

Supplementary information for Electricity- and Hydrogen-Driven Energy System Sector-Coupling in Net- Zero CO₂ Emission Pathways

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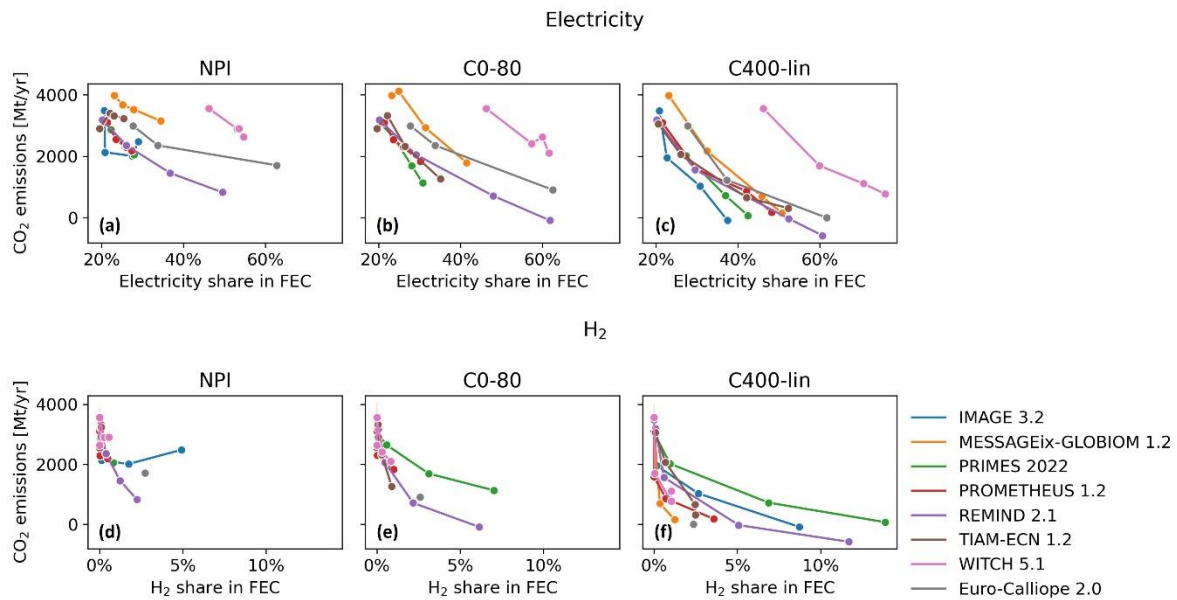
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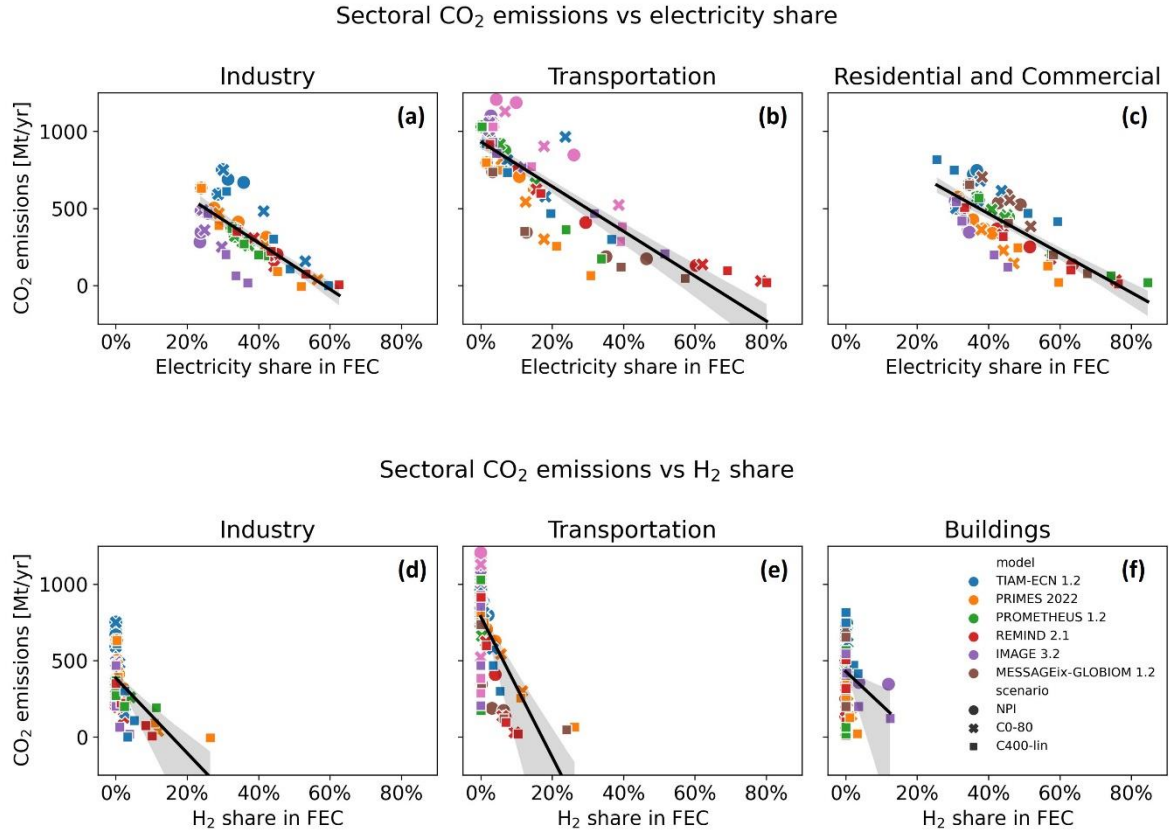
Supplementary Items:

- Supplementary Figure 1
- Supplementary Figure 2

Supplementary Figures



Supplementary Figure 1. CO₂ emissions (in Mt/yr) against electricity share (in %, panels a, b, c) and direct H₂ share (in %, panels d, e, f) in final energy consumption (FEC) across models and scenarios. The colour coding refers to individual models, and the dots to individual years (2020, 2030, 2040, 2050). The three scenarios depicted are NPI (National Policy Implementation), C0-80 (CO₂ price growing to 80 \$/tCO₂ in 2040), and C400-lin (CO₂ price growing to 400 \$/tCO₂ in 2040). In the C400-lin scenario, net CO₂ emissions become around zero in 2050 for all models, while one model (REMIND) even reaches substantial negative CO₂ emissions by that year. Both for electricity and H₂ shares, significant differences can be observed across models in 2050, with for electricity REMIND being consistently on the relative high side and IMAGE at the low side of the range, while for H₂ PRIMES yields typically the highest share and MESSAGEix-GLOBIOM the lowest share.



Supplementary Figure 2. Sectoral CO₂ emissions (in Mt/yr) against electricity share (in %, panels a, b, c) and direct H₂ share (in %, panels d, e, f) across models, scenarios, sectors and four intervals (2020, 2030, 2040, 2050). The colour coding of the dots corresponds to individual models; the shape of the dots refers to scenarios. The solid black line indicates a linear regression, and the grey shading the variance. The three scenarios depicted are NPI (National Policy Implementation), CO-80 (CO₂ price growing to 80 \$/tCO₂ in 2040), and C400-lin (CO₂ price growing to 400 \$/tCO₂ in 2040).