Executive Summary

How green is green steel? The importance of doing hydrogen right

Report - April 2025

Hydrogen is considered a cornerstone of the green transition. But an overreliance on 'green' hydrogen could derail Europe's climate goals by diverting renewable energy that could be better used to decarbonise the grid. In this report, we take a deep dive into the risks associated with high deployment of Renewable Fuels of Non-Biological Origin (RFNBO), and the unintended consequences it could have for the EU's decarbonisation strategy.

In its amended Renewable Energy Directive (RED III), the EU commanded a steep increase in the overall share of renewables in its energy mix, from 24.5% in 2023 to 42.5% in 2030, and set ambitious sectoral sub-targets. While this ambition is welcome, the way in which these targets are met could have significant consequences for the EU's energy mix. A high reliance on Renewable Fuels of Non-Biological Origin (RFNBO), including renewable hydrogen, could hinder rather than help the EU achieve its climate goals. This is due to the weak additionality criteria for renewables used to produce these fuels.

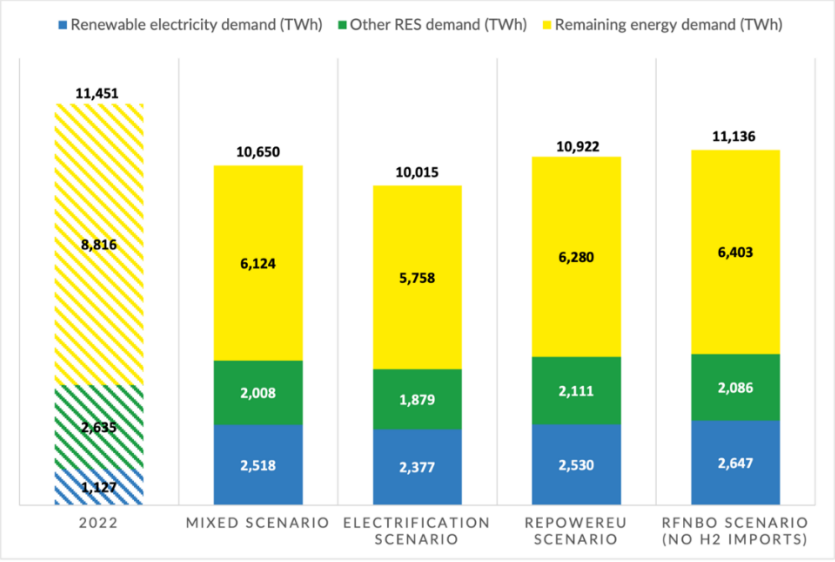


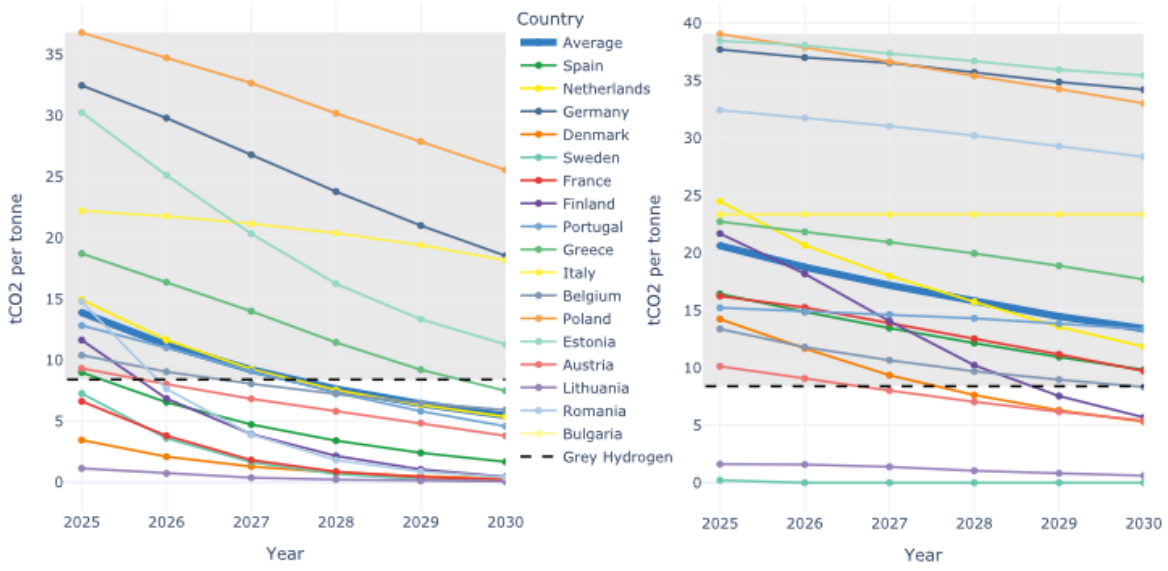
Figure 1: Total EU energy demand in each of the modelled scenarios in 2030, broken down into renewable electricity, energy from other RES sources and remaining (non-renewable) energy

We first developed scenarios for meeting the overall RED III target: through greater reliance on electrification, an increased use of RFNBO, or a mixed scenario based on the EU's Fit-for-55 modelling.[1] The electrification scenario leads to the lowest final energy demand while meeting RED III targets (10,015 TWh in 2030). In contrast, an increased reliance on RFNBOs would lead to a significantly higher energy demand (up to 11,136 TWh in 2030), and increase reliance on fossil energy: up to 6,403 TWh, compared to only 5,758 Twh with electrification.

The increased demand for fossil energy would naturally have a knock-on effect on CO_2 emissions. While the additionality criteria of the RFNBO standard makes eligible any hydrogen produced from recently built renewables capacity, it fails to recognise that new renewables capacity could otherwise be used to decarbonise the electricity mix.

Emissions induced by RFNBO production (in tCO2 per tH2):

with RED-compatible renewables build **with current trend of renewables build**



We have quantified the emissions that RFNBO production fails to reduce by diverting renewables from feeding into the electricity mix. Assuming all RED targets are met, these **induced emissions** of hydrogen production can be as high as 25 tCO_2 per tH_2 in some EU Member States by 2030, which is actually higher than emissions from the production of hydrogen from steam methane reforming (8.47 tCO_2 per tH_2[2]). This is because, whenever

[1] In all scenarios, sectoral sub-targets, for example for RFNBO use in transport, are met

[2] Katbah et al. (2022) Analysis of hydrogen production costs in Steam-Methane Reforming considering integration with electrolysis and CO2 capture

hydrogen induces emissions from fossil electricity, these induced emissions are very high, at about 32 tonnes of CO2 per tonne of hydrogen. The emissions induced by RFNBO production are highly dependent on available renewables capacity. If the pace of renewables build continued in its recent trend, the emissions induced by RFNBO production could be as high 15 tCO2 per tH2 on average.

In some Member States, the induced emissions associated with RFNBO production will be much lower (e.g. 0.07 tCO2 per tH2 for Sweden). However, using new renewables capacity for hydrogen production should be compared with the alternative use of such electricity to feed neighbouring Member States through improved interconnections.

In a "perfectly connected" European grid, i.e. if any excess power supply in one country could flow through borders to meet the demand in any neighbouring country, the climate benefits of trading electricity across borders would be such that the emissions induced by RFNBO production would be as high as 9.8 tCO_2 per tH_2 in 2030 in all countries, still higher than grey hydrogen.

This calls into question the climate benefits of the RFNBO standard. Although it is possible to produce relatively high amounts of low-carbon hydrogen (without induced emissions), failure to account for induced emissions from fossil electricity could reverse any otherwise gained benefit.