EFFECT OF CHANGING TURKEY'S ELECTRICITY MIX ON ADAPTING THE STEEL INDUSTRY TO EUROPEAN GREEN DEAL

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Overview

European Union Green Deal (EUGD) is a set of proposals to make the EU's climate, energy, transport, and taxation policies fit for reducing net greenhouse gas emissions by at least 55% by 2030 [1]. One of the critical aspects of EUGD is Carbon Border Adjustment Mechanism (CBAM). According to CBAM, EU importers will buy carbon certificates corresponding to the carbon price that would have been paid had the goods been produced under the EU's carbon pricing rules. Conversely, once a non-EU producer can show that they have already paid the price for the carbon used in making the imported goods in a third country, the corresponding cost can be fully deducted for the EU importer. The CBAM will help reduce the risk of carbon leakage by encouraging producers in non-EU countries to green their production processes [2].

Turkey's biggest export market is European Union. Amongst the products that Turkey exports to the EU, steel has an important place, with the annual steel export of Turkey being worth $12.6 billion and approximately 30% of the steel that Turkey exports going to the EU. The expected growth in Turkish iron & steel production is most noticeable, associated energy needs increasing by 48.5% in a 10-year period from 2021 until 2031. Being a highly energy-and-carbon-intensive product (with average electricity consumption of 395 kWh/ton being required for steel production) [3], steel is one of the prior targets of the CBAM. Consequently, Turkey is likely to be significantly affected by the CBAM come 2026. Thus, Turkey is in the process of developing policies and mechanisms for reducing its greenhouse gas (GHG) emissions. One of these mechanisms is the addition of nuclear energy into Turkey's electricity mix. Turkey plans to commission its first nuclear power plant in Akkuyu-Mersin in 2023 and to commission a second plant in Sinop before 2030. In this study, the effectiveness of adding nuclear energy into the Turkish electricity mix on the GHG emissions associated with steel production have been analyzed.

Methods

The carbon footprint of Turkish steel has been calculated by employing the life cycle assessment (LCA) approach by using CCaLC software and the CML2001 methodology. The change in the carbon footprint of steel production has been estimated by assuming that the entire electricity generated in the nuclear power plant will replace natural-gas-originated electricity, thereby significantly reducing the carbon footprint of Turkish electricity. Turkey plans to create 38.7 TWh/year of electricity from nuclear power [4]. In recent years, Turkey's annual electricity production has been approximately 291.5 kWh, with the share of natural gas being around 27.4%. Thus, about 79.9 TWh of electricity is generated annually from natural gas. In the light of the figures provided above, our scenario assumes that the amount of electricity generated from natural gas would reduce to 79.9 – 38.7 = 41.2 TWh. Thus, nuclear power and natural gas will have 13.3% and 14.1%, respectively, after adding nuclear energy into the Turkish electricity mix. The carbon footprint of Turkish steel production has been calculated once with the current electricity mix and once by using the shares reported above. While estimating the future Turkish electricity mix, we have made two significant assumptions:

i) The annual electricity demand of Turkey will remain constant in the short run. While electricity demands usually keep increasing, the pandemic and unstable economic conditions might render this assumption quite realistic.

ii) The shares of other sources in the Turkish electricity mix (coal, hydropower, renewables) will remain constant in the short run.

While analyzing the conformity of Turkish steel production to EUGD regulations, we have assumed that in its current state, Turkish steel would not exceed the emission cap value that will be introduced for steel production in due course. Therefore, what we have analyzed is essentially how effective the addition of nuclear energy into the Turkish electricity will be in meeting the annual GHG emissions reduction requirements of the EU (linearly 2.2%) as indicated elsewhere [5].

Results

As shown in Figure 1 below, even when we assume that the entire electricity generated in Turkish nuclear power plant will replace electricity generated via natural gas, the reduction in the carbon footprint of Turkish steel is approximately 0.7%, which is far away for meeting the current EUETS requirements for even the first year, let alone in the long run. At this point, we think that investigating further scenarios where nuclear power replaces a mixture of different sources rather than solely natural gas in the Turkish electricity mix is not necessary. In those scenarios, the reduction in the carbon footprint of steel is likely to be even lower. Even when the second nuclear power plant comes into operation in 2030, the reduction in the carbon footprint would probably be much lower than what is required in CBAM.

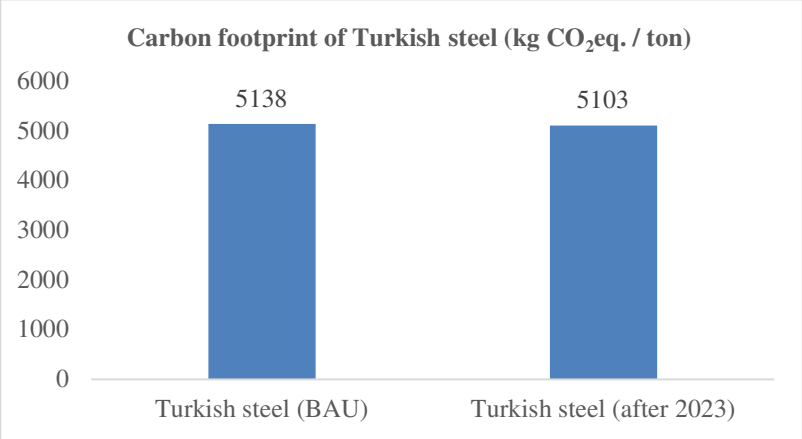

Figure 1. The carbon footprint of Turkish steel (kg CO_2eq. / ton)

Conclusions

The main conclusion of this study is that improvements in the Turkish electricity mix are far from meeting the requirements of EUGD and CBAM when it comes to reducing the carbon footprints of Turkish export products, the most important of which is steel. Thus, producers must take matters into their own hands and come up with solutions that would significantly reduce the carbon footprints of their products. Some examples of such solutions include but are not limited to utilizing renewable energy sources such as photovoltaics in their factories, replacing fuel-powered vehicles partially or wholly with electricity-powered ones for goods and personnel transportation, educating their staff and also their suppliers about EUGD and CBAM.

While this study focuses only on steel production, the approach developed and the conclusions reached provide essential guidance for policy-makers on the steel industry in particular as well as for the entire Turkish manufacturing industry in general.

References

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