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ON THE GERMAN AND EU COST DISCOURSE – IS LARGE-SCALE RENEWABLE POWER SUPPLY "UNAFFORDABLE"?

Staffan Jacobsson
Energy and Environment, Chalmers University of Technology*

Volkmar Lauber
University of Salzburg

*Division of Environmental Systems Analysis
Chapter reviewer: Lisa Göransson, Energy Technology, Energy and Environment, Chalmers

INTRODUCTION

Germany's Renewable Energy Act (EEG), adopted in 2000, played a decisive role for the remarkable development and deployment of renewable energy technologies in Germany between 2000 and 2012, and of a capital goods industry able to fulfil that task. It was controversial with some actors from the beginning, essentially with those who opposed its philosophy of an active government's role in the far-reaching transformation of the electricity sector, either for ideological reasons (because they would leave things to the "market") or for reasons of self interest (fossil fuel incumbents threatened by the advance of renewables). However, only since about 2009 has the EEG come in for radical attack from the government. The chief argument behind its discourse is that the transformation of the energy system (*Energiewende* in German) has become too expensive, threatens to sap Germany's economic strength and, therefore, needs to be slowed down and made "affordable". Our goal is to critically analyse this argument by showing that the cost calculations used are highly political in what they take into account and what they neglect, even if they may reach their aim of curtailing *Energiewende*.

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In 2000, the EEG replaced the 1991 Feed-in-Law. It introduced fixed and technology-specific cost covering payments per kWh for 20 years; automatically decreasing payments for new investments; unlimited obligation by grid operators to buy all tendered electricity from renewable sources and priority dispatch. EEG led to i) growth of renewable power production from 29 TWh in 1999 to 144 TWh in 2012, ii) 1.3 million owners of decentralised power plants in 2012 and iii) a German industry employing over 350 000 in 2011.[1] EEG is an unusual and, in some important ways, successful policy which draws its legitimacy from a long history of concern over the risks of nuclear power, forest dieback and climate change. The legitimacy was continuously nurtured by a strong social movement which focused on the long-term *total impact – and costs* – of energy supply.[2]

The large utilities, the energy intensive industry, the Conservative and Liberal Party leaderships and, on several occasions, the Ministry of Economic Affairs attempted, however, to undermine or stop even the modest 1991 Feed-in law and vigorously fought the EEG, both its initial adoption and its subsequent extension in 2004. A temporary pragmatic consensus between Conservatives and Social Democrats ended when a Conservative-Liberal coalition came to power in 2009, arguing the need to restrict the "excessive" deployment of renewables in order to make *Energiewende "affordable".* EU energy commissioner Oettinger fuelled the critique of the EEG as did some academics who suggested that the EEG surcharge levied on consumers to finance investment in renewables constitutes a large "burden" on electricity consumers. A clear shift in the discourse took place from a focus on long-term total costs of energy supply to short-term consumer costs. In early 2013, the Minister of the Environment, Peter Altmaier responded by submitting legislation to stop the increase in electricity bills supposedly caused by the EEG and Liberal members of the government even suggested discarding the EEG entirely.[3]

The German debate on "affordability" spilled over to many EU countries, raising legitimacy questions over this form of support and associated technologies. For instance, it is present in the European Commission's Green Paper which discusses policy for 2030 and where it is argued that a central consideration for future policies is "*concerns of households about the affordability of energy and of businesses with respect to competitiveness*".[4] Another example is the head of the Committee on Industry in the Swedish Parliament, M. Odell, who explicitly links the German price of electricity (for non-privileged customers) of about 28 eurocents to

1 Arbeitsgemeinschaft Energiebilanzen (AGEB) (2013) *Bruttostromerzeugung in Deutschland von 1990 bis 2013 nach Energieträgern.* Berlin, Germany: AGEB; German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (FME) (2012) *Development of renewable energy sources in Germany 2011.* Berlin, Germany: FME.

2 Jacobsson, S. and 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; Dewald, U. and Truffer, B. (2012) The local sources of market formation: explaining regional growth differentials in German photovoltaic market, *European Planning Studies*, 20(3):397-420.

3 Frondel, M. et al. (2010) Economic impacts from the promotion of renewable energy technologies: The German experience. *Energy Policy* 38(8):4048–4056; German Environment Ministry Plans to Cap Subsidies for Renewables (2013). *Der Spiegel*, Jan. 29 [accessed 2014-06-16].

4 EC (2013) *A framework for climate and energy policies.* Green Paper. Brussels, Belgium: European Commission. (COM (2013) 0169).

wind power policy.[5] Yet, a simple calculation reveals that the impact was at most in the order of 0.3 eurocents/kWh in 2012.[6]

Hence, the perhaps most successful regulatory framework for promoting the deployment of renewables, and an associated growth of innovative capital goods industries, was contested from its start. Moreover, it is contested with increasing ferocity at the same time as the International Energy Agency warns about the prospect of towards five degrees global warming.[7]

In this chapter, we reflect on the German cost discourse with special emphasis on the notion of "affordability". We discuss how the discourse (i) misrepresents the impact of the EEG surcharge on consumer costs and (ii) exaggerates the "burden" from renewable electricity by shifting focus from total cost to consumer cost. These two themes involve ascertaining how costs are calculated and therefore what is meant by "cost-efficiency", "subsidy" and "affordability". We then proceed to discuss (iii) inter-generational equity issues arising from our (in)ability to foster the development of new capital goods industries with innovative capabilities. In the final section we identify two complementary explanations of the ferocity of the discourse.

MISREPRESENTING THE EEG SURCHARGE'S IMPACT ON CONSUMER COST

The EEG surcharge is usually discussed as the "extra cost" of renewable electricity supported by EEG payments which is charged to consumers, i.e. the price gap to conventional electricity (fossil or nuclear) as reflected in spot-market prices. It was initially low but rose to 1.2, 3.5 and 5.3 eurocents in 2008, 2011 and 2013, respectively.[8] It would be easy to conclude that there is a growing "burden" on consumers. However, the surcharge is only one element of consumer price – in 2011, it accounted for 14 per cent of household electricity prices,[9] and grew to about 18.5 per cent by 2013. In addition, had the extra costs from EEG installations been allocated evenly across *all* electricity consumers and other distortions been removed, the "burden" from compensating EEG installations in 2013 would have been – according to an analysis widely referred to[10] – 2.3 cents/kWh instead of 5.3 cents.[11] This may well be argued not to be an overly large share of a consumer price of about 28 eurocents.

5 Odell, M. (2014) Dags att trappa ner stöden till vindkraft. *SvD Opinion*. Jan. 27 [accessed 2014-06-16].

6 In 2012, wind power supply was 51 TWh and was remunerated by 8.8 eurocents/kWh. The spot price for electricity was 5.4 eurocents/kWh, see Arbeitsgemeinschaft Energiebilanzen (AGEB) (2013) *Bruttostromerzeugung in Deutschland von 1990 bis 2013 nach Energieträgern*. Berlin, Germany: AGEB; Kuechler, S. and Meyer, B. (2012) *Was Strom wirklich kostet.* Berlin, Germany: Forum Ökologisch-Soziale Marktwirtschaft (FÖS). The extra cost of wind power then equals 1734 million EUR. Dividing with a total electricity consumption of 607 TWh, we come to an added cost of 0.29 eurocents/kWh. This overestimates the added cost as it ignores merit-order effects of wind power (reducing spot market prices) and subsidies for conventional generation (increasing the gap between wind power feed-in tariffs and spot market prices).

7 International Energy Agency (IEA) (2013) *Redrawing the energy-climate map, World Energy Outlook Special Report*. Paris, France: OECD/IEA.

8 German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (2012) *Renewable Energy Sources in Figures*. Berlin, Germany: FME,

9 Traber, T., Kemfert, C. and Diekmann, J. (2011) Weekly Report. German Electricity Prices: Only Modest Increase Due to Renewable Energy expected. *German Institute for Economic Research* 6(7):37-46..

10 Bundesverband Erneuerbare Energie e. V. (BEE) (2012) *BEE-Hintergrund zur EEG-Umlage 2013.* Berlin, Germany: BEE.

11 The cost will increase to 2.54 cents in 2014, see Fraunhofer ISE (2013) *Aktuelle Fakten zur Photovoltaik in Deutschland.* Fig. 15, p.18. Freiburg, Germany: Fraunhofer ISE.

The discrepancy means that there are other cost components in the surcharge. First, a growing range of industries is largely exempted from the surcharge.[12] In 2013, this industry privilege amounted to 1.3 eurocents/kWh, i.e. this part of the "burden" was shifted from industrial firms to small consumers, mostly households and small business.

A second factor increasing the surcharge in 2013 is the reduced spot price of electricity due to the merit-order effect (induced by a growing supply of renewable electricity with priority dispatch status), falling coal prices and declining ETS certificate prices.[13] This meant that the gap between the spot price for electricity and the feed-in rates widened, increasing the need for compensation. This effect was estimated by to account for 0.69 cents/kWh in 2013 and would constitute a benefit rather than a "burden" if the reduced spot price led to reduced household consumer costs, which it does not.[14] As it was, this only benefited industrial firms negotiating their own contracts.

Third, another 0.69 cents was due to balance the surcharge account for 2012, i.e. payments decided on in 2011 were not sufficient to cover the year's cost. This constitutes only a temporary increase in the surcharge.

SHIFTING FOCUS FROM TOTAL COST TO CONSUMER PRICE

The shift from total costs to consumer price means that significant cost items are left out of the analysis. The first are external costs which are those that electricity suppliers and users impose on others without paying for the consequences. These costs are real in that they involve damages, e.g. those who suffer from respiratory diseases or are affected by damages to buildings and those who suffer directly from more frequent climate-related draughts and storms. They are also real for those who have to pay for adjustments to various effects of climate change, for example, the costs of avoiding the flooding of coastal cities. The present "affordability" discourse ignores these cost items altogether or considers the EU emission trading scheme as an adequate answer, which at current prices it is not (and which does not cover all types of emissions).

While calculating external costs of electricity generation is fraught with difficulties, the German Federal Environment Agency estimates these to be about 11 and 9

12 Industry includes not only energy-intensive firms facing international competition but also golf courses, newspapers and cheese makers (Germany to Exempt 1 550 Firms From Power Price Surcharge (2012) *Der Spiegel*, Dec. 24; European Commission Plans to Probe German Renewable Energy Law (2013) *Der Spiegel*, Jul. 15). The initial regulations gave exemptions to firms using more than 10 GWh a year but this was lowered in several steps (Dohmen, F. and Pauly, C. and Traufetter, G. (2013) European Commission Set to Fight German Energy Subsidies *Der Spiegel - Spiegel Online*, May 29). Exempted industry pays some of the lowest electricity prices in Europe, non-exempted industry one of the highest (Strompreis-Kluft spaltet deutsche Industrie (2014) *IWR - Institute of the renewable energy industry,* Oct 24 [accessed 2014-06-17]). Fraunhofer ISE reports that 53% of the electricity consumed by industry was associated with payment of a reduced surcharge (Fraunhofer ISE (2013) *Aktuelle Fakten zur Photovoltaik in Deutschland.* Fig. 15, p.18. Freiburg, Germany: Fraunhofer ISE.). Industry uses almost half of all electricity, households about one quarter.

13 From a peak at 6.8 Ct/kWh in 2009, spot market prices fell about 28% to 4.8 Ct in 2013 (Fraunhofer ISE 2013).

14 Bundesverband Erneuerbare Energie e. V. (BEE) (2012) *BEE-Hintergrund zur EEG-Umlage 2013.* Berlin, Germany: BEE. See also Tveten, A., Bolkesjo, T.F., Martinsen, T. and Hvarnes, H. (2013) Solar feed-in tariffs and the merit order effect: A study of the German electricity market. *Energy Policy* 61:761-770. This phenomenon (reduced spot prices not being passed on to consumers) is usually attributed to lack of competition among suppliers and the fact that suppliers strongly rely on futures so that price reductions are not reflected immediately; some also perceive a lack of market supervision and abuse of the "basic supply" tariff.

eurocents/kWh for soft and hard coal respectively.[15] These estimates are used by Kuechler and Meyer who add a second ignored cost item, subsidies channelled through the state budget, to estimate the total costs of electricity.[16] Table 14.1 contains their cost estimates (column 1), volume of electricity supplied by various technologies (column 2) and total costs associated with each technology in 2012.

A weighted average cost per kWh is then 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. In the table, we use the term legacy cost for renewables since it averages payments to earlier installations, with higher tariffs, and those to new installations, with lower tariffs.

Table 14.1: An estimate of the weighted average total cost of electricity supply for renewables versus coal in Germany in 2012

Technology	Total cost (cents/kWh)	Electricity supply (TWh/year)	Total costs (billion EUR/year)
Renewables (weighted average legacy cost)	15.4		
Onshore wind	*8.0*	*51*	*4.1*
Hydro	*7.6*	*22*	*1.7*
PV	*36.7*	*26*	*9.5*
Coal (weighted average cost)	15.3		
Hard coal	*14.8*	*116*	*17.2*
Soft coal	*15.6*	*159*	*24.8*

Sources: Kuechler and Meyer (2012); AGEB (2013).

As Table 14.1 shows, the weighted average cost per kWh of the three renewables is the same as that of coal and the cost of onshore wind and hydro is much below, i.e. these are not subsidised but cost-efficient. Thus, the "burden" of renewables is negligible when total costs are considered. The contrast with analyses failing to include external costs and subsidies is sharp. An example is Frondel et al. (2010):

> "*…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*".

As Table 14.1 also shows, the historically very high feed-in rates of PV as *legacy* costs have a large impact on the weighted average cost. These are, however, sunk costs and should not form the basis for decisions on future deployment. Current PV feed-in rates are, indeed, much lower (e.g. 9.5 to 13.7 eurocents in January

15 Umweltbundesamt (UBA) (2012) *Methodenkonvention 2.0 zur Schätzung von Umweltskosten*. Dessau-Rosslau, Germany: UBA; Umweltbundesamt (UBA) (2012a) *Schätzung der Umweltkosten in den Bereichen Energie und Verkehr*. Dessau- Rosslau, Germany: UBA.

16 Kuechler and Meyer (2012) calculate total costs for coal power by adding three cost components: a) market price of electricity b) subsidies and c) not internalised external costs. As an example, the cost components for hard coal were 5.4, 1.9 and 7.5 eurocents respectively. For renewable energy technologies, they add the feed-in cost to subsidies and not internalised external costs. We are uncertain how much of the hydropower that receives feed-in remuneration.

2014).[17] As external costs and subsidies are low, *even PV is now becoming competitive with coal in terms of total costs which implies that, henceforth, coal power is the cost-inefficient option*. Moreover, when green-house gases accumulate, the external cost of fossil fuel use will rise.[18]

To conclude, with these German estimates of external costs and subsidies, it is evident that the cost discourse grossly exaggerates the "burden" of renewables and raises strong doubts about arguments referring to "cost-efficiency", "subsidies" and "affordability" when these terms are used in ways that neglect important cost items. Yet, any consumer cost increase puts low-income households under pressure and these have, of course, to be shielded from the cost of transformation.[19]

SHIFTING FOCUS FROM LONG-TERM BENEFITS TO SHORT-TERM COSTS

The shift in focus from *long-term* benefits, in the form of e.g. avoidance of impacts of climate change[20] to *short-term* costs means that the discourse has come to ignore large inter-generational equity issues. Renewables are a major requirement for the civilised survival of future generations, not just one possible option among others (See Chapter 3 for an appraisal of the potential of renewables to fully replace fossil fuels). If we accept this, there are large inter-generational positive externalities coming from building capital goods industries and developing technologies that will be able to provide a rapidly rising volume of "low-carbon" electricity, at reasonable consumer prices, as other energy sources are phased out in the second quarter of this century.

For this to happen, a short-term focus on costs must be replaced by a long-term view allowing for the decades long time-scale in the development and diffusion of new technologies.[21] In the innovation system literature, efforts have been put into assessing the length and character 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.[22] 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 forms) until the market is saturated.

17 Solarförderverein (2013), http://www.sfv.de/lokal/mails/sj/verguetu/htm

18 Umweltbundesamt (UBA) (2012a) *Schätzung der Umweltkosten in den Bereichen Energie und Verkehr*. Dessau- Rosslau, Germany: UBA. argues that these may increase from 80 EUR/t to 145 EUR/t in 2030.

19 See for example discussion in: International Energy Agency (IEA) (2013) *Energy Policies of IEA Countries, Germany, 2013 Review*. Paris, France: OECD/IEA.

20 Additional expected benefits are reduced problematic imports and reduced consumer costs of electricity as renewable technologies come down in price.

21 Grübler, A. (1996) Time for a change: On the patterns of diffusion of innovation. *Daedalus* 125(3); Carlsson, B. and Jacobsson, S. (1997) Variety and Technology Policy - how do technological systems originate and what are the policy conclusions? In Edquist, C. (ed). *Systems of Innovation: Technologies, Institutions and Organizations*, London, UK: Pinter; Jacobsson, S. et. al. (2009) EU renewable energy support policy: Faith or facts? *Energy Policy* 37(6): 2143–2146; Wilson, C. (2012) Up-scaling, formative phases, and learning in the historical diffusion of energy technologies, *Energy Policy* 50:81–94.

22 Jacobsson, S. and Bergek, A. (2004) Transforming the energy sector: the evolution of technological systems in renewable energy technology. *Industrial and Corporate Change*, 13(5):815:849; Suurs, R. (2009) *Motors of sustainable innovation. Towards a theory on the dynamics of technological innovation systems*. Innovation Studies Group, Copernicus Institute, Utrecht University; MacKerron, G. (2011) Renewable energy and innovation policies: European experience. Presentation. *International workshop on Innovation policies and structural change in a context of growth and crisis*. Rio de Janeiro, Sep.13-15.

Onshore wind and PV have gone through the formative phase and can now be deployed on a large scale with total costs lower than coal (Table 14.1). The 1991 feed-in law and EEG greatly contributed to the formation of capital goods industries and the maturation of these two technologies. Another potential large source of low-carbon electricity in Germany is offshore wind power but this innovation system is still in the formative phase (see Chapters 15-16). The annually installed new capacity of offshore wind turbines in Europe increased from 0.9 GW in 2010 to 1.2 GW in 2012 and is estimated to increase to 1.9 GW in 2014. If we are to reach the targets for the EU of 44 GW in 2020[23] and 200-300 GW by 2050,[24] the addition of new power plants needs to grow to almost 10 GW per year in the coming decade and thereafter remain at that level.

A northern European supply chain is, indeed, being developed and Germany is integral to this effort, both as a market and a supplier of capital goods and services. Danish and German firms dominate the market and large investments are made in the whole value chain, including harbours, to develop a supply capacity. However, the proposed cap on EEG payments by Minister of the Environment, Peter Altmaier (see above) led to large political uncertainties and made investors hesitant. Ronny Meyer, managing director of industry association WAB, informed that “the market has collapsed” and, in summer 2013, the Cuxhaven harbour, which invests substantially in infrastructure to enable deployment of turbines, sent out a plea to the government to reduce uncertainties.[25] Hence, the discourse focus on short-term consumer costs, and the associated political uncertainties, puts at risk the formation of a supply chain large enough to develop and deploy offshore wind turbines on the required scale, in time and at a reasonable cost.

Offshore wind is just one example of a technology that is far from being “market ready” and in need of support such as the one granted by EEG in the past. Other technologies – more relevant for other countries than Germany – include wave and tidal power and concentrated solar power. For their early availability, and thus for phasing out fossil fuels and – in the European case – for reducing dependence on energy imports, it makes a big difference whether they are only supported by R&D or also by an appropriate level of market creation of the kind achieved by EEG in the past.

The focus on short-term costs obscures the need to form growing protective market spaces to take the technologies through their formative phase and into the growth phase. With the long time-scales involved (and associated learning costs), current investments should not only be judged by their present costs but also by their contribution to reduce future costs of avoiding climate change by enabling

23 This is the current targets of EU member states, see Beurskens, L., Hekkenberg, M. and Vethman, P. (2011) *Renewable Energy Projections as Published in the National Renewable Energy Action Plans of the European Member States*. Petten, the Netherlands: ECN and EEA. (ECN-E--10-069). In our scenario, the 2020 goal of 44 GW is reached in 2022.

24 In European Commission (2011) *Energy Roadmap 2050, Impact assessment and scenario analysis.* Brussels, Belgium: European Commission (SEC (2011) 1565)., the average supply of offshore wind power in five decarbonisation scenarios is 818 TWh which is equal to 234 GW installed capacity with a 40% capacity factor.

25 *Der Spiegel* (2013b); Bündnis unterzeichnet Cuxhavener Appell (2013) *Handelsblatt* Aug. 26 [accessed 16 Oct 2013].

the development of a capital goods sector and other parts of the supply chain. An appropriate cost concept should therefore also include long-term benefits from learning, strengthening the economic case of renewables further.[26]

The German Liberals, some economists, the German Council of Economic Experts and the Monopoly Commission maintain, however, a short-term view and argue that a reduction in the "burden" would be achieved by a quota system, such as the Swedish "technology-neutral" system of tradable green certificates in the electricity system for renewables.[27] Unlike the highly differentiated German feed-in system, such a system – unless it provides for technology banding (i.e. granting more certificates for specific technologies, a crude imitation of the differentiation allowed by feed-in tariffs)[28] – provides incentives to invest in only the *currently* most cost-efficient technologies and may, therefore, appear attractive with today's German cost discourse.[29]

Yet, it does not drive technical change more than incrementally since it does not stimulate the formation of the markets required to induce the build-up of new supply chains until lower-cost technologies have saturated their markets.[30] In response, it is often argued that immature technologies should not be fostered by market formation policies but rather by R&D policy. For instance, Frondel et al., 2010, p. 4055, argue that: " …one should have abstained from strongly subsidizing the market penetration of relatively immature PV technologies. Rather, from an economic perspective, R&D funding should have increased first".

It is, however, only in the much criticised linear model of innovation that the innovation process constitutes a smooth flow down a one-way street,[31] i.e. where research leads to development, development to production and production to market diffusion and where, hence, (academic) 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 has to be supplemented by market formation in order to stimulate the formation of a capital goods sector and induce it to conduct R&D, product development and other measures that drive down cost (e.g. standardisation efforts). Hence, while in the linear model markets materialise after a technology is fully developed, real life technologies co-evolve with markets. The limitation of a pure quota system

26 See e.g. Sandén, B. (2005) The economic and institutional rationale of PV subsidies, *Solar Energy,* 78(2):137-146; Sandén, B. and Karlström, M. (2007) Positive and negative feedback in consequential life-cycle assessment, *Journal of Cleaner Production* 15(15): 1469–1481.

27 Frondel, M. et al. (2010) Economic impacts from the promotion of renewable energy technologies: The German experience. *Energy Policy* 38(8):4048–4056; Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung (2012) *Jahresgutachten 2012/13*, chapter 7 (III), 279-297, [2013-10-31]; Monopoly Commission (2013) *Monopoly Commission publishes Special Report on the situation of competition on the energy markets*. Press release. [2014-06-30].

28 Such banding (introduced in the UK Renewables Obligation) also makes a quota system more expensive.

29 It should be noted that the German association of electricity incumbents does not think that this system is able to resolve current problems and now supports market premiums, see IWR (2013) *Empfehlungen der Monopol-Kommission: Energiewirtschaft lehnt das Quotenmodell ab*, Sep. 5 [accessed 2013-10-28].

30 Jacobsson et al., 2009; Bergek, A. and 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. See also Azar, C. and Sandén, B. (2011) The elusive quest for technology-neutral policies. *Environmental Innovation and Societal Transitions* 1(1):135–139, on the concept of "technology-neutrality".

31 Kline, S. and Rosenberg, N. (1986) An Overview of Innovation. In *The Positive Sum Strategy: Harnessing Technology for Economic Growth*, Washington DC, USA: National Academy Press.

(without technology banding) is, thus, that it does not contribute much to "putting new technologies on the shelf"[32] through providing the time and markets required for fostering new capital goods industries with innovative capabilities.[33] An extensive use of a quota system would, therefore, mean that we risk failing to provide future generations with the ability to supply carbon-neutral electricity on a large scale with technologies that have gone through decades of improvement.

CONCLUDING DISCUSSION – TOWARDS EXPLAINING THE FEROCITY OF THE DISCOURSE

In sum, the cost discourse is not only extremely weak and misleading but also ferocious. We conclude by pointing to a few contributing explanations to its ferocity, acknowledging that there are more.

The German discourse is not unique but reflects a broader, partly ideological, debate between those arguing the advantages of industry- or technology-neutral policies[34] 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 and the long time-scale involved in building such industries.

In the former camp of the German debate, we find those who (i) emphasise high consumer costs of new technologies and not their total costs; (ii) take a short-term view on both costs and required learning periods; (iii) neglect or play down the role of market formation in innovation and cost reduction and (iv) neglect the volume of past development and deployment support to conventional generation which reached hundreds of billions of EUR.

In the latter, we find those who (i) emphasise total costs, including costs for environmental degradation; (ii) take a long-term view on costs and required learning periods and (iii) argue that market formation is central to innovation and cost reduction. To an extent, the ferocity of the debate can be explained by these diametrically opposite views on the nature of large-scale transformation processes and the different roles to be played by the state.

As much of the debate has centred on the cost of PV, it is though important to acknowledge that in 2010-2012, the inordinate cost of new PV installations in Germany (22.5 GW in three years) impacted very strongly on the surcharge (Table 14.1). The problem arose because the price of modules decreased much faster than the feed-in tariff, creating extra profits and drawing new investors – and because no decisive steps were taken in time. But this is a legacy cost item in the surcharge that will not come down even if a quota system is installed today.

32 Sandén, B. A. and Azar, C. (2005) Near-term technology policies for long-term climate targets—economy wide versus technology specific approaches. *Energy Policy*, 33:1557-1576.

33 As the diffusion of renewables increases, there is a growing need for additional policies to support e.g. demand-side management (Chapter 10), electric grids (Chapter 9) and energy storage technologies (Chapter 5 and 12). For the latter, the German government has a programme involving 100 million EUR in investment support just for batteries connected to small PV systems. Grid financing also takes place outside of the EEG.

34 Although these are inspired by neoclassical economics, it is noteworthy that some neoclassical analysts participating in the debate, e.g. Frondel, M. et al. (2010) Economic impacts from the promotion of renewable energy technologies: The German experience. *Energy Policy* 38(8):4048–4056, neglect external costs.

In a long-term perspective, the central observation is that PV has now become so cheap that the impact of its future deployment on the surcharge will be very modest.

Yet, the divide is also due to genuinely conflicting economic interests of firms. Schumpeter once argued that

> *… in capitalist reality as distinguished from its textbook picture, it is not that kind of competition*[35] *which counts but competition from the new commodity, the new technology, the new source of supply, the new type of organization – competition which commands a decisive cost or quality advantage and which strikes not at the margins of the profits and the outputs of existing firms but at their foundations and very lives.*[36]

The large utilities which neglected to invest significantly in renewable generation are now threatened by declining market shares and lower prices for conventional generation, particularly at hours of peak demand when PV is abundant (see Chapter 2 and 11). In a perhaps overstated case of their pain, the Economist 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".*[37]

The current wave of investment in new coal generation plants in Germany – one of the biggest since post-war reconstruction– is likely to exacerbate that problem.[38] Indeed, Becker (2011) paints a dramatic picture of the prevailing relations between the two systems, fossil vs. renewables: two trains headed for each other at full speed on the same track, with a crash impending.[39] Hence, behind the ferocity of the discourse also lurk the vested interests of a threatened industry, forming a discourse coalition with those arguing for a passive state, aiming to protect a status quo which threatens future generations (see also Chapter 13).

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35 "That kind of competition" refers to price competition and competition within a rigid pattern of invariant conditions, methods of production and forms of industrial organisation.

36 Schumpeter, J. (1943) *Capitalism, Socialism and Democracy*. New York, NY, USA: Harper.

37 European utilities: How to lose half a trillion euros. Europe's electricity providers face an existential threat (2013) *The Economist*, Oct. 13. [accessed 2013-10-06]. In 2013, RWE made its first loss in sixty years, though only partly in connection with *Energiewende*.

38 International Energy Agency (IEA) (2013) *Energy Policies of IEA Countries, Germany, 2013 Review*. Paris, France: OECD/IEA.

39 Becker, P. (2011) *Aufstieg und Krise der deutschen Stromkonzerne*. Bochum, Germany: Ponte Press Verlag GmbH.

Finally, the European Commission made several attempts in the past to ban "German-style" feed-in tariffs or at least to subject them to state aid control (which would probably come close to banning them). Up to now Germany was a strong opponent of such moves. Things are likely to be different with new Commission efforts under way in early 2014. In the name of affordability and industrial competitiveness, these proposals aim to slow down the shift to renewables via low targets for 2030 (27 per cent overall, just seven per cent more than for 2020) and strict limits to support for technologies as soon as they have a European market share of 1-3 per cent.[40] If adopted, this may well put an end to EEG-style energy system transformation and similar efforts elsewhere in the EU. It would be tragic if a weak and flawed cost discourse is allowed to contribute to such an ending.

40 EC (2013) *Draft guidelines for environmental and energy State aid, 2014-2020*. Brussels, Belgium: European Commission.