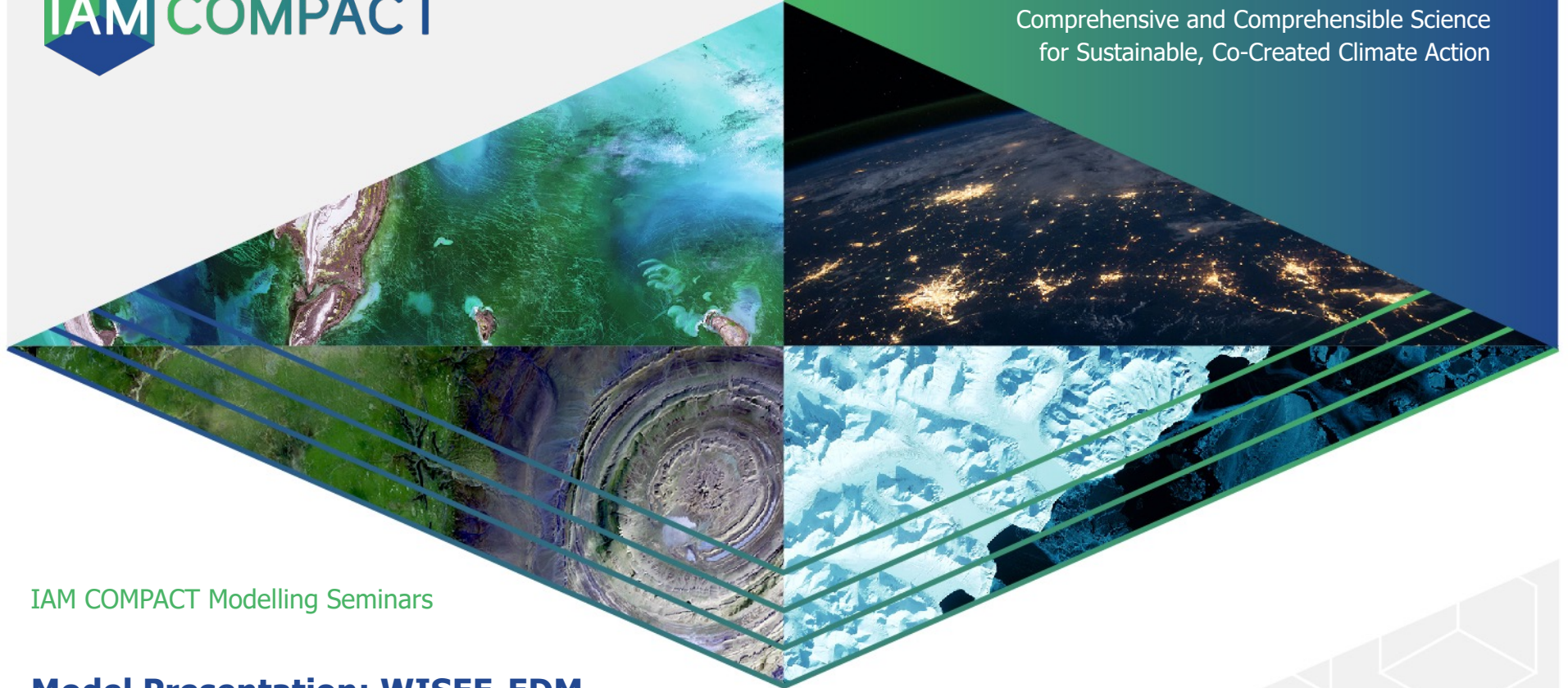




Expanding Integrated Assessment Modelling:
Comprehensive and Comprehensible Science
for Sustainable, Co-Created Climate Action



IAM COMPACT Modelling Seminars

Model Presentation: WISEE-EDM EU-Industry/Global Steel

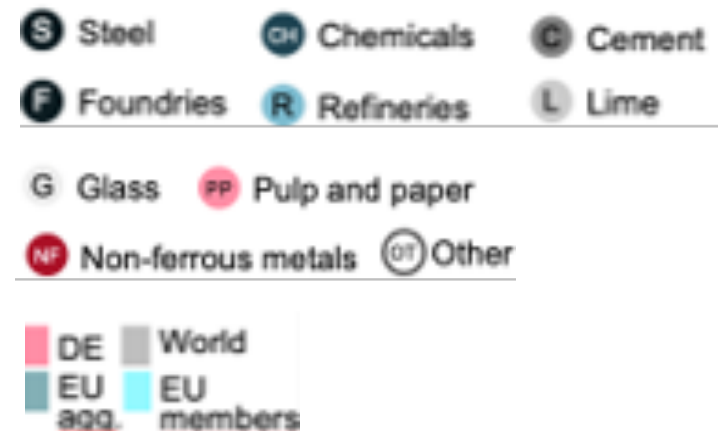
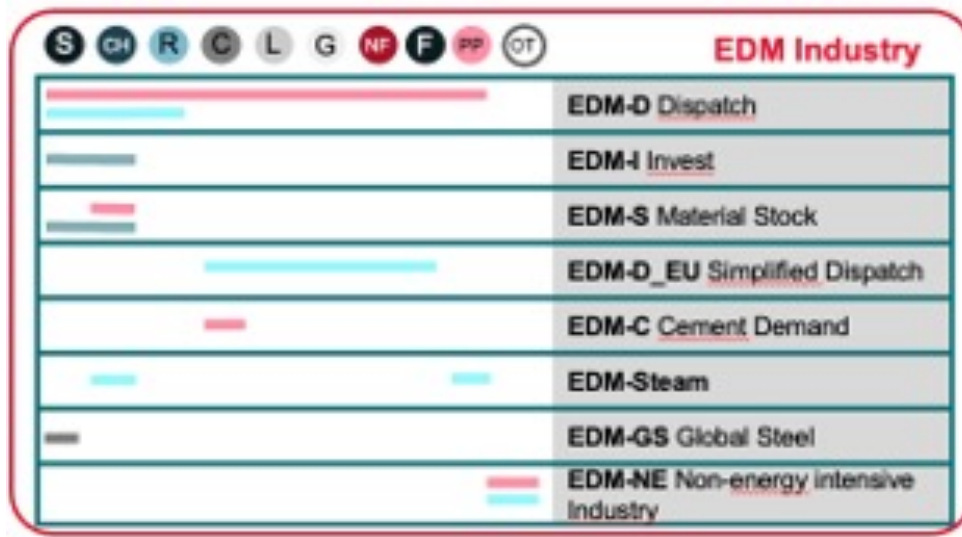
Wuppertal Institut



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- The EDM is a model family developed at Wuppertal Institut over the last 10-15 years
 - EDM stands for „Energy Demand model“
 - EDM Industry *EU* – (partly) new
 - EDM Global Steel – very new
- Models are selected and combined according to targeted industrial sub-sectors, research question and coverage



- The EDM is a tool to analyse possible future industrial production systems and to explore consistent pathways of getting there
- EDM is used for technologically detailed bottom-up modelling
- Main objectives typically not “optimal” pathway but target achievement and plausibility

Sectoral roadmaps and scenarios, government targets, databases, scientific literature, industry media, exchange with stakeholders

Demand, TRLs,
asset age and lifetimes

prices (energy, CO₂), constraints on energy carriers,
infrastructure, engineering capacities, acceptance, ...

EDM

CO₂ (emissions, CCS/U) / energy and feedstock use
(Investment costs, re-location effects,...)



"Which technologies will enable compliance with set CO₂ emission reduction targets in 2050?"

"When does a phase-in of break-through technologies need to start in order to reach a target state while maintaining usual reinvestment cycles?"

"What energy sources are needed for a target pathway, in what quantities, when and where?"

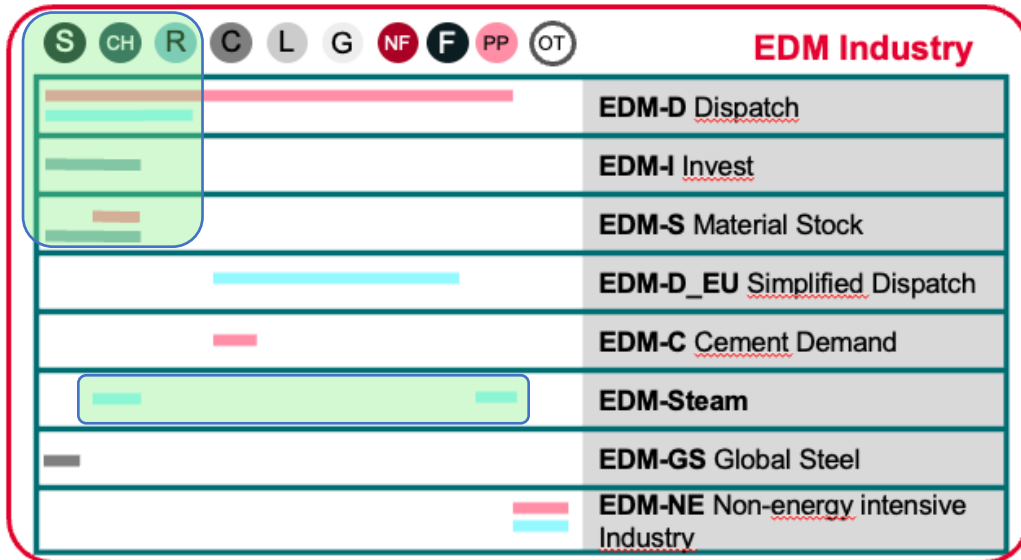
"What do future production networks look like technologically and geographically?"



EDM – Industry EU



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Tools used for modelling steel / chemicals / refineries on EU level

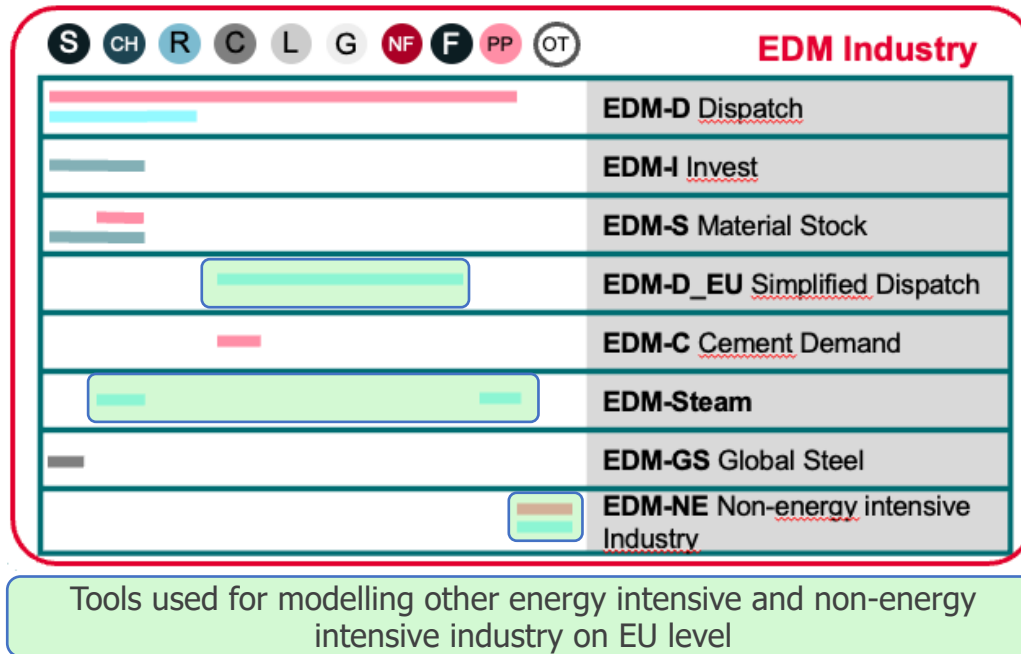


Steel, (Petro-)Chemicals, Refineries:

- Modelling of physical production
- Detailed representation of EU27+UK industrial processes and sites (→ analysis on sub-national level possible)
- Bottom-up coverage of about 80 base chemicals
- Scrap / waste availability: stock-model (EDM-S¹; Material-Flow-Analysis, based on ODYM-Framework)
- Investments: optimisation model (EDM-I¹) considering demand, age of assets, specific costs, transport of intermediate products between sites (pipeline network)
- EDM-D: bottom-up calculation of CO₂ and energy demand. Site- / network based balancing of industrial by-production (H₂, steam, steel gases). Rule based energy carrier shift (considering e.g. infrastructure at site)

¹ Currently available for petro-chemicals. Under development for steel (most likely available during 2nd modelling cycle).





Other energy-intensive industry:

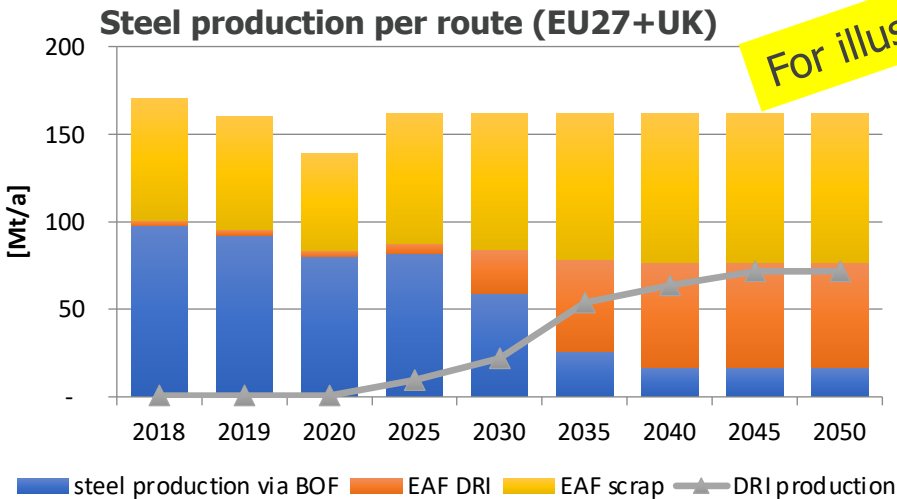
- Modelling of physical production
- Activity based modelling at country level (no explicit representation of capacities)
- Sector specific mitigation options and strategies

Non-energy intensive industry:

- Extrapolation of energy demands based on economic indicators, efficiency parameters and technology shifts
- Differentiation of heat levels (room temp., < 150°C, 150-500°C, >500 °C)

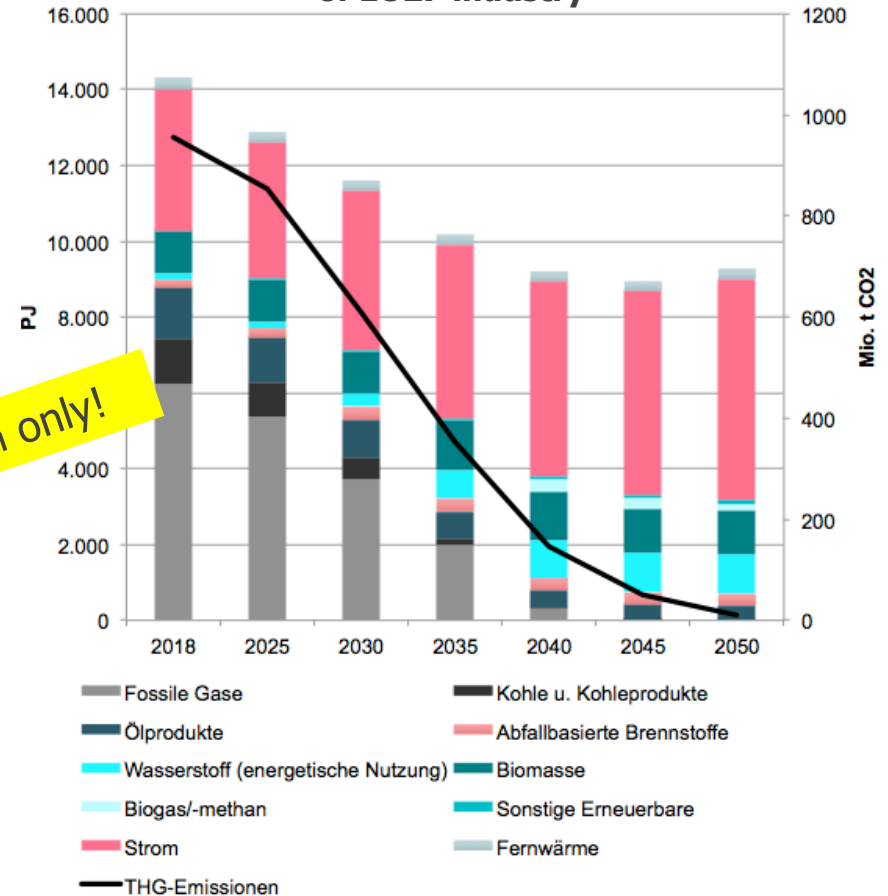


- GHG emissions, final energy and feedstock demand at EU and country level (right)
- Changes of production routes (below)
- Other possibilities: invest costs, geographical analyses
- (No specific link to SDGs, yet)



For illustration only!

Final energy demand and GHG emissions of EU27 industry

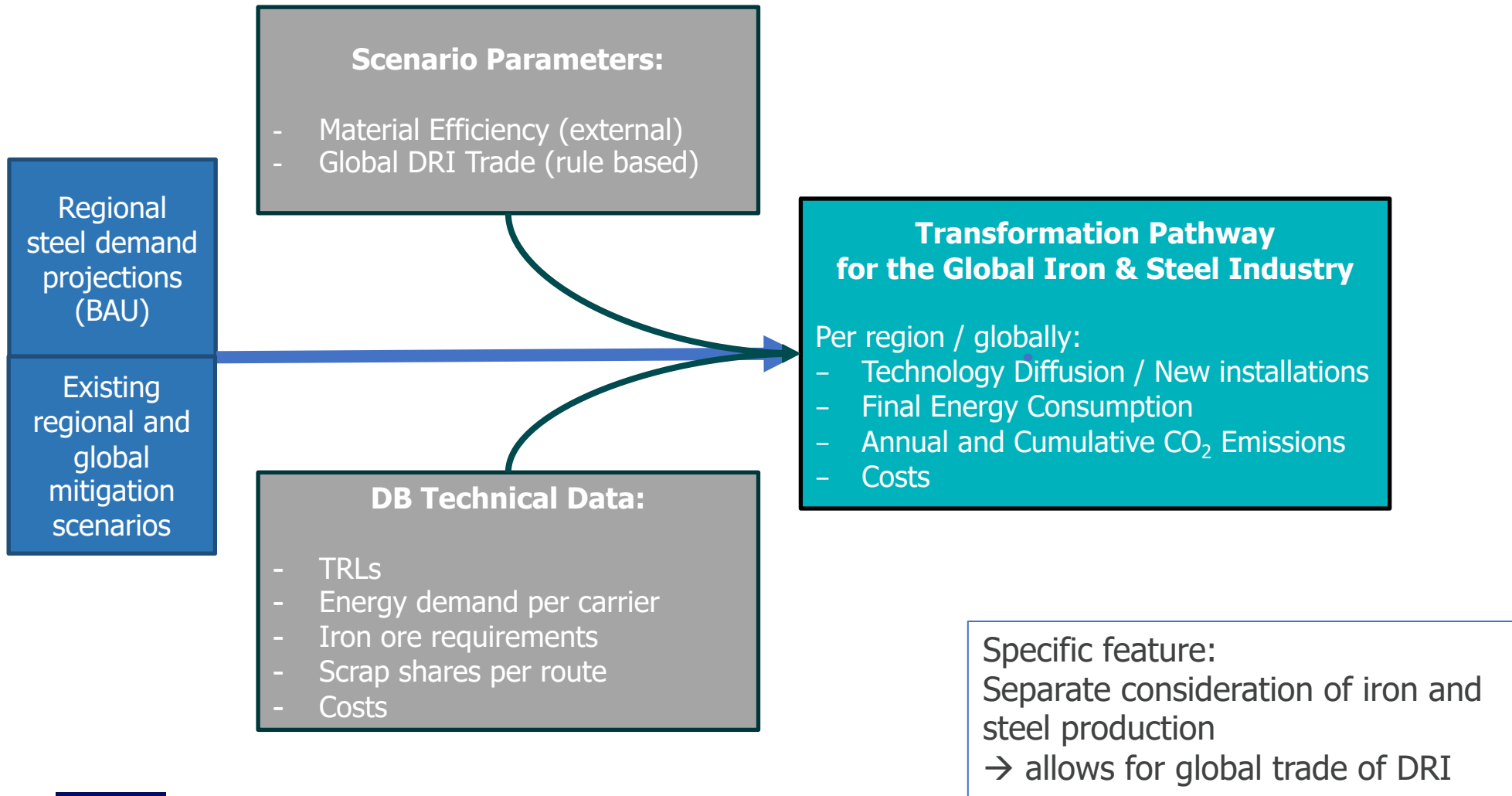


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EDM – Global Steel



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11 regions + RoW (see map)

- EU27 represented as one region
- The chosen 11 regions cover 92% of today's global steel production

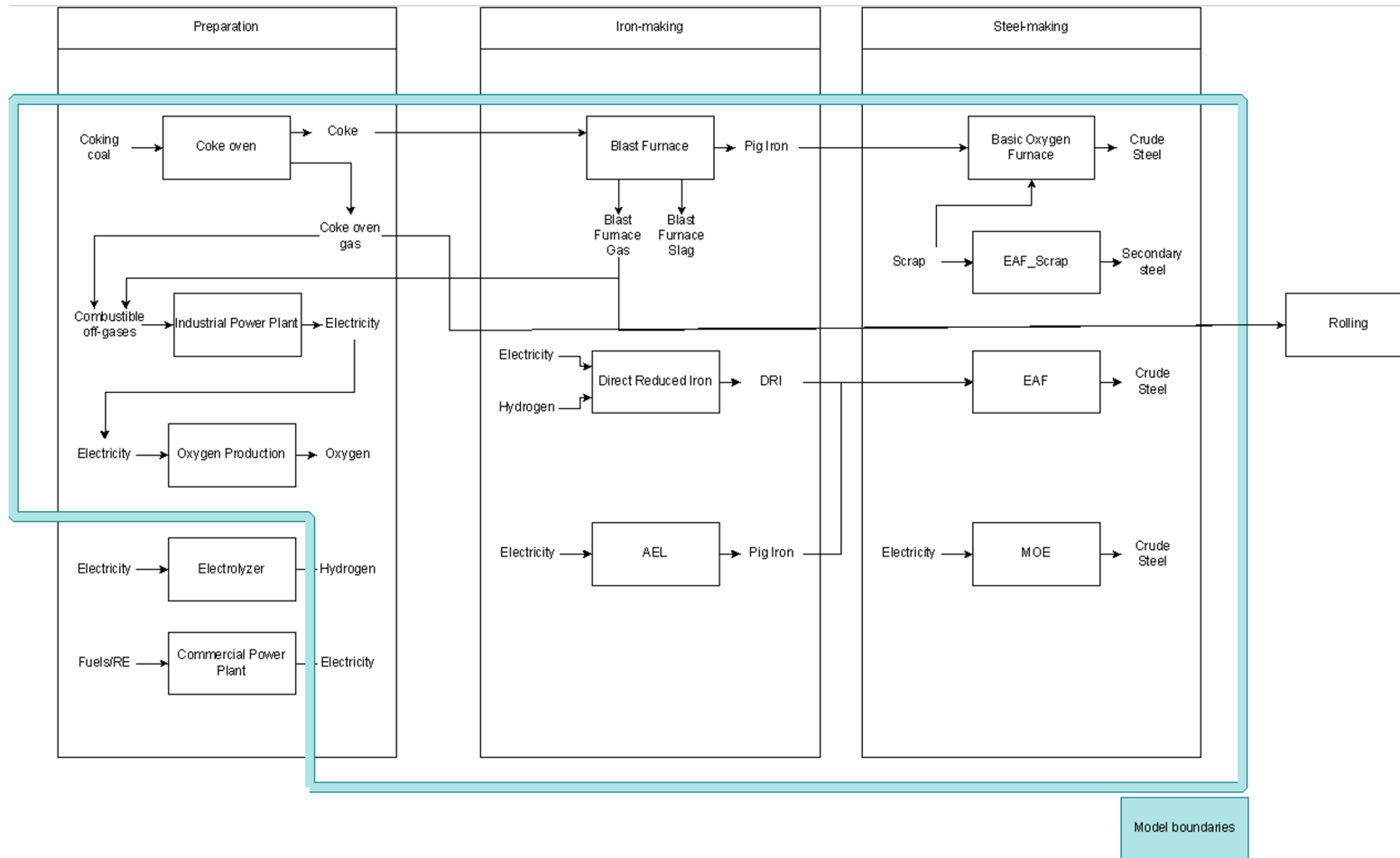
21 Technologies:

- 14 primary steel
- 3 iron (DRI) production for export
- 2 steel from imported iron (DRI)
- 2 secondary steel



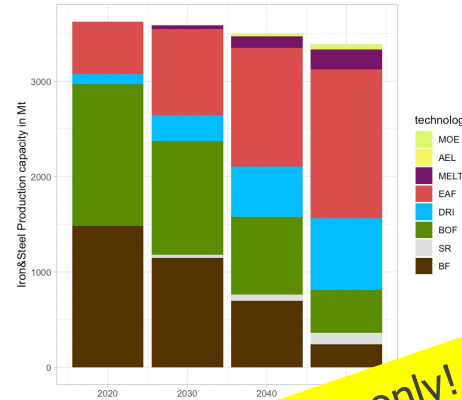
Explicitly considered regions in EDM - Global Steel



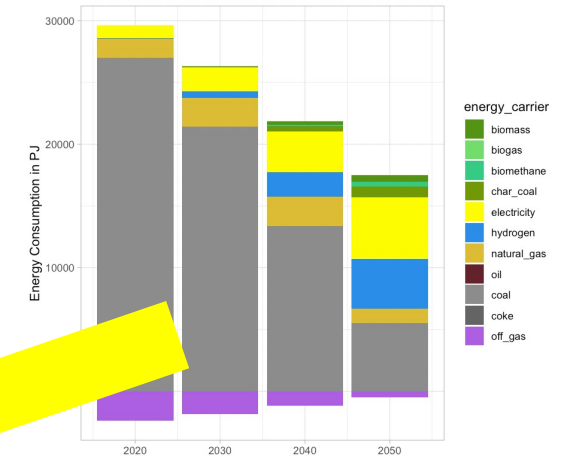


- Final energy consumption
- Technology asset
- Annual/cumulative GHG emissions
- Scrap & material consumption
- Investment & production costs
- (No specific link to SDGs, yet)

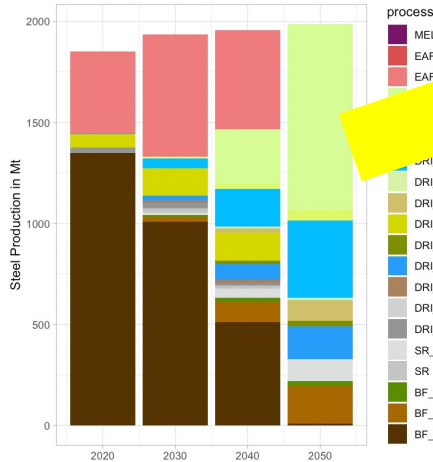
Technology asset



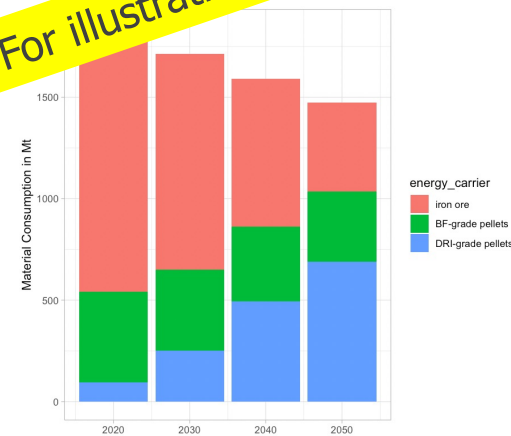
Energy Consumption



For illustration only!



Material Consumption



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Journal & conference papers:

Schneider, C; Saurat, M. (2020): Simulating geographically distributed production networks of a climate neutral European petrochemical industry. ECEEE Industry 2020 conference paper.

Schneider, C; Lechtenböhmer, S.; Samadi, S. (2019): Risks and opportunities associated with decarbonising Rotterdam's industrial cluster. In: Environmental innovation and societal transitions; DOI: 10.1016/j.eist.2019.05.004

Lechtenböhmer, S; Schneider, C.; Yetano Roche, M.; Höller, S. (2015): Re-Industrialisation and Low-Carbon Economy—Can They Go Together? Results from Stakeholder-Based Scenarios for Energy-Intensive Industries in the German State of North Rhine Westphalia. In: Energies 2015, 8, 11404-11429; DOI: 10.3390/en81011404

Selected reports:

Klimaneutrales Deutschland 2050. Studie im Auftrag von Agora Energiewende, Agora Verkehrswende und Stiftung Klimaneutralität. Prognos, Öko-Institut, Wuppertal Institut (2020). <https://www.agora-energiewende.de/projekte/klimaneutrales-deutschland-2050/>

Klimaneutrale Industrie – Schlüsseltechnologien und Politikoptionen für Stahl, Chemie und Zement. Agora Energiewende und Wuppertal Institut (2019). <https://www.agora-energiewende.de/veroeffentlichungen/klimaneutrale-industrie-hauptstudie/>

Schneider, C. et al. (2020): Decarbonisation pathways for key economic sectors. Deliverable 4.3 to the REINVENT project. Wuppertal.





Thank you!

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