550G-RULE AS AN ACCESS REQUIREMENT TO CAPACITY MARKETS[1]

How useful is such an approach?

Expert report commissioned by RWE AG

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[1] Convenience translation of a Frontier Economics report (July 2017) "CO_2-GRENZWERT ALS ZUGANGSVORAUSSETZUNG ZU KAPAZITÄTSMÄRKTEN"

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EXECUTIVE SUMMARY

On behalf of RWE AG, Frontier Economics has analysed the implications of the possible introduction of the “550g rule” proposed in the draft of the EC winter package (Art 23 of the Electricity Regulation recast). The 550g rule would restrict access to capacity markets for installations with CO_2 emissions at or in excess of 550g CO_2/kWh_{el}. The rule is set to apply for existing and future capacity mechanisms (a number of EU member states have already introduced a capacity market, and it is also possible that a capacity market will be introduced in other member states with the intention of guaranteeing future security of supply.)

Even if many practical questions regarding the form of this rule are yet unresolved, the effects of the 550g rule can already be assessed:

- From a climate policy perspective, the 550g rule would be ineffective. As a result of the “waterbed effect” within the emission trading scheme (“EU-ETS”), no greenhouse gas emissions would be saved, but instead merely shifted to other installations. This is because the fall in CO_2 emissions in the electricity sector would lead to a price drop for CO_2 certificates – and therefore to higher emissions in other countries or sectors within the EU-ETS.
- As a result of the 550g rule, coal-fired power plants, older gas-fired power plants and diesel engines (and depending on the details of the 550g rule, this may also include more modern, open cycle gas turbines) would be excluded from capacity markets. This would affect about 25% of the controllable capacity installed in Europe. These controllable and reliable power plants would therefore not be recompensed for their contribution to supply security (“guaranteed capacity”) and would be prematurely decommissioned in the medium term. The 550g rule would lead to significant additional economic costs as a result:
  - Partly due to the devaluation of existing installations, which would be decommissioned early.
  - Partly due to costs associated with new substitute installations that would need to be built (these would typically be natural gas-fired CCGT installations under the 550g rule).
  - For the sake of simplicity, let us assume that only around 25% of the installed – and subsequently not qualified for capacity markets – power plant capacities (which in Europe corresponds to around 159 GW of plant capacity, of which 77 GW come from member states that already have a capacity market or are concretely planning one) would need to be decommissioned 5 years earlier (i.e. before the end of their technical and economic lifetime) and replaced with new CCGT installations. This would mean a devaluation of capital (or costs for the early additional construction work required) amounting to **EUR 18 billion.**
  - Considering the EU’s long-term CO_2 targets (2050), it is also doubtful whether even the new CCGT installations will achieve an economic lifespan of 30 years (there is a risk of “double capital devaluation”).

- Electricity prices for consumers could, as a result of the decommissioning of existing power plants and their replacement with new gas-powered installations, rise by around EUR 3 to EUR 5 per MWh. At the same time, capacity prices would also rise significantly as a result of the growing and more technically challenging need for new installations ("CCGT instead of open gas turbines").
- The decommissioning of existing power plants and the focus on gas generation hampers supply security in Europe.
  - In terms of electricity: in Europe, power plants outside the capacity mechanism would have to compete with power plants within the mechanism. As described above, this leads to the premature decommissioning of existing installations (coal and older gas-fired power plants), which in turn need to be anticipated in the execution of the capacity mechanism (which makes the implementation of the capacity mechanism significantly more complicated). The devaluation of existing installations is all the more critical when considering the planned electrification of the heat and transport sector as part of the energy transition, which would still lead to an increased demand for guaranteed electricity generation.
  - In terms of gas: focusing thermal electricity generation on natural gas may lead to a rise in the demand for gas in Europe of around 30%. Other things equal, this increases the dependency on imports, e.g. from Russia or Qatar.
- The 550g rule would also lead to further distortions in energy policies:
  - Nuclear energy in Europe would become more attractive and be one of the winners from this rule.
  - There are significant distribution effects between member states with winners (Austria, France, Scandinavia) and losers (Germany, Poland, Czech Republic and many smaller Eastern European countries). Overall, the rule will raise the price of electricity in Europe.
  - The 550g rule would dilute the price signal in the EU-ETS (i.e. suppress CO_2 prices further) and therefore cause a further loss of trust in the EU-ETS. This increases the risk of national interventions into climate policy legislation.

Summary: the 550g rule offers no advantages in terms of climate policy; its negative impacts on costs and security of supply also represent serious disadvantages. The 550g rule should therefore not be applied.

1 BACKGROUND

On behalf of RWE AG, Frontier Economics Ltd ("Frontier") has investigated the CO_2 limit value ("550g-rule") proposed by the European Commission as an access requirement to electricity capacity markets.

1.1 CO_2 limit in the Clean Energy Package

On 30 November 2016, the EU Commission published a proposal for a package of reforms entitled "Clean Energy for all Europeans". The package also includes an "environment criterion" for access to electricity capacity markets. The **CO_2 limit ("550g-rule")** would restrict the technologies that are eligible to participate on capacity markets:

- **New power plants** are only allowed to participate in capacity markets if they emit less than 550g CO_2/kWh_{el} ("CO_2 limit").
- For **existing power plants**, this rule is proposed to be applied following a transitional period of 5 years after the inception of the rule, i.e. from 2025.

The EU Commission is justifying its proposal with the need to do more to protect the climate and the desire to avoid supposedlyfraught investments in the setup or continued operation of coal-fired power plants. The 550g rule is aimed at allowing modern gas and steam turbine combined cycle power plants (CCGT) to participate on capacity markets, while excluding coal-fired and older gas-fired power plants, and open gas turbines (OCGT) from capacity markets.

The 550g-rule intends to bring together two key areas of the European energy policy:

- Climate policy measures to promote the **environmental sustainability of energy supplies** – the core tool of this area of policy is the European Emissions Trading Scheme (EU-ETS), which is intended to provide the incentives necessary for the power sector and industry to achieve climate targets.
- Measures to promote **supply reliability** – national capacity markets must ensure adequate provision of generating capacity in the member states.

1.2 European emissions trading (EU-ETS) as a key instrument for climate policy

The core instrument for achieving European climate protection targets in the electricity sector is the European Emissions Trading Scheme (EU-ETS – for a more detailed explanation of the scheme, see Appendix A).

This scheme involves the limited allocation of emissions certificates restricting the maximum volume of emissions that can be emitted from the obliged sectors.

To this end, the authorities of the member states allocate or auction off a maximum number of certificates (European Union Emission Allowance, EUA) to the energy sector and power-intensive industry each year. Emitters must then submit such a certificate for each tonne of CO_2 they produce. The number of certificates allocated or auctioned off each year is declining over time, forcing the European electricity sector and other obligated sectors to reduce their CO_2 emissions over time. **The EU-ETS sectors are prohibited from emitting a single tonne of CO_2 more than the permitted amount**[2].

Where this reduction in emissions eventually takes place is determined by the market, or more specifically, the certificate market. Market players are able to trade certificates amongst themselves. A player with high avoidance costs (e.g. a conventional electricity generator with low fuel costs and a high margin on the electricity market) will attempt to acquire certificates instead of curtailing its own production and emissions, whereas a player with low CO_2 avoidance costs (high production costs and a low margin) will be willing to sell its own certificates and curtail its own production and emissions.

The market prices of these tradable CO_2 certificatessignal the costs of CO_2 avoidance. Currently, the price of CO_2 certificates is around EUR 6 per tonne. The price is comparatively low due to a combination of

- fixed emissions budgets, which were defined politically in 2012 (for the years 2013 to 2020);
- the rapid (and subsidised) expansion of renewable energies (and also through other national measures such as the so called "security reserve" (Sicherheitsbereitschaft) by lignite plants in Germany, the Carbon Price Floor in the UK, etc.) which is already leading to significant CO_2 savings, and
- the temporary reduction in demand for certificates that occurred following the 2008/2009 economic crisis, which has in the meantime led to "surpluses" of certificates that are still currently in the system (but which are likely to be removed via the market stability reserve[3]).

1.3 National capacity mechanisms for security of supply

Motivation for capacity mechanisms

A growing proportion of the generation park is based on supply-dependent production technologies, especially photovoltaics (PV) and wind. Given long term (2050) emission targets for the EUAs well as medium term Renewable targets , the proportion of generation from PV and wind will continue to increase significantly.

Electricity generation from PV and wind alone, however, would depend on the availability of solar radiation and wind in order to avoid a collapse of the electricity system and widespread power cuts. Such level of availability is not always

[2] If a power plant that is subject to the scheme emits a tonne of CO_2 without submitting a certificate, it must pay a EUR 100 fine and retrospectively submit the certificate.

[3] In addition to the 550g rule, the change of EU-ETS rules for the period from 2021–2030 is currently also under political discussion.

guaranteed. Therefore, reliable supplies require safeguarding through controllable capacities (such as coal-fired power plants, gas-fired power plants or batteries) in order to be able to keep up with the high level of supply reliability in the industrial nation of Germany and Europe.

Falling electricity prices – strongly driven in part by the subsidised expansion of renewable energies[4] – have led to many conventional power plants on the traditional energy market (on which MWh are sold) no longer being able to recover their full costs (and operators expect that they will also not be able to do so in the near future, either). The utilisation of conventional power plants is dwindling, and installations need to attempt to recover the margins required in ever-decreasing hours over a year while electricity prices in which electricity prices would need to be higher. With some installations, the revenues from the energy market do not even cover the fixed annual operating costs. From a business perspective, it may be sensible to “mothball” such installations or close them permanently.

In this case, with extensive decommissioning of conventional power plants, there can be a risk that the supply reliability in a system with growing reliance on electricity generation from PV and wind is no longer guaranteed.

With this background, EU member states are allowed, under certain circumstances, to introduce capacity mechanisms or capacity markets.[5] These would give power plants a payment for the capacity provided (MW) as well as the standard payment they already received for the energy produced (MWh), with reliable supply being remunerated via the market.

Various member states (e.g. France, United Kingdom and Italy) use capacity mechanisms (Capacity Remuneration Mechanisms, CRMs) to keep existing conventional power plants online despite falling utilisation hours, or fund the building of new peak load power plants (e.g. diesel engines, gas turbines, gas CCGT plants).

EU COM proposal for the CO_2 limit value in capacity mechanisms

With the 550g rule, the European Commission is seeking to restrict participation on capacity markets to certain technologies. This would turn any capacity mechanism into a **focused capacity market** on which certain technologies are eligible to participate (and from which others will be excluded ex ante).

Over time, technologies with emissions above the CO_2 limit will therefore be forced out of the market prematurely. : this is because the market pressure from new plants that enjoy capacity payments (in EUR/MW) will depress energy prices (EUR/MWh). With the introduction of the CO_2 limit value, non-eligible installations that achieve sales revenues only on the energy market and not on the capacity

[4] Falling electricity prices are not driven exclusively by the subsidised expansion of renewable energies; they are also a result of a combination of the economic crisis, falling fuel prices, increased efforts to be more energy-efficient and a number of power plant projects that were planned too optimistically at the start of the millennium, based on the assumption of the free distribution of CO2 certificates.

[5] See also the Impact Assessment of the EC on capacity mechanisms http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52016DC0752&from=EN. For example, a production gap would need to be demonstrated and it would have to be shown that market failure is occurring, preventing the capacity gap from being closed even without a capacity mechanism in place.

market would then lose their sales base more quickly. These installations would exit the market more rapidly.

ENERGY PRICE TENDS TO FALL WITH THE INTRODUCTION OF THE CAPACITY MARKET

This interaction can be explained as follows:

Pricing without a capacity market – let us assume we have a pure energy market on which a certain market price is paid for energy (EUR/MWh): this energy price is determined by the price set by the most expensive power plant still dispatched. The prices include at least the variable production costs of the most expensive power plant still in use. In situations of tight capacity, the prices can also include an uplift (for capacity costs). This way secured plant capacity is rewarded through price peaks in the energy market.

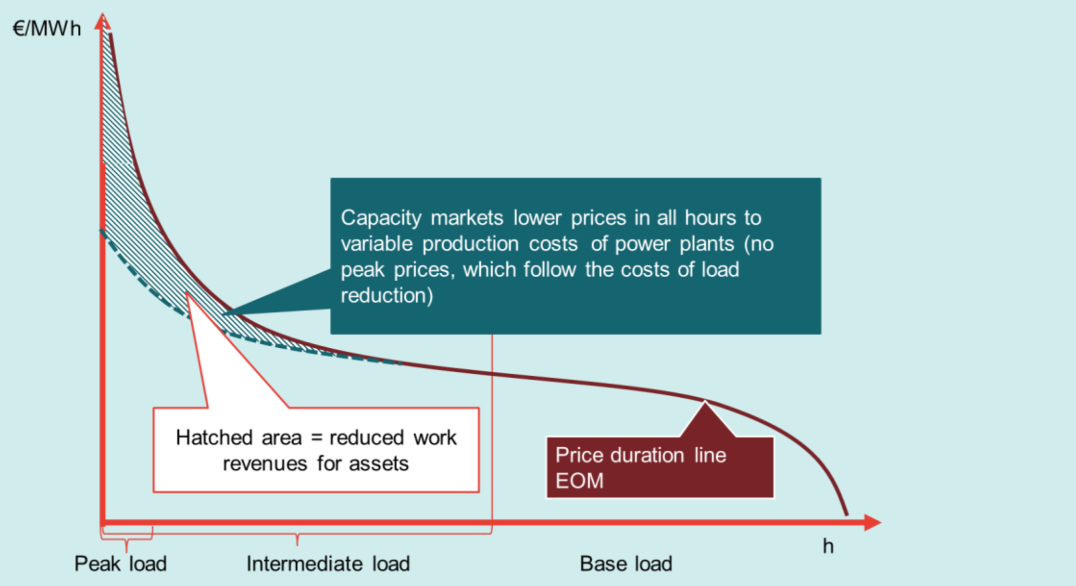
Pricing with capacity market – if secured plant capacity is now remunerated explicitly with a capacity price determined in a capacity market (EUR/MW), the incentives to close existing (qualified) installations falls and/or the construction of new installations is stimulated: there is therefore more capacity on the market than without the mechanism. The more capacity there is on the market, however, the lower will be the prices on the energy market (in scarce situations).

Power plants then earn their revenue from two markets (by selling capacity and selling energy). Generally speaking, the energy price will fall if additional power plants come onto or are kept on the market thanks to the capacity market. New installations in particular generate price pressure: new installations (of the same technology) are usually more efficient and have lower variable costs than existing installations. Existing installations with the highest variable costs are then barely used any more if at all in ongoing operations.

“Producer surpluses” at peak load times are also in some circumstances lower, since as a result of the capacity payments, there is an adequate number of power stations available even during periods of high demand, which are competing on the energy market. Consumers therefore pay through the capacity payments, but benefit from lower energy prices in peak hours.

Figure 1 illustrates the interaction between the capacity market and the energy market. The capacity mechanism reduces peak prices. If a capacity market is used in the form of a strategic reserve, price peaks are capped first and foremost (at the price level from which the strategic reserve is activated). With other forms of the capacity mechanism, energy prices may also reduce at interdiate levels of (net) demand.

Figure 1 Interaction CRM and energy prices at energy-only market – price duration line in the energy market



Source: *Frontier Economics*

Installations excluded from the capacity market would therefore be disadvantaged compared to other qualifying installations (with emissions below the CO_2 limit value), which could achieve revenue both from the energy market and the capacity market.

1.4 Many production technologies would be excluded from the capacity market

1.4.1 The 550g rule excludes coal- and oil-fired power plants as well as diesel engines and older gas turbines from capacity markets

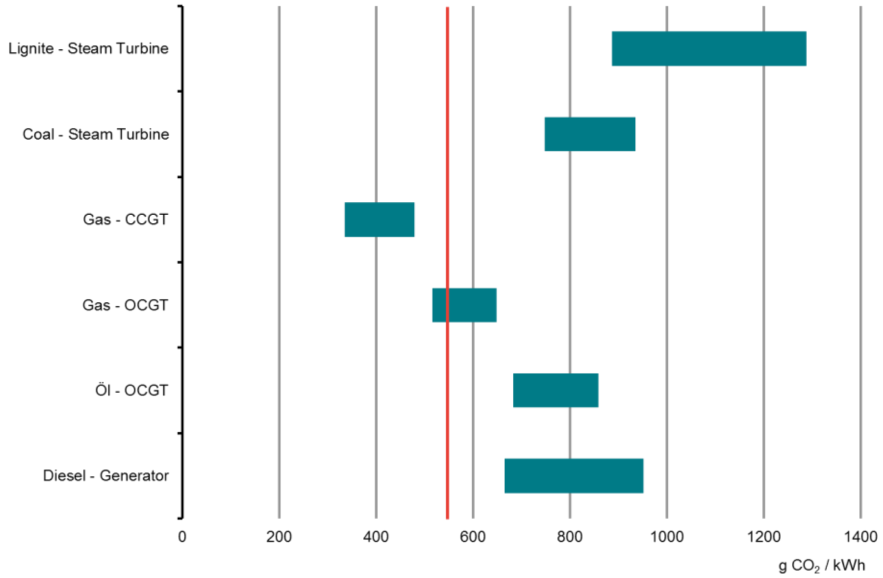
The 550g rule excludes coal- and oil-fired power plants as well as diesel engines and older gas turbines from capacity markets. For this type of market, a limited set of controllable technologies would still be available:

- nuclear energy;
- gas and steam power plants (CCGT);
- new open gas turbines (open cycle gas turbines, OCGTs) in an optimum operating condition[6];
- storage installations (e.g. batteries, reservoirs);
- biogas/biomass installations;
- co-generation units where appropriate

[6] If, when calculating the 550g limit, partial load losses or the emissions at the start-up of a power plant are included, new OCGTs would also drop out of the capacity market. Older OCGTs with efficiency levels below 37% would also fall out of the capacity market.

Figure 2 provides an indication of the CO_2 intensity of various conventional electricity production technologies in Europe, which vary (also depending on the age of the system and fuel used) from installation to installation. A limit value of 550g CO_2/kWh_{el} (shown as a red line) leads to the majority of established generation technologies (hard coal, lignite, older open gas turbines, diesel engines) not being eligible for the capacity market.

Figure 2 Overview – CO_2-intensities typical power plant technologies[7]



Source: *Frontier Economics based on emission factors according to the German Federal Environment Agency and typical efficiencies. The ranges reflect different efficiencies of plants (old plants with lower efficiencies than modern plants).*

The Commission has not yet specified the exact formulation of the limit value rule (beyond the value of $550g/kWh_{el}$). Depending on the details, certain co-generation plants (depending on how the heat coupling is taken into account when calculating the limit value) or even storage technologies (depending on how the demands on the minimum dispatch period are defined on the capacity market) may also "slip through the net". This would ultimately mean that only nuclear power plants and CCGT installations would be able to participate in capacity mechanisms as "preferred" suppliers of guaranteed capacity. As illustrated, the installations excluded from the capacity market would be disadvantaged compared to other qualifying installations (with emissions below the limit value), which could achieve revenue both from the energy market and the capacity market. These excluded installations are therefore at risk of closure.

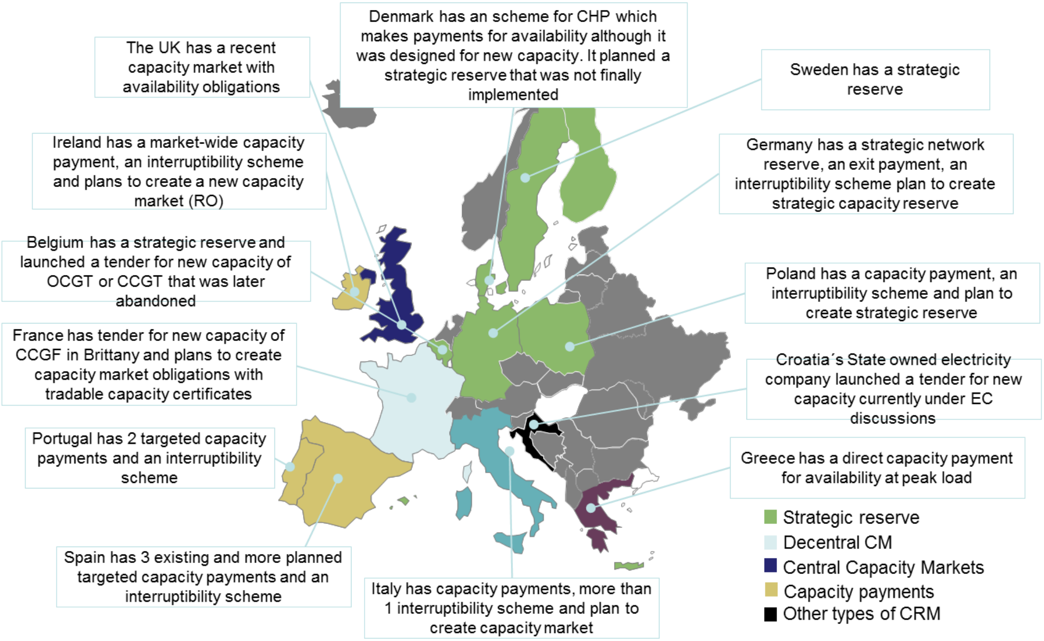
1.5 Capacity mechanisms are relevant in most leading member states

Many member states have already installed CRMs or are considering introducing them over the next few years (Figure 3 shows the most significant CRMs in

[7] The values concerned are typical average values under average environmental conditions – precisely how the limit value (or ex ante) should be determined in practice remains unclear.

Europe). The 550g rule would therefore have a direct effect in these member states. As a result of international electricity trading, however, neighbouring states would also be indirectly faced with the effects of the 550g rule.

Figure 3 CRM proliferation in Europe



Source: Frontier Economics based on ACER

Germany has spoken out against a comprehensive capacity mechanism (and also vehemently against a focused CRM), however its lignite security provision, the network reserve (or network stability installations) and the capacity reserve establish three capacity products that may be affected by the 550g rule[8].

[8] The capacity products in Germany have a limited lifespan in their current form (security provision through lignite-fired power plants, for example, only until around 2023) and are being reviewed. It is therefore unclear how the 550g rule will impact on these products.

2 THE 550G-RULE IS INEFFECTIVE FROM A CLIMATE POLICY PERSPECTIVE, EXPENSIVE AND JEOPARDISES SUPPLY RELIABILITY

2.1 The 550g-rule is from a climate policy perspective and distorts emissions trading

The intention of promoting climate policy targets through the 550g rule is fundamentally misguided, as the following simple considerations very clearly illustrate:

The "550g-rule" is ineffective in with regard to climate objectives

The "550g-rule" does not impact CO_2 emissions in the EU (or anywhere else in the world). CO_2 emissions are instead ultimately defined politically as part of the ETS (see Section 1.2 and Appendix A). If the "CO_2 limit value" crowds coal-fired power plants out of the market, then the emissions avoided as a result of this will be emitted somewhere else in the system ("waterbed effect" of the EU-ETS; see also text box below). [9]

NO CLIMATE PROTECTION EFFECT FROM A CO_2 LIMIT VALUE

As a result of the 550g-rule, certain power plants, especially coal-fired units, may be decommissioned early. This is clearly one of the regime's intended effects. It means that, in an initial stage, the prematurely decommissioned coal-fired power plants' emissions are avoided. This is, however, compensated for in two ways:

- **Need to substitute coal-fired electricity generation** – the electricity generation lost through the 550g-rule is replaced in order to continue covering electricity consumption. This is also achieved in part through CO_2 emitting power generation in gas-fired power plants.
- **"Waterbed effect" in the EU-ETS** – as a result of the net reduced emissions in the initial stage in the electricity sector, there is also a reduced demand for CO_2 certificates. This reduces the market price of CO_2 certificates, since the reduced demand for permits meets a (politically defined) constant supply of certificates. This means that the emission of CO_2 in all EU-ETS sectors and countries becomes cheaper, which in turn leads to more being emitted. The CO_2 price falls through the interaction of the market until all of the certificates are "used up". In other words, across Europe, the same volume of emissions

[9] The provision of capacity alone (this is the idea of a capacity mechanism) does not decide on the use of the capacities. It is therefore possible that additional capacities will be created in gas-fired power stations, but due to current fuel and CO2 prices, these capacities will not be used, and instead existing coal-fired power plants that are still in use will turn out to be advantageous. The instrument therefore does not tackle the target parameter of CO2 emissions, but rather an indirect parameter: capacities.

will be output as without the 550g rule. In a best-case scenarios, the mechanism (e.g. through the temporary transfer of available certificates to the market stability reserve) will shift CO_2 emissions volumes to the future without actually providing any respite for the climate.

The CO_2 limit therefore has no effect on overall emissions in Europe, and therefore no impact on climate protection. What is more, the price of CO_2 will fall further in this interaction.

Despite the skimming off of some "excess permits" through the mechanism of the market stability reserve[10] ("MSR") currently under discussion, this effect still occurs:

- The political siphoning-off of quantities of certificates can be applied at any rate, and regardless of the 550g rule (e.g. by permanently decommissioning certificates that are in the market stability reserve). The siphoning-off process is not a constituting element of the 550g-rule.
- In practice, the volume of certificates initially released (in a first step) as a result of the 550g-rule will most likely lead very quickly to lower certificate prices, and the certificates will then be assumed by other emitters so that no volume effect would occur in relation to emissions with the 550g-rule[11].

The European Emissions Trading Scheme (EU-ETS) would be undermined by the 550g-rule

The EU-ETS uses a pricing mechanism to determine where and how greenhouse gas emissions are avoided at least cost (see Section 1.2). The EU-ETS is a typical volume control mechanism ("Cap& trade") – a target volume of emissions is tendered out/specified and is achieved as cost-effectively as possible (unlike price control (e.g. taxation), where a price is specified and a resulting (undetermined) volume is then reduced on the market).

However, CO_2 avoidance in (modern) coal-fired power plants is currently an expensive option for CO_2 abatement. This is due to the fact that coal can be obtained relatively cheaply on the global market and that modern coal-fired power plants have relatively high efficiency rates[12]. In light of current electricity prices, ceasing production in such installations would be associated with a high degree of value loss. CO_2 avoidance in gas-fired power plants is currently

[10] As part of the definition of the EU-ETS, rules are being discussed for the 2020–2030 period in order to siphon off part of the "surplus" in the EU-ETS and remove it from the system. The European Council proposes that volumes that are to be transferred to the market stability reserve in 2024 should be siphoned off if the surplus is greater than the volume auctioned off the previous year. The European Parliament is proposing to siphon off 800 m tonnes of CO_2 in 2021. The exact details of the rule have not yet been decided.

[11] The European Council is currently discussing a mechanism by which certificates are "deleted" from the market stability reserve once a certain threshold value is reached (i.e. not return to the market again during times of scarcity, as generally the case with the MSR). If the 550g rule were to contribute towards achieving this threshold value, there would in certain circumstances be a CO_2 avoidance effect. This is, however, extremely uncertain, since it depends on the behaviour of the competitors (other power plants, industry), who can certainly accumulate available certificates cheaply (instead of avoiding CO_2 themselves), and on general economic development in Europe. The current EU-ETS rules produce no avoidance effect.

[12] Modern coal-fired power plants in Germany now have an efficiency level of around 45% for 2030. For 2030, the World Energy Outlook predicts an efficiency for coal-fired power plants of 47%.

cheaper, given today's /relatively high) gas and CO_2 certificate prices on the market.

If the option of CO_2 abatement in coal-fired power plants is now imposed by the CO_2 limit value, then the pressure on alternative CO_2 reduction options is reduced: the demand for CO_2 certificates and the CO_2 price falls.

This politically intended reduction of the CO_2 price through the 550g-rule undermines the mechanism's steering effect to drive least cost CO_2 abatement . Simple calculations indicate that up to around 65 million certificates per year could become available (in a first step) with the 550g rule. corresponding to around 5% of the certificate allocations in 2025. This would dilute the CO_2 price.[13]

Low CO_2 prices also fuel the political debate over the effectiveness of the EU-ETS. There are threats of national, uncoordinated measures to be taken in order to "support" the CO_2 price (see, for instance, the minimum CO_2 price in the UK). This risk harming the main instrument of European climate policy: the European Emissions Trading System.

In any case, capacity mechanisms would be the wrong starting point for climate policy measures

For supply security, the first priority is safeguarding the provision of capacity (MW). Power plant capacity must be available for the few hours in the year (or even just every few years), during which demand could threaten to exceed the power plant capacity available on the market.

However, capacity on its own does not produce any emissions. Emissions only arise if conventional power plants are also running, especially if they run for many hours a year and therefore generate many MWh per year.

However, capacity mechanisms (to which the 550g rule applies) have no direct influence on how many hours a power plant runs. The utilisation hours of power plants are decided instead first and foremost by the hourly changing prices for electrical energy (MWh), the power plants' fuel costs and CO_2 prices – not capacity prices (and therefore the CO_2 limit value).[14]

From this perspective, too, the CO_2 limit value does not offer any contribution to climate protection. As illustrated, however, the climate policy effect of the CO_2 limit value will be neutralised by the mechanisms of the EU-ETS, anyway.

[13] Assumption: out of the 159 GW of non-qualifying production installed in the EU, 25% will exit the market early as a result of the 550g rule. We assume that these will all be coal-fired power plants with 4000 h/a utilisation and an average CO_2 intensity of 0.3 t/MWh$_t$ and an average efficiency of 40%, which will then be replaced by natural gas-fired CCGT with an efficiency of 58% (and an average CO2 intensity of 0.2 t/MWh$_t$).

[14] A context does arise indirectly, however, if coal-fired power plants were to be forced out of the market due to the limit value.

2.2 The CO_2 limit value unnecessarily makes energy supplies more expensive

Economic capital is destroyed

The CO_2 limit may (and is likely to) lead to the premature decommissioning of consequently unprofitable existing power plants (coal, old gas turbines). As a result, the expansion of other capacities will be required in order to close the capacity gap created by the decommissioning. This will destroy capital that could have been used from a technical and economic perspective and unnecessarily ties up capital in new installations (without avoiding any CO_2).

For simplicity, we assume that only around 25% of the installed power plant capacities which will in future not be admitted to the CRM (which in Europe equates to around 159 GW of power plant capacity) would have to be decommissioned just 5 years earlier as a result of the 550g rule (i.e. before the end of their technical and economic lifetime) and replaced with new CCGT installations. This implies a devaluation of capital (or costs for the early additional construction work required) amounting to **EUR 18 billion (25% of 159 GW)** (for details, see Section 3.1).

CO_2 limit value pushes up capacity prices

If existing power plants are crowded out from the market from 2025 onwards by the 550g rule before the end of their technical lifespan, new controllable power plants must be built to maintain the security of supply.

With the 550g-rule priority will effectively be given to CCGT power plants. Without the 550g rule, new open gas turbines or existing installations would typically be preferred to safeguard supply, since they have significantly lower incremental capital costs.

This changes with the introduction of the 550g-rule in the capacity mechanism. Emissions from CCGT power plants are below the 550g threshold, while those of older open gas turbines are above it[15]. This means that CCGT are overall more profitable with the 550g rule and they ultimately also determine the price on the capacity market.

If the capital costs of CCGTor open gas turbines are split over the few operating hours a year, open gas turbines have a cost advantage (even taking into account the CO_2 costs).

The following indicative comparison of the annual fixed costs of different technologies (depreciation, interest on capital employed and fixed operating and maintenance (O&M) costs) highlight this[16]:

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[15] Depending on the definition and/or measurement of limit values in practice – modern OCGTs can achieve efficiencies of up to 39% (depending on the outside temperature and operating methods) – the 550g rule implies a minimum efficiency of 37% as the limit value when gas is used.

[16] In practice, the values can fluctuate according to the time, interest rate and size of the installation or site. Here are some simplified assumptions: Investment costs: EUR 1200/kW for black coal; EUR 900/kW for a new CCGT, EUR 400/KW with a new OCGT, WACC technology-neutral: at 10%, depreciation period (here

- The annual fixed costs of a new CCGTare around EUR 120/kW and year.
- The annual fixed costs of a new open gas turbine are around EUR 50/kW and year.
- The annual fixed costs of a fully depreciated existing power plant are around EUR 40/kW and year.

The capacity price that emerges on a capacity market depends – among other things – on the margins that the various technologies can achieve on the energy market. Therefore, it is not possible to directly infer the capacity price from the full cost of plants. The effects of excluding certain technologies form the capacity market will, however, be felt: if existing installations and open gas turbines are excluded from the capacity market, and if they are replaced by a new CCGT this can have significant implications on the capacity market price, since a new CCGT is much more expensive to procure and maintain than an open gas turbine or a (depreciated) existing power plant.

Ultimately, consumers will be burdened with rising electricity prices

The devaluation of existing installations and the additional demand for new investments as a result of the 550g rule will, in the short term most likely also lead to rising electricity prices on the energy market: the price in the energy market will depend will depend on the variable costs (EUR/MWh) of the most expensive technology still used ("marginal plant"). Coal-fired power plants (based on current CO_2 prices) have comparatively low variable costs and their use leads to low prices for electricity. If the 550g-rule were to be used, coal-fired power plants would be partially replaced by gas-fired power plants with higher variable costs. If the 550g-rule pushes coal-fired power plants with low variable costs are out of the market rule, prices for electricity would rise as a result. Simple calculations indicate that the effect on the base price in 2020 can quickly amount to EUR 3-5/MWh[17] (which for a base price of around EUR 35/MWh would correspond to a rise of 10%).

Ultimately, rising capacity and commodity prices that result from the 550g-rule would have to be funded by consumers. Consumers would therefore be burdened with additional cost without the 550g-rule bringing any climate policy advantages whatsoever.

2.3 The CO_2 limit value impairs the security of the power supply

The challenges for practically implementing the 550g-rule are very high

The complex design of a focused capacity market (of the type that would result from the 550g-rule) is particularly problematic: this is because the responsible

too, assumed to be technology neutral) 40 years. Annual O&M costs estimated at 3% of the investment costs.

17 Assumption based on the current forward data for 2020: CO_2: EUR 5/t, black coal: EUR 9/MWh_th, natural gas: EUR 18/MWh_th and efficiencies of 40% (coal-fired power plant) or 58% (natural gas CCGT), as well as the assumption that coal-fired power plants were price-determining for 50% of the hours in a year and that these will then be replaced by CCGT as a result of the 550g rule.

authority must establish an expectation of how many power plants will remain on the market, but outside of the capacity market. On this basis, he must then define a tendering volume for the capacity market which then still covers unsatisfied capacity needs. In cases of doubt, he will "estimate on the side of caution", which will likely make the mechanism even more expensive. In the context of the 550g rule, for example, the following would need to be defined:

- On what basis is the specific emissions value of a power plant measured or defined? Who is responsible for this?
- How are co-generation or co-firing plants treated?
- How do the authorities define the power plant capacity that is still on the market outside the CRM (and reduces the output required within the CRM)?

The challenge of formulating this type of focused capacity market (with the 550g rule) can be explained in terms of magnitude using the example of the German Merit Order[18]:

- The total capacity demand for guaranteed capacity in Germany is around 85 GW (if the guaranteed capacity is provided exclusively from domestic sources)[19].
- Applying the 550g rule, all lignite-fired and hard coal-fired power plants, as well as some gas-fired power plants would be excluded from a capacity market. This excludes some 50 GW from a capacity market that would have technically been available[20].
- CCGT and new gas turbines would remain in the market representing for a total eligible capacity of around 25 GW. Adding to this would be controllable output from renewable energies (hydropower plants, biomass) with an output of around 15 GW.
- This would lead to a situation in which the output within the capacity market, amounting to 40 GW in total, would be smaller than the guaranteed capacity outside the capacity market, which is an estimated 50 GW. The capacity (at the beginning) within the capacity market would therefore only be around half as that of the capacity outside the capacity market (25 GW vs. 50 GW).
- Since the closures of coal-fired power plants are difficult to predict for the authority, the authorityis also unable to definitively estimate the need for new builds (since each year, the regulator must determine for the near future what proportion of the 50 GW power plants that are excluded from the capacity market would continue to operate commercially). This either results in higher costs if the regulator tenders out more new installations than required, or reduced supply security if he underestimates the closures.
- In case of doubt, one rational strategy for the regulator would be to tender a relatively high number of new build capacities. This may be expensive in economic terms, but a large new build tender creates a type of self-fulfilling

[18] In other member states (e.g. Poland), the ratio would be even more uneven.

[19] Compare also the output balance sheet of the TSOs http://www.bmwi.de/Redaktion/DE/Publikationen/Energie/bericht-uebertragungsnetzbetreiber-leistungsbilanz-2015.pdf?__blob=publicationFile&v=6. The exact demand would also be dependent on the scope of the sector coupling that had been achieved up until that point and the contribution from neighbouring countries.

[20] See EU reference scenario.

prophecy: the larger the new build tender, the more existing installations will be crowded out of the market, which will then retrospectively justify the large new build tender. The energy system - and especially conventional production – would need to be regulated much more strictly, for example with 5-year plans, updated annually, for the need for guaranteed capacity.

Major challenges for insular states

A number of insular member states such as Ireland, Malta or Cyprus, or major islands such as Corfu, Mallorca and Sardinia, could run into difficulties depending on the formulation of the 550g rule, even though coal-fired power plants do not play a major role in these places, generally speaking[21]. The 550g rule would exclude diesel installations from any capacity mechanism, as well as open gas turbines (depending on the details of how the 550g rule will be implemented in practice or the age of the gas turbine)[22].

Planned electrification as part of energy Transition brings new challenges for supply security

The planned decarbonisation of the heat and transport sector is only possible in practical terms with the help of direct[23] or indirect[24] electrification. Depending on the technology choices and energy efficiency assumptions, studies anticipate a rise in electricity demand by 2050 of 35% to 300% (between different studies the electricity demand forecast for Germany in the long term varies between 800 TWh/a and 1300 TWh/a)[25]. This higher demand also leads to higher peak loads – and this, too, must be accommodated through controllable production capacities.

In the long term, the energy and climate policy aims at creating a low-emissions electricity sector. However, the technical and economic challenges for the electricity sector and the resulting security of supply risks are high. Existing generation capacities must not be needlessly crowded out of the market in the medium term. This is especially true because the rules of the EU-ETS will in any case ensure that decarbonisation of the electricity sector will advance as planned (see Appendix A).

2.4 The CO_2 limit value indirectly impairs security of the gas supply

If the 550g-rule exerts its politically intended effect and European coal-fired power stations are systematically replaced by gas-fired power stations, gas

[21] In Ireland, alongside many oil-fired power plants, there is also a coal-fired power station.

[22] The impact depends on the details of the 550g rule and also whether the various member states are planning a CRM.

[23] This includes electric heat pumps on the heat market and electric vehicles in the transport sector.

[24] With indirect electrification, renewable electricity is converted into synthetic gases or liquid fuels, which are then themselves used as fuel.

[25] For example: Fraunhofer IWES et al.(2015), Interaction between RE power, heat and transport; Fraunhofer Institute for Wind Energy and Energy System Technology, Fraunhofer Institute for Building Physics, Heidelberg Institute for Energy and Environmental Research, Stiftung Umweltenergierecht on behalf of the Federal Ministry for Business and Energy or Quaschning/Htw Berlin (2016), Sector coupling through the change in energy policy

imports – e.g. via pipeline from Russia or via liquid natural gas ("LNG") from Qatar – will increase. This greater dependence on gas imports for Europe may have a negative impact on the reliability of the gas supplies.

It is in fact an explicit goal of the European Union to reduce this dependency of its energy sector on gas imports in the future[26] – provided synthetic fuels are not yet available cheaply, an implicit or explicit ban on coal-fired generation works against this goal.

To better understand the orders of magnitude, the EU reference scenario (2016) for 2025 assumes coal-based power generation (hard coal and lignite[27]) across Europe of around 655 TWh/a. If this power generation were to be hypothetically replaced completely by gas-fired power plants as a result of the 550g rule, this would entail an additional natural gas consumption of around 1300 TWh/a, which equates to around 30% of Europe's gas consumption at around 4100 TWh/a[28].

2.5 The CO_2 limit value also raises other political issues that have so far not been considered

Double capital devaluation

Since many storage technologies are still very expensive despite their falling costs in recent years (and often they can only cover a few hours, and not a prolonged slack period of renewable energies) and inexpensive open gas turbines often also do not satisfy the 550g rule, CCGT power plants in particular would be built as a result of the 550g rule. Compared to open gas turbines, these are relatively capital costs intensive (see Section 2.2). These will have a technical lifespan of several decades (or will need to be decommissioned early, which will lead to additional costs and discussions). A strategy of using existing power plants (and cheaper open gas turbines or diesel engines) to safeguard output in the medium term, however, appears to be much more expedient. In the long term, inexpensive alternatives such as batteries or other energy storage devices would possibly be available, as would be demand-side flexibility thanks to digitalisation. If a new wave of investment in "new CCGT" takes place in the medium term (around 2025) as a result of the 550g rule, these power plants will also be available until 2050 and beyond in technical terms, and if necessary, discussions will need to be had regarding their early closure (see also, for example, the discussion regarding the security reserve in Germany). If the "new CCGT" are then also prematurely closed, there is a risk of "double capital devaluation".

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[26] See also the regulation on the security of gas supplies http://europa.eu/rapid/press-release_MEMO-16-308_de.htm

[27] In the EU reference scenario, this is listed under "solids".

[28] Calculated with an average natural gas power plant efficiency of 50%, i.e. a mix of open gas turbines and CCGT installations. With an accordingly only proportional replacement of coal-based power generation through gas-based power generation, or if efficiencies vary, the ratio would change accordingly. EUROSTAT states that in 2015, gas consumption (across all sectors) in the EU was 4162 TWh/a.

International financial redistribution

There are (unintended?) distributional effects between member states and market players. Companies and countries that currently have a high proportion of coal (e.g. Poland, Czech Republic, Germany, the Netherlands, Estonia) will be harmed by an unnecessary destruction of capital. Other companies and countries (e.g. France, Austria, Scandinavia) may benefit from rising electricity prices and growing electricity exports (see Figure 6).

Implicit boost for nuclear energy

Nuclear power plants would be the big winners of the 550g rule. Nuclear power plants would benefit as a result of rising capacity prices and energy prices, since competitors will be crowded out from the market thanks to the 550g-rule. Countries such as Poland have already announced that they will be rethinking and expanding their nuclear energy policy in response to the rule[29].

2.6 The proposal also has formal flaws, partly because the required impact assessment is missing

Contrary to formal requirements, the proposal for the 550g-rule lacks an impact assessment

Given the significant economic detriments of the 550g-rule, without any apparent benefits for climate policy, it is all the more astonishing that the instrument has not been subjected to the required impact assessment. This is most likely due to the fact that the instrument of the 550g-rule was included in the Clean Energy Package virtually “at the last minute”, when the far-reaching impact assessment on capacity mechanisms had already been completed. This is especially surprising given the distribution effects outlined above between various countries within the EU. It appears as though climate policy intervention that cannot be consented upon in transparent negotiations (e.g. in the context of EU-ETS reforms) is being implemented by the back door, although without any impact on climate protection.

In the meantime, the European Commission published a set of slides entitled “Impact Assessment of 550 gr/KWh CO_2 for plants participating in capacity mechanisms” and very recently also a written report[30], which, however, only examines the impact of an ex ante defined additional 5.7GW coal-based power plant capacity. This, however does not constitute an impact assessment of the 550g-rule in either content or formal terms. Moreover, the EC analysis exhibits

[29] See the statements made by Polish energy minister Krzysztof Tchorzewski in an interview at http://minexforum.com/en/poland-can-add-nuclear-plant-to-its-energy-mix-to-meet-the-eu-s-requirements/

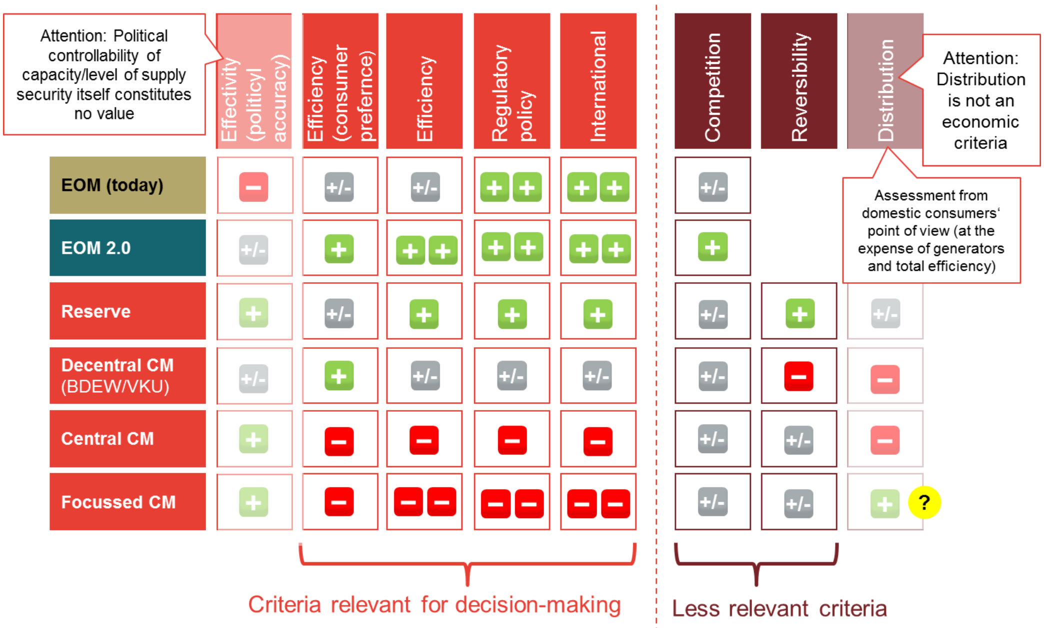
[30] See E3MLab (2017): “Modelling study contributing to the Impact Assessment of the European Commission of the Electricity Market Design Initiative”. The passage from p. 139 onwards mentions the 550g-rule (unfortunately the situation of lignite plant subsidies in analysed rather than the impact of the 550g rule).

serious methodological deficiencies[31]. All this means an effective impact assessment of the 550g-rule remains pending.

The lessons learned from the Impact Assessment on capacity mechanisms previously implemented in Germany have not been drawn

There is a reason why Germany rejected the concept of a focused capacity market: Extensive capacity market studies have been performed on behalf of the German Economics Minsitry BMWI (Federal Ministry for Economic Affairs and Energy) 2014[32]. These studies clearly showed that “focused capacity markets” (a mechanism which the 550g-rule constitutes) performs poorly when compared to alternatives. De facto, by introducing the 550g-rule, the Commission is attempting to impose precisely such a focused capacity market in Europe – this contradicts the findings of the study published by the BMWI (cf. Figure 4).

Figure 4 Overview – Results of the Impact Assessment of CRM options in Germany on behalf of BMWI[33]



Source: BMWI (2014): Impact assessment capacity mechanisms – processed by Frontier Economics and Consentec

Contravention of the subsidiary principle and the results of the sector inquiry

The 550g-rule also contradicts the fundamental concept, as outlined in the EU Impact Assessment on capacity mechanisms, that the individual member states

31 Details on the EC set of slides and our classification can be found in Appendix B.

32 https://www.frontier-economics.com/de/documents/2014/07/folgenabschatzung-kapazitats-mechanismen-frontier-report.pdf
https://www.bmwi.de/Redaktion/DE/Publikationen/Studien/funktionsfaehigkeit-eom-und-impact-analyse-kapazitaetsmechanismen.html

33 A second expert opinion, conducted by R2B Energy Consulting, also elicited similar results.

be allowed to design their "capacity market" ("subsidiarity principle"). According to the respective report by the EC, markets should be technologically neutral and accessible to producers, consumers, storage, and participants from abroad. By contrast, the idea of a one-size-fits-all European market design for all EU member states was explicitly rejected. Firstly, capacity levels differ among different member states (some of which have overcapacity and others risk a shortfall), and secondly, existing national energy policies, capacity products and policy approaches are very diverse. So while the Commission sets out basic rules, there is not yet any detailed market design for CRM with a 550g-rule. Interestingly, the EC reached the following conclusion in a report on capacity mechanisms: "*The inquiry has also shown that overly selective capacity mechanisms risk over-compensating their participants because the competitive pressure is weaker when the allocation process has only limited participation. The payments to capacity providers resulting from this limited competition are typically at a higher level than the funding they actually require to provide the availability service".*

The 550g-rule thus puts the Commission in breach of its own results on capacity mechanisms:

- Rather than being open to all technology, the approach effectively targets specific technologies.
- Accordingly, this approach tends to restrict the range of suppliers and also reduces competition in the capacity market.

The 550g rule (Article 23 (4)) also contradicts the objectives of the preceding sentence of the same paper: *"Capacity mechanisms must not lead to unnecessary market distortions and should not restrict cross-border trade. The intrinsic level of capacity in the mechanism must not exceed the extent necessary to eliminate concerns." (Art. 23 (3). A Draft REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL)* – as set out above – such a regulation would significantly hinder and distort competition for existing installations and new installations with emissions exceeding the 550g-rule compared to other qualifying facilities.

3 QUANTITATIVE ANALYSES REVEAL WHO LOSES OUT WHEN THE 550G-RULE IS IMPOSED

3.1 Significant cost implications to be expected

Introducing the 550g-rule would involve the following two cost implications in particular (compared to circumstances where the restrictions of the 550g-rule):

- **Existing power plants leaving the system at an early stage** – Existing power plants (e.g. coal- and diesel-fired) which are not admitted to the capacity market leave the electricity market at an early stage and have to be replaced (by new CCGTs).
- **Cost-effective technologies that could resuce capacities are excluded** – The 550g rule also excludes cost-effective open gas turbines (OCGT) or diesel engines as a fresh option from the performance market[34].

Quantifying the cost implications accurately would require complex modelling and clearer details for the planned application of the rule. But the following simplified calculations, based on the EU Reference Scenario[35] for 2025, already give an indication of the considerable cost implications that the 550g-rule could entail:

- Of the controllable capacities of around 640GW in Europe under the EU Reference Scenario for 2025, around 159GW would not be eligible to participate in a capacity market[36].
  - in those countries alone that already have a capacity market or are currently planning one, the relevant amount would be around 77GW.
  - In some countries, this share as a proportion of generation capacity exceeds more than half the installed capacity (cf. Figure 6).
- If we adopt a simple assumption, that the 550g-rule would only accelerate the decommissioning of 25% of affected power plants (i.e. excluded from CRM) (equating to 25% of 159GW), and by just 5 years, and that the resulting capacity gap would be filled by new (“advanced”) CCGTs, the additional cost would be approximately **EUR 18 billion** (159GW x 25% x EUR 92,000 / MWa x 5 years).
  - If all the power plants concerned (100% x 77GW) in the affected regions were decommissioned 5 years earlier and replaced by new CCGTs, it would cost almost **EUR 35 billion**.
  - If all the power plants affected (100% x 159GW), i.e. non-approved power plants in member states with no CRM at present, were shut down 5 years earlier, additional costs of around **EUR 73 billion** would be incurred.

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34 The key point for the OCGT is the precise configuration of the 550g rule – if there is a need to take partial load losses or starter emissions into account, the overall efficiency of 37% required for natural gas combustion would probably not be reached, even with new OCGTs.

35 EU Reference Scenario 2016 https://ec.europa.eu/energy/sites/ener/files/documents/ref2016_report_final-web.pdf

36 See Chapter 3.4 or Section 5.

It is worth noting again: The estimated additional cost is not the full investment costs of the new CCGTs, but rather only the portion of investment costs of prematurely investing 5 years earlier (of the total 40-year service life).

The above cost estimation is primarily aimed at the early decommissioning of power stations. As also highlighted, additional costs are also incurred due to restrictions on potential new buildings ("CCGT instead of OCGT"), as indicated by the following rough calculation: If, rather than focusing on CCGT to secure generation capacity (with investment costs of approx. 900 EUR/kW), there were scope to rely on open gas turbines (OCGT – investment costs of approx. 450 EUR/kW), the creating a capacity back-up for 25% of 77GW could result in savings of around **EUR 4.4 billion** per year compared to the CCGT alternative[37] (i.e. halving the additional costs). However, it remains unclear how exactly the 550g-rule value will be measured in practice. If the benchmark for the 550g-rule value is based on the real operation of an open gas turbine, this becomes increasingly infeasible to achieve, given increasing in-feed volatility. The back-up have to be started up more often and some have to be operated in partial load. Both factors result in a decline in efficiency, which means a rise in specific CO_2 emissions.

3.2 Poland, the Czech Republic, Estonia and Germany would be particularly hard hit by the 550g-rule

The 550g-rule particularly affects at member states in which lignite, hard coal or older gas-fired power plants dominate. The rule initially limits only participation in the capacity market (and does not entail ad hoc closure of the thermal power plants in question). Even so, the 550g-rule is likely to increase up economic pressure on many of the excluded power plants, given that they are competing in the energy market with power stations capable of generating further revenues through capacity mechanisms. In the worst case scenario, they will be eliminated from the market. If this were not the case, the 550g-rule would have the effect set out by its advocates.

The largest direct restrictions imposed by the 550g-rule would apply to Poland and the Czech Republic as well as smaller island states (Malta, Cyprus)[38]. In Poland, 57% of installed power plant capacity would be affected, and 50% in the Czech Republic. Here, those losing out include the thermal generators and, given the expected rise in power prices, also the electricity consumers (Figure 5).

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[37] The calculation excludes potential advantages of the CCGT system due to increased efficiency (approx. 60% as opposed to approx. 40% with the OCGT) – but this is contingent on the plants being used sufficiently frequently (rather than as a "hedge" and for just a few hours of operation). The issue of whether new OCGTs can comply with the 550g-rule depends on the details of the implementation (handling of partial load losses, start-up processes etc.).

[38] Provided CRM are present or have been established there (or in key neighbour states).

Figure 5 Capacities in the EU reference scenario for the year 2025 and proportion of the unauthorised power plant output in MW[39][40] due to the 550g-rule

Country	Net generation capacity 2025	Net generation capacity eligible to CRM (controlable + not controlable)	Controlable capacity 2025	Controlable capacity not eligible to CRM	share of non-eligible capacity of total controlable capacity	CRM
	MW	MW	MW	MW	%	
Austria	25,329	23,748	18,973	1,581	8%	
Belgium	21,065	20,073	11,262	992	9%	yes
Bulgaria	12,479	8,863	8,984	3,616	40%	
Croatia	5,276	4,341	4,272	935	22%	
Cyprus	2,052	1,070	1,455	982	67%	yes
Czech republic	19,073	9,454	16,256	9,620	59%	
Denmark	13,146	10,730	6,474	2,417	37%	yes
Estonia	2,210	772	1,864	1,438	77%	
Finland	19,380	16,128	16,725	3,252	19%	
France	151,245	144,672	101,013	6,573	7%	yes
Germany	199,424	151,642	81,516	47,782	59%	
Greece	22,088	17,627	13,015	4,461	34%	yes
Hungary	7,666	6,950	7,084	716	10%	
Ireland	9,164	7,647	5,158	1,517	29%	yes
Italy	119,387	103,481	83,802	15,905	19%	yes
Latvia	3,107	2,962	2,821	145	5%	
Lithuania	2,336	2,136	1,795	200	11%	yes
Luxembourg	960	910	542	50	9%	
Malta	913	613	728	300	41%	yes
Netherlands	37,206	30,713	21,524	6,493	30%	
Poland	36,938	15,753	27,190	21,186	78%	yes
Portugal	21,384	20,222	15,253	1,162	8%	yes
Romania	24,313	20,031	17,658	4,282	24%	
Slovakia	7,632	6,704	6,993	928	13%	
Slovenia	3,907	3,174	3,126	733	23%	
Spain	108,361	94,584	66,628	13,777	21%	yes
Sweden	38,425	37,452	30,220	973	3%	
UK	110,488	103,406	65,905	7,082	11%	yes
	1,024,954	865,857	638,235	159,097	25%	

Source: Frontier Economics based on EU reference scenario.

Countries such as France (mainly nuclear energy) and Sweden (nuclear and hydro power) will be less significantly affected by the regulation. However, international trade is likely to drive an overall increase in power prices across Europe – in other words, in countries with power plants that remain on the market (although producers will benefit as a result).

As Figure 6 shows, the effects of the 550g rule will be considerable.

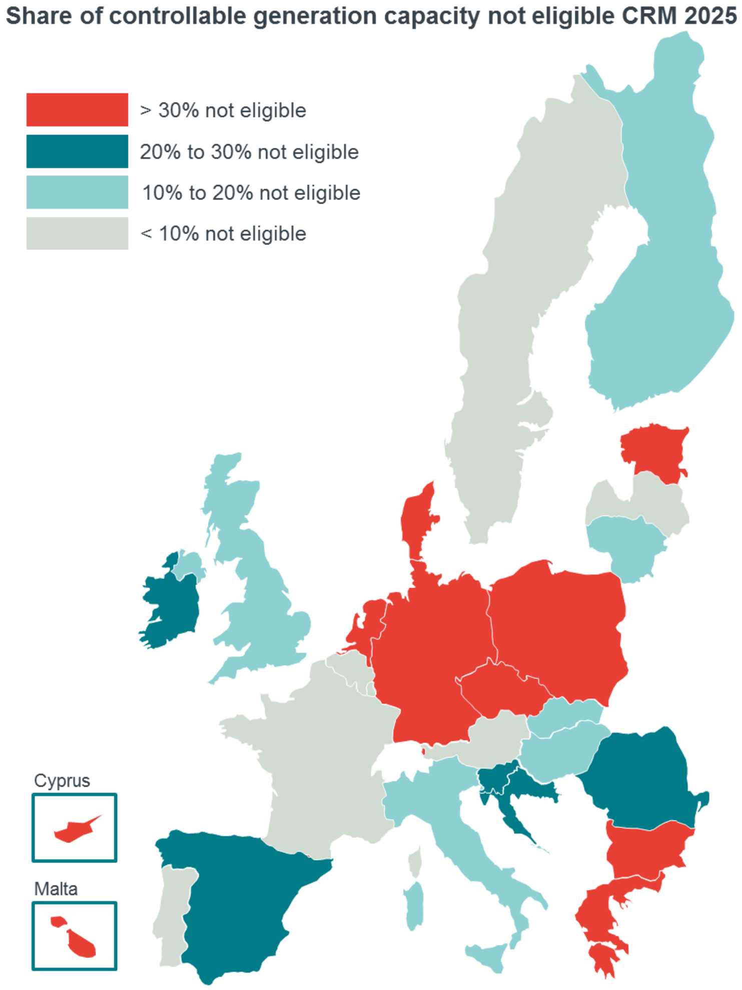
In Poland and the Czech Republic, more than 50% of all installed capacity would be excluded from the capacity market (including renewable energies). As well as the impact on installed controllable production capacity of member states, more than half the controllable production capacity would be affected in Germany and Estonia (conversely, countries benefiting would include those such as France,

[39] Figure 3 shows the installed power plant capacity in Europe in tabular form, based on the EU reference scenario in 2025 in Europe and indicates the areas of performance which would be affected by the 550g scheme (and would then compete with other power plants that could generate additional revenues through CRM). The "disallowed" category includes combustion of lignite and hard coal. Oil, diesel and 10% of the gas power plants (assuming 10% OCGT). In the "allowed" category are nuclear energy, renewable energies and CCP.

[40] The taxable benefit was assumed - based on the categories in the EU Reference Scenario (2016): Nuclear power, "solid" (brown and hard coal); natural gas, hydroelectric power (total power – i.e., besides reservoirs and pumped storage, also running water) and geothermal energy. Other power sources (wind, PV) were categorised as non-taxable.

Switzerland and Sweden, where nuclear energy or hydroelectric generation dominate).

Figure 6 Member states with significant generation shares, which would be excluded due to the 550g-rule



Source: Frontier Economics based on EU reference scenario 2016 for the year 2025.

4 CONCLUSION – THE ROAD TO HELL IS PAVED WITH GOOD INTENTIONS

Various European and national energy policy instruments, such as renewable energies, capacity markets, emissions trading or also instruments used to boost energy efficiency, are already impacting on the electricity market, resulting in partially contradictory signals and inefficient and unsatisfactory results. The motivation to leverage the 550g-rule to reconcile climate protection and security of supply are thus fully understandable – but this goal will be completely missed with the introduction of the 550g-rule. The key and critical problems with the 550g-rule are:

- **The 550g-rule is toothless from a climate policy perspective** (**"Water bed effect of the EU-ETS")** – CO_2 emissions in the EU are determined politically by limitations imposed on the issued emission certificates within the European Emission Trading Scheme. The (minimum) result of the ever-declining trajectory of the certificate volume will automatically spawn the desired emission reduction necessary to achieve the target in Europe. The 550g-rule does not alter the volume of allocated emission certificates in any way, meaning it has no impact on CO_2 emissions, either.

  The initially reduced emissions in the electricity sector (due to the elimination of plants rendered ineligible for capacity markets under the 550g-rule) lead to an initial decline in demand for CO_2 certificates. This reduces the market price of CO_2 certificates, since the reduced demand meets a (politically defined) constant supply of certificates. This means that the emission of CO_2 in all EU-ETS sectors and countries becomes cheaper, which in turn leads to more being emitted. The CO_2 price will decline by the same extent as all certificates are "consumed". In other words: overall and Europe-wide, the same total emissions will be generated as would apply without the 550g rule.

  In the most optimistic scenario, the mechanism will result in CO_2 emissions being shifted to the future (for example, the temporary transfer of released certificates into the market stability reserve) without, however, easing the burden on the climate. Therefore, the 550g-rule value has no impact on total emissions in Europe, and thus no climate protection effect. And things will remain that way, despite the announced market stability reserve (namely, the effects of altering the market stability reserve would also be achievable without the 550g-rule).

- **The 550g rule undermines the effectiveness of the EU-ETS** – The effective mechanism of the EU-ETS, aiming to abate emissions in the most cost-effective way, is being systematically undermined. Forced (expensive) savings achieved in coal-fired power plants reduce the "pressure" in the system and lead to lower EU-ETS certificate prices and thus lower incentives elsewhere in the system to abate CO_2 (see above). Political discussions have interpreted the current relatively low CO_2 price as a sign of "dysfunction" (lacking a steering effect) – any further decline in the CO_2 price as a result of the 550g rule would add further fire to the debate and, under certain circumstances, prompt additional (national) uncoordinated market interventions.

- **The 550g-rule leads to considerable additional economic costs** – On the one hand, the 550g-rule causes the value of existing assets to decline, and on the other, it imposes additional costs on the economy, since existing power plants decommissioned prematurely (e.g. coal-fired) have to be replaced by new installations (for example CCGT) to avoid any threat to the security of supply. Simple calculations (simplified assumption: 25% of excluded power plants, in countries where current capacity markets apply or are being planned, will be decommissioned 5 years than if this rule did not apply) indicate additional costs could be in the range of **EUR 18 billion**[41].
- If 100% of the excluded power plants (which would equate to 159 GW Europe-wide by 2025) were to leave the market prematurely (i.e. only 5 years earlier) and were replaced by CCGTs, additional costs of up to EUR **70 billion** could result. It is worth reaffirming the following at this point: In this case, the amount concerned is not the full investment costs of the new CCGT, but rather the portion of investment costs which would be omitted for the 5-year period (of the total 40-year service life). If additional electricity grid expansion were required as a result of these shutdowns, this would increase costs still further.
- **Consumer prices will rise,** since many existing power plants, as well as inexpensive new technologies such as OCGT or diesel engines, would no longer be used as back up capacity, and more expensive CCGT (or, even costlier, batteries or nuclear energy) would be used instead. This makes power supply needlessly costlier (depending on CO_2 pricing), both in terms of capacity prices and energy prices . Simple calculations show that the energy market can result in an increase in the base price of electricity of 3-5 EUR / MWh, which would also entail price effects on the capacity markets, whereby instead, favourable back-up technologies (e.g. depreciated assets or new open gas turbines) are excluded in favour of more expensive CCGT plants used in their place. Limiting production or capacity back-up options for political reasons is bound to result in cost increases, which will then also be reflected in consumer prices.[42]
- **This needlessly narrow and limiting approach affects the security of supply**, by
  - making it more difficult to secure sufficient availability of power plant capacity (secured capacity) (since the current installations will not be used as much to ensure capacity); and

[41] If we adopt the simplest assumption, namely that the 550g rule would only accelerate the decommissioning of 25% of affected power plants (i.e. excluded from CRM) (equating to 25% of 77GW), and by just 5 years, and that the resulting capacity gap would be filled by new (“advanced”) CCGs, the end cost would be approximately **EUR 9 billion** (77GW x 25% x EUR 92,000 / MWa x 5 years). If all the power plants concerned (100% x 77GW) in the affected regions were decommissioned 5 years earlier and replaced by new CCPs, it would cost almost **EUR 35 billion**. If all 159GW (i.e. non-approved power plants in member states with no CRM at present, of capacity was lost from the grid 5 years early, additional costs amounting to around **EUR 73 billion** would be incurred. It is worth reaffirming the following at this point: In this case, the amount concerned is not the full investment costs of the new CCP, but rather the portion of investment costs which would be omitted for the 5-year period (of the total 40-year service life).

[42] The total costs can remain at a constant maximum, but never sink.

- configuring capacity markets in a far more complex way, since the authority must define an expectation of how many power plants remain outside the capacity market and define a corresponding tender volume for the capacity market. The example of Germany shows that, in some countries, only about 1/3 of the thermal capacities in the capacity market would be eligible in the capacity market at the start of the regulation and 2/3 will remain outside.
- Given the difficulty for the authority in forecasting the decommissioning of the power stations excluded from the capacity market, the authority is also unable to provide a valid estimate of the demand for new construction. This leads to either cost hikes, if the regulator tenders for more new plants than are necessary, or to a decline in the security of supply if the decommissioning is underestimated.
- In case of doubt, one rational strategy for the authority would be to tender a relatively high number of new build capacities. This is, however, economically costly. Even so, a large new construction tender represents a kind of "self-fulfilling prophecy": namely, the larger the new construction tender, the more existing plants are pushed out of the market, which, in turn, retrospectively justifies the large new building tender.
- The capacity market would have to be regulated more strongly with 550g-rule, for example including the 5-year plans to meet the demand for guaranteed capacities both within and outside the capacity mechanism.
- Dependence on natural gas imports would also intensify with the shift from coal production (completely switching from coal-based production to natural gas would increase gas demand in the EU by approx. 30%). Given that demand and the challenges in the electricity sector are set to grow in the medium term, direct and indirect electrification of the heat and transport sector as part of the energy transition mean that forcing functional and economic power plants out of service makes little sense.

- Further **energy policy distortions**, which have yet to be addressed, include:
  - **The regulation sparking significant redistribution effects in Europe –** While countries (or producers in countries) like France, Austria or Scandinavian countries will gain, other countries such as Germany, Poland, the Czech Republic, Estonia, Bulgaria and the Netherlands will lose out. In addition, this will render some smaller islands (such as Malta, Cyprus, Mallorca, Corfu, ...) vulnerable to more complex challenges, whereby capacity mechanisms should be applied (or introduced) and existing facilities should not be approved.
  - **The regulation supports nuclear energy –** As well as CCGTs, nuclear power plants emerge as one of the big winners from the 550g-rule. The Polish Minister of Energy has already initiated a relevant discussion on additional nuclear power plants in Poland[43].
- **The regulation in its current form fuels uncertainty in the market**, given the lack of clarity over exactly how it should be implemented (which operating

[43] See statements made by Polish energy minister Krzysztof Tchorzewski in an interview at http://biznes.pap.pl/en/news/all/info/1831640,poland-could-add-nuclear-power-to-energy-mix-to-secure-longer-usage-of-coal---energymin

condition will be used for the measurement / calculation? Will annual averages be used? How should CHP, CCS or co-firing plants be handled? etc…). Economically viable projects (modernisation of coal-fired power stations in Spain or Poland, co-firing initiatives in the Netherlands and cogeneration projects in Germany are suffering from uncertainty.

ANNEX A EU-ETS AS A KEY INSTRUMENT OF EU CLIMATE POLICY

In 2005, EU member states agreed to introduce the EU-ETS European trading system for the power generation and energy-intensive industry. The EU-ETS was launched on 1 January, 2005. From the start of 2013, private aviation emissions (for internal European flights) were included in the system.

To understand the importance of the EU-ETS as well as the economic advantages it delivers (and to understand its link with national climate protection measures) it is helpful to recall how the EU-ETS functions. In particular, it is worth noting that the EU-ETS, through trading in cross-country and cross-sectoral certificates, ensures that

- **a politically agreed emission reduction target is achieved in all cases** – regardless of how the economy and/or fuel prices develop and regardless of political decisions, such as the decision to phase-out nuclear energy in Germany; and
- **emission reduction is achieved at the lowest costs**, since there is scope to avoid emissions from plants/industrial units in countries and regions where this will result in lowest cost. The question of which plants and in which countries and regions are involved is difficult to predict and may vary over time, e.g. due to changing fuel prices or technological developments.

We address this in more detail in the following section.

Functionality guarantees emissions reduction

The basic idea of the European Emissions Trading System (EU-ETS) for CO_2 certificates is that the operators of CO_2 emitting installations in the sectors of energy (from a plant size of 20 MW rated thermal input and above), energy-intensive industry and private air transport (domestic European flights) have to produce a certificate for every tonne of CO_2 emissions.[44] The certificates for the quantities of CO_2 emitted must be submitted by the issuers to the respective member states, who validate them. The number of certificates available in the trading system overall places a cap on CO_2 emissions and emitting CO_2 is thus given a price (a cost for the emitter).

The number of CO_2 certificates issued to market actors in the European trading system as a whole is determined by the emission reduction targets of the EU: the shortage in the market is therefore given on the basis of annually tightening CO_2 reduction targets (falling emissions budgets) in the EU-ETS, to which the member states have agreed. From a practical point of view, the certificates are issued to market actors in the context of competitive award procedures (auctions) by the individual member states (in particular in the area of electricity production) and in

[44] The ETS covers a total of 6 GHGs, not just CO2.

some cases by free allocation by means of benchmarking procedures (especially in industry).

The fact that every operator of installations covered by the EU-ETS has to present a certificate for each tonne of CO_2 emitted ensures that this EU-wide cap on emissions is not exceeded. Correspondingly, the system itself ensures that the set CO_2 reduction targets in the EU-ETS are achieved. Therefore, there is **no** need for further measures, even at the national level.

Functionality ensures emissions reduction at the lowest cost

The market actors have the option to trade CO_2 certificates among themselves. This ensures that the CO_2 reductions required to achieve the CO_2 reduction targets are undertaken by the most cost-effective measures.

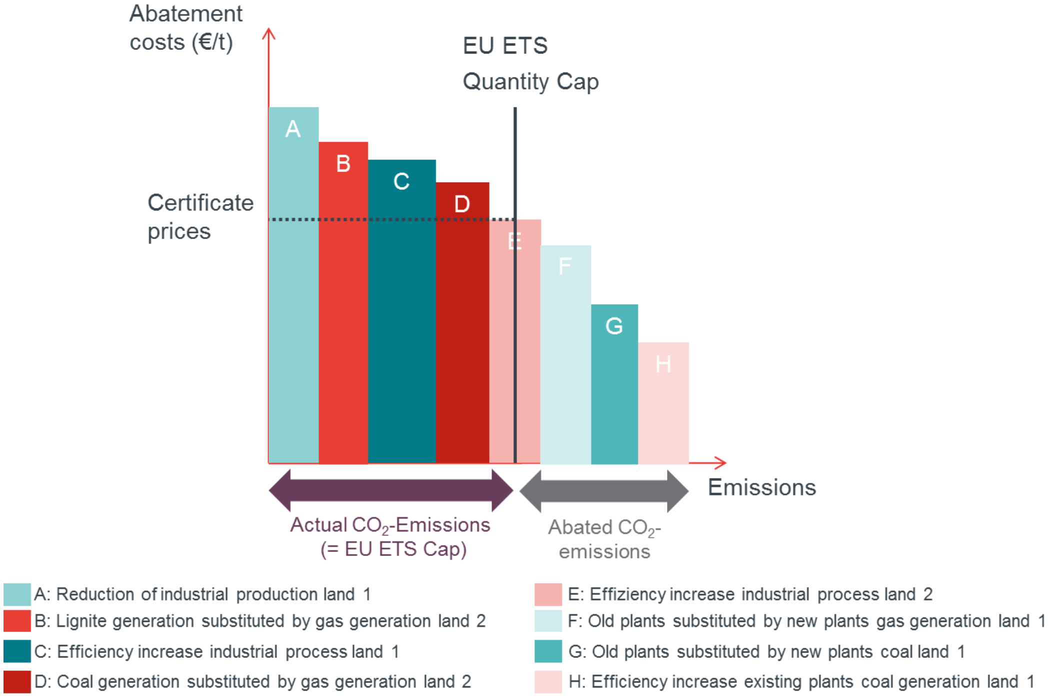
The economic calculation by operators of CO_2 emitting installations ensures the necessary optimisation in the context of CO_2 certificate trading: The plant operators face the choice of either emitting CO_2 and acquiring CO_2 certificates or avoiding emissions by not operating the plant (or operating it at a reduced scale). The costs of certificates can then be saved.[45] To this end, operators compare the certificate price in the EU-ETS with the costs (or lost profits) which would be incurred by avoiding emissions themselves. These avoidance costs may be incurred, for example, for losses in sales resulting from a reduction in production or for a change in fuel (e.g. from coal to gas). A plant operator will always avoid CO_2 when the CO_2 reduction costs are lower than the CO_2 certificate price, and emit CO_2 when the avoidance costs are higher than the certificate price.

There is therefore **no** need for a governmental rule stating in which companies, in which sectors or in which countries the CO_2 reduction should take place. On the contrary, state intervention leads to disruption of the cost effective results of emissions trading and thus to unnecessary cost increases and inefficiencies. The way in which emissions trading works is illustrated further by Figure 7.

The figure shows different example CO_2 avoidance options ordered by the amount of their avoidance costs. For the sake of simplicity, it is assumed that the avoidance options are spread over two countries.

45 The same applies in the case of a free allocation via benchmarking procedures, as is widespread for industrial sectors: in this case, the opportunity to emit and “consume” the CO_2 certificate exists in that the certificate can be sold in emissions trading.

Figure 7 Emission trading guarantees achievement of emission target at the lowest cost



Source: Frontier Economics.

In the example, on account of emissions trading, the necessary CO_2 reduction is achieved by implementing options F, G, H and, in part, E. The cost of avoidance options F, G and H are below the market price of the EU-ETS certificates. Therefore, an emissions reduction represents the cost-efficient alternative compared to purchasing certificates. Avoidance options A to D, on the other hand, whose costs are higher than the certificate price, are not used in the context of the market-based EU-ETS mechanism (or not at this time[46]). In the case of these options, it is cheaper in each case to purchase certificates at the market price than, for example in the case of option A, to reduce production levels in the industrial sector or, for example in the case of option B, to replace electricity production in country 2 in lignite-fired power stations with electricity generation in gas-fired power stations. The costs of avoidance option E are exactly equal to the certificate price, so that operators of the corresponding industrial plant in country 2 would be indifferent between undertaking efficiency increases themselves and purchasing certificates.

This market-based choice of the avoidance options used is efficient: for example, if all market participants were required to make CO_2 [reduction] efforts to the same extent, relatively costly options would also have to be implemented. This can be avoided by means of certificate trading – still, plant operators who continue to emit face the costs for emitting.

The **avoidance costs to achieve the EU's GHG target are being minimised at all times**, since the emissions reduction is always avoided by those installations,

[46] By increasing the reduction of the EU-ETS cap, over time, more and more avoidance options with higher costs will be implemented.

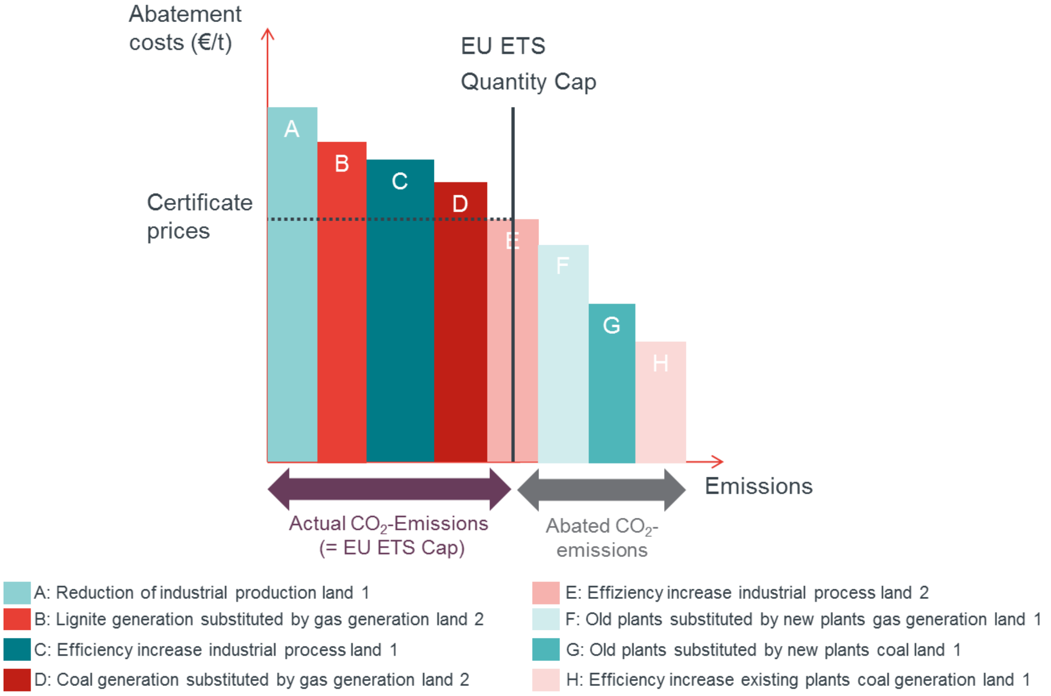
in those sectors and countries where this is possible at the lowest costs. In the example, the emissions are produced almost exclusively in country 2 because of the circumstances: this is the result of the market process, and is this is a cost efficient outcome. The cross-border trading system therefore helps to save overall costs – a core objective of the EU-ETS!

In sum, just as much CO_2 is emitted as is prescribed by the EU in the form of emission caps. This is true regardless of how

- **CO_2 certificates are originally issued.** In other words, regardless of whether certificates have to be purchased at auction for a price, as is largely required for electricity producers, or allocated free of charge, as is partly the case for industrial CO_2 emitters.[47]
- **the avoidance costs evolve**. If the avoidance costs rise – for example as a result of an economic upturn (as a consequence of which demand for electricity and industrial goods rises) total emissions in the EU ETS sectors will not increase despite higher demand for certificates, because the supply of certificates is capped. Only the market price for CO_2 certificates increases. The same is true in the opposite case: if CO_2 avoidance costs fall, for example as a result of an economic crisis, the market price for CO_2 certificates falls so that emissions become cheaper until, ultimately, all existing CO_2 certificates are used up.

[47] Free allocation is undertaken for industrial sectors which are subject to intense international competition, and the costs of the EU-ETS certificates could not therefore be passed on to customers via the prices of the goods produced. The free allocation is intended to avoid companies relocating their production to non-EU countries in order to avoid the costs of the EU-ETS (this relocation is referred to as “carbon leakage”). The amount of the free allocation is based on a benchmark emissions value. Companies should not have an incentive to raise this emissions value (e.g. by increasing production during the period in which the benchmark value is determined). The benchmark values in the EU-ETS are therefore based on the average of the EU-wide most efficient technologies per sector. Particularly efficient companies therefore receive more certificates than needed and can sell them. Companies with low efficiency, on the other hand, must purchase certificates. These mechanisms give companies an incentive to steadily reduce their emissions, despite the free allocation.

Figure 8 Emission trading guarantees achievement of emission target even to external shocks



Source: Frontier Economics.

- Finally, the question arises as to whether the functionality of the EU-ETS is at risk if in one year plant operators require fewer CO2 certificates than are issued by EU member states, i.e. there is a significant “certificate surplus”. This phenomenon could be observed due to the economic crisis following 2008 – the result was comparatively low CO_2 certificate prices of EUR 5 to EUR 8 per tonne.
- As long as it is possible to “carry over” certificates to future years and trading periods (“banking”), certificates will continue to have a value: Also in that case, the certificate value does not fall to EUR 0 per tonne, since a certificate can be kept and used for future emissions. Even if the availability of certificates should decrease in future due to intensified climate targets, the “storage” of certificates will have a value. Future scarcity therefore has an impact on today’s certificate price. **The total emissions relevant to global warming, added up over all years, do not change as a result of this;** emissions and reductions are merely “shifted” between the years. The introduction of the Market Stability Reserve (MSR) also does not change the underlying mechanism of the EU-ETS, because any withdrawal from the market is only temporary, due to these certificates.[48]
- Due to the possibility of “carrying over” certificates to future years and trading periods (“banking”), a moderate level of a temporary certificate surplus is therefore not unusual: risk-averse companies can hedge against the risk of

[48] The goal of the Market Stability Reserve, coming into effect in 2019, is to stabilise CO_2 prices by redistributing the numbers of EU-ETS certificates from times with low demand for certificates to times with high demand: If more than 833 million additional certificates are in circulation, 12% of this number is absorbed annually into the Market Stability Reserve Once the temporary certificate surplus drops below a certain threshold, certificates are removed from the Market Stability Reserve again and put up for auction.

future high certificate prices by purchasing certificates early and, for this reason, have an economic incentive not to consume (or resell) all certificates acquired or allocated in a year in the same year. In this case, certificates are used for “hedging” against future market risks.

Further cost reductions through global approaches

The idea of the international trade in CO_2 reductions within the EU-ETS has been extended to the exchange of CO_2 avoidance with third states outside the EU via so-called “flexibility mechanisms”. Since 2008 in particular, it has been possible to use avoidance potentials outside the EU to reduce emissions within the framework of the Kyoto Protocol, via Clean Development Mechanisms (CDM) and Joint Implementation (JI) measures. Under these mechanisms, industrialised countries or companies in industrialised countries, in developing countries (CDM) or other industrialised countries (JI) can finance emissions reduction measures outside the EU. In this way, they receive “credits”, which can be used to meet the emissions reduction obligation within the EU-ETS, i.e. can be converted into EU-ETS CO_2 certificates.

The flexible mechanisms have come under increasing criticism in recent years. It is disputed whether the CDM and JI measures have actually helped achieve additional emissions reductions in every case (additivity).[49] Among other things, the restrictions for the use of CDM/JI measures within the EU-ETS were tightened in 2013.[50] In the current draft of the NDCs (nationally determined contributions) under the Paris agreement, the EU envisages achieving an emissions reduction of at least 40% by 2030, exclusively within the EU. Offsetting emissions reductions outside the EU (at state level) would not therefore be possible.

Although criticism is expressed specifically about the flexibility mechanisms on account of the implementation, from an economic perspective, global approaches to emissions reduction are fundamentally to be welcomed, provided they are designed in a functional manner. They increase the cost-effectiveness of climate protection: Cost-effective CO_2 avoidance options in one region (e.g. outside the EU-ETS) can be used to meet reduction obligations in another region (e.g. within the EU-ETS), which would be associated with significantly higher costs (or vice versa). In principle, this is the same as the idea of the EU-ETS itself, in which the goal is also to develop cost-effective CO_2 avoidance options, regardless of the country in which they are implemented.

[49] Friends of the Earth (2009): “A dangerous distraction. Why offsetting is failing the climate and people. The evidence.” p. 13ff.

[50] See press release of the European Commission dated 25 November 2010 on the proposal to introduce further restrictions on reduction measures of certain industrial gases and the website of the European Commission on the “Use of international credits” for an overview of all currently applicable restrictions on the use of CDM/JI measures within the EU-ETS framework.

ANNEX B COMMENT ON THE IMPACT ASSESSMENT OF THE EUROPEAN COMMISSION

The European Commission (EC) published a short presentation entitled “Impact Assessment of 550 gr/kWh CO_2 for plants participating in capacity mechanisms” and recently a report by E3M Lab that touches on the issue of the 550g rule[51] in its Annex A. Unfortunately, at present we do not have any further and more explicit analyses from the EC on this Impact Assessment; therefore below, we briefly comment on the existing material.

Original objective of Impact Assessment

At the start of the presentation,

- reference is made to the 550g-rule in the draft of the winter package; and
- it is mentioned that the analysis is intended to show the impact of the 550g-rule on
  - CO_2 emissions and CO_2 prices;
  - installed power station capacities;
  - electricity production;
  - electricity prices; and
  - the EU’s dependency on imports.

Approach of the analysis

The EC uses the following methodology for its Impact Assessment:

- Two scenarios of power supply in Europe are defined and compared
  - baseline (PRIMES EU CO27); and
  - an alternative “Domestic Fuel Support” scenario, in which 5.7 GW of coal-based generation in Poland, Romania, Estonia and Greece are also **defined** as new, additional capacities, and these plants are subjected to a “Must Run” obligation (details in this respect are not explained in the slide pack).
- For these assumptions, the power plant utilisation, the impact on the CO_2 price, the impact on the energy price (consumer prices) and the “fuel import dependency”[52] of the EU are then determined using an electricity market model.

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[51] See E3MLab (2017): “Modelling study contributing to the Impact Assessment of the European Commission of the Electricity Market Design Initiative”. The passage from p. 139 onwards mentions the 550g-rule (unfortunately the situation of lignite plant subsidies in analysed rather than the impact of the 550g rule).

[52] It is not specified to which fuels this applies – gas, coal or both?

Our assessment

- The goal and the requirements of an analysis of the impact of the 550g-rule on the European energy sector are completely missed.
- The task of an appropriate impact assessment should be to analyse the incremental effect of the implementation of the 550g-rule and, if possible, to quantify it. Since the overall objectives of European energy policy are the efficiency/affordability, security and sustainability of the energy supply, it is appropriate to analyse the impact of the 550g-rule on these objectives.
- In this regard, the analysis shows some serious methodological weaknesses and errors:
- **Scenario approach unsuitable in several respects**
  - **Incorrect counterfactual** – as has been said, an appropriate Impact Assessment should be an analysis of the incremental effect of the 550g-rule. However, this question is not analysed at all in the EU Commission's document (neither within the slides nor the Annex A of the report). Instead – for reasons we cannot understand – consideration is given to what impact the assumed additional construction of coal-fired power stations in four countries would have. Thus, the approach offered is not suitable for an impact assessment of the 550g rule: **an Impact Assessment of the 550g-rule still does not yet exist.** It is totally unclear why power stations are constructed in one scenario and not in another (and how that is meant to be linked to the 550g-rule).
  - *Possible interpretation of the Commission's analysis: It is therefore unclear what incremental effects the Commission studied in the first place. It can charitably be deduced that the Commission analyses what effect the introduction of subsidies for coal-fired power stations would have. However, that is not what should be analysed in the Impact Assessment on the 550g rule.*
  - The development of coal-fired power stations is an input assumption for the modelling and not – as it should have been – the result of the analysis to be verified. It would have been appropriate to investigate, on the basis of simulations, the effect the additional introduction of the 550g-rule would have on the continued operation, decommissioning or new construction of power stations of different technologies. However, none of this seems to have been analysed. Instead, the construction of 5.7 GW coal plant capacity is exogenously added to the calculation as a scenario assumption. However, this assumption is wholly irrelevant to the Impact Assessment.
- The impact of the 550g-rule on the security of supply in the electricity sector is not properly analysed – even if the Commission had employed the correct comparison (with introduction of the 550g-rule): in the PRIMES electricity market model used, a level of security of supply is achieved by definition – but this is not guaranteed in practice. The modelling approach is thus unfit for analysing the effect of the 550g rule on the security of supply.
- **The effect of the 550g rule on efficiency in the electricity sector is not properly analysed** – even if the Commission had employed the correct

comparison (with introduction of the 550g-rule): Only impacts on end-user electricity prices are reported in the framework of the Impact Assessment. Impact on the system costs or prices on the wholesale market or capacity markets are not fully analysed. Therefore, the analysis is incomplete.

It should also be mentioned that the European Commission assumes that, in one way or another, no emissions in the energy industry are saved – in the "Domestic Fuel Support" scenario, the CO_2 prices rise as a consequence of the additional "coal generation defined herein" and the binding emissions cap: this is precisely the "water bed effect" we also predicted in our analysis: If coal-fired power stations are forced out of the market then the CO_2 prices would fall at first, but emissions would remain unchanged overall; cf. section 2.1 above.

Possible interpretation of the Commission's analysis: All the Commission actually shows is that if a capacity mechanism were introduced without a 550g-rule, CO_2 output would remain unchanged, even if coal-fired power stations should be built up as a result of the introduction of a capacity mechanism.

Even if the Commission had employed the correct comparison (with introduction of the 550g-rule): The Commission itself confirms that there is no change in the CO_2 output. Any change in policy (apart from one which reduces the supply of certificates) is therefore ineffective in the eyes of the Commission from a climate policy perspective. We had also already demonstrated this (section 2.1 above).

Conclusion – The Commission does not examine the impacts of the 550g-rule: it examines the subsidisation of 5.7 GW of new coal-fired power stations in Eastern Europe (as a result of the incremental introduction of a capacity mechanism without 550g-rule?). The impact the incremental introduction of the 550g-rule has, still remains entirely unanswered in the Commission's analysis. There is still no sound Impact Assessment on the part of the European Commission. Thus, the formal requirements for testing the impact of the 550g-rule are still not satisfied.

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