CECILIA 2050
OPTIMAL EU CLIMATE POLICY

Choosing Efficient Combinations of Policy Instruments for Low-carbon development and Innovation to Achieve Europe's 2050 climate targets

Country report: Germany

Contribution to CECILIA2050 Deliverable 1.2: Review of the existing instrument mix at EU level and in selected Member States

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Executive Summary

In the years leading up to 2050, the European Union (EU) will face immense challenges as it aims to simultaneously reduce its greenhouse gas (GHG) emissions by as much as 80%, stimulating "green" economic growth and ensure the ongoing competitiveness of the EU in global markets, both existing and emerging. The choice of policy instruments that will be needed to drive the required change is as of yet largely unexplored. Therefore, initially the CECILIA2050 project will take stock of the instruments currently implemented in Member States, and the interactions between them. This initial stock taking seeks to gain an understanding of current policy mixes in the EU, and will be used in further research done for CECILIA2050. The present report illustrates and focuses on the German policy mix.

The German climate policy mix is both very diverse and fairly dynamic, with several new instruments added to the mix in the last 15 years, and existing instruments refined and developed. The climate policy mix has been driven *inter alia* by policy initiatives in the Integrated Climate and Energy Programme adopted in 2007 (Bundesregierung, 2007) and its successor, the 2010 Energy Concept (Bundesregierung, 2010). The decision to phase out nuclear energy after the Fukushima nuclear disaster in 2011 marked another turning point in German politics and called for the implementation of a new energy concept, now known as the *Energiewende* (energy transformation). Building on the succession of different programmes and concepts, the objective of decarbonisation of major parts of the economy by mid-century is now largely established and accepted across party lines, even though a lively debate continues on the pace of the transformation, the most suitable policy instruments, and the acceptable burden on businesses, private households and taxpayers.

In terms of major policy instruments, Germany has taken part in the EU ETS since its launch in 2005. However, it is disputed how much GHG emission reductions can actually be attributed to this instrument, due to the volatile and at times very low price signal it creates. The second key measure in Germany is the feed-in tariff for renewable electricity anchored in the Renewable Energy Sources Act (EEG). The feed-in tariff is regarded as a successful instrument, in that it has lead to a dynamic development in the German renewable sector. In 2011, renewable energy covered 20% of total electricity consumption. (BMWi, 2013) The downside of this success story, which is receiving increasing attention, is the cost associated with the expansion of renewables. There is a general understanding that the instrument needs continuous improvement and fine tuning in order to keep its costs low and to provide incentives for technology innovation. A third important measure is the Ecological Tax Reform that was introduced in 1999 – 2003, which increased the taxes for transport and heating fuels and introduced a new tax on electricity, using the tax revenue to lower the cost of labour. Yet, while the tax had in principle achieved its objectives, it remains unpopular with the public and with decision makers – which may explain why there have been no attempts to further develop the Ecological Tax Reform in the last ten years, despite the increased ambition level in climate policy.

In the field of energy efficiency, some progress can be observed, but the pace of change (in particular in the building sector) is insufficient to achieve the existing objectives. In its Energy Concept, the German Federal Government stated that Germany aims to realise a climate neutral building stock in 2050.

But neither for transport nor for agriculture is there a comprehensive strategy on how to address the emissions from the two sectors. For both sectors, there were only few notable policy initiatives or new policy instruments at the national level – the little dynamic that there is mostly stems from the EU level, such as through CO_2 emission limits for new cars.

1 Description of policy landscapes

1.1 Classification of the instruments previously selected into policy landscapes

The objective of this report (and report series) is to perform an initial 'stock-take' of the climate policy instrument mix at the EU-level and a representative group of Member States – the United Kingdom, Germany, France, Spain, Italy, the Netherlands, Poland and the Czech Republic. An initial list of up to 50 instruments from each country and from the EU-level was created, from which up to 15 key instruments for each state covering a broad selection of the economy, instrument type and objectives were selected for further analysis. Please refer to the Taxonomy of Instruments, developed under Task 1.1 of CECILIA 2050, for a full description of instrument classification. For each report, the selected instruments were categorised into policy 'landscapes', described below.

(1) **Carbon Pricing:** this includes policies that price CO_2 emissions or otherwise change the relative prices of fuel use, depending on the carbon intensities of fuels. Apart from the obvious candidates (carbon taxes and emissions trading) this would also include the reform or removal of fossil fuel subsidies;

(2) **Energy Efficiency and Energy Consumption:** this includes measures targeted at either increasing the efficiency of the energy sector, including power generation / combustion processes, transmission of energy (heat, electricity) and end-use efficiency, or at reducing overall energy consumption (demand-side management, energy saving, sufficiency);

(3) **Promotion of Renewable Sources of Energy:** this includes policies aimed at increasing the share of energy from renewable sources (solar, wind, hydro, biomass, geothermal);

(4) **Non-Carbon Dioxide Greenhouse Gases:** this covers policies geared at reducing non-CO_2 greenhouse gas emissions, typically from sectors other than the energy sector. It may include emissions like methane emissions from landfills or animal husbandry, N_2O emissions from agriculture, or greenhouse gas emissions from chemical industries (SF6, NF3, HFC etc.)

The list of instruments for Germany along with their landscape classifications may be seen in

Table 1 below. This report describes each instrument and makes an attempt at assessing each instrument's individual 'optimality', based on the concept developed for use in the CECILIA2050 project also developed in Task 1.1, is provided. The categories and methods of interaction are based on best practice in instrument interaction assessment, and are completed in pairs against a single key instrument, or when important interactions between non-key instruments are present.

The resulting optimality of each landscape based on instruments and their interaction are then assessed, followed by interactions between each landscape and, finally, an analysis of the optimality of the climate policy mix as a whole in each country and at the EU-level is provided.

Table 1: Classification of the instruments by landscape

	Policy Landscapes			
Policy Instrument	Carbon Pricing	Energy Efficiency and Energy Consumption	Promotion of Renewable Sources of Energy	Non-Carbon Dioxide GHGs
Implementation of EU ETS in Germany	✓	✓	✓	✓
Phase out of subsidies for hard coal mining		✓		
Electricity and Energy Taxes		✓	✓	
Air travel tax	✓	✓		
Energy performance standards for buildings		✓		
Financial support for building refurbishment		✓	✓	
Premiums for electricity produced in CHP units		✓		
Feed-in tariffs for renewable electricity			✓	
Measures to accelerate electricity grid extension			✓	
R&D funding for energy storage systems			✓	
Biofuels quota			✓	
Obligation to use renewable energy for heating		✓	✓	
Integration of climate policy in spatial planning and building codes			✓	
Ban on landfilling on untreated waste				✓
Standards for the use of fertilisers				✓

1.2 Detailed description of instruments within each policy landscape

Carbon Pricing

There are different climate policy instruments that affect relative prices between fuels with different carbon content, and thereby aim to influence consumption or investment behaviour. The only such instrument which is directly linked to CO_2 emissions is the EU emissions trading scheme. Other pricing tools, such as taxes on transport fuels or electricity, are linked to the energy content of fuels rather than its carbon content; nonetheless these taxes are also considered a form of carbon pricing within this report. Additionally the removal of harmful subsidies, such as hard coal mining subsidies are discussed in this chapter.

Implementation of the EU-ETS in Germany

The EU emissions trading scheme (EU-ETS) is the centrepiece of the EU climate and energy policy, covering 41% of EU GHG emissions in 2011. (EEA, 2012) The instrument is market-based as it puts a price on direct GHG emissions. By establishing a trade among emitters, it allows for some flexibility on how emitters want to comply with their obligations, and provides an incentive to reduce GHG emissions where it is cheapest to do so. GHG emission allowances are distributed to operators of installations by grandfathering or auctioning. Allowances can be traded and the price of allowances is determined through supply and demand in the market. Member States are directed to allocate allowances to the regulated installations and ensure their compliance.

In Germany, the EU-ETS covers about 1,600 stationary installations in different sectors, including energy supply (power plants) and certain energy-intensive industries like steel or cement. It also includes commercial airlines, of which about 450 are administered by Germany. Sector-specific capacity thresholds exist for all these installations: e.g., combustion installations are only subject to the EU-ETS when their total rated thermal input exceeds 20 MW. Renewable energy installations that are eligible to receive feed-in-tariffs under the German Renewable Energies Sources Act are not subject to EU-ETS. Moreover, Germany also implemented the small emitter exception (Art. 27 ETS Directive). Emitters that produce less than 25,000 CO_2 equivalents are eligible to apply for an exemption, so long as they implement other measures for GHG emission reductions. In 2011 the ETS covered 49% of all German GHG emissions (EEA, 2012).

The main vehicle to transpose the EU-ETS Directive into national legislation is the German Greenhouse Gas Emission Trading Act (*Treibhausgas-Emissionshandelsgesetz, TEHG*), the Allocation Act (*Zuteilungsgesetz*) and the associated Allocation Ordinance (*Zuteilungsverordnung*). The responsible authority for implementing the ETS in Germany is the

German Emission Trading Authority (*Deutsche Emissionshandelsstelle, DEHSt*), a division of the German Federal Environment Agency (*Umweltbundesamt, UBA*).

Like other economic instruments, one of the EU-ETS' features is that it generates revenue, in this case from the auctioning of emission allowances. These revenues can in turn be used to fund other objectives – climate-related or otherwise. The decision on how to spend the revenues from auctioning rests with the Member States; the EU-ETS Directive merely stipulates that 50% of the revenues should be used to fund climate protection measures, albeit with a fairly broad definition of climate protection. The main use of ETS auctioning revenue has been to fund climate protection programmes and initiatives through the Climate and Energy Fund (*Sondervermögen des Bundes Energie- und Klimafonds*, a separate federal public budget), which was established at the beginning of 2011. In specific, the following instruments are funded (Bundesregierung, 2013):

- CO_2 Building Rehabilitation Programme,
- R&D for renewable energy and energy efficiency,
- Energy Efficiency Fund,
- Market Penetration Programme (for renewable heating),
- The 'National Climate Initiative' (covering a range of domestic climate mitigation projects addressing consumers, businesses and municipalities),
- The 'International Climate Initiative' (covering a range of international climate mitigation and adaptation projects addressing industry and low-carbon economy, adaptation, deforestation and biodiversity).

The resources for the CO_2 Building Rehabilitation Programme – one of the key measures in the field of energy efficiency - are meant to be made permanent over the next years, i.e. €1.5 billion annually (2011: €936 million, 2012-2014: €1.5 billion/year). However, so far, the effectiveness of the fund is low. Funding for the Building Rehabilitation Programme, like several other initiatives, had to be temporarily suspended when a lower-than-expected allowance price led to insufficient revenues from auctioning. (Bundesregierung, 2013) The auctioning revenues needed now being complemented by funds from the federal budget.

While the above are examples of how auctioning revenue can be used to fund climate protection efforts, auctioning revenue is also used to alleviate perceived competitiveness impacts. Pursuant to Article 10a of the ETS Directive, Member States can also adopt financial measures to compensate for additional costs on the part of large power consumers, to whom the carbon price is passed on as part of the electricity price. At the end of 2012, the German government decided to make use of this provision and began to reimburse the energy-intensive industry for the increase in electricity prices that can be attributed to emission trading (BMWi, 2012). This compensation is expected to amount to €350 million annually after 2014.

The ETS determines the emission limit (cap) ex-ante. Its **effectiveness** as a climate policy instrument therefore directly depends on the stringency of the cap, i.e. the difference between the emission cap and the counterfactual emissions that would have resulted in the absence of the ETS. The price of emission allowances is driven by the scarcity of allowances, and thus provides a measure of the effectiveness of the scheme. Yet, since its introduction in 2005 with a three-year trial phase, the effectiveness of the EU-ETS is considered variable at best. There have been short periods of relatively high prices for carbon allowances (ranging up to 30 Euro), but also protracted phases with carbon prices below the 10 Euro mark. Overall allocations in the first trading period turned out to be in excess of the actual demand for allowances, leading to a sharp decline in allowance prices in 2006. Since these allowances could not be transferred to the second period, their price fell to almost zero in 2007. After 2007, the supply of allowances was tightened, causing a temporary increase of the allowance price. However, the economic crisis beginning in 2008 resulted in a slowdown of economic activity and a contraction of industrial production, consequently contributing to overall drop in emissions. Since this economic contraction was not foreseen in the original ex-ante planning, the following was a surplus of emission allowances, and an associated decline of the carbon price to below 10 Euro (since mid-2011) and at times even below 5 Euro per ton. Since many analysts and stakeholders consider that, at such price levels, the EU-ETS cannot be expected to provide directions e.g. for investment decisions, discussion is ongoing about different options to stabilise the price of EU allowances at higher levels, including a proposal to "backload" 900 million allowances. Despite the limited effectiveness, the first two trading periods proved in general that emissions trading between the 31 Countries works in practice (Skjoerseth, J. and Wettestad, J, 2010).

In terms of the effectiveness of the ETS as a tool for climate policy, one issue that remains to be resolved is the discrepancy between the current EU-target of a 20% emission reduction, and the German national emission reduction target of 40% (both compared to 1990 emission levels). 49% of Germany's emissions are covered by the ETS (EEA, 2012), and are therefore not under the direct control of national climate policy in Germany—if emissions in German ETS-sector installations were to fall, the resulting surplus of allowances would lead to rising emissions elsewhere, unless the cap is adjusted. It remains to be seen how the existing EU-level target of a 20% reduction and the associated, current ETS cap can be reconciled with the more ambitious 40% reduction target that Germany has set for itself.

In terms of **static efficiency**, the ETS as such is close to the optimal instrument, as it sets an equal carbon price for all emitters under the scheme, and thus provides an incentive to use the cheapest option to reduce emissions. This assessment is somewhat nuanced through the complex allocation system and the high share of free allocations. In theory, the allocation method should be irrelevant for the abatement incentive provided by the ETS, as installations would factor the opportunity cost of allowances into their decision, irrespective of whether these allowances were purchased or received for free. In practice, though, it is debatable whether this assumption is always justified, especially where the decisions of installations in the present have an effect on their future expected allocation.

With regard to **dynamic efficiency**, the potential effect of the ETS has arguably been undermined by the volatile and at times very low prices observed since the start of the scheme. One fundamental criticism that has been raised is that, at price levels below 10 or even below 5 Euro per ton of CO_2, the ETS does not create a sufficient incentive to guide investment decisions into low-carbon technologies, let alone R&D efforts. A more fundamental line of criticism is whether the ETS, even at high prices, can and should actually be expected to provide this long-term signal, or whether it can only function as an instrument for short-term optimisation with given technologies and infrastructure (e.g. by changing the dispatching order of existing power plants or the co-firing of biomass).

The **political feasibility** of the instrument is a given in the sense that, in principle, it has the support of all political parties and government departments in Germany, and is backed by all major stakeholders, including business associations and environmental NGOs. There continue to be hefty controversies on issues of ETS design and implementation, such as the question of 'backloading' a significant amount of allowances in order to stabilise the carbon price. Notably, there continues to be a rift within the government, between the ministries of economy (BMWi) and environment (BMU). At different levels of intensity, this rift has been present since the early days of the ETS implementation, irrespective of the party affiliations of the two responsible ministers. It should also be noted that political feasibility has necessitated several compromises, which continue to undermine the performance of the ETS in other ways – such as the loose cap in the first trading period, the generous rules for the use of offset credits, and the huge number and the high complexity of allocation rules. The latter was especially true in the first trading period, during which the regulator sought to accommodate a number of particular and special circumstances of individual operators through a large number of specific allocation provisions.

The **legal feasibility** of the ETS was established only after a series of lengthy legal disputes, which were carried out on different levels throughout the first trading period. The relatively large amount of lawsuits also reflects the fact that the ETS represented an entirely new type of legislative instrument for environmental policy in Germany. For instance, some 700 of 1,600 regulated installations in Germany filed a complaint against allocation decisions. In a notable court case, one operator challenged the legality of the instrument as such, questioning its compliance with the German Federal Constitution on the grounds that the ETS represented an expropriation (of the right to use the atmosphere as a repository for emissions). In this case, the Federal Administrative Court established that the ETS as such does conform to the Federal Constitution. In addition to the legal proceedings between the federal government and the regulated entities, there were also court cases brought forward by federal states against the federal government and by the federal government against the EU commission, to establish the respective competencies and responsibilities or to establish the conformity of particular implementation decisions in Germany with the EU law. The number of legal proceedings has since fallen considerably, as the legality of the instrument is now widely accepted, and because the implementation has become more streamlined and harmonised.

The **administrative feasibility** of the ETS implementation in Germany has arguably been improved, as the scheme has been simplified and harmonised over the years. While the implementing authorities have made efforts to streamline processes, for instance by using IT – based solutions for all communication and decision processes, the considerable complexity of the allocation rules and the large number of court proceedings have resulted in an administrative infrastructure that is larger than necessary. Also, some still question the efforts required for application, management and submission of allowances, and the monitoring, reporting and verification processes impose an undue and disproportionate administrative burden particularly on small emitters. Germany used the exclusion of small installations subject to equivalent measures (Art. 27 in Directive 2009/29/EC) to reduce administrative burdens.

Energy and Electricity Taxes

In order to reduce energy consumption and shift taxation from labour to energy, the Federal state raised taxes on energy (including electricity). In 1999, an extensive tax reform was launched, the so-called 'Ecological Tax Reform'. It was amended in 2000 and partly modified in 2003. It was further developed the EU Energy Taxation Directive, which entered into force in 2004 and was transposed to German law in 2006.

The 1999 reform basically contained an increase in taxes on mineral oil (which had existed since the foundation of the Federal Republic after the Second World War), and introduced for the first time a tax on electricity. It was driven by two objectives: first, it aimed to contribute to energy conservation and greenhouse gas emission reductions. Although the tax rates are not based on the CO_2 content of fuels (Lehmann, 2010), they are generally considered as a tool to internalise externalities of energy production, including those related to GHG emissions. To this end, the tax also provides incentives to reduce energy consumption. The second main goal of the instrument was to generate revenues for other budget purposes. The additional public income is used to contribute to the lowering of non-wage labour costs: thus, the tool explicitly increases the cost of energy use in order to lower the cost of labour. To achieve this, the 1999 Ecological Tax Reform is for the most part revenue-neutral to the state budget. Effects on firms depend on the energy and labour intensity of the production process. ? E.g. energy intensive firms with relatively low employment would likely find increased cost, and vice-versa. (Knigge and Görlach, 2005).

The taxes are levied according to the fuel and the customer category. Also, a number of derogations apply for both energy and electricity tax, making the instrument quite complex. The extent of the ecological tax covers:

- Fuels: tax rates on mineral oil for fuel (gasoline and diesel) were increased in five steps between 1999 and 2003 by 3.07 Cent per litre each year, i.e. by a total of 15.34 Cent per litre compared with 1998. It is 2 Cent per litre for natural gas. Added to the previously existing taxes, the total tax levels amount to 47.94 Cent per litre for diesel and 65.45 Cent per litre for gasoline.
- Heating fuels: the ecological tax on mineral oil for light heating oil increased by 2.05 Cent per litre, and for heavy fuel oils to 0.97 Cent per litre. Natural gas amounts to 0.37 Cent per litre.
- Starting in 1999, a tax of 1.02 Cent per kWh for electricity consumption in all sectors was introduced. The tax rate increased until 2003 by 0.26 Cent per kWh yearly to reach a current 2,05 Cent per kWh.

The ecological tax's revenue flows primarily towards the public pension scheme, in order to reduce non-wage labour costs or at least to limit their increase. The additional tax revenues raised amounts of €18 billion annually. The reduction of non-wage labour costs creates stimuli for more employment, while the price increase of energy generates incentives for an economical energy use. It caused GHG emission reduction of about 24 million tons CO_2e by 2010 (Umweltbundesamt, 2011).

This instrument is **effective** as it creates an incentive to reduce energy consumption or to invest in energy efficiency, but no real breakthrough on behavioural change could be identified (Rodi, M and Sina, S., 2011). The effectiveness of the instrument is tempered by the fact that it is targeted to too many externalities (environment, social) (Klein, C., 2012), and that it does not create a clear carbon price signal and would be more climate effective if it was based on direct CO_2 content. . Moreover, its effectiveness could be increased if the derogation for individual sectors was reconsidered and competitiveness concerns were addressed in a way that incentives for GHG emission reductions could be maintained (Klein, C., 2012). A further criticism is that, since the tax level is fixed by nominal rates and is not adjusted for inflation, the effective tax level has declined continuously since 2004, and does not reflect the increasing importance of reducing GHG emissions.

As with all taxes the **static and dynamic efficiency** of this instrument is low, as all consumers of energy are affected by the same tax level regardless of the costs required to reduce energy consumption. The reduction of consumption that does not reflect the total abatement costs of the society.

To achieve **political feasibility** a number of derogations were introduced with the ecologic tax reform (Knigge and Görlach, 2005). For example, brown coal and hard coal, as well as fuels produced therewith, were exempted from energy tax. This exemption was dropped in 2006. The tax now generally applies to coal used as fuel or for heating. However, coal that is used for power generation is not covered by the tax, based on the reasoning that these emissions are already covered by the ETS.

The most important derogation in place concerns the electricity consumption of the manufacturing sector and agriculture, and is supposed to help them to maintain competitiveness. They enjoy tax exemptions of about 25%. Additionally, manufacturing companies are eligible to apply for a tax cap (“*Spitzenausgleich*“) in order to refund the unequal amount if the burden resulting from the electricity and energy tax is greater than the tax relief from reduction in pension contributions. In 2012, this rule, that would have otherwise lapsed, was extended beyond 2012 (Bundesregierung, 2012). However, stringent energy efficiency efforts are a precondition for the granting of this derogation. Companies are now required to implement and operate energy or environment management systems. Moreover, from 2016, companies can only apply for these benefits when the sectors concerned have agreed upon legally defined targets for energy intensity by 2013 and thereafter. In addition to the economically and socially motivated tax reductions, derogations were introduced to accelerate technology development. For example, combined heat and power plants (cogeneration and use of electricity and heat) with a certain minimum utilisation rate are exempted from the taxes. Also electricity from renewable sources meant for the use of the producer is exempt from the electricity tax. Fuel with a sulphur content over 10 ppm is taxed at an additional 1.53 Cent per litre. All the different derogations and the different tax rates have reduced the **administrative feasibility** of the tax, as it became increasingly complex.

Air Travel Tax

A tax on air travel is levied for all commercial air travels that depart from German airports. The Air Travel Levy Act (*Luftverkehrssteuergesetz*) was adopted in 2010 and became effective in January 2011. It was meant to relieve public budgets with regard to the 2008 economic crisis. The general monetary aim was to generate €1 billion per year through this tax. However, as stated in the act itself, a secondary goal is to provide an incentive for environmental-friendly behaviour. It was also argued that the tax contributes towards a more equal burden across all modes of transportation, as air travel – unlike road or rail transport – was at the time not burdened by energy taxes or other pricing tools (Bundesregierung, 2012).

It is a market-based instrument, which is legally binding for basically all passenger airlines. It falls in the competencies of the Federal level, under the auspices of the Ministry of Finance. The main custom offices are responsible for enforcing the tax. The amount of the tax depends on the destination. The tax is €7.50 per passenger for every short-haul departure, € 23.43 for medium-haul services and €42.18 on long-haul flights. Certain types of air transportation are not covered, such as cargo flights or military flights. Rates were adjusted (decreased) in 2012 due to the inclusion of air travel in the EU-ETS. Before 2012, they amounted to €8 per passenger for short-haul departures, €25 for medium-haul travels and €45 on long-haul travels.

The air travel tax is linked to the EU-ETS and is designed to complement the scheme without creating an additional burden on obligated activities. Thus, the Air Travel Levy Act states that revenues through the EU-ETS after the inclusion of air transport have to be taken into account in the amount of the tax rates. It includes a flexible mechanism by which the Federal Ministry of Finance in agreement with the Federal Environment Ministry and the Federal Ministry of Transport can adjust rates easily without a formal amendment of the act. This decrease can be conducted at the end of each year. For its calculation, the revenues of the ETS (only aviation allowances) are then used to offset the targeted revenue value of €1 billion.

The tax and its **effectiveness** are highly controversial between the industry and environment groups. Several studies were commissioned to assess the economic impact of the instrument (Bundesregierung, 2012). The German government published a study itself, which concluded that the tax had no considerable impact on the growth of the air transport industry. It decreased in 2011 only by 2 million passengers due to higher ticket prices, which corresponds to 1.2 % of the entire German passenger air traffic. While still noticeable, this was less than a study commissioned by the industry, which estimated a loss of 5 million passengers (Intraplan Consult GmbH, 2012). For this reason, a number of Federal States (Bavaria, Hessen, Lower Saxony, and Saxony) requested through their competencies in German Parliament the removal of the tax entirely. The German Parliament did not follow this motion but did decide to keep the tax rate unchanged throughout 2013. When it comes to **static efficiency** the evaluation of the tax is low, as efficient aircrafts with low emissions are charged the same tax as inefficient aircrafts. Additionally there is no **dynamic efficiency** as the tax does not encourage the airlines to use more efficient vessels. The administrative efficiency is high as flights are perceived as a cheap travelling option in comparison to the train. **The political and administrative feasibility** of the instrument is high. The implementation is easy as there are only a few companies involved and the number of flights can easily be recorded and verified.

Phase out of subsidies for hard coal mining

Germany is known to have still a relatively high emission intensive energy mix, especially due to a high share of coal in the electricity sector. The cost of producing coal in Germany is far higher than the price of imported coal; the difference is made up by a subsidy to the RAG Deutsche Steinkohle, a company that mines all hard coal in Germany. Subsidies are provided jointly by the coal intensive Länder and the Federal Government. These subsidies amounted to €30 billion from 1996 until 2007. In 2007, the public funders, together with the unions and the RAG agreed on a road map to remove these subsidies by 2018. Starting in 2014, the Federal Government will be solely responsible for financing the production subsidy.

This phase-out was laid down in the Act on Hard Coal Financing (*Steinkohlefinanzierungsgesetz*). In order to make this cut off as socially acceptable as possible, it will be implemented in stages. By the year 2018, funds are supposed to have been removed completely, but some will still be made available for closure costs and other charges (Pensions and redundancy packages for workers) beyond that date. The objectives of this instrument are to relieve the public budget from payments to this industry and to make the phase out as smooth as possible. A provision that would have allowed a revision to the phase out decision was cancelled in 2011.

Yet, the subsidies paid to hard coal mining have a very limited effect on the price of coal, as the price of coal (as an internationally traded commodity) is determined by supply and demand on the world market. Therefore, the subsidies are relevant regarding the *origin* of the coal used in Germany, but they do not have a strong effect on the price of coal versus other fuels. Consequently, the phase out of coal subsidies is not expected to have a noticeable effect on emissions, as most of the power plants now using German coal will begin using imported coal. Differences may only arise due to higher transportation costs, as the imported coal would be unloaded at harbours in northern Germany and would then need to be transported south by inland waterway or railroad. Currently, there are new hard coal power plants under construction, nearly all of which are located in areas with ample access to imported coal.

In contrast, lignite mining or firing in Germany does not receive direct government support. Because the energy density of lignite is very low, transports costs are prohibitive for longer-distance transports, and therefore lignite is not marketed globally. There continues to be a discussion on the external costs of lignite mining and lignite combustion for power generation (e.g. impacts on air quality, landscape or groundwater), yet this does not constitute an explicit, on-budget subsidy. Because of the limited effect for climate change policies this instrument is not being evaluated further.

Energy Efficiency and Energy Consumption

Germany has adopted a number of measures addressing energy efficiency and energy consumption, including command-and-control (e.g. energy efficiency standards for buildings and products), financial support (grants or low-interest loans for energy refurbishment of buildings) and measures focusing on information (labelling of vehicles, products and buildings; information campaigns on energy savings for low income households).

One key area is the **residential sector,** responsible for about 25% of final energy consumption in Germany and about a third of all CO_2 emissions (BMWi, 2013). However, the implementation of energy efficiency measures in this sector is the most challenging, especially when it comes to the existing building stock. The German government specifically targets existing buildings, with the aim of having the building stock climate-neutral by 2050. **Transportation** is another critical sector as it is coupled with ever increasing emissions. In Germany there is a mixture of measures in place to address efficiency and consumption in this sector, including CO_2 emission standards for vehicles as well as energy labelling and car tire regulations (all EU based through Regulations (EC) No 443/2009, Directive 1999/947EC and Regulation (EC) No 1222/2009). Germany specific are taxes such as the air travel tax, the road vehicle tax and the truck toll. Moreover, research in electro mobility is funded. There are few specific instruments that focus solely on the **industrial sector**.

As discussed in the previous section, a number of taxes on energy are in place in Germany, including taxes on mineral oil fuels for transport, heating fuels and electricity, as well as an air travel tax. There is no hard-and-fast rule as to whether these taxes are to be considered as carbon pricing tools (with the objective to internalise the external cost of greenhouse gas emissions), or to whether these taxes are mainly intended to reduce energy consumption. As a matter of fact, most of them serve both objectives; both rationales are put forward in the political discussion.

Energy Performance Standards for Buildings

In Germany, buildings account for about 40 % of final energy consumption and about a third of CO_2 emissions (Bundesregierung, 2010). Mainly due to global energy supply concerns, standards for the energy performance of new buildings were adopted quite early, for example in 1979 with the first Thermal Insulation Ordinance (*Wärmeschutzverordnun*g). In 2002 a new Energy Saving Ordinance (*Energieeinsparverordnung*) was adopted, and was revised substantially in 2009, introducing much stricter standards. The ordinance also places provisions on energy certificates of buildings, standards for heating and hot water installations as well as inspections of air-conditioners.

The main aim however is to set strict energy performance standards for new buildings, lowering the standards for allowable energy demand by about 30% for a reference building in comparison to the previous regulation. To calculate the primary energy demand, the building envelope, the heating, and other energy installations are taken into account (Section 3 Energy Saving Ordinance). The use of renewable energy is factored in as well, but only if it is produced and primarily used within the building (Section 5 Energy Saving Ordinance). The ordinance also sets out energy standards for existing buildings, but only in exceptional cases, i.e. if they are subject to a major renovation (Sections 9-12 Energy Saving Ordinance).

The Energy Saving Ordinance transposed the 2002 Energy Performance of Building Directive into national law. It now needs to be adjusted to match provisions set forth by the 2010 Energy Performance of Building Directive. The latter requires that Member States increase the obligatory energy performance standards for buildings, in order to ensure that by 2021 all new buildings are ‘nearly zero-energy buildings.’ A new Energy Saving Ordinance is currently in the legislative process. Pursuant to its energy concept, Germany aims to have a climate-neutral building stock by 2050, meaning that the energy demand of buildings will be as low as possible and covered by energy from renewable energy sources, produced within the building by private installations or otherwise locally. These measures are also meant to contribute to a secure and reliable energy supply.

As the Energy Saving Ordinance is a clear case of a command-and-control policy, its **effectiveness** depends on the enforcement of the law.

Though this measure, if fully implemented, will make an important contribution to lowering CO_2 emission from the building sector, it is only one tool in a much bigger kit. That is because three quarters of the building stock date back to a time before any energy efficiency standards applied (Bundesregierung, 2010). It needs to be highlighted that a big challenge is not being tackled as the existing building stock is not being regulated.

The **static and dynamic efficiency** of this instrument is low. All new buildings are treated the same and things like regional peculiarities are not taken into account. Investors in new buildings have no incentives to overachieve the limits set by the ordinance. Additionally there are little incentives to use new technologies that achieve the same insulation results with lower costs. Using new technologies requires a permitting procedure that certifies an equivalence with existing technology.

As to the **political and administrative feasibility** of the instrument the ordinance is federal law, developed under the auspices of the Federal Ministry of Transport, Building and Urban Development, together with the Federal Ministry of Economics and Technology. , The different Länder authorities are responsible for enforcing the law in their jurisdiction. However, it has been criticised that the Länder lack adequate and systematic controls (Ziem, 2011). Authorities only do checks based on samples, which limits the environmental effectiveness of the Ordinance. Under the new Energy Saving Ordinance, the administrative requirements will be tightened, as the federal government plans to formulate binding standards for controls that the Länder will be required to abide to. Moreover, administrative fines will have to be paid in the case of non-compliance.

With regards to the existing buildings the German government has as of yet declined to introduce binding command-and-control measures. This is mainly due to a lack of political feasibility as there are concerns about the financial burden this would impose on home owners.

Financial Support for Refurbishment of Buildings

To tap the energy efficiency potential in the existing building stock, the German government funds private investments in energy rehabilitation and in new heating installations. This is meant to accelerate the rehabilitation rate of existing buildings from 1% to 2% annually without setting any legal requirements to this effect. It is also intended to support relevant technology development. House owners can choose between low-interest loans and grants. The amount of the financial support depends on the energy performance level that is meant to be achieved by the refurbishment. The requirements are also adjusted based around the energy performance standards laid down in the Energy Saving Ordinance for new buildings.

This scheme, the so-called 'CO_2 Building Rehabilitation Programme' (*CO_2 Gebäudesanierungsprogramm*), is supposed to contribute to the objective of a climate-neutral building stock, to be reached by 2050. Through the scheme, grants and low-interest loans are made available by the state-owned bank Kreditanstalt für Wiederaufbau (KfW). Financial support (in the form of grants or subsidised interest rates) is funded from the Climate and Energy Fund, which is fed from auctioning revenues of the EU ETS. Payments vary between €5,000 and €75,000, either for individual measures or the refurbishment of the entire building. Provided that eligibility criteria are met, the loans are allocated on a first-come-first-serve-basis. Eligible for funding are private house owners (grants and loans), but also housing companies and contractors (only loans). House owners can basically choose between a grant and a loan. Tenants are not eligible to receive funding. There is also a sub-programme that targets regional authorities and municipalities in order to mobilise refurbishments in public buildings such as hospitals, schools and indoor pools.

According to the Federal Ministry of Transport, Building and Urban Development, the CO_2 Building Rehabilitation between 2006 and 2012 received a total funding of €9.3 billion. €1.6 billion were allocated to grants and low-interest loans. This had triggered investments of about €117.6 billion. About 3 million apartments were rehabilitated, as well as 1,400 public buildings. The refurbishing efforts correspond to a CO_2 emission reduction of 6 million tonnes annually (Bundesministerium für Verkehr, Bau und Stadtentwicklung, 2013).

The funding is supposed to amount to €1.5 billion annually from 2012 to 2014. An additional €300 million annually was added to these pledges at the end of 2012. Whether this money actually becomes available will largely depend on the development of the EU ETS price and hence the auctioning revenue, and whether a shortfall of revenues can be compensated though the federal budget.

The instrument is a key measure in tackling emissions from the building sector. It has proven to be **effective** so far, as it helped to facilitate investments in building rehabilitation and to reduce CO_2 emissions. Nevertheless the refurbishment rate is still below 2 %

The **static efficiency** of the instrument is debated. While the scheme in principle taps into an abatement potential that is considered as efficient and cost-effective, there is actually no information whether investments are indeed made where they are most efficient. A recent economic study on building rehabilitation concluded that the costs of this instrument have not yet been sufficiently considered and that the rehabilitation of the existing building stock is in fact much less economic than commonly believed, especially due to the energy standards that were already implemented in private households over the last years, and the changes in energy consumption (Simons, 2012). In addition, the impact on public budgets is not yet clear as there are revenues from taxes and costs due to low interest rates (Kuckshinrichs, 2011). The **dynamic efficiency** of the instrument is debateable as well. As most of the investments are linked to specific technologies the innovative search for new applications that achieve the same results at lower costs is not being supported.

When it comes to **administrative and political feasibility** the funding is the main concern as the general support for the instrument is high and the KfW is very experienced in implementing these types of programmes. The availability of funds is linked to the Climate and Energy Fund, which hinges on the development of auctioning revenues from the ETS and other revenue streams, such as a tax on nuclear fuels. Since these funding streams have fallen, the available funding has declined from €2.25 billion in 2009 to €0.9 billion in 2011 and 2012, far below the €1.5 billion pledged (WWF et al 2011, Bündnis 90/Die Grünen Bundestagsfraktion, 2012). The majority of experts agree that the amounts prescribed so far are not enough to meet the targets for primary energy reduction in the housing sector, and that the funding should be increased to €2.5 billion annually (Bundesregierung, 2012a). Also the constant uncertainty about the amounts actually available in the programme has become an obstacle hindering investments. It has also been suggested that the funding should be targeted more precisely, especially targeting low-income households, which otherwise may not have the capacity to finance profitable energy-efficient investments. Moreover, the support given to house owners should better reflect the actual energy efficiency gains that can be reached by rehabilitation measures (Klein, C., 2012).

Premiums for Electricity Produced in CHP Units

In Germany the deployment of combined heat and power (CHP) is promoted by a number of mechanisms. The key instrument in this respect is the premium paid for electricity from CHP units. It is anchored in the Act on Combined Heat and Power (*Kraft-Wärme-Kopplungs-Gesetz*). It was adopted in 2000 and amended twice, most recently in 2012. Its objective is mainly emission mitigation, although it is also meant to accelerate technology development in general and contribute to the reliability of the energy supply. It aims to incentivise investments in the modernisation of existing CHP plants and in new CHP plants. Moreover, it is supposed to stimulate investments in new thermal power stations (with no size limit) and district heating grids as well as promote the market penetration of fuel cells. It aims to increase the share of CHP electricity generation in total electricity generation to 25 % by 2020 without specifying the fuel used.

The instrument is similar to a feed-in-tariff for renewable electricity. The producers of CHP electricity receive a fixed premium to the market price. The grid operators are required to connect CHP plants to their grids and to buy their electricity. There are different remuneration categories, varying between 5.41 ct/kWh CHP electricity for new small CHP plants (< 50 kW) up to 2.4 ct/kWh for new CHP plants <2 MW. Depending on the size of the plant, the premium is paid for a period of 10 years or as a lump sum for a total of 30,000 full load hours. Modernised plants also receive 5.41 ct/kWh CHP, for a period to 5 to 10 years or a lump sum.

District heating grids receive €100 per meter, but not more than 40% of the investment or 30% of their total investments. This is capped at €10 million per project. Additionally, small CHP plants up to an electric power of 20 kW can apply for an investment grant. Few amendments were made in 2012. This was mainly an adjustment to compensate the fact that CHP producers are now required to buy certificates within the ETS. Until 2006 the payments amounted to €800 million per year. This amount has decreased considerably (to €490 million in, 2009), as funding was phased out for certain installation types. The total sum of all premiums and investment subsidies to district heating grids is however capped: it cannot exceed €750 million per year. It is allocated on a first-come-first-served-basis. However, the available funds were not exhausted in recent years (BMWi, 2011).

A recent governmental assessment showed that from 2002 to 2010, the net electricity production from CHP increased by 14 TWh, from 76 to 90 TWh annual production. The share of CHP electricity in the total electricity generation increased to 15.4% annually. This contains both CHP electricity production plants that received the CHP bonus and those that did not. In 2009, 53 TWh of the CHP electricity produced received the CHP premium. 27,000 installations in total were funded in 2008 (BMWi, 2011). The instrument is therefore **effective** as it has increased the share of electricity produced in CHP units. CHP makes a contribution to energy efficiency targets and reduction of CO_2 emissions. This instrument achieves annual CO_2 emission reductions of 20 million tonnes. (Matthes, 2010) Nevertheless there are concerns regarding the effectiveness of the instrument, in relation to the defined target: there are concerns whether the instrument is sufficient to reach the 25% target for CHP by 2020. These concerns are founded on the reduced demand for heat and an increasing demand for electricity in private households. New CHP plants therefore need a different power coefficient (the relationship of electrical energy to thermal energy**)** to produce more electricity and less heat from the same amount of input energy.

Static efficiency is achieved if the target is met with minimum costs. This would be the case if only the cheapest technology with the lowest premium would be supported by the policy instrument. As the German CHP support scheme uses different rates for different technologies, this could only be efficient if the cheapest technology does not have enough potential to meet the target.

The dispatch of the CHP units are efficient as the CHP premium is added to the market prices for electricity instead of replacing it. This gives the owners of the CHP plants incentives to consider price signals in the investment decision and the dispatch of the units. This increases the to support market integration of CHP in the long run (Lehmann, 2010).

Long term effects and therefore the **dynamic efficiency** of the instrument are difficult to assess, as the role of CHP in an electrical system with high shares of renewable and a heating sector with houses using almost no energy for heating is unclear. Long term perspectives might be a good reason to also support technologies with higher costs and premiums.

The **political and administrative feasibility** of the instrument is high. As costs are equalised in a nation-wide scheme and passed on to the final consumers through the grid fees there are no burdens to the public budget. The current surcharge for the year 2013 for private households is only 0.126 ct/kWh and therefore receives little attention from the consumers. Additionally the CHP units are often owned by public utilities. This increases the support to this technology among all political parties. The grid operators bear the administrative burden.

Promotion of Renewable Sources of Energy

Feed-In Tariffs for Renewable Electricity

The key instrument for the expansion of renewable electricity is the Renewable Energy Sources Act (*Erneuerbaren-Energie-Gesetz, EEG*), which dates back to 2000. It has been revised several times since then, but without changing its main mechanism, the feed-in tariff for renewable electricity combined with priority access to the grid. According to Section 1, it aims to increase the share of renewable energy sources in electricity supply to at least 35% by 2020, 50% by 2030, 65% by 2040 and 80% by 2050. These targets are even more ambitious than the targets set out for Germany in the 2009 EU Renewable Energy Directive (Schomerus, 2012). It is federal law, under the auspices of the Federal Environment Ministry and is therefore binding for grid operators. Renewable energy producers are free to sell their electricity on the markets or to make use of the feed-in tariff.

The act lays down an obligation for grid operators to buy electricity produced from renewable energy sources and to grant priority access to the grid. Renewable electricity producers receive a guaranteed feed-in tariff for a period of 20 years from the grid operators. The tariffs vary for the different sources of renewable electricity (hydropower, landfill gas, sewage treatment gas, mine gas, biomass, geothermal energy, wind energy on land, offshore wind energy, solar radiation). Only biogas plants >750 kW are not eligible to receive renumeration. Operators of about 80,000 plants benefit from this system. The feed-in-tariff rates for newly installed generation units are reduced on a yearly basis (degression), in order to facilitate market integration and stimulate innovation. The same applies to the so-called market premium (*Marktprämie*) that is paid to producers who sell their electricity directly on the market instead of using the transmission system operator.

Table 2: Feed Iín Tariffs in the EEG

Energy source	size	Tariff
Hydropower	Different size categories, for installations with rated average annual capacity between up to 500 kW till >50 MW	Varies per size, from 12.7 ct/kWh for small plants to ct/kWh 3.4 ct/kWh for big plants
Landfill gas	up to 500 kW_{el}/ up to 5 MW_{el}	8.60/ 5.89 ct/kWh
Sewage gas	up to 500 kW_{el}/ up to 5 MW_{el}	6.79 kWh/ 5.89 kWh
Mine gas	Up to 1 MW_{el}/ up to 5 MW_{el}/over 5MW_{el}	6.84/ 4.93/ 3.98 kWh

Biomass	Different size categories, for biogas installations, biowaste fermentations installations and small manure installations with an average annual capacity between <75 kW_{el} till 20,000 kW_{el}	Biogas installations: basic tariff between 14.3 and 6 ct/kWh, with an bonus between 4 and 8 ct/kWh depending in the substance used
		Biowaste fermentation installation: between 16 and 14 ct/kWh
		Small manure installations (<75 kW_{el}): 25 ct/kWh
Geothermal energy		25 ct/kWh, with an additional bonus of 5 ct/kWh for electricity with is also using petrothermal technology
Onshore wind	big and small installations (up to 50 kW)	Big: 8.93 ct/kWh in the first five years, after that 4.87 ct/kWh basic tariff, plus system services bonus (0.48 ct/kWh) and repowering bonus (0.5 ct/kWh) Small: 8.93 ct/kWh
Offshore wind		15.0 ct/kWh in the first 12 years, after that 3.5 ct/kWh
Solar radiation	Different tariffs for different installations and sizes	Free-standing installations up to 10 MW : 13.50 ct/kWh Installations in, attached to, or on top of buildings, between 10 kW up to 10 MW: 19.50 – 13.50 ct/kWh

The costs are equalised to all final electricity consumers through a nation-wide mechanism. This is meant to cover the difference between the price that is paid at the stock market and the feed-in tariff that is paid to producers (so called EEG surcharge/*EEG-Umlage*). Currently, this surcharge amounts to 5.3 Cent/kWh.

A number of consumers are exempted from the surcharge (Sections 40 et. subs.), such as electricity-intensive industry and railroad operators, due to concerns about their competitiveness. Enterprises that purchased at least one GWh at a certain delivery point in the last financial year but not less than 10 GWh in total are eligible to benefit from these derogations. The surcharge is then limited in stages. The full surcharge has to be paid for the first GWh. Above that, certain limitations apply (2-10 GWh = 10% of the surcharge, 11-100 GWh = 1 % of the surcharge, <100 GWh = 0.5 cents/kWh).

The performance of the instrument and progress towards meeting the renewable energy targets is assessed on a regular basis (monitoring). Finally, the act introduced a clearing mechanism. The relevant actors can choose to solve any conflicts on the application of the law outside of court with the help of a clearing body (*Clearingstelle EEG*).

In terms of **effectiveness**, the instrument has performed remarkably well. In 1990, the renewable share of electricity consumption was just 3.1% (most of which from hydropower plants, often dating back several decades), by 2011 this figure had increased to 20%. This can mainly be traced back to the feed-in tariff. Various countries in the world have adopted a feed-in tariff scheme modelled on or inspired by the German example, in order to promote the production of electricity from renewable energy. One of its key strengths is the long-term investment certainty it creates for investors, and its independence from national budgets, reducing the necessity for state intervention (Schomerus, 2012).

In contrast the **static and dynamic efficiency** of the instrument is debatable. The instrument does not reach the targeted share of electricity from renewable sources with the lowest possible costs. A support mechanism for renewable that meets the criteria of static efficiency would need to focus on the technology with the lowest costs. However the EEG also supports higher cost options such as PV. The rationale behind this is that on the long run the costs for generating electricity from renewable energies can be reduced. This requires a perfect foresight by the legislative body and an adjustment of the tariffs according to the technological development and the reduction of production costs. As a matter of fact a number of adjustments became necessary over the last few years in Germany. In order to incentivise development and innovation of the PV technology, tariffs for PV electricity were initially set at a very high level. Rapidly falling prices for solar panels meant that, despite the in-built degression of tariffs, tariffs soon exceeded the cost of PV generation by a large margin, leading to a mushrooming of new PV installation. In order to limit the rapid growth of PV, and the associated costs (and future payment obligations), the feed-in tariff for PV was reduced in several rounds. The overall evaluation of efficiency including the dynamic effects generated by the drop of the prices is not straight forward.

In terms of **political feasibility**, the EEG has generally benefited from broad, bipartisan support across the political spectrum. Recently though, it has sparked increasing controversy, mostly because of the rising EEG surcharge that energy consumers have to face, but also because of the unequal distribution of costs between private households and industrial power consumers. There are a number of factors that drive up the EEG surcharge, beyond the increase in deployed renewables: as the surcharge is designed to cover the price differential between the wholesale price of electricity and the guaranteed feed-in tariff, a falling wholesale price translates into a higher surcharge. Ironically, higher output of renewable electricity tends to drive down the wholesale price of electricity (merit-order effect), and hence works to increase the EEG surcharge. In addition, the low carbon price under the EU ETS has contributed to lower electricity prices, driving up the surcharge. Beyond the total volume of the surcharge, the contribution also matters: the exemptions for the energy-intensive industry increase the weight of the costs on private consumers, thus creating distortions (Klein, 2012). Different options are currently under discussion as to how to develop the system in the future, maintaining the impetus for further expansion of renewable while keeping electricity prices at an acceptable level, including a capping of the EEG surcharge and a reduction of exemptions for the energy-intensive industry.

The **administrative feasibility** of the instrument is generally good. The day-to-day operation of the system is essentially administered by grid operators (Schomerus, 2012). However, since any change in the tariffs has to go through the full legislative cycle, the flexibility of the instrument has its limits (Klein, C, 2012).

Measures to Accelerate Electricity Grid Extension

The optimisation and expansion of the electricity transmission and distribution grid is required to further increase the share of renewable electricity and facilitate the full implementation of the Energiewende. Electricity has to be transported from areas with high production of wind electricity (north of Germany) to key demand areas (mainly south of Germany). The German Energy Agency, which works under the Federal Ministry of Economics and Technology, has assessed the grid extension needs in cooperation with the transmission system operators in two different studies. These studies were the first approach for identifying the future grid extension needs and helped to define the problem. Additionally the duration of the planning and construction process for new grid investments was made public. The regulator and the grid operators claimed that it was impossible to build a new high voltage transmission line in less than 10 years.

After being raised to the agenda by the grid operators, the 2005 Infrastructure Planning Acceleration Act and the 2009 Power Grid Expansion Act (*Energieleitungsausbaugesetz*, EnLAG), were adopted to accelerate planning procedures. The latter identified and codified 24 priority grid expansion projects. However, there still has been considerable delay concerning the implementation of these projects, especially due to differences in the planning procedures and practices in different *Länder*. By 2012, only 214 km of the planned 1,834 km lines had been built and none of the pilot underground cables were operational (Bundesnetzagentur, 2012).

In 2011 the Grid Expansion Acceleration Act (*Netzausbaubeschleunigungsgesetz*) was adopted to tackle these and other shortcomings. The planning procedure was basically lead at the federal level with several stages. At the first stage, the four German transmission system operators had to prepare different scenarios for grid extension according to their needs, with a focus on the next 10 and 20 years. These scenarios have to be updated on an annual basis. After approval from the Federal Network Agency, the operators were obliged to work on a joint grid development plan. The first one had to be submitted by June 2012. After approval by the Federal Network Agency, the plan was put forward to the Federal Parliament, together with an impact assessment. It adopted a binding Federal Grid Plan (*Bundesbedarfsplan*) which contains the start and end points of necessary high-voltage lines. The law also provided for public participation at different levels of the process. The main advantage of this approach is that the need for specific grid projects is not open for further discussion in the planning procedure but identified and codified in national law. Moreover, the approval procedure of the individual projects has been centralised, by making the Federal Network Agency the competent approval authority for projects that cross the borders of two or more *Länder*. This 'one-stop-shop' approach is meant to accelerate the procedure considerably.

The first national grid development plan was completed in November 2012. The plan called for an update to 2,800 km of additional lines and 2,900 km of lines that needed to be optimised. The Federal Grid Plan that the German government prepared is expected to be discussed by the Federal Parliament in early 2013.

In order to facilitate the connection of offshore wind projects to the grid, the Energy Industry Act (*Energiewirtschaftsgesetz*) was amended in November 2012. This was to encourage grid operators to work on an offshore grid development plan, also needing to be updated on an annual basis. Moreover, liability rules for grid operators were introduced. The grid operators are now liable for any damages that offshore electricity producers suffer due to delayed grid connections. However, these costs can be equalised for final energy consumers through a surcharge.

As to effectiveness, these new instruments seem to be useful answers to the challenges in infrastructure. The specific needs – i.e. a coordinated, nation-wide approach – have been targeted. Acceptance issues – also regarding the difficult questions of expensive, but acceptable underground cabling versus much cheaper, but controversial overhead power lines – have been addressed by providing for public participation at different stages of the process. This will potentially slow the process down a bit, but will help to balance out the acceptance issues to some extent.

R&D Funding for Energy Storage Technologies

The German government, under the auspices of the Federal Ministry of Economics and Technology launched the 6th Energy Research Programme of the Federal Government (*6. Energieforschungsprogramm*) in 2011. It is meant to complete the Energy Concept as it formulates key priorities and guidelines for R&D in the areas of energy efficiency, renewable energy and grid and storage technologies. It is coordinated through a platform administered by the leading ministry (*Koordinierungsplatform Energieforschung*). The programme is funded by the Energy and Climate Fund and the German government pledged to provide €3.5 billion annually in support of the project.

One initiative under this programme, called the "energy storage initiative" (*Speicherinitative*), focuses on storage technologies. It is an interministerial initiative and its priority funding areas include research, development and demonstration. The programme began with the launch of 60 innovative research projects in five different universities. Those projects with the most promising potential are clustered around 'lighthouse' projects—the conversion of wind power to hydrogen as well as high-efficiency batteries. The fund set aside an initial €200 million for this specific initiative (BMWi, 2012).

At the current stage an evaluation of the instrument is not possible. However, it targets specific R&D needs for energy transformation and contributes to an overall aim of achieving dynamic efficiency in the energy system with high shares of renewable energy. At the current state of technological development a direct support mechanism is suitable.

Biofuels Quota

In order to promote the use of renewable energies in the transport sector and to meet the 10% sector target laid down in the 2009 Renewable Energy Directive, Germany generally relies on biofuels. For that purpose, it introduced regulatory measures. The Biofuel Quota Act of 2007 partly replaced the tax exemptions for pure biofuels by a biofuel quota (by energy content not volume), and was also integrated into the Federal Immission Control Act (*Bundesimmisionschutzgesetz*). The quotas were adjusted once in 2009.

Pursuant to Section 37a of the Federal Immission Control Act, mineral oil companies have to reach a biofuels quota of 4.4% in diesel by 2015 and 2.8% in petrol on average for the period 2009 to 2014. In addition they are required to meet an overall target of 6.25% by 2014. Since 2011 it is also possible to offer gasoline with a 10% biofuel content, in accordance with the Fuel Qualitative Directive 2009/39/EC,

Moreover, from 2015 onwards, the quota system will effectively be dropped and instead a CO_2 emission target will then apply. Mineral oil companies will be obliged to achieve a total 3% net GHG emission reduction by 2015, 4.5% by 2017 and 7% by 2020 due to the addition of biofuels. The 7% in net reduction of greenhouse gases is supposed to correspond to a share of approximately 12% of biofuels in transport (Knebel, 2011).

The main custom office in Frankfurt (Oder) in Cottbus is responsible in enforcing the quota obligations. Mineral oil companies have to record their progress annually until March 31 of each year. The offices in Frankfurt (Oder) can impose a penalty of up to €50,000 in cases of non-compliance. In addition, the quota obligations can be traded. This is to create a trading effect in order to allow the fulfilling of the quota at the cheapest price. This system is administered by the custom office in Frankfurt as well.

Originally, the use of biofuels was only promoted by tax exemptions. In 2006 the fiscal costs resulting from tax exemptions for biofuel and heating oil made from biomass peaked at €2.1 billion (Rauch, A. and Thöne M., 2012). The federal government decided to switch to a command-and-control promotion scheme in 2007, when the expansion dynamic in this area caused considerable losses of tax revenues. According to the 2006 bill, the instrument aims to contribute to the reliability of the energy supply, to climate policies and – as the type of instrument is concerned – to reduce state aid as well as consolidate the public budget.

There have been further adjustments in 2010 to transpose the EU Fuel Quality Directive. Mineral oil companies are obliged to offer petrol with a 10% volume of bioethanol (“E10”) in order to meet the biofuels quota. Introduction of E10 started at the beginning of 2011 but was met with consumer resistance due to concerns regarding the engine compatibility and sustainability of the fuels. In response the government started a broad information campaign in cooperation with relevant business associations.

All biofuels - in mixes or in pure form - that are used to meet the quota are subject to energy taxes. In Germany there are different fuel duties for petrol and diesel. For petrol, the fuel duty is 65.45 cent per litre and for diesel it is 47.04 cent per litre (Section 2 Energy Tax Act). There are tax exemptions in Section 50 Energy Tax Act for biofuels that are not covered by the biofuels quota, i.e. pure biofuels. Only second generation biofuels are completely exempted from taxes, but even this provision will be phased out by 2015. Biofuels can only be used for the quota obligations when they meet the sustainability standards of the Biomass-Sustainability Ordinance.

Imposing regulatory provisions such as mandatory blending requirements are very **effective.** The regulation guarantees a certain biofuel market share. The share of biofuels amounted to 5.5 % in 2011 and Germany will likely meet the 10% transport target required by the 2009 Renewable Energy Directive (Löschel et. al, 2012).

Static efficiency of regulation instruments is low. The previous instrument changed the relative prices by imposing different taxes on the fuel. This is seen as a more economically efficient way to change the behaviour and internalize the negative externalities (Klein, C., 2012)

The **dynamic efficiency** of the instrument is low as the development of second generation biofuels is not addressed directly. Additional instruments aim to close that gap and address this issue.

The **administrative and political feasibility** of the instrument is high, as it does not directly affect government on-budget expenditure. Additionally, it does not require car manufacturers to increase efficiency or reduce consumption of the automobiles. This is of special importance has Germany's premium car manufacturers have a high fleet consumption. Mandatory blending requirements shift the costs of increased biofuel use towards the private sector—the producers and consumers of biofuel. Problems arise due to a decreasing domestic biomass potential and discussions on the price effects in the food sector. German car owners are very sceptical on the effects the biofuels might have on the engine. In combination with increasing debates on monoculture in agriculture and interactions with food prices, biofuels are not seen very positively by the German public. This reduces the political feasibility in the future in case of higher target ambitions.

Obligation to use renewable heat

The key measure in order to increase the share of renewables in heating/cooling sector is the mechanism laid down in the Renewable Energy Heat Act (*Erneuerbaren-Energien-Wärme-Gesetz*), which entered into force in 2009. The act aims to contribute to the increase of the renewable energies' share in final energy consumption for heating (space heating, cooling and process heat and hot water) to 14% by 2020.

New buildings, both domestic and public, are required to cover a certain share of their heat demand with energy produced from renewable sources. The share of energy that needs to be covered by renewable energy depends on the source that is used. The obligation can be met by either covering at least 15% of the heat demand through solar thermal energy, 30% through biogas in CHP-use or 50% by using liquid or solid biomass, heat pumps or geothermal energy. Alternatively, the obligation can also be met by an "overfulfillment" of the Energy Saving Ordinance (by 15%) or from waste heat, district heating or cogeneration plants. Administrative penalties up to €50,000 in value apply in the case of non-compliance. The law was revised in 2011 in order to make public buildings subject to its provisions and set a good example by actively using renewable energy in the heating sector. Due to the alternative fulfilment options (e.g. district heating) this law has interactions with the power sector by means of CHP. The law also promotes district heating and cooling, stipulating that municipalities are competent to make connection and use for their citizens obligatory, especially if the aim is to contribute to climate policy. This is to clarify that the local level is allowed to adopt these types of measures, though they normally only have the facilities to regulate matters impacting their own territory.

Renewable heat measures are complimented by a financial support programme – the Market Incentive Programme – that provides investment grants for renewable heating technology (such as solar panels, biomass plants and efficient heat pumps) in existing buildings and thus facilitates their market penetration. Although the share of renewable heating is increasing constantly, the growth is not as strong as it is in the electricity sector. The Market Incentive Programme is strongly dependant on the national budget and is therefore susceptible to fluctuations in national allocations. The programme had to deal with a budget closure in May 2010 that was partly called off in July of the same year, but not before causing severe uncertainty in the market (Bundesregierung, 2012b). To measure the **effectiveness** of the instrument the Federal government published a report on the implementation of the act in December 2012 (Bundesregierung, 2012b). It stated that the share of renewable energy in heating/cooling has risen over the last years (up to 10.2%). However, the impact of the Renewable Energy Heat Act is difficult to measure because different instruments – such as the Market Penetration Programme, the Energy Saving Ordinance and the CO_2 Building Rehabilitation Programme – all have an independent effect on the building sector. In general, Germany is making good progress in increasing the share of renewable in the heating sector.

The evaluation of the **static and dynamic efficiency** of the instrument is strongly influenced by the alternative fulfilment options such as district heating and a reduction in the total energy consumption. The alternative fulfilment options reduce the risk of inefficient investments if the renewable heat can only be gained with very high costs. If balanced wisely the different options can lead to a competition between the technologies and help to decrease the costs for generating heat from renewable sources. Nevertheless the instrument is a strong regulation for the construction sector and is not as efficient as a market-based instrument.

The **political feasibility** is high as there is strong support to extend the success from the electricity sector to the heating sector. In addition, the different fulfilment options support other technologies, such as CHP, that have a high political support. The **administrative feasibility** is strongly linked to the monitoring. The obligatory compliance with use provision relies heavily on the monitoring by the local authorities of the private house builders. However, sufficient monitoring systems have not been set up yet (Ziem, C., 2011).

Integration of Climate Policy in Land Use Planning and Zoning

Spatial planning plays an important role for emission mitigation, as it has a considerable impact on the number and location of renewable energy installations. A number of instruments are utilised to tackle this issue, reaching from allocating areas for certain renewable energy production on the highest planning level (set by *Länder*, planning associations and districts), to restrictions in certain cities on using fossil fuels for heating purposes (set by municipalities). Germany has a multi-level system, composed of the Federal state, the *Länder* and municipalities, all with competences that are protected by the German Constitution.

Thus, German municipalities are not restricted to the duties mandated to them from the federal and the state level. The Basic Law (*Grundgesetz*) guarantees the right of 'self-government'. However, they can only use this discretion abiding by certain standards that are laid down in the building law of the Federal state (Federal Building Code, *Baugesetzbuch* and the Building Codes of the *Landesbauordnungen*). It is at the Federal level where renewable energy and energy efficiency standards are set, and these standards must then be considered by municipalities in their legally binding land-use plans.

Despite the multiplicity of laws and regulations that are relevant for climate protection, climate change policy is considered as a voluntary task and municipalities have the freedom to choose whether to become active or not. The municipalities also have a certain extent of flexibility in 'how' such measures should be implemented (Bulkeley, 2006). However, municipalities generally do make use of the opportunities, not only by integrating them in national land use plans, but also by adopting additional overarching strategic plans on how to tackle climate change in their territory (municipal climate protection concepts). These efforts are also supported by the Federal state, through the National Climate Initiative, which is funded by the Energy and Climate Fund. Municipalities are eligible to get funding for external consultancy in setting up these concepts and for the implementation of certain measures (*Kommunalrichtline*).

German legislators recently adopted a new law in order to integrate climate protection even more in planning and building. The Act for the Promotion of Climate Protection in Urban Development (*Gesetz zur Förderung des Klimaschutzes bei der Entwicklung in den Städten und Gemeinden*) was one of the legal acts adopted to facilitate the German *Energiewende* in 2011. The objective of the act is to promote climate protection by means of spatial and planning law (see Section 1). It was a continuation of the strategy to facilitate a more local climate policy presence and thus included a series of relevant amendments to the Building Code of previous years. With the 2011 revision, the issue of climate protection in building and zoning was emphasised and upgraded in importance to an independent objective in spatial planning. As said before, climate protection measures are not obligatory for municipalities, but they are at least obliged to consider them when setting up their legally binding land-use plans. If municipalities choose to integrate requirements on energy efficiency as well as pinpointed renewable energy projects into their plans, they become obliged to abide by certain standards. Eventually, these plans then become binding for the citizens subject to their jurisdiction. For example, cities can set out requirements for the usage for renewable energy and CHP in buildings. Opt-outs are possible in individual cases in which the measure could result in undue hardship. Moreover, new rules were introduced in order to facilitate the approval of renewable energy plants.

There is only one *Land* so far that obliges municipalities to adopt the climate-energy concept; Nordrhein-Westfalen provides an extra €50 million for project implementation..

As to the optimality of the measure, it is very difficult to quantify any of the progress in terms of effectiveness and static and dynamic efficiency. There are however no concerns regarding the potential impact this instrument can have (Otting 2011, Eckhardt, 2012). It is a necessary contribution to the overall instrument mix as it includes the local level and at the same time respects the principle of subsidiary and the rights of the municipalities in governing their own issues. This contributes to the feasibility of the instrument.

Non- Carbon Dioxide Greenhouse Gases

Ban of Landfilling Untreated Waste

Methane emissions from the landfilling of biodegradable municipal waste is a considerable source of GHG emissions. Given the enormous GWP (global warming potential) of methane emissions, the reduction of this type of waste treatment is crucial. Very strict landfill criteria have existed in Germany since 1993, though only in administrative provisions. When the EU adopted the Landfill Directive 1999/31/EC in 1999, Germany had to transform the pre-existing standards into binding legal legislation and did so with the Landfill Ordinance (*Ablagerungsverordnung*) in 2002. The requirements laid down were beyond what was required in the Landfill Directive. In 2003 the Landfill Directive was amended by a Council Decision, which established criteria and procedures for the acceptance of waste at landfills (2003/33/EC). A number of derogations were skipped. It was replaced by new legislation in 2009 (*Deponieverordnung*), with yet again even stricter requirements than the EU legislation.

The instrument is very **effective**. The German legislation led to a phase out of landfilling waste without prior treatment, i.e. thermal (incineration) or mechanical and biological processes. These processes serve to limit the organic content of landfilled waste responsible for methane emissions. Beginning on June 1, 2005 a complete ban on the landfilling of waste was introduced in Germany. This has lead to decreases in the volumes of total municipal waste landfilled, and, consequently, the number of municipal landfills in operation decreased from approximately 300 in 2004 to 160 in 2006, amounting to an overall estimated 50% decrease (European Commission, 2007). Since the deadline, the amount of municipal waste landfilled has fallen to 1% with just some waste after treatment remaining. By 2012, methane emissions from landfilling were reduced by 90% compared to 1990. Through the shift from landfilling to recycling and other treatments, significant advancement has been made in other forms of GHG emission mitigation as well. The ban of an activity has obviously a very low **efficiency** as it reduces the available options in the economic system. A ban is a suitable measure if the danger associated with the activity is very high. It can be argued that this is the case as methane has a very high damaging rate. However, the interactions this instrument has with other policy fields need to be considered. The ban can also be interpreted as support mechanism for recycling in order to reduce the resource demand.

Administrative and political feasibility differs across the federal states as local governments are responsible for the enforcement of federal legislation. Depending on the administrative structure in each of the 16 German Länder, enforcement is ensured at the state, regional or county/local level. There are, however, no considerable implementation deficits. Sanctions for non-compliance with the legal requirements are set by federal law at up to €50.000.

Fertilisation Standards in Agriculture

Mineral fertilisers and manure (fertilisers from waste) in agriculture are used to accelerate cultivation of agriculture crops. Fertilisation leads to a higher organic carbon level in the soil, which has a positive impact on the global greenhouse. However, these effects are outweighed by the negatives ones, i.e. the considerable amount of N_2O and CH_4 emissions caused by the use of mineral fertilisers and manure. GHG emissions caused by fertilisers are a complicated issue, as there are many different stages of fertiliser use that are relevant. The extent to which emissions are released depends not only on actual use but also the storage, the timing and method of applying manure or – in the case of mineral fertilisers – on the amount of nitrogen that is spread.

The Fertiliser Ordinance (*Düngeverordnung*) of 1996 was substantially revised in 2006 and was most recently amended in 2012. It falls in the competence of the Federal state, under the auspice of the Federal Ministry of Agriculture, but is implemented by regional authorities. It is adopted on the basis of the Fertiliser Act (*Düngegesetz*) and is also meant to transpose EU law. The Fertiliser Ordinance mainly reflects the Nitrate Directive. It is relevant for climate mitigation as it potentially reduces GHG emissions, however, it is not meant to contribute to climate change policy neither does it refer to climate change and how to tackle it.

The ordinance sets standards on the application of fertilisers in agriculture. It requires that fertiliser must be spread immediately after it is applied to the soil (Section 4(4)). This leads to a quick absorption of the nutrients by the crops and reduces the release of nitrogen emissions into the atmosphere. It also set outs capacity thresholds for manures of animal origin (Section 4 (3-4)) and puts restriction on the surplus of nitrogen that is admissible (Section 6). This is one major improvement compared to the old ordinance from 1996 and is potentially a very effective improvement with regard to GHG emissions (UBA, 2009).

The surveillance by authorities is crucial for the **effectiveness** of the measure. If farmers fail to comply with these standards they have to pay administrative fines and – as the fertiliser legislation is linked to the CAP Cross Compliance regime – can lose up to 100% of their subsidies for agriculture activities. Against this backdrop it must be emphasised that the

German fertiliser legislation does not aim to tackle climate change, but rather to meet other objectives, namely food security and the sustainable use of resources (especially soil, air and water). However, it is legally binding and the tightening of thresholds and the improvement of the timing of application are rather simple and cost-efficient ways to tackle emissions from fertilisations. Their full effect, however, depends considerably on official regulation, of which there is still a lack of in Germany (Rodi, M and Sina, S. 2011, UBA, 2013). Moreover, climate protection could be more comprehensively targeted (UBA, 2013) by realigning this measure to a climate change policy.

The evaluation of the **administrative and political feasibility** of this instrument concerns the possibilities of surveillance of the ordinance. To date, controls have only been based on samples which were picked randomly and most pinpointed, systematic inspections are missing from the scheme. It is therefore unclear whether the Fertiliser Ordinance is implemented to its full capacity in Germany (UBA, 2009). Since no binding standards for authorities are given, this lowers the feasibility of the measures. Moreover, there is also room for substantial improvement in the ordinance itself. For example, the phase out of inefficient tools for spreading fertiliser could be sped up, according to the Federal Environment agency, increasing emissions reductions considerably (UBA, 2009).

1.3 Identification of Interactions of Instruments within each Policy Landscape

The aim of this chapter is to analyse the interactions of the instruments described above within each policy landscape.

Carbon Pricing

In Germany, the main instrument for putting a price on carbon emissions is the ETS, which is primarily driven by EU law. Germany uses also other market-based instruments such as electricity and energy taxes, which indirectly affect the price of emissions in those sectors not covered by the ETS (transport, households, small industry emitters). As discussed above, only the EU ETS can be directly subsumed under carbon pricing, as tax levels are generally not linked to the carbon or energy content of the taxed fuels or energy services. While such a linkage can be construed for transport and heating fuels (where taxes are based on the unit of fuel), it is less straightforward for electricity and air travel taxes.

Objectives

The objectives of the different instruments that together form the carbon pricing landscape are not identical, but are largely commensurate. The EU ETS is arguably the only instrument that is a pure and clear-cut carbon pricing tool; it targets CO_2 emissions (rather than energy consumption), and it was introduced with the single main objective of establishing a carbon price. By contrast, the last round of increases to energy taxes as part of the 1999-2003 Ecological Tax Reform was introduced with a twin objective: to increase the cost of energy consumption (and thereby CO_2 emissions), and, through the use of revenue, to lower the cost of labour. In this way, the tax was expected to generate a 'double dividend' of environmental improvement and increased employment. Marking the other extreme, the air traffic levy (*Luftverkehrsabgabe*) was introduce with the explicit main objective of generating one billion Euro of revenue to help balance the public budget. The environmental objective of shifting the modal split from aviation to other transport modes is merely a supporting argument, but not the main objective of the levy.

Scope and Coverage

In general, there is only very limited direct overlap between the different tax instruments and the ETS, as fuels that are used in industry installations covered by the ETS are generally exempted from energy taxes (Heilmann and Bertenrath, 2008). The only incidences of double counting occur for installations that are covered by the ETS, but do not fall under the exemption rules of the energy sector. This applies either to public-sector installations such as heat generators of large hospitals or universities, or to particular industry installations like crackers in the chemical industry. On the whole, however, these incidences are negligible in terms of emission volume and economic significance.

There is, however, considerable indirect overlap between the ETS and other pricing tools: By establishing a price for carbon, the ETS also has an impact on the price of electricity. The carbon price becomes part of the short-run marginal cost of the marginal power plant (typically a gas-fired plant) that sets the price for the entire market, and thereby increasing wholesale electricity prices. In addition, the electricity tax increases the cost of electricity for consumers by about 2 cents per kWh. Likewise, other support mechanisms (such as the EEG or CHP promotion) are financed through a surcharge on the electricity price. While these are mechanisms for financing the support schemes, and not a carbon price in the sense of a pigouvian tax on externalities, they nonetheless all drive up the cost of electricity.

At the same time, there is also indirect overlap in terms of the functioning and effects of the ETS and other support schemes. As for CHP generation, plants benefit both from the dedicated CHP support mechanism, but also receive preferential treatment under the EU ETS. In the previous, second trading period, CHP plants in Germany received favourable treatment through free allocation based on a "double benchmark", i.e. both for the heat and for the electricity they produced. As of the current, third phase, as there is no more free allocation for electricity generation, this is reduced to a heat-based allocation. Still, the fact that CHP producers will be receiving less allowances for free, and need to purchase allowances, was cited as one main reason to introduce more favourable terms in the dedicated CHP support scheme.

As for renewables, the situation is more intricate. While there is no overlap in the sense that a single installation cannot be part of the ETS and receive EEG payments at the same time, there are ways how EEG plants benefit from the carbon price set by the ETS. For most EEG-supported installations, the EEG and ETS are a zero-sum game: the ETS raises the market price of electricity by adding a carbon price. This reduces the difference between the market price of electricity and the guaranteed, fixed feed-in-tariff, which needs to be covered through the EEG. In other words, the carbon price reduces the need for support to renewables in equal measure. What differs is the distribution of the cost, since both these systems have their own set of exemptions and derogations. However, an increasing number of installations will also forego the fixed feed-in tariff, and instead sell its production on the market. The “market premium”, an incentive funded through the EEG, has been introduced to promote this. Since this mechanism is based on the market price for electricity, it means that the carbon price set by the ETS will act as an extra incentive for renewables.

Other instruments with levies based on CO_2 emissions exist in the transport sector. Since 2009, the German vehicle tax is partly based on vehicle’s CO_2 emissions, the other factor being engine size. Pursuant to the Vehicle Tax Act (*Kraftfahrzeugsteuergesetz*), cars emitting less than 110 g/km are exempted (this constitutes the tax-free threshold). The additional tax above that level is €2 /g/km. The threshold will be reduced to 95 gram of CO_2 emitted per kilometre in 2014. The carbon price signal is however blurred by the fact that the GHG emission performance is mixed with another factor (UBA 2010, Gawel, 2010).

The air traffic levy (Luftverkehrsabgabe) introduced in 2011 does not constitute a proper example of carbon pricing, as the levy does not directly depend on the actual carbon emissions of the flight, but only on the approximate distance of the flight (using three country categories to define short- / medium- and long-haul flights). The air traffic levy does overlap with the EU ETS, as flights departing from EU airports are covered by the scheme as of 2012. This overlap is recognised in the legislation, and addressed in a pragmatic way: the law stipulates that the levy should be adjusted annually, to ensure that the combined revenue from the levy and the sale of emission allowances to aircraft operators adds up to one billion Euro.

Functioning and Influencing Mechanisms

As noted above, the ETS is the only policy instrument in Germany that explicitly puts a price on carbon emissions. However, there are several other pricing tools that are related to the energy content of fuels or products, which effectively have a function similar to carbon pricing, although the tax rate is not explicitly linked to their carbon content. This includes, above all, taxes on mineral fuels for transportation and heating. Taxes on electricity can also be included as 60% of the German electricity is generated from fossil fuels emitting CO_2. (BMWi, 2013)

One common difficulty with such an instrument is that it is impossible to discern what proportion of the tax should be considered as climate-induced. For instance, the tax rate on petrol fuels increased from about 3 cent per litre in 1950 to 66 cent in 2010. About 40% of this increase occurred before 1991 (adoption of the UN Framework Convention on Climate Change), and would therefore appear to be unrelated to climate policy. About a third of the increase occurred in the early 1990s, and is generally considered as a contribution for balancing the public budget following Germany's reunification, leaving climate and energy objectives as an afterthought at best. Only about a quarter of the total increase (15 of 65 cent) was introduced with an explicitly environmental motivation as part of Germany's ecological tax reform efforts between 1999 and 2004. For the larger part, though, taxes on motor fuels would have to be considered either as a general consumption tax to raise revenue and to reduce the overall consumption to reduce the dependency of fossil fuel import. The tax serves also to internalise other transport-related externalities (noise, air pollution, cost of accidents), or as a contribution towards infrastructure cost.

While the tax rates are not explicitly linked to the carbon content of fuels and the associated CO_2 emissions, in the case of mineral oil fuels for transport and heating, it is relatively straightforward to convert tax levels based off the carbon content. Regarding electricity and the air travel tax, however, this conversion is more complex. While tax levels could in principle be converted using the average emission intensity of a kWh or a passenger-kilometre of air travel, there is no mechanism in the respective policy instruments that transmits a better-than-average GHG emission performance into a lower tax burden per unit.

Acknowledging these conceptual limitations, three types of taxes are discussed in this document: the taxes installed as part of the 1999 ecological tax reform (on mineral oil fuels for transport, heating fuels and electricity), the air travel tax introduced in 2011, and the process of phasing out subsidies for coal mining

Implementation Network/Administrative Infrastructure

The main instrument (EU-ETS) has a defined scope that is limited to large industry, electricity generation and aviation. The set of energy taxes targets consumers of electricity (mostly private households, since industrial consumers enjoy broad exemptions), as well as consumers of transport fuels and heating oils. In terms of scope, as argued above, there is little direct overlap in the sense that emitters that fall under the ETS are generally not covered by energy taxes (with few, marginal exceptions). The one clear case of an overlap is the aviation sector, where aircraft operators are covered both by the ETS and by the air traffic levy.

The possibility of linking the pricing of CO_2 in other sectors to the EU-ETS prices has not been considered. More specifically, the last round of increases to the energy taxes dates to 1999-

2003, i.e. before the ETS was even conceived, and before many of Germany's current climate targets were negotiated. The only linkage that exists between EU-ETS prices and other instruments is in the case of aviation, where the total revenue from ETS and the air traffic levy is fixed at one billion Euro, and the levy adjusted in response to ETS revenues.

Energy Efficiency and Energy Consumption

The policy landscape is characterised by specific policies in the different sectors, such as buildings, transport and cogeneration. This includes an air traffic levy, road tolls for freight transport, CHP remuneration and support mechanisms for investments to increase energy efficiency. This policy landscape is strongly influenced by EU policies, e.g. energy standards and labelling for cars and products.

The focus of this policy mix is on "soft measures" that include support schemes and information and motivation campaigns. In its 2012 monitoring report on its energy policy, the German government argued that this mix gave rise to a market for energy services. The aim of this policy is to create a competitive market for **Energy Service Companies** (ESCOs) that compete to deliver the best energy service instead of just selling units of energy. This was backed by the adoption of the Energy Services Act in 2010, which was meant to transpose the 2006 Energy Service Directive (now repealed). The government founded a federal office for energy efficiency (Bundesstelle für Energieeffizienz) with the aim to observe the developing market for energy services and provide information to consumers on suppliers of services. Besides the Energy Service Directive, the policy landscape is to a great extent determined by other EU rules (especially Directives 2010/31/EU, 2010/30/EU, 2006/32/EC [repealed], 2005/32/EC, Regulations (EC) No 1222/2009 and No 443/2009), but is less centralised when compared to the renewable policy landscape (which has the Renewable Energy Directive as its cornerstone). This is expected to change with the implementation of the recently adopted Energy Efficiency Directive, which will be the key measure in this field over the next years, integrating different measures and sectors.

Objectives

In its 2010 Energy Concept, the German government states that energy efficiency is the key factor for a successful energy transformation. Not least, achieving the targets for the share of renewable energy and emission reductions depend on energy savings. Its potential in Germany, however, remains largely untapped (Bundesregierung, 2010). The government target is to increase energy productivity by 2.1 % annually. Moreover, if the current targets are met, the German government predicts that by 2050 the primary energy consumption will be reduced by 50% in comparison to 2008; energy consumption in heating by 80% and in the transport sector by 40% in comparison to 2005. Electricity consumption shall also be cut by a quarter by mid-century in comparison to 2008.

From the instruments that were assessed above there are different interactions within the sectors. A relevant interaction exists between the Energy Saving Ordinance and the CO_2 Rehabilitation Programme. They are organised around the same objective, i.e. reductions of primary energy consumption in the building sector

Scope and Coverage

Direct interactions generally only exist within the different sectors. A number of measures, however, cover buildings and private households, including building acquisition, higher electricity prices and the acquisition of energy efficient products. . The hierarchy between them is clear. They have an equal status and complement each other, with one focusing mainly on existing buildings, the other on new buildings.

Functioning and Influencing Mechanisms

For the better part, policy instruments for energy efficiency work through incentives for voluntary action. While this approach would generally seem to be a relatively weak influencing mechanism (compared to mandatory standards), it has nonetheless proven to be relatively popular and effective. Voluntary measures benefit from the efforts to increase the carbon price, which increase the profitability of energy efficiency measures. Interactions exist when it comes to the demand for energy services. With increasing energy efficiency the demand for energy is reduced. Additionally there is a competition for scarce resources to implement energy efficiency measures in private households. Currently the investment in renewable energies seems to be more profitable to the private households.

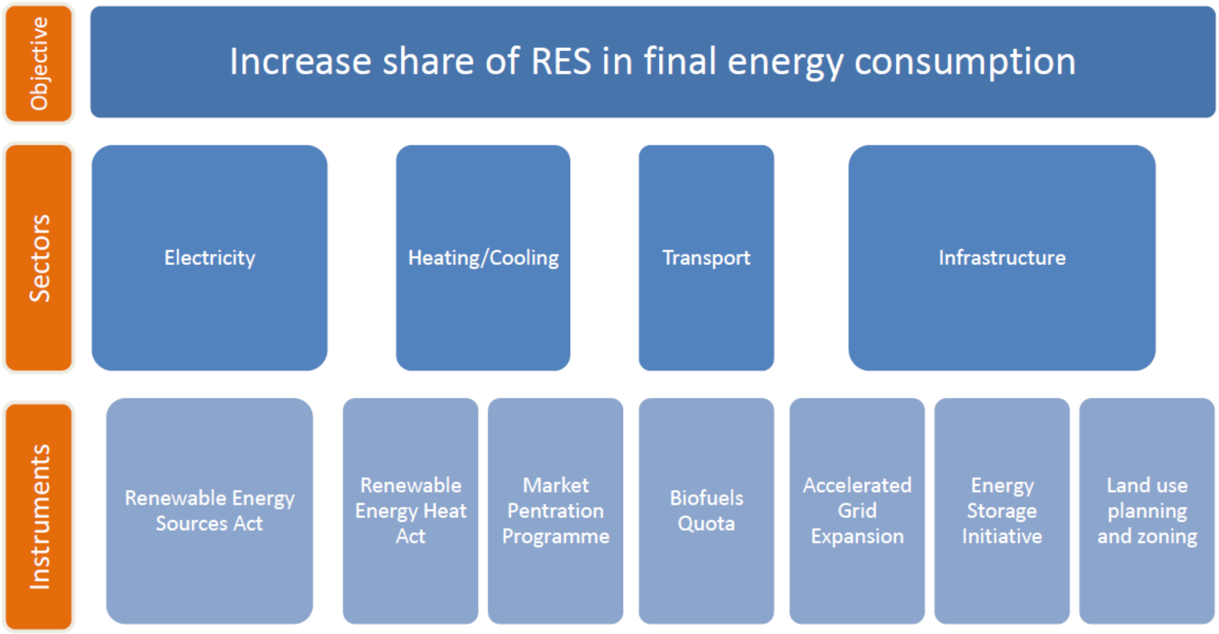
Implementation Network/Administrative Infrastructure

The lack of coordination between the different measures in this policy landscape is partly due to the fact that they fall into different ministerial competencies, such as in that of the Federal Environment Ministry (which is generally responsible for climate policy), that of the Federal Ministry of Economics and Technology or that of the Federal Ministry of Transport Building and Urban Development. This split competency, as well as differences in the political ownership have had an impact on the level of ambition and the coordination of the individual measures.

Difficulties also exist with regard to enforcement of measures. Where *Länder* authorities are responsible for transposing the instruments (such as Energy Saving Ordinance), the effectiveness depends highly on consistent and systematic controls.

Promotion of Renewable Sources of Energy

Figure 1: Policy landscape: Promotion of Renewable Sources of Energy in Germany



Renewable energy policy in Germany is characterised by a number of different measures. In the **electricity** sector a feed-in tariff is the key instrument. Tariffs are generally technology-specific and are adjusted regularly to the current development of costs and include a guaranteed revenue rate to the investor.

In other areas than electricity, Germany has implemented different kinds of instruments, such as obligations (renewable heat), financial support (renewable heat), technology support (feed-in tariff) and quotas with a trading element (biofuels). Some are market-based (partially biofuels quota); others are command-and-control (obligation to use renewable heating).

The instruments are complemented by a number of infrastructural instruments, such as the measures to accelerate the extension of the electricity grid, R&D funding for energy storage as well as integration of climate policy in land use planning and zoning.

Objectives

All key measures within this policy landscape (feed-in tariff for electricity, obligation to use renewable heat as well as biofuels quotas) are organised around the same set of objectives, i.e. to increase the share of renewable energy in total energy consumption.

Scope and coverage

The instruments address distinct types of energy use, such as electricity, heating/cooling and transport. All of these measures are also meant to contribute to the trias of objectives that is laid down in the Energy Law and the energy concept, i.e. to ensure energy supply that is environmentally sound, reliable and economic. There are certain overlaps that have an impact on the functioning of the different instruments. The instruments in the different sectors have a very similar target group as most of the additional costs and investments need to be financed by private households. This may lead to a competition for private funds and available investment space. This applies mainly to the competition for scarce resources that exist between them, i.e. limited private investments and rooftop space (photovoltaic vs. solar thermal energy).

Functioning and Influencing Mechanisms

Thus, while the different (sub-)objectives are mutually compatible, there is at the same time little coordination between the individual instruments. For example, there is no coordinating mechanism to ensure that, of the different types of renewable energy, the least costly options are put forward, so that the target of a 60 % share of gross final energy consumption from renewables is met at the lowest cost possible. Moreover, there is also no coordination with regard to the use of biomass, on which a number of instruments rely. This is especially problematic as the domestically available resources in Germany are limited (about 3.5 % of the German crops). Most biomass, however, needs to be imported, with the associated, well-known sustainability issues. Biomass is a limited resource with relatively little domestic potential. Currently about 92% of the renewable heating supply is produced from biomass. However, all key instruments in this policy area rely on biomass (Renewable Energy Act, Renewable Sources Heat Act, Biofuels Quota Act). Given this competition for the use of biomass, a coordination mechanism is needed as part of the regulatory framework.

A further overlap with regard to functioning is the relationship between accelerated electricity grid expansion, R&D of storage technologies and the feed-in tariff for renewable electricity. In order to increase the share of renewable electricity, electricity needs to be transported from the centres of generation (many of which are in the north of Germany, along the coast) and the centres of demand (many of which are the in the south and west of Germany). Also, storage capacities will play an increasing role as the system moves to higher shares of renewable electricity, to provide flexible short-term backup instead of ramping up fossil fuel power generations. Having said this, there is also interaction between measures to accelerate the electricity grid extension and measures to expand electricity storage capacities, as greater grid capacity diversifies the supply and demand, reduces the risk of sudden outages, and hence also reduces the need for energy storage.

Implementation Network/Administrative Infrastructure

Most measures need to be agreed upon between different ministries representing different interests. Above all these are the Federal Environment Ministry and Federal Ministry of Economics and Technology.

The Renewable Energy Sources Act provides considerable exemptions for the manufacturing industry from the overall costs. Difficulties also exist with regard to enforcement of measures. Where *Lände*r authorities are responsible for transposing the instruments (such as Renewable Energy Heat Act), the effectiveness depends highly on consistent and systematic controls.

Non-carbon dioxide greenhouse gases

This policy landscape is much more diverse than the other three described above. It covers policies geared at reducing non-CO_2 greenhouse gas emissions, typically from sectors other than the energy sector. It includes emissions like methane from the landfilling of waste or animal husbandry, N_2O emissions from agriculture and GHG emissions from chemical industries (SF6, NF_3, HFC etc.).

Objectives

This policy landscape is the only one which is not addressed in the 2010 Energy Concept. The objectives in this area are less clear. The different instruments tackling non-CO_2 emissions are generally not well integrated into the wider set of climate policy instruments. Although all of the selected instruments have an impact on climate policy, that is not their primary focus. If at all, greenhouse gas mitigation is a secondary objective (except for HFC legislation). The measures assessed for this report are in most cases command-and-control instruments.

The primary objective of the Landfill Ordinance is to reduce methane emissions from landfilling. This is aligned with other objectives of the waste management law in Germany, i.e. to minimise the environmental impact of waste disposal and to save resources. All measures are generally organised around the same objectives. The same applies to the measures to tackle HFC emissions, the Chemicals Climate Protection Ordinance. The case is different in the case of agriculture. Here, there are a variety of different measures (command-and-control, subsidies etc.) that are related to multiple objectives. Mitigation, if emphasised at all, is only of secondary importance. An integration of climate protection concerns in this policy sector is still missing.

Scope and Coverage

Methane emissions in Germany were halved over the last decades. The waste sector contributed the largest share of this, especially due to the phase out of landfilling and improved waste management. The EU Landfill Directive (implemented in Germany by the Landfill Ordinance/*Deponieverordnung*) basically prohibits since 2005 the landfilling of biogenous waste without prior treatment, thus reducing the organic content of waste. Pre-treatment can either be incineration, mechanical-biological treatment or separate collection and treatment of organic waste. The better these treatments are optimised with regard to their potential to reduce the organic content of waste, the larger the methane reduction after landfilling. Waste management is required by the Waste Framework Directive (implemented by the Life-Cycle Act/*Kreislaufwirtschaftsgesetz*) and has led to considerable emission reductions as well. These measures were, however, not driven by climate policy considerations, but mostly due to economic and resource efficiency reasons.

The most significant GHG emissions sources in the agriculture sector are released by a diverse array of sources; drained wetlands, conversion of greenlands, intensive husbandry and nitrogen surpluses from fertilising. The agricultural sector is not subject to emissions trading, but is instead covered by the Effort-Sharing-Decision. Germany is obliged to reduce GHG emissions in this sector by 14 % by 2010 on the base year 2005 (Art. 3 I, Annex II). Depending on the calculation method, this sector is the main emitter of methane, and responsible for 6-13% of German greenhouse gas emissions. The policy mix for this sector is complicated by the fact that agriculture is a diffuse policy area, involving a number of actors with different competences. Relevant aspects include EU subsidies, environmental and fertiliser standards as well as animal protection. Subsidies are allocated to farmers at an EU-level on the basis of the Common Agriculture Policy (CAP), laid down in a number of Regulations (No 73/2009, 1698/2005 and 834/2007). The payment of subsidies to farmers is already partially linked to mitigation efforts, under the system of “cross compliance”. Member States authorities have to assure compliance. Moreover, Member States are competent to set out further eligibility criteria for funding, including measures having an impact on GHG emissions. In Germany, this falls into the competencies of the *Länder*. Assessments have concluded that there is potential for improvement with regard to both control compliance and formulating mitigation requirements (Rodi, M and Sina, S., 2012).

Trends of HFC emissions (so called fluorinated gases, F-gases) are generally increasing, as these gases are being used to substitute ozone-depleting substances to meet the Montreal Protocols’ objectives. This is boosted by the fact that the demand for cooling – one major application area – is constantly increasing. Total emissions of F-gases in Germany have more than doubled since 1995. Projections commissioned by the Federal Environment Agency have shown that this trend can be reversed, if the instruments that are already in place are fully implemented: this includes Regulation (EC) No 842/2006, Directive 2006/40/EC and the national Chemicals Climate Protection Ordinance (*Chemikalien-Klimaschutzverordnung*). They could be expected to fall to 7.9 million tonnes CO_2 equivalent by 2030. However, from 2030 the trends could rise again, to a total of nearly 20 million tonnes CO_2 equivalent by 2050, unless further measures are adopted (UBA, 2009).

Functioning and Influencing Mechanisms

Interactions in this policy landscape are limited, as there is a diverse mix of measures in the different sectors, especially agriculture, waste and F-gases.

In general it can be stated that climate policy instruments in the agriculture sector are neither well developed nor well integrated with the rest of climate policy, despite the sector's importance with regard of GHG emissions. Therefore, experts claim that Germany should upgrade and target climate protection in its agriculture policy, for example by preparing binding policy strategies and GHG reduction targets (Naumann, S. and Frelih-Larsen, A. 2010, UBA, 2013)

Implementation Network/Administrative Infrastructure

Due to the heterogeneity of the policy instruments applied in this policy landscapes, there are no interactions of relevance. It is, however, worth mentioning that the ministerial responsibilities are less distributed compared to the other policy landscapes. They are mostly centred within the Federal Environment Ministry and the Federal Ministry of Food, Agriculture and Consumer Protection. The Federal Environment Agency, the subordinated authority of the Federal Environment Ministry, supports work on non-GHG emissions in all the sectors concerned, including through reporting obligations, data gathering and research. Moreover, the policy landscape is characterised by multi-level governance, with the EU and the Federal adopting legislation and the *Länder* in charge of issuing ordinances and other implementation guidelines as well as assuring the enforcement of the legislation.

1.4 Description and evaluation of policy landscapes in the light of the concept of optimality developed in task 1.1

Carbon Pricing

In classical economics, establishing a binding carbon price across sectors offers a cost-efficient way to mobilise and coordinate efforts in reducing GHG emissions. The emitters themselves identify and implement abatement options that are economically viable when taking this price into account. The instruments used to set the price can function through a tax or a trading scheme for emission allowances, and governments are able to create income through tax revenue or from the auctioning of allowances.

The effectiveness of carbon pricing as a policy tool obviously hinges on the carbon price implemented or generated. For the 1999 Ecological Tax Reform, an empirical investigation concluded that the policy had indeed achieved its twin objectives of reducing emissions and stimulating employment (Knigge and Görlach, 2005). Since the introduction of the tax, the fuel consumption for road transport has peaked and has been in decline since. On a more sceptical note, it can be argued that the effectiveness of the tax reform was limited by a range of exemptions, such as tax breaks for industrial electricity consumption. Also, since the tax rates are fixed in nominal terms and have not been increased since 2003, the actual price signal (in real terms) is in fact declining, despite the fact that the ambition level of German climate policy has increased considerably in the same time. As for the ETS, its effectiveness inevitably depends on the price level, which is determined by supply and demand. One of the main criticisms raised is that there was a structural oversupply of allowances in the system, and that the scheme for this reason failed to set a sufficiently high carbon price for long periods of its existence. Others maintain that the observed oversupply and the low price is largely a testimony that the ETS is achieving its objective – to reduce emissions in line with the given target level, the cap.

In terms of static efficiency, the set of carbon price policies produce considerable discrepancies between the sectors covered by the ETS and the non-ETS sectors when nominal tax burdens are converted to the carbon content of fuels. Expressed as cost per ton of CO_2, the tax burden ranges from 2,31 Euro per ton for coal to more than 250 Euro per ton for petrol (Bach, 2009). By comparison, the carbon price of the EU ETS has fluctuated wildly, since the start of the scheme in 2005, at times peaking above 30 or falling below 5 Euro (as at present). However, this comparison is of limited value, as it basically takes the entire tax burden on fossil fuels as a carbon price. But as noted before, in reality it is not possible to identify the "environmental" share e.g. of taxes on transport or heating fuels. If all taxes for transport fuels were viewed purely as carbon taxes, the tax burden would seem disproportionately high, and the set of pricing tools very inefficient. However, this neglects the fact that the majority of these taxes were introduced before climate change entered the political agenda, and that they were intended to fund the infrastructure cost of road transport, or to internalise transport externalities other than carbon emissions. Adding to the discrepancy in carbon prices between different tools is the range of exemptions that apply for each of the different tools. Within each tool that has a bearing on prices – i.e., not only the ETS and taxes on energy use, but also the support schemes for renewables and for CHP – certain categories of firms or installations are exempted partly or entirely, in order to avoid impacts on their international competitiveness. In addition, compensation mechanisms may apply where an exemption is not possible; for instance, large industrial power consumers are eligible for a compensation payment to offset the electricity price increase introduced through the EU ETS. To complicate matters further, the criteria and thresholds that emitters need to fulfil differ for each instrument, which makes for a very heterogeneous situation (Rieseberg and Wörlen, 2012).

Carbon pricing in theory would offer a superior mechanism to achieve dynamic efficiency than command and control regulation, since there is a continuous incentive to improve efficiency, unlike command-and-control regulation, which simply imposes minimum standards to be achieved (e.g. Anger et al., 2005). However, it is widely acknowledged (and frequently criticised) that the low carbon price currently observed in the EU ETS is too low to have a strong effect on investment decisions or R&D spending. Some scholars argue that the problem is predominantly one of too low prices, and that a higher carbon price would induce innovation (e.g. Rogge, 2010). Others maintain that the ETS – or any pricing tool, for that matter – is not sufficient to induce a sufficient level of R&D investment to avoid technological lock-in, and that targeted technology support therefore has to be part of the policy mix (Matthes, 2010). For the energy taxes, the case is less clear-cut: a qualitative assessment conducted in 2005 did find anecdotal evidence of innovations induced by the 1999 Ecological Tax Reform (Knigge and Görlach, 2005). However, it also noted that attribution of observed innovation trends to the general price signal is very difficult. This attribution was possible with a higher degree of confidence for the exemptions established under the Ecological Tax Reform, such as a preferential treatment for vehicles burning natural gas, which had a noticeable effect on the diffusion of this technology. In either case, the dynamic efficiency of the current set of carbon pricing tools appears to be limited, which is not least due to the relatively low carbon price observed.

The fact that all carbon pricing tools are rigged with multiple exemptions can be read as evidence of the trade-off between (static) efficiency (which calls for an equal treatment of all emission sources) and political feasibility (which may make it necessary to grant preferential treatment to some emitters). As noted above, the majority of industrial energy consumption is exempted from taxes, and industrial CO_2 emitters receive the majority of emissions allowances for free. These exemptions are justified on the grounds that they maintain the international competitiveness of domestic industries. Yet, these exemptions also mean that significant parts of the energy and electricity consumption profile are exempted from the carbon price signal, reducing the overall efficiency of the policy mix. A further consequence is that, in the case of renewable and CHP support, the exemptions for industrial power consumers mean that private households are charged at a higher rate, in order to recover the necessary funding. This has been quoted as a cause of undue social hardships and as contributing to an inequitable distribution of the cost burden. As regards the trade-off between static efficiency and political feasibility, one consideration is that the ETS at least covers all emitters, but grants preferential treatment to some of them by allocating allowance free of charge. At least in theory, this maintains the incentive function of the carbon price, as emitters will consider the opportunity cost of allowances in their decisions, even if they received the allowances for free. By contrast, taxes or charges work through exemptions, which mean that emitters are simply not affected by the instrument.

Regarding the legal feasibility, there are no specific challenges for the existing set of carbon pricing policies. While it is true that German environmental policies have traditionally tended to rely on command-and-control approaches, taxes on energy use are also a long-established part of the tax system. The EU ETS, by contrast, was a novelty also in legal terms when it was introduced, but has since become an accepted and established tool of the policy mix. Both for the ETS and for the 1999 Ecological Tax Reform, the conformity of the policies with the German constitutional freedoms was challenged before the constitutional court, but without success.

Energy Efficiency and Energy Consumption

The instruments that constitute this policy landscape are for the most part effective because the overall energy consumption is decreasing, though the picture may be distorted by seasonal variability and cyclical fluctuations due to the economic situation (see also Bundesregierung, 2012c). Between 2008 and 2011, energy productivity has increased by 2%, i.e. almost in line with the government target. Nevertheless, an independent assessment found that additional measures are necessary in order to reach the long-term targets for energy efficiency (Löschel et al, 2012).

Improvements in energy efficiency and reduced energy consumption are supported through a wide range of tools, such as taxes on energy and electricity (see above), as well as air travel charges and vehicle taxation. A number of information campaigns are supposed to address energy consumption, such as an initiative on energy savings in low-income households launched in 2012. Important sources of funding for such measures are the Energy Efficiency Fund, which was set up in 2011 and is a sub-programme of the Climate and Energy Funds, as well as the National Climate Initiative. Both of these are fed by auctioning revenue from the EU ETS; yet the collapse of allowance prices in the EU ETS means that the funding volume remains below expectations. At the same time, the allocation of funds is also behind schedule, as a clear funding concept and guidelines yet needed to be defined (Bundesregierung, 2011).

The building stock represents a particular challenge for energy efficiency policies. In order to achieve a climate-neutral building stock by 2050, efforts to tackle emissions from the existing building stock need to be scaled up. In addition, spilt incentives and other market failures need to be addressed, e.g. by adapting the legal conditions for cost sharing between landlord and tenant. In general, the effectiveness of policies in these areas could benefit from a stronger enforcement of existing standards, e.g. through controls and sanctions.

As investments in energy efficiency often have a relatively short payback period (or even negative abatement costs), the economic efficiency of policy interventions is typically high. As a matter of fact, energy efficiency policies often work by removing barriers or overcoming market failures that otherwise prevent profitable investment. For this reason, energy efficiency policies are also less amenable to simple pricing solutions, whereby investments are triggered through a carbon price. While the price signal may work to further enhance the profitability of energy-saving investments, it is arguably rather the use of revenues from carbon pricing tools that drives energy efficiency improvements, given the manifold constraints and barriers that need to be overcome. As regards the energy efficiency in industry, it should be noted that most energy-intensive industries are anyway exempt from fiscal measures or receive preferential treatment under the ETS. Such exemptions are granted in order to maintain the competitiveness of energy-intensive industries. Even though some exemptions are now contingent upon the introduction of energy-saving efforts, the fact remains that they render the carbon price signal less effective, distort incentives for energy efficiency and thereby undermine the overall efficiency of the climate policy instrument mix.

Given the limited role of pricing tools for energy efficiency improvements (particularly in the building sector), the dynamic efficiency in this area is rather achieved through sector specific support schemes and dynamic building codes, which are regularly updated and tightened. There is currently discussion whether the longer-term dynamic efficiency of the policy area could be enhanced by resorting to national-level binding targets and associated delivery mechanisms, such as energy saving obligations. However, these ideas have not progressed beyond the discussion stage.

In the transport sector, it is unlikely that the existing set of policies will achieve a sufficient improvement in energy (fuel) efficiency. While pricing tools should in principle encourage greater fuel efficiency, there are several factors (such as the tax privilege for company cars) that undermine the price signal. In addition, there have been no changes to the existing set of road fuel taxes since the Ecological Tax Reform in 1999-2003. In effect, fuel efficiency of new passenger cars has increased only in small increments until 2008, when more ambitious fuel efficiency targets were agreed at the EU level.

Promotion of renewable sources of energy

The feed-in tariff as a key instrument in the electricity sector has proven to be highly effective. Targets are being met in the electricity sector so far. In the other sectors there is still room for improvement, especially with regard to renewable heating and biofuels. Heating/cooling from renewables is not being addressed in a satisfactory manner so far. The level of ambition of existing measures needs to be increased, especially with regard to achieving a climate-neutral building stock by 2050. Use of second-generation biofuels could be more targeted under the current strategy (Löschel et al, 2012)

Recent developments have shown, however, that the feed in tariff system needs to be improved in order to integrate renewable electricity in the energy system. The lack of infrastructure development, in the long run, puts the effectiveness of the current instruments in danger.

There are two important issues that need to be considered when it comes to evaluating the effectiveness and economic efficiency of the current policy mix in promoting renewables:

- There is currently no mechanism that ensures that the renewable shares are increased in the different sectors, taking into account the different costs in the sectors. There is no entity or concept that ensures that the most efficient combination is chosen.
- All measures to increase renewables in heat and electricity generation have a clear focus on providing incentives for the development of new technologies. From a static perspective the technologies used do not represent the cheapest possible option to realise the targets.

Both considerations explained above do not take into account possible dynamic developments. The effects become obvious in the area of PV. Because of the support in several European countries and to a large extent because of the German feed in tariff, the costs for a PV installation was reduced dramatically in the last five years. A thorough evaluation of the dynamic efficiency of the instruments is not intended in this first evaluation of instruments. But it is safe to assume that the early cost reduction in the PV area is beneficial for achieving future targets with low costs.

Acceptance for the instruments in this policy landscape is generally high. Public opinion strongly supported the nuclear phase out and the expansion of renewable energy long before the Fukushima nuclear disaster in 2011. It is also welcome due to the positive effects on the labour market. The Federal Ministry of Environment estimates that in 2011 the promotion of renewable Energies created a total of 381.600 jobs. (Bundesministerium für Umwelt, 2012)

In the area of electricity production public acceptance is a prerequisite for feasibility. The level of the EEG-surcharge that private households need to pay influences this acceptance. A sharp increase in this rate over the last year has brought attention to the costs for the Energiewende and possible social implications. There have been undesirable developments in the past that weakened this support. Especially the support for photovoltaic and biomass, has been weakened. This slight shift in public perception was boosted by the fact that energy-intensive benefits from a number of derogations do not equally participate in the costs.

Funding – for example of the Market Incentive Programme – is not provided in a way that is reliable or curbs investments to the extent that is needed, in part due to its dependency on the significantly underfinanced Climate and Energy Fund. Concerning cost-effectiveness, the dependency of some instruments on biomass is an issue, as the domestic resources are limited. Moreover, there are sustainability concerns. Experts suggest reconsidering the approach that the Federal government has chosen, namely a strong focus on biomass for different instruments (Löschel et al, 2012).

Sufficient progress can only be made with a proper, nation-wide coordination of these activities and funding of R&D, as past experiences have shown. This has been achieved with regard to grid expansion. The planning procedure was drawn to the Federal level in 2011, also with new rules on public participation. Moreover, this has a considerable impact on the feasibility of this measure.

The extension of renewable electricity production is one of the main drivers for a high demand for new transmission lines. Though the exact grid need is somewhat controversial, there is no doubt that certain adjustments and extensions are needed to transmit the electricity from north to south. Such a setup results from a high wind resource in the north of Germany and a high demand in the south. The acceptance for these investments is very low. As stated above storage can, if used specifically for that purpose, reduce the investments required in the electricity grid in electricity systems with high but not dominant shares of renewables. Even if this is associated with higher costs than a grid investment, this option is discussed in Germany to make the further extension of renewables in the electricity sector feasible.

Non-carbon dioxide greenhouse gases

In Germany this landscape receives low attention by policymakers and the general public in comparison to the other landscapes. Instruments that induce reductions of non-CO_2 GHG gases often have a main focus different from climate protection. Progress can mainly made by 'Climate Mainstreaming', meaning that actors whose main tasks are not directly concerned with emission reduction also work to attain this goal. Nevertheless the instruments implemented, such as the ban of landfilling untreated waste, are very effective in reducing methane emissions.

The instruments used in this sector have a strong command and control focus. Economic instruments are used in a lesser extent than in other landscapes. In total the instruments in this area have a low coverage. The economic efficiency of these instruments is low by definition. Emission reductions are achieved by a drop in physical output or substitution of activities (ban of landflilling). With regards to the emission in the agricultural sector this is not a suitable solution as the production of regional food is beneficial. Additionally the production of energy crops is necessary to achieve the goals in the renewable landscape.

The administrative and political feasibility of instruments in the agriculture sector is strongly interlinked with the discussions on the future of the Common Agricultural Policy (CAP). Cross compliance can give strong incentive for emission reduction in this area.

2 Description and Initial Evaluation of the Overall Instrument Mix

2.1 Identification and Description of the Main Interactions between Policy Landscapes

Objectives

The first general statement regarding overall interaction is that the set of climate policy targets – greenhouse gas emission reductions, renewable energy and energy efficiency – depend to a great extent on each other (SRU, 2008; Löschel et all, 2012). The main target itself, to reduce greenhouse gas emissions 40% below their 1990 levels by the year 2020, can only be met if all policy landscapes are integrated, and if the policy instruments across all landscapes are implemented successfully.

In terms of objectives, there is indeed considerable overlap between the different policy landscapes. Effectively, all climate policy instruments – including the ETS and the Renewable Energy Sources Act – aim to reduce greenhouse gas emissions – one by creating a carbon price and accelerating investments in mitigation efforts (wherever they are the cheapest, irrespective of the technology used), and the other by replacing fossil fuels with renewable energy. Nevertheless, the Renewable Energy Act has other objectives as well, including, a reliable energy supply and reduced import dependence, support for technology development, as well as industrial policy objectives (see Section 1 Renewable Energy Act).

Interactions also exist between the carbon pricing and energy efficiency policy landscapes, in terms of both the objective and scope of the relevant policies

Scope and Coverage

Section 2 of the German ETS Act takes into account the direct overlaps between the German feed-in tariff and the EU-ETS, by stipulating that certain renewable energy installations (mainly small power plants that combust only biomass) cannot be subject to the EU ETS. They are also exempted if they make no use of the feed-in tariff but sell their electricity directly on the market. However, these installations account only for a marginal share of the coverage of either instrument, both in terms of the emissions covered by the ETS or the financial support volume of the feed-in tariff.

Regarding CHP use, an interaction with carbon pricing exists where it overlaps with the German CHP Act. The EU ETS does not apply to all CHP installations but only to larger ones with a capacity in excess of 20MW. CHP plants operating under the ETS have received preferential treatment – in the past (up until, 2012) by receiving an allocation based on a “double benchmark”, i.e. covering both the heat and the power they produce. Under the current rules (since, 2013), CHP plants remain eligible under certain conditions to receive free allocation based on the heat they produce.

Direct overlaps between energy taxes and the EU ETS are limited to very few installation types and activities (Wartmann et al., 2008). Overlaps are limited in particular due to the exemptions under both instruments; for instance, emissions from energy production and process emissions are generally exempt from energy taxes (see Section 9 Electricity Act, Section 37 and 53 Energy Tax Act). There are incidents of indirect overlaps, since both electricity taxes and the ETS affect the electricity price. Yet, for industrial energy use, this is again mitigated through the exemptions for industry, as well as the compensation mechanism for industrial electricity consumption under the ETS: the manufacturing industry that is subject to both EU ETS and taxes benefits from reduced tax rates as well as the ability to apply for further tax reliefs (*Spitzensteuerausgleich*).

With regard to the relationship between renewable energy and energy efficiency, interactions exist with regard to scope and coverage of the different instruments. This applies especially to the residential sector, in which the instruments (Renewable Energy Sources Heat Act, Market Penetration Programme on the one hand, Energy Saving Ordinance and CO_2 Building Rehabilitation Programme on the other) are designed in an interactive way.

Functioning and Influencing Mechanism

In principle, a high carbon price will further increase the pressure on industries to reduce the consumption of fossil fuels and improve their energy efficiency. However, it should be noted that this mechanism rarely applies: industrial energy use is mostly exempt from the carbon price signal due to concerns about the competitiveness impact. For private households and transports, there are several systemic constraints that limit the possible effect of carbon pricing – such as split incentives (landlord-tenant dilemma) in the housing sector, or tax privileges for company cars in the transport sector, which effectively mute the carbon price signal for a certain share of emitters.

An important way how the ETS interacts with instruments in other policy landscapes is through the use of auctioning revenues from the EU ETS. Several other instruments, programmes and initiatives are financed through the Climate and Energy fund, such as the Market Incentive Programme or the Energy Efficiency Fund. Considering the importance of the residential and building sector, reliable funding is crucial. The Climate and Energy Fund generally offers a suitable tool to provide such funding, mostly because it is independent from the annual budget and therefore less likely to fall victim to day-to-day politics. However, the falling price of allowances in the ETS means that auctioning revenues have remained below expectations, necessitating budget closures and thereby undermining the reliability of funding that the fund was expected to provide.

Yet another relevant overlap is linked to the EU-ETS carbon price. The current, low carbon price has lowered electricity prices, which increases the gap between market prices and the guaranteed feed-in tariff that needs to be covered through the renewable support mechanism. This results in a higher EEG surcharge, and therefore – as industrial power consumers are largely exempt from the EEG surcharge – a higher burden on private households and other small energy consumers. A low carbon price will therefore affect the profitability of renewables in two ways; at first it makes fossil-based electricity generation cheaper and therefore more attractive. Secondly, it increases the payments to renewable energy generators under the German support scheme and consequently threatens to reduce the acceptance of renewable energies.

Energy efficiency and renewable energy are also linked. First of all, regarding their objectives, both highly depend on the success of the other. The share of renewable energy in final energy consumption can only increase to the levels envisioned in the Energy Concept if at the same time primary energy consumption is curbed (Löschel et al, 2012). Finally, another link between the two landscapes is the competition for scarce investment sources. The main investors into renewable energy are private households and cooperatives financed by private households. This is the same target group for investment in energy efficiency. A private house owner will only invest in energy efficiency if the possible revenues resulting from energy savings are higher than the revenues from electricity produced from renewables.

For example, the obligation to use renewable energy for heating can be reduced if the energy performance has been improved beyond what is required in the Energy Saving Ordinance. This is meant to grant high flexibility to homebuilders when it comes to methods of increasing energy performance.

Implementation Network/Administrative Network

The implementation and administrative network in German energy policy is large. With several Ministries involved there is a large potential for conflicts of competence. Energy policy was formerly mainly as Industrial policy with the main focus on affordability and security of supply. These are still the main topics of the Ministry of Economics and Technology. The renewable energies and the supervision of the nuclear installations are within the responsibility of the Ministry of Environment. Additionally the Ministry for Transport, Building and Urban Development is in charge of all regulations within the transportation sector and the energy use in buildings. This dispersed structure leads to an ongoing discussion on the creation of a Ministry of Energy. While the proponents of the current practice argue, that the dispute between the different Ministries increases the quality and legitimation of the policies adopted.

In addition the federal structure of Germany allows the Bundesländer to define stricter rules and targets on local level. Furthermore the Länder are implementation bodies for some guidelines. Instruments in the residential sector benefit from the fact that they have the same implementation network. Building authorities in the *Länder* are required to comply with both the Energy Saving Ordinance and the Renewable Energy Heat Act. Though there are deficits with regard to control; if improved, both instruments would benefit from these improvements at the same time.

In the electricity sector the federal government has passed on several task associated with the implementation of the renewable energies and the CHP feed-in tariffs to the grid operators. This gives the regulatory authority (Bundesnetzagentur) also the power to make regulations affecting the support of renewable and CHP.

2.2 Summary discussion of the combination of policy landscapes

Economic Efficiency

Germany has a large mix of different instruments with each instrument addressing a different area or sector of the economy. Some of the instruments used for the different objectives have a high economic efficiency such as the EU-ETS. But there are also instruments, such as the command and control regulations in the building sector with a low economic efficiency. When it comes to the key measure in the area of renewable electricity, the Renewable Energy Sources Act, the economic efficiency depends if it is evaluated from a static or a dynamic point of view.

But when it comes to the evaluation of the instrument mix, the reduction efforts in the different sectors are not chosen by economic criteria. Some cheap abatement options, such as the improvement of existing buildings are not being used in an efficient way. The German transport and agriculture sectors also require a better integration of climate policy in order to tackle greenhouse gas emissions from these sectors more efficient.

Environmental Effectiveness

Germany has set ambitious targets in all areas relevant to climate policy, i.e. GHG emission reduction, energy efficiency and saving as well as renewable energy sources. Under the EU Effort Sharing Decision and under the Kyoto Protocol, Germany was required to cuts its GHG emissions by a total of 21% in the period between 2008 and 2012 compared with base year 1990, which amounts to a large share of the EU-wide target of 8% GHG emission reductions. The national targets go even further, i.e. beyond the EU requirements. Germany's Energy Concept which details German energy policy until 2050 requires that GHG emissions be reduced by 40% by 2020 compared to 1990 and by 80% by 2050. In addition, primary energy consumption shall be reduced by 20% by 2020 and by 50% by 2050 compared with 2008 figures. The share of renewable energy sources shall be increased to 35% by 2020 for electricity consumption (50% by 2030 and 80% by 2050) and to 30% by 2030 for final energy consumption (60% by 2050).

Currently Germany is on track meeting most of these targets. But neither for transport nor for agriculture is there a comprehensive strategy on how to address the emissions from the two sectors. For both sectors, there were only few notable policy initiatives or new policy instruments at the national level – the little dynamic that there is mostly stems from the EU level, such as through CO_2 emission limits for new cars. New policy instruments in the transport sector included a reform of vehicle registration taxes and the introduction of an air traffic levy. Other than that, policy interventions are mostly restricted to funding programmes in support of specific technologies, such as electric mobility.

In the field of energy efficiency, some progress can be observed, but the pace of change (in particular in the building sector) is insufficient to achieve the existing objectives. In its Energy Concept, the German Federal Government stated that Germany aims to realise a climate neutral building stock in 2050. The main policy instruments in this field – obligatory energy performance standards for buildings laid down in the Energy Saving Ordinance and the KfW-administered CO_2 Building Rehabilitation Programme – are generally successful and effective, but are insufficient in terms of scale and impact. One problem that limits the effectiveness of energy efficiency policies (like the KfW programme) is the availability of funding. The Energy Efficiency Fund and other funds and initiatives are fed by auctioning revenue from the ETS. However, due to the decline of the allowance price in the ETS, the volume of auctioning revenue remains below expectations.

‘Instrument Mix Feasibility

An aspect that has had an increasing impact on the German climate and energy policy is the discussion on the competitiveness and distributional impacts. It is commonly understood, as expressed in the 2010 Energy Concept, that climate and energy policy should not only support ambitious emission reductions, but should also “secure a reliable, economically viable and environmentally sound energy supply. These three objectives are reflected in most of the instruments found in the German climate policy mix. However, there are trade-offs to be made between the efficiency of the climate policy instrument mix and its political feasibility. In order to accommodate concerns about (alleged or real) competitiveness impacts, industrial energy consumption enjoys a range of exemptions under each of the major climate policy instruments. From an efficiency perspective, these exemptions are problematic, as they imply that a considerable share of the energy consumption faces a much lower economic incentive to reduce emissions than the rest of the economy does. However, the different exemptions were considered necessary for the political acceptability of the different instruments.

Not only the efficiency of the instrument, but also the total price tag of the energy transformation and its distribution among different actors has become an issue in the political debate. In order to safeguard the competitiveness of domestic manufacturing, energy-intensive industries are largely exempt from many of the pricing tools and financing mechanisms that are part of the German climate policy mix. As the rules for exemptions have been softened over time, more producers have become eligible for exemptions or other support, in some cases benefiting companies that do not face international competition. Arguably, not all of the exemptions that are granted are justifiable on the grounds of international competitiveness. Moreover, given the level of ambition of the German Energiewende, it can be questioned if the narrow interpretation holds that competitiveness necessarily requires low energy prices, and that in increase in energy prices inevitably damages competitiveness.

Energy and electricity tax exemptions can be considered as one form of environmentally harmful subsidies. These remain a divisive topic – which is, again, marked by a trade-off between competitiveness concerns on the one hand, and the distributional impact of higher energy prices on the other. In the case of transport, one of the largest subsidies is the tax privilege for company cars, which effectively mutes the carbon price signal for a large share of the car market. In the case of energy generation, the largest remaining direct subsidy is the support mechanism for hard coal mining in Germany. However, these subsidies are to be phased out by 2018. Also, since hard coal is freely traded and its price determined on the world market, the subsidies mostly affect the *origin* of coal that is burned in Germany, but only to a very limited extend the *price* of hard coal, and hence its quantity burnt in Germany.

Energy efficiency and energy savings are addressed by a number of measures. The key sectors in this field are the residential and the transport sectors. A number of different measures exist, including the Energy Saving Ordinance, the CO_2 Building Rehabilitation Programme and taxes air travel and vehicle registration. Yet none of these measures has so far managed to initiate a dynamic that would be comparable to that in the area of renewable energy. It is doubtful whether Germany is on track to tap the enormous potential of CO_2 reductions in this area and achieve a climate-neutral building stock by 2050. This is supported by the fact that the German government sends out different political signals, especially regarding the considerable volume of exemptions for industrial energy consumption. Last not least, the fact that the *Energiewende* has focused political attention on the electricity sector, and here mostly on the generation side, means that energy efficiency (particularly in the building sector) may not be getting the attention it deserves. The same applies for the transport sector, for which a comprehensive climate strategy is still missing.

Climate policy is less integrated in the non-CO_2 landscape. No attention is given to them in the Energy Concept. This is true especially for the agriculture sector. The emission reduction potential in this sector is far from being tapped and should be targeted more.

3 Conclusions

The German climate policy mix is both very diverse and fairly dynamic, with several new instruments added to the mix in the last 15 years, and existing instruments refined and developed. The climate policy mix has been driven *inter alia* the Integrated Climate and Energy Programme adopted in 2007 and its successor, the 2010 Energy Concept. The decision to phase out nuclear energy after the Fukushima nuclear disaster in 2011 marked another turning point in German politics and called for the implementation of a new energy concept, now known as the *Energiewende* (energy transformation). Building on the succession of different programmes and concepts, the objective of decarbonisation of major parts of the economy by mid-century is now largely established and accepted across party lines, even though a lively debate continues on the pace of the transformation, the most suitable policy instruments, and the acceptable burden on businesses, private households and taxpayers.

In terms of major policy instruments, Germany has taken part in the EU ETS since its launch in 2005. However, it is disputed how much GHG emission reductions can actually be attributed to this instrument, due to the volatile and at times very low price signal created through the EU ETS. The second key measure in Germany is the feed-in tariff for renewable electricity anchored in the Renewable Energy Sources Act. The feed-in tariff is regarded as a successful instrument, in that it has lead to a dynamic development in the German renewable sector. In 2011, renewable energy covered 20% of total electricity consumption. The downside of this success story, which is receiving increasing attention, is the cost associated with the expansion of renewables. There is a general understanding that the instrument needs continuous improvement and fine-tuning in order to keep its costs low and to provide incentives for technology innovation. A third important measure is the Ecological Tax Reform that was introduced in 1999 – 2003, which increased the taxes for transport and heating fuels and introduced a new tax on electricity, using the tax revenue to lower the cost of labour. Yet, while the tax had in principle achieved its objectives, it remained unpopular with the public and with decision makers – which may explain why there have been no attempts to further develop the Ecological Tax Reform in the last ten years, despite the increased ambition level in climate policy.

In the field of energy efficiency, some progress can be observed, but the pace of change (in particular in the building sector) is insufficient to achieve the existing objectives. In its Energy Concept, the German Federal Government stated that Germany aims to realise a climate-neutral building stock in 2050. The main policy instruments in this field – obligatory energy performance standards for buildings laid down in the Energy Saving Ordinance and the KfW-administered CO_2 Building Rehabilitation Programme – are generally successful and effective, but are insufficient in terms of scale and impact. One problem that limits the effectiveness of energy efficiency policies (like the KfW programme) is the availability of funding. The Energy Efficiency Fund and other funds and initiatives are fed by auctioning revenue from the ETS.

However, due to the decline of the allowance price in the ETS, the volume of auctioning revenue remains below expectations.

Finally, the German transport and agriculture sectors also require a better integration of climate policy in order to tackle greenhouse gas emissions from these sectors more effectively. Neither for transport or agriculture is there a comprehensive strategy on how to address the emissions from the two sectors. For both sectors, there were only few notable policy initiatives or new policy instruments at the national level – the little dynamic that there is mostly stems from the EU level, such as through CO_2 emission limits for new cars. New policy instruments in the transport sector included a reform of vehicle registration taxes and the introduction of an air traffic levy. Other than that, policy interventions are mostly restricted to funding programmes in support of specific technologies, such as electric mobility.

An aspect that has had an increasing impact on the German climate and energy policy is the discussion on the competitiveness and distributional impacts. It is commonly understood, as expressed in the 2010 Energy Concept, that climate and energy policy should not only support ambitious emission reductions, but should also “secure a reliable, economically viable and environmentally sound energy supply” (Energy Concept). These three objectives are reflected in most of the instruments found in the German climate policy mix. However, there are trade-offs to be made between the efficiency of the climate policy instrument mix and its political feasibility. In order to accommodate concerns about (alleged or real) competitiveness impacts, industrial energy consumption enjoys a range of exemptions under each of the major climate policy instruments. From an efficiency perspective, these exemptions are problematic, as they imply that many energy end-users, comprising a considerable share of total energy consumption, faces a much lower economic incentive to reduce emissions than the rest of the economy. However, the different exemptions were considered necessary for the political acceptability of the different instruments.

Interactions between different policy landscapes have been receiving increasing attention in the German political debate. German climate policy employs a range of sector-specific policy instruments (such as the renewable feed-in-tariff EEG, CHP support, standards and subsidy programmes for the building sector, fuel efficiency standards for cars), most of which promote specific technologies. At the same time, Germany also has a number of cross-cutting pricing tools such as the ETS, or energy taxes. These apply across different sectors (ETS mostly for industry and power generation, energy taxes mostly for households and transport), and they ideally should not discriminate between particular technologies. Designed as cross-cutting policies, it is inevitable that they overlap with the sectoral, technology-specific policies. This holds in particular for the EU ETS, which sets an ex-ante emission limit for about half of Germany’s greenhouse gas emissions, and which therefore has to take account of the developments and dynamics that occur in this sector, including developments that are induced by other policies.

However, some argue that the observed overlaps between cross-cutting pricing tools and sector-specific technology support should be resolved by abandoning the sector-specific support mechanisms, and relying only on the cross-cutting pricing tools (e.g. Sinn, 2008). There is a fairly broad consensus that, while pricing tools are indispensable to set the context and create the right framework conditions for climate policies, there is also a need for specific sector- and technology-oriented policies to complement the general pricing tools (e.g. Kemfert and Diekmann, 2009; Matthes, 2010).

4 References

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Annex I: Table for the description of instruments

Areas of Policy interaction in design parameters	Emissions Trading Scheme	Phase out of subsidies for hard coal mining	Electricity and Energy Taxes	Air travel tax	Energy performance standards for buildings	Financial support for building refurbishment	Premiums for electricity produced in CHP units
Instrument category	ETS	Command-and-Control	Tax	Tax	Command-and-Control	Subsidy	Subsidy
Instrument subcategory	Cap-and-Trade	Subsidy phase out	Energy tax	Transportation Tax	Energy Efficiency Regulation	Federal Grants and Loans	Premium Market Access
Level of governance	EU	National	National	National	National	National	National
Degree of bindingness	Legally binding	Legally binding	Legally binding	Legally binding	Legally binding	Legally binding (after opt-in)	Legally binding (for grid operators)
Objectives							
Goal(s)	Mitigation through direct GHG emission reduction as well as stimulating the development of more efficient technologies	Removal of hard coal mining subsidies and relief of public budget	Reduction of energy consumption and GHG emissions, a shift of taxation from labour to energy and revenue generation for government expenditure	Relief of public budgets and incentivize environmentally conscious behaviour	Implementation of strict energy performance standards for new and renovated buildings	Refurbishment of existing building stock to meet new energy efficiency standards	Emission mitigation and acceleration of innovation and technology development
Type of target	Cap on total emissions from all sectors	Zero hard coal subsidies	No specific target	No specific target	Low-carbon building stock	Low-carbon building stock	Increase share of CHP electricity
GHG Scope							
GHGs covered	CO_2, Nitrous Oxide and Perflourocarbons	NA	CO_2	CO_2	CO_2	CO_2	CO_2
Direct/indirect emissions	Direct emissions	NA	Indirect emissions	Indirect emissions	Indirect emissions	Indirect emissions	Indirect emissions
Primary/final energy	Primary	Primary	Final	Final	Final	Final	Primary
Opt-in/opt-out	MS can opt-in emissions	NA	NA	NA	NA	NA	NA
Sectoral scope							
Sectors of economy	Energy supply, select industrial sectors, aviation	Energy supply	Industry, transportation, commerce, agriculture, public	Transportation, aviation	Residential, industrial, building, public	Residential, building, public	Energy supply

Covered entities	Installations	Installations	Energy Consumers	Airlines	Installations	House owners/Installations	Installations
Covered sites	Installations for the production of energy, refining of mineral oil, coke, metal ore, iron and ferrous metals, aluminium, non-ferrous metals, cement, glass, ceramic products, pulp from timber, paper, carbon black, nitric acid, adipic acid, ammonia, bulk organic chemicals, hydrogen, soda ash	Installations for the mining of hard coal	Any industrial, commercial, agricultural or public site that consumes fuel (gasoline and diesel), fuel for heating, and electricity.	Commercial air travel departing from German airports	New and renovation building projects	Private house owners (grants and loans); building companies and contractors (loans)	Installations for the production of CHP electricity
Capacity thresholds entities/sites	Installations with a total rated thermal input >20MW	NA	Fuel with a sulphur content over 10ppm is taxed at a higher rate	NA	NA	NA	Remuneration categories vary: <50kW to <2MW; Small CHP plants (<20kW) can apply for investment grants
Opt-in/opt-out for sectors	Renewable energy sectors eligible to receive feed-in-tariffs are not subject to EU-ETS MS can opt-in entire sectors subject to conditions	NA	Manufacturing and agriculture sectors have a 25% exemption	NA	NA	NA	NA
Opt-in/opt-out for entities	Small industrial emitters (<25,000 tonnes CO_2) can opt-out	Lignite mining does not receive government support	Installations that use cogeneration technologies (heat and electricity) are exempted Coal used for power generation is exempted (already covered by ETS)	Military and cargo flights are not covered		All entities must op-in to receive funding	
Opt-in/opt-out for sites	No	NA	Manufacturing companies are eligible to apply for a tax cap	NA		All sites must opt-in to receive funding	
Implementation network							
Competent bodies for adopting instrument	German Emission Trading Authority	Federal Government, Länder, RAG	Federal Government	German Ministry of Finance	Federal Ministry of Transport, Building and Urban Development	Federal Ministry of Transport, Building and Urban Development	Federal Government

Competent body for setting-up instrument	German Emission Trading Authority	Federal Government, Länder, RAG	Bundestag	German Ministry of Finance	Federal Ministry of Transport, Building and Urban Development	Federal Ministry of Transport, Building and Urban Development	Grid operators
Competent body to administer instrument	German Emission Trading Authority	Federal Government, Länder, RAG	German Customs Offices	German Customs Offices	Federal Ministry of Transport, Building and Urban Development	Federal Ministry of Transport, Building and Urban Development	Grid operators
Competent body for registration of participating entities	German Emission Trading Authority	Federal Government, Länder, RAG	German Customs Offices	German Customs Offices	Federal Ministry of Transport, Building and Urban Development	Federal Ministry of Transport, Building and Urban Development	Grid operators
Competent body for Monitoring & verifying compliance	German Emission Trading Authority	Federal Government, Länder, RAG	German Customs Offices	German Customs Offices	Länder Authorities	Federal Ministry of Transport, Building and Urban Development	Grid operators
Competent body for enforcement of compliance	German Emission Trading Authority	Federal Government, Länder, RAG	German Customs Offices	German Customs Offices	Länder Authorities	Federal Ministry of Transport, Building and Urban Development	Grid operators
Rules & influencing mechanisms							
Market arrangements							
Non-obligatory for eligible parties							
Number of participants	1,600 installations		NA			3 million apartments rehabilitated and 1,400 public buildings	27,000 installations (in 2008)
Market flexibility							
Trading	Yes	No	No	No	No	No	No
Unit type and name	EUA (the right to emit one tonne of covered GHGs)	NA	NA	NA	NA	NA	NA
Nature of unit		NA	NA	NA	NA	NA	NA
Lifetime of unit		NA	NA	NA	NA	NA	NA
Banking provisions							

Borrowing provisions							
Financing							
Cost-recovery	NA	NA	NA	NA	NA	NA	NA
Revenues raised	Auctioning of EUAs produces revenue that is funnelled back into climate protection programmes (Building Rehabilitation Programme, R&D for renewables, Energy Efficiency Fund, National Climate Initiative and International climate Initiative) through a separate federal public budget called the Climate and Energy fund.		Revenue raised equals roughly €18 billion annually and is used primarily to fund the public pension scheme			Funding comes from ETS auctioning revenue and amounted to €9.3 billion between 2006-2012	Direct governmental support is capped at €750 million per year
Technological parameters							
Eligible technologies							
Opt-in/opt-out							
Treatment of additionality							
Timing							
Operational?	Yes (2004-present)	Yes (2007-present)	Yes (2006-present)	Yes (2011-present)	Yes (2002-present)	Yes (2006-present)	Yes (2002-present)
Operational changes foreseen?		Beginning in 2016 companies will only be able to apply for exemptions when legally defined targets have been established			Amendements to Energy Saving Ordinance now in process (tightening of administration requirements and additions of administrative fines)	Constraints in funding due to a lack in ETS auctioning revenues may lead to future changes including a focus on low-income households	
Compliance period(s)	2004-2007; 2008-2012; 2013-2020	2007-2018					
Future continuation	Yes with the new compliance period beginning in 2013	Full phase out by 2018	Yes	Yes	Yes	Yes	Yes
Compliance							

Monetary penalties							
Naming and shaming							
Administrative liability							
Civil liability							

Areas of Policy interaction in design parameters	Feed-in tariffs for renewable electricity	Measures to accelerate electricity grid extension	R&D funding for energy storage systems	Biofuels quota	Obligation to use renewable energy for heating	Integration of climate policy in spatial planning and building codes	Ban on landfilling on untreated waste	Standards for the use of fertilisers
Instrument category	Subsidy	R&D Funding	R&D Funding	Command-and-Control	Command-and-Control	Command-and-Control	Command-and-Control	Command-and-Control
Instrument subcategory	Premium Market Access	Infrastructure Optimisation	Energy Technologies	Quota	Quota	Energy Efficiency Regulation	Ban	Regulation
Level of governance	National	National	National	National	National	National and local	Transposed EU Law	Transposed EU Law
Degree of bindingness	Legally binding (for grid operators)	Legally binding (for grid operators)	NA	Legally binding	Legally binding	Not legally binding (until opt-in)	Legally binding	Legally binding
Objectives								
Goal(s)	Increase the share of renewable energy sources in the electricity supply	Optimisation of grid to further increase the share of renewable energy	Promote innovation in the areas of energy efficiency, renewable energy and grid and storage technologies	Promotion of renewable energies in the transport sector and increase the reliability of the energy supply	Promotion of renewable energies in final energy used for heating (space heating, cooling and process heat and hot water)	Inclusion of mitigation efforts into zoning, spatial planning and land use	Phase out landfuilling waste without prior treatment in order to reduce methan	To reduce the amount of Nitrogen that is spread, potentially reduces GHG emissions but this is not its main purpose.
Type of target	Percentage of power grid	No specific target	No specific target	Energy share quota	Energy share quota	No specific target	Emissions of Methane from Landfilling	
GHG Scope								
GHGs covered	CO_2	CO_2	NA	CO_2	CO_2	CO_2	Methane	N_2O and CH_4
Direct/indirect emissions	Indirect emissions	Indirect emissions	NA	Indirect emissions (2015 onwards: direct)	Indirect emissions	Indirect emissions	Indirect emissions	Indirect emissions
Primary/final energy	Primary	Primary	NA	Primary	Final	Final	NA	NA
Opt-in/opt-out	NA		NA			NA	NA	NA
Sectoral scope								
Sectors of economy	Renewable energy supply	Energy supply	Research	Energy supply	Building (domestic and public)		Waste management	Agriculture
Covered entities	Installations	Installations		Installations	House owners/Installations		Installations	Installations
Covered sites	Installations for the production of renewable sources of energy	Installations for the transportation of		Mineral oil installations	Private house builders, commercial buildings		Landfills	Installations that use mineral and manure

	including: hydropower, landfill gas, sewage gas, mine gas, biomass, geothermal energy, onshore wind, offshore wind, solar	electricity (grid operators)							fertilizers
Capacity thresholds entities/sites	Tariffs vary for the different sources of renewable energy and the installation size (see Table 2, section 1.2.3)	NA						NA	NA
Opt-in/opt-out for sectors		NA						NA	NA
Opt-in/opt-out for entities	All entities must opt-in for Feed In Tariff	NA						NA	NA
Opt-in/opt-out for sites	All sites must opt-in for Feed In Tariff	NA						NA	NA
Implementation network									
Competent bodies for adopting instrument	Federal Environment Ministry	Federal Government	Federal Government; Federal Ministry of Economics and Technology	Federal Government	Federal Government	Federal Government	Federal Government	Federal Ministry of Agriculture
Competent body for setting-up instrument	Federal Environment Ministry	Federal Network Agency	Koordinierungsplatform Energieforschung	Custom office in Frankfurt (Oder) in Cottbus		Municipalities	Länder/Regional/local level	Länder/Regional/local level
Competent body to administer instrument	Federal Environment Ministry	Federal Network Agency	Koordinierungsplatform Energieforschung	Custom office in Frankfurt (Oder) in Cottbus		Municipalities	Länder/Regional/local level	Länder/Regional/local level
Competent body for registration of participating entities	Federal Environment Ministry	Federal Network Agency	Koordinierungsplatform Energieforschung	Custom office in Frankfurt (Oder) in Cottbus		Municipalities	Länder/Regional/local level	Länder/Regional/local level
Competent body for Monitoring & verifying compliance	Federal Environment Ministry	Federal Network Agency	Koordinierungsplatform Energieforschung	Custom office in Frankfurt (Oder) in Cottbus		Municipalities	Länder/Regional/local level	Länder/Regional/local level
Competent body for enforcement of compliance	Federal Environment Ministry	Federal Network Agency	Koordinierungsplatform Energieforschung	Custom office in Frankfurt (Oder) in Cottbus		Municipalities	Länder/Regional/local level	Länder/Regional/local level
Rules & influencing									

mechanisms								
Market arrangements								
Non-obligatory for eligible parties								
Number of participants	80,000 installations							
Market flexibility								
Trading	No			Yes				
Unit type and name	Tariff/Feed in Tariff			Quota				
Nature of unit	Reduced on a yearly basis (degression)							
Lifetime of unit	20 years							
Banking provisions								
Borrowing provisions								
Financing								
Cost-recovery								
Revenues raised								
Technological parameters								
Eligible technologies								
Opt-in/opt-out								
Treatment of additionality								
Timing								
Operational?	Yes (2000-present)	Yes (2005-present)	Yes (2011-present)	Yes (2007-present)			Yes (2005-present)	Yes (1996-present)
Operational changes foreseen?				After 2015 the quota system will be replaced with a CO_2 emissions				

				target system				
Compliance period(s)								
Future continuation	Yes	Yes	Yes	Yes				
Compliance								
Monetary penalties				Up to €50,000 in fines	Up to €50,000 in fines		Up to €50,000 in fines	Fines and potential loss of subsidies
Naming and shaming								
Administrative liability								
Civil liability								