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Corrigendum to "Decarbonizing copper production by power-to-hydrogen: A techno-economic analysis" [J. Clean. Prod. 306 (2021) 127191]

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The authors regret that our recent paper (Röben et al., 2021) contains an error in our calculations presented in section 4.3, where we analyze varying water electrolyzer efficiencies. The water electrolyzer efficiency was not correctly updated in our code when converting the investment costs from EUR/kW$_{el}$ to EUR/kW$_{H2}$. In the results, the investment costs are always converted based on the reference efficiency (60%). The error affected the results shown in Figs. 12–14 of the original manuscript but does not concern model equations and parameters stated but was limited to the implementation. The updated results are shown in the updated Figs. 12–14 below.

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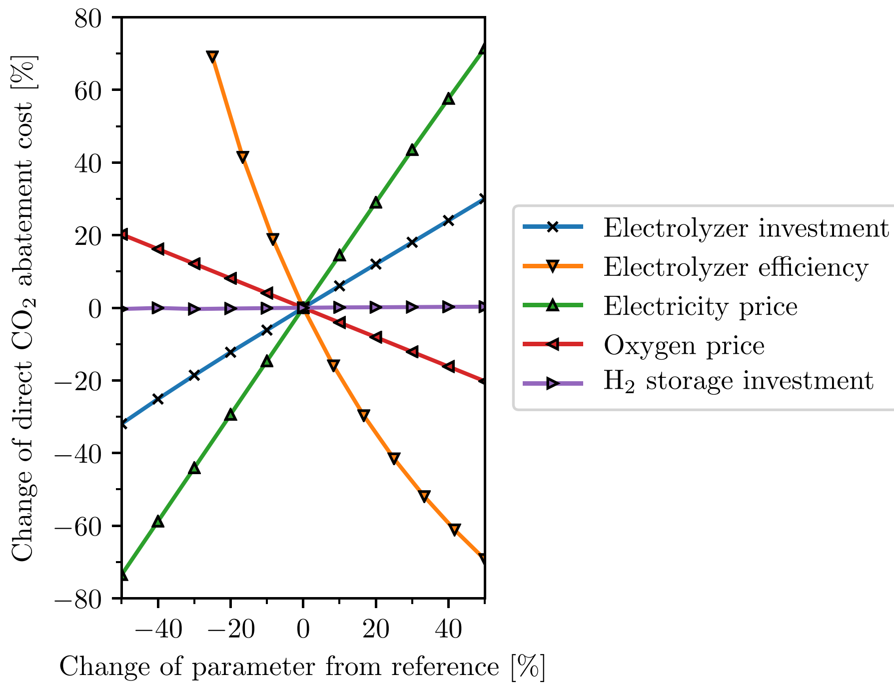

Fig. 12. Sensitivity analysis for the fully-decarbonized system. The values are set in relation to the reference case with direct CO_2 abatement cost of 201 EUR/t CO_2.

Fig. 12 shows the impact of parameter changes on the direct CO_2 abatement cost for the decarbonized copper production. Comparing the new Fig. 12 to the erroneous Fig. 12 from the original manuscript, it can be noted that the impact of the water electrolyzer efficiency is larger and now affects the CO_2 abatement costs as strong as the electricity price. The abatement cost decrease by 32 EUR/t CO_2 (16.0%) when improving the electrolyzer efficiency by 5% in absolute terms, e.g., from 60 to 65% system efficiency (corresponding to a relative increase of 8%).

The corrected Fig. 13(b) shows the impact of the water electrolyzer efficiency on the total direct CO_2 abatement costs, which now decrease to 97 EUR/t CO_2 for an electrolyzer efficiency of 80%.

In Fig. 14, the impact of the combined development of water electrolysis efficiency and investment costs on the CO_2 abatement cost is shown, highlighting the projected future development (Smolinka et al., 2018). The erroneous calculations overestimated the CO_2 abatement cost for water electrolyzer efficiencies that exceeded the reference efficiency of 60%. Particularly for high efficiencies, significantly lower CO_2 abatement costs are found, compared to the erroneous Fig. 14. CO_2 abatement cost are now expected to lie at 31 EUR/t CO_2 for system parameters expected for SOEL systems in 2050. The expected values for AEL systems achieve direct CO_2 abatement cost of around 91 EUR/t CO_2 in 2030 and 80 EUR/t CO_2 in 2050. The PEMEL system achieves direct CO_2 abatement cost of around 176 EUR/t CO_2 in 2030 and 98 EUR/t CO_2 in 2050.

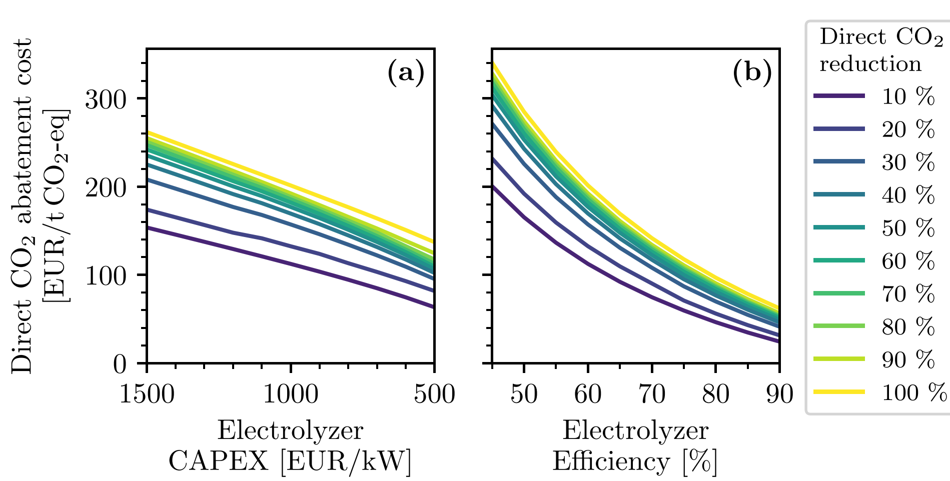

Fig. 13. Total direct CO_2 abatement cost under varied parameters: (a) electrolyzer investment cost and (b) electrolyzer efficiency.

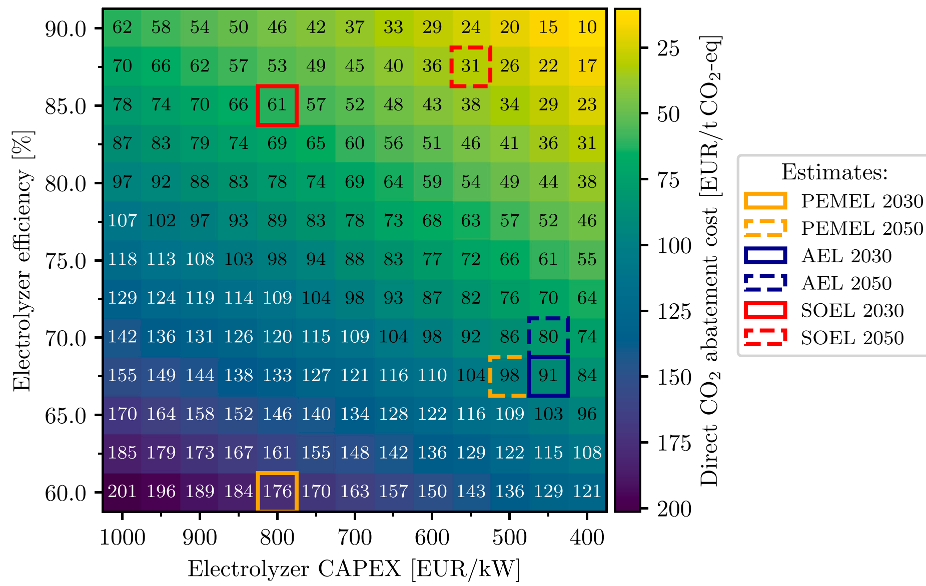

Fig. 14. Direct CO_2 abatement cost under decreasing electrolyzer investment cost and increasing efficiency. Highlighted estimates for the electrolyzer system parameters are taken from Smolinka et al. (2018). To display the estimations on our parameter grid, we rounded each value to the nearest increment in our sensitivity analysis. The stated efficiency of the solid oxide electrolysis (SOEL) does not consider the energy for steam generation (Smolinka et al., 2018).

Instead of the erroneous value of 54 EUR/t CO_2 given in the abstract, highlights, and conclusions of the original manuscript, the abatement cost reduce to 31 EUR/t CO_2 for the projected future water electrolysis development. Further, in the conclusions, the results for the SOEL and AEL in 2030 need to be updated to 61 EUR/t CO_2 and 91 EUR/t CO_2, respectively. Thus, the corrected calculations show the potential for lower CO_2 abatement costs for Power-to-H_2 in copper production.

The authors would like to apologise for any inconvenience caused.

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