

CLIMATE TAXES IN GERMANY (INTEGRATED IN THE EU)

Benefits for development cooperation

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1 PRELIMINARY REMARKS ON METHODOLOGY

The communicative purpose of the presentation is to enable stakeholders from third countries to draw on Germany's experience with 'climate taxes'. The aim is to describe Germany's experience in such a way that third parties can use the lessons learned. The goal is not to accurately describe the situation prevailing in Germany for a domestic audience.

1.1 Understanding the term 'climate taxes' – terminology

The key terms used for the topic covered have a very specific meaning under financial law in Germany's jurisdiction. Statistics are likewise affected by this. Within the EU's jurisdiction, the taxonomy may differ. In the relevant branch of economics, namely public finance, different terms again are used. In view of the fact that this paper is intended for stakeholders in third countries, the chosen mode of presentation takes a functional perspective regarding the key terms.

As a consequence, the terms 'taxes' and 'duties' are used as synonyms. This is in contrast to German tax law, which distinguishes between taxes (*'Steuern'*) and duties (*'Abgaben'*). *'Abgaben'* is the generic term for all 'sovereign' levies. The distinction is made in Germany by reference to a quid pro quo relationship. 'Taxes' as defined in Germany are levied without promise of anything in return; their sole purpose is to fund the government budget in general. In contrast, special duties are paid on a *quid pro quo* basis. They may also serve to create a comprehensive state monopoly in the case of goods that cannot be replicated at will. Any surplus, which constitutes the economic rent obtained, can be transferred to the general budget without earmarking.

1.2 Understanding the term 'climate taxes' – function

'Climate taxes' are designed to modify pricing for economic agents such that climate-friendly options become more profitable. In practice, this can be done with a varying emphasis on two functions:

a) Maximising tax revenue – with high distributional effects;
b) Maximizing the effect in terms of climate policy – with low distributional effects.

1.3 On the presentation scope 'Germany (integrated in the EU)'

With its membership in the EU, Germany is today integrated in a multi-tier system that is highly sophisticated in terms of its intensity of integration. For the third countries for which Germany is referenced as the 'model case', this may be different. When transferring experience from Germany to third countries, this disparity must be considered appropriately. The solution is to attribute to Germany regulations that were in fact enacted by the EU as the superordinate regulatory level.

The act of 'climate taxation' is generally associated with levies on tradable goods – probably the oldest form of taxation in human history. From a technical standpoint, they are excise duties and customs duties respectively – both of which are functionally equivalent, but are named differently depending on the point at which they are levied. With the trend towards increased integration of economic areas over time, customs duties are being eliminated and are mutating into levies on tradable goods.

Germany's integration into the EU's 'common market' is very far advanced. Different taxation of tradable goods in different Member States is likely to disrupt the free movement of goods in a common economic area, known within the EU as the 'internal market'. For this reason, at a level of integration such as that achieved in the EU, the competence to levy excise duties is generally taken away from the nation states and shifted to the top of the multi-tier structure. For the transfer to third countries, however, it should be irrelevant whether the competence is located in Germany or at EU level.

The usual fate of such levies on tradable goods can be illustrated by reference to a brief, stylised historical outline – using Germany as an example in Europe. It is the story of an intertwining of two historical developments, that of excise duties and that of multi-tier systems.

1.4 The co-evolution of excise duties and economic integration towards fully integrated multi-tier government systems

In Central Europe, specifically German/Prussian history, 'consumption taxes' (*Verbrauchsteuern*) were typically levied on consumables such as tobacco, coffee and salt, later also alcoholic beverages and energy sources. Originally 'luxury' goods, these were thus suitable for levies and they could not be produced ubiquitously, thus resulting in trade flows. Such 'consumption taxes' stem from a pre-modern government practice – in contemporary civil wars the phenomenon reappears, in the form of roadblocks intended to obtain funding for the warring parties. 'Consumption taxes' are typically based on the product properties that are physically verifiable at the inspection point. Hence the focus on 'specific products' (rather than on 'consumption' more generally, as established in contemporary practice with the 'general goods value-added tax'), and on a physical tax base (rather than on a value base as rendered under a general value-added tax).

A different tradition prevails in southern Europe, that of 'excise' – and hence the term 'excise duties' in English-speaking countries. There, the excise duty was levied domestically mainly on domestically produced staple foods, which required the treasury to adopt far more burdensome tax collection methods. Excise duties were correspondingly hated in Spain and in France. With the introduction of what was referred to as 'direct' taxation, that is the taxation of personal income and wealth, the French Revolution closed the justice gap and, using modern but also more demanding sovereign taxation methods, removed the pressure to take the poorer classes' livelihood as the central tax base. However, emotions against this type of levy can easily be reignited in the public domain at any time.

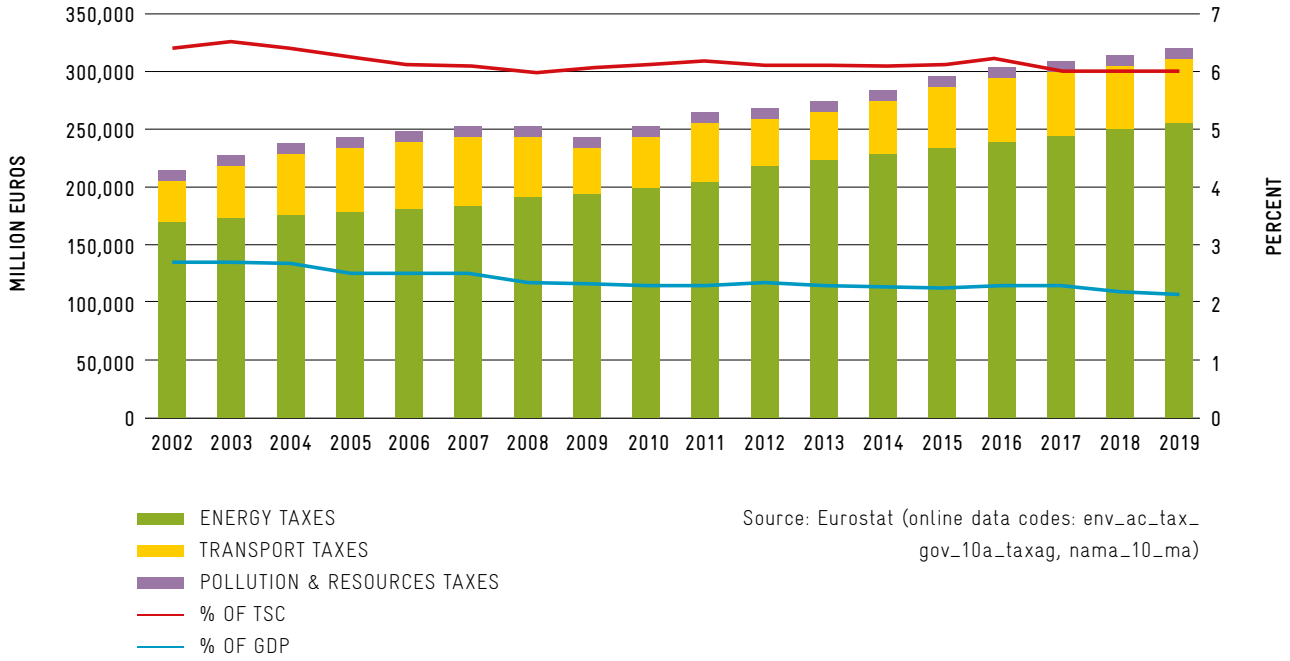
This ancient simple taxation method was revived with the advent of environmental politics – the lessons of the French Revolution were forgotten. Since many environmental problems are linked to energy sales, the obvious course of action was to increase the tax burden on energy sources – which were usually subject to excise tax already – either according to their energy content or, more specifically, in relation to the respective environmental problem, which is typically the idea of the carbon tax today. The rationale behind this mode of action is to influence relative prices. This can be achieved provided that a mark-up is applied in the market, and it is presupposed that that is the case. Yet this is only correct to a limited extent – only if consumer prices are actually the sum of the production costs at all upstream stages, that is if they are consistent with costs. If, on the other hand, as is the case in particular with petroleum products, there are significant economic rent elements in the final consumer price, the effect of a tax mark-up on consumers can easily be close to zero. This is the case when the additional skimming claim expressed in the tax on the part of a consumer state is offset by a corresponding withdrawal of the producer state's claims to economic rents.

Since this simple taxation method is very transparent, it continues to inspire the imagination and is quite common as a guiding principle. Modern government practice, however, is now able to use advanced techniques and a very different systemic data availability to levy taxes much more efficiently in order to achieve environmental policy effects – and, as a side effect, is able to deal much more wisely with the expected effects in relation to economic rents.

1.5 Quantitative aspects

The revenue from what are referred to as 'environmental taxes' and their share in the total tax revenue of the EU Member States is regularly communicated in accordance with an EU definition. Here is the chart from Eurostat[1] on the latest status.

GRAPHIC 1 ENVIRONMENTAL TAX REVENUE BY TYPE AND TOTAL ENVIRONMENTAL TAXES AS SHARE OF TSC AND GDP, EU–27, 2002–2019 (MILLION EUR, %)

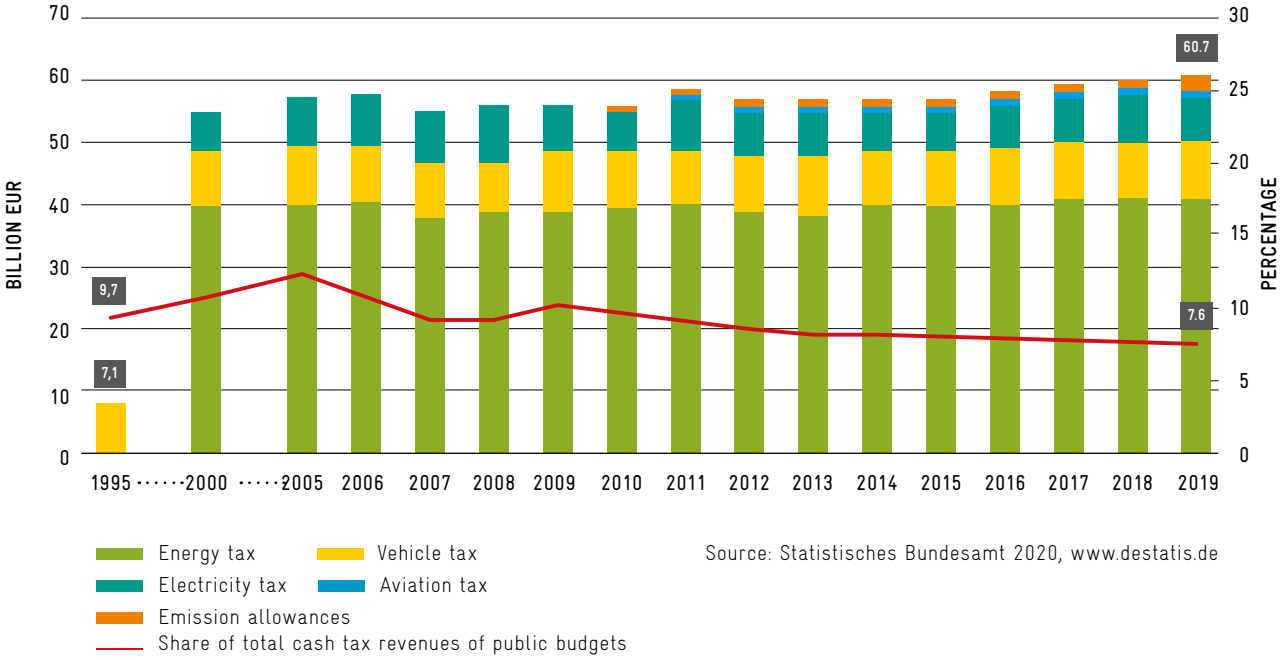


Source: Eurostat (online data codes: env_ac_tax_gov_10a_taxag, nama_10_ma)

Germany has reported annual tax revenue of just under EUR 60 billion per annum with practically no changes for several years. The German Federal Environment Agency (UBA) describes this in the chart below.[2] Revenue under the Fuel Emissions Trading Act (BEHG) is not classified as revenue from a 'tax' in Germany for legal reasons and will therefore not be included in this index in future.

1 https://ec.europa.eu/eurostat/statistics-explained/index.php/Environmental_tax_statistics
2 https://www.umweltbundesamt.de/daten/umwelt-wirtschaft/umweltbezogene-steuern-gebuehren#entwicklung-umweltbezogener-steuern

GRAPHIC 2 REVENUE FROM ENVIRONMENT-RELATED TAXES



Source: Statistisches Bundesamt 2020, www.destatis.de

Given the nomenclature, it is evident that the share of revenue was in the order of 7% (of tax revenue) and 3% (of gross national product) and has been steadily declining slightly since measurement began – an effect of an unprofessional choice of tax base.

Of interest in terms of distribution policy is the share of energy duties in the cost of living, measured in its price index. This analysis focuses on the direct expenditure of private households on energy, which breaks down into expenditure on stationary uses in the home, including fuel for heating and for electricity, and uses outside the home for running motor vehicles. The shares of these expenditure types (in the current weighting scheme (for 2015))[3] are shown in this table.

TABLE 1 POSSIBLE STARTING POINTS FOR A REDUCTION OF A PRODUCED ENVIRONMENTAL IMPACT

No.	Category	Weighting in per mill
045	Electricity, gas and other fuels	68.82
0451	of which electricity	25.92
0722	Fuels and lubricants for vehicles	35.25
07213	of which diesel	8.64
07222	of which petrol	25.66
Total: Share of direct expenditure on energy sources		**104.07**

Source: own table

3 https://www.destatis.de/DE/Themen/Wirtschaft/Preise/Verbraucherpreisindex/Methoden/Downloads/waegungsschema-2015.pdf?__blob=publicationFile

(Direct) expenditure on energy sources thus accounts for around 10% of the cost of living. One-third of this is attributable to the highly taxed fuel, one-quarter to electricity and a good 40% to fuels of far greater significance in terms of volumes.

In the case of expenditure on electricity, it is necessary to add, from the point of view of distribution, what is not considered a 'levy' for reasons of legal nomenclature, but which is in fact completely influenced by the state. These are what are referred to as 'cost allocations' (*'Umlagen'*) on electricity consumers on the regulated electricity market, including the cost allocation based on climate policy under the Renewable Energy Sources Act (EEG). There are plans to lower EEG cost allocation to the same extent as BEHG revenue increases. This will relieve the burden in the electricity sector, while shifting it to the transport sector. Both taxation elements between which the burden is shifting are not formally deemed 'environmental taxes' – but *de facto* (functionally) they are.

1.6 Production-theoretical architecture of possible starting points

A service is produced by using three inputs with completely different life cycles. Transport from A to B requires infrastructure (100 years), a vehicle (10 years) and fuel (< 1 year). The inherent environmental effects are generated by the properties of all three products. Their properties provide the starting points for environmental policy. Taxation can also be used as a policy element to influence them.

This is illustrated by the interplay between fuels and vehicles. The same applies to the interrelationship between heating fuels and buildings. Environmental effects occur when a consumable, in this case a final energy carrier, is used in a capital good, specifically a (durable) energy-converting system. The environmental effects of using an energy carrier in an energy-converting system are proportional to four factors: to the **properties** of the two products used as well as to the **intensity** of their use.

There are four starting points for reducing the environmental impact produced.

TABLE 2 ALL FOUR STARTING POINTS USE LEVIES (DUTIES) AS A MEANS OF ADDRESSING THE ENVIRONMENTAL IMPACT

Starting point		Addressing impact (taking mobility as an example)
1.	**Consumable's process properties**	Greenhouse gas emissions during fuel production ('upstream')
2.	**Consumable's product properties**	Greenhouse gas emissions from the use of a fuel (CH_4; CO_2)
3.	**Capital good's product properties**	Energy efficiency or specific NO_x or CO_2 emission of the energy-driven vehicle
4.	**Intensity of use of the capital good**	Mileage or energy consumption

2 OVERVIEW

In the following discussion, the term 'climate taxes' (with low tax revenue) is understood very broadly. It is structured by the production-theoretical terminology introduced in Section 1.6. This provides a kind of 'architecture' for possible starting points for such taxes.

This modern understanding of 'climate taxes' is illustrated by reference to 'fields' (sectors). Transport, buildings, electricity (consumption and generation, the latter as an example of the production of energy-intensive goods) and agriculture were chosen for this purpose.

3 STARTING POINTS IN THE TRANSPORT SECTOR

3.1 (Modern) energy tax (of the EU) – simultaneously a tax for climate action

An established energy tax policy has long been in place. After discovering the climate problem and establishing its climate policy, the EU advocated the concept of a 'carbon/energy tax' in the 1990s. The introduction was time-consuming due to the unanimity principle of the EU in tax matters. It finally succeeded in 2003 as framework legislation. In 2011, the European Commission drafted an amendment proposal. This proposal failed and was withdrawn in 2015. From a structural perspective, however, the proposal was exemplary.

An 'energy tax' directive of this nature would set the structure and minimum rates for national legislation. Energy tax rates are determined additively from two components: One is based on the CO_2 content and the other on the energy content of the respective final energy carrier. It is therefore more than its name suggests; it is also a climate action tax.

For CO_2 emissions, a (non-dynamised) minimum rate of EUR 20/t CO_2 would apply to all sectors that are not subject to the EU Emissions Trading System (EU ETS) (cf. Section 5.2). Energy carriers from renewable sources, i.e. biofuels and e-fuels, are set at zero in this element of the tax rate. For the energy component, it has been ensured that the minimum tax rates are based on the energy content, in EUR/GJ for all energy sources. The revenue from the (realised) energy tax – without the CO_2 element – in Germany is in the order of EUR 40 billion p.a., of which 90% in the transport sector, 10% for heating.[4]

3.2 The retrospective climate action tax on fuels for small-scale consumption: the second BEHG

New in Germany is an excise duty regulation that will introduce an **additional** levy starting in 2021. This is based on CO_2, more specifically on the quantity, but is dynamised in the rates (but not, by indexation, hedged against inflation). The rates start at EUR 25/t CO_2 in 2021 and increase every year to finally EUR 55/t CO_2 by 2025.

The law that enshrines the new levy is entitled 'Act on National Allowance Trading for Fuel Emissions (Fuel Emissions Trading Act)' (BEHG). With this title, more has been announced at a programme level than has actually been implemented to date. It is not a cap&trade system, nor is more than CO_2 from fossil fuels included in the tax base. The vast majority of emissions from agricultural activities, as not 'combustion-related', have been excluded and left unaddressed (cf. Section 6).

4 https://www.bundesfinanzministerium.de/Content/DE/Standardartikel/Themen/Steuern/Steuerschaetzungen_und_Steuereinnahmen/Steuerschaetzung/2020-11-12-ergebnisse-159-sitzung-steuerschaetzung-dl.pdf?__blob=publicationFile&v=6

3.3 Distributional effects of targeted taxation of energy carriers (negative economic rents at the expense of vehicle owners/users)

Assuming that an energy-driven machine could instantly have its energy efficiency properties adapted to increased prices of energy carriers, then the vehicle owner and user would be exposed to a small effect in the event of an increased energy taxation on the cost of mileage driven (assuming the economic optimum were reached, the cost increase would be limited to the net effect). In practice, however, as the production-theoretical architecture in Section 1.6 shows, capital goods have 'rigid' properties depending on their technical life cycle. In the case of vehicles, with a life cycle of roughly 10 years, the effect is still relatively moderate; but the effect is considerable in the case of buildings with a life cycle of more than 50 years. The 'aging' structure of a portfolio of assets has distributional or negative economic rent effects in the event of an increase in energy taxes. This varies from sector to sector. Environmental taxes or complementary policy measures, differentiated by sector, can help compensate for the distributional effect.

Long-term transparency of the energy tax increase is crucial for the corresponding volume required. If the energy properties of vehicles, that is their fuel consumption values, are reliably known on the market and if the energy or climate policy of a state reliably announces the tax rates a decade in advance (and sticks to them), then the distribution problem is solved, as all vehicle owners can then calculate in advance what they can expect when they buy their vehicle.

That is easier said than done. Even in a region like Europe, an automotive hub and a major powerhouse in terms of demand, such practice has been rare so far. Published consumption statistics for passenger cars are unreliable, and with regard to the setting of tax rates, the standard mode of operation is surprise policy with (nominal) rigidity followed by one-off increases – instead of working with mathematically formulated dynamic tax rates (as is common practice today in the volume-driven targets of climate policy). As a result, the energy design of Europe's vehicle fleet from the user's perspective is already massively under-optimised, which means that passenger car users consume and have to spend far more on fuel than would be necessary if the energy properties had been designed to be economical from the user's perspective. There is a corresponding high and justified resistance to tax rate changes that trigger negative economic rent effects for vehicle owners (consider the recent 'yellow vest' protests in France).

The distributional effect from the unadjusted aging structure can be compensated for individually in terms of taxation, provided there is complementary taxation of the capital good, in this case the motor vehicle (cf. chapter 3.6). In the event of a periodised vehicle tax – i.e. as opposed to a one-off tax upon the vehicle's purchase – which is based on the vehicle's energetic properties, it is possible to grant a discount in it that is scaled back gradually and is reduced to zero by the 10th year of the vehicle's life cycle.

As mentioned above, there are also statistical and intersectoral options for offsetting negative distributional effects on the existing vehicle fleet[MM7]. The compensation of the energy tax increase via BEHG, i.e. for fuels and heating fuels, by reducing the cost allocations under the EEG, i.e. for electricity, was mentioned in Section 3.2. However, intrasectoral options are also available. In Germany, car commutes to work have long been subsidised in the income tax regime. For long distances to the place of work, this subsidy was increased with the introduction of the BEHG through what is referred to as the 'commuter allowance'.

3.4 'Property' (of an energy carrier) as a key term for regulatory purposes

The term 'property' (of a fuel) was introduced in Section 1.6 in its dual meaning as process property and product property. In German, this term originated in commercial law. For the design of environmental taxes, both points of reference are important.

The product properties can be discerned by analysing the given product. To know the process properties of a product, one must have access to information on the product's (manufacturing) history, i.e. the 'processes' at 'upstream' stages of the ultimate product. This concept has been clarified under commercial law – the 'tuna-dolphin' case played a paradigmatic role in WTO jurisprudence. Food chemistry methods can be used to determine the product quality of tinned tuna. In contrast, the process quality, e.g. whether the tuna was caught with nets deemed 'dolphin-safe' or not, is a property of the production process and cannot be discerned by looking at the finished product. This case served to clarify under commercial law that states are permitted to discriminate imported goods by reference to process properties.

This topic is of relevance for the taxation of energy carriers motivated by climate policy. Re-contextualised, the implications are as follows: The energy content of a fuel such as diesel can be determined by chemical analysis. The carbon emissions resulting from the fuel's (complete) combustion can also be precisely determined in the same way. CO_2 is a pollutant within the context of climate policy, although that does not apply to all CO_2, but rather only to the share produced through the combustion of fuels 'from fossil sources', as it is commonly formulated in EU legal texts. The counter-term used there, which is symmetrical, is 'fuel from renewable sources'. In other words, climate-neutral fuels are distinguished from climate-polluting fuels by reference to a **process** property.

The implication is that CO_2 produced in the combustion of fuels from renewable sources is not an environmental burden and must therefore be excluded from the tax base. Strictly speaking, what is referred to as 'carbon taxation' or 'fossil fuels tax' is not based on a product property but rather on a process property: 'from ... sources.' It is based on the origin. But only in so far as it concerns carbon, which is a product property contained in the fuel and is released into the atmosphere on (complete) combustion.

The upstream property principle can be taken a stage further. A fuel (from fossil sources) that is marketed in Germany and originates abroad and has also undergone a large part of the processing steps in the refinery abroad can be assigned all GHG emissions from the sum of these upstream steps as a property. The technical term for this perspective in the EU is the 'climate quality' of a fuel (Art. 7a Fuel Quality Directive, FQD). This has also been made the subject of environmental specifications – cf. Section 3.5.

3.5 The 'greenhouse gas reduction target' pricing technique – without generation of economic rents

In Germany, this option has recently gained in relevance in the fuel sector, in the context of what is known as 'mandatory blending'. The factual background: Fuel additives, which have chemically similar properties to imported fuels (petrol, kerosene, diesel), can be (easily) produced from plants – but with different technologies, depending on the given substrate. Mixed in moderation with conventional fuel, the resulting blended fuel is compatible for use in engines of conventional vehicles – an ideal option for the aptly-named 'drop-in' solution.

The German Government was faced with the task of implementing this option in regulatory terms. A classic excise duty solution would have been to define additional fuel categories according to the blending percentage (5%; 10%) and to prescribe various energy tax rates for them – differing from the basic fuel. The Government did not opt for this 'environmental tax' solution. Instead, it opted for a volume-based solution, or more precisely a solution based on a minimum target. EU regulation also provided the corresponding framework.

A mandatory minimum percentage of biofuels has been in place since 2007, and since 2015 a generalised form of promoting the use of energy from renewable sources in transport has been in place through the greenhouse gas reduction target. The Directive obliges Member States to demonstrate a share of renewable energies in the transport sector's energy consumption of at least 10% by 2020. The target of the Fuel Quality Directive 2009/30/EC (FQD) is to achieve a reduction of greenhouse gas emissions from fuels, in terms of the 'climate quality' of fuels, i.e. including upstream emissions, of at least 6% (relative to 2010) by 2020. This can also be achieved by placing energy products from renewable sources on the market.

The amendment of the Renewable Energy Directive (RED II) raised the stipulated share of renewable energies in the final energy consumption of the transport sector (road and rail) per Member State to at least 14% for 2030. Germany has set a more ambitious increase in the greenhouse gas reduction target to 22% by 2030. The underlying rationale is the consideration that this instrument has proven to be effective, market-based and widely accepted.

Germany has implemented the obligation addressed to the EU Member States by setting a joint annual average minimum percentage of fuel from renewable sources for companies that 'market' fuel (which is already a key category of energy tax regulation, cf. Section 3.1). Any failure to satisfy the requirement is subject to massive financial penalties. The companies are allowed to transfer their certificates among themselves, such that a market (with few participants) has been created, which facilitates the achievement of 'on average'.

The special environmental tax treatment can be explained by the fact that the drop-in solution from sustainable biomass does not allow for ramp-up at will, but the aim is to be able to move towards 100% in the long term. First, we need to switch to biomass from residues to avoid competition with food production. Then we need the transition to so-called 'e-fuels', i.e. fuels from renewable sources, but from electricity, without touching the organic carbon world. The increase in the greenhouse gas reduction target is therefore calculated in such a way as to allow time for industry to react and develop production capacities for energy products such as green hydrogen and advanced biofuels. Also defined is a pioneer sector for this induced technological development, namely air transport. It is suitable because there is hardly any technological alternative for it; in future, it will likely be dependent on liquid power-to-X (PtX) fuels.

This solution is appealing because markets emerge in response to the (somewhat abstract) specifications for volume growth. They produce a fuel surcharge, which the regulator does not prescribe by means of a tax, but rather emerges – and, provided there is sufficient competition, relatively precisely covers the additional costs incurred for the additional effort to enable the technological change needed to produce the fuel, which can then, in the next phase, be scaled up to 100%. The pricing of these products, in these markets, can be left open by regulatory authorities – the pricing mechanism can be left to work freely depending on supply and demand, i.e. with corresponding seasonal deviations. There is also a sales market for blended products to consider. It is up to the stakeholders addressed by the regulation how they fine-tune the differentiation of fuel prices over the accounting period (one year) in such a way that the demand at year-end exactly matches the given minimum percentage.

The rationale for not providing an explicit tax solution thus stems from the function that is being sought. Usually part of the function is to influence prices – it is assumed that a mark-up model is the appropriate notion of the mechanism. In the present case, both products fed into the blend – the mineral oil and the ethanol from agricultural sources – are commodities traded on world markets. A country like Germany has no influence on their pricing, not to mention their relative development.

3.6 Starting point vehicles' (energetic) properties

In the transport sector, the energy-converting systems are vehicles that have energy efficiency properties.

The EU has a system of CO_2 fleet limits to address this. As long as all vehicles had internal combustion engines and only fuel from fossil sources was used, this regulation was a policy to promote the energy efficiency of vehicles. Limit values are set for the fleets that the manufacturers market in Europe, based on average emissions. Here, too, failure to adhere to the limits is subject to high penalties (equivalent to approx. EUR 500/t CO_2). Moreover, the manufacturers are permitted to exchange compliance certificates between them, thus creating a market with a small number of participants.

The reference to energy efficiency has been diluted or removed by two decisions:

- At Germany's request, the energy efficiency was parameterised by reference to the vehicle weight;
- With the transition to electric cars, which by definition produce zero emissions.

In doing so, the EU, including Germany, has not only adopted a policy to address the energy efficiency of vehicles, but also an (appropriate) measure.

The result is environmental taxation of energy efficiency by means of the motor vehicle tax. This is currently based in part on the aforementioned EU CO_2 fleet value based on vehicle certification.

3.7 Shadow pricing

A very elegant option is to assess energy-converting systems by reference to energy or CO_2 price calculations that deviate from current market prices, using instead prices that will be required or expected in the future[MM9]. Prices of a completely different order of magnitude can be calculated without any (noticeable) distributional effects.

In Germany, this is the case in the Federal Transport Infrastructure Plan, and international development banks make it a condition in granting loans for the construction of power plants.[5]

5 https://www.dandc.eu/de/article/warum-preise-fuer-co2-emissionen-und-co2-schattenpreise-sinnvoll-sind
https://www.dandc.eu/en/article/why-carbon-emissions-pricing-and-carbon-shadow-pricing-both-make-sense

4 STARTING POINTS IN THE BUILDINGS/HEATING SECTOR (ROOM TEMPERATURE CONTROL)

Buildings are designed for their occupation by people, which requires the temperature control/air conditioning to be different inside, i.e. more comfortable, than outside. In southern regions, it is an issue of air conditioning; in northern regions, it is more of a heating issue. Energy is needed to create and maintain this temperature difference between the interior and exterior – the amount depends on the energetic properties of two capital goods: that of the building envelope (life cycle of over 50 years); that of the ventilation and air-conditioning system (life cycle of approximately 10 years).

In principle, therefore, all arguments discussed in Section 3 apply by analogy – with the difference that in this case we have a second capital good with a significantly longer life cycle. The consequence of this product structure is that all three leverage points are used.

4.1 Energetic properties of the building envelope, including building-related recovery of renewable energies

The option to change price incentives is hardly used here, with the exception of BEHG (Section 3.2). Instead, the following instruments are used: For new builds, an 'economic' assessment is prescribed – but without anticipating any future environmental tax surcharges. For existing buildings, additional costs can be subsidised and surcharges applied to leases in the amount of costs saved as a result of refurbishment.

4.2 (Efficiency) properties of heating systems

The efficiency potential of conventional heating systems has been exhausted. The focus is therefore on incentives for fuel switching. In future, the drop-in solution will also play a role, but e-fuels are still far from ready for broad market adoption (cf. Section 3.5). For heating systems, in practice, the emphasis is placed around electricity as the new primary energy source: either electric heating with recovery of renewable energy (e.g. heat pump); or fuel-based heating with combined heat and power (CHP). Incentives in both cases include subsidies and, in the latter case, supplementary income from the new electricity market regime (cf. Section 5), in which sources of electricity that can be controlled are becoming scarce and increasingly valuable.

4.3 Pricing of the fuel used for heating

Due to the considerable economic rent effects and distribution conflicts of a consumption tax of this nature, Germany long contented itself with the (static) solution of the energy tax it had introduced. That changed in 2019. Since 2021, Germany has had a tax surcharge that is progressively structured until 2025: framed in BEHG (cf. Section 3.2).

5 STARTING POINTS IN THE ELECTRICITY SECTOR (GENERATION AND CONSUMPTION)

Electricity generation in Germany is now integrated into a liberalised electricity market model based on the Anglo-American model. This is the framework within which environmental policy is effected in this sector. In a first instance, this is only a market for optimising the use of existing power plants by reference to their marginal costs – technically speaking, it is an 'energy only market' (EoM). In addition, there is a monopsonistically organised market for all those services that are necessary for the electricity market to function, including services to ensure the electricity system's security. These systemic services are funded by electricity consumers via 'cost allocations' (cf. Section 1.5).

The marginal costs serve as a point of reference to prioritise the use of different types of power plants, which also differ in terms of their varying GHG intensity. They are essentially the same as fuel costs. The resulting prioritisation order is as follows: renewables; coal-fired power plants (high specific GHG emissions); gas-fired (or oil-fired) power plants (half the specific GHG emissions of coal).

This EU-established EoM enables two approaches to taxation.

- Saving electricity by increasing the efficiency of electricity-consuming appliances and systems reduces the GHG emissions of fossil-fuel power plants, and thus enables appropriate discrimination. Saving electricity, through changes in appliances and behaviour, can be stimulated by an electricity price surcharge. Given the prevalence of mark-up calculation practice, an electricity tax can also be efficient. However, this only applies if appliance manufacturers and their customers have identical interests.

- A surcharge on the cost of the fuel used, which is proportional to the climate impact and therefore varies depending on the fuel, can change the order of prioritisation, and is therefore effective. This can be achieved through GHG-specific levies, i.e. typically, through the issue of 'carbon offset certificates' with a market value.

5.1 Consumption

There are two levies in Germany that are included in the electricity price.

5.1.1 Electricity tax in Germany

An electricity tax was introduced in Germany in 1999 as part of the Law on the Introduction of Environmental Tax Reform (referred to as the 'Ökosteuer' or 'green tax'). The electricity tax was conceived as a quantity-based consumption tax, rather than value-based. The tax rate has remained unchanged since 2003 at EUR 20.50 per megawatt-hour, which is around 7% of the average household electricity price. Total annual tax revenue comes to around EUR 7 billion.

It thus completed the ensemble of existing taxes on final energy sources, in the form of what is referred to as the 'mineral oil tax' (since 2006 'energy tax'), which was and continues to be levied on fossil hydrocarbons. This is clearly differentiated in the rates, by a factor of more than 10 (!), according to the sector of use (!) – transport or heating. From a taxation point of view, this is very interesting. Firstly, it shows that differentiation is made according to the completely different potential for taxing economic rents. And, secondly, it shows that it can be done with modern governance technology. The basis for this considerable differentiation of tax rates according to use, which triggers massive pressure for tax avoidance, is not a property of the energy carrier, but of its 'later' use (relative to delivery to the consumer). Appropriately designed monitoring techniques are needed, in Germany by customs officials, to keep the high black market potential of this construction in check.

In the case of the tax on electricity, there is no comparable tax rate differentiation according to the potential for taxing economic rents – nor are there plans to do so with the penetration of battery electric vehicles.

5.1.2 EEG levy

In Germany, the decision was taken in 1990 and 2000 respectively to supplement the deficient EoM electricity market regime to obtain compensation for the construction of plants for generating electricity from 'renewable energies'. This compensation was not capacity-dependent, but was instead designed to be 'performance-based' in proportion to the amount of electricity generated and fed into the grid. In Germany, this 'feed-in tariff' construction is called the EEG levy. It was designed to scale back gradually over time, in line with the technological development it was expected to promote. Meanwhile, the levy has grown to a considerable electricity price element, at EUR 60/Mwh, making it significantly greater than the electricity tax. Revenue from the newly introduced BEHG (effective as of 2021) is to be used to reduce the now politically sensitive level of the EEG levy.

5.2 Generation

With regard to electricity generation, the environmental policy objective is to reduce the associated environmental effects. In terms of climate policy, the task is to arrive at an electricity system with zero emissions of greenhouse gases.

In the mid-2000s, the EU took on this task directly. It introduced a 'cap-and-trade' system for all 'large fuel-fired plants'. The 'levy' payable to the state reflects the scarcity imposed by the state that emissions of greenhouse gases are only permitted if the emitter can produce certificates for them. The state can issue such certificates for a fee, as the basis for its tax revenue. The distribution of this additional financial revenue was the central subject of negotiation during its introduction. As a result, the EU level has given Member States discretion for revenue matters, but has ensured in return that the revenue must be earmarked for climate protection tasks, the implementation of which is monitored by the EU. It has thus prevented the generation of general budget appropriations. The quantity limit itself is simply constructed mathematically in terms of the law: by a negatively sloped straight line intersecting the zero line at about 2050.

Plants other than electricity generation plants have also been included. The scope of greenhouse gases covered has been extended beyond CO_2.

The 'industry' sector, which is not covered separately in this paper's analysis, is nevertheless included in this respect, as it concerns large plants in Section 5.2 and with regard to smaller plants in Section 4.

6 STARTING POINTS IN THE AGRICULTURAL SECTOR

The agricultural sector's climate impact largely stems from greenhouse gas emissions that are not combustion-related. The combustion-related portion from the operation of vehicles and equipment is subject to environmental tax regulations discussed in Section 3.1, Section 3.2 and Section 5.1.1 – in some cases with generous exemptions. The (overwhelming) remainder has not been addressed so far[MM10] because the options for farmers to switch to emission-reducing production methods have so far been rather poorly developed. The aspect of (food) consumption – a topic that is not considered in this paper – remains to be addressed.

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