WELFARE DISTRIBUTION EFFECTS OF INTRODUCING A MULTICOUNTRY CARBON PRICE FLOOR IN THE 2030 EU POWER SYSTEM

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Overview

A significant share of the EU power sector falls under the EU Emission Trading System (EU ETS) where as of 2005 CO_2 emission rights are traded, and demand and supply of these rights determine a price per ton of CO_2-equivalent. Due to the economic crisis of 2008, an oversupply of CO_2 allowances resulted, leading to a significant drop in CO_2 prices [1]. This fuelled the discussion on whether the design of the EU ETS was sufficient to serve its purpose, i.e. stimulating low carbon investments. Subsequently, the EU ETS, which is viewed by the European Commission as the main mechanism for meeting climate targets [2], was reformed in steps to improve its effectiveness. As of 2014, measures were taken to reduce the oversupply of allowances (see [2]). Due to these measures and due to hedging behaviour, the CO_2 price increased. However, it is still volatile and the discussions on the effectiveness of EU ETS are ongoing, initiating (political) discussions on alternatives, e.g. a CO_2 minimum price.

Currently, some EU countries are discussing the implementation of a Carbon Price Floor, CPF. Only the UK has implemented a CPF[1] that became effective as of 2013. However, in the UK the continuation of the CPF – since no price is set beyond 2021 - is uncertain due to mixed perceptions ([3],[4]). E.g., consumer groups and industry said that it has disadvantaged them due to higher energy bills and reduced competitiveness, respectively. On the other hand, many power companies are in favour of the CPF since it stimulates low carbon investments. To take it one step further, various stakeholders point out the need for collaboration between countries for implementing a CPF to provide longterm investment signals and to maintain an equal 'level-playing-field'. In December 2018, nine EU countries[2] signed a declaration for strengthening CO_2 pricing in the EU where they commit to cooperate[3]. However, Germany[4] did not sign the declaration and a debate followed. Again, the main objections related to the impact on welfare distribution, i.a. the expectation that the nuclear dominated French power sector would mainly benefit from a regional CPF.[5] Therefore, a country's decision whether to introduce a (regional) CPF seems to highly depend on (anticipated) welfare distribution effects. This is also pointed out by [5]: "*..dealing with political narratives around winners and losers of a floor price is a key prerequisite for its successful implementation..*".

This study will look into the CO_2 emission effects and welfare distribution effects of the main stakeholders on the EU power market only, assessing the impact of introducing a multicountry CPF, assumed as a top-up tax. More specifically, the questions to be addressed are the following: 1) *what is the impact on social welfare and CO_2 emissions when a regional CPF is introduced, and the impact of Germany deciding to cooperate or not?*, 2) *what is the impact on social welfare and CO_2 emissions in case the EU ETS price is considered sufficiently high?*

Methods

In order to assess this, four 2030 scenarios are analysed utilizing the EU electricity market model COMPETES:

- Reference scenario: Low EU ETS price
- Alternative scenario 1: Low EU ETS price & multicountry CPF (see countries listed in footnote 2)
- Alternative scenario 2: Low EU ETS price & multicountry CPF (including DE)
- Alternative scenario 3: High EU ETS price

According to [3] a carbon price of 15-20 €/tonne would accelerate the decommissioning of less efficient power plants, while a carbon price of around 30 €/tonne would, according to [3] and [5], lead to significant emission reductions. Hence, to represent the low EU ETS price, a CO_2 price of 15 €/tonne is assumed for 2030, which is also in line with CO_2 price projections in [6] that can be considered as a relatively low price path. For the high EU ETS

[1] In UK the CPF was initially aimed at £30/tonne in 2020. However, in 2014, the CPF was capped at £18/tonne (about 21 €/tonne) for the period 2016-2020 which was extended in 2016 up to 2021 [3].
[2] Denmark, Sweden, Finland, France, UK, The Netherlands, Portugal, Ireland and Italy.
[3] https://www.gouvernement.fr/sites/default/files/locale/piece-jointe/2018/12/2018.12.12_statement_carbon_pricing.pdf
[4] Where about half of the 30 most polluting entities are located [1]
[5] https://www.euractiv.com/section/energy/news/franco-german-new-cooperation-treaty-drops-carbon-price/

price, and multicountry CPF, a price of 30 €/tonne is assumed for 2030. Furthermore, installed capacities and demand will be based on the ENTSO-E Sustainable Transition scenario [7] that can be considered as a ‘business-as-usual’ situation.

The model that is utilized, COMPETES[6], is an hourly power optimization and economic dispatch model that seeks to minimize the total power system costs of EU[7] power market whilst accounting for the technical constraints of the generation units, transmission constraints between the countries as well as generation capacity expansion for conventional technologies. The model assumes a perfectly competitive market. With COMPETES the following results can be obtained on an hourly basis that are relevant for this study: electricity prices; production per technology; trade flows of electricity; CO_2 emissions. Furthermore, from the investment module of COMPETES the impact on generation (dis)investments can be assessed (NB: renewable capacities will be assumed as fixed).

Results

The runs are not finalized yet, but the welfare assessment per country/node of the three alternative scenarios, using modelling results, will be based on the following indicators that are calculated w.r.t. the reference scenario:

- Change in Producers’ surplus (PS): short-run producers’ profits (generation revenues – generation costs) + (annualized) investments in thermal capacity and avoided fixed costs for decommissioned units
- Change in Consumers’ payments (CP): determined by (hourly sum of) product of demand and e-prices
- Change in TSO’s Congestion Rents (CR): theoretical congestion rents are determined by the product of hourly price differences between two corresponding connected nodes and the power flows[8].

The sum of the indicators listed above give an overview of ‘losers’ and ‘winners’ per alternative scenario on a country/nodal level. Other indicators to be assessed are: the change in installed capacities; change in CO_2 emissions; (average) consumer prices; (net) import or export; and production per technology.

Conclusions

The results will give a better insight in who will be the ‘losers’ and ‘winners’ within a country and between countries of introducing a CPF, however for the power sector only and with respect to the modelling assumptions. This study also will give further insight into the relevance of Germany cooperating in a multicountry CPF and the impact on CO_2 emissions.

References

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[7] ENTSO-E, 2017, TYNDP2018 – Maps & Data: https://tyndp.entsoe.eu/maps-data/

[6] COMPETES UC is an extension of COMETES Model (Hobbs and Reijkers (2004a)) which has been developed in cooperation with Benjamin F. Hobbs, Professor in the Whiting School of Engineering of The Johns Hopkins University, as a scientific advisor of ECN.TNO/PBL.
[7] EU28 (excl. Cyprus and Malta), Norway, Switzerland and Balkan countries.
[8] The Congestion Rent is assumed to be divided on a 50-50% basis for the corresponding connected nodes/countries.