the Energy Concept of the Federal government adopted in 2010 (Bundesregierung, 2010), renewable power generation was to reach 35% in 2020 (down from the 38.6% goal communicated to the EU; Bundesrepublik Deutschland, 2010) and to grow by 15% each decade so as to reach 80% by 2050. This contrasted with actual renewable power deployment which was already faster, reinforced by PV deployment which added 7.4 GW just in 2010, vastly overshooting expectations. An EEG amendment by Environment Minister Röttgen was meant to reduce PV growth by increasing tariff reductions ("degression") depending on how much the new annual target of 2.5–3.5 GW was exceeded ("flexible cap"). The Conservatives' business wing and the Liberals wanted still steeper degression and a much lower fixed cap but Röttgen prevailed.[11]

A new EEG amendment to restrain the other renewable sources was under preparation when Fukushima, and the flare-up of anti-nuclear sentiment in Germany, moved chancellor Merkel to reinstate nuclear phase-out and call for accelerating *Energiewende* against resistance from the Conservatives' business wing and the Liberals. Röttgen presented *Energiewende* as a huge project based on national consensus but demanding a market framework. EEG 2011 was adopted simultaneously with (renewed) nuclear phase-out and changed the targets of the Energy Concept 2010 into values to be achieved "at least", and possibly surpassed.

These zig-zag policies reflected a struggle over policy opposing the business wing and Liberals to the ecological wing and agrarian interests. In the *Bundestag* debates of EEG 2011, the government built up a rhetoric of market dynamism (introducing market premiums as a voluntary alternative to FIT), cost reduction and system integration, of moving towards F&C, but was unwilling to force the issue. Meanwhile many *Länder* meant to keep EEG and to seriously step up renewable power deployment after Fukushima.

3.1. Government attempts to reduce protective space stopped by Länder, 2012–13

3.1.1. EEG amendment 2012

When news came that PV installations had grown by 3 GW during December 2011 alone (totalling 7.5 GW for the year), Röttgen's moderate approach was upset. He was told to come to terms with his chief adversary, Liberal Economic Affairs minister Rösler, who wanted to cut annual PV installations by about 90%. The resulting compromise – modified in parliament – would have lowered the cap from 2.5–3.5 GW for 2012 and 2013, to 0.9–1.9 GW in 2017, and reduced tariffs dramatically, supposedly to make PV fully competitive within a few years (Deutscher Bundestag, 2012a,b).

The Social Democrats argued that the government had abandoned *Energiewende* and was taking its cues from the big electricity incumbents, restraining PV when its price had come down (Deutscher Bundestag, 2012a,b).[12] The Greens joined this reproach, argued that excessive PV cuts would ruin German PV producers and proposed raising the annual PV target to 5 GW. They also accused the government of pushing the interests of coal against PV.[13] LINKE[14] MPs also joined the reproach of

[11] A cap was also demanded by strong EEG supporters fearing legitimacy problems due to a big surcharge increase.
[12] They also criticised the government's passive stance in the face of Chinese PV dumping.
[13] The Greens also criticised the government for lack of an industrial policy that would respond to the existential crisis of the PV industry.
[14] Small Leftist party founded in 2007 when former East German Communists joined forces with dissenters from the Social Democrats.

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abandoning *Energiewende*, criticised the unfair distribution of surcharge costs (Section 4) and the policy-induced collapse of PV producers leading to deindustrialisation in East Germany (ibid).[15]

More importantly, a two-thirds majority of the *Länder* governments in the *Bundesrat* (upper chamber) opposed this bill and called for revision by conciliation committee, backed up by veto power,[16] motivated by concern for replacing nuclear in time and for an electorate strongly favouring renewables. Additionally, some Conservative *Land* delegations opposed the Conservative-Liberal *Bundestag* position in the name of industrial policy (Bundesrat, 2012). In conciliation, the government made considerable concessions. It reinstated the 2.5–3.5 GW flexible annual target (rather than halving it), guaranteed EEG support for PV until 52 GW would be reached and reduced the drastic extra cuts in PV feed-in tariffs. It also promised a market creation programme for small energy storage and more R&D for renewables, particularly for PV.[17]

This compromise was violently attacked by the Liberals who accused the Conservatives of betrayal and now denounced EEG's basic principles. The EEG surcharge increase for 2013 offered the perfect window of opportunity.

3.1.2. The surcharge controversy

In summer 2012, EU Energy Commissioner Oettinger[18] asked the German government to stop electricity price increases by capping the EEG surcharge (Die Welt, 2012). When the surcharge increase – of almost 50% – took effect in January 2013, Rösler insisted on an immediate "cost-brake" via legislation. New Environment Minister Altmaier proposed to cap the surcharge for two years by reducing existing (legacy) tariffs and industry exemptions while delaying feed-in payments to new installations by several months. The proposal never became a formal bill due to *Länder* objections but impacted investor confidence.

Discussions on EEG reform now became chaotic. Until then, Conservatives and Liberals had cooperated to reduce the protective space by applying a F&C narrative, assisted by EU commissioners Oettinger and Almunia (Competition) who renewed attacks on EEG. But now the coalition partners disagreed on new initiatives; Conservative moderation contrasted with FDP radicalism. In any case, in autumn of 2013, electricity incumbents received much attention for their claims that "over-subsidised" renewables were destroying energy security (by making their fossil fuel plants unprofitable) and threatened German industrial competitiveness (by high energy costs). By contrast, renewable power supporters could not find a common line. The Greens did question the mode for calculating the surcharge. Some Social Democrats supported this position, but key leaders stated their support for industries which claimed that their competitiveness was threatened by the high cost of *Energiewende*, supposedly about to explode due to the need to build up storage facilities and the distribution grid – a claim which largely evaporated after the elections.[19]

3.2. EEG 2014: Conservatives and Social Democrats reduce protective space

The chaotic debate on the future of EEG continued until the parliamentary elections of September 2013 which weakened the Greens and eliminated the Liberals from the Bundestag. Soon afterwards the Conservatives formed a coalition with the much weaker Social Democrats. Their coalition agreement already revealed a perfect U-turn on EEG policy on the part of the Social Democrats; the coal faction of the party seems to have gained the upper hand.

[15] Cell and module producers were most affected and were located in the Eastern *Länder* where they played a big role after the deindustrialisation following reunification in 1990. PV equipment producers are located mostly in Baden-Württemberg and were in a better position.

[16] A two-thirds majority *Bundesrat* objection can only be overridden by a two-thirds majority in the lower house.

[17] Additionally, it promised to make an effort to secure fair competition for German PV producers under WTO rules.

[18] Oettinger is a German Conservative and former governor of Baden-Württemberg.

[19] In September 2014 (a year after the elections), two studies commissioned by the Ministry of Economic Affairs, or organisations close to it, concluded that *Energiewende* did not require storage for another 10–20 years (Agora Energiewende, 2014) and that upgrading the distribution grid could be done for slightly over one billion Euro/year (Solarthemen, 2014), a rather modest amount when compared to the nearly 20 billion annually raised by the EEG surcharge.

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The coalition tackled the reform of the EEG without delay, giving parliament little chance to debate far-reaching reforms. First, in line with earlier proposals from the Conservatives, EEG 2014 (adopted in July) maintained the long-term targets formulated in 2010 (at the time of life extension for nuclear plants) but transformed them into caps (unlike EEG 2011). The annual cap for onshore wind and solar PV was set at 2.4–2.6 GW,[20] for biomass at 0.1 GW per year; offshore wind should reach 15 GW by 2030. This meant an addition of about 10 TWh per year – a reduction from preceding years. If the annually installed capacity exceeds the cap, this will result in lower payments to generators ("flexible caps"). Second, feed-in tariffs were replaced by obligatory market premiums, to be succeeded in 2017 or 2018 by bidding systems (they were only announced in the 2014 act). These systems, due to their legal and financial hurdles, tend to favour incumbents and other large-scale corporate operators; particularly incumbents who had mostly neglected renewable power investments until then, at least within Germany. Third, solar autogenerators and "self-consumers" have to pay part of the EEG surcharge, another discouragement for small investors.[21] Hence, the institutional changes brought about by EEG 2014 will not only reduce protective space for renewables but also change the playing field in favour of the incumbent utilities and similar players. These changes were legitimated by a further shift from S&T narratives towards F&C narratives. Their emphasis was on "accelerating market integration" of renewables by driving down "excessive" incentives and by additionally lowering the flexible caps for annual installations (reversing market creation). Renewables would have to increasingly adapt to market rules developed for conventional electricity.[22]

4. A critical analysis of the cost discourse

As explained in Section 2, the rationale behind the changed rules of the game, as articulated in the Explanatory Memorandum of EEG 2000 (FME, 2000), contained three central S&T themes: the definition of cost should include negative externalities and subsidies (through the state budget); the time-frame must be extended to future generations both in terms of costs (e.g. of climate change) and benefits (in the form of the outcome of learning processes – over decades – that lead to lowered costs of new technologies); market formation is essential to reduce initially high costs. However, in the political debate (Sections 2 and 3), the F&C discourse ignored this rationale and (i) emphasised "unaffordable" consumer cost of new technologies, (ii) took a short-term view on costs and learning periods and (iii) neglected or played down market formation in the process of innovation and cost reduction.

We will scrutinise this discourse and discuss how it (i) misrepresents the impact of the EEG surcharge on consumer costs, (ii) exaggerates the "burden" by shifting focus from total cost to consumer cost[23] and (iii) ignores inter-generational equity problems. The first two items involve ascertaining what is meant by costs, and therefore cost-efficiency, subsidy and "affordability", i.e. the nature of the cost concept needs to be specified. The third involves the two additional themes which are present in both FME (2000) and in the F&C discourse: (i) the time-scale for transformation and (ii) the role of market formation in the innovation process.

4.1. The EEG surcharge's impact on consumer price

The EEG surcharge is usually discussed as the additional cost of renewable power compared to the spot market price of electricity. In the F&C discourse, this surcharge is argued to constitute a large

[20] The flexible cap for solar power had been 2.5–3.5 GW/a since 2010; wind power was capped for the first time. Actual 2014 installations remained below 2 GW for solar but approached 4.4 GW for onshore wind.

[21] Additionally, energy intensive firms – largely exempted from paying the surcharge so far – will generally pay 15 percent of its full amount (EEG, 2014, sec. 64).

[22] Many other key issues for renewable power's future now reached the political agenda but not yet decision stage: the design of the electricity market and grid of the future when fluctuating sources will play the main role (centralised vs. decentralised renewables; capacity payments vs. energy only market; how to balance additional fluctuation: by power storage, grid extension or conventional reserve plants). Undoubtedly there will be change, but its direction is not yet clear. See also fn. 35.

[23] Consumers include also smaller industrial firms as only about half of industrial consumption was exempted (now paying about 1.2 Ct/kWh, with new EEG 2014). Households, small industry and commercial facilities pay full surcharge unless they can claim that they are energy-intensive and facing international competition.

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and growing "burden" on electricity consumers (Frondel et al., 2010). Initially very low, it rose to 1.16 cents/kWh in 2008, 3.53 cents in 2011 and 6.24 cents in 2014 (Mayer and Burger, 2014).

The surcharge is, however, only one element of consumer price – in 2011, it accounted for 14 per cent of household electricity prices (Traber et al., 2011) and about 18.5% in 2013 (FME, 2012). In addition, this share overstates the "burden" for at least three reasons. First, a growing share of industry[24] was exempted from the surcharge; in 2013 this cost non-privileged consumers 1.29 cents/kWh. A second factor increasing the surcharge is the declining spot price of electricity[25] due to the merit-order effect (induced by a growing supply of renewable electricity with priority dispatch status), reduced demand, falling coal prices and declining ETS certificate prices. This widened the gap between spot market prices and feed-in rates, increasing the need for compensation by an estimated 0.69 cents/kWh in 2013 (BEE, 2012; see also Tveten et al., 2013). It would constitute a benefit if the reduced spot price also reduced price for household consumers, which it did not.[26] Third, another 0.69 cents was due to a need to balance the surcharge account for 2012, which constitutes a temporary increase.

Indeed, according to BEE (2012), only about half of the 5.28 cents surcharge in 2013 constituted "extra cost" of renewables under EEG, which is less than 10% of a consumer price of 28–29 eurocents.[27] Linking this consumer price to wind power policy, as the head of the Committee on Industry in the Swedish Parliament, M. Odell did (Section 1) is, at best, ignorant but may also be seen as an act of manipulation in support of a F&D discourse. In fact, a simple calculation reveals that the impact was less than 0.3 eurocents/kWh in 2012.[28]

4.2. Shifting focus from total cost to consumer cost

The discursive shift from total cost (in e.g. FME, 2000) to consumer cost ignores significant cost items. First, external costs are those that electricity suppliers and users cause but impose on others. These costs are real and paid for by people who suffer from e.g. respiratory diseases or various effects of climate change such as flooding of coastal cities (or the cost of avoiding it), droughts and extreme weather events. The "affordability" discourse ignores these cost items or considers the EU emission trading scheme as an adequate answer, which at current prices it is not – by far.[29] The omission of a standard textbook cost category reflects a weak institutionalisation of environmental values, resulting in a misleading cost analysis. This weakness may well be, at least in part, a consequence of a deliberate choice by those who engage in a F&C discourse, as an omission of this cost element favours utilities with conventional power generation (particularly coal, see Section 5).

The German Federal Environment Agency (UBA, 2012b)[30] estimates these costs at 10.75 cents/kWh for lignite and 8.94 cents/kWh for hard coal. These figures are based on "best-practice" cost estimates of climate change effects and other damages from emissions using e.g. an assumption of a cost of 80 EUR2010/t CO_2. UBA (2008) recognises the methodological difficulties in estimating these costs as well as the ethical dimension; e.g. what is the value of a life and how much consideration should

[24] Exempted industry includes energy-intensive firms facing international competition but in practice was extended to also cover golf courses, newspapers, etc. (Der Spiegel, 2012, 2013b). The initial regulations gave exemptions to firms using more than 10 GWh/year but this was subsequently lowered (Der Spiegel, 2013a). Exempted industry pays some of the lowest electricity prices in Europe, non-exempted industry one of the highest (IWR, 2013b).

[25] From a peak of about 8 Ct/kWh in 2008, it fell to 4 Ct in 2013 and to around 3.5 Ct in mid-2014 (Mayer and Burger, 2014).

[26] FME (2013, p. 39). This is usually attributed to lack of competition and long-term contracts of suppliers with generators, sometimes also to lacking market supervision and abuse of the "basic supply" tariff; heavy reliance on futures contracts may also contribute.

[27] The "extra" cost is also affected by subsidies to conventional generation which widen the gap. For example, Kuechler and Meyer (2012) argue that hard coal is subsidised by 2.3 eurocents/kWh.

[28] In 2012, wind power supply was 51 TWh (AGEB, 2013) and was remunerated by 8.8 eurocents/kWh (Kuechler and Meyer, 2012, Appendix, Table 8). The average spot (and futures) price for electricity was 5.4 eurocents/kWh (January–June) (Kuechler and Meyer, 2012, Table 3 and Appendix, Table 8). The extra cost of wind power would then be 3.4 eurocents times 51 TWh which equals 1734 million EUR. Total electricity consumption was 607 TWh (AGEB, 2013). Dividing the extra cost over this consumption generates an added cost of 0.29 eurocents/kWh. Even this small figure overestimates the added cost as it ignores merit-order effects of wind power and subsidies to conventional generation.

[29] UBA (2008) estimates climate costs to Euro 70/t whereas ETS costs hovered around 4 € in 2013.

[30] We are grateful to Simone Stöhr for pointing out this source.

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Table 1
An estimate of the weighted average total cost of producing electricity from renewables and coal in Germany in 2012.

Technology	Total cost (kWh)	Supply of electricity (TWh)	Total costs (billion Euro)
Onshore wind	8.0	50.7[a]	4.06
Hydro	7.6	21.8	1.66
PV	36.7	26.4	9.69
Weighted average legacy cost/kWh – RES	15.6		
Hard coal	14.8	116	17.17
Soft coal	15.6	161	25.12
Weighted average costs – coal	15.3		

Sources: Kuechler and Meyer (2012, Appendix, Table 8) and AGEB (2013).
[a] This figure includes about 1% offshore wind.

be given to future generations (via the choice of discount rate)?[31] Kuechler and Meyer (2012, Table 8) use these estimates and add a second ignored cost item, subsidies channelled through the state budget, to estimate total costs of electricity.[32] Table 1 contains the cost estimates (column 1), volume of electricity supplied (column 2) and total costs associated with each technology in 2012 (column 3). A weighted average (legacy)[33] cost per kWh is calculated for the present stock of onshore wind, hydro and PV as well as for hard and soft coal generation facilities – coal being the dominant source of electricity in Germany.

The weighted average legacy cost/kWh of the three renewables is only slightly above that of coal and the cost of onshore wind and hydro is much lower, i.e. they are not subsidised but cost-efficient. The contrast with the message from analyses failing to include external costs and subsidies through the budget is sharp. An example is Frondel et al. (2010, p. 4049):

> "...utilities are obliged to accept the delivery of power...into their own grid...paying...feed – in tariffs far above their own production costs...even on-shore wind...requires feed-in tariffs that exceed the per kWh cost of conventional electricity by up to 300% to remain competitive".

Moreover, the originally high feed-in rates for solar PV have a large impact on total cost but *current* feed-in rates (9.2–13.1 cents in September 2014) are much lower (VBEW, 2014). As external costs and subsidies are low (Kuechler and Meyer, 2012, Table 8), even solar cells are now competitive with coal. Replacing the legacy cost for just solar cells in Table 1 with the cost in the middle of the range (11.6) of feed-in tariffs in January 2014 (and adding 1.2 cents in external costs for solar cells) generates a *weighted average cost of 10.7 eurocents for the three renewables*. This is substantially below that of coal power (15.3). This difference, which is likely to increase further as the climate costs of fossil fuels rise,[34] may well more than balance costs arising from the intermittency of large-scale wind and solar power, such as maintaining reserve capacity and building storage facilities.[35]

[31] In 2007, Umweltbundesamt (UBA) prepared a first convention on the methodology for estimating external costs after consulting a large variety of government agencies and experts. This was updated in 2012 after additional consultations with INFRAS (Zürich), Fraunhofer ISI, Energy Research Institute IER (Stuttgart) and others, see UBA (2012a). The estimates do not differ much from the ones in a recent study commissioned by the European Commission (Alberici et al., 2014, Table A3–8).
[32] They calculate total costs for coal power by adding market price of electricity, subsidies and not internalised external costs. For renewables, they add feed-in payments, subsidies and not internalised external costs. We are uncertain how much of hydropower supply receives feed-in remuneration.
[33] We use the term legacy cost for renewables since it averages payments to earlier installations, with higher tariffs, with those to new installations, with lower tariffs.
[34] When greenhouse gases accumulate, the climate cost of fossil fuel use will rise. UBA (2012b) argues that it will increase, from the current figure of 80 EUR/t, to 145 EUR/t by 2030.
[35] Large-scale deployment of some intermittent renewables creates additional system costs. However, there are large uncertainties over the size of these costs. Much balancing may be done by distributing fluctuating generation over a larger geographical area in the EU and by making conventional power plants more flexible (something that is already happening). As to the need for new grid investments (another system cost), it should be noted that in 2013, the average age of high voltage lines was 32 years for 380 kV and 50 years for 220 kV lines, so most required investments are normal upkeep or new trans-border linkages – something long neglected by the incumbents (Kemfert, 2013). A recent study for the Ministry of Economic Affairs shows that the projected expansion of the distribution grid can be drastically reduced (Solarthemen, 2014).

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When these estimates of external costs and subsidies through the state budget are included, it is plain that the F&C cost discourse exaggerates the "burden" of renewables and strong doubts are, therefore, raised over its use of the terms "cost-efficiency", "subsidies" and "affordability" as these neglect important cost items. Yet, any consumer cost increase puts pressure on low-income households who need to be shielded from the cost of transformation.[36]

4.3. Shifting focus from long-term benefits to short-term costs

The shift from long-term benefits (e.g. avoiding climate change) to short-term costs means that the F&C discourse ignores inter-generational fairness issues. If Germany is to achieve a share of renewables of 80% by 2050, large inter-generational positive externalities will be generated from building capital goods industries that develop technologies that can provide a rapidly rising volume of "low-carbon" electricity in the next three decades. Failing to enable future generations to supply carbon-neutral electricity on a large scale with technologies that have gone through decades of improvement implies that we will burden them with the costs of climate change.

Avoiding this requires adopting a time-scale for developing and diffusing new technologies which spans decades (e.g. Grübler, 1996; Jacobsson et al., 2009; Wilson, 2012). The innovation system literature has assessed the length of the "formative phase" in which the technology is "put on the shelf", i.e. a rudimentary capital goods industry is developed that provides a technology with a reasonable price/performance ratio (e.g. Jacobsson and Bergek, 2004; Hellsmark, 2010). This phase often takes a couple of decades and two to three additional decades may be required to increase the capacity of the capital goods sector and deploy the technology (in further improved form) until the market is saturated. This perception of the time-scale stands in sharp contrast to the critique of the 1990 Feed-in Law and EEG in the name of a F&C approach which, in turn, is similar to that of opponents of strategic industrialisation policies aiming to induce large-scale structural change in catching-up countries in the 1980s, e.g. Korea (Jacobsson, 1993).

Onshore wind and PV have gone through the formative phase and can be deployed on a large scale with total costs lower than coal (Table 1). The 1991 Feed-in Law and EEG greatly contributed to the formation of capital goods industries and the maturation of these two technologies (Jacobsson and Bergek, 2004). Other technologies, such as offshore wind power, currently in their formative phases, are vital for replacing fossil fuels and need to shift into a growth phase and, ultimately, mass deployment. Given the long time-scale, investments in these technologies should not be judged only by their present costs but also by their ability to contribute to avoiding future costs, e.g. from climate change, by enabling the development of a capital goods sector and other parts of the supply chain. These long-term effects are, however, played down in the F&C discourse which reflects either an ignorance of innovation and industrialisation processes or a practice of heavily discounting future benefits of learning in new technological fields – a standard reason for government intervention in large-scale structural change (Corden, 1974, 1980).

A focus on short-term costs also obscures the need to form the growing protective market spaces required to take these technologies through their formative phases and into the growth phases, in particular when external costs are not internalised. Indeed, the Liberals, Frondel et al. (2010), the German Council of Economic Experts (Sachverständigenrat, 2012) and the Monopoly Commission (2013) insisted on a short-term focus and argued that the current "burden" should be reduced by introducing a quota system, such as the Swedish technology-neutral system of tradable green certificates.[37] Such a system provides incentives to invest in only the *currently* most cost-efficient technologies and may, therefore, appear attractive with today's German cost discourse.[38]

[36] For the "energy poor", an electricity price of 28 eurocents/kWh (as in Germany) is punishing. It could be reduced by taking away the electricity and value added taxes (about 8 eurocents) or by upward adjustment of the energy element in welfare payments.

[37] Also discussed and similar in impact is a system of technology-neutral competitive bidding.

[38] In 2013, the German association of electricity incumbents did not consider this system capable of resolving current problems (IWR, 2013a).

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Yet, a quota system does not drive technical change more than incrementally as the required markets are not formed to induce the build-up of new supply chains until lower-cost technologies have saturated their markets (Bergek and Jacobsson, 2010). This usually leads its proponents to argue that immature technologies should be fostered by R&D policy rather than market formation. For instance, Frondel et al. (2010, p. 4055) argue that: "...one should have abstained from strongly subsidising the market penetration of relatively immature PV technologies. Rather, from an economic perspective, R&D funding should have increased first".

However, it is only in the much criticised linear model of innovation that the innovation process is seen as "... flowing smoothly down a one-way street" (Kline and Rosenberg, 1986, 285), with research leading to development, development to production and production to marketing so that R&D is sufficient for driving innovation and cost-reductions. Of course, R&D is required throughout the life-cycle of a technology but it takes market creation to stimulate the emergence of a capital goods industry and induce it to conduct product development and other measures that drive down cost (e.g. standardisation). Real life technologies, thus, *co-evolve* with markets, as recognised by FME (2000), see Section 2.1. Technology-neutral systems, even together with R&D subsidies to higher-cost technologies, contribute, therefore, little to "putting new technologies on the shelf" as they don't provide the time and markets required for fostering new capital goods industries with an innovative capacity. Indeed, Hoppmann et al. (2013. p. 1000) conclude that German PV deployment policies

> ...are effective instruments for inducing innovation ...since many effects such as economies of scale, learning-by-doing and *the build-up of an equipment industry would be harder – even impossible – to achieve when using conventional R&D support"* (our emphasis).[39]

Hence, the use of technology-neutral market formation policies coupled to the linear model of innovation is not likely to lead to processes of innovation and cost reductions which may enable a transition in time. Of course, this is consistent with the "inertia interest" of incumbents (if they define their interest that way; see next section) and may help explain the persistent use of a F&C discourse.

To conclude this critical analysis of the now dominant F&C discourse, it is plain that (a) its focus on consumer costs instead of social costs, (b) its emphasis on short learning periods and (c) its neglect of the role of market formation in the process of innovation and cost reduction not only turned the logic in the Explanatory Memorandum to the EEG 2000 (Section 2.1) upside down but managed to neglect basic textbook messages as well as lessons from a large literature on technical change and industrial development. We will now turn to elements of an explanation how a discourse with such weaknesses can become dominant.

5. Towards explaining the current dominance of the F&C discourse

In the political process of constructing, contesting and reducing the "socio-political space" for renewables connected to the 1990 Feed-in Law and the EEG, there is a long-standing battle between S&T and F&C discourses, a battle which is now dominated by those with a F&C perspective.[40] This divide between S&T and F&C discourses reflects a broader, partly ideological, debate between those arguing the advantages of industry or technology-neutral policies and those advocating a more powerful state implementing industry or technology-specific policies. The latter also highlight the capital goods industry as a bridge between policy, market formation and technical change as well as the long time-scale involved in building such industries (MacKerron, 2011). This divide is, moreover, not

[39] We acknowledge difficulties in balancing market formation and R&D policy.

[40] Our analysis is largely limited to the discourse of the elites. Popular support for different aspects of Energiewende has been measured by many surveys and show an overwhelming support for an Energiewende in which citizens play a major role, with only minor variations due to political party sympathies (EMNID, 2013). Indeed, a majority of respondents find the level of the EEG surcharge appropriate (EMNID, 2014). Presumably they have the bigger picture in mind, in which the surcharge permits nuclear phase-out and an effective climate policy for the power sector, two priorities dear to earlier popular movements described in Section 2. Already in 2000, the Explanatory Memorandum to the EEG (FME, 2000) cited non-internalised external costs of conventional generation as one of the factors legitimising feed-in tariffs. The same arguments have been articulated since by a wide range of organisations.

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limited to Germany and EU as a whole, but is similar to that between advocates of a uniform protection of infant industries in developing countries, assuming short learning periods, and those advocating industry-specific interventions with longer learning periods (Jacobsson, 1993).

The divide is, however, also due to conflicting economic interests of firms in the respective coalitions. While the supply of electricity from renewable energy sources initially increased greatly with EEG 2000, this growth was from a small base. However, by 2014, a continued strong growth had led to a total supply of 161 TWh while the supply of nuclear power was reduced from 170 (in 2000) to 97 TWh and that of coal from 291 to 265 TWh (AGEB, 2015). Continuing with average absolute installation levels between 2009 and 2014 for renewables, a two-thirds share by 2030 was within reach. Hence, with the growing maturity of renewables, including the growth of an innovative capital goods sector with a large supply capacity, the process of Schumpeterian creative destruction shifted from the 'creative' to a 'destructive' phase.

The large utilities, which neglected to invest significantly in renewable generation, feel these forces of creative destruction as they are threatened by not only declining market shares but also by lower prices for conventional generation, particularly at hours of peak demand when PV is abundant. Possibly overstating this cause (the incumbents suffer from many other factors; Kungl, 2015), The Economist (2013) argues that deployment of renewables creates an "existential threat" to the large utilities, stating that

> "the country's biggest utility, E.ON, has seen its share price fall by three-quarters. . .and its income from conventional power generation. . .fall by more than a third since 2010. At the second-largest utility, RWE. . .net income has also fallen a third since 2010. As the company's chief financial officer laments, "conventional power generation, quite frankly, as a business unit, is fighting for its economic survival".[41]

In their support, large utilities would, therefore, be expected to call for a F&C strategy, reducing the protective space for renewables to slow their deployment. The nuclear power life-extension in late 2010 would have served this purpose. The recent wave of investment in new coal generation plants in Germany – one of the biggest since post-war reconstruction (IEA, 2013b) – could have a similar effect, if combined with appropriate legislation. Indeed, in September 2013, nine leading European utilities (Enel et al., 2013) submitted their own demands to EU, a veritable catalogue of F&C principles: consumer bills reflecting only market costs of energy; emissions trading as the main driver for a low-carbon economy; only the most mature RE technologies to be integrated into the regular market, the least mature to benefit from R&D only; public support for renewable electricity production to be adjusted towards "reflecting. . .electricity market needs".[42]

An intensified F&C discourse may, therefore, serve to protect the vested interests of a threatened industry by (i) hiding some of its costs (in particular negative externalities), (ii) heavily discounting future benefits of learning related to competing technologies and (iii) obstructing market formation of these technologies.

An F&C discourse is, however, pursued not only by utilities with a stake in coal (and nuclear) power but also by others who ignore or play down total costs in favour of consumer costs, discount future benefits heavily and claim superiority of technology-neutral policies in combination with leaning towards a linear view of the innovation process. These include the European Commission which has made several attempts to ban "German-style" feed-in tariffs or at least to subject them to state aid control (another way to dismantle them).[43] Indeed, the Commission contributed to intensifying the

[41] In 2013, RWE made its first loss in sixty years, though only partly in connection with *Energiewende*.

[42] This was well received by the European Commission (2013b) which drafted a paper intended to demonstrate excessive support for renewables, distorting market prices. Commission services figures (mostly from OECD and IEA) however showed, for fossil fuels, a bill of € 26 bn in subsidies and another 40 bn in health care costs passed on to the taxpayer; for nuclear energy, € 35 bn; and for renewables, € 30 bn per year. Energy commissioner Oettinger intervened to remove these figures from the draft (Keating, 2013).

[43] European Commission attacks on feed-in tariffs have a long history: 1998 (failed), 2001 (failed), 2007 (failed), 2013 (Oettinger before Council, 2013; failed), 2013 (Commission proposal for framework for renewables support) and 2014 (Commission guidelines on state aid for environmental purposes and energy) in which it banned feed-in tariffs for most situations.

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F&C discourse when, in the name of "affordability" and industrial competitiveness, it aimed to slow down the shift to renewables via (i) low targets for 2030 (27 per cent overall, just seven per cent more than for 2020) and (ii) technology-neutral bidding processes for the support of technologies as soon as they have a European market share of 1–3 per cent (European Commission, 2013c, para. 116–127).[44] Hence, the European Commission allied itself with advocates of a slow-down of the transition process which, among other things, means prolonging investments in socially cost-inefficient technologies.

6. Concluding discussion

This paper has addressed the politics and economics of constructing, contesting and reducing the "socio-political space" for renewables connected to the German 1990 Feed-in Law and the EEG with emphasis on the discourse and its impacts on institutions, i.e. the politics of empowerment.

The paper has made five main contributions. First, it updates, and adds to, prior research on 'the politics of policy' centred on one of the more controversial policies to support a transition of the energy system. Second, in doing so, it demonstrates the long time-scale involved – intense political controversy over protective space for the development of renewable power technologies goes back to the 1980s in Germany. In that controversy, the 1990 Feed-in-law created a market space which supported the growth of a political network empowering renewables. From a discursive-institutional perspective the framings and institutional setting supporting renewables altered greatly over time, in part influenced by the growing relative strength of this network. With the initial Feed-in-law, the frame was one of renewables as an additional source, probably marginal. With the S&T inspired EEG 2000, the frame and institutional setting altered greatly – renewables should become the mainstay of the power supply and conventional generation should only furnish a declining share of "residual load". With the rapid deployment of renewables after the introduction of EEG 2000, the vision of a transition which marginalises conventional power generation became increasingly realistic. This led to an intensification of the F&C discourse and, after a chaotic debate post-2009, the framing and institutional setting changed radically again; EEG 2014 may signal the end to S&T-inspired policies.

Third, the current dominance of the F&C discourse is the outcome of a political struggle related to three S&T themes which were central to the rationale for EEG 2000: (i) the definition of cost should include negative externalities and subsidies (through the state budget), (ii) the time-frame must be extended to future generations both in terms of costs (e.g. of climate change) and benefits in the form of learning processes that lower costs of new technologies, (iii) market formation is seen as essential for reducing initially high costs.

Fourth, in spite of the solid grounding of this rationale in the literature of both economics and innovation studies, and the fact that applying this rationale has enabled even solar power to be socially cost efficient in Germany, the F&C discourse came to impact on EEG 2014 with its message of reducing high consumer costs, shortening learning periods and downplaying market formation in the innovation process. This may largely be explained by the real threat that matured renewables, and those close to maturity (e.g. offshore wind), pose to incumbents in terms of a transition which marginalises conventional generation – excluding important cost elements, arguing for a shorter than required learning period and limiting the deployment needed to cut costs all empower incumbents protecting their investments by limiting the threat of substitutes to conventional power generation. This defensive reaction of a politically powerful industry realising that it is in the midst of a process of creative destruction was supported by the European Commission and others who, in part for ideological reasons, advocate technology-neutral policies pursued by a less powerful state.

Finally, the case gives ample evidence of the central role of politics in the transformation of the energy system, which, of course, supports Meadowcroft's (2011) call for a fuller integration of politics into various transition perspectives. However, it also demonstrates how knowledge in other disciplines enables a critical analysis of the arguments, and helps gaining an understanding of the rationale for

[44] The Commission proposed to authorise policies for a maximum of ten years (para 116). All this means that the Commission shares the F&C emphasis on short learning periods and its neglect of the need to differentiate between technologies with respect to the length of the learning period beyond the criterion "deployed" (at least 1–3%) or "not deployed".

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the particular foci in a given discourse. In this paper, this was achieved by applying a slightly modified version of the key concepts in Smith and Raven (2012) to classify positions within the discourse, e.g. the F&C's focus on consumer costs and short learning periods, and then assess the validity of, and explain the rationale for, the arguments drawing on literature from e.g. economics of innovation. Hence, to strengthen the analysis of 'politics of policy' in transition studies, integration may need to go both ways, ending up with a plea for developing frameworks for analysing transition processes which are even more interdisciplinary than those currently deployed (Geels et al., 2008).

References

AGEB Arbeitsgemeinschaft Energiebilanzen, 2013. Bruttostromerzeugung in Deutschland von 1990 bis 2013 nach Energieträgern, data as of 12 December 2013.
AGEB Arbeitsgemeinschaft Energiebilanzen, 2015. Bruttostromerzeugung in Deutschland ab 1990 nach Energieträgern, data as of 27 February 2015.
Agora Energiewende, 2014. Stromspeicher in der Energiewende. Agora Energiewende, Berlin.
Alberici, S., et al., 2014. Subsidies and Costs of EU Energy, Interim Report, 10 October, Ecofys, commissioned by the European Commission, http://www.ec.europa.eu/energy/./20141013_subsidies_costs_eu_energy.pdf
Balassa, B., 1975. Reforming the system of incentives in the developing countries. World Dev. 3 (6), 365–382.
BEE, 2012. BEE-Hintergrund zur EEG-Umlage 2013. BEE, Berlin, http://www.bee-ev.de/_downloads/publikationen/sonstiges/2012/120926_BEE_Hintergrund_EEG-Umlage-2013.pdf (accessed 24.10.13).
Bergek, A., Jacobsson, S., 2003. The emergence of a growth industry: a comparative analysis of the German, Dutch and Swedish wind turbine industries. In: Metcalfe, S., Cantner, U. (Eds.), Change, Transformation and Development. Physica-Verlag, Heidelberg and Berlin, pp. 197–228.
Bergek, A., Jacobsson, S., 2010. Are Tradable Green Certificates a cost-efficient policy driving technical change or a rent-generating machine? Lessons from Sweden 2003–2008. Energy Policy 38, 1255–1271.
Bundesrat, 2012. Stenographischer Bericht, Plenarprotokoll 896, 896. Sitzung, 11 May., pp. 196–300.
Bundesregierung, 2010. Energiekonzept für eine umweltschonende, zuverlässige und bezahlbare Energieversorgung, http://www.bundesregierung.de/Content/DE/_Anlagen/2012/02/energiekonzept-final.pdf?__blob=publicationFile&v=5 (accessed 20.10.13).
Bundesrepublik Deutschland, 2010. National Renewable Energy Action Plan, http://ec.europa.eu/energy/renewables/action_plan_en.htm (accessed 20.03.14).
Buschmann, M., (Doctoral dissertation in political science) 2011. Erneuerbare Energie und das politische System. University of Salzburg.
Corden, W.H., 1974. Trade policy and economic welfare. In: Cody, J., Hughes, H., Wall, D. (Eds.), Policies for Industrial Progress in Developing Countries. Oxford University Press, Oxford.
Corden, W.H., 1980. Comments. In: Hong, W., Krause, L. (Eds.), Trade and Growth of the Advanced Developing Countries in the Pacific Basin. Korea Development Institute, Seoul.
Der Spiegel, 2012, December 24. Germany to Except 1550 Firms From Power Price Surcharge (Spiegel Online, accessed 07.08.13).
Der Spiegel, 2013a, January 29. German Environment Ministry Plans to Cap Subsidies for Renewables (Spiegel Online, accessed 07.08.13).
Der Spiegel, 2013b, July 15. European Commission Plans to Probe German Renewable Energy Law (Spiegel Online, accessed 07.08.13).
Deutscher Bundestag, 1999. Stenographischer Bericht, 79. Sitzung, 16 December, Plenarprotokoll 14/79, I (List of Speakers) and 7240–7274.
Deutscher Bundestag, 2004. Stenographischer Bericht, 87. Sitzung, 16 January, Plenarprotokoll 15/87, I (List of Speakers) and 7663–7681.
Deutscher Bundestag, 2008. Stenographischer Bericht, Plenarprotokoll 16/167, 167. Sitzung, 6 June 2008, I–III (List of Speakers) and 17729–17748.
Deutscher Bundestag, 2012a. Stenographischer Bericht, Plenarprotokoll 17/161, 161. Sitzung, 29 February, IV (List of Speakers) and 19161–191200.
Deutscher Bundestag, 2012b. Stenographischer Bericht, Plenarprotokoll 17/166, 166. Sitzung, 9 March, I (List of Speakers) and 19723–19746.
Die Welt, 2012, August 14. Deutsche Strompreise hoechste in Europa, http://www.welt.de/wirtschaft/article108607217/Deutsche-Strompreise-zweithoechste-in-Europa.html (accessed 10.10.13).
EEG Erneuerbare-Energien-Gesetz, 2014. Inofficial Version by Federal Justice Ministry, www.juris.de, http://www.gesetze-im-internet.de/bundesrecht/eeg-2014/gesamt.pdf (accessed 13.10.14).
EMNID, 2013, September. Emnid-Umfrage zur Bürger-Energiewende, http://www.100-prozent-erneuerbar.de/2013/./emnid-umfrage-zur-burger-energiewende-september-2013/ (accessed 18.02.15).
EMNID, 2014, October. Akzeptanzumfrage erneuerbare Energien, http://www.unendlich-viel-energie.de/./akzeptanz-umfrage/akzeptanzumfrage-2014 (accessed 18.02.15).
Enel, Eni E.on, et al., 2013. Heads of Nine Leading European Energy Companies Propose Concrete Measures to Rebuild Europe's Energy Policy, http://www.eon.com/en/media/news/press-releases/2013/9/10/heads-of-nine-leading-european-energy-companies-propose-concrete.html (accessed 31.10.13).
European Commission, 2013a. Green Paper: A Framework for Climate and Energy Policies, COM (2013) 169 Final. Department of Energy and Climate Change, Brussels.
European Commission, 2013b. Delivering the Internal Electricity Market: Making the Most of Public Intervention, Unofficial Draft Leaked to the Media, http://www.igwindkraft.at/redsystem/mmedia/2013.09.30/1380546117.pdf (accessed 28.10.13).

Please cite this article in press as: Lauber, V., Jacobsson, S., The politics and economics of constructing, contesting and restricting socio-political space for renewables – The German Renewable Energy Act. Environ. Innovation Soc. Transitions (2015), http://dx.doi.org/10.1016/j.eist.2015.06.005

European Commission, 2013c. Draft Guidelines for Environmental and Energy State Aid, 2014–2020, http://ec.europa.eu/competition/consultations/2013_state_aid_environment/index_en.html (accessed 15.05.14).
European Commission, 2014, June. Guidelines on State Aid for Environmental Protection and Energy 2014–2020. Off. J. Eur. Union C200, 1.
FME (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety), 2000. Act on Granting Priority to Renewable Energy Sources. Explanatory Memorandum.
FME, 2012, July. Development of Renewable Energy Sources in Germany 2011. Graphics and Tables Version, http://www.bmu.de/fileadmin/bmu-import/files/english/pdf/application/pdf/ee_in_deutschland_graf_tab_en.pdf (accessed 11.10.13).
FME, 2013, July. Renewable Energy Sources in Figures, http://www.erneuerbare-energien.de/fileadmin/Daten_EE/Dokumente__PDFs_/ee_in_zahlen_en_bf.pdf (accessed 19.03.14).
Freeman, C., Louca, F., 2002. As Time Goes By. Oxford University Press, Oxford.
Frondel, M., Ritter, N., Schmidt, C., Vance, C., 2010. Economic impacts from the promotion of renewable energy technologies: the German experience. Energy Policy 38, 4048–4056.
Geels, F., Hekkert, M., Jacobsson, s., 2008, September. The dynamics of sustainable innovation journeys: Introduction to the special issue. Technol. Anal. Strateg. Manage. 20 (5), 105.
Grübler, A., 1996. Time for a change: on the patterns of diffusion of innovation. Daedalus 125 (3), 19–42.
Hellsmark, H., (PhD thesis) 2010. Unfolding the formative phase of gasified biomass in the European Union. Environmental Systems Analysis, Energy and Environment, Chalmers University of Technology, Sweden.
Hirschl, B., 2008. Erneuerbare Energien-Politik. Verlag für Sozialwissenschaften, Wiesbaden.
Hoppmann, J., Peters, M., Schneider, M., Hoffman, V., 2013. The two faces of market support – how deployment policies affect technological exploration and exploitation in the solar photovoltaic industry. Res. Policy (42), 989–1003.
IEA, 2013a. Redrawing the energy-climate map. In: World Energy Outlook Special Report. International Energy Agency, Paris.
IEA, 2013b. Energy Policies of IEA Countries – Germany (Review).
IWR, 2013a, September 5. Empfehlungen der Monopol-Kommission: Energiewirtschaft lehnt das Quotenmodell ab, http://www.iwr.de/news.php?id=24478 (accessed 28.10.13).
IWR, 2013b, October 24. Strompreis-Kluft spaltet deutsche Industrie (accessed 29.10.13).
Jacobsson, S., 1993. The length of the learning period. Evidence from the Korean engineering industry. World Dev. 21 (3).
Jacobsson, S., Alam, G., 1994. Liberalization and Industrial Development in the Third World: A Study of Government Policy and Performance of the Indian and Korean Engineering Industries. SAGE Publications.
Jacobsson, S., Bergek, A., 2004. Transforming the energy sector: the evolution of technological systems in renewable energy technology. Ind. Corp. Change 13 (5), 815–849.
Jacobsson, S., Lauber, V., 2006. The politics and policy of energy system transformation: explaining the German diffusion of renewable energy technology. Energy Policy 34 (3), 256–276.
Jacobsson, S., Bergek, A., Finon, D., Lauber, V., Mitchell, C., Toke, D., Verbruggen, A., 2009. EU renewable energy support policy: faith or facts? Energy Policy 37, 2143–2146.
Keating, D., 2013, October. Commission to clarify state aid rules for energy. Eur. Voice, 5.
Kemfert, C., 2013. Kampf um Strom. Murmann, Hamburg.
Kline, S., Rosenberg, N., 1986. An overview of innovation. In: Landau, R., Rosenberg, N. (Eds.), The Positive Sum Strategy: Harnessing Technology for Economic Growth. National Academy Press, Washington, DC, pp. 275–305.
Kords, U., 1993. Die Entstehungsgeschichte des Stromeinspeisungsgesetzes vom 5.10.1990. Fachbereich für Politikwissenschaft, FU Berlin.
Kuechler, S., Meyer, B., 2012, September. Was Strom wirklich kostet. Forum Ökologisch-Soziale Marktwirtschaft (FÖS), Berlin.
Kungl, G., 2015. Stewards or sticklers for change? Incumbent energy providers and the politics of the German energy transition. Energy Res. Soc. Sci. 8, 13–23.
Laird, F., Stefes, C., 2009. The diverging paths of German and US policies for renewable energy: sources of difference. Energy Policy 37, 2619–2629.
Lauber, V., Schenner, E., 2011. The struggle over support schemes for renewable electricity in the European union: a discursive-institutionalist analysis. Environ. Polit. 20 (4), 508–527.
MacKerron, G., 2011, September 13–15. Renewable energy and innovation policies: European experience. In: Presentation to the International Workshop on Innovation Policies and Structural Change in a Context of Growth and Crisis, Rio de Janeiro.
Mayer, J., Burger, B., 2014. Kurzstudie zur historischen Entwicklung der EEG-Umlage. Fraunhofer ISE, Freiburg.
Meadowcroft, J., 2011. Engaging with the politics of sustainability transitions. Environ. Innov. Soc. Transitions 1, 70–75.
Monopoly Commission, 2013, September. Special Report on the Situation of Competition on the Energy Markets, Press Release. Monopoly Commission, Bonn.
Odell, M., 2014, January 27. Dags att trappa ner stöden till vindkraft. In: SvD Opinion.
Podewils, C., 2008, July. Constant State of Revision. Photon International, pp. 28–32.
Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung, 2012. Jahresgutachten 2012/13., pp. 279–297 (Chapter 7 (III)), http://www.sachverstaendigenrat-wirtschaft.de/jahresgutachten-2012-2013.html (accessed 31.10.13).
Siemer, J., 2008, March. We Have to Get Rid of That Cent. Photon International, pp. 50–51.
Smith, A., Raven, R., 2012. Reconsidering niches in transitions to sustainability. Res. Policy 4, 1025–1036.
Solarthemen, 2014, September 25. Verteilnetzstudie: EE-Integration kein Problem., pp. 10–11, Issue 432.
The Economist, 2013, October. European utilities: how to lose half a trillion euros. In: Europe's Electricity Providers Face an Existential Threat, http://www.economist.com/news/briefing/21587782-europes-electricity-providers-face-existential-threat-how-lose-half-trillion-euro (accessed 16.10.13).
Traber, T., Kemfert, C., Diekmann, J., 2011, March 16. Weekly Report. German Electricity Prices: Only Modest Increase Due to Renewable Energy expected, Vol. 7, No. 6. German Institute for Economic Research.
Tveten, A., Bolkesjo, T.F., Martinsen, T., Hvarnes, H., 2013. Solar feed-in tariffs and the merit order effect: a study of the German electricity market. Energy Policy 61, 761–770.

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UBA Umweltbundesamt, 2008. Economic Valuation of Environmental Damage, Methodological Convention for Estimates of Environmental Externalities. Federal Environment Agency, Dessau-Rosslau, Germany.
UBA, 2012a. Methodenkonvention 2.0 zur Schätzung von Umweltskosten. Umweltbundesamt, Dessau-Rosslau.
UBA, 2012b. Schätzung der Umweltkosten in den Bereichen Energie und Verkehr. Umweltbundesamt, Dessau-Rosslau.
Van de Ven, A., Garud, R., 1989. A framework for understanding the emergence of new industries. Res. Technol. Innov. Manage. Soc. 4, 195–225.
VBEW (Verband der Bayerischen Energie- und Wasserwirtschaft), 2014. EEG-Vergütungsübersicht für Inbetriebnahmen ab 1.8. bis 31.12.2014, http://www.vkw.at/downloads/de/842_10_140724_VBEW-Verguetungsuebersicht_EEG2014.pdf (accessed 13.10.14).
Wilson, C., 2012. Up-scaling, formative phases, and learning in the historical diffusion of energy technologies. Energy Policy 50, 81–94.
World Bank, 2014. Turn down the Heat. Confronting the New Climate Normal. World Bank Group, Washington, DC.

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