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Decarbonizing Germany's Power Sector

Ending Coal with A Carbon Floor Price?

Felix Christian MATTHES

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ifri Center for Energy

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Abstract

Germany has a long tradition of climate policy programmes with ambitious greenhouse gas emisson reduction targets and comprehensive climate and energy policy packages.

However, the target-driven policy approach increasingly faces challenges due to the lack of progress on greenhouse gas emission reductions in key sectors, i.e. the power, the transport and the building sectors. Without additional policies and measures, Germany is to miss its 40% emission reduction target for 2020 by 7 to 8 points and will not be on track to reach its emission reduction targets for 2030 which were specified for the different sectors in Germany's Climate Action Plan 2050 for the first time in 2016.

Although the German power sector experienced a strong growth of power generation from renewable energy sources, the sector's greenhouse gas emissions almost stagated over the course of the last years. This is essentially a result of the fact that the large coal-based power generation fleet maintained its production levels and the surplus generation was increasingly exported to neighboring countries. Coming from an allmost balanced cross-border exchange of electricity at the turn of the millenium, the net electricity exports amount currently to a share of 8 % to 9 % of total production.

Since 2014, the lacking emission reduction in the power sector has triggered an increasing political debate on coal phase-out which has led to a first round of forced decomissioning of lignite-fired power plants which was, however, linked to significant compensation payments. The next steps of coal phase-out have been subject to controversial discussions in the recent efforts for building a new government coalition after the federal elections in 2017 and will definitely remain on the political agenda for the upcoming years.

Germany's system of energy taxation is complex and inconsistent from the persepective of (implicit) carbon pricing and needs updating and streamlining to live up to the recent challenges and future needs in the framework of the energy transition (broader incentives for emission reductions, sector integration etc.). The interest in carbon pricing has grown significantly during the last years and this creates a window of opportunity for concerted action on carbon pricing between Germany and its neighbors.

With a view on the French effort to complement the traditional energy taxes by a CO_2 adder, a closer cooperation and convergence of energy taxation approaches could add significant value to both countries' climate and energy policy. Introducing a carbon floor price for power generation within the European Union Emissions Trading System – EU ETS - should, however, be a key priority at least for the countries that are interlinked by the Central Western European regional power market.

Such a regional price floor would increase the integrity and consistency of greenhouse gas emission reduction efforts in the participating countries and make a significant contribution to the emerging coal phase-out in countries like Germany, France, the Netherlands or Denmark. If static and also dynamic effects are considered, carbon price levels of € 15 to € 25 would trigger significant emisson reductions and very significant emission reductions could be achieved at price levels of € 30 to € 35. The introduction of a regional carbon floor price for electricity generation faces however legal, technical and political challenges.

- For Germany, restrictive legal constraints need to be considered which would potentially require new approaches for harmonization of carbon pricing outcomes.
- Finding accountable mechanisms to make the compensation for indirect CO_2 costs for electricity-intensive industries (20-25 % of industrial electricity consumption in Germany) available also in the framework of a carbon price that is not triggered by the EU ETS will be crucial (the British model of a carbon floor price is the most promising model here).
- Dealing with political narratives around winners and losers of a floor price is a key prerequisite for its successful implementation.

With respect to the existing and emerging political narratives it will be important to frame a carbon floor price which is part of a larger package :

- making the initiative part of a broader and accountable energy policy package that includes carbon pricing as part of a transformative effort towards a sustainable energy system and deep decarbonization (phase-out of coal and nuclear);
- making the carbon pricing effort part of a pro-European narrative but delinking it from highly controversial and highly politicized issues like European funding mechanisms; and
- making the carbon price floor part of a high-level initiative that creates a robust policy arena.

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Introduction

German energy and climate policies are at a crossroads. Building on a history of climate policy programmes, target-driven policies and technology-specific approaches, the next policy steps which Germany will have to undertake face major challenges. It will be no longer possible to escape from tighter interventions on coal-based power generation and more transformative approaches for the transportation sector, both being highly sensitive sectors in German politics.

In this context carbon pricing approaches are gaining new attention in different areas and not only in Germany. There is plenty of opportunity to design more consistent and effective carbon pricing mechanisms for different sectors in different Member States of the European Union (EU). For the sectors regulated by the European Union Emission Trading System (EU ETS) a carbon pricing gap of up to ten years is foreseeable. The next review and reform cycle for the EU ETS will, however, come too late to put on track at the right time the necessary modernization measures, especially for the power sector. Due to this challenge the interest in national or regional carbon floor prices is growing in Germany as well as in France, the Netherlands and in other Member States of the EU.

The purpose of this paper is to provide some background on the energy and climate policy background for Germany, the recent situation with regard to carbon pricing in the country and the perspective of carbon pricing approaches. It will include a special reflection on the potential and the needs for cross-border cooperation on carbon pricing, including a specific focus on a concerted carbon floor price for the power sector. It is structured and written for an audience that is not deeply involved in German energy and climate policies or politics and is not familiar with the traditions, potentials and restrictions of energy and climate policy-making or with the specifics of the German power sector. It shall allow structural insights but also provide some numerical foundations of key issues or contexts.

The paper is structured as follows: Section 2 provides some information and data on the historical context with regard to climate programmes and greenhouse gas emission reduction targets as well as data on emission trends at aggregate levels. Section 3 contains some more detailed information on the role and the specifics of the German power sector with a specific focus on the coal-based power generation and the

debate on a managed decline of coal-fired electricity generation. Section 4 discusses the recent status, the potentials and perspectives of carbon pricing in Germany and from a German perspective but also with a view to cross-border cooperation. Section 5 deals with some important specifics of the arguments and narratives related to the specific French situation which need to be considered for successful cross-border cooperation. Section 6 summarizes key points of the analysis and makes some suggestions for the way forward.

The essay is based on a review of a broad range of literature, personal experience from debates in the academic arena and from exchanges with policy makers. It provides personal views and assessments and does not reflect at any point an official or institutional position.

Germany's Greenhouse Gas Emission Trends and Targets and the Role of the Electricity Sector

Germany has a long tradition of climate policy programmes which specify greenhouse gas emission reduction targets and at the same time policies and measures for implementation.

These climate policy programmes have usually been updated in two year cycles (with the exception of the period between 2000 and 2007) and are characterized by a general trend towards higher climate policy ambitions (Table 1):

- The first explicit greenhouse gas emission target was laid down in the first Climate Policy Programme which was approved in June 1990. The carbon dioxide (CO_2) emission reduction target was set at 25% below the levels of 1987. In the same year, at least for the new Eastern states of Germany, a tighter CO_2 emission reduction was envisaged.
- With the third Climate Policy Programme (1994) the range of CO_2 emission reductions for 2005 was widened from 25 to 30 % on the basis of the 1987 emission levels.
- Following Germany's announcement at the first Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) the fourth Climate Policy Programme changed the 25 % CO_2 emission target to the base year 1990: this new base year effectively set the target to the upper range of the previous target of 30%, based on the 1987 emission levels.
- The fifth Climate Policy Programme complemented the CO_2 emission reduction target from the previous programmes with Germany's commitment under the Kyoto Protocol to the UNFCCC. This commitment differed significantly, however, from the previous target in terms of the time horizon (2008-2012) and the scope of the commitment, which was shifted from CO_2 to the six greenhouse gases that were regulated by the Kyoto Protocol.
- After a seven years period in which the climate policy programmes

were not updated, the German Integrated Energy and Climate Programme introduced in 2007 targets for 2020 for the first time. This 2020 target was set at 30 % on a unilateral basis and at 40% under the condition that the EU would establishes comparable ambitions.

- The German Energy Concept of 2010 was essentially geared to extending the lifetime of the German nuclear power plants beyond the limits negotiated with the operators of nuclear power plants in 1990. These earlier limits of plant lifetime were made legally binding after the revised Nuclear Energy Act entered into force in 2002. This decision on nuclear policy was, however, accompanied by a broader framework of energy and climate policy targets which included a now unconditional 40% greenhouse gas emission reduction targets for 2020 and newly introduced longer term targets (55 % for 2030, 70 % for 2040 and 80 to 95 % for 2050).
- As a consequence of the Fukushima Daichii nuclear disaster, the German government and the Federal Parliament in 2011 reversed the decision on lifetime extensions for nuclear power plants (and slightly accelerated the phase-out schedule of 2002 by approximately 3 years) but explicitly approved the other elements of the Energy Concept of 2010.

Table 1 – Climate change programmes and emission reduction targets for Germany

Year	Climate Policy Program	Key targets (all programs contain also policies & measures)
1990 (Jun)	First Climate Policy Programme (West Germany)	CO_2 emission reduction of 25% by 2005 (compared to 1987)
1990 (Nov)	First Climate Policy Programme (incl. E Germany)	CO_2 emission reduction of 25% by 2005 (compared to 1987) and more in East Germany
1992	Second Climate Policy Programme	CO_2 emission reduction of 25-30% by 2005 (compared to 1987)
1994	Third Climate Policy Programme	CO_2 emission reduction of 25-30% by 2005 (compared to 1987)
1997	Fourth Climate Policy Programme	CO_2 emission reduction of 25% by 2005 (compared to 1990)
2000	National (Fifth) Climate Policy Programme	CO_2 emission reduction of 25% by 2005 (compared to 1990) GHG-6 emission reduction of 21% by 2008/2012 (compared to 1990)
2007	Integrated Energy and Climate Programme	GHG-6 emission reduction of 30% (unconditional) or 40% (conditional) by 2020 (compared to 1990)
2010	Energy Concept	GHG-6 emission reduction of 40% by 2020 (unconditional), 55% (2030), 70% (2040), 80-95% (2050, compared to 1990), energy efficiency & RES targets
2011	Energy Concept and Nuclear Phase-out	GHG-6 emission reduction of 40% by 2020, 55% (2030), 70% (2040), 80-95% (2050), all unconditional and compared to 1990, nuclear phase-out by 2022
2014	Climate Action Programme	Gap closure for GHG-6 emission reduction of 40% by 2020 (compared to 1990)
2016	Climate Action Plan 2050	Approval of 2020, 2030, 2040 and 2050 targets, sectoral targets for 2030

Notes:
1. Germany's National Climate Change Programmes are embedded in European Union Climate Policy Programmes/ Packages (2000, 2005, 2008, 2011, 2014, 2017/2018)
2. All German and EU programmes were based/accompanied on/by extensive modelling exercises (modelling cycles of typically 2 years)

Source: Compiled by the author.

After it became clear in the course of 2013 and 2014 that the policies and measures implemented to date would not be sufficient to meet the 40% target for 2020, a Climate Action Programme was approved that year which contained additional measures (especially for the power sector) to close the emission reduction gap for 2020. As part of the 2014 Climate Action Programme, the German government developed a Climate Action Plan 2050 to be adopted in 2016, which approved the long-term targets and contained new sectoral targets to improve the accountability for the policies and measures for reaching the targets for 2030 and beyond. The Climate Action Plan 2050 will be subject to an impact assessment in 2018 and a specification of the necessary policies and measures.

German energy and climate policy is a typical target-driven policy with a target framework that evolved over time and became, on the one hand, more comprehensive and complex over time, partly driven by technology specific orientation (nuclear, renewables etc.) and partly driven by an attempt to improve the accountability of targets and the respective policies and measures. On the other hand, the target framework became more and more long-term to improve the consistency of policies and measures with

regard to the lifetime of relevant capital stocks, the necessary lead-times for infrastructure adjustments and the necessary innovation cycles.

Table 2 – Energy and climate policy framework for Germany

	Targets as of …												
	2010	2016	2016	2016	2016	2016	2010	2014	2010	2010	2010	2010	2011
	Greenhouse gas emissions						Renewable energies		Energy efficiency				Nuclear energy
	Total	Energy sector	Buildings	Transport	Industry	Agri-culture	Gross final energy	Power gene-ration	Primary energy	Space heating	Final energy ransport	Electricity con-sumption	
2011													-41%
2015													-47%
2017													-54%
2019													-60%
2020	-40%						18%	35%	-20%	-20%	-10%	-10%	
2021													-80%
2022													-100%
2025								40 to 45%					
2030	-55%	-61 to -62%	-66 to -67%	-40 to -42%	-49 to -51%	-31 to -34%	30%						
2035								55 to 60%					
2040	-70%						45%	65%					
2050	-80 to -95%						60%	80%	-50%	-80%	-40%	-25%	
Base year	1990	1990	1990	1990	1990	1990	-	-	2008	2008	2005	2008	(2010)

Source: Compiled by the author.

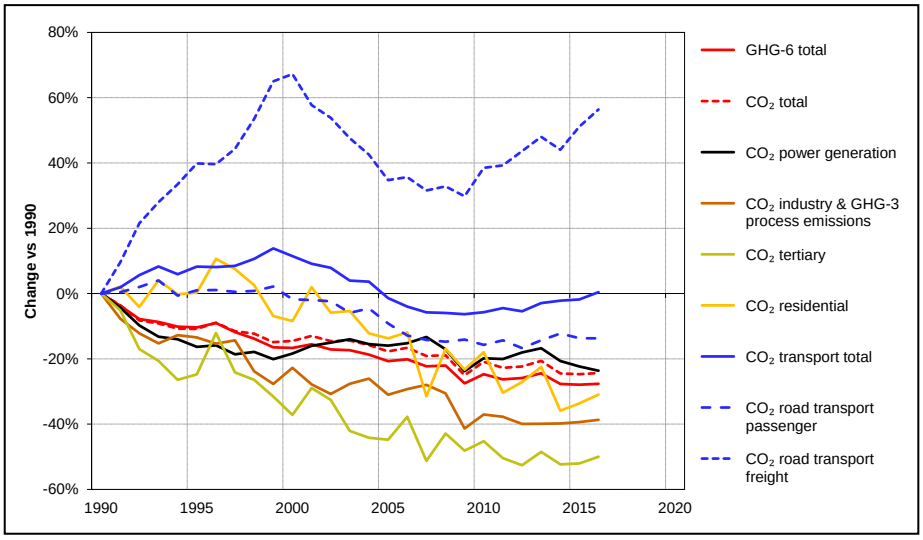
The target framework (Table 2) of German energy and climate policy is linked to the efforts of the EU and its different energy and climate packages or legislation from 2000 onwards. To a large extent it was harmonized step by step with the European programmes or policies and measures.

Germany's climate and energy policy follows clearly a target-driven approach. Although all climate and energy policy programmes of the last 27 years not only contained targets but also triggered a wide range of policies and measures with an increasing intensity of intervention and large-scale financing mechanisms. The policies and measures or its outcomes were, however, not or only partly sufficient to deliver the climate and energy targets of the past or for the short-term future (Figure 1):

- The greenhouse gas emissions in unified Germany declined sharply by 10 % from 1990 to 1995. A more in-depth analysis shows that the contributions from one-off structural change and the strongly accelerated modernization process in Eastern Germany during the 1990ies amount approximately to 10 percentage points of emission reduction achieved in Germany to date. It should be pointed out, however, that both processes, the structural change and the rapid modernization process in Eastern Germany required enormous financial transfers.

- The CO_2 emission levels stagnated at around -15 % from 1995 for approximately a decade. The rapidly increasing living standards with regard to transportation and housing especially in the Eastern states largely compensated (in the residential sector) or overcompensated (in the transportation sector) the strong political efforts to improve energy efficiency and to shift the energy supply to cleaner fuels. Equally important, the CO_2 emission levels in the power sector started to stagnate after the growing private and the industrial electricity consumption, partly driven again by the trends in Eastern Germany, outpaced the modernization of the power plant fleet.
- The 2005 target for a reduction of CO_2 emissions by 25 % was clearly missed by 7 points. During the subsequent 10 years period, the CO_2 emissions slightly decreased by nearly another 10 points but started stagnating again around 24 % in the most recent years.
- The emission reduction of all greenhouse gases (GHG-6) was less steep during the 1990s and follows steadier trend over the last 27 years. The higher emission reductions achieved for non-CO_2 greenhouse gases, as a result of structural change in agriculture but also of effective policies and measures with regard to waste management and strong emission reductions for industrial process emissions, made the key contribution for overachieving Germany's emission reduction commitment for the period from 2008/2012 (-25 % compared to the commitment auf -21 %).
- The level of achieved emission reductions by 2016 (-28 %), however, clearly shows that it will be extremely difficult to reach the 40% target for 2020 and to get back on track for reaching the 2030 (-55 %) targets. Actual projections show that with the additional measures taken recently (forced shut-down of 2.8 GW of old lignite power plants, broader support for new investments in combined heat and power plants etc.), an emission reduction of 32 % to 33 % can be achieved within the system boundaries of national accounting for greenhouse gas emissions by 2020.

Figure 1 – Greenhouse gas emission trends for Germany



Source: National inventory report, AG Energiebilanzen, calculations by author.

Against the background of the traditionally target-driven approach in German energy and climate policy, the outlook in terms of missing the national greenhouse gas emission reduction targets (and potentially also the EU target for the expansion of energy supply from renewable energy sources) has triggered heated political debates about the reasons for this situation and some action on additional policies and measures (see section 3).

The German government, however, officially and repeatedly reaffirmed their aspiration to meet the 40 % emission reduction target by 2020.

A closer look at the sectoral emission trends clearly underlines the key reasons for the stagnation in greenhouse gas emission reductions. Besides the fact that additional efforts will be needed for all sectors, two sectoral trends are of specific importance:

- The emission reduction from the power sector – by far the sector with the highest emissions (approx. 40 % of total greenhouse gas emissions) – was lower than the total greenhouse gas or CO_2 emission reductions since 2003 and has more or less stagnated since 2010. A key determinant for this trend is the almost unchanged level of CO_2 emissions from German coal-fired power plants and the huge increase in net electricity exports from Germany. These were driven by the existing fleet of coal-fired power plants and the favourable energy market environment, namely the relatively high coal-gas price spreads and the low allowance prices in the EU ETS. Without these significant net electricity exports, Germany would be 4 to 5 percentage points closer to meet its emission reduction target for 2020.

- The emissions from the transport sector – the second largest emitting sector (approx. 20 % of total emissions) – grew from 1990 to 2000 as a result of the rapidly increasing motorization, especially in Eastern states of Germany. In the subsequent years up to 2007, the sector's greenhouse gas emissions fell under the base levels of 1990 but then started to stagnate and increase again from 2011 onwards. In 2016 the emissions from transport reached the base level of 1990 again. It is worth noting, however, that the total emission trends of the transport sector are a result of quite different trends for passenger transport on roads (approx. 11 % of total greenhouse gas emissions) and freight transport on roads (approx. 6 % of total emissions). The CO_2 emissions from cars were almost constant from 1990 to 2000, declined in the subsequent decade by 14 % and have remained stagnant since then. The emission trends of freight transport offset, however, even the small emission reductions and was the main driver for the return to increasing emission trends after 2010.

The evidence from emission trends and the underperformance of the many policies and measures implemented to achieve the different targets over time as well as the major political turmoil created by the fraud and gaming of car manufacturers with respect to emission limits (and the great challenges that German cities are facing with conventional air pollution and an increasingly tighter court ruling in the relevant legal cases) led to new political momentum in three dimensions:

- The power and the transport sectors gained much greater attention in public and political debates about energy and climate policy;
- The perception of policy mechanisms changed significantly: debates about pricing policies but also tougher command and control approaches gained momentum;
- The role of diesel (which was thought to deliver major greenhouse gas emissions but did not do this for a variety of reasons) is increasingly being perceived with greater skepticism and the debate on the role of natural gas is gaining momentum (although there is still controversy about the role of gas in the transport sector and for the long term).

At the intersection of these structural changes in the energy and climate policy debates, driven by an unchanged and still highly respected role of the target framework, a new window of opportunity for cross-border cooperation is opening which goes beyond the traditional national approaches and the EU-wide cooperation.

The most promising field of cooperation relates to the power sector given its role for the German emission balance, the strong electricity market integration and the lack of sufficient progress in EU-wide policies and measures. The lack of progress in the transport and the building sector indicates, however, that more cooperation and convergence, especially of pricing policies, could add significant value to the national energy and climate policies which focus on these sectors.

Recent and Emerging Debates on Emission Reductions in the Power Sector and Coal Phase-Out in Germany

As highlighted in section 2, the power sector is the single most important sector for German greenhouse gas emissions. The stagnating emission trends for this sector seem however counter-intuitive with respect to the major structural changes in the German power sector during the recent years (Figure 2):

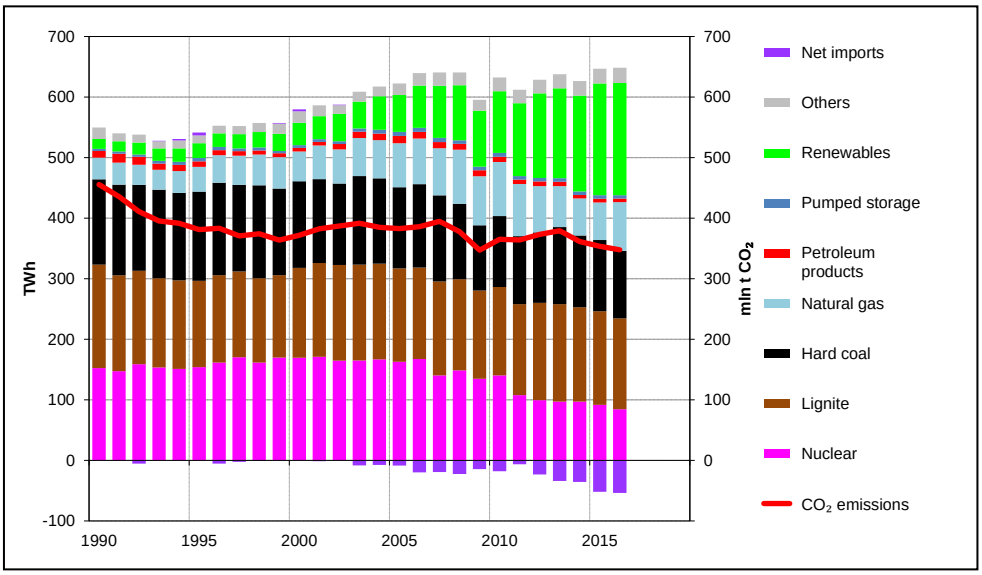
- The most significant change was the roll-out of power generation from renewable energy sources after the turn of the millennium. Starting with a share of approx. 5 % in total power generation, the share of renewables exceeded the level of 30 % in 2015 and will surpass 35 % in 2017. The installed capacity of renewable power plants increased from 13 % to almost 50 % in the same period.
- In 2006, 2011 and subsequent years the nuclear phase-out took effect. Compared to the highest production levels around the turn of the millennium, nuclear electricity generation fell by about 50 % by 2016. It should be pointed out, however, that the decline in nuclear generation from 2000 to 2016 was approx. 40 % less than the increase of power generation from renewables over this period.
- The power generation from lignite, with some fluctuations, has remained almost unchanged for the last 25 years and represents a share in total power generation of 24% in recent years.
- Power generation from hard coal was almost constant for the years from 1990 to 2007, declined by approx. 20 % after this but has remained at an almost constant level since 2010 onwards and represented a share of 18 % in 2016.
- Power generation from natural gas comes mainly from gas-fired cogeneration plants and increased slightly after 2005 but shrank again after 2010 due to the unfavourable energy market environment. In

2016 and 2017, the gas-fired power generation recovered slightly with an increasing share in total power generation from approx. 10 % in 2015 to 13 % in 2016 and 2017.

- As a result of the effective oversupply and the competitive situation compared to the power generation fleets of many neighbouring countries there were huge increases in net electricity exports from Germany after 2005, specifically from 2013 onwards. In the most recent years, between 8 % and 9 % of the total net power generation was exported. A more detailed analysis of the seasonal patterns (Figure 3) shows very robust patterns for the last years: Electricity imports are rather constant over the year and electricity exports peak in the winter months and decrease during the summer, reflecting the relatively low marginal costs of the generation fleet.[1]
- As a result of the slowly changing production of the German coal fleet and the increasing net electricity exports, the CO_2 emissions from power generation have stagnated, with some fluctuations, or declined only slightly over the last 25 years. Against the background of their position in the power market, the net electricity export surplus can be attributed to the coal fleet with their comparatively high emissions. If these net electricity exports had been avoided based on adjustments to the coal generation fleet that would have changed capacities or production patterns, the gap for achieving Germany's 40 % greenhouse gas reduction target for 2020 would be 4 to 5 percentage points lower than currently expected (approx. 7 to 8 points) and German climate policy would be performing much better in terms of its national targets.

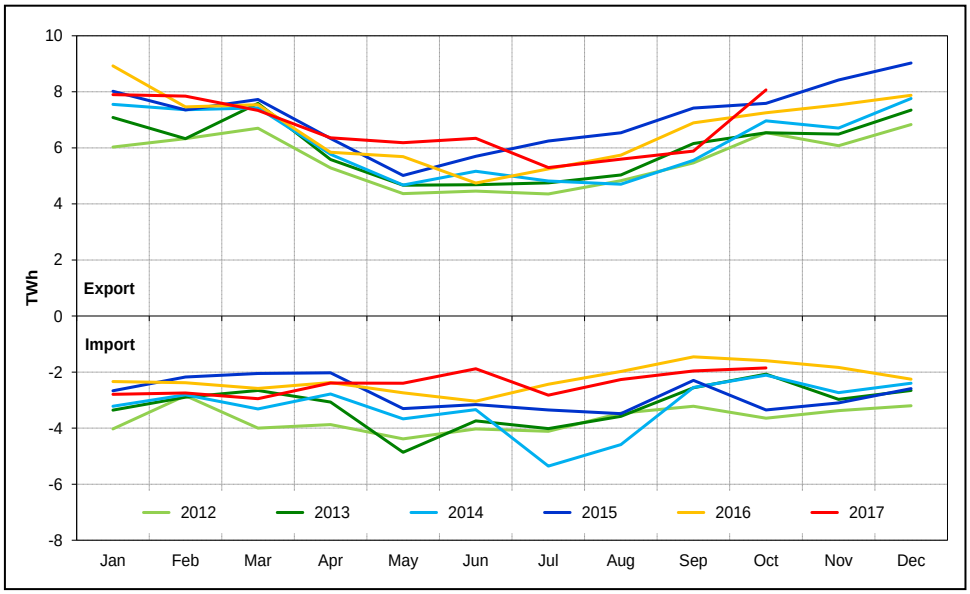
1. A series of modelling exercises shows Germany will be a net exporter of electricity also after the nuclear phase-out. Only for scenarios with an additional and very short-term phase-out of coal in power generation, Germany would need to rely on net electricity imports at least for an interim phase and at a limited scale.

Figure 2 – Electricity generation by fuel source and CO_2 emissions from power generators in Germany



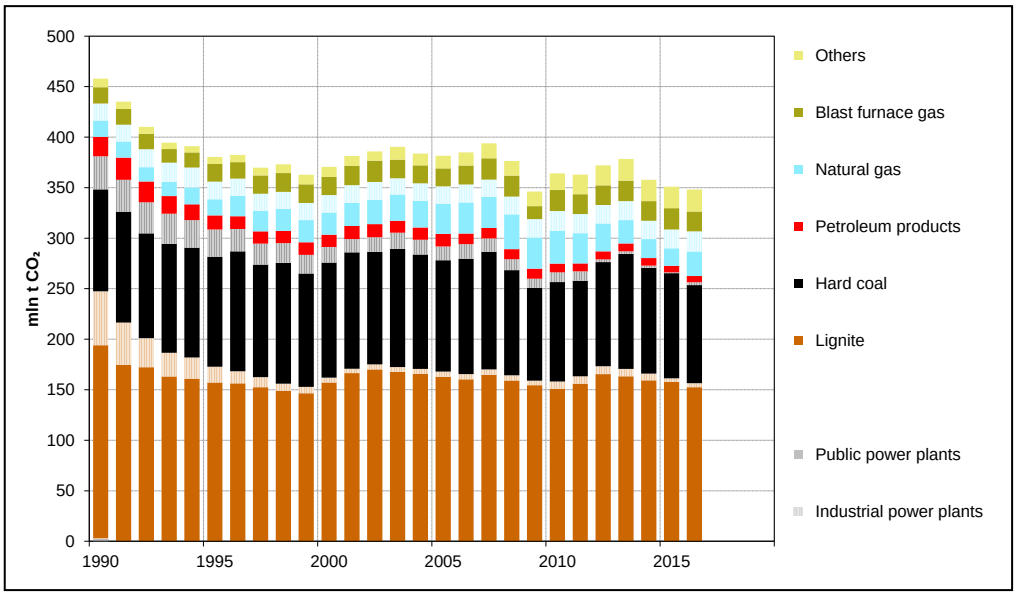
Source: German Federal Ministry for Economic Affairs and Energy, German Federal Environment Agency, calculations by author.

Figure 3 – Seasonal patterns of electricity exports and imports from and to Germany



Source: German Association of Energy and Water Industries, calculations by author.

Figure 4 – CO_2 emissions from power generators in Germany



Source: German Federal Environment Agency, Öko-Institut, calculations by the author.

A closer look at the emission patterns of the German power generation sector underlines the key role of the lignite- and hard coal-based power generation. More than 40% of the total CO_2 emissions come from lignite power plants and an additional 30% are from hard coal power plants.

The analysis presented in Figure 3 also shows that a significant, if not dominant share of the contributions to emission reductions in the power sector can be attributed to the shut-down of extremely low-efficient coal-based industrial power plants during the course of industrial modernization in Eastern Germany and not to public power production.

The delay in emission reductions that triggered the 2014 Climate Action Programme led to a strong focus on options to accelerate CO_2 emission reductions in the German power plant fleet. Starting with this Action Programme a number of political efforts were taken:

- After a series of discussions, the Climate Action Programme specified the target that the German power sector should reduce its emissions by 22 million tons (mln t) CO_2 compared to the Projection Report 2013 of the German government. Effectively this means a reduction by 71 mln t CO_2 compared to 2014 levels (or 58 mln t CO_2 to the most recent levels as of 2016).
- Based on this target, the German Federal Ministry of Economic Affairs and Energy made a proposal for a selective carbon pricing mechanism in early 2015, the climate levy. The climate levy was planned as an extra payment for each ton of CO2 that was emitted by a power plant older

than 20 years. From the 21st year of operation the climate levy would have been paid for the emission of CO2 that exceeds a certain threshold level and would have made it effective exclusively for coal-fired plants. This level was initially planned to start at 7 mln t CO2 per gigawatt (GW) installed capacity, should decrease to 3 mln t CO2/GW by the 30th year of operation in a linear way and then hold constant. The proposal went relatively far along the political process, underwent some changes (indexation of the levy etc.) but finally failed because of strong resistance from the mining trade union, the lignite industry and the states with strong lignite mining activities (North-Rhine Westphalia, Brandenburg, Saxony, Saxony-Anhalt).

- As a substitute for the climate levy, a bundle of different measures was approved that included a stronger support for combined heat and power (CHP) production plants and a programme to buy out of the market 2.8 GW old lignite power plants. Of the latter power plant capacity, the shutdown of 0.6 GW was foreseen anyway and 0.35 GW came from a failed business experiment on the long-range transport of lignite. These generation units are transferred for 4 years to a so-called security reserve (Sicherheitsbereitschaft) and receive compensation for the lost contribution margins (revenues minus costs) in the power market (approx. € 1.6b in total). Following the approval by the European Commission, this model was legally implemented in 2016. The first three generation units were transferred to the security reserve in October 2016 and in October 2017. Another five units are to follow by October 2018 and October 2019 respectively.
- In 2016 and 2017 a broad range of studies were undertaken to analyse the contributions of the power sector needed to reach the 2020 targets and, at the same time to focus more strongly on what adjustments in the coal-based electricity generation fleet would be necessary to achieve the emission reduction targets in 2030.
- Emission reductions from coal-based power generation became a subject of debate during the election campaign for the German Federal Parliament in 2017 and the pre-coalition talks in October and November 2017. The political debate between the four parties in the pre-negotiation talks (Christlich Demokratische Union – CDU, Freie Demokratische Partei – FDP, Bündnis 90/Die Grünen – Greens and Christlich-Soziale Union – CSU) essentially focused on the short-term closure (2020) of certain coal-based power generation capacities. This closure was debated vigorously until the termination of the talks and ranged from 3-5 GW (FDP), 5-7 GW (CDU/CSU) and 8-10 GW (Greens), with a tendency towards a short-term closure of 7 GW coal-

fired capacity by 2020.

- In the run-up to the coalition talks between CDU/CSU and the Social-Democrats (Sozialdemokratische Partei Deutschlands – SPD) the German Association of Energy and Water Industries (BDEW) proposed a shut-down of 5 GW coal-fired power plants, based on a tender for shut-down.

Against this background, it is clear, that the phase-out of coal-fired power plant capacities or/and electricity generation will definitely remain on the political agenda and that is unlikely to change, irrespective of which parties will form the German federal government for the years ahead. Beyond this general assessment, there are, however, major uncertainties on the outcome with regard policy mechanisms:

- There will be a need for short-term closures of coal-fired power plants. The key issues here are the amount of capacities to be shut-down and the type and the level of potential compensation payments.
- There will also be a need to close additional capacities in the run-up to 2030. The key questions here are when this shut down will start, the extent to which the level of capacities and/or production needs to decline, what trajectory will be foreseen for this decline, the need for a potential compensation mechanism and its design.
- The most recent debates have been focused on the shut-down of capacities. The heated debate about the security of supply aspects related to the removal of significant capacities from the system, however, showed that hybrid approaches of capacity and production management could deliver some value added (the German Federal Environment Agency put forward such a proposal which consisted of 4 GW plant closure and certain generation limits on high-carbon electricity production).
- Another key issue and/or uncertainty is the role of the EU ETS in a (partial) phase-out of coal in the 2020s. The positions on this differ widely and depend essentially on the assumption of whether the most recent structural reforms of the EU ETS will lead to scarcity prices in the EU ETS already from 2020 to 2025 or whether will occur rather in the period from 2025 to 2030, if not later (the author takes the latter position).

With regard to the latter point, evidence-based reflection cannot occur before the next evaluation or reform cycle of the EU ETS in the early 2020s:

- At that point, it will be clear whether the emission trajectories are closer to the assumptions of those who believe that the structural surplus of allocation in the EU ETS is less significant and the recent structural reforms will help to quickly absorb the surplus of allowances in the market or those who believe that this will take much longer (the author takes the latter position).
- At that point, it will be clear whether the idea of the hedging band survives the reality check or has been instead a rather speculative academic idea. The theory of the hedging band assumes that there is a physical demand for allowances from the side of hedging product providers that lead to scarcity prices even if there is a surplus of 400 to 833 million allowances in the market (the author does not agree with this idea).

As a result, strategies and decisions for a major decline of coal-based power generation in Germany will need to reflect these uncertainties and opt for robust approaches. Such approaches could lead to hybrid strategies of capacity shut-downs and more carbon-optimized electricity generation. The second part of this hybrid approach provides an opportunity for carbon pricing.

What Role for Carbon Pricing?

Apart from the fact that carbon pricing could play a more prominent role in German energy and climate policy it should be noted that there is already a certain level of implicit carbon pricing in the German system of energy taxation and remuneration system. Table 3 provides an overview of the recent status of energy taxation in terms of implicit carbon pricing. There are, however, some specifics that need to be reflected:

- The energy taxation does not apply to the fuel input of power generators. Electricity is, however, taxed at the output side.
- The German industry is widely exempted from energy taxes via a complex mechanism that monitors the energy efficiency improvements of industry overall and requires some institutional efforts to opt for a permanent improvement of energy efficiency (e.g. energy management systems, energy auditing).
- For the interpretation of motor fuel taxes, a part of the revenue from taxes on motor fuels serves as an income stream for investments and maintenance of road infrastructure. The income from motor fuel taxation on the one hand exceeds the annual investments significantly (tax revenue of € 36b compared with annual investments or investment needs of €15-20b) but is roughly in line with the annuity of the existing road infrastructure (approx. € 35b). On the other hand, other revenues, e.g. the vehicle tax and the truck toll, need to be reflected for the interpretation of energy taxes in CO_2 terms. This is a complicated issue because, for example, the vehicle tax differs significantly for diesel- and gasoline-fuelled vehicles and the truck toll creates revenues more or less explicitly from diesel trucks. The compilation in Table 3 reflects this based on a detailed analysis of the different revenue streams, which takes into consideration the uncertainties on the annual system costs of the road system with a sensitivity analysis for the annual investments or the total annual costs of the system.
- A specific situation also arises for the electricity sector. Whereas the allowances price in the EU ETS as well as the electricity tax can be easily transformed into CO_2 terms, this is more complicated for the remaining surcharges in the system. Due to the specifics of the

electricity system, the wholesale price reflects only the marginal operational costs of the system and ignores the remaining costs of the system that need to be covered by some sort of mechanism. To reflect the total (counterfactual) system costs, the level of surcharges was adjusted for this fixed part of the system costs and only the additional cost levels were transformed into CO_2 pricing terms.

- Last but not least, it should be considered that the compilation translates tax rates into CO_2 terms only. There are, however, other externalities beyond climate change which could be reflected. This is an issue for all energies but especially for motor fuels for which externalities like air pollution, noise, health impacts etc. are much more significant than for other energies.

Table 3 – Energy taxation and implicit carbon pricing in Germany, 2016

		Nominal tax rate	Implicit tax rate	Excl. infrastructure costs*		Excl. counter-factual invest**
				€ 15b p.a.	€ 35b p.a.	
		€ per unit	€ per t CO_2	€ per t CO_2	€ per t CO_2	€ per t CO_2
Gas oil	EUR/1,000 l	61,35	23,03			
Heavy fuel oil (heating)	EUR/t	25,00	7,87			
Heyvy fuel oil (power)	EUR/t	25,00	7,87			
Natural gas (heating)	EUR/MWh	5,50	30,23			
Natural gas (motor fuel)***	EUR/MWh	13,90	76,40	-26,00	-198,20	
LPG (heating)	EUR/100 l	6,06	20,56			
LPG (motor fuel)***	EUR/100 l	18,03	61,16	-11,37	-159,73	
Gasoline leaded***	EUR/1,000 l	721,00	315,90	279,79	134,93	
Gaseline unleaded***	EUR/1,000 l	654,50	286,76	253,99	122,49	
Diesel***	EUR/1,000 l	470,40	179,06	165,55	35,23	
Coal (non-power)	EUR/GJ	0,33	3,47			
Electricity ETS	EUR/EUA	5,35	5,35			
Electricity tax	EUR/MWh	20,50	22,78			
Electricity surcharges	EUR/MWh	76,84	85,38			45,20
Electricity total	EUR/MWh	102,69	113,51			73,33

Notes: * Considering road infrastructure financing from motor vehicle tax (€ 8.7b) and truck toll (€ 3.1b). The lower range of infrastructure costs represents the annual investments and the upper range the annuity of total road system costs. - ** Considering a counterfactual investment of 36 €/MWh. - *** The implicit CO_2 tax rate for motor fuels covers also other significant transport externalities (other pollutants, noise, health impacts) which are less significant for other energies.

Source: Compilation and calculations by the author.

The systematic comparison of implicit carbon pricing levels highlights a series of issues:

- There are essentially three clusters of implicit carbon pricing. The implicit carbon pricing for heating fuels ranges from € 3.50 to € 30, the implicit pricing for electricity is approx. € 73 and the implicit pricing of motor fuels ranges effectively from -€ 198 to € 280 (it should be pointed out, however, that the taxation of motor fuels also covers other externalities that exceed significantly those of other energies).

- Even within these three clusters the implicit carbon pricing is inconsistent, high-carbon fuels are usually taxed lower than cleaner fuels. The tax deductions for natural gas and LPG as motor fuels led to a situation that even the attributable infrastructure costs are not covered.
- The recent taxation approaches do not allow for a rational price-based approach of sector integration (e.g. the use of electricity in the heating and/or transport sector).

Carbon or energy pricing beyond the EU ETS has not played a major role in the last fifteen years of operational energy and climate policy in Germany. This is partly due to the fact that the implementation of the ecological tax reform in 1998/2000 had rather disillusioning results, at least with a view to the emphasis put on this reform at the time. Furthermore, the strong focus on technology-specific policies has driven at least some lobby groups in the German energy and climate policy arena towards heavy criticism of the more technology-neutral carbon pricing approaches. An ever broader and growing criticism has been targeting the EU ETS and its malfunction.

Based on the current stage energy transition, however, the reform of energy and carbon pricing approaches are increasingly seen as in need for reform:

- The number of voices asking for carbon floor prices in the EU ETS or in addition to the EU ETS is increasing and ranges from more academic interventions or statements of different advisory bodies of the German government to programmes of political parties and statements from green NGOs or a number of major industrial companies. This is not to say that there is a broad consensus on the mechanism in general or, even more importantly, on the specific implementation approach (e.g. national versus regional versus EU-wide).
- At a smaller scale, there are voices asking for reform of the diesel privileges in motor fuel taxation because the carbon pricing asymmetries in motor fuel taxation are huge, even when the other contributions of diesel-fuelled vehicles to infrastructure financing are considered.
- The implicit carbon pricing imbalances between electricity and heating fuels need to be adjusted. The different levers of implicit carbon pricing for electricity offer sufficient flexibility for adjustments (the effects of a carbon floor price could be compensated by lowering the electricity tax to the minimum possible, shifting parts of the remuneration mechanisms to other sources etc.). In combination with this, a more

consistent design and an adjustment of taxation for heating fuels need to be addressed in any case sooner or later.

This overview shows that a reform of carbon pricing approaches in Germany will be on the political agenda sooner or later. And there are and will obviously be interactions with the EU directive on energy taxation and could be windows of opportunities for joint activities towards more harmonized carbon pricing in general. These topics are complex and will require mid- to long-term efforts within the EU and potentially between single Member States.

In the short- to medium-term there is, however, a need for action. There is a window of opportunity for more coordinated activities on carbon pricing, more specifically, a carbon floor price for power generation.

The needs and opportunities for a more harmonized approach to carbon pricing go, however, also beyond the floor price for power generation. The whole system of energy taxation, including the taxation of motor fuels remained unchanged for more than decade (it was adjusted for the last time in 2004) and was not even updated for inflation. With the new attempts of introducing a significant CO_2 adder to energy and motor fuel taxes in France, the level of taxation will soon and significantly exceed the tax rates in Germany. This will trigger complex political debates in France as well as in Germany but could also lead to challenging effects like fuel tourism between the two countries.

The Case For a Carbon Floor Price for Power Generation and its Restrictions

A carbon floor as a hybrid element within an ETS has been subject of intense debate in academic circles and is being introduced in a series of ETS implementations internationally. A EU-wide floor price will be an issue again for the next evaluation and revision cycles of the EU ETS and is as such more of a medium-term issue.

The present analysis focuses more on the short-term aspects of a carbon floor price for the EU ETS which, however, might be a precursor for a broader floor price in the EU ETS or not. It is about how a floor price could help the more recent challenges in the continental European power markets, e.g. low contribution margins for low-carbon assets and the cementation of high-carbon power generation in the system.

Given the general political setting and the issue of timing, the decision to opt for a carbon price floor for all EU ETS-regulated entities is probably illusionary. The impacts on industries like iron and steel, non-ferrous metals, chemicals and the influence of these industries in the German policy arena are too significant to make significant progress on a carbon floor price in a rather short period of time. In the recent political framework, only a selective carbon floor price for power generation would have a chance to succeed within the next few years.

In this respect, managing the decline of coal-fired power generation in Germany will be a major short-, medium- and long-term topic on the energy and climate policy agenda of the country. There will be a role for capacity shut-downs, whether with or without compensation mechanisms and there is a role to be filled for CO_2-optimized operations of power plants (clean dispatch).

This leads to the question of what levels of carbon pricing would be needed to make a difference in this respect and whether these levels could be feasible in political and/or economic terms.

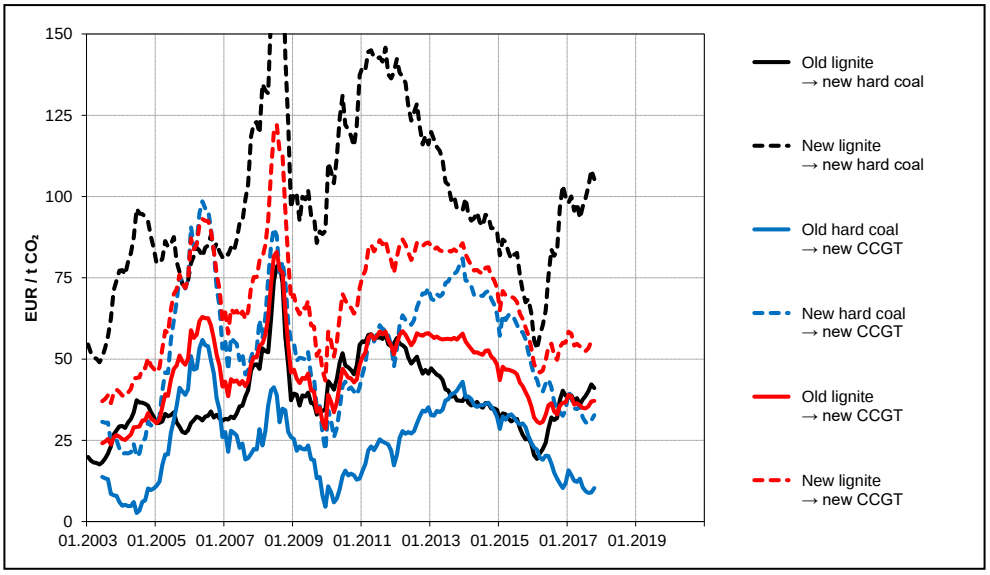
Figure 5 presents an analysis of the fuel switch costs in the Central Western European (CWE) regional electricity market. These costs represent the carbon price levels that would be needed to switch power

generation between different types of plants. The overview indicates significant volatilities during the last 15 years, which makes the case for responsive carbon pricing with an ETS, but also some convergence:

- There is some potential for emission reduction from old hard coal plants to new gas-fired plants at carbon prices of around € 10. Due to the low load factors and the decreasing stock of such old coal plants, this potential is limited.
- There is a much larger potential for different fuel switch options at carbon prices of around € 30.

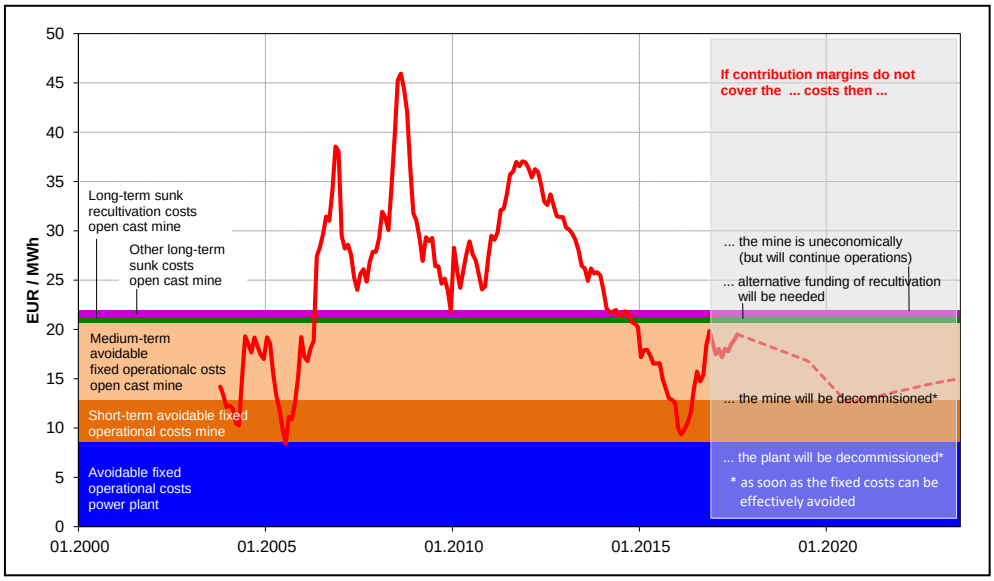
There are additional levers for emission reductions at lower carbon prices if a more dynamic perspective is taken. If carbon prices lead to lower contribution margins (the difference between revenues from the electricity markets and the costs for fuels and emission allowances), the incentives to shut down power plants increase if these are no longer able to cover the fixed operational costs (e.g. personnel, maintenance, revisions). This is specifically relevant for lignite-based power generation in integrated mining and power generation companies, which is the typical configuration in Germany. For these companies incentives to shut down power plans also exist if they cannot cover the fixed operational costs of the mines as soon as these can be avoided.

Figure 5 – Fuel switch costs in the continental European electricity market, 2003-2017



Source: European Energy Exchange, Öko-Institut, calculations by the author.

Figure 6 – Contribution margins (clean brown spread) for old lignite-fired power plants in Germany, 2000-2023



Source: European Energy Exchange, Öko-Institut, calculations by the author.

Figure 6 shows the trends for the contribution margins for old lignite-fired power plants in Germany which make up for a significant share of the power sector emissions. The graph underlines that these power plants are currently able to cover the fixed operational costs of both the power plants and the mines. As soon as there are significant investment needs in the mines and based on the most recent futures for electricity and emission allowances, this will change in the next years ahead. A carbon price of € 15 to € 20 would thus accelerate the incentives for decommissioning outdated plants significantly.

As an interim result it can be stated that an effective carbon price for the power sector in range of € 15 to € 30 could significantly help to achieve the emission reduction targets in Germany (and in other countries).

There are, however, some aspects that need to be considered in the case of a carbon floor price:

- The German electricity system is heavily interconnected with the systems of other countries. A unilateral carbon floor price would have a major impact on the cross-border electricity flows and put the climate integrity of the mechanism in question if emission reductions in Germany are compensated to a large extent through emission increases

abroad. Existing and forthcoming modelling analysis shows clearly that a national and unilateral implementation of a carbon floor is highly questionable in this respect. Large-scale emission increases abroad and/or significant electricity imports caused by a national carbon floor price would outpace the effects on the national emission inventories and make the floor price subject to attacks from very different constituencies in the political arena. A jointly implemented floor price would soften or even avoid such situation and be more acceptable for broader constituencies and enable broader coalitions.

- This does not necessarily mean that there is a need for an EU-wide implementation of a floor price which would take time and would probably not achieve the necessary majorities in the EU in the present settings. The modelling exercises show, however, that the implementation for a floor price among a group of countries in the CWE regional electricity market would be sufficient to achieve significant emission reductions for Germany as well as the group in total and avoid changes in cross-border electricity flows which would create major political obstacles. In this case also, accountable emission reductions could be achieved from price levels between € 15 to € 25 and very significant emission reductions would occur in the framework of an effective carbon price at the level of € 30 to 35.

A carbon floor price for the EU ETS or the power sector within the EU ETS could so be seriously challenged if implemented as Germany's stand-alone approach. In contrast to this, a joint approach between the countries which are interlinked in the CWE regional electricity market, Germany, France, Austria, the Netherlands, Belgium, Luxembourg and Denmark would be an effective and coherent approach for a floor price. Other countries (Switzerland, Italy, potentially the Czech Republic) might be willing to join with this core group of countries.

The costs from a carbon floor price would undoubtedly be passed through to the wholesale electricity prices. The effects on wholesale and retail prices in Germany would however differ significantly:

- Raising the effective carbon prices from €5 to € 15-30 would increase the wholesale prices for electricity by € 6 to € 20 per megawatt hour (MWh), depending on the scope and the energy market environment.
- For non-energy intensive industries, the increase in wholesale prices would partly be compensated by a decline of the surcharge for financing power generation from renewable energy sources which depends on the revenues that operators of these power plants can get from the wholesale market. Modelling shows that approx. 40% of an

increase of wholesale power prices is absorbed by these interactions with the renewables surcharge. With a view to the additional income from a carbon floor price mechanism (€ 2.5b to 4.5b), an increase in retail prices could be compensated by a partial relief from the electricity tax with a recent income of € 6.5b at a rate of € 20.5/MWh.

- For energy-intensive industries that are more or less completely exempted from the renewables surcharge and the electricity tax changes, in the wholesale market, prices would increase electricity costs. On the one hand, this would make unilateral approaches for Germany extremely difficult and could be a key argument for concerted action between Germany and a group of other European countries. On the other hand, it would make additional compensations for the indirect costs of carbon pricing necessary for the electricity-intensive industries (see below).

The scope, the environmental effectiveness and integrity as well as the costs of a carbon floor price are not the only challenges for the introduction of a floor price without EU-wide implementation in the framework of EU ETS legislation. A number of legal issues need to be addressed here:

- The implementation of a coordinated floor price in EU ETS auctions would require changes in EU legislation (e.g. the Auctioning Regulation) which would take time and is uncertain with respect to gaining sufficient support from the EU Member States. Hence why a floor price would need to be implemented via complementary pricing or a taxation mechanism if it is to be implemented before the next review and reform cycle of the EU ETS. This is feasible in principle, as the implementation approach for the price floor in the UK shows (closing the gap between actual allowance prices and the carbon price floor with adjustments of the Climate Change Levy and excise duties).
- The recent ruling of the German Constitutional Court (the Nuclear Fuel Tax case) created major barriers for straightforward implementation in Germany. According to this ruling the legislator is not allowed to expand the list of taxation categories laid down in the German constitution and built high barriers to designing an input tax like a carbon tax as a consumption tax. There is a controversial legal debate about the implications of this court decision for a carbon floor price but it might create a need to opt for indirect or more complex implementation approaches (energy tax, special charges, resource levies) that might not be possible or suitable for other jurisdictions and thus require new forms of cooperation (e.g. with a view to the pan-Canadian carbon pollution pricing approach).

- The effects of a carbon price floor on the electricity price and potential compensation measures have at least partly legal implications. From the German perspective, it will be infeasible to opt for a carbon price floor without compensating electricity-intensive industries for increasing power prices resulting from the increasing carbon costs. Under the EU ETS such compensation was made possible with a specific state aid guideline which makes a share of 20% to 25% of total electricity supply to German industries eligible for the compensation of indirect carbon costs. The EU guidelines apply, however, only to the allowance costs from the EU ETS and not for add-ons that might be the appropriate way to implement a carbon price floor. The case of the British carbon price floor indicates again that there are more complex ways to implement a carbon price floor and getting the related compensation measures approved in line with EU state aid rules. The closer the implementation of a carbon price floor is to the British model, the less risky the way should be for introducing a carbon price floor and the related compensation measures for electricity-intensive industries should be.

In political terms, the introduction of a carbon floor price in the EU ETS or in addition to the EU ETS is still a controversial issue. The interest in it has, however, definitely risen:

- Among the political parties, only the Green party is outspoken and clearly in favour of a carbon floor price. In the pre-coalition talks, the carbon floor price was on the agenda until the end and there should have been a middle ground between the Greens and CDU/CSU. SPD had a carbon floor price included in early versions of its programme for the federal elections in 2017 although it was not included in the final version. Recent statements from SPD lawmakers indicate that there is no fundamental opposition to carbon pricing approaches.
- The carbon floor price is also controversial within the administration and its different institutions. In early drafts of Germany's Climate Action Plan 2050 the carbon floor price was mentioned as a mechanism that helps the 2030 emission reduction targets to be achieved. The proposal did, however, also not survive the negotiation process within and between the different ministries. The German government has not supported the concept of a carbon floor price in the negotiations on the structural reform of the EU ETS but has at least held serious internal debates on this occasion.
- The carbon floor price is not supported by the German industry at the level of its associations and lobby institutions. Some of the major industrial companies (e.g. E.ON, Siemens) and some more green

business groups have, however, supported the idea of a price floor for the EU ETS. The energy-intensive industries (e.g. the chemical industry) and coal-based utilities (RWE, LEAG, Steag) are explicit opponents to the concept of a floor price.

- After a longer period of more fundamental criticism against the EU ETS and at least partly against other means of carbon pricing, the renewable energy industry and lobby changed their position remarkably and is now proactively driving the debate on it.
- Among green NGOs there is certainly a consensus about carbon pricing but the views on appropriate implementation mechanisms differ widely.
- There is a broad range of different views on a carbon price floor among influential advisors and the academic community, yet there is at least a growing interest in carbon pricing.

In addition to that, the political economy of coal phase-out and more ambitious carbon pricing needs to be considered. The recent German energy policy debate is strongly focused on shutting down capacities of the coal fleet according to the role model of the German nuclear phase-out. This approach is attractive in terms of reliable emission reductions and limited electricity price impacts but faces challenges with regard to security of supply and potential compensation payments to the operators. Opponents to the coal phase-out could use a lengthy process towards a reasonable carbon price for postponing action on coal phase-out and provoking the corresponding resistance against the carbon pricing pathway. It will be of key importance to settle the debate on a carbon price floor in Germany as an accountable companion mechanism to the overall efforts on a coal phase-out trajectory that brings Germany back on track for achieving the upcoming emission reduction targets.

Having said that, there is at least a growing support for a carbon price floor although there is not yet a consensus emerging on what the scope and the implementation mechanism for a carbon price floor should be. A harmonized carbon price floor for the power sector among a group of countries that are interlinked by the CWE regional electricity market is, however, one of the promising options in terms of gaining broader support.

Perceptions of and Narratives around the French Proposal on A Carbon Floor Price

The proposal of President Macron on a carbon price floor triggered a series of reactions in the German energy and climate policy arena even though it was not very specific on issues like scope, timing etc. The traditional supporters of floor prices gave prominence to the proposal but there have been a number of voices and opinions put forward more or less fundamental concerns or narratives:

- The proposal would only intend to drive wholesale market prices and create huge windfall profits for the French nuclear power generators;
- The French final consumers would not have to carry the burden of higher prices because of widely regulated prices and tariffs;
- The initiative would only be a new attempt to create new European funding mechanisms.

These arguments or narratives are not entirely consistent (e.g. between the first and the second line of arguments) or new but deserve careful reflection because they are decisive for the political setting of a potential concerted carbon floor price initiative:

- With respect to the major differences on how European funding mechanisms are seen among German and French mainstream politics, it will probably essential to de-link concerted carbon pricing proposals from the debate on European funding or budget mechanisms. If German politics maintains its broad and strong resistance against new or extended European funds, all proposals that foresee the carbon floor price as a source for European funds face the challenge of possibly triggering fundamental opposition. In addition to this, the legal constraints to implement a carbon floor price should be taken into consideration.
- A large part of the debate about distributional effects from a carbon floor price has focused on distributional effects between nations which is not an appropriate perspective. The necessary analysis here needs to

be re-focussed on the distributional effects between small and large consumers, state budgets, clean power generators and high-emitting power generators in the different jurisdictions in and between the respective countries. Such an analysis will lead to much more differentiated insights and foundations that are less vulnerable to misinterpretation and denunciation.

- Due to the sensitive nature of the nuclear and the coal debate in German politics, it would be useful if the proposal on a concerted carbon floor price for the power sector were part of a larger package that includes accountable plans or aspirations for phasing out at least parts of the nuclear and the high-emitting power generation fleets. One might not see this as a hard link in terms of substance but it will be nearly impossible to get broad support in German politics and the public if the narrative cannot disprove that a carbon floor price will accelerate the shut-down of German coal plants, increase power prices and at the same time would be a key factor for the economic survival of older French nuclear plants. Such toxic narrative would, however, not object the general efforts for coal phase-out in Germany but would make alternative approaches much more attractive which have lower impacts on power prices, even if they are less cost-efficient und would cause more distortions in the cross-border electricity markets.
- The initiative should highlight that the French floor price for heating and motor fuels is an extremely accountable effort to address emission abatement in sectors that are lagging behind with respect to emission reductions in both countries. Against this background and to avoid unintended effects of large taxation gaps, a streamlining of German energy taxation approaches could also be part of the package.
- The initiative should be framed as a part of a broader initiative for tighter and more ambitious cross-border coordination within the EU or at least subsets of its Member States.
- The project should be triggered at the highest level possible to create sufficient momentum and a robust arena.

A concerted cross-border initiative on carbon pricing or a carbon price floor with its undisputable merits should definitely address these complementary activities as well as a broader and deeper framing to make it a success.

Conclusions and Outlook

German energy and climate policy faces serious challenges over the course of the next few years. There is a need for far-reaching political action on reducing greenhouse gas emissions to limit the gap to the 40% emission reduction target for 2020 and to set the modernization of the energy system on track to reach the energy and climate policy targets and commitments for 2030 and beyond. Especially for coal-based power generation and the structural change in the transport sector, this will require significant interventions.

Although pricing of externalities played a significant role in German energy and climate policies for a while, it has not been a major issue over the last decade. The challenges ahead and the changing perceptions on carbon pricing create a window of opportunity for making carbon pricing a more prominent mechanism in the broader policy mix of energy and climate policy. This is of specific importance because the existing mechanisms for implicit carbon pricing via energy taxation in Germany are inconsistent and partly ineffective or even counterproductive.

For the short- and medium-term a carbon price floor could deliver significant emission reduction contributions for the German power sector at levels of € 15 to €-30 per ton of CO_2. It could be introduced at levels of between € 15 to € 20 and steadily increase by 2030. The effectiveness and integrity of CO2 reductions would be significantly enhanced by a wider scope than a unilateral carbon price for Germany. At this point there needs to be a concerted action of France, Germany, Austria, the Netherlands and other countries to introduce a harmonized floor price for power generation in the heavily interconnected Central Western European regional electricity market. Such a project would however face a series of legal but also political challenges that need to be addressed in a comprehensive manner:

- Dealing with the legal restrictions for the different jurisdictions;
- Exploring the respective options for cross-border harmonisation;
- Making a carbon floor price concept work that is eligible for compensation of indirect CO_2 costs for the electricity-intensive industries (20 % to 25 % of industrial electricity consumption in Germany);

- Providing analytical capital that can move the narratives away from over-simplified distributional effects between countries;
- Making the initiative part of a broader and accountable energy policy package that includes carbon pricing as part of a transformative effort towards a sustainable energy system and deep decarbonisation;
- Making the carbon pricing effort part of a pro-European narrative but delinking it from highly controversial and high politics issues like European funding mechanisms; and
- Making the carbon price floor part of a high-level initiative that creates a robust policy arena.

There is a need for carbon pricing and especially a carbon price floor in Germany and other countries, which presents an opportunity and a challenge. It could, however, also emerge as a rather short-term opportunity to opt for a more effective energy and climate policy and tighter European integration. Introducing a carbon price floor for the power sector and potentially for heating and motor fuels in the present situation needs to be part of a package that makes a difference at the substance and disproves political narratives which label carbon floor prices among a subset of EU Member States primarily as unbalanced attempts of redistribution of wealth among these Member States or their industries.

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