CHAIRE EUROPEAN ELECTRICITY MARKETS
Fondation Paris-Dauphine

# EUROPEAN ELECTRICITY AND CARBON MARKETS AFTER THE ETS REFORM: IS A NEW REFORM NEEDED?

**The present document summarizes the main messages outlined during the Seminar organised by the Chaire European Electricity Markets (CEEM) at University Paris-Dauphine on November 8, 2018.**

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*All presentations are available on the Internet site of the Chaire EEM*: Click here.

## INTRODUCTION

Recent events raise several questions to which this conference may hopefully bring some answers. For instance, how to explain the recent upsurge of the $CO_2$ allowance price in the EU-ETS market? What are the consequences of this increase on the decarbonisation of the electricity sector? Does this rise lead to lower $CO_2$ emissions? We also see demonstrations led by the increase of oil price. It reminds us that giving carbon a price is certainly a central tool for tackling $CO_2$ emissions, but a price cannot be a substitute to a social policy. This is apparent in Germany, where the government hesitates between a strictly political decision to shut down its coal-fired plants or an economic approach driven by the carbon price. Although the Dutch government has decided in favour of a strategy based solely on a high $CO_2$ price, it seems that the optimal combination consists in associating the price with policy and measures.

I- STATE OF THE EU ETS POST REFORM AND OUTLOOK FOR POWER MARKETS DECARBONISATION

**A New Concept: The Effective Carbon Rate**

For $CO_2$ emitters, the value of carbon includes three components: the price of carbon from market tools such as the ETS system, the level of specific taxes on $CO_2$ and the amount of more general taxes on energy. We will designate the value resulting from the combination of these three components under the term "Effective Carbon Rate" (ECR). It measures the strength of price-based incentives to reduce $CO_2$ emissions from energy use. Its composition varies considerably according to the sector: while taxes constitute 99% of the ECR in road transport, they represent only 21% in the electricity sector.

Operators are encouraged to undertake any action to reduce emissions whose cost will be lower than the ECR; the reductions are thus decentralized. Two examples confirm that we obtain a maximum volume of reduction for every euro invested:

- In the United Kingdom, the introduction of a tax pushed the ECR from 7.24 to 32.4 €/t$CO_2$ between 2012 and 2016 for the electricity sector; in the same period the latter decreased its emissions from 156 to 66 Mt$CO_2$.
- In Australia, the application of a tax within the electricity sector between 2012 and 2014 caused a 6% emission drop over the period; emissions went up again as soon as the tax was removed in 2014.

The ECR appears to be a relevant indicator as it takes into account multiple factors, for example the fact that some industries benefit from free allowances in the EU-ETS. It is understandable that its "tax" component allows the ECR to remain significant even under the assumption of a strong reduction in emissions, whereas the price of the quota in the EU-ETS would then become extremely volatile.

It is possible to calculate a "Carbon Pricing Gap" that shows the extent to which prices are in line, or not, with the levels to decarbonise smoothly. The exercise was conducted for the 42 Member States of the OECD and for the G20 countries. If we consider a benchmark ECR of 30 €/t$CO_2$, then the average gap for all the countries studied reaches 76.5% in 2018. It has certainly decreased since 2012, when it was 83%, but at this pace it will not close before 2095...

At the country level, the Carbon Pricing Gap is also an indicator of long-run competitiveness:

- A zero gap indicates that a country decarbonises at lowest costs
- A high gap shows that decarbonisation efforts remain limited or likely are overly costly
- A high gap may increase sovereign risk, such as economic hardship and crisis due to a sudden variation in the demand for fossil fuels, a technological breakthrough, lawsuits...

The Carbon Pricing Gap differs greatly by sector. Compared to a benchmark ECR of 30€/t$CO_2$, it is only 21% for transport but 91% for industry. It also differs considerably across countries: 41% in France, 53% in Germany, 75% in the United States, 90% in China... If China extended nationwide a market for emission permits or generalized a tax of 250 RMB/t$CO_2$ (about 32 €), it would reduce its gap to 42% and that of all countries studied to 43%! Within the EU, with a price of 30€/t$CO_2$ in the ETS system the deficit would fall from 52% to 18% for the 22 largest States. Globally, the margin of progress remains important: 46% of all emissions are still unpriced in 2018.

**The ETS Post-Reform: Impact of the Adopted Changes until 2030**

Since 2009, the European Emissions Trading Scheme (ETS) is hindered by a surplus of allowances compared to counterfactual emissions. Given this surplus already in the market, one needs to anticipate a shortage after 2030 to have a non-zero price today. Three measures have been adopted to create this expected scarcity, inducing a higher price equilibrium:

1. The auctioning timetable for the 2013-2020 ETS phase was adapted to allow for the delayed auctioning ("backloading") of some 900 million allowances that would have been auctioned in 2014-2016.
2. The linear reduction factor of the ETS cap will be raised from 1.74% per year to 2.2% per year from 2021.
3. Each year from 2019 to 2023, 24% of the cumulative surplus of allowances will go to the Market Stability Reserve (MSR); from 2023 the allowances held in the reserve above the total number auctioned during the previous year will be cancelled.

The effect of the reform was assessed by the Climate Economics Chair with the Zephyr model. In this simulation model, supply equals observed free allocation, auctions and offset (ex post) or allocation as written in adopted texts (ex-ante). Demand is represented by counterfactual emissions depending on observed and projected industrial production, renewables and energy efficiency (the assessment was done before the adoption of the new 2030 targets resulting from the recent Trilogue). According to Zephyr, the reform will lead to an overall withdrawal of nearly 4 Gt $CO_{2eq}$ allowances by 2030, compared to a no reform situation. The surplus should then fall from about 3 to 2 Gt and the allowance price should increase from 13 to 38 €/t by 2030.

Without any unexpected shocks and all things remaining constant, it seems that the adopted reform is sufficient to put the price back on a 25 -40 €/t range up to 2030. However, more simulations showed that the MSR is not able to neutralize the effect of the "companion policy" related to the promotion of renewable energy. In high renewable energy scenario, the model indicates that the allowance price remains below 25 €/t until 2030. The MSR is neither able to neutralize the effect of an economic crisis of the same magnitude than in 2008. Should such a crisis happen again in 2022, simulation results in a price of 12 €/t in 2030.

As all models, Zephyr has some weaknesses, such as not including the price of primary fuels or being extremely sensitive to the counterfactual emissions. Keeping this caveat in mind, the Zephyr model reveals that in the event of disruptions such as policy interactions or economic cycle, the Market Stability Reserve does not stabilize the market. A real stabilizer would be a uniform price floor for all sectors and all countries (as is the case for example in the US). The option of having a partial price floor on some countries/sectors instead of the entire ETS perimeter seems like an additional destabilizing factor. Even with a uniform ETS price floor (and ceiling), the necessity to reform the price levels over time would still exist.

## II- COULD A CARBON PRICE FLOOR SUPPORT A MORE AMBITIOUS DECARBONISATION OF THE POWER SECTOR?

**The Impact of a Carbon Price Floor on the German Power Sector**

Any German climate policy requires the closure of the thermal generation fleet, as the electricity sector emits more greenhouse gases than the transport and industry sectors together. The German Federal Government has set up a "Coal Commission" to propose, on the one hand, a timetable for the phase-out of this energy and, on the other hand, measures enabling the last three mining regions to prepare for this transition. This commission will rely in particular on simulations delegated to Öko Institut e.V.

The first studies of the Institute show that results differ widely depending on the hypothesis used to build the models. If we assume that the market sends long-term scarcity signals, then the allowance price will still be high in 2023. If we deem that the allowance price results from short-term market fluctuations, then the price could remain low even beyond 2023, despite the cancellation of allowances stored in the Market Stability Reserve. Moreover, the price of fuels drives switches. Thus, since gas was rather cheap at the beginning of 2018, a 25 €/t allowance price was sufficient to run combined-cycle gas plants rather than old hard coal-fired plants, but the price should have exceeded 50 €/t to trigger a switch from old lignite plants to these same gas plants.
In its current design and setup, the contribution of the EU ETS to a rapid power sector decarbonisation remains questionable or at least uncertain for the next decade. However, carbon pricing is not the sole solution. Öko Institut published in 2014 and 2018 studies assessing the consequences of various options with 2020 as time horizon[1]. A third study to be soon published will consider 2025 and 2030 as time horizons. All studies are based on one fuel price scenario. Options are:

- A unilateral carbon floor-price for Germany at various levels,
- A carbon floor-price for the CWE countries (Centre West Europe) at various levels,
- Two different forced shut-down strategies,
- Hybrid approaches (floor-price and forced shut-downs).

The simulations show that the effects of a carbon floor-price are higher than those of exclusive forced shut-down policies. For instance, a floor price of 25 €/t in Germany alone would lead to 91 Mt$CO_2$ emission reductions in the country by 2020 compared to the reference scenario (43 Mt at EU scale, as emissions would increase in other Member States[2]). A price of at least 30 €/t would be needed at regional level if the German power sector were to achieve its target for 2030 (- 40% emissions). In the latter scenario, Germany would remain a net electricity exporter but at a lower level than in the reference scenario (25 TWh instead of 80 TWh in 2030); the price of electricity would increase to 48 €/MWh (instead of 40 €/MWh).

Some interactions with other mechanisms need to be considered:

- Interactions between German renewable energy surcharge (*EEG Umlage*) and wholesale market prices will compensate more than 50% of retail price effects for non-privileged end-consumers (approximately 2/3 of total consumption).
- With a floor-price add-on to the allowance price, large electricity consumers should be eligible for compensation of indirect $CO_2$ costs. This will lead to effective electricity costs which are approximately 10% less than for the wholesale price effects of exclusive forced shut-down mechanisms that trigger comparable $CO_2$ emission reductions.
- A floor-price has a positive side-effect: it enhances the profitability of wind farms generation beyond the contract period, hence extending their duration of life.

[1] Öko Institut e.V., *Integrating a carbon floor price in the policy mix for Germany's coal phase-out*, Berlin, March 2018

[2] A study by the French Transmission Operator RTE confirms this "rebound effect". The closure of the French coal power plants would induce an emission reduction of 7 Mt$CO_2$ in France, but at EU level the reduction would only be 4 Mt$CO_2$.

- A carbon floor-price will create significant additional revenue streams for most producers (at different levels) and for the public budget (50% of additional revenues would, however, be needed for compensation of indirect $CO_2$ costs in the German case).

In conclusion:

- Modelling and analysis of policies and politics show that there would be many benefits from a France-Benelux-Germany carbon floor price (overall efficiency gains, higher emission reductions with lower losses of firm capacity, lower electricity costs for electricity-intensive industries due to compensation of indirect $CO_2$ costs).
- The Dutch approach (start with ~20 €/t $CO_2$ and end with ~40 €/t $CO_2$ in 2030) is an interesting blueprint for a CWE carbon floor price.
- The British way needs to be the role model for implementation (it is compatible with legal constraints in Germany and provides compensation of indirect $CO_2$ costs for electricity-intensive industries).
- It is necessary to overcome the political narrative "*French nuclear will be the big beneficiary*" of a carbon floor price. Distributional effects mobilize politicians. Oddly enough, they focus on France, although other countries like Norway and Sweden would benefit from a carbon floor price.
- A hybrid approach (carbon floor price + some early capacity buy-out) seems to be a promising approach for Germany.
- A floor-price may not be adapted permanently, though; it is unsuitable when the share of renewable sources drives the electricity price near zero on power markets.

**The Impact of a Carbon Price Floor on the European Power Markets**

The power sector has a key role to play in the decarbonisation of the European economy. FTI-CL Energy has been mandated to assess the EU ETS price outlook and resulting progress against EU objectives and to identify the possible contribution of a carbon price floor to an efficient decarbonisation of the power sector. More information about the study can be found on this link: HERE.

The assessment is conducted with the use of fact-based modelling and assumptions based on third parties recognized independent studies. The model shows that despite the recent reform, projected ETS prices are insufficient to drive the decarbonisation of the EU power sector to a level compliant with the overall target of 80 to 95 % emission reductions by 2050. Current prices are lying around 20 €/t when the analysis suggests that sustained coal and lignite to gas switching across Europe would require prices around 15-35 €/t in the near term and around 20-50 €/t in the 2020s. In the long run, carbon prices may need to reach 130-150 €/t from 2040 on to drive a full decarbonisation of the EU economy.

It should be underlined that what matters is not the actual price but the anticipated price. Investors focus on the *expected* carbon price and the risk that the price in the future may be lower than anticipated. Furthermore, any volatility of the carbon price will reflect on the electricity price and on the cost of financing for new investments. This will in turn affect the cost of generating electricity from capital intensive technologies. Greater exposure to power price risk ("merchant risk") would increase the risk premium required by investors, reduce debt levels achievable in the capital structure of projects ("gearing") and finally reduce the pool of investors willing to fund projects. Conversely, a carbon price floor reduces the premium due to the electricity price risk on wholesale power markets.

Different implementation models for a CPF could be used:

1. Permit buybacks – the Government or a market operator could commit to buying allowances at a minimum price.
2. An auction reserve price (e.g. the Government could hold back permits from auction if the price went below a certain level).
3. A top up tax on the ETS. This tax should be based on a forecasted trajectory; it should not be adjusted each year by budgetary vote, as it is the case with the UK model.

The simulations show that a Carbon Price Floor (CPF) would ease the power sector transition[3]:

- CPF acts as an insurance mechanism for investors, protecting them against sudden ETS price drops caused by a significant demand/supply imbalance, and against potential weak macroeconomic conditions leading to oversupply and insufficient abatement.
- Emissions in the CPF countries could be significantly reduced in 2030, and a coordinated ETS policy could lead to net emission reductions across the EU as whole. Coordination is notably needed to ensure automatic cancellation of extra allowances by involved Member States, as authorized by the new directive. The MSR is not adapted to cancel the surplus resulting from a CPF.
- Electricity and emissions leakage through cross-border flows can be minimised by an ETS policy to maintain ETS demand levels and by ensuring that the CPF zone is of a minimum acceptable size. According to the model, the CPF zone will remain a net exporter of electricity even in the hypothesis of a high carbon price.
- Renewables investment would be supported in a world where projects are increasingly exposed to merchant price risk. If we remove subsidies without a CPF, investments in renewable energy sources could decrease dramatically. A credible and predictable carbon price floor would reduce the cost of capital and provides some more certainty for the investors.
- A CPF would drive greater coal to gas switching and provide a clearer investment signal to avoid lock-in of fossil plants.
- The CPF would increase power prices in the short to medium term (to 2025) through the impact on coal and gas plants generation costs. However, in the medium to long term (after 2030) this is counterbalanced by the "merit order effect", which leads to lower wholesale power prices win the CPF scenario: if the CPF encourages higher renewables penetration, this shifts the merit order and lowers market prices.
- Impacts on Energy Intensive Industries can be mitigated using Government revenues raised from the CPF.

[3] The simulations do not include the aviation sector.