

TRA105 - Fuel Cell Systems

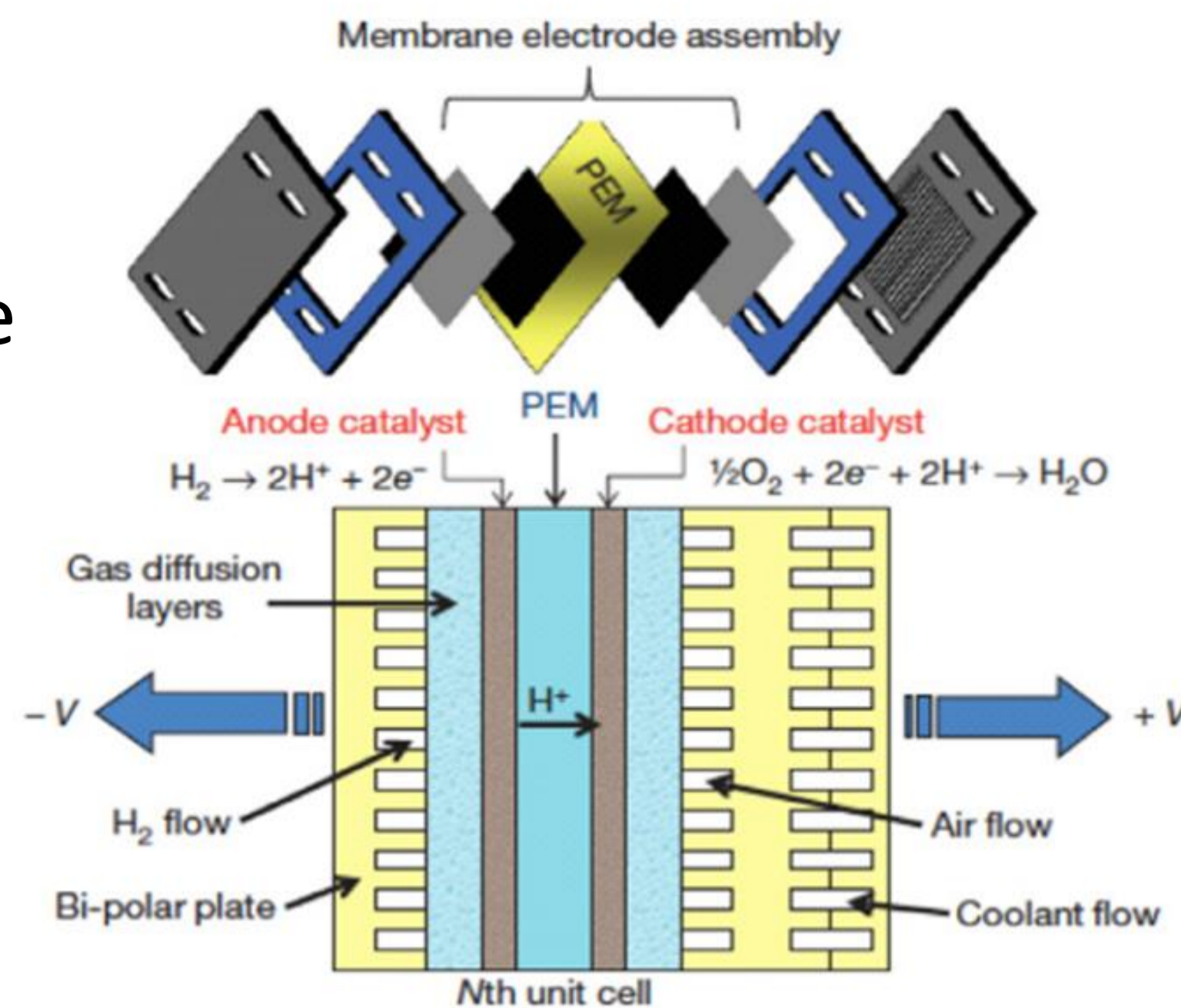
Project #8 : LCA for PEMFC

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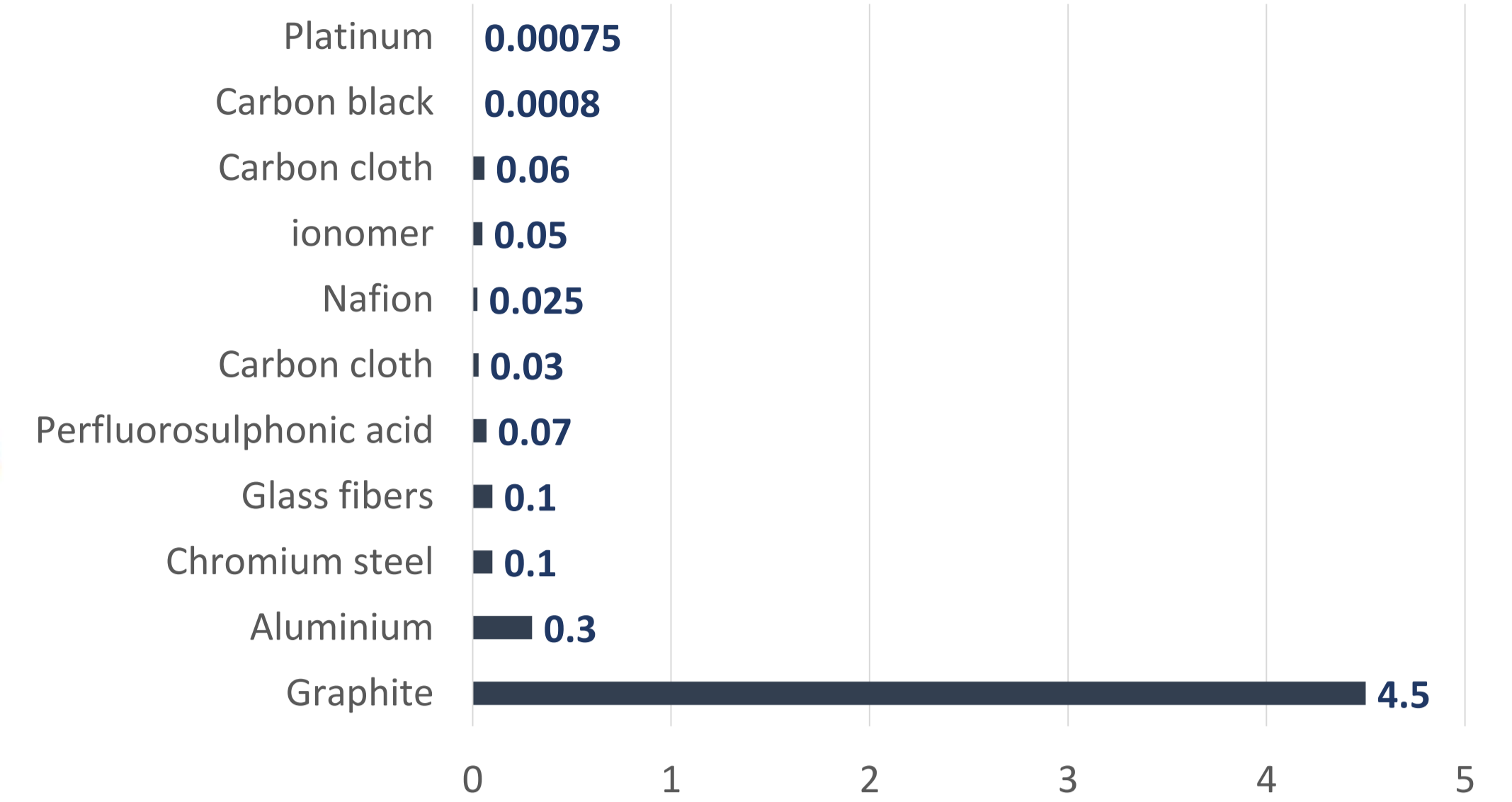
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Introduction

- LCA analyses environmental impact of every stage of life cycle of a product
- PEMFC is a new cleaner technology and LCA helps us see how it can be cleaner

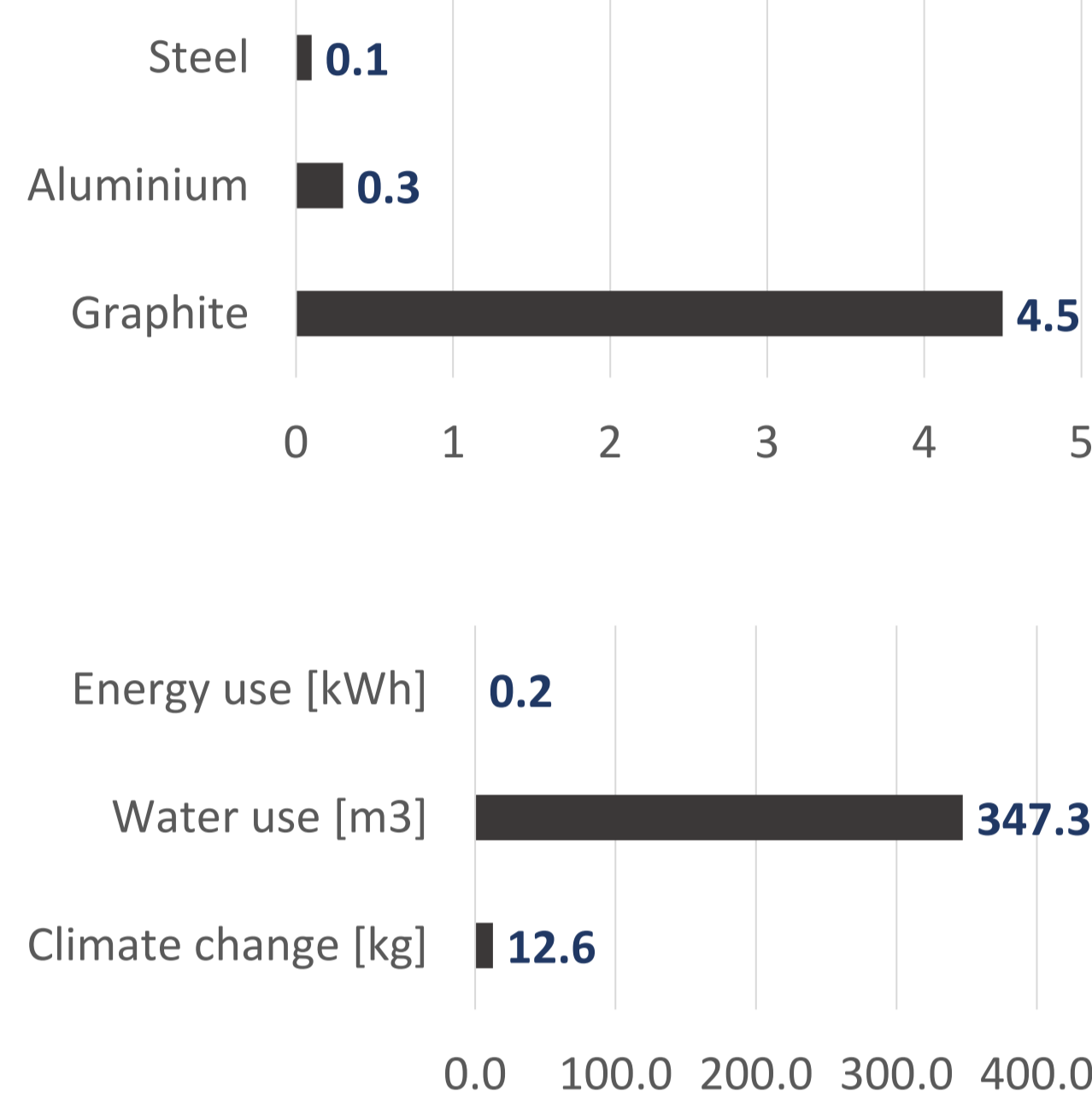


List of materials needed for a 1kW PEMFC [kg]

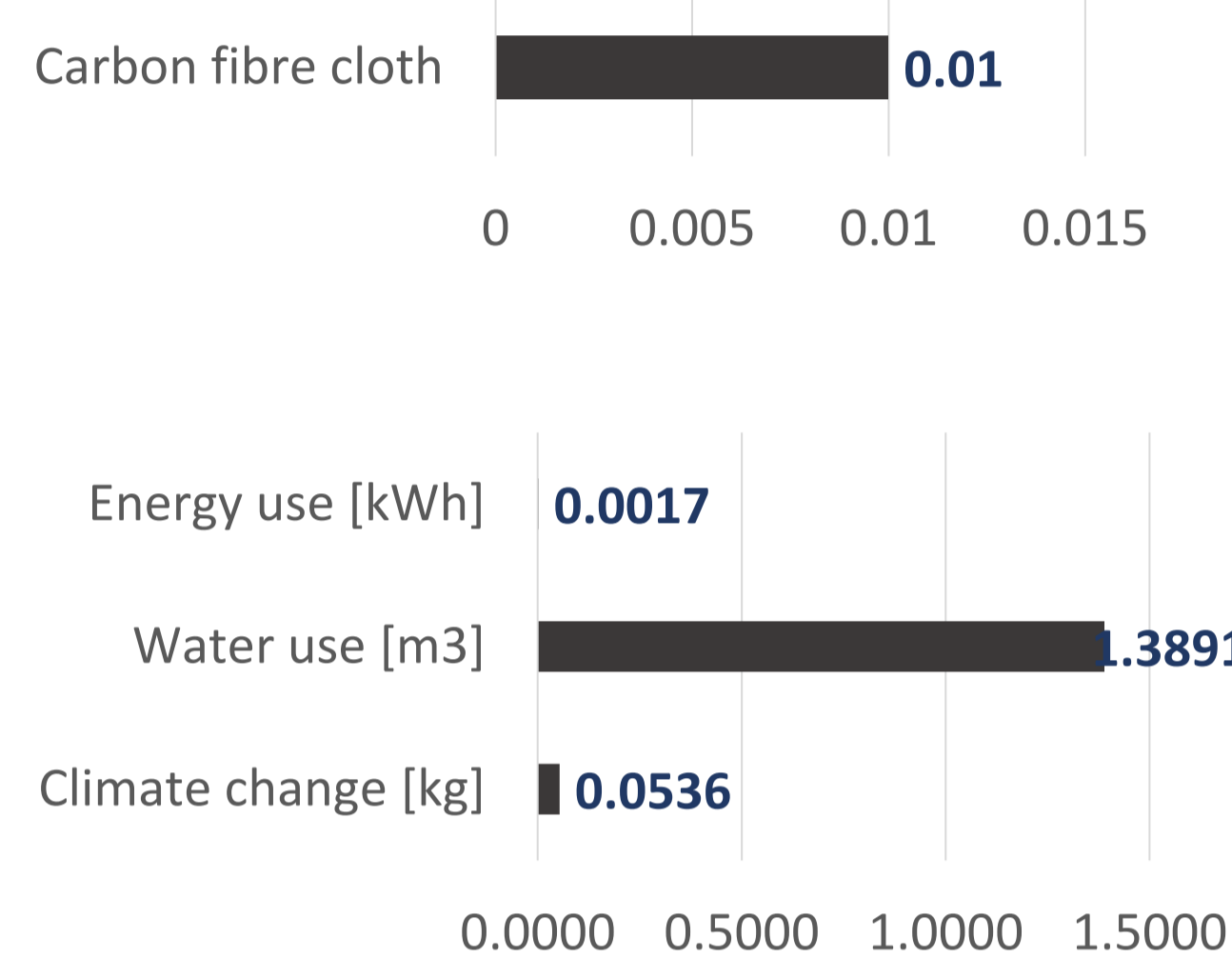


PEMFC assembly LCA

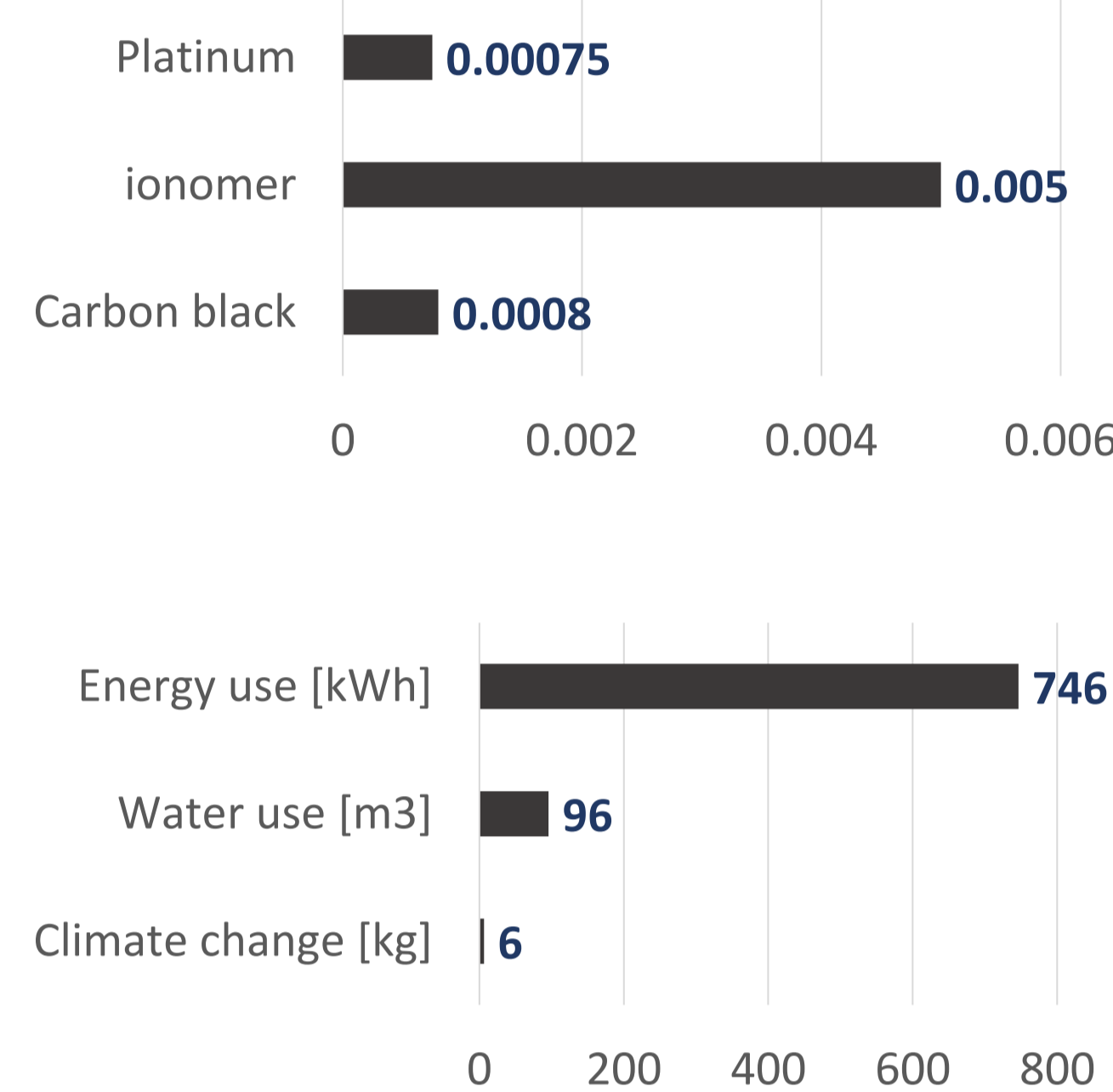
Bi-polar plates



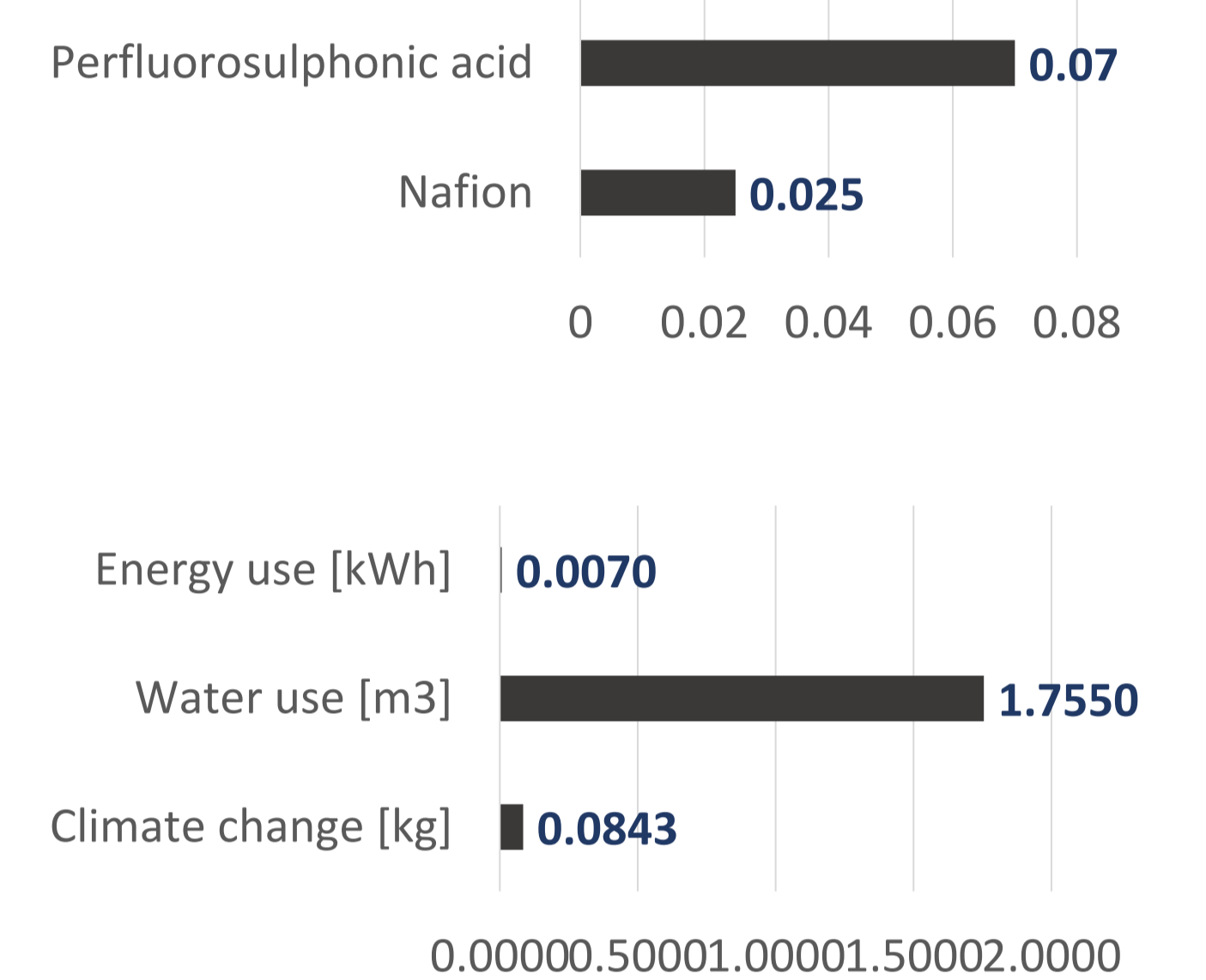
Gas Diffusion Layer (GDL)



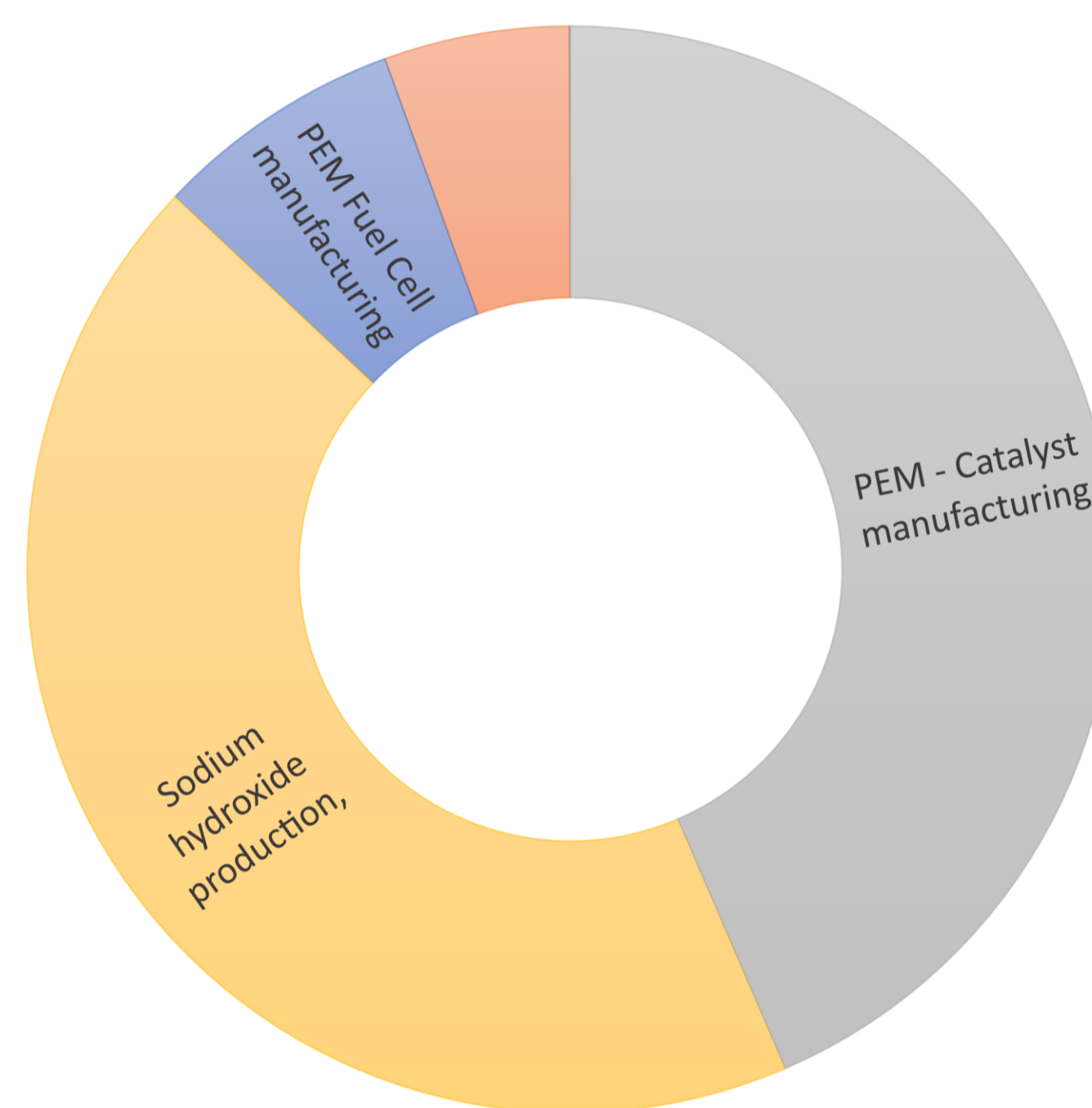
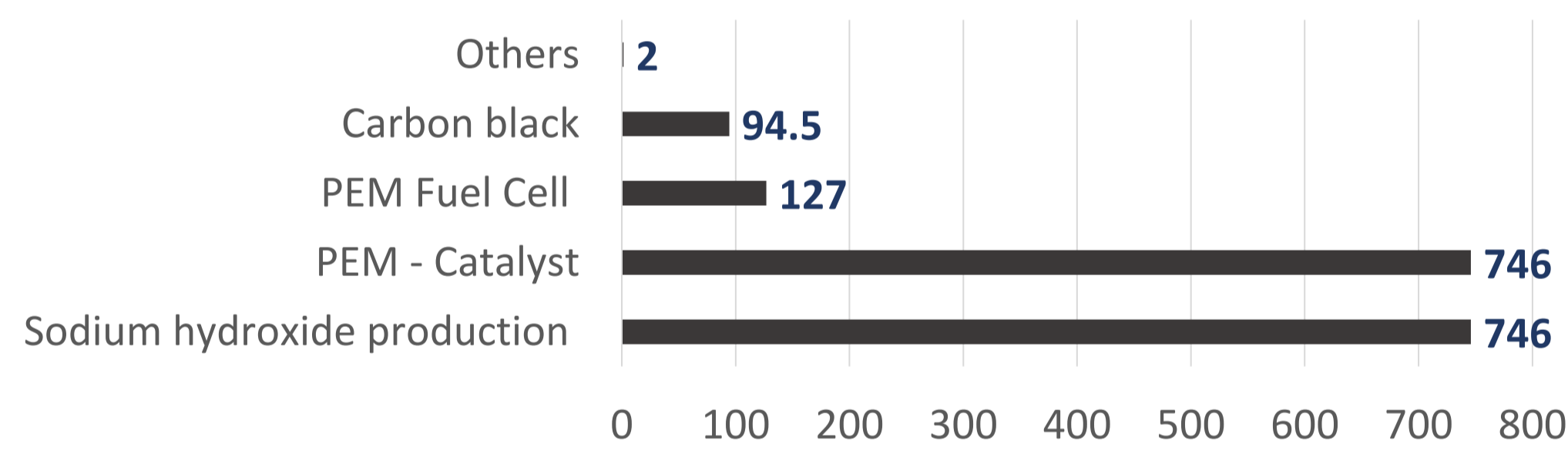
Anode & Cathode Catalyst Layer



Proton Exchange Membrane (PEM)



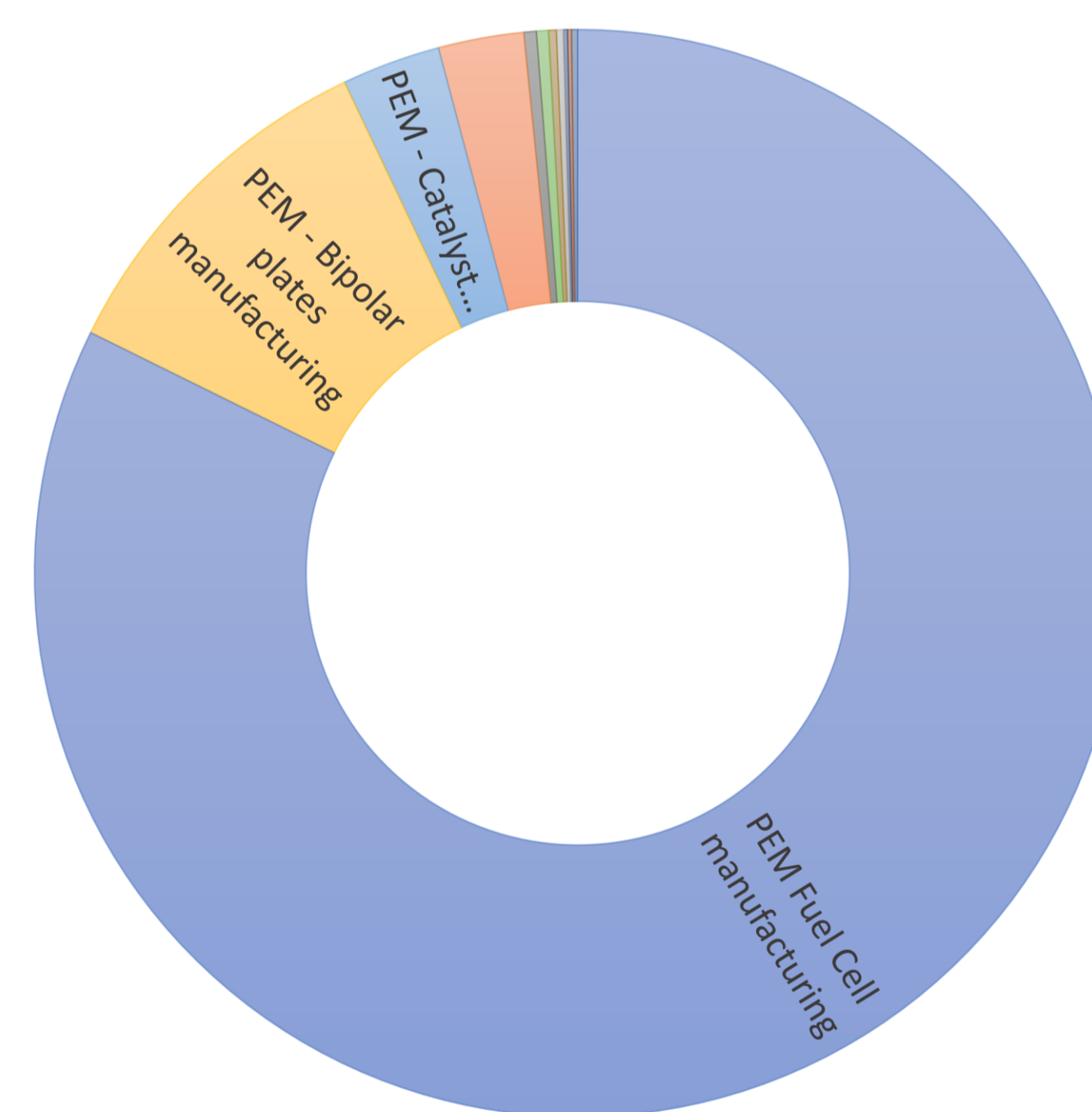
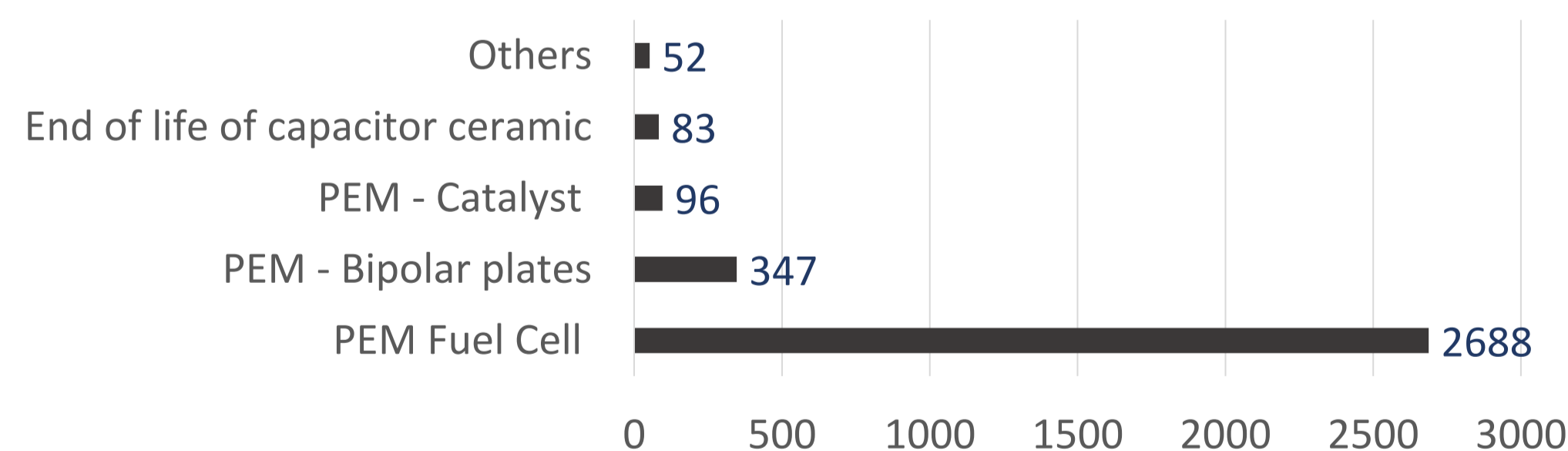
Energy use PEMFC manufacturing, 1715kWh



Background and scope

- PEMFC is a new clean energy technology, but it's still developing
- Environmental impact at every stage can be improved in terms of materials used, processes chosen etc.
- We have used processes and material data from the journal paper <https://doi.org/10.1016/j.jclepro.2020.125086>
- Energy considerations have been omitted and focus is on materials used
- We have limited our study to only PEMFC and its environmental impact

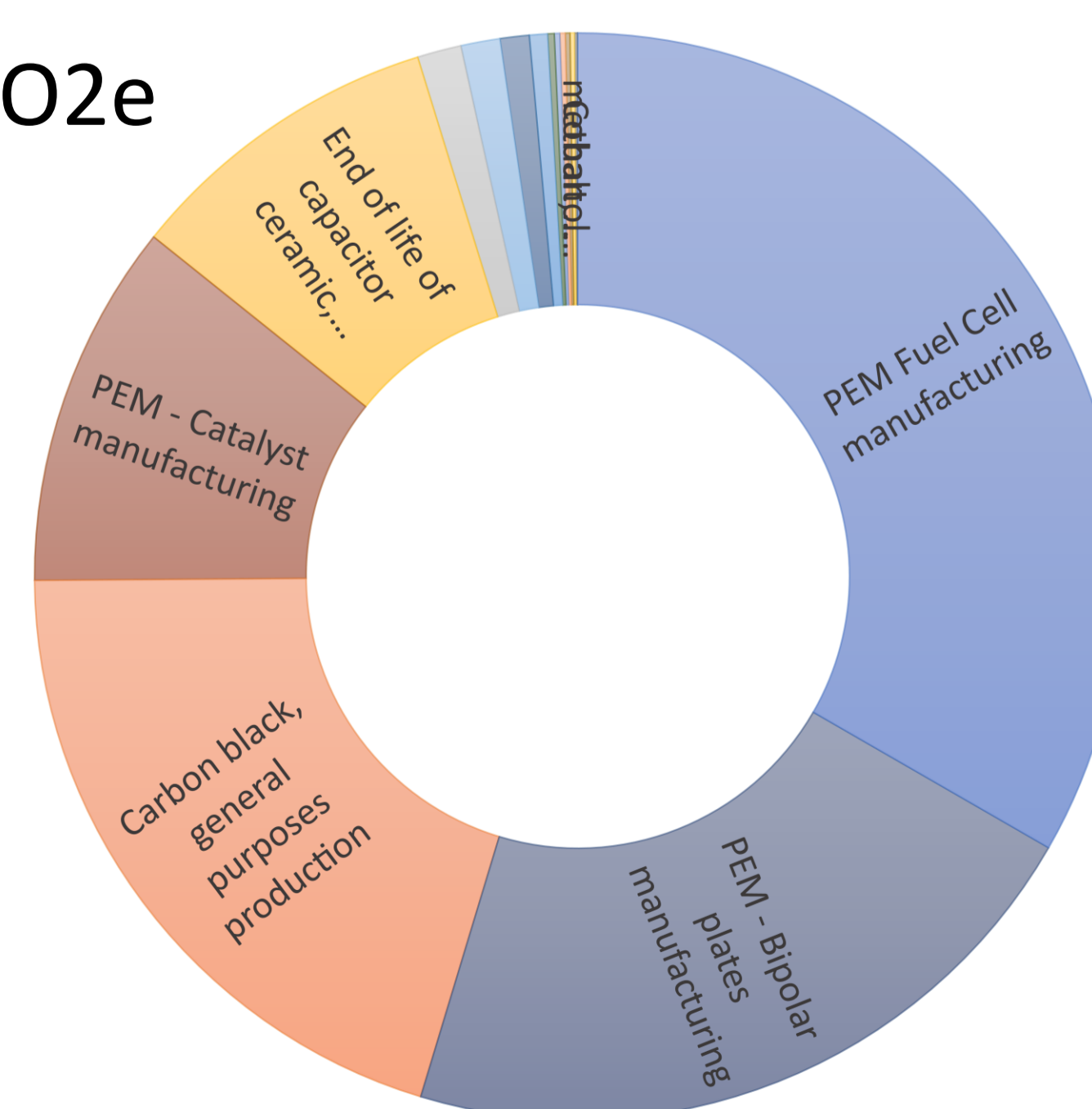
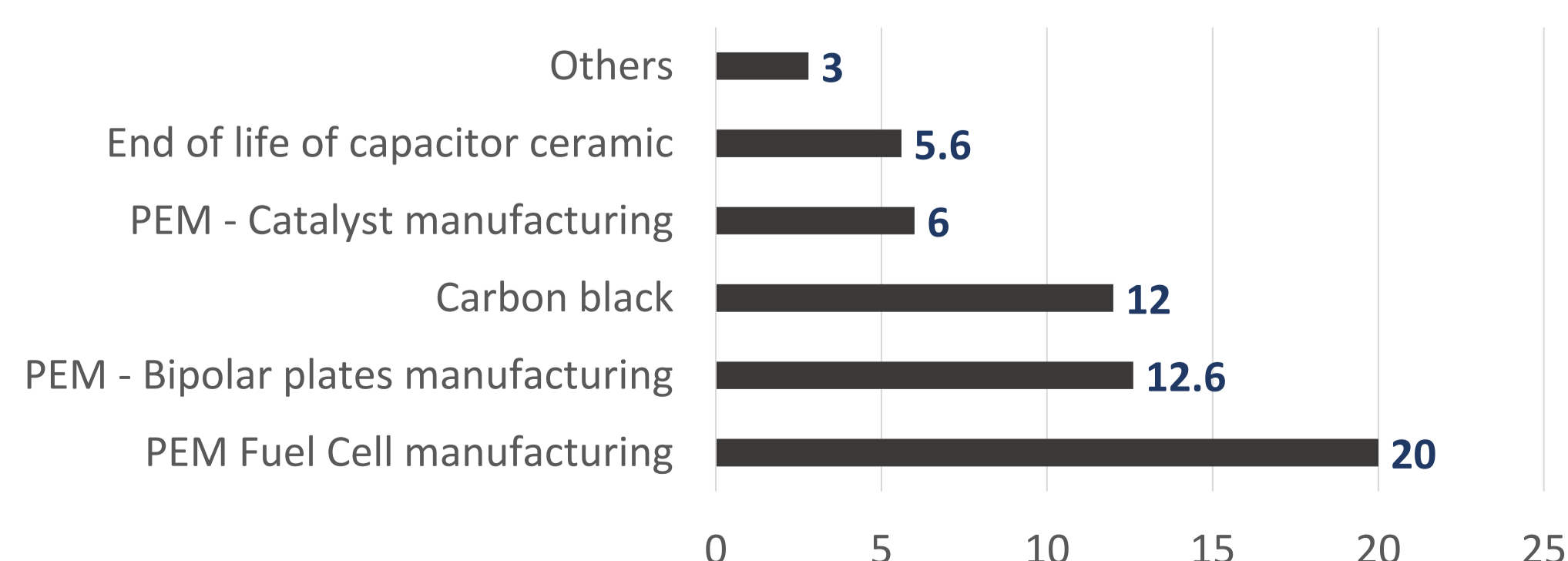
Water use PEMFC manufacturing, 3270m³



Method

- Cradle-to-gate LCA of a PEM FC
- Modelled in OpenLCA
- Material production data from the Environmental Footprint database

Climate change PEMFC manufacturing, 59kg CO₂e



Results and Conclusion:

- PEMFC associated with low climate change- but high environmental impact (mining)
- High water usage and energy intensive manufacturing
- Substitutes for graphite and platinum decreases the environmental impact