

Replacing location-based electricity consumption with market-based residual mixes in background data to avoid possible double counting: a quantitative analysis of effects and challenges

Supplementary material

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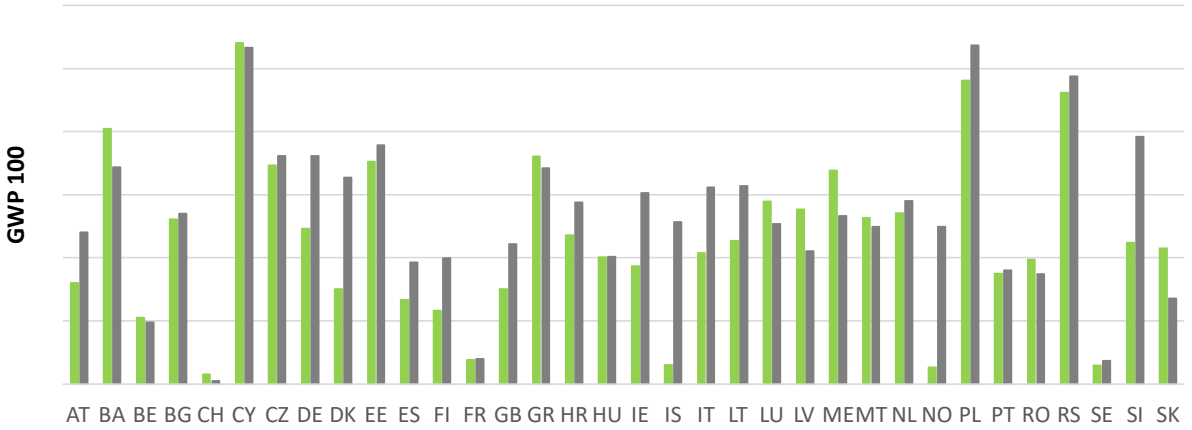
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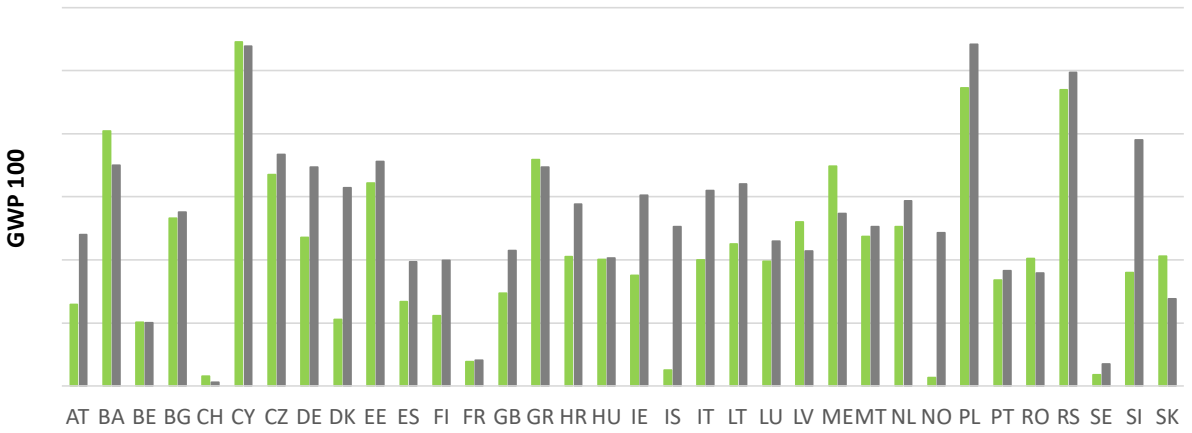
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a) High voltage



b) Medium voltage



b) Low voltage

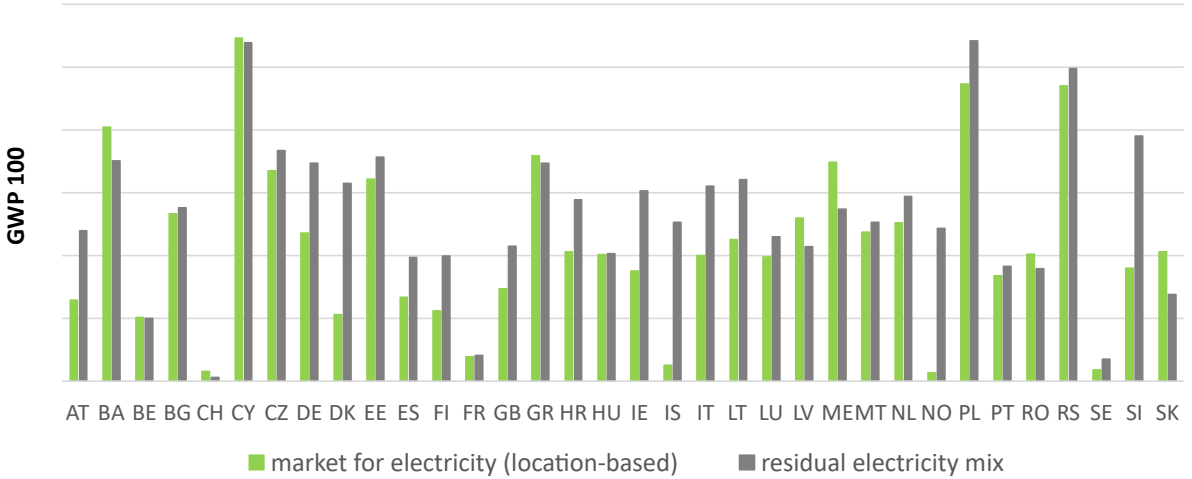


Figure 1: Comparison of European location-based market for electricity mixes and residual electricity mixes on high voltage level as included in ecoinvent 3.9.1; The residual mix for Austria corresponds to the European average residual mix, based on (Association of Issuing Bodies 2023; Wernet et al. 2016)

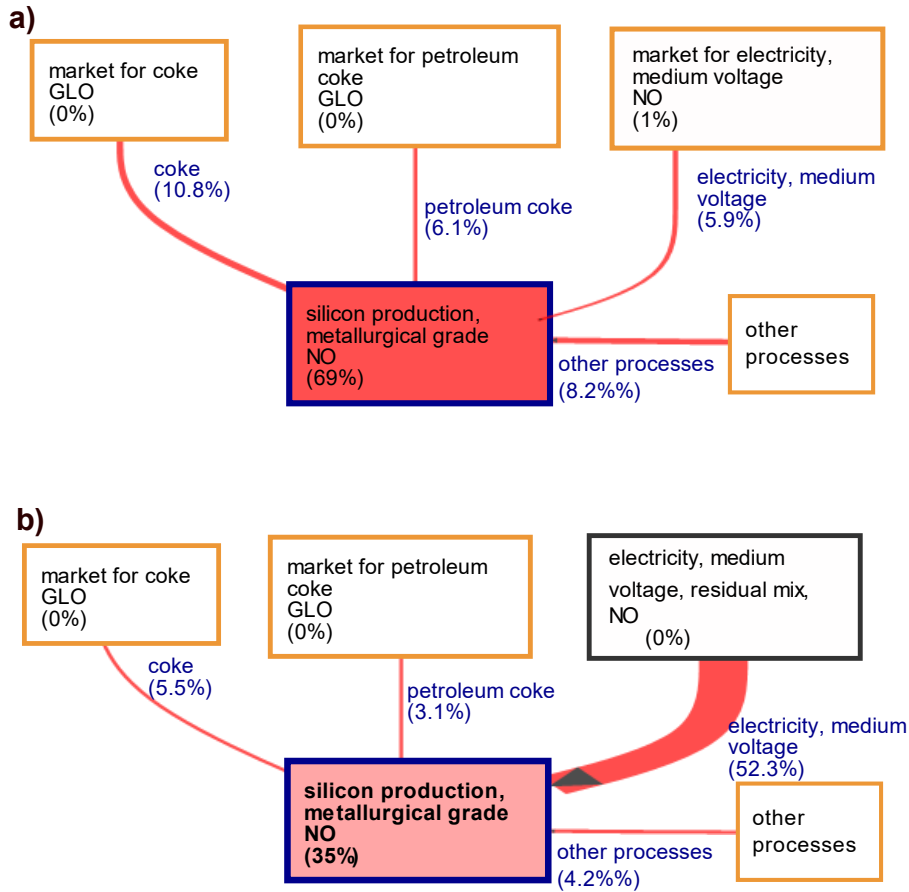


Figure 2: Sankey diagrams of the GWP 100 results for silicon production, metallurgical grade (NO) using both the original ecoincent database (a) and the modified databased with residual electricity mixes as default (b)

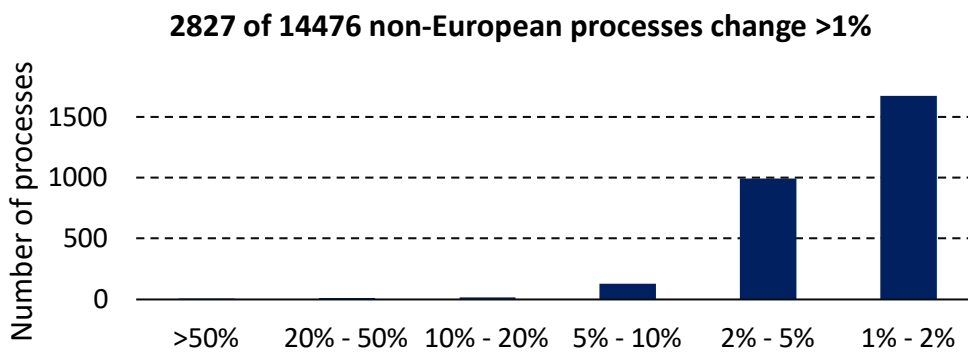


Figure 3: Non-European processes categorized by relative change in GWP 100 and the number of processes per category

IPCC 2021 - global warming potential (GWP100)
 Activity Coverage: 5386 of 14476 (37%); Regional Coverage: non-Europe;

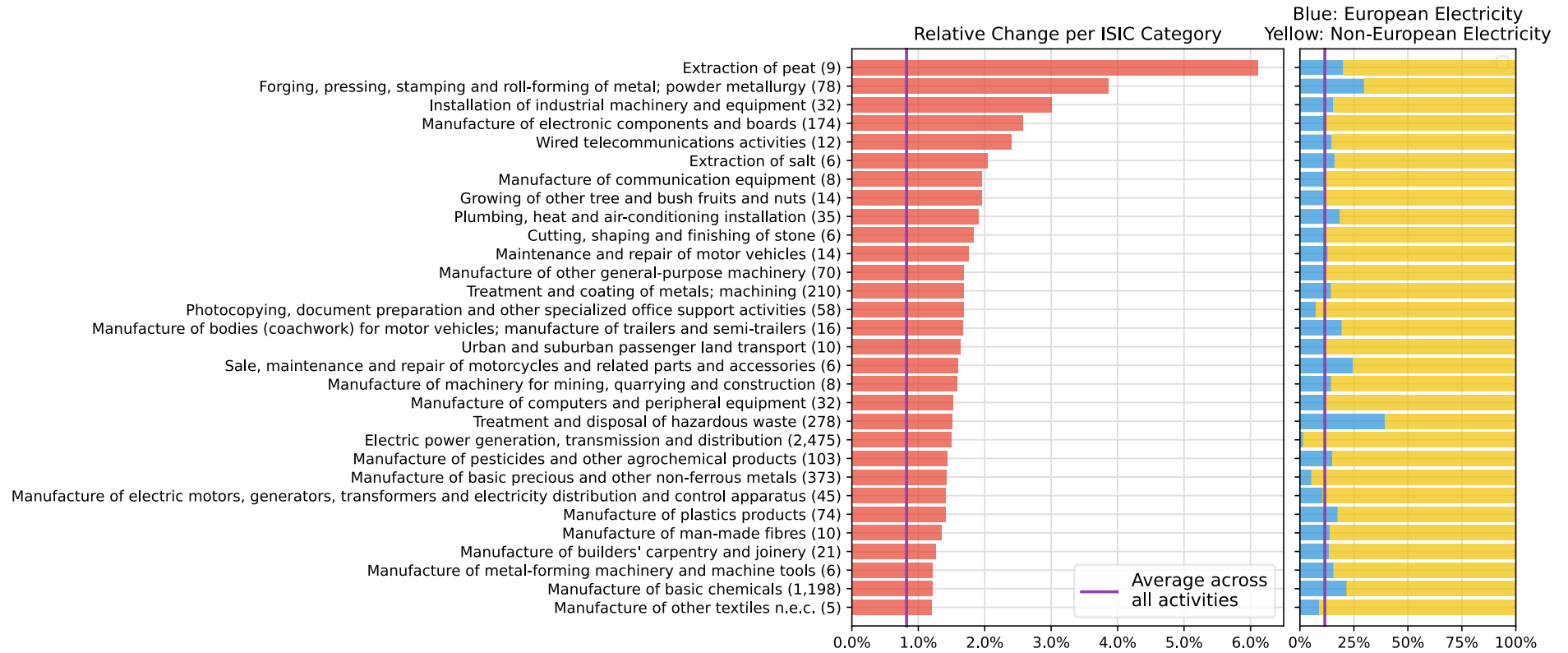


Figure 4: Relative change in GWP 100 (left) and ratio of European electricity consumption from total electricity consumption (right), displaying the average change over all 14,476 non-European processes (purple vertical line) and the change per ISIC category for the 30 ISIC categories with the most pronounced changes

ReCiPe 2016 v1.0 - acidification: terrestrial
 Activity Coverage: 2922 of 6762 (43%); Regional Coverage: Europe;

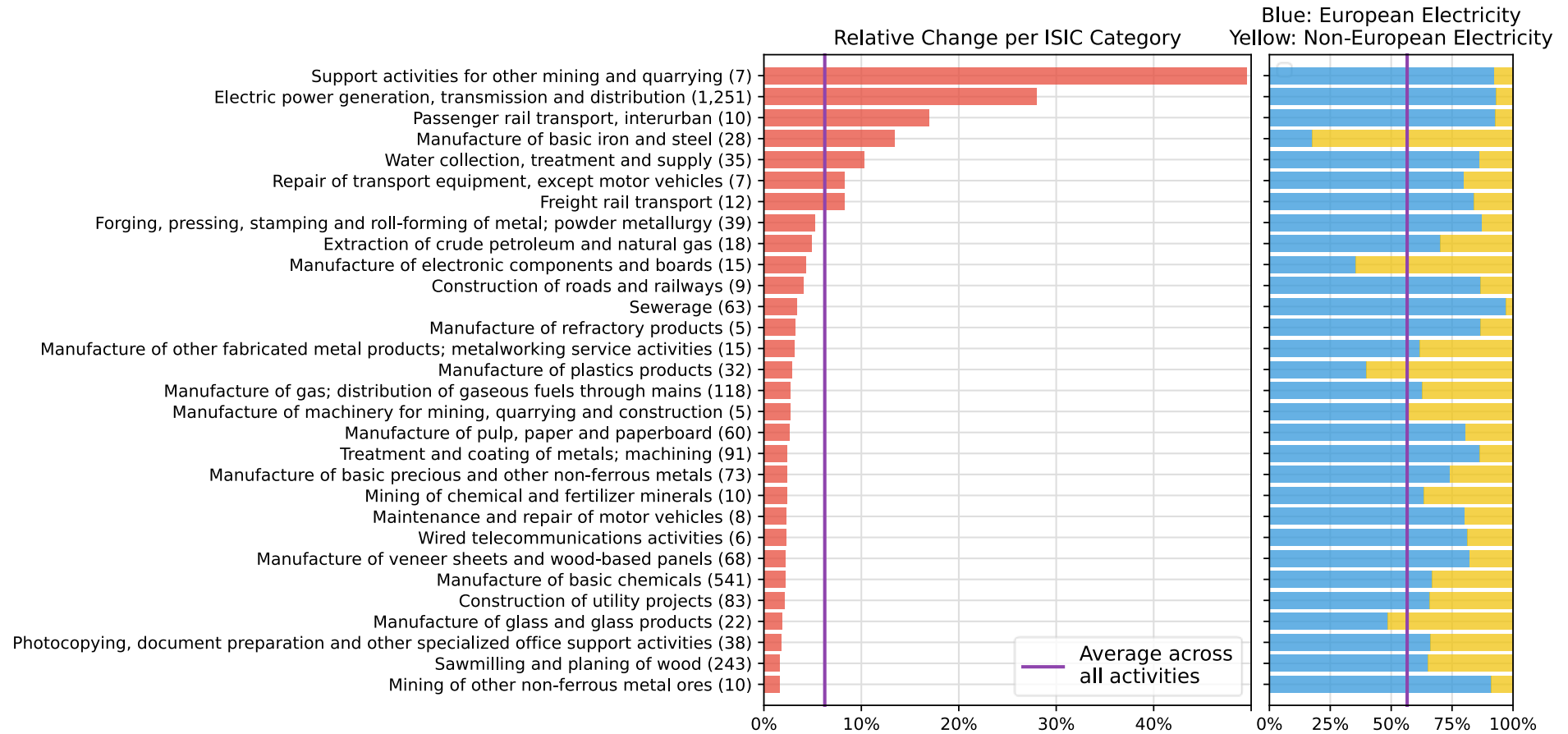


Figure 5: Relative change in terrestrial acidification (left) and ratio of European electricity consumption from total electricity consumption (right), displaying the average change over all 6,762 European processes (purple vertical line) and the change per ISIC category for the 30 ISIC categories with the most pronounced changes

ReCiPe 2016 v1.0 - acidification: terrestrial
 Activity Coverage: 5317 of 14476 (36%); Regional Coverage: non-Europe;

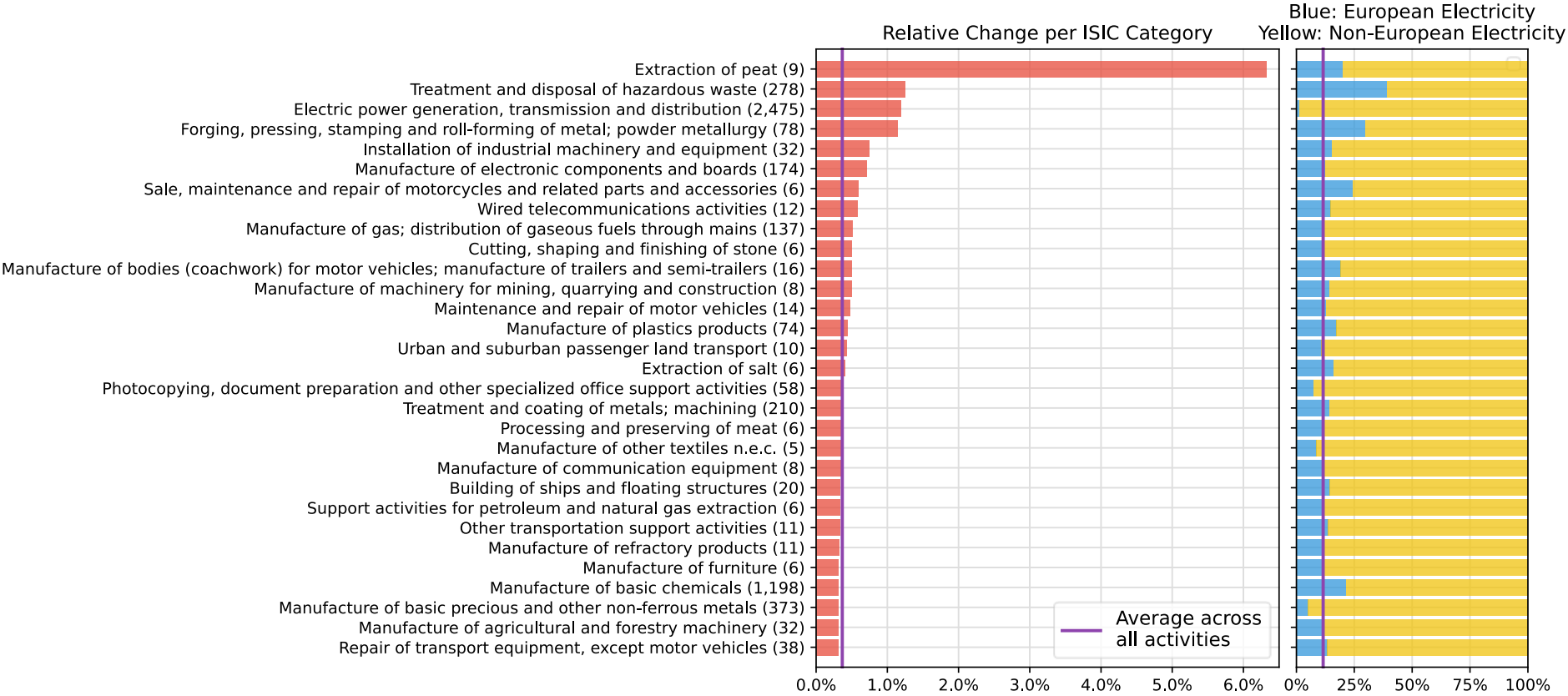


Figure 6: Relative change in terrestrial acidification and ratio of European electricity consumption from total electricity consumption (right), displaying the average change over all 14,476 non-European processes (purple vertical line) and the change per ISIC category for the 30 ISIC categories with the most pronounced changes

ReCiPe 2016 v1.0 - eutrophication: freshwater
 Activity Coverage: 2831 of 6762 (41%); Regional Coverage: Europe;

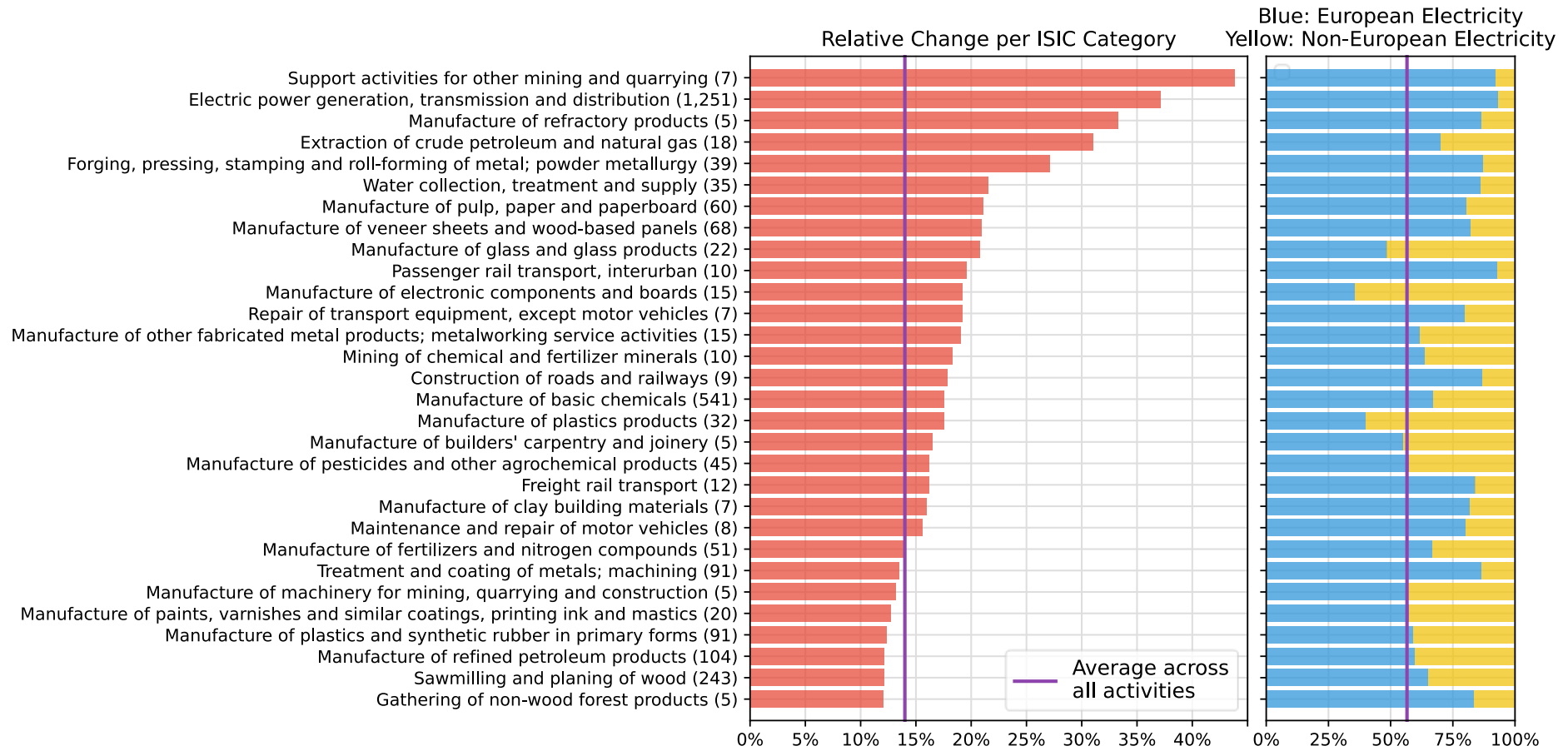


Figure 7: Relative change in freshwater eutrophication (left) and ratio of European electricity consumption from total electricity consumption (right), displaying the average change over all 6,762

European processes (purple vertical line) and the change per ISIC category for the 30 ISIC categories with the most pronounced changes

ReCiPe 2016 v1.0 - eutrophication: freshwater
 Activity Coverage: 1442 of 14476 (9%); Regional Coverage: non-Europe;

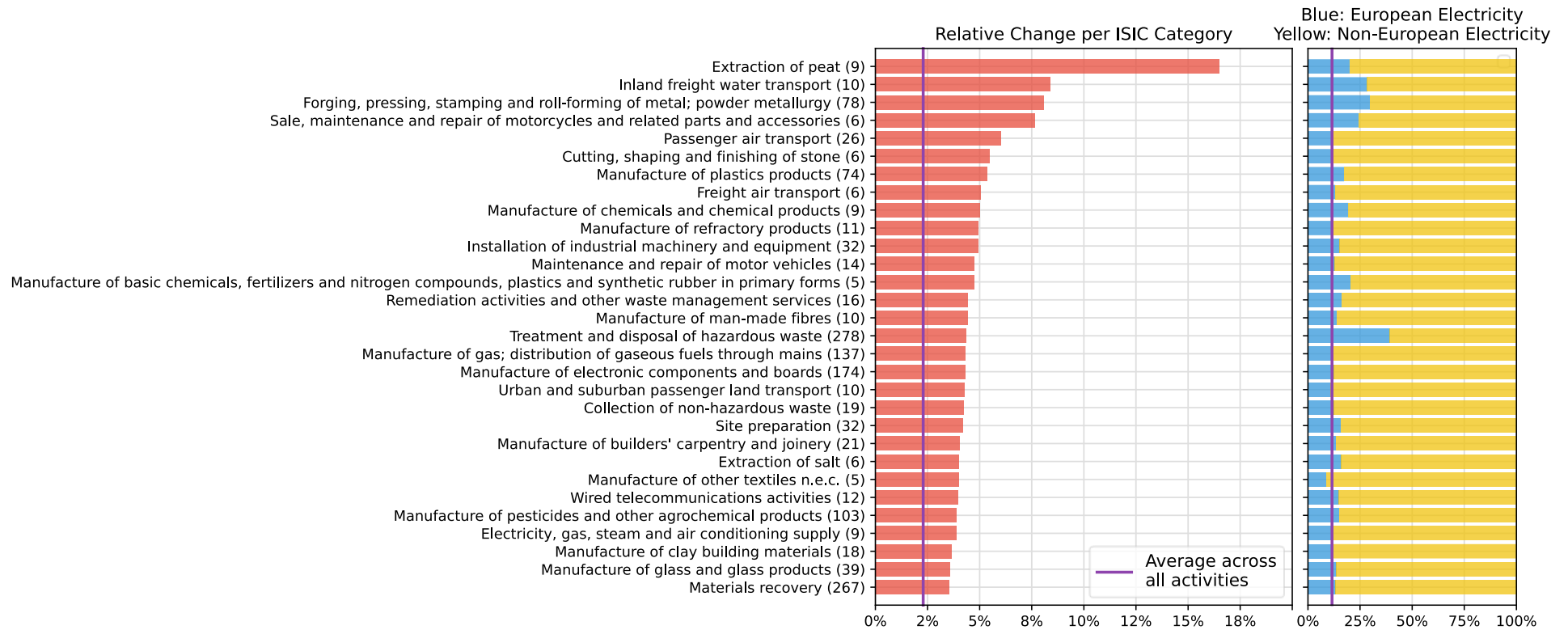


Figure 8: Relative change in freshwater eutrophication and ratio of European electricity consumption from total electricity consumption (right), displaying the average change over all 14,476 non-European processes (purple vertical line) and the change per ISIC category for the 30 ISIC categories with the most pronounced changes

ReCiPe 2016 v1.0 - eutrophication: marine
 Activity Coverage: 2643 of 6762 (39%); Regional Coverage: Europe;

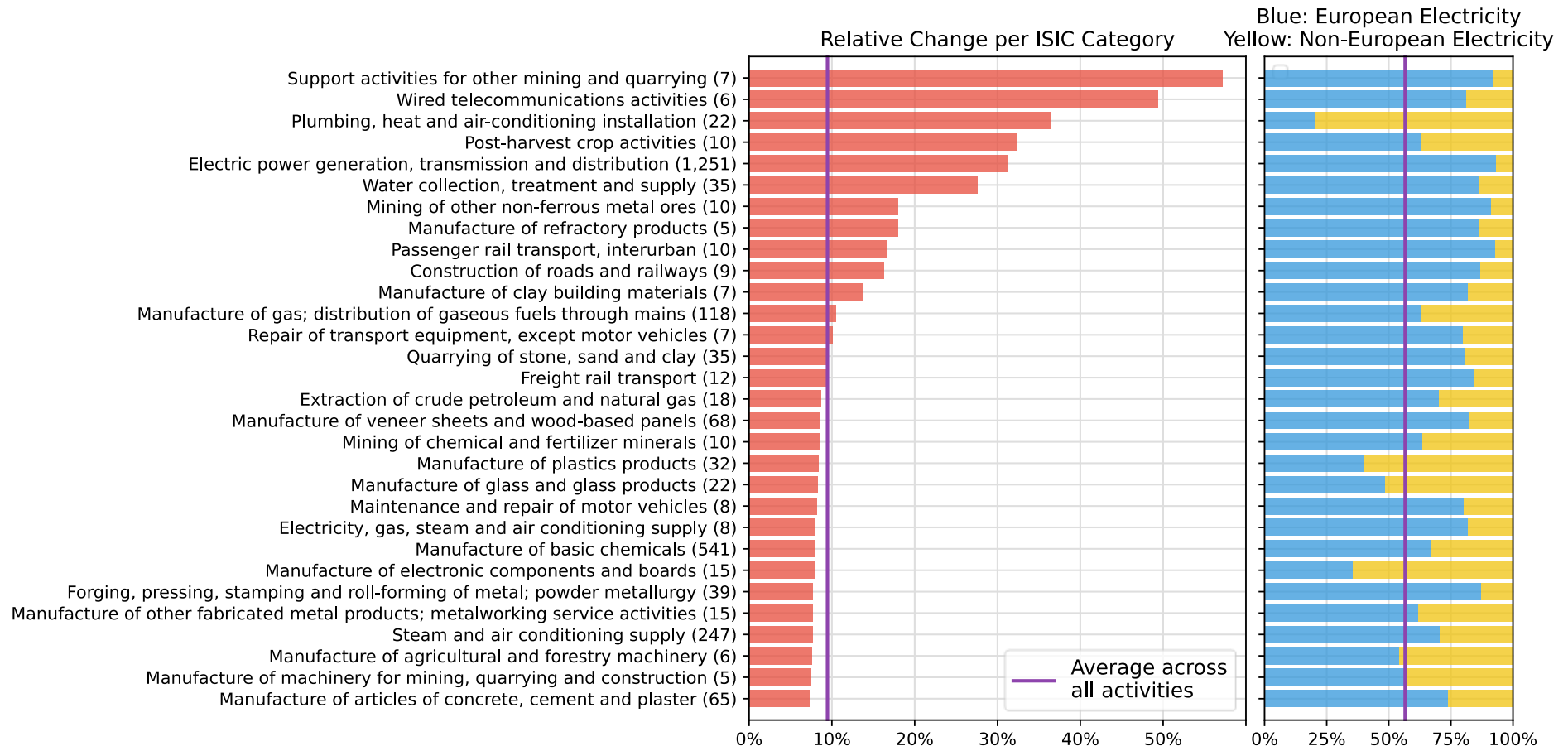


Figure 9: Relative change in marine eutrophication (left) and ratio of European electricity consumption from total electricity consumption (right), displaying the average change over all 6,762 European processes (purple vertical line) and the change per ISIC category for the 30 ISIC categories with the most pronounced changes

ReCiPe 2016 v1.0 - eutrophication: marine
 Activity Coverage: 4802 of 14476 (33%); Regional Coverage: non-Europe;

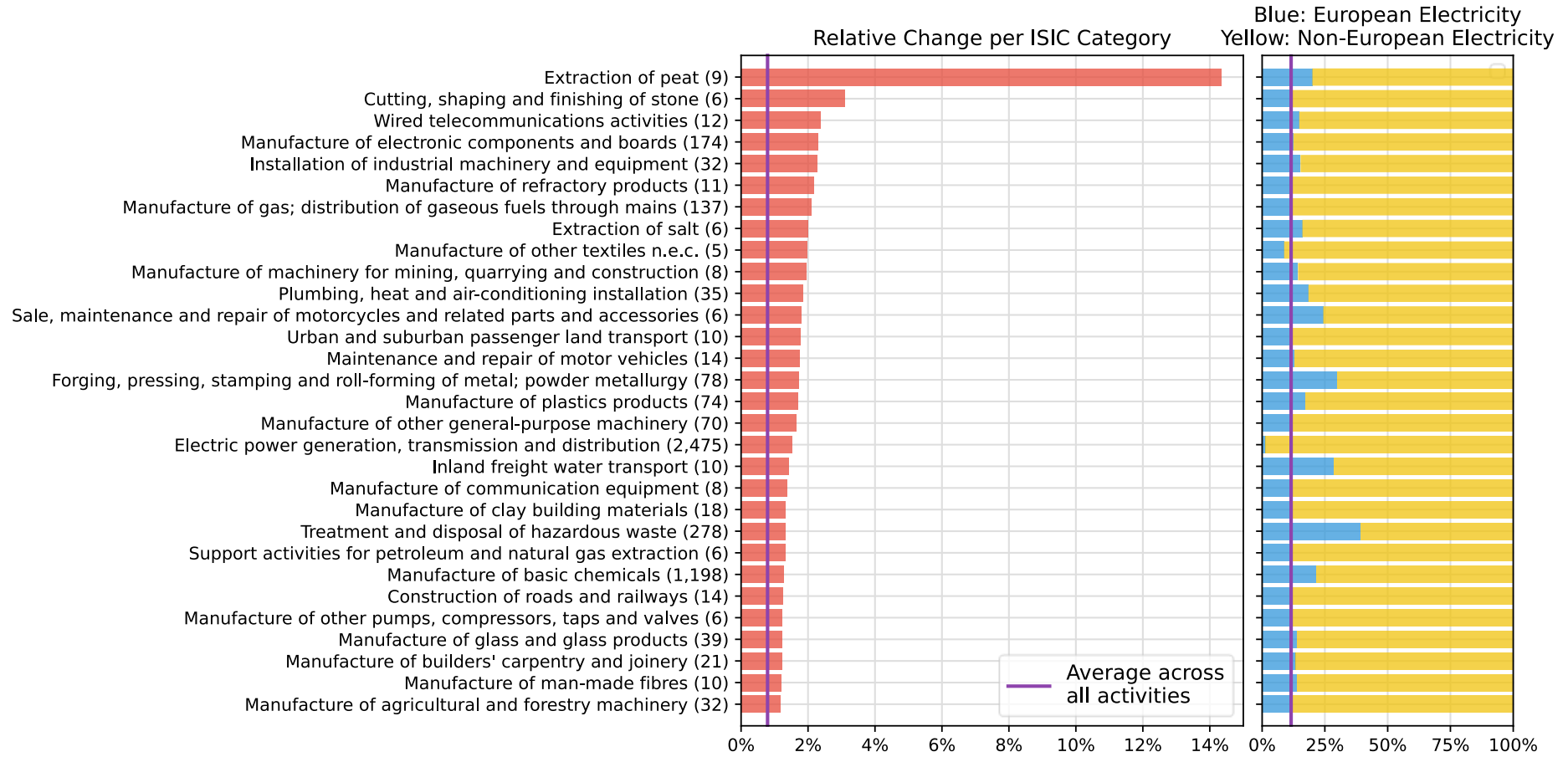


Figure 10: Relative change in marine eutrophication and ratio of European electricity consumption from total electricity consumption (right), displaying the average change over all 14,476 non-European processes (purple vertical line) and the change per ISIC category for the 30 ISIC categories with the most pronounced changes

ReCiPe 2016 v1.0 - ozone depletion
 Activity Coverage: 2636 of 6762 (38%); Regional Coverage: Europe;

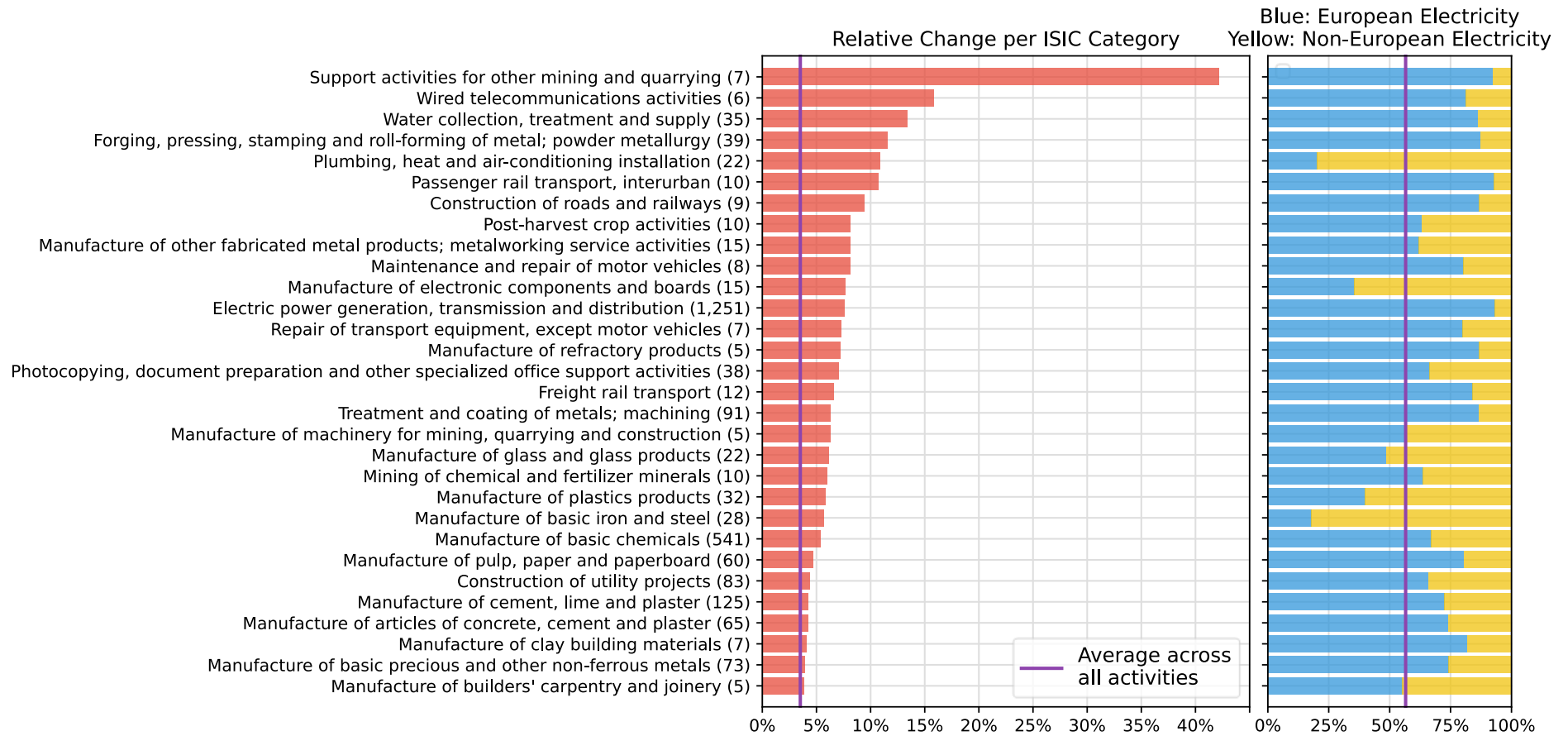


Figure 11: Relative change in ozone depletion (left) and ratio of European electricity consumption from total electricity consumption (right), displaying the average change over all 6,762 European processes (purple vertical line) and the change per ISIC category for the 30 ISIC categories with the most pronounced changes

ReCiPe 2016 v1.0 - ozone depletion
 Activity Coverage: 1265 of 14476 (8%); Regional Coverage: non-Europe;

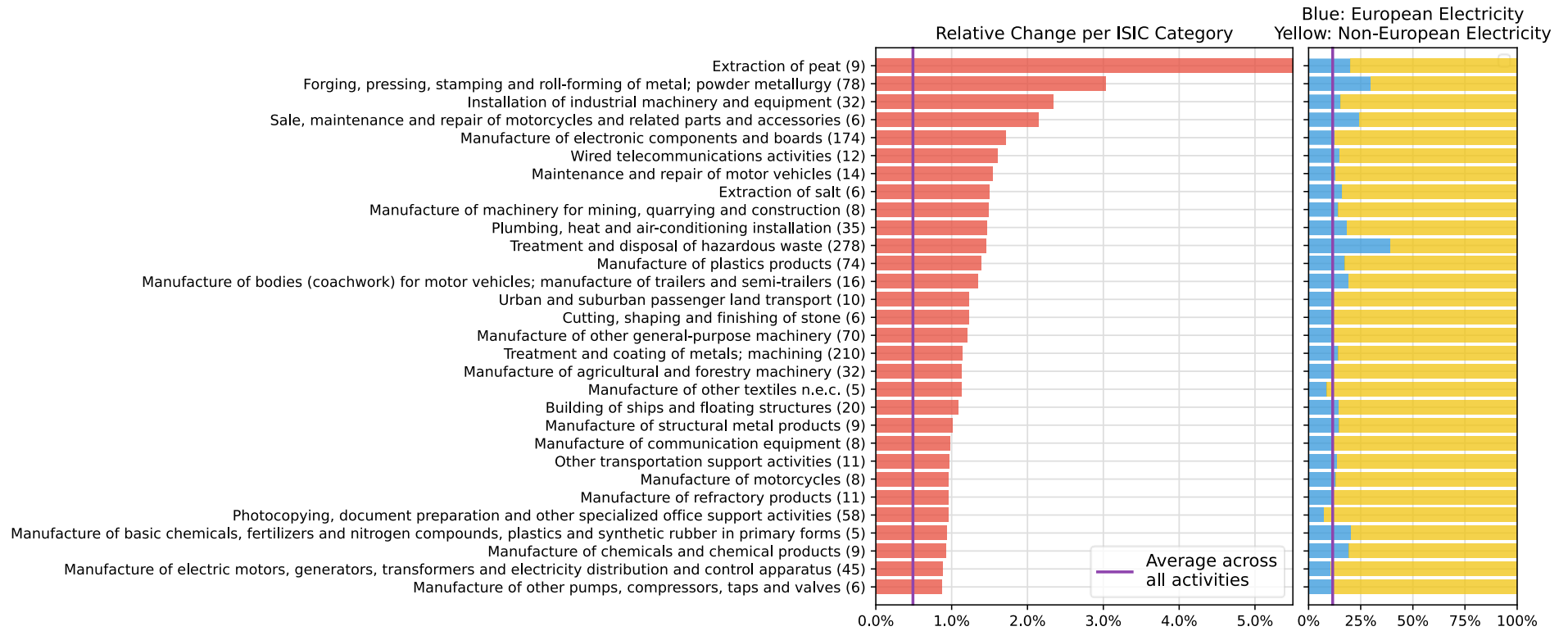


Figure 12: Relative change in ozone depletion and ratio of European electricity consumption from total electricity consumption (right), displaying the average change over all 14,476 non-European processes (purple vertical line) and the change per ISIC category for the 30 ISIC categories with the most pronounced changes

ReCiPe 2016 v1.0 - particulate matter formation
 Activity Coverage: 2686 of 6762 (39%); Regional Coverage: Europe;

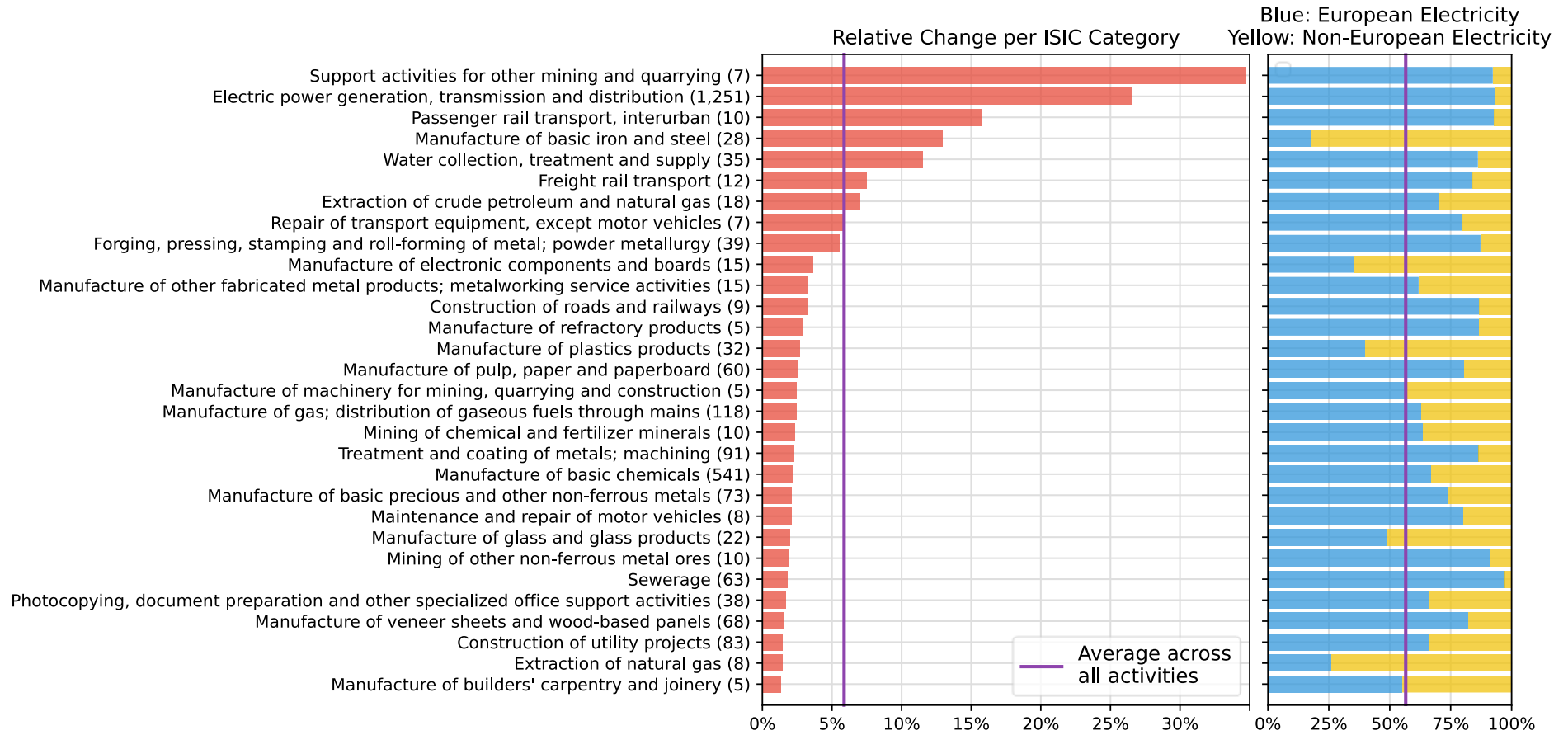


Figure 13: Relative change in particulate matter formation (left) and ratio of European electricity consumption from total electricity consumption (right), displaying the average change over all 6,762 European processes (purple vertical line) and the change per ISIC category for the 30 ISIC categories with the most pronounced changes

ReCiPe 2016 v1.0 - particulate matter formation
 Activity Coverage: 5094 of 14476 (35%); Regional Coverage: non-Europe;

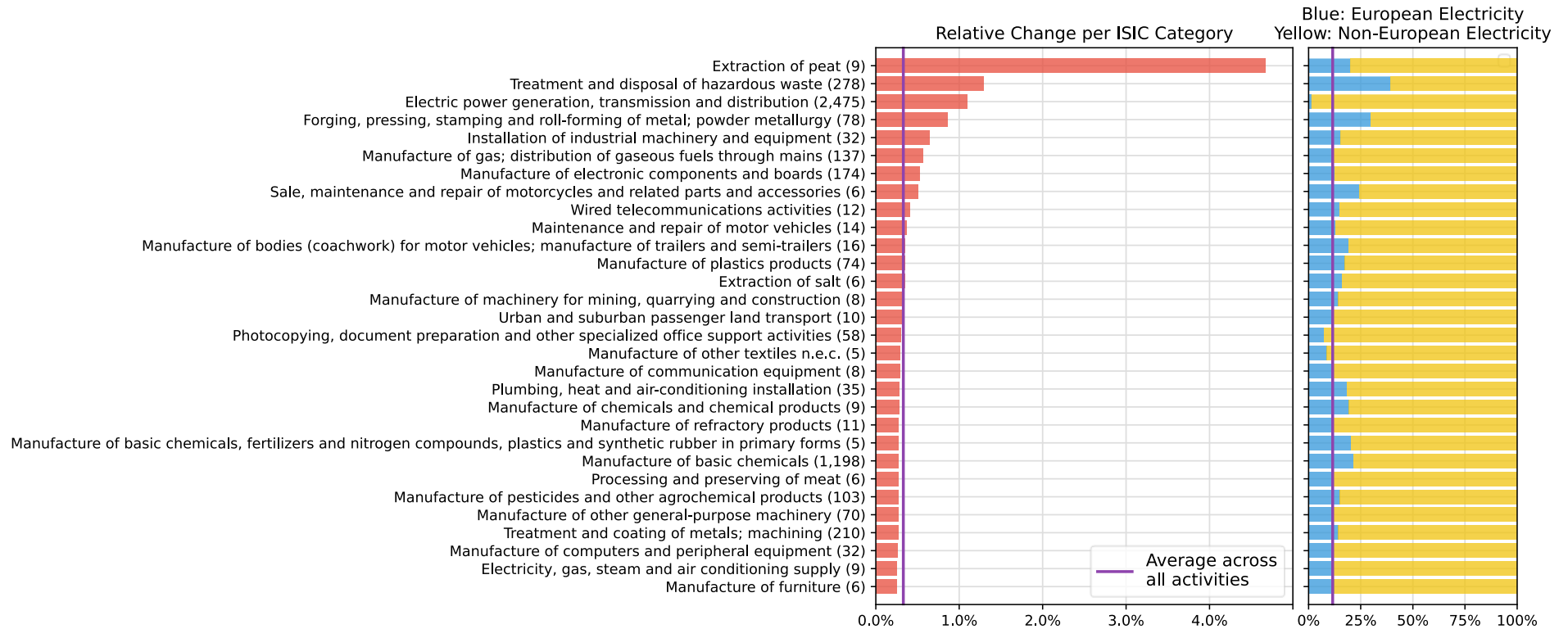


Figure 14: Relative change in particulate matter formation and ratio of European electricity consumption from total electricity consumption (right), displaying the average change over all 14,476 non-European processes (purple vertical line) and the change per ISIC category for the 30 ISIC categories with the most pronounced changes

References

- Association of Issuing Bodies (2023) European Residual Mixes Results of the calculation of Residual Mixes for the calendar year 2021
- Wernet G, Bauer C, Steubing B, Reinhard J, Moreno-Ruiz E, Weidema B (2016) The ecoinvent database version 3 (part I): overview and methodology. *Int J Life Cycle Assess* 21:1218–1230.
<https://doi.org/10.1007/s11367-016-1087-8>