

Extended ETS outperforms carbon border adjustment in the power sector

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Carbon leakage occurs in any carbon pricing regime that is not global, which means all of them so far. That is inherently unfair to sectors that are subject to a carbon price but compete with those that are not. The European Green Deal aims to rectify the problem in the EU Emissions Trading System (ETS) by moving beyond the current second (or third) best option, which allocates emissions quotas for free for industrial sectors, and putting a [price on carbon at the EU border](#) for selected but not yet named sectors. The merits with respect to energy-intensive industries have already been [questioned](#). What would a [border carbon adjustment](#) mean for the European power sector?

Our recent model-based analysis, which uses REKK's [European Electricity Market Model \(EEMM\)](#), concludes that expanding the EU ETS is a more effective policy option because it would reduce emissions, while a carbon border adjustment would not. The aim of the analysis was to shed light on how the differences in the two policy tools translate into markedly different impacts. The modelling captures how power plants would respond to the introduction of these carbon policy tools in their operational decisions and opportunities. We did not model the impact on investment decisions; the various generation capacity mixes are exogenous and based on the official EU scenario EUCO3232.5.¹

Coverage and regions used in the analysis

The analysis splits countries neighbouring the EU into three geographically separated regions:

- WB6 (Albania, Bosnia and Hercegovina, Kosovo, Montenegro, North-Macedonia and Serbia)
- Eastern Europe (Belarus, Moldova and Ukraine)
- Turkey

These regions are contiguous and grouping states to such regions treats the problem of electricity origin. The analysis refers to the EU+ region, which includes the 27 EU Member States plus Switzerland, Norway and the UK. Trade between Spain and Morocco is not included, and the trade with Russia is kept on an exogenously set level in the model.

¹ [Technical Note Results of the EUCO3232.5 scenario on Member States](#)

Scenarios

The study focuses on the different impacts of two policy tools: the border carbon adjustment (BCA) and the expansion of ETS (ETS+) to all the three non-EU regions modelled. We developed two scenarios for the BCA:

- BCA based on the carbon intensity of the imported source from non-ETS regions - (REG-CO₂)
- BCA based on the average carbon intensity in the EU+ countries modelled - (EU-CO₂).

The first scenario BCA is based on the assumption that the carbon tax should reflect the carbon intensity of the power imported to the EU, while the second considers the tax a tool for creating a simplified, level playing field for EU and non-EU competition, by assuming the average carbon content of the EU power mix.

All graphs below show the difference in the various modelling outputs of the ETS+ and BCA scenarios respectively compared to the reference scenario.

Assumptions

The assumed CO₂ prices are based on EUCO32325 i.e., 25.1 euros/tonne in 2025 and 30.6 euros/tonne in 2030. The analysis includes a sensitivity analysis for the CO₂ price (+/- 10 euros/tonne). The CO₂ tax levels in the BCA scenarios are the outcome of these CO₂ price projections and the modelled CO₂ intensity projections (per region) for 2025 and 2030.

Table 1: Regional level CO₂ intensities used in the modelling and the derived CO₂ tax levels for 2025 and 2030

	CO2 intensity in REF scenario, t/MWh		CO2 tax level, €/MWh	
	2025	2030	2025	2030
EU+	0.22	0.16	5.42	5.01
WB6	0.72	0.64	18.00	19.73
UA+BY+MD	0.29	0.21	7.28	6.42
TR	0.40	0.33	9.95	10.17

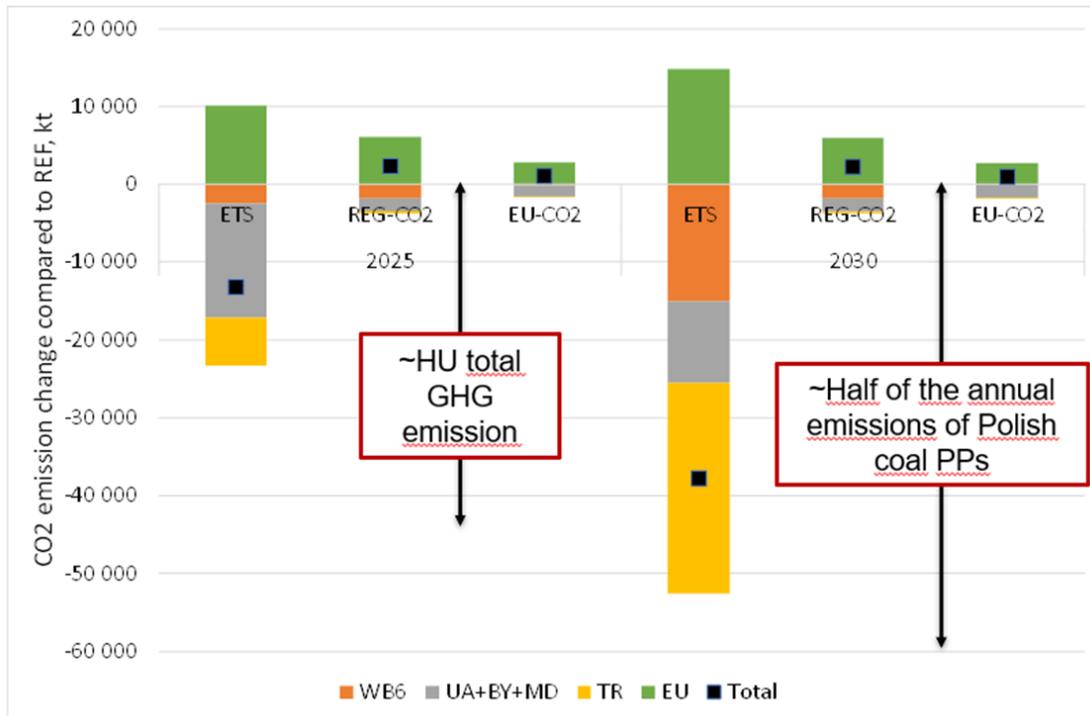
Table 2: Assumed generation capacity per region in 2025 and 2030 in gigawatts

	2025					2030				
	Coal +lignite	Natural gas+Oil	Nuclear	Hydro	Other RES	Coal +lignite	Natural gas+Oil	Nuclear	Hydro	Other RES
EU+	116.3	214.6	111.8	211.7	498.0	91.9	191.8	108.8	218.7	616.0
WB6	9.6	1.3	0.0	10.6	2.3	9.6	1.1	0.0	13.0	4.5
UA+MD+BY	12.1	9.9	16.2	5.9	7.2	5.2	9.8	16.2	6.0	10.3
TR	20.0	18.0	5.8	26.4	31.8	19.7	15.8	9.3	26.4	44.5

Impact on emissions

The two policy options have markedly different impacts on carbon dioxide emissions. Counterintuitively, our analysis shows that the border carbon adjustment increases overall carbon emissions. Emissions increase in the EU as additional coal-fired and gas-fired generation comes online to substitute for the fenced-off imported generation. This increase exceeds the emissions reductions in the exporting countries, where gas power plants reduce their production to make room for coal generation that is no longer imported to the EU. A larger EU ETS, however, would reduce emissions by 52,000 kt in 2030 compared with business as usual, an amount slightly less than the annual emissions of Polish coal plants. Expanding the ETS reshuffles the merit order (i.e., the order in which power plants are called on to meet demand) by driving up the cost of dirty coal and lignite plants in the West Balkans, Turkey and Ukraine and crowding those plants out. It is worth noting — especially in the context of the current upgrading of 2030 climate targets — that EU emissions compared to the reference scenario will increase regardless of the policy tool. used. A higher-level BCA results in larger change compared to the reference scenario (REF), but this is relatively less important than the choice of tool, i.e., BCA versus ETS.

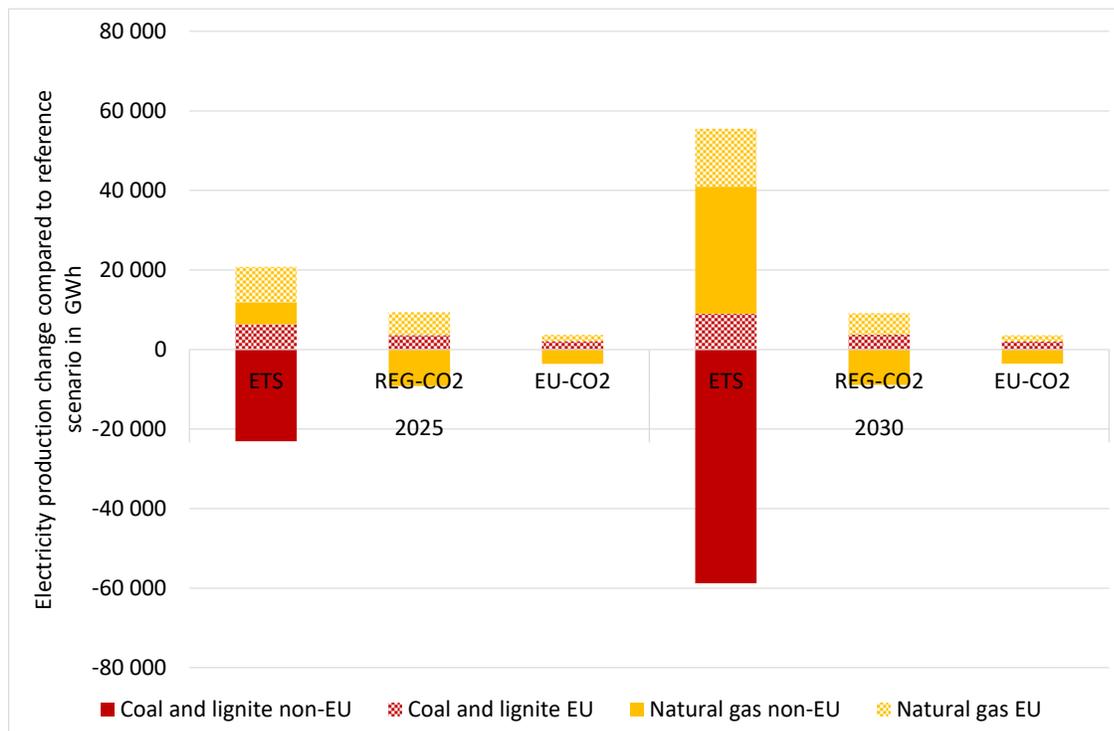
Figure 1: CO₂ emissions changes in the three scenarios, compared to reference scenario, in 2025 and 2030



Impact on the electricity mix

The different logic of the two tools shows up in the resulting electricity mix, more specifically in the impact on fossil-fuelled generation. The emissions reductions due to the ETS in the exporting countries is the result of a marked reduction — 60,000 gigawatt-hours — of coal and lignite generation in 2030 compared with business as usual. This is predominantly replaced by gas-based power generation both within the EU and in the exporting countries. By contrast, the border tax results in resource shuffling in the regions well interconnected with the EU (the West Balkans); the same coal and lignite plants instead sell power to domestic consumers and not for export. While the ETS and the carbon tax put a price on the carbon intensity of each generation unit, a border tax essentially socialises to cost of carbon intensity of the region in which the unit operates or in the EU. The overall production of WB6 coal plants remains unaffected by the border tax, but their profitability suffers as they get locked into their domestic region. Moreover, they crowd out domestic gas production.

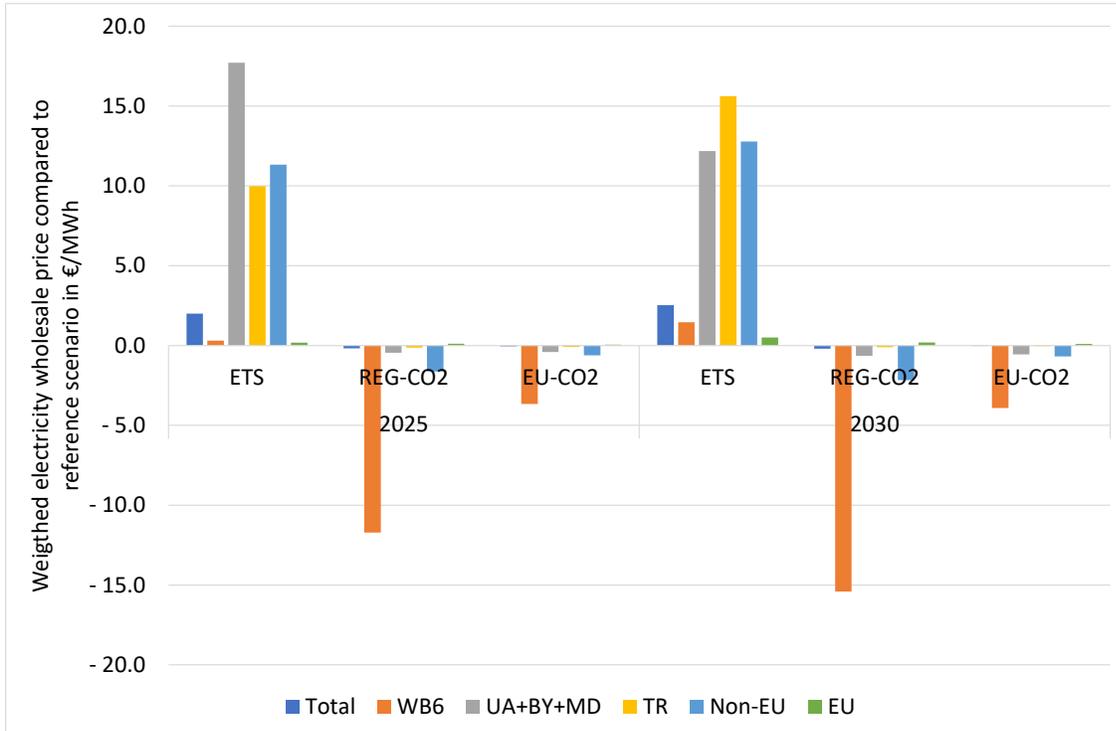
Figure 2: Changes in coal/lignite and gas-based power production in the three scenarios, compared to reference scenario, in 2025 and 2030



Impact on prices

The impact on wholesale prices in the EU is negligible with either policy tool. Expanding the ETS increases the price in the exporting countries by approximately 10 to 15 euros per megawatt-hour, except for the WB6 countries. A border adjustment has a negligible impact, except in the West Balkan countries, which would enjoy a price cut of a similar size. Their originally high level of energy export — facilitated by their better network integration with EU countries — is reduced significantly. Instead, their coal power plants continue to generate but sell their output at a lower price to domestic consumers.

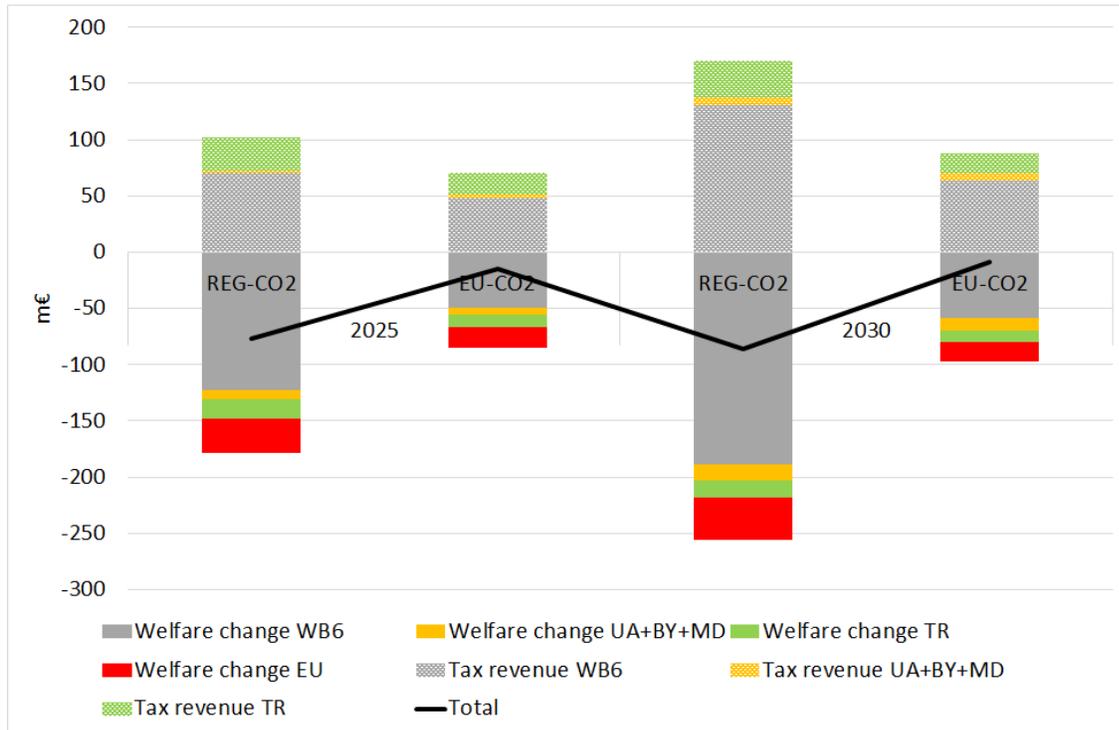
Figure 3: Price changes in the three scenarios, compared to reference scenario, in 2025 and 2030



Impact on revenues

Changes in wholesale prices always translate into changes in welfare. If prices go up, producers are better off but consumers pay higher bills. And it's the other way around in the case of price reductions. Tax revenues — if the EU should decide to channel it back to the neighbouring countries to assist their energy transition — would be roughly equal to the aggregate detrimental impact of a border tax for these regions. Higher tax level would imply higher welfare effect. The ETS, however, would generate 1.4 billion euros in 2030 for the six West Balkan countries, significantly more than the 70 to 140 million euros generated by the border carbon adjustment.

Figure 4: Welfare change and tax revenue in the two BCA scenarios in 2025 and 2030



Summary: Impact on countries exporting power to the EU

Expanding the geographical scope of the EU ETS — or setting up a national or regional ETS² or carbon tax³ — is a more effective climate policy tool than a border adjustment mechanism. Emissions trading brings real competition: Regions neighbouring the EU will be better integrated into the EU single market with a level playing field and lower greenhouse gas emissions. On the other hand, the border carbon adjustment would fence off the EU power sector and increase greenhouse gas emissions. Significantly lower wholesale prices in the West Balkans reduce the incentives for energy efficiency investments, increase the need for support to renewable energy sources and discourage low-carbon generation investments. Compared to a border carbon tax, expanding the ETS also yields more revenue to exporting neighbouring countries facing higher-than-average challenges to change their fossil-heavy power systems. In addition, the border carbon adjustment requires a new mechanism and the blessing of the World Trade Organization, and means settling for an inferior alternative to a larger ETS across countries that already have integrated power systems and markets. And we should not forget that many of these countries would like to be EU members — a bilateral process, unlike the imposition of a border tax.

Table 3: Summary of results of analysis of the two policy tools

	ETS+	BCA
CO ₂ emissions total	Reduce	Increase
CO ₂ emissions EU+	Increase	Increase
Power mix	Non-EU coal is crowded out by gas and EU coal	No impact on coal-based generation but crowding out of non-EU gas: "reshuffling"
Wholesale price	No impact in EU+ 10 EUR increase in non-EU	No impact in EU+ No impact in non-EU (except WB6)
Welfare and revenue	An order of magnitude higher than BCA	Approx. equal for each non-EU trading region

² Montenegro and North Macedonia

³ Ukraine