WasteEng Conference Series

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Integration of Mixed Plastic Waste Pyrolysis into the Chemical Value Chain via Steam Cracking and Gasification

M. Hennig, M. Pillich, N. Netsch, S. Tavakkol, A. Bardow, D. Stapf

Karlsruhe Institute of Technology

Institute for Technical Chemistry

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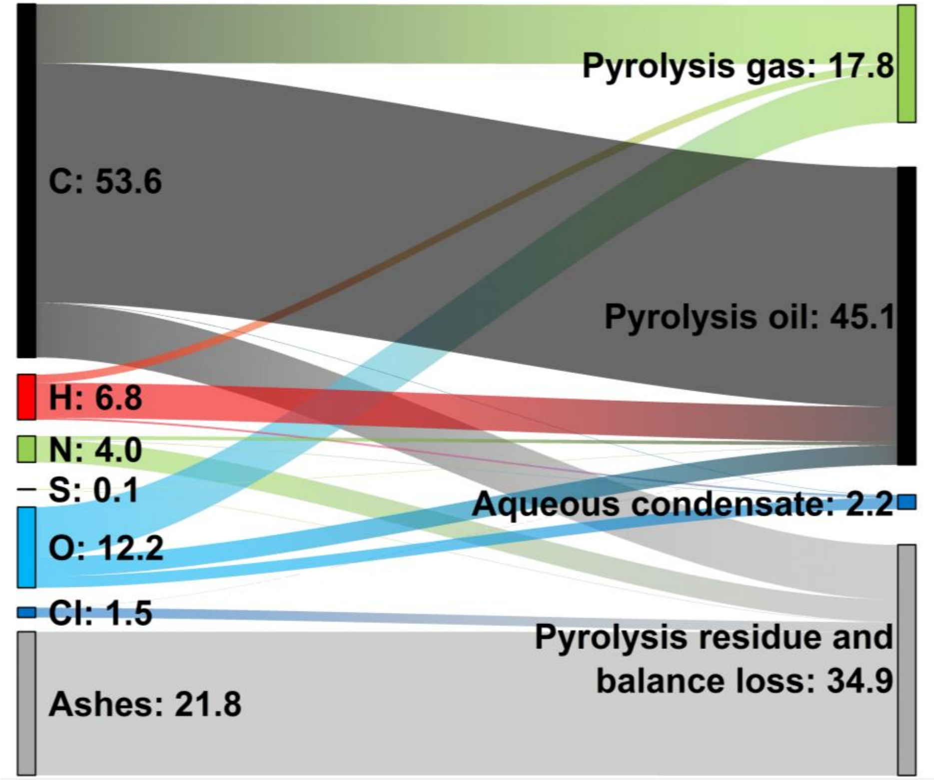
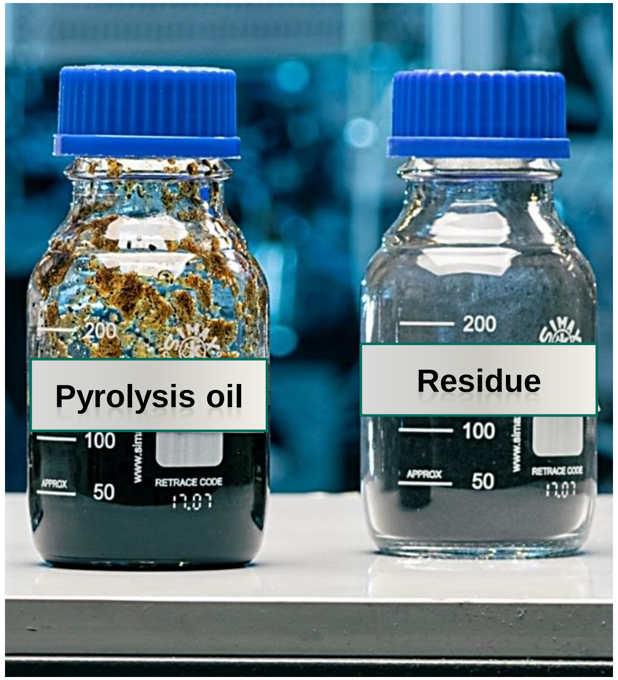
Pyrolysis of mixed plastic waste (MPW)

Case study feedstock



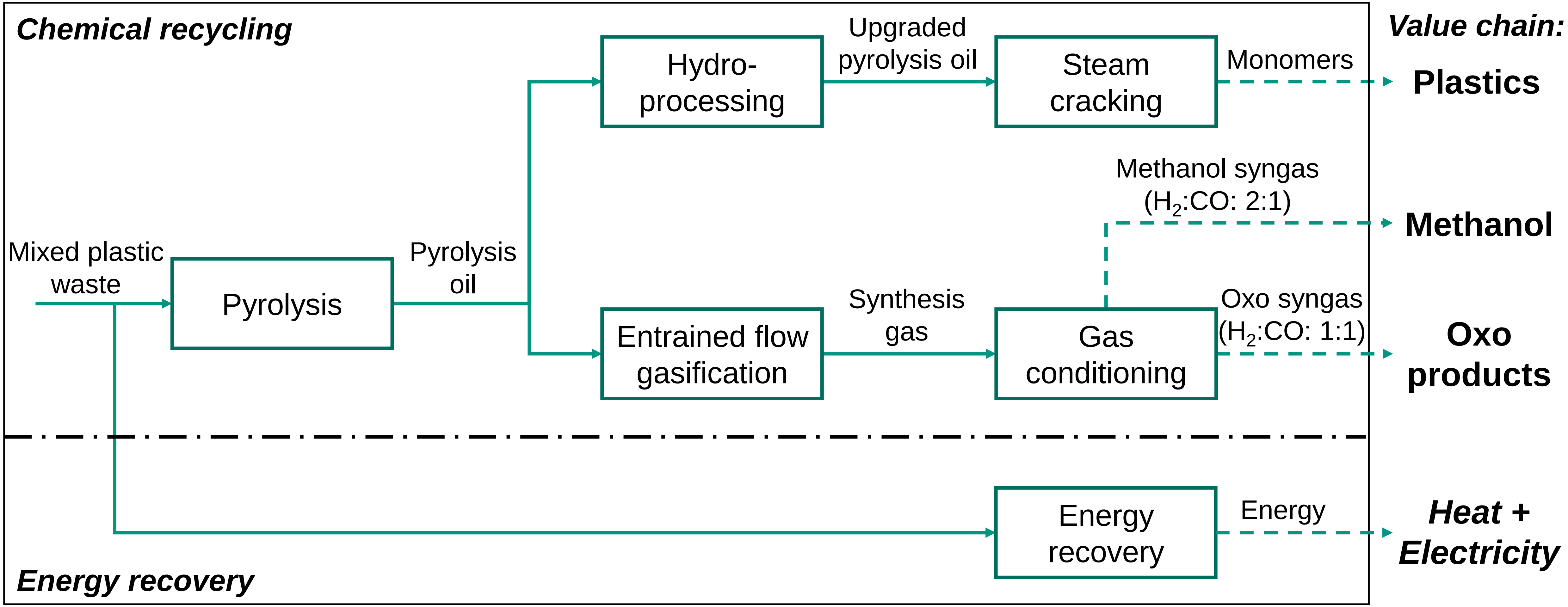


Pyrolysis products

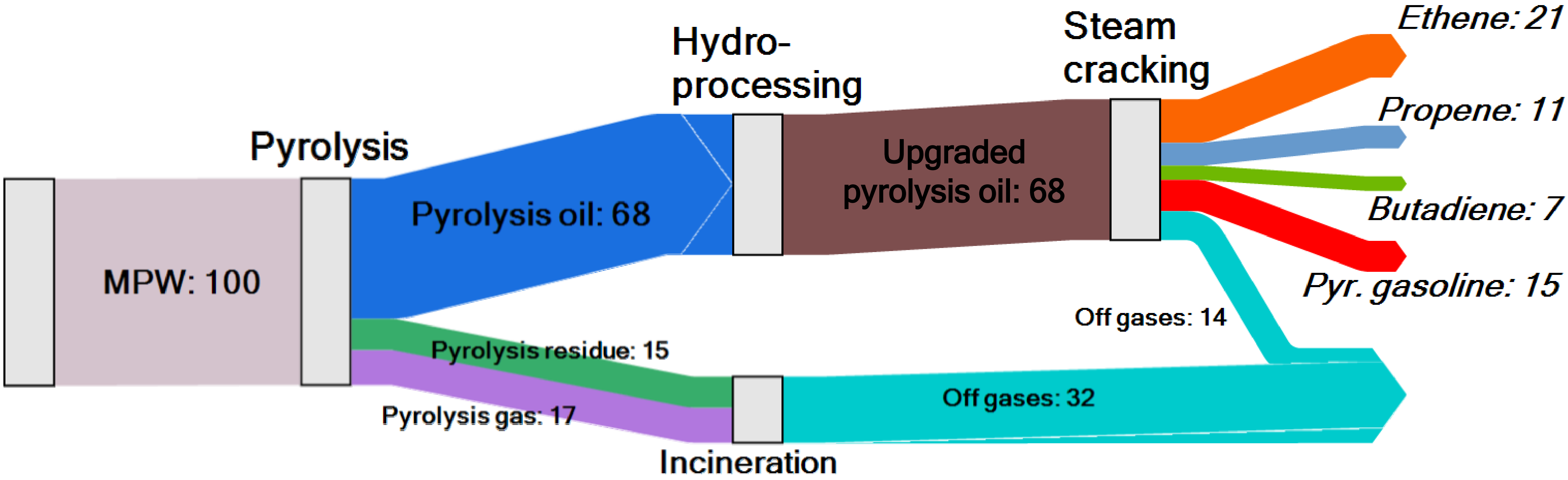
Stallkamp, C., Hennig, M. et al. (2023). J. Ind. Ecol., DOI: 10.1111/jiec.13416.

What is the most beneficial process for using pyrolysis oil in terms of climate change impact?

Integrating pyrolysis into the chemical value chain



Steam cracking for monomer production
Carbon balance

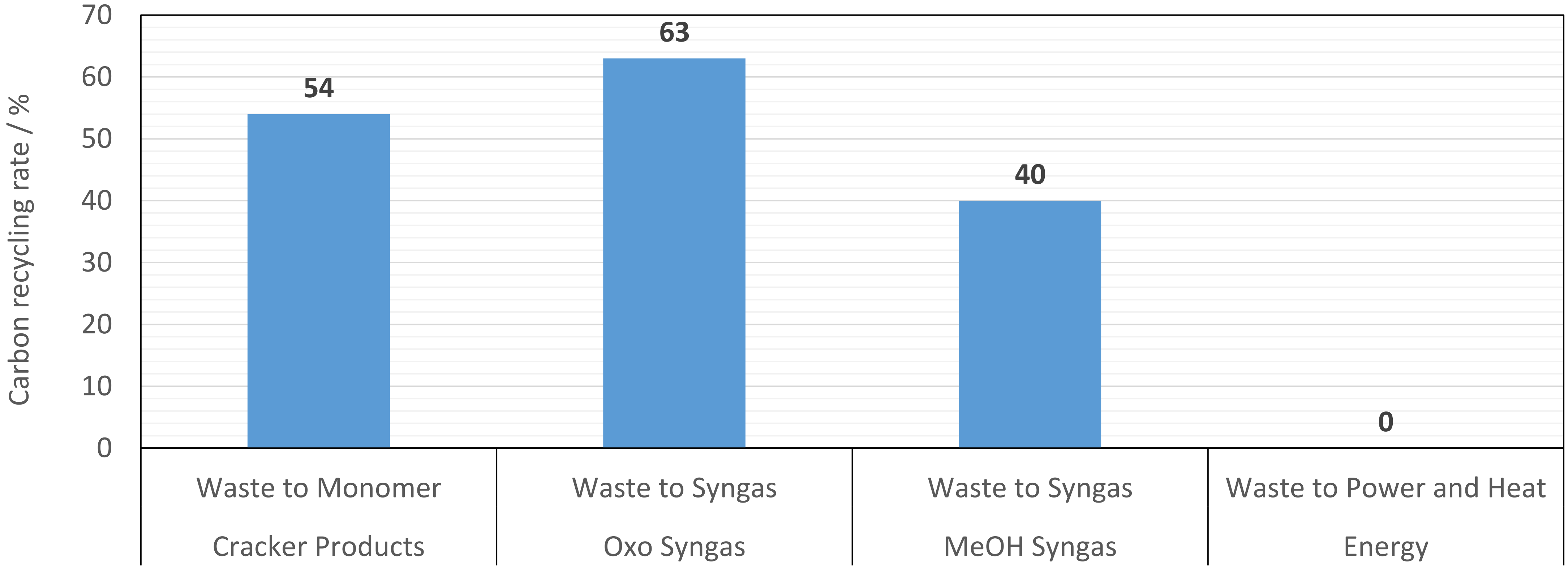


MPW: Mixed Plastic Waste

Percentages refer to input carbon mass flow of MPW

Carbon recovery > 50 % for Waste-to-Monomer process route

Carbon recycling rates of chemical value chains

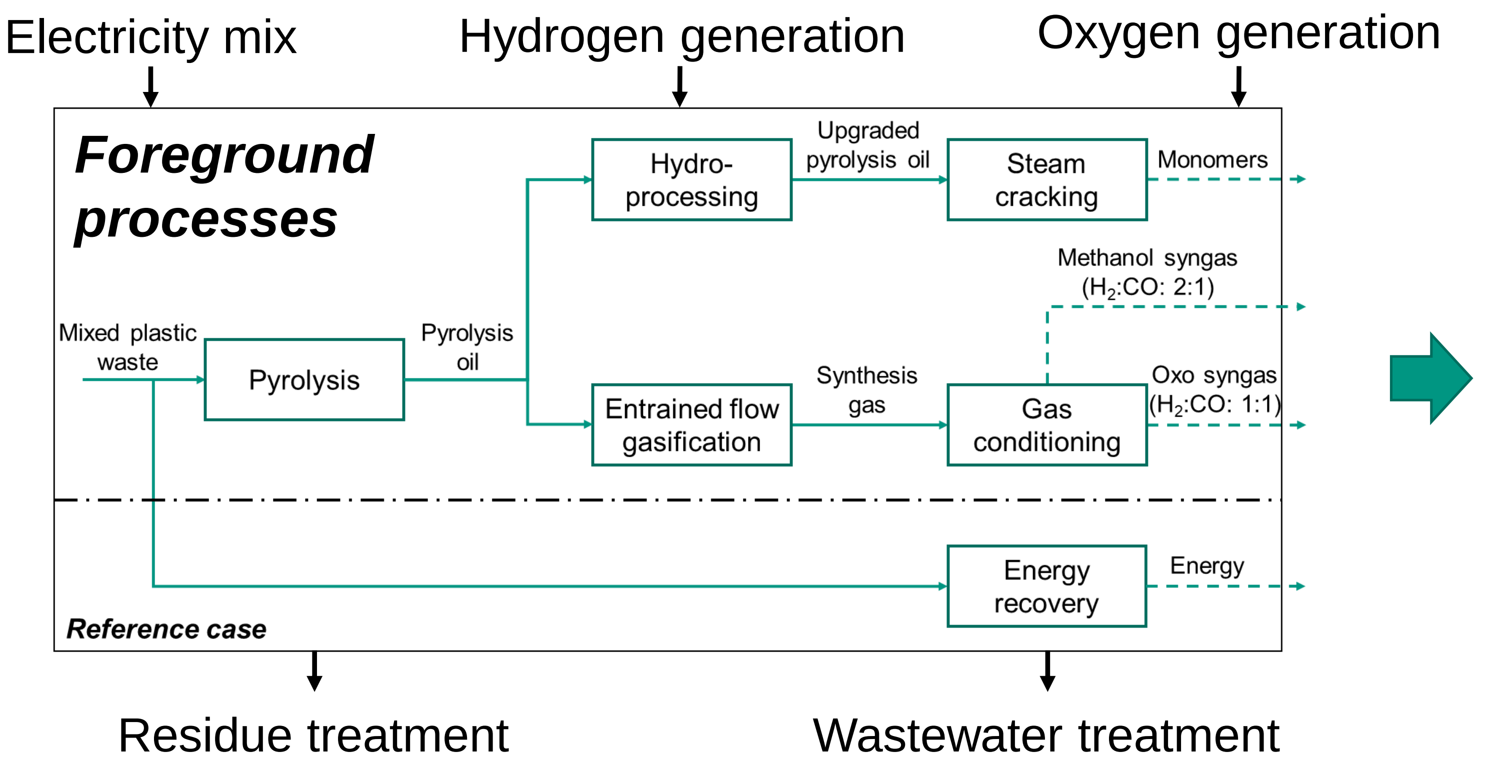


The choice of process and product greatly impacts the carbon recycling rate

System definition for Life Cycle Assessment

Background processes

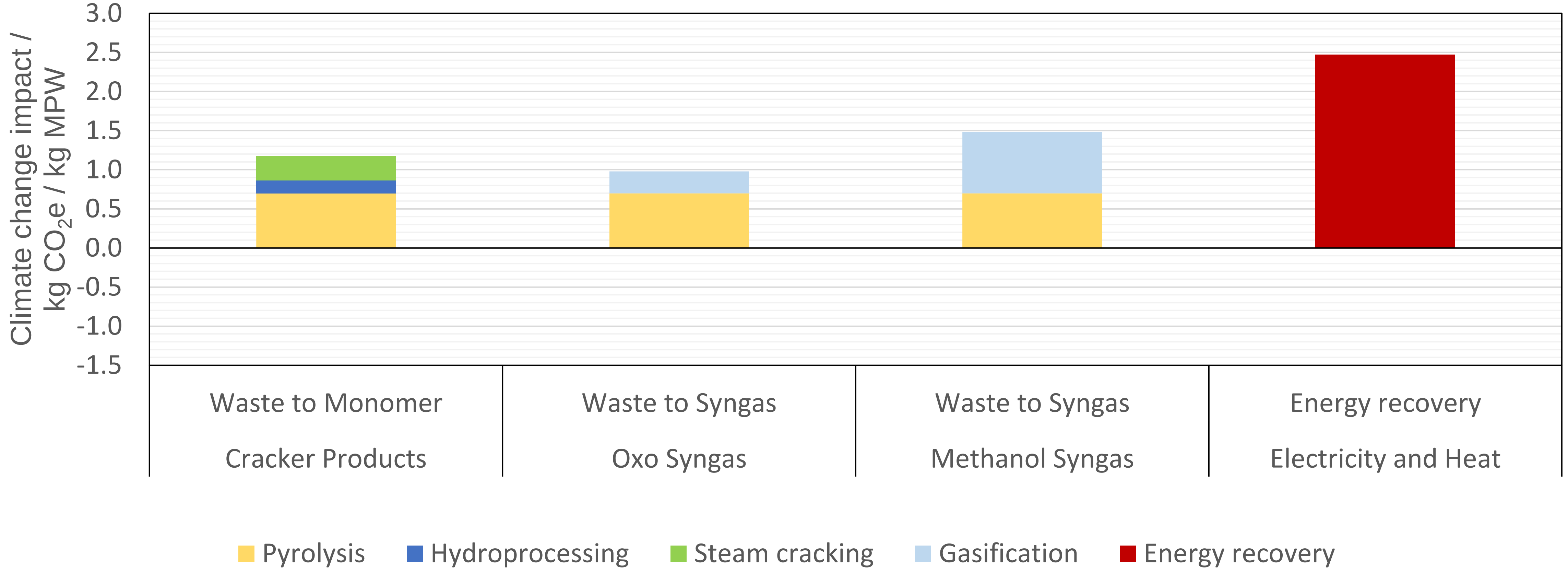
Functional unit: 1 kg MPW



Avoided burdens for:

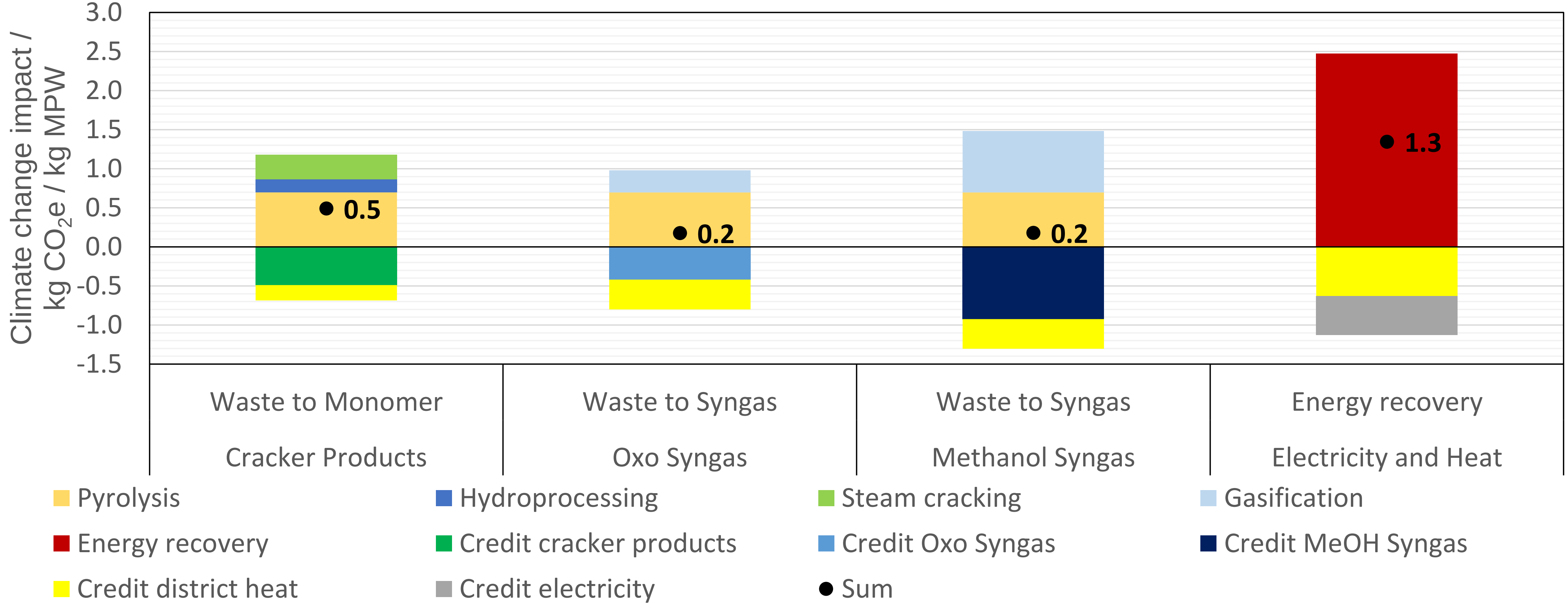
- *Steam cracker products*
- *Methanol syngas*
- *Oxo syngas*
- *Electricity*
- *District heat*

Comparison of climate change impact



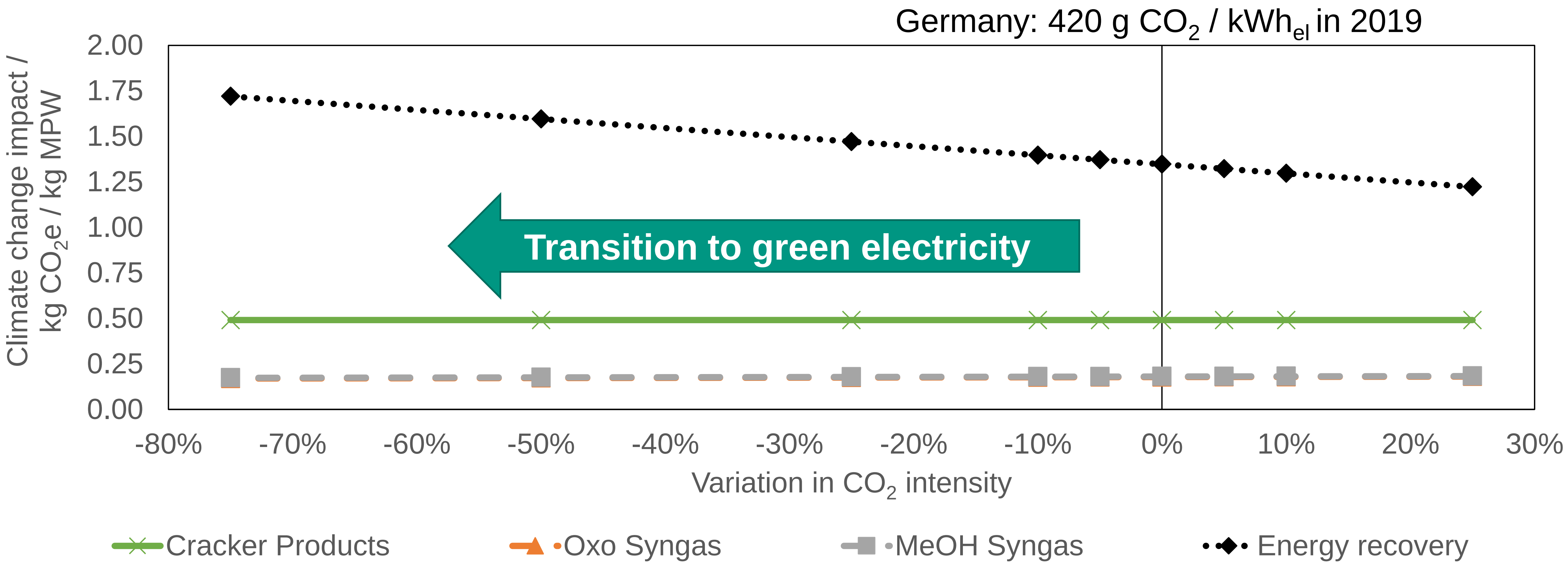
All chemical recycling routes show potential to reduce gross impact of MPW treatment

Comparison of climate change impact



Syngas production (Oxo and Methanol) shows lowest climate change impact by substituting syngas production from heavy fuel oil

Sensitivity analysis: Electricity mix CO_2 intensity



Advantage of chemical recycling routes will increase with greener electricity mix

Thinking ahead

- In the short term:
  - Pyrolysis oil from MPW could reduce CO_2 emissions through substitution of heavy fuel oil in gasification
- In the medium term:
  - Reduce byproduct formation in pyrolysis
  - CCS could be used for unavoidable CO_2 emissions
- In the long term:
  - Integration with emerging technologies (CCU, biomass)

AI generated with Microsoft Designer

Thank you for your attention!

…and the financial support of *THINKTANK Industrielle Ressourcenstrategien* and the *Karlsruhe House of Young Scientists (KHYS)*

Literature

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