SHORT STUDY

# Advancement of the individual network charges

## Objectives, trade-offs, and design choices for the reform of the network charge rebates according to §19(2) Strom-NEV

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On behalf of TenneT TSO GmbH

Authors:
Lion Hirth (hirth@neon.energy)
Anselm Eicke (eicke@neon.energy)

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Contact:

Neon Neue Energieökonomik GmbH
Karl-Marx-Platz 12
12043 Berlin

Prof. Dr. Lion Hirth
hirth@neon.energy
+49 157-55 199 715

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# Summary

**Need for reform**. In Germany, large consumers of electricity are entitled to an individual grid fee if their electricity consumption is constant. This means a rebate on grid fees of up to 90%. In 2024, this so-called 7000h-regulation will save electricity-intensive industry around 1.5 billion euros. However, the mechanism has long been criticized because it makes it practically impossible for companies to react to electricity price signals and services for grid operators. The flexibilization of industrial electricity consumption - where economically viable - and thus the use of cheap green surplus electricity is, however, an essential building block for the affordability of the energy transition and Germany's industrial competitiveness. For this reason, the Federal Network Agency has now announced a reform of individual grid fees and published a corresponding key issues paper. In this brief study, we explain the significance and problems of the current regulation, explain the objectives and conflicting goals, and outline three conceivable directions for reform.

**Conflicting objectives**. Various objectives are mentioned in the debate as to what a reform should achieve: The current existing flexibility barrier should be removed, the relief should be based on the actual grid costs, the previous level of relief should be maintained, and the costs of the instrument should be limited. These objectives are legitimate, but conflict with each other. In particular, if the actual grid costs are taken into account, it is unlikely that the current level of relief will be achieved across the board. Weighing up the competing objectives is a preference decision that cannot be based on scientific criteria but is inherently political in nature. Depending on the weighting of the objectives, very different reform directions are conceivable. For this reason, we develop two fundamentally different reform models in this study: cost-reflective network charges and a reform of the existing rebate logic.

**Cost-reflective charges**. The first model focuses on cost reflectivity. This means that those who cause lower costs in the electricity grid pay lower grid charges. The marginal costs of the electricity grid depend primarily on the grid load. Therefore, in this variant, the grid fees are lowered when and where additional electricity demand relieves the grid or at least does not cause any grid congestion. Because the grid situation is dynamically dependent on the time of day and weather, this means that grid charges change over time, differ between regions and are set at short notice. This makes implementation complex. In addition, grid fees in regions with a generation surplus, i.e. generally in northern and eastern Germany, would naturally be reduced.

**Rebate reform**. This is why we are discussing reforms within the existing rebate logic as a second thrust, which also takes into account the political desire for comprehensive relief for the industry. The focus here is particularly on reforming the eligibility criteria, i.e. abolishing the 7000h criterion. For example, flexible electricity consumption could be a condition for receiving the rebate, or, in order to avoid distortions of the electricity price signal altogether, a behavioral criterion could be dispensed with completely and a pure volume rebate could be

granted instead. In addition to the question of eligibility requirements, a change in the calculation and application of individual grid charges is also an option. Regionalization to reflect longer-term bottlenecks in the transmission grid is conceivable here.

Recommendation. As a long-term solution, we recommend from an economic perspective that the grid fees for all consumers be closely aligned with the grid costs. In the short term, we consider a continuation of individual grid charges in the simpler rebate logic to be justifiable. We recommend a switch to a pure volume rebate, i.e. the deletion of the 7000h requirement without replacement. The rebate should only be applied to electricity consumption above the threshold value in order to avoid tipping point effects and should be differentiated regionally in order to include a grid-supporting component. In addition, the performance price of the grid charges should be reduced more than the energy price in order to further reduce this flexibility barrier.

# 1 Introduction

Origin. The Electricity Grid Charges Ordinance (StromNEV) came into force in 2005. It was therefore a key component of the liberalization of the electricity market and the division of the integrated electricity supply into generation, grids and suppliers. It already contained a regulation for individual grid fees in Section 19. This was expanded again in 2011 and has been in its current form ever since.

Current regulation. Electricity consumers receive a rebate on their grid fees if they either exhibit atypical consumption behavior, i.e. their peak consumption is outside the peak load time windows of their grid level, or if their electricity consumption is particularly even. While pumped storage power plants are the main beneficiaries of atypical grid usage, the rebate for constant electricity consumption is of great importance for industry. With an estimated total volume of just under €1.5 billion (2024), it is one of the four major relief mechanisms for electricity-intensive industry. The paper, metal and chemical industries are the biggest beneficiaries in terms of the volume of relief. Uniformity is determined on the basis of full utilization hours, i.e. the ratio of annual electricity consumption to the individual quarter-hourly peak load. A rebate of up to 80% is granted for more than 7000 full usage hours, which is why the rebate is also known in the industry as the "7000h rule". Specifically, the rebate is calculated in the form of a special grid fee, in which the "physical path" to the nearest base load-capable power plant is determined and the costs of the individual grid elements along the path are added proportionately.

Flexibility barrier. This regulation has been the subject of scientific debate for many years. It is particularly problematic because the requirement of uniform electricity consumption prevents industrial consumers from dynamically adapting their electricity consumption to the market situation, as both a reduction and an increase in consumption generally reduce the full utilization hours. Flexible electricity procurement, which follows the generation of wind and solar energy and thus the electricity price, is an essential prerequisite for the success of the energy transition and the economically sensible use of cheap energy. The previously untapped flexibility potential is high. The §19(2) regime currently applies to just under half of industrial electricity consumption: around 90 out of 210 TWh of industrial electricity consumption pay individual grid charges for even consumption. For all of these consumers, this de facto prevents any flexibilization measures that would be possible in this area. For the future, the scenario framework for the grid development plan for 2037 assumes industrial flexibility potential in industry of up to 4.1 GW (2045: up to 7.8 GW) (grid development plan, 2025 version, p. 64).

Further problems. In addition to this flexibility barrier, the current regulation also has a number of other problems. For example, it sends the wrong local investment signals because the coal and nuclear phase-out means that fewer and fewer base-load-capable power plants are available, particularly in regions with high surpluses of renewable energy, meaning that the physical path for consumers in these regions is becoming longer and longer. Companies are also currently using flexibility options downstream of the grid connection point to stabilize electricity procurement, which represents a waste of resources in economic terms.

Affordability of the energy transition. A reform of Section 19(2) of the StromNEV can make a significant contribution to the affordability of the energy transition. By removing this strong flexibility barrier, industrial electricity consumption could adapt better to the supply of renewable energy and benefit from lower electricity prices, insofar as this is technically and economically possible for companies. This would also mean that less renewable electricity generation would be curtailed due to negative prices, which would reduce the subsidy costs for renewable energies.

This study. The Federal Network Agency has now announced a revision and presented a key issues paper (Federal Network Agency 2024). Against this backdrop, this brief study aims to analyze the problems of the current regulation, identify objectives and conflicting goals and develop options for further development.

# 2 Current regulation

In this section, we present the regulations on individual grid charges in detail, discuss their significance and utilization against the background of other relief mechanisms for electricity-intensive industry and analyze the problems of the current regulation. Our focus here is on the rebate for uniform grid usage; we only deal with atypical grid usage in passing.

## 2.1 Individual grid charges according to §19(2) StromNEV

Rebates. Section 19(2) of the StromNEV provides for two regulations for grid fee reductions for large consumers of electricity: atypical and uniform grid usage. Both regulations are rebates on the grid fee, i.e. if the eligibility criterion is met, a flat-rate rebate is granted on the total grid fee, i.e. the sum of payments for the service price and the energy price for grid usage.

- Atypical grid usage exists if the individual annual peak load is outside the peak load time window defined by the grid operator for the respective grid level. In this case, the grid operators must grant an appropriate rebate, up to a maximum of 80%.
- Even grid usage exists if a consumer with an annual consumption of at least 10 GWh has more than 7000 full usage hours. In this case, grid operators must determine an individual grid fee by calculating the pro rata costs of a physical path to the nearest base load-capable power plant. However, the rebate may not exceed 80% to 90% (depending on the number of full utilization hours).

Below we present the rebate for equal grid usage in detail. This consists of three aspects: The criterion for qualifying for the rebate, the calculation and the application.

Criterion. A minimum of 7,000 full utilization hours and an annual consumption of more than 10 GWh, determined per grid connection point, are required for equal grid utilization. The full utilization hours are calculated ex post as a quotient of the actual annual electricity consumption and the measured individual quarter-hourly peak load:

$$\text{Full utilization hours (h)} = \frac{\text{Annual energy consumption (MWh)}}{\text{1/4h peak consumption (MW)}}$$

Calculation. If a consumer meets these criteria, the rebate is calculated in two steps. In the first step, an individual grid fee is calculated on the basis of the so-called "physical path" to the nearest base load-capable, i.e. thermal, power plant. The logic behind this is that the industrial consumer, instead of using the public electricity grid, could also lay a direct line to this power plant and would therefore no longer be a payer of grid charges. To reflect this situation financially, the grid operators calculate the proportionate use of each individual grid element (transformer, lines, etc.) on the shortest physical path between the consumer and the power plant. Instead of the regular grid fee, the consumer only pays the costs calculated in this way. In the second step, the rebate calculated in this way is capped. This amounts to 80% if the full utilization hours are over 7000 hours. At 7500h, the maximum rebate increases to 85%, and then to 90% at 8000h. These upper rebate limits have often been exhausted in practice.

Application. The calculated rebate is applied to the total grid fee. The performance price and the working price are thus effectively reduced by the same percentage.

## 2.2 Utilization and Financial Significance

Equal grid usage. Most recently, electricity consumption amounting to around 90 TWh benefited from individual grid charges for equal grid usage. These are primarily electricity-intensive large consumers from the primary industry. They are spread across 578 extraction points with an average consumption of 154 GWh (Bundesnetzagentur 2022, p.205). The financial relief volume has risen continuously in recent years with the increase in grid fees (Illustration 1). In 2024, the financial benefits are expected to add up to around EUR 1.4 billion, which corresponds to an average relief of around € 16/MWh for the beneficiary electricity procurement. A current breakdown of the relief volume by sector is not available. In an evaluation by the Federal Network Agency for 2014, the beneficiary companies were primarily from the paper, chemicals and non-ferrous metals sectors (Federal Network Agency 2015, p.24).

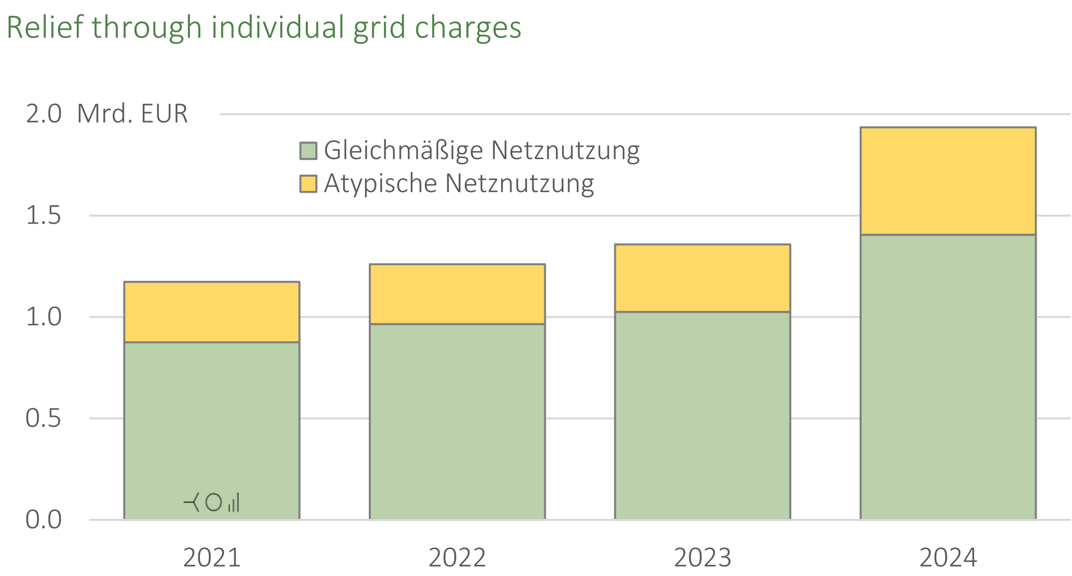


Illustration 1. The volume of relief provided by individual grid charges has risen continuously in recent years. The figure is based on the costs forecast by the transmission system operators for the following year (www.netztransparenz.de). The forecast for 2024 increased by € 613 million due to the elimination of the federal subsidy. In accordance with the original cost distribution, 27% of these costs are allocated to atypical grid usage and 73% to uniform grid usage.

Atypical grid usage. The individual grid fees for atypical grid usage recently benefited a total of around 38 TWh (Bundesnetzagentur 2022, p.205) with a relief amount of around € 530 million (Illustration 1). A sector distribution was last published in 2014; at that time, pumped storage power plants accounted for the largest share of the financial relief, but around 40%

also went to the industrial sector (Bundesnetzagentur 2015, p.24). Applied to electricity consumption and to the year 2022, this share corresponds to a preferential electricity consumption of 15 TWh in the industrial sector. The subsidized consumption is distributed across more than 7600 consumption points with an average consumption of 5 GWh, i.e. much smaller consumers than with uniform grid usage.

Classification. In total, around 100 TWh of industrial electricity consumption is therefore likely to benefit from individual grid fees. This makes individual grid charges one of the four major relief mechanisms for electricity-intensive industry in Germany, alongside electricity price compensation (SPK), §9b of the electricity tax and the special equalization scheme (BesAR). Compared to the other industrial subsidies, the rebates under Section 19(2) reach a relatively large group of consumers. Overall, more than half of industrial electricity consumption benefits from reduced grid charges. Only §9b of the Electricity Tax Act reaches a larger share of industrial consumption (89%).

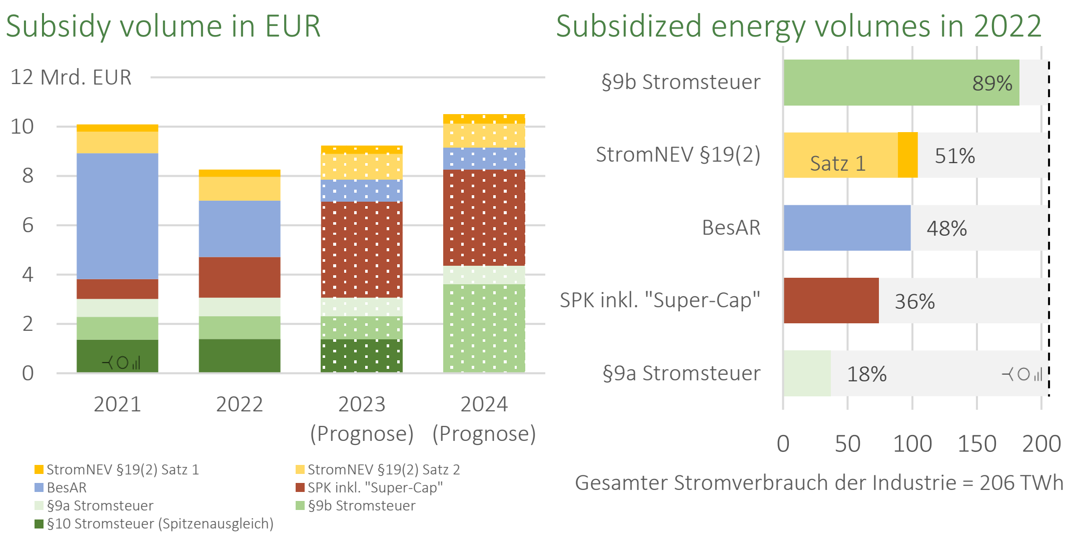


Illustration 2. § 19(2) in the context of other industrial subsidies

## 2.3 Problems with the current regulation

Problems. The current regulation of rebates for equal grid usage leads to numerous problems:

- Flexibilization of industrial electricity consumption is de facto prevented
- Particularly strong disincentives at the rebate thresholds
- Rebate does not reflect the actual savings in grid costs, so it is questionable whether the rebate leads to grid-friendly behavior
- Rebate creates false local incentives
- Existing regulation is becoming increasingly obsolete in the course of the energy transition
- Individual determination causes administrative efforts

- Strong incentives for grid operators to approve individual grid fees
- Rebate causes real costs

Flexibility barrier. The most well-known problem with the current regulation is that it makes flexibilization of industrial demand financially unattractive and often de facto impossible. It is therefore probably the biggest regulatory obstacle to industrial demand flexibility in Germany. This is due to the nature of the 7000h rule: the more consumers react to electricity prices, the lower the number of full utilization hours. Both an increase and a reduction in consumption in individual quarter hours reduce this indicator, which is decisive for the rebate. Even without rebates, consumers with high full usage hours pay lower grid fees per MWh than those with low full usage hours due to the power price (Illustration 3left). The rebate for even grid usage massively reinforces this (Illustration 3right). A reaction to electricity prices, such as an increase in consumption in hours with low prices, becomes unattractive as a result. However, the flexibilization of industrial electricity consumption, where economically viable, and thus the use of cheap green surplus electricity is an essential building block for the energy transition and the country's industrial competitiveness. The 7000h regulation also leads to the absurd situation that local flexibility through CHPs, heat storage and batteries is used or even newly built in order to stabilize individual grid consumption and not to react to the fluctuating generation from renewable energies in the overall system. The associated costs are a burden on companies and reduce economic welfare.

Threshold effects. The flexibility barrier has a particularly strong effect at the thresholds of 7000, 7500 and 8000 full utilization hours. Flexibilization there can jeopardize the (higher) rebate on the total grid fees. For example, the absolute grid fees at 7001 full utilization hours are more than 79% lower than at 6999 full utilization hours (green line in Illustration 3right). Additional electricity consumption in some hours can therefore lead to a massive reduction in total grid charges for the consumer. It is therefore attractive for consumers to exceed these thresholds by consuming electricity unnecessarily. Economically speaking, the additional electricity consumption has strongly negative marginal costs, for which we see no sensible explanation: A consumer does not become significantly more grid-serving by leaps and bounds just because it increases its full utilization hours from 6999h to 7000h. If uniformity were beneficial to the grid, this would not start abruptly either, but rather increase gradually. Similar undesirable incentives are also created by the threshold of 10 GWh annual consumption that a connection point must reach in order to receive an individual grid charge: here, additional electricity consumption can be financially attractive for companies, even if it is wasted unnecessarily.

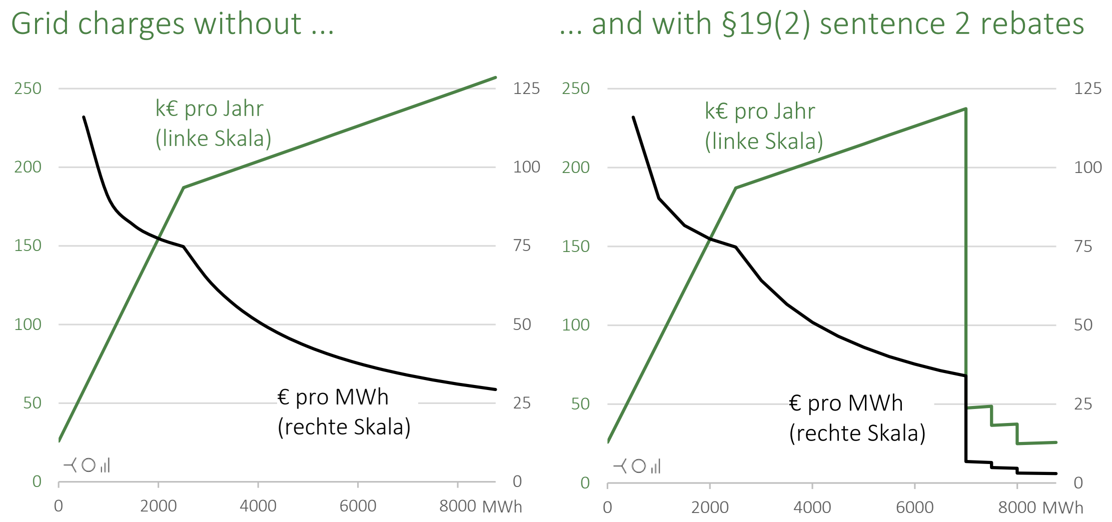


Illustration 3. Grid charges in the Berlin medium-voltage grid in 2024 as a function of annual consumption for a consumer with a peak load of 1 MW. The demand charge ensures that a constant, i.e. inflexible, electricity consumption results in significantly lower grid charges per MWh. With a rebate, a 1 MW consumer with 8000 MWh would pay *absolutely* lower grid fees than with a consumption of 1 MWh.

**No cost reflectivity.** The rebate for uniform grid usage is not cost-reflective.  This means that a consumer response to the price incentives does not necessarily reduce grid costs. The lack of cost reflectivity is shown, among other things, by the fact that additional consumption can reduce the absolute grid charge payable. For example, for a consumer with a peak load of 1 MW and 6999 full utilization hours, the grid fees fall by EUR 190,000 if they consume an additional MWh (Illustration 3, right). With the same peak load, consumption of 8000 MWh even results in lower *absolute* grid charges than 1 MWh. Lower absolute grid charges due to higher electricity consumption mean negative marginal costs, which are not plausible. Instead, an increase in electricity consumption generally leads to an additional load on the distribution and transmission grids, especially if it takes place in a load-dominated distribution grid in southern Germany. The load on the grids is only relieved if consumption is reduced during the hours of highest grid consumption. Only if the consumer would have drawn more electricity in the critical hours without the rebate than with the rebate is a more grid-friendly behavior achieved. In addition, the generally (but by no means inevitably) lower contribution to the peak load of a grid with more even electricity consumption is already taken into account in the power price system of the general grid charges - a further rebate for particularly high full utilization hours does not appear to be justified by grid costs.

**Incorrect local incentives.** The calculation of the rebate amount via the physical path to the nearest base load power plant is also problematic. This creates false local incentives because base-load power plants are generally shut down first in regions with a lot of renewable energy. This puts industrial companies at a disadvantage precisely where they tend to relieve the grid. The existence of a nearby base-load power plant is therefore not a meaningful criterion for regional control in a renewable electricity system.

Expiry of the rebates. With the shutdown of fossil base load power plants as part of the energy transition, the existing regulation is becoming increasingly obsolete. For many companies, the physical path is becoming longer and longer, which reduces the level of rebates. In addition, the preservation of base-load power plants takes on an undesirable regional industrial policy significance, as this ensures that local industry is relieved.

Administrative effort. The current regulation leads to a significant administrative burden for grid operators. They have to calculate the physical path individually for each large consumer.

Incentives for distribution grid operators. The rebates mean that large consumers pay lower grid fees. As a result, the grid operators lose revenue, which is passed on to all consumers nationwide via a levy. The financial benefit thus accrues locally, while the costs are passed on nationwide. Distribution grid operators, which are often rooted in the region or are even publicly owned by the municipality as municipal utilities, could therefore have an incentive to approve individual grid fees benevolently in order to support local companies.

Real costs. When evaluating individual grid fees, it is often overlooked that these cause real costs. In order to achieve high full utilization hours, companies incur expenses, e.g. for consultancy fees and investments in flexible equipment such as batteries and combined heat and power plants. Many companies are also changing their operating processes to meet the rebate criterion. For example, production is already being throttled in some hours in order to stabilize consumption. While the (low) grid fees are published and perceived politically, these real costs are statistically invisible.

# 3 Goals and conflicting objectives

Objectives. A reform of individual grid charges for equal grid usage can pursue very different objectives. We see four fundamentally sensible but very different objectives:

- Reduction of flexibility barriers (distortion-free)
- Cost-reflective instrument that rewards grid-friendly behavior (grid-friendly)
- Preservation of existing relief for industry (relieving)
- Costs of grid fee exemption kept low (cost-efficient)

Freedom from distortion. An obvious aim of the reform of individual grid fees is to reduce barriers to flexibility. The wholesale price as a good indicator of the costs of electricity generation should therefore not be distorted by individual grid charges, especially if these are not useful to the grid.

Grid efficiency. Individual grid charges provide incentives for grid-friendly consumption if they reflect the actual grid costs. Only those consumers who cause low grid costs due to their behavior or location would then pay reduced grid charges. This would be economically efficient. Such a cost-reflective instrument only makes no sense if the grid efficiency of consumers is already adequately reflected elsewhere. Although instruments for this already exist, they have so far been limited to certain consumer groups. For example, a construction cost subsidy can only influence siting decisions for new plants and the "use instead of curtailment" instrument in accordance with Section 13k of the Energy Industry Act is limited to a few coastal regions and certain technologies.

Relief. A frequently cited goal of individual grid fees is to relieve the burden on electricity-intensive industry to an extent comparable to the current rebates of 80-90% of grid fees. Whether relieving the burden on energy-intensive industry through reduced grid fees makes sense from a regulatory perspective is open to debate, but substantial relief for the electricity-intensive industry is likely to be a secondary political condition for a reform.

Cost efficiency. The lack of income for grid operators due to reduced grid fees is currently passed on to all consumers via a levy. The more consumers benefit from individual grid charges and the greater the reduction, the more expensive the instrument becomes. It therefore makes sense to strive for sparing and targeted relief.

Other objectives. In our view, other conceivable objectives such as reducing $CO_2$ emissions or strengthening the price signal on the electricity market do not belong in the grid fee and are therefore not considered further below. Furthermore, the proposed instrument must not violate European state aid law, which also severely limits the scope for solutions but is not examined here.

Conflicting objectives. Some of the above-mentioned objectives conflict with each other and cannot all be achieved at the same time. In particular, a cost-reflective instrument will lead to lower benefits for many consumers than before and therefore have less of a relieving effect.

**Outlook.** A reform recommendation will vary greatly depending on the prioritization of the objectives. In order to illustrate the range of reform options, we discuss two fundamentally different, internally constant schools of thought below (Illustration 4). The first approach is grid charges that reflect grid costs as accurately as possible, thereby promoting grid-friendly behavior (Chapter 4). The second direction is reform options within the existing rebate logic with the primary aim of eliminating the obstacles to flexibility in the current regulation (Chapter 5).

## Two schools of thought on reform

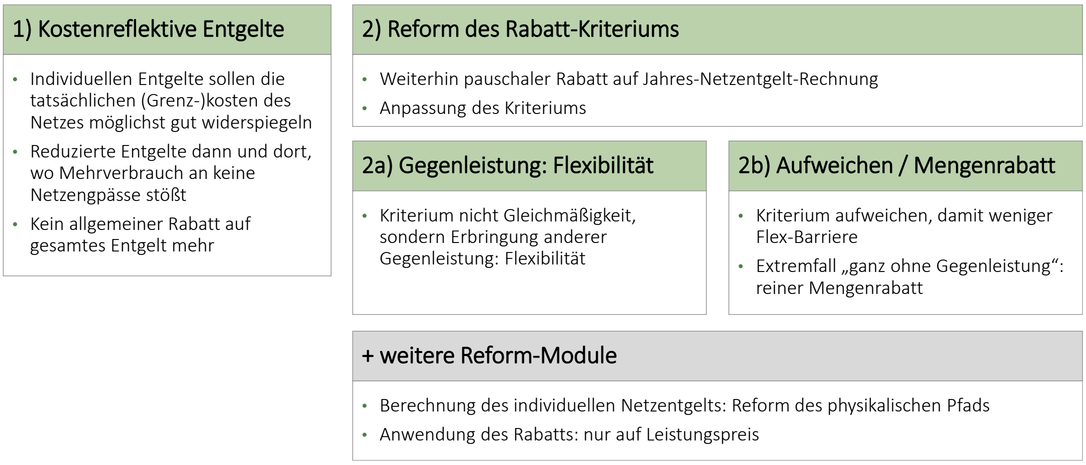


Illustration 4. Two lines of thought for a reform of individual grid charges for equal grid usage

# 4 Cost-reflective charges

In this section, we outline a reform of individual grid charges that focuses on grid costs and thus incentives for grid efficiency. To this end, we first define optimal grid charges in theory and then discuss their practical implementation under the conditions of the real electricity market.

## 4.1 COST-REFLECTIVE GRID CHARGES IN THEORY

In this section, we define grid utility and explain how grid charges would in theory reflect grid costs.

### 4.1.1 Grid efficiency and marginal costs of grid usage

**Grid serviceability.** The term "grid adequacy" is often used without being uniformly defined. For the purposes of the analysis, we believe it makes sense to define grid serviceability on the basis of the grid costs caused by the consumption of an additional MWh of electricity. These marginal costs of electricity consumption in the grid should include grid expansion and congestion management as well as control power costs and other system services. In practice, it does not seem plausible to consider more than these two criteria. Whether and how much costs are incurred is not a constant, but fluctuates over time and differs from place to place. Additional consumption can burden the grid in one region and at the same time relieve it in another. Additional consumption at one extraction point can place a strain on the grid at one time and relieve it at another. The marginal grid costs of electricity consumption are therefore variable in terms of time and location. (This already indicates that cost-reflective grid charges must also be variable in terms of time and location).

**Three cases.** Using the marginal cost approach of the electricity grid, three cases can be conceptually distinguished: Consumption can be grid-burdening, grid-neutral or grid-supporting (Illustration 5).

- Additional electricity consumption is *a burden on the grid* if it causes high additional costs in the grid. This is the case if the consumption requires short-term redispatch and long-term grid expansion, for example if the electricity consumption coincides with a design-relevant peak load at its own distribution grid level, or if it occurs in southern Germany during times when the transmission grid is at full capacity.
- Electricity consumption is *grid-neutral* if it can be served in the existing grid and therefore only very low costs (for grid losses) are incurred. This is likely to be the case in the vast majority of grid areas in the vast majority of hours of the year, i.e. whenever the grid is not under design-relevant load.

- Additional electricity consumption is only *beneficial to the grid* in the narrower sense if it causes negative grid costs, e.g. by reducing the curtailment of generation or consumption or the need for additional grid expansion. This is the case, for example, when electricity is consumed at midday in a distribution grid that is heavily overloaded by solar power, or in northern Germany when the transmission grid is overloaded.

## Marginal costs of additional consumption in the electricity grid

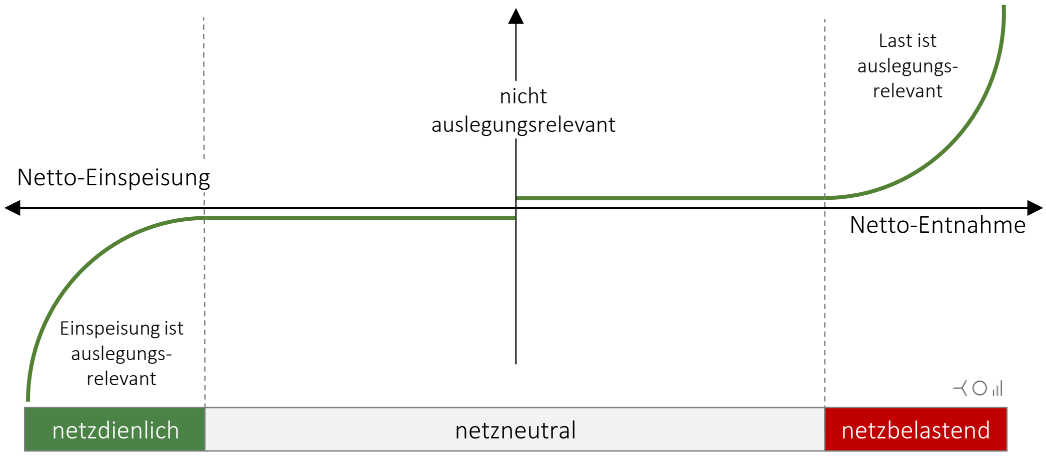


Illustration 5Additional consumption can be grid-supporting, grid-neutral or grid-burdening, depending on how high the marginal costs of the electricity grid currently are.

**Uncertainty.** In practice, the marginal costs of the grid can only be determined approximately and with uncertainty. In practice, this is due to the fact that time-resolved electricity flows in the lower voltage levels are generally not known due to a lack of measurement infrastructure; instead, only annual maximum values are recorded. Furthermore, additional grid expansion is always based on assumptions about future grid usage.

**Grid levels.** Additional consumption can increase or decrease grid congestion at various points. In addition to its own grid level, this can also be at transformer stations and substations, in upstream (higher) grid levels or in another distribution grid, depending on where the resulting additional generation takes place (Illustration 6). Therefore, when calculating the marginal grid costs, it is important which grid levels are considered. A shift in consumption can reduce the costs at one voltage level and increase the costs at another voltage level. For example, a stabilization of consumption in southern Germany could lead to cost reductions in the distribution grid and simultaneously to cost increases in the transmission grid. This aspect is ignored in the current regulation of §19(2) StromNEV on atypical grid usage: The peak load time windows are only determined on the basis of the respective grid level. Upstream grid levels, on the other hand, are not included in the calculations.

Marginal costs with several network levels

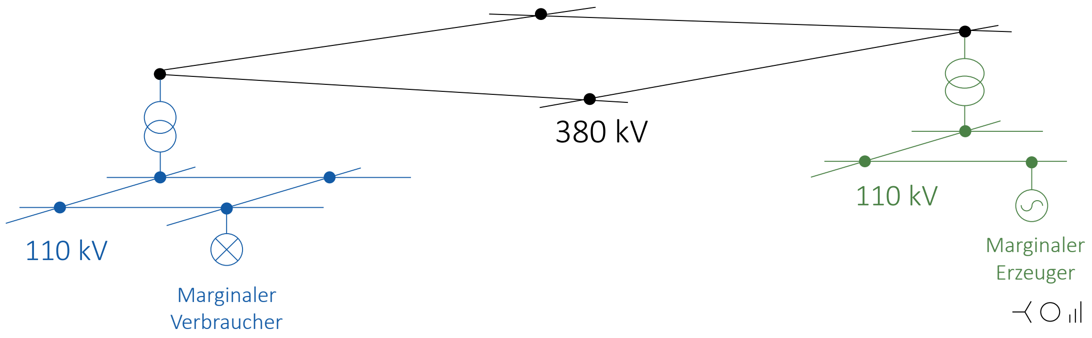


Illustration 6Additional consumption can influence marginal costs at several grid levels. In addition to the own grid level, these are in particular upstream grid levels or other distribution grids.

### 4.1.2 Economically optimal grid fees

**Theoretically optimal price.** The economically "correct" price for electricity results from the increase in the total system costs for the delivery of one MWh of electricity to a specific location at a specific time. It therefore reflects the costs and scarcity of electricity generation as well as those of the grids. For this reason, this price is always instantaneous and local, so that it potentially changes from quarter to quarter and differs from connection point to connection point. In the absence of market failures such as market power, non-shareability of investments and regulatory uncertainty, we speak of "hypothetical nodal pricing" in this very theoretical case. In this case, a joint price is calculated for energy and grid usage, so that there would be no separate grid charges in the long-term equilibrium.

**Theoretically optimal grid fee**. The optimal grid charge in a zonal electricity market would therefore be determined as the difference between the zonal wholesale price and the hypothetical nodal price. The theoretically optimal grid fee therefore depends on the design of the wholesale market. In the case of bidding zone splitting, transmission grid congestion between the bidding zones would already be priced into the wholesale market and would therefore no longer need to be taken into account in the grid charges.

## 4.2 COST-REFLECTIVE GRID CHARGES IN PRACTICE

In this section, we outline a concept of grid charges that is based on the basic idea of theoretical-optimal charges, but takes into account the limitations of the real electricity market, in particular the lack of knowledge about the current grid situation, the complexity of calculating marginal costs across all grid levels and the transaction costs of highly granular prices. We first explain the resulting key points and then present a concrete design proposal.

### 4.2.1 Basic ideas and principles

**Basic idea.** Grid adequacy is always momentary and local. In practice, grid-beneficial grid charges would therefore have to be dynamically adapted to the current grid load and regional conditions. Determining cost-reflective grid charges is anything but trivial. Under reasonable simplifications, hypothetical nodal prices would have to be approximated at all grid levels. For this purpose, the marginal costs of the own and all upstream grid levels would have to be determined. As congestion in the transmission grid in particular is very dynamic and multi-factorial, it is unlikely to be possible to translate this into simple rules of thumb.

**No flat-rate rebate.** In order to estimate the grid load of individual consumers, the criteria used to date such as full utilization hours (for even grid use) or static peak load time windows (for atypical grid use) are too imprecise in today's energy system. This means that cost-reflective individual grid charges must move away from the concept of a flat-rate rebate, which is granted as a rebate on the grid charges as soon as consumers meet a certain criterion.

**Key points and principles.** Instead, grid charges are (only) reduced in the quarter hours and at locations where the additional consumption does not encounter any grid bottlenecks. The following key points seem sensible:

- Not only the connection grid level, but also all other grid levels in which bottlenecks could potentially occur due to a change in consumption should be taken into account.
- The charges have a regional component: in regions with a lot of renewable energy, consumption is (almost) always grid-relieving or grid-neutral, especially if the grids are dimensioned for feed-in.
- The grid situation depends heavily on the weather and is subject to substantial uncertainty even on the day before. For this reason, cost-reflective grid charges can only be determined at short notice. On the other hand, the grid fees must not be published too late so that market participants can take them into account in their operational planning. In practice, transmission and distribution grid operators would therefore forecast daily for each grid node in which hours a load will exacerbate congestion and in which hours it will not.

**grid fee system.** This approach would not only be conceivable as individual grid charges for certain consumer groups, but could also be extended to all load metered consumers in the long term. This would represent a fundamental reform of the grid fee system, in which the individual annual performance price, the constant time-based energy price and the parameterization of the simultaneity function according to full usage hours would become obsolete.

### 4.2.2 A design proposal

**Approach.** In a practicable model of cost-reflective grid charges, grid charges should be low when and where additional consumption does not cause bottlenecks either in the own grid or in other grid levels. High grid fees should be charged when consumption causes or increases grid congestion. The grid charges could even become negative if the own grid level is over-supplied or lies before a bottleneck in the transmission grid. Theoretically, the marginal grid costs of excess consumption can assume any value. In practice, however, it will not be possible in the foreseeable future to calculate actual marginal grid costs in the highly meshed German transmission grid. To simplify matters, we therefore propose two or three different grid charge levels in the transmission grid. We consider this simplification to be necessary in the highly meshed and heterogeneous transmission grid. In the much more homogeneous distribution grid, on the other hand, we consider it sensible to use several different price levels, which are calibrated, for example, on the basis of the residual load at the local grid transformer.

Existing concept. In the context of the discussions on the topic of benefits instead of curtailment, we have proposed an instrument on behalf of Agora Energiewende to make electricity usable for consumers that would otherwise be curtailed: the regional reduction of charges during periods of strong winds (2023). In periods and regions in which substantial curtailment of renewable energies is expected, grid operators will reduce the grid fees. This creates a financial incentive for regional consumption of electricity instead of curtailment. As all load metered consumers benefit from the reduction in charges, there are no incentives for strategic bidding such as inc-dec gaming; however, consumers who do not adjust their behavior also benefit (deadweight effect). This proposal can be used in an adapted form for cost-reflective individual grid charges.

The mechanism. The core idea of the proposal is that grid operators recalculate each day in a coordinated manner and across all grid levels at which quarter hours in which regions additional consumption is grid-burdening, grid-neutral or grid-beneficial. Different grid charges are then applied on this basis. The criterion used to decide how high the grid fees are in a particular quarter of an hour should not be the amount of curtailed renewable energy, but the occurrence of grid congestion, in contrast to the benefit-instead-of-curtailment instrument. We consider two variants to be feasible for this. In the first variant, the tariffs are significantly reduced if the additional load is *useful for the grid*, i.e. reduces existing bottlenecks and thus reduces the necessary congestion management. There would then be two grid fee levels: regular fees and reduced fees for grid-friendly behavior. In this two-stage model, reduced grid fees would currently apply in around 30-40% of the hours per year in the North Sea coastal region, in around 5-20% of the hours in the rest of Lower Saxony and eastern Germany and probably only in a few hours per year in the rest of Germany. The second variant supplements the first variant with a medium fee level. The grid fees would already be slightly reduced if an additional load does not cause a redispatch, i.e. in the case of grid neutrality. In this variant, loads in southern and western Germany would also benefit if their own distribution grid and the transmission grid are congestion-free.

Assessment. Cost-reflective grid charges provide sensible incentives for grid efficiency and are fair to the polluter. However, a sensible and practicable model of cost-reflective grid charges is anything but trivial and would de facto represent a fundamental reform of the grid charging system. This would be politically and legally challenging and would require a significant improvement in the metering infrastructure in the grids. In addition, such a reform would lead to a considerable additional burden on electricity-intensive industry compared to the current rebates, particularly in southern Germany. For these reasons, we consider such a reform to be desirable in principle, but hardly feasible in the short term.

# 5 Reform within the rebate logic

The approach of cost-reflective grid charges differs fundamentally from the existing rebate approach. However, cost-reflective grid charges are complex to implement, which makes short-term feasibility questionable. Alternatively, a reform within the existing rebate logic is conceivable. To this end, each of the three aspects of the regulation can be addressed: Eligibility requirement, determination of the rebate amount and application of the rebate.

## 5.1 Eligibility requirement

Currently, a rebate is granted if consumers meet the criterion of 7000 full usage hours. The eligibility requirement fulfills two independent functions: it creates incentives for companies to change their behavior in order to meet the criterion - and it restricts the group of rebate recipients, as many companies have a significantly more uneven electricity consumption. As the flexibility barrier is particularly criticized by the current regulation, we discuss two approaches that no longer hinder the provision of flexibility:

- A rebate for consumers who provide flexibility
- A rebate without a requirement for specific behavior, i.e. a pure volume rebate

### 5.1.1 Rebates in exchange for flexibility

Idea. Until now, consumers have received the grid fee rebate in accordance with Section 19 (2) sentence 2 StromNEV for the consideration of "even consumption". Due to the changes described in section 2.3 the BNetzA's key issues paper introduces the demand for "flexibility" as a new consideration. Flexibility is a broad term with many different meanings. For example, the following three definitions of flexibility are conceivable:

- Reaction to electricity prices (as mentioned in the key issues paper)
- Upper limit of full utilization hours (instead of the current lower limit)
- Controllability by grid operators

Problems. A rebate in exchange for flexibility entails a number of problems:

- Flexibility requirement distorts incentives from spot prices
- Reaction to electricity prices is beneficial to the market but not systematically beneficial to the grid
- Forcing flexibility is economically inefficient
- Rebate for switch-off capability can lead to undesirable behavior

New distortions. By placing a premium on consumption reactions to the spot price, the economically efficient price signal of the spot market is distorted. If a reduction in consumption is made a rebate criterion when electricity prices are high, the effective price in these hours is greatly increased: those who forego electricity consumption save on the electricity price *and* receive the rebate. This leads to inefficient behavior of flexible systems, as the following example illustrates: If the wholesale price of electricity in one hour is EUR 50/MWh higher than the price in another hour, load shifting makes sense as long as it does not incur costs of more than EUR 50/MWh. With a flexibility premium in the form of a grid fee rebate worth EUR 20/MWh, load shifting would also incur costs of EUR 60/MWh, but this would destroy economic welfare. The goal should therefore be an undistorted spot price, as this reflects the value of load shifting for electricity generation across borders as a first approximation. In view of the investment and transformation costs for flexibilization, however, it could be argued that strengthening the electricity price signal is better than the current weakening.

Lack of grid utility. A distortion of the electricity price is also justifiable if it encourages grid-friendly behaviour and indirectly internalizes the marginal costs of the grid. However, a reaction to electricity prices is not always systematically beneficial to the grid. With regard to the own distribution grid, this tends to be the case in load-dominated grids because exchange prices tend to be high in times of high electricity consumption (Neon 2024). However, there is no such correlation with regard to the transmission grid: Bottlenecks can occur during windy hours with low prices, so that additional consumption in southern Germany places an additional burden on the grid. Conversely, additional consumption in northern Germany can relieve the grid even when exchange prices are high.

Compulsory flexibility. A rebate for flexibility de facto forces companies to become more flexible, even if it makes no economic sense. As a result, such companies are likely to invest in batteries, heat storage or power plants downstream of the grid connection point in order to receive the rebate. Such investments waste economic resources.

Premium for disconnectability. A grid fee rebate in exchange for controllability by the grid operator is comparable to a voluntary redispatch with performance-based payment. Such a concept poses significant implementation challenges, as we show in a recent study (Ehrhart et al. 2024). We have examined three implementation options, which would, however, entail significant disadvantages. The main problem is how the shutdown is actually designed: A mandatory switch-off can be associated with high costs for consumers. In practice, a voluntary switch-off would probably be rejected by consumers in most cases. A limited switch-off obligation, which for example prescribes a minimum number of switch-offs, provides an incentive to indicate higher consumption at times when electricity consumption is likely to be curtailed, which has the effect of increasing grid congestion. The findings are directly transferable to grid charges.

### 5.1.2 Pure quantity rebate

Idea. An alternative to rebates in exchange for flexibility would be the complete renunciation of certain consumer behavior, i.e. the introduction of a pure volume rebate. This would avoid the problems discussed in the previous section.

Justification. The main argument for dispensing with an eligibility requirement is that there is no behavior that can be represented in a blanket approach that is beneficial to the transmission grid. Neither uniformity, nor electricity price response, nor rigid peak load time windows fulfill this requirement. This is primarily due to the fact that the grid situation is situational and is strongly influenced by the weather in particular.

Location. The only meaningful general criterion for grid serviceability appears to be the location of consumers. For example, with regard to the transmission grid, a load on the North Sea coast should currently almost always be grid-serving or at least grid-neutral. It therefore seems sensible to make the determination of the level of the rebate dependent on the location of the consumer, as we discuss in the following section.

## 5.2 DETERMINATION OF THE REBATE AMOUNT

Status quo. If an industrial consumer meets the eligibility requirements for the rebate, the amount of the rebate is determined in two steps. First, an individual grid fee is determined based on the physical path to the nearest base load-capable power plant. To do this, the grid operators calculate the proportionate use of each individual grid element on the shortest physical path between the consumer and the power plant. Instead of the regular grid charge, the consumer only pays the costs calculated in this way. In the second step, the calculated rebate is capped at 80% to 90%, depending on the number of full utilization hours.

Three problems. This approach is problematic for three reasons: it is administratively complex because it has to be recalculated individually for each customer. In addition, it probably sets the wrong local incentives. Due to the very limited number of base load power plants in regions with many renewable energies, which are switched off first if possible due to technical grid requirements, industrial companies are disadvantaged at locations where they would relieve the grid in the long term. Finally, the regulation is becoming increasingly obsolete with the shutdown of fossil base-load power plants: for many companies, the physical path is becoming longer and longer, which reduces the rebate amount.

Reform options. Instead of calculating the costs of a physical path to the next thermal power plant, a number of alternatives can be considered:

- Flat-rate rebate amount for all eligible customers
- Determination of the physical path to another "destination"
- Regional differentiation of the rebate without individual calculation

Flat-rate rebate amount. The application of flat-rate rebate amounts for all eligible customers, for example the current maximum limits of 80% to 90%, would dispense with differentiation between consumers. This is easy to implement but would mean that any reference to the actual grid costs would be lost.

New destination. When determining the physical path, a different "target" could be selected, for example the next overfed substation. This would maintain the existing system of regulation but would take into account the fact that the electricity supply today is predominantly generated from distributed renewable energies and not from thermal base load power plants. However, it is problematic that an oversupplied substation is not necessarily a meaningful indicator of a grid-serving location. For example, a substation to which only generators are connected can also be located in a region with an electricity shortage. Consumption in the vicinity of this substation would probably not relieve the electricity grid.

Regional differentiation. A regional differentiation of the rebate would follow the logic that only the location of consumers reflects the grid load caused in a reasonably meaningful way. At present, consumers north of the longer-term bottlenecks in the transmission grid practically never increase congestion, while this is regularly the case for consumers in the west and south of the country. In the case of regional differentiation, a higher rebate would be granted across the board in regions where there is a structural generation surplus. This creates a link to actual grid costs. In contrast to cost-reflective grid charges (section 4), the differentiation here is made on a flat-rate basis, i.e. not based on the actual quarter-hourly grid load. Based on existing regulations and data, different approaches to regional differentiation are conceivable:

- The relief regions defined for the benefit-instead-of-curtailment instrument under Section 13k EnWG to avoid grid-related curtailment of renewable energies. However, these are closely tailored to the purpose of Section 13k EnWG and limited to a few coastal regions, meaning that the majority of industrial consumers lose their existing privileges.
- The redispatch demand per region in Germany. This can be determined in each of 5 to 10 larger regions in Germany based on the number of hours with positive and negative redispatch demand due to bottlenecks in the transmission grid.
- The determination of regional marginal costs using the long-term congestion management costs on the basis of calculations from the network development plan or other system analyses with a medium-term perspective.

In any case, regional differentiation should take into account other instruments for local signals.

## 5.3 Application of the rebate

Status quo. The final step is the application of the calculated rebate. Currently, the total grid charges are rebateed. This means that the payments based on the energy and demand price are reduced by the same percentage for each kWh of consumption. Alternatively, the rebate could be focused on the demand charge in order to reduce another flexibility barrier.

Distortion due to demand charge. The constant annual demand charge for RLM customers is itself a barrier to flexible consumption, irrespective of the exemptions under Section 19(2) StromNEV. In particular, an increase in electricity consumption in individual hours, for example when prices are negative, is heavily penalized financially by the demand charge. This is due to the fact that the grid charges incurred for the consumption of an additional MWh fluctuate within the year as a result of the demand charge: if electricity is purchased below the peak load, only the demand charge is due; if the current electricity consumption is already at the peak load, an increase in consumption also leads to a higher demand charge. In other words: in these hours, the marginal grid charges due for an increase in consumption are much higher.

Therefore, under the current grid fee design, it is practically never worthwhile for RLM customers to increase their electricity consumption above the peak output in order to behave in a system-friendly manner. Exchange prices, even if they are strongly negative, cannot generally compensate for the demand charge.

Power price rebate. Against this background, it seems sensible to give a disproportionately large rebate on the capacity price. For example, instead of an 80% rebate on the capacity price and energy price, a 100% rebate on the capacity price could be combined with a 50% rebate on the energy price.

Threshold value. Harmful incentives to change behavior are also created in the current regime by the fact that consumers can receive a rebate on their total grid fees as soon as their annual consumption exceeds the threshold value of 10 GWh per grid connection point ("toggle switch effect"). This makes it financially advantageous for them to raise their consumption above this threshold, if necessary through inefficient additional consumption. This problem is easy to solve: It disappears if only the consumption above a certain limit is rebated - not the entire consumption. This change has practically no disadvantages and is highly recommended, regardless of any other changes.

# 6 Our proposal

Based on these considerations, we present a proposal below. In the long term, grid fees should be based on the grid costs incurred. In the short term, we consider a continuation of rebateing for industrial consumers to be justifiable but recommend a switch to a volume rebate with regional differentiation. However, due to the irreconcilable conflicts of interest, a recommendation is necessarily a weighing of interests based on preferences, so that decision-makers may well come to different conclusions.

## 6.1 In the long term: cost-reflective grid charges

Cost-reflective charges. In the long term, we consider more cost-reflective grid charges to be sensible. As the grid costs depend on the grid load and this varies over time and regionally, this means grid charges that are variable over time and differentiated locally on the basis of the expected short-term grid situation.

Bidding zone. If the German bidding zone is split, the costs of grid congestion between the bidding zones will be priced in on the wholesale market in the form of quarter-hourly price differences. If a significant part of the congestion in the transmission grid is represented by the bidding zones, we believe that a temporal and regional differentiation of transmission grid fees is unnecessary.

Other goals, other instruments. Other political objectives, such as the relief of certain energy-intensive sectors motivated by industrial policy or the promotion of heat pumps, should be achieved through instruments outside the grid fee system, which are subject to regular political decision-making, legislation and control of public budgets. Of course, industrial consumers and heat pumps should be able to benefit from favorable grid charges - but only within the scope of actual cost savings, just like other consumers. We do not believe that any further rebates on grid charges are justified.

## 6.2 Medium-term: cost-reflective individual charges

Individual charges. A system of dynamic grid charges, as described in Section 4 could initially only be implemented for large industrial consumers in the medium term. This would have several advantages: The grid charge methodology could be developed and tested with a smaller number of grid customers before being extended to all grid users. It would also make it possible to provide greater, selective relief for more price-sensitive large consumers.

## 6.3 SHORT-TERM: REGIONALIZED VOLUME REBATE

Reformed rebate. In the short term we see good reasons to retain the principle of rebates. We propose four key changes to the status quo:

- The deletion of the 7000h requirement without replacement and the waiver of other behavioral requirements. The rebate will therefore be a pure volume rebate.
- Rebating only the consumption exceeding the threshold value, not the entire consumption, to avoid toggle switch effects.
- Replacing the physical path as the basis for calculation with a regional differentiation that reflects the longer-term bottlenecks in the transmission grid. This gives the instrument a reference to actual grid costs.
- A higher rebate on the service price than on the labor price in order to remove further barriers to flexibility.

Pure volume rebate. We recommend removing the 7000h rule as a prerequisite for individual grid charges, as this often represents a prohibitive penalization of flexible consumption. As other behavioral requirements did not appear to make much sense from the grid's point of view, we recommend dispensing with such requirements entirely. The rebate would therefore be a pure volume rebate for all customers with an annual consumption of over X GWh per grid connection. This would consistently eliminate distortions. However, this would have the potentially undesirable side effect of significantly expanding the customer base. If necessary, further restrictions could be added in order to reduce the volume of relief and thus the costs:

- Increase in the current threshold of 10 GWh. This would exclude smaller consumers and commercial customers.
- Restriction to connection points at higher voltage levels, e.g. grid levels 1 to 3. This would also reduce the group of authorized parties to large industrial consumers.
- Restriction to certain sectors, e.g. manufacturing industry.
- Restriction to companies that have already agreed individual grid fees, as a form of grandfathering.

The feasibility of these restrictions on the scope of reference is primarily a legal issue.

Rebate beyond the threshold. In any case, the rebate granted should not affect the entire electricity consumption, but only the consumption above the threshold. With a threshold of 10 GWh and an electricity consumption of 15 GWh, only 5 GWh would be relieved. This prevents undesirable distortions ("toggle switch effects"), i.e. companies saving grid costs through additional electricity consumption, even if this additional consumption is harmful to business and the economy without rebates. As a positive side effect, this reduces the costs of the instrument.

Regional differentiation. We recommend replacing the calculation of individual grid charges based on the physical path to the nearest base load power plant with a regional differentiation that reflects the longer-term grid bottlenecks. This would give the instrument a cost-reflective component and provide sensible regional incentives for the relocation of electricity-intensive processes and industrial electrification. However, this would necessarily mean that companies in southern and western Germany would tend to be worse off financially compared to the status quo. Regional differentiation could, for example, be based on the existing §13k EnWG regions, determined based on the redispatch hours of the previous year for 5 to 10 regions in Germany, or determined on the basis of the long-term congestion management costs according to the grid development plan.

Focus on the capacity price. We consider a stronger rebate on the capacity price, possibly 100%, and a correspondingly lower rebate on the energy price to be sensible in order to mitigate this flexibility barrier.

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