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A successful energy transition requires a CO_2-oriented energy price reform

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The Paris Climate Agreement aims to make the global economy largely carbon-neutral by the middle of the century. Many experts regard a uniform carbon price that covers all energy sources as the most efficient approach to achieving this ambitious goal. Most European countries, however, are not pursuing this approach consistently and neither is Germany. While steps have already been taken in the right direction, the current system of levies and charges still contains price distortions that hamper the integration of renewables and the intended sector coupling. This is generally increasing the cost of the energy transition in Germany and making it difficult to achieve climate targets. The core elements of a reform might consist of a floor price under the EU ETS and a CO_2-oriented amendment to energy taxation. Transnational coordination is also conceivable here. In addition, the measures would have to be revenue-neutral so that they place no additional net burden on households and industry. Implementing such a reform requires a strong political will and a clear commitment to climate action.

Status quo of politically determined components of the energy price

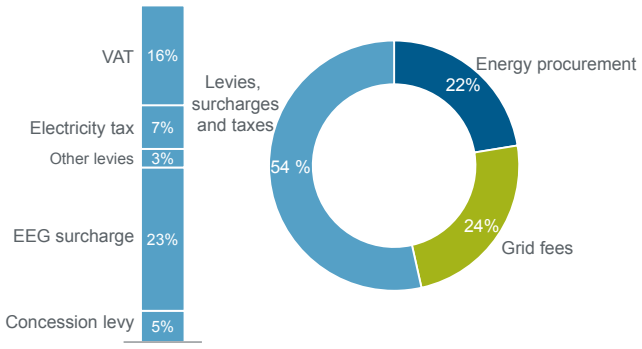
High household power prices

According to a recent survey by the Bundesnetzagentur (Federal Network Agency)[1], the average electricity price for private households in Germany is just under 30 eurocents/kWh. Germany thus has the highest prices in the entire EU, even ahead of Denmark and Belgium, which are both on a similar level. Household power prices across the EU average around 20 eurocents/kWh. Yet in Germany the price component for energy procurement, distribution and margin represents a share of only 22% of the retail price (Figure 1). The remaining electricity price components are composed of grid fees (around 24%) as well as levies, surcharges and taxes (totalling around 54%).

Power prices for commercial customers depend heavily on consumption and exemption rules

Electricity prices for commercial customers carry significantly lower levies, taxes, surcharges and fees than household power prices (Figure 2). The actual price level, however, is heavily dependent on power consumption and profile and on exemptions that may be claimed by commercial or industrial customers. Power prices for industrial customers that consume 24 GWh of electricity per annum vary from 5 to 15 eurocents/kWh, depending on the exemptions applied. For companies with no exemption, the EEG (Renewable Energy Sources Act) surcharge is the largest component, at almost 7 eurocents/kWh. With this range, German industrial customers with full exemption are at the bottom of the range compared with other EU states (Figure 3), while those without exemption are at the top. Across the EU, the mean power price for industrial customers with an annual power consumption of 20–70 GWh was around 9 eurocents/kWh in 2017.

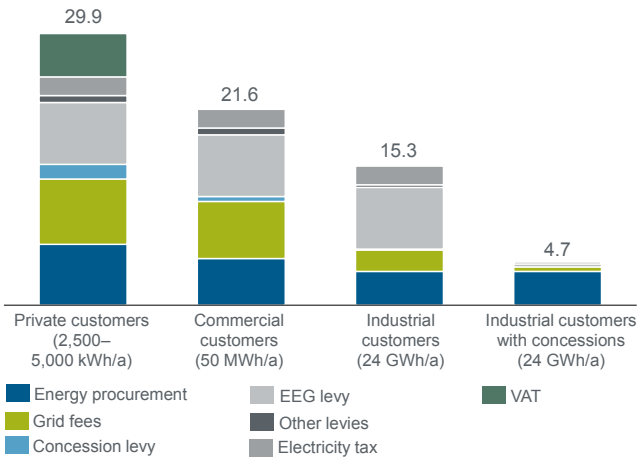
Figure 1: Power price components for private households



Note: Composition of average power price for households with an annual consumption of 2,500 to 5,000 kWh in Germany in 2018.

Source: BNetzA Energy Monitoring Report 2018

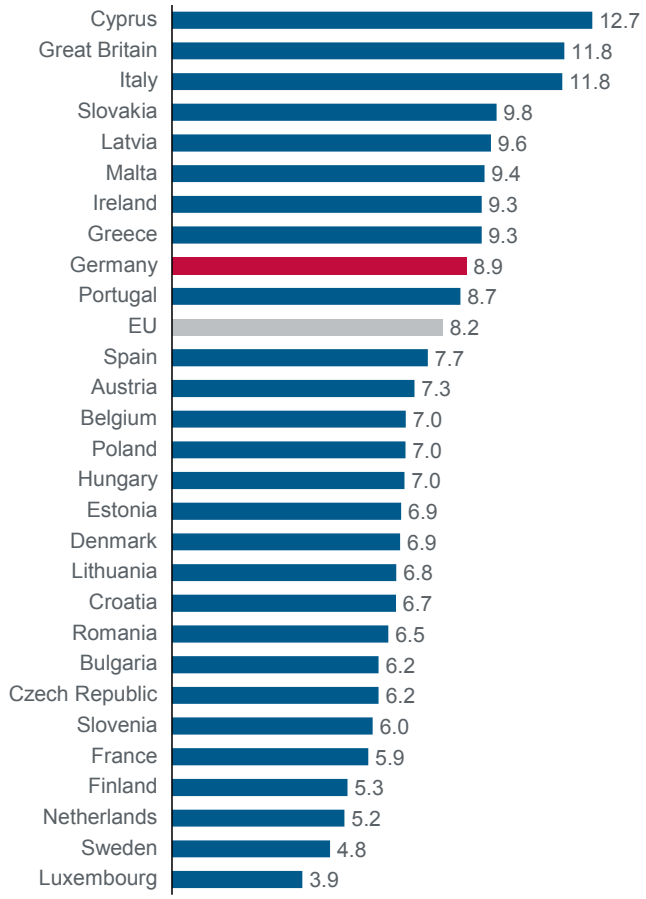
Figure 2: Power price components for different types of customers



Note: Level and composition of average power price in eurocents/kWh for types of customers with different annual power consumption and exemptions in Germany in 2018.

Source: BNetzA Energy Monitoring Report 2018

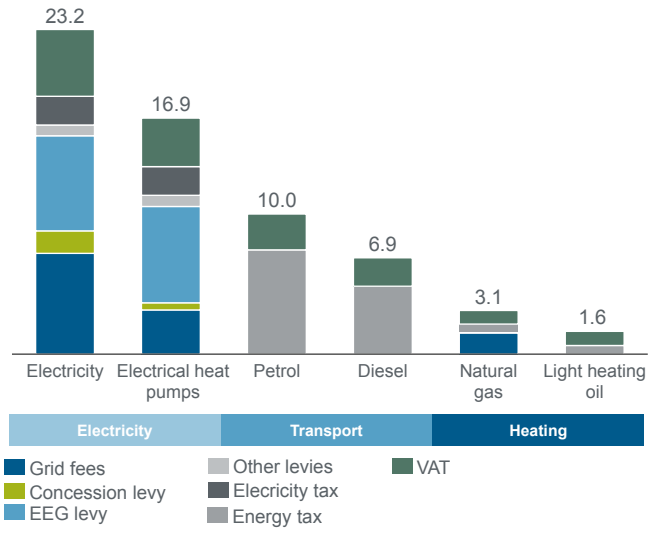
Figure 3: Comparison of industrial power prices in the EU



Note: EU comparison of power prices in eurocents/kWh for industrial customers with an annual consumption of 20–70 GWh (with average rebates); survey 2017.

Sources: Eurostat, BNetzA Energy Monitoring Report 2018

Figure 4: Politically determined energy price components for households



Note: Levies, surcharges, fees and taxes on electricity, motor fuels and heating fuels for households in Germany in eurocents/kWh in 2018.

Sources: Federal Network Agency, German Petroleum Industry Association, Federal Ministry of Economics and Technology 2018

Charges are higher for electricity than for fossil fuels

A comparison of levies, surcharges and taxes on different sources of energy shows that the electricity price is burdened much more with external price components set by the state than fossil motor fuels or heating fuels (Figure 4). Price components set by the state for household power total more than 23 eurocents/kWh. Light heating oil, by comparison, is charged with a mere 1.6 eurocents/kWh.

Critique of the status quo

Change is necessary for efficient climate action

The current structure of politically determined energy price components creates a steering effect that prevents an efficient achievement of climate action targets. From an economic perspective, efficient climate action can be achieved only through the most comprehensive and uniform possible internalisation of the external costs caused by greenhouse gases (GHGs). However, GHG emissions[2], the root cause of climate change, are inadequately taken into account in setting the levies, surcharges and taxes on energy sources in the current energy price system. This becomes clear when we compare electricity and heating oil. Electricity generators pay an explicit carbon certificate price that is passed on to the electricity consumers. Electricity consumers additionally have to pay an implicit CO_2 price through the EEG levy and the electricity tax. Heating oil, in turn, only carries an energy tax, which can be seen as an implicit carbon price similar to the electricity tax. Based on the respective emission factors, this results in a CO_2 price for electricity that is many times higher than that of heating oil. However, where GHG emissions do not carry a uniform price there is always the possibility of a more cost-effective GHG avoidance option not being realised.[3] That makes the system inefficient.

Sector coupling is made more difficult

According to the latest scientific findings, the emission reduction targets set in the energy sectors heating and transport can be achieved only if the growing share of electricity generated from renewables is used in transport (e.g. e-mobility) and heating (e.g. electrical heat pumps) in the future. This is known as sector coupling but it is being hampered by the current system. For example, the sharp differences between levies, surcharges and taxes on electricity on the one hand and natural gas and light heating oil on the other hand (Figure 4) hamper the broad diffusion of low-emission and system-balancing electrical heat pumps and promote the spread of fossil oil and natural gas heating systems. And this is happening even though heat pumps would be more economical because of their higher efficiency and despite an initial higher investment when calculated on the basis of the purely competition-based price components.

Barrier to the integration of renewable energy

As the shares of renewables continue to grow, fluctuations created by wind and solar energy increase in power generation. To ensure that generation and consumption of power are balanced at all times in the future as well, as demanded by the laws of physics, this fluctuation must be

balanced by what are referred to as flexibility options. These flexibility options include, for example, storage technologies or power consumers that are able to keep their consumption flexible. The most important indicator for this is the price signal of the electricity wholesale market. But this original price signal has only little influence on the retail price to be paid by the electricity consumer because it is overshadowed by the non-competitive price components, which are many times higher. The high levies, surcharges and taxes on electricity thus hamper the diffusion of new technologies or business models in the market.

Incentives for low-emission electricity generation
As described above, only complete internalisation of the external costs caused by GHG emissions will lead to efficient climate action. Although electricity generation in Germany falls under the European Emissions Trading System (EU ETS), most experts agree that the average level, the fluctuation to date and the expected future development of the certificate price for GHG emission rights are insufficient for meeting the climate targets[4]. A stabilisation and gradual increase of the certificate price (e.g. with a floor price) would enable low-emission electricity generation technologies (such as renewable energy systems) to hold their own in the market without additional promotion. The competition-related electricity price component for retail customers would hence rise. But at the same time, the level of the EEG surcharge[5] would drop accordingly so that the effect for end consumers (who are not exempt from the EEG surcharge) is nearly offset.

Further demands on the energy price system

International competitiveness of businesses
According to a recent survey by the DIHK (Association of German Chambers of Commerce and Industry), many enterprises in Germany perceive the high energy and, in particular, electricity costs as a threat to their international competitiveness.[6] Figures 2 and 3 have already shown that companies to which the exemption rules do not apply are particularly affected by high power prices in a European comparison. These companies would benefit most from a reduction in levies, surcharges and taxes on electricity under a reform. From the perspective of environmental economics, however, extending the exemptions generally does not appear to be helpful unless this could prevent carbon leakage[7]. Against this background, it would be highly relevant for measures to be coordinated at international level and to have a long-term, reliable framework for investment in low-emission technologies.

Socially disadvantaged households
Socially disadvantaged households spend a higher share of their disposable income on energy and in many cases have little influence on the choice of energy source (e.g. oil heater in rented unit). Raising levies and surcharges on fossil fuels in the context of a CO_2-oriented reform of energy price components may create a disproportionately high burden for them, for which a compensation mechanism should be created.

Revenue neutrality
A reform should have no impact on the financing of state functions, nor should it lead to an additional burden on households and industry. These demands form the basis for the criterion of revenue neutrality, which ensures that possible additional state revenue obtained from reforming the energy price system should be redistributed to households and industry.

Current state of debate in Germany

Core elements of a reform
In the course of the debate, numerous actors within the expert community[8] have arrived at a consensus on the core elements of a reform of energy price components. This consensus combines efforts to achieve higher and more reliable pricing of CO_2 emissions within and outside the EU ETS while taking into account distribution effects. The recommendations put forward by the German Federal Government's Commission of Experts for Research and Innovation (EFI) are the most recent example.[9]

CO_2 floor price in the EU ETS
The ideal solution would be to introduce a Europe-wide CO_2 floor price in the EU ETS by amending the EU Emissions Trading Directive. Taking into account the duration of the legislative procedure and implementation timelines, however, implementation cannot realistically be expected before the mid-2020s.[10] An approach aligned with the example of the UK may promise to work much sooner, ideally in cooperation with like-minded neighbouring countries such as France and the Netherlands. It provides for a CO_2-based primary energy tax to be levied on energy sources used in electricity generation. Exemption rules for energy-intensive industry that apply under the EU ETS could apply here as well. Additional revenues obtained from the 'floor price' would flow into the Energy and Climate Fund in a similar way as under the EU ETS.

CO_2 price outside the EU ETS
The EU-ETS covers less than 50% of the German GHG emissions. A "floor price in the EU ETS" is, therefore, just the first step: A CO_2 price signal is also required in the heating and mobility sectors.[11] A promising approach could be a CO_2 component based on existing energy taxes, on petrol, diesel, heating oil and natural gas, following France's example. Even outside the EU ETS it is best to set the price and development of the CO_2 surcharge together with likeminded neighbouring countries to ensure that price distortions over national borders are kept to a minimum.

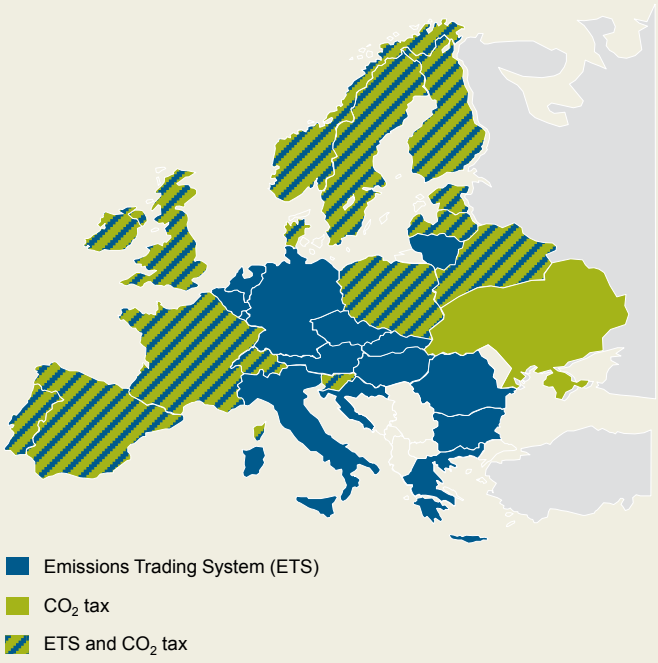
The approaches on how to use the funds vary significantly. However, experts agree that the reform should be revenue-neutral, the existing electricity tax should be reduced to the minimum rate within the EU and the EEG surcharge should be lowered. Depending on the structure, it is also being debated whether to use the funds to finance the heating and mobility transition and to set up a so-called adjustment fund for users particularly affected by the CO_2 surcharge[12].

Approaches in other European countries

CO2 price initiatives in Europe

Many European states have now expanded the core element of the European climate policy, the EU ETS, by adding further CO_2 components to the energy price system (Figure 5). Germany could benefit from their respective approaches in its considerations on restructuring the energy price system.

Figure 5: European emissions trading and CO_2-oriented taxes implemented or planned



Source: World Bank and Ecofys 2018

CO_2 floor price for electricity generation in the United Kingdom

In 2013 the United Kingdom introduced a CO_2-based primary energy tax on fossil fuels burned in electricity generation.[13] The affected companies are required to pay the difference between the target price of what is referred to as the 'carbon price floor' (currently around EUR 20/tCO_2) and the EU ETS certificate price. Together with the certificate price, the instrument functions as a national floor price in the EU ETS. The stable price signal provides certainty for investors and creates reliable conditions for low-emission technologies. The revenue is used to promote the expansion of renewables.

Energy taxes with CO_2 component in France

France has levied a CO_2 component which it refers to as a 'Contribution to Climate and Energy' from households and commercial consumers since 2014.[14] It does not apply to the facilities that fall under the EU ETS. The contribution rises each year and reached around EUR 45/tCO_2 in 2018. The Energy Transition and Green Growth Act sets out a development pathway with a target level of EUR 100/tCO_2 for the year 2030.[15] The additional revenue is to be used to finance the expansion of renewables and for accompanying measures to mitigate social impacts (energy cheques for low-income households, trade-in premiums for old motor vehicles).

Energy taxes with CO_2 component in Sweden

Sweden added a CO_2 component to existing energy taxes already in 1991, and these have been gradually increased.[16] In 2018 the total tax rate was around EUR 110/tCO_2.[17] It applies to sectors not covered by the EU ETS. Certain sectors pay the tax on a prorated basis only. This affects mostly enterprises that compete internationally. The additional revenue goes into the national budget.

CO_2 levy on fossil fuels in Switzerland

The 'CO_2 levy' on fossil fuels has been in effect in Switzerland since 2008; around two thirds of it is redistributed the private households and enterprises irrespective of consumption. Roughly one third is allocated to a programme aimed at promoting emission reduction measures in buildings. In 2018 the levy amounted to around EUR 84/tCO_2.[18] The levy rises in accordance with an automatic correction mechanism when the emission reduction targets are not reached.[19] Enterprises that participate in the national emissions trading system and high-emission enterprises are exempted from the CO_2 levy.

The purpose of this fund would be to promote the substitution of high-emission with low-emission technologies, particularly in socially disadvantaged households. Alternatively, an 'Energy Transition Bonus' modelled on the example of Switzerland could be introduced as per-capita revenue redistribution among the population.

Obviously, a CO_2 levy would also not only have to protect socially disadvantaged households but also ensure the competitiveness of German enterprises. Exemptions in the form of tax relief or tax reductions for affected enterprises could alleviate the situation, as is the case in France, Sweden and Switzerland.

Impacts

The described measures within and outside the scope of validity of the EU ETS could tackle the challenges of the existing energy price system and make climate action more efficient. The impacts on power prices for households and commercial customers would depend on their final design. It is generally expected that retail prices would drop. Besides, the current imbalance between the price components set by the state for electricity, motor fuels and heating fuels (Figure 4) would be eliminated. This would make electricity applications in the heating and transport sectors more

competitive. Sector coupling would accelerate and system integration of renewables would improve. Undistorted price signals could set investment incentives for flexibility options. Accompanying measures such as an adjustment fund or exemptions cord mitigate undesirable effects on particularly affected households or enterprises.

Conclusion

The current design of the energy price system creates disincentives for an efficient implementation of the energy transition in Germany and thus hampers the realisation of climate change mitigation targets. For more than two years now, experts have developed a discourse along these lines that has now resulted in a very broad consensus. The common objective is to adopt a CO_2-oriented reform of energy price components set by the state that takes into account redistribution effects. A number of robust expert opinions that outline clear recommendations for policymakers have now been presented. Implementing these recommendations requires a strong political will and commitment to climate action. But as with all changes, this reform would also create winners and losers. Without accompanying communication and education campaigns on the one hand and measures that mitigate the impact on affected stakeholders on the other hand, the discussion may become emotionally charged, as could recently be witnessed in France. ■

[1] Bundesnetzagentur (Federal Network Agency) and Bundeskartellamt (Federal Cartel Office), Energy Monitoring Report 2018, in accordance with the German Electricity and Gas Supply Act (EnWG), Bonn 2018.

[2] Greenhouse gas emissions are often expressed in CO_2 equivalents (CO_2e); in pricing GHG emissions the CO_2 price is often given for reasons of simplicity.

[3] Expert Commission on the monitoring process 'Energy of the Future', representation on the sixth monitoring report of the German Federal Government for the 2016 reporting year, Berlin 2018.

[4] Edenhofer et al., Decarbonization and EU ETS Reform: Introducing a price floor to drive low-carbon investments, Policy Paper, Mercator Research Institute on Global Commons and Climate Change (MCC), Berlin 2017.

[5] Höfling, H. (2016): Kosten der Erneuerbaren Energien – Wie teuer ist der Ökostrom wirklich? (*Cost of renewables – How expensive is green electricity really?* – In German only), Focus on Economics No. 145, KfW Research.

[6] IHK-Energiewende-Barometer 2018 (*Energy Turnaround Barometer 2018*), Akzeptanz in der Wirtschaft schwindet (*Acceptance among businesses is waning* – our title translation, in German only), Association of German Chambers of Industry and Commerce Association of German Chambers of Industry and Commerce, Berlin 2018

[7] The term 'carbon leakage' refers to a situation that can occur when enterprises react to costs associated with climate measures by shifting their production to other countries with less stringent emissions standards. This can lead to an increase in overall emissions. (https://ec.europa.eu/clima/policies/ets/allowances/leakage_de)

[8] The advocates of such a reform include, among others, the Commission of Experts for Research and Innovation (EFI), the Energy Transition Commission, the Commission on Coal, the state of Schleswig-Holstein, the German Federal Environment Agency, Ottmar Edenhofer (PIK/MCC), Christoph M. Schmidt (RWI/SVR), Agora Energiewende, Green Budget Germany, energy companies (Siemens, EDF, eon, EnBW, Vestas, Enercon, Stiebel Eltron, etc.).

[9] Commission of Experts for Research and Innovation (EFI): Report 2019, Berlin 2019.

[10] Agora Energiewende: Eine Neuordnung der Abgaben und Umlagen auf Strom, Wärme, Verkehr. Optionen für eine aufkommensneutrale CO_2-Bepreisung (*A reorganisation of levies and surcharges on electricity, heat, transport. Options for revenue-neutral CO_2 pricing* – our title translation, in German only), Berlin 2018.

[11] Edenhofer and Schmidt, Eckpunkte einer CO_2-Preisreform, Gemeinsamer Vorschlag von Ottmar Edenhofer (PIK/MCC) und Christoph M. Schmidt (RWI) *(Key features of a CO2 price reform, a joint proposal from* Ottmar Edenhofer (PIK/MCC) and Christoph M. Schmidt (RWI) – *our title translation, in German only)*, RWI Position #72, Essen 2018

[12] Agora Energiewende: Eine Neuordnung der Abgaben und Umlagen auf Strom, Wärme, Verkehr. Optionen für eine aufkommensneutrale CO_2-Bepreisung (*A reorganisation of levies and surcharges on electricity, heat, transport. Options for revenue-neutral CO_2 pricing* – our title translation, in German only), Berlin 2018.

[13] Agora Energiewende: Eine Neuordnung der Abgaben und Umlagen auf Strom, Wärme, Verkehr. Optionen für eine aufkommensneutrale CO_2-Bepreisung (*A reorganisation of levies and surcharges on electricity, heat, transport. Options for revenue-neutral CO_2 pricing* – our title translation, in German only), Berlin 2018; Edenhofer et al., Decarbonization and EU ETS Reform: Introducing a price floor to drive low-carbon investments, Policy Paper, Mercator Research Institute on Global Commons and Climate Change (MCC), Berlin 2017.

[14] French-German Office for the Energy Transition (DFBEW), memo: CO_2-Bepreisung in Frankreich, Europäisches Emissionshandelssystem EU-ETS und CO_2-Steuer (*CO_2 pricing in France, European Emissions Trading System EU ETS and CO_2 tax* – our title translation, in German only), Berlin 2018.

[15] Scientific Services of the German Parliament, situation: Die CO_2-Abgabe in der Schweiz, Frankreich und Großbritannien, Mögliche Modelle einer CO_2-Abgabe für Deutschland (*The CO_2 levy in Switzerland, France and the United Kingdom, possible models of a CO_2 levy for Germany* – our title translation, in German only), Berlin 2018.

[16] CO_2 Abgabe e.V., discussion paper: Welchen Preis haben und brauchen Treibhausgase? Für mehr Klimaschutz, weniger Bürokratie und sozial gerechtere Energiepreise (*What price do greenhouse gases have and need to have? For more climate action, less bureaucracy and socially more equitable energy prices* – our title translation, in German only), Freiburg 2017.

[17] Agora Energiewende: Eine Neuordnung der Abgaben und Umlagen auf Strom, Wärme, Verkehr. Optionen für eine aufkommensneutrale CO_2-Bepreisung (*A reorganisation of levies and surcharges on electricity, heat, transport. Options for revenue-neutral CO_2 pricing* – our title translation, in German only), Berlin 2018.

[18] Federal Office for the Environment (FOEN, Switzerland), https://www.bafu.admin.ch/co2-abgabe 2019.

[19] Scientific Services of the German Parliament, situation: Die CO_2-Abgabe in der Schweiz, Frankreich und Großbritannien, Mögliche Modelle einer CO_2-Abgabe für Deutschland (*The CO_2 levy in Switzerland, France and the United Kingdom, possible models of a CO_2 levy for Germany* – our title translation, in German only), Berlin 2018.