

OPTIMAL ELECTRIFICATION OF INDUSTRY IN REGARDS TO SYNTHESIS, DESIGN AND OPERATION

DLR - German Aerospace Center, Institute of Low-Carbon Industrial Processes

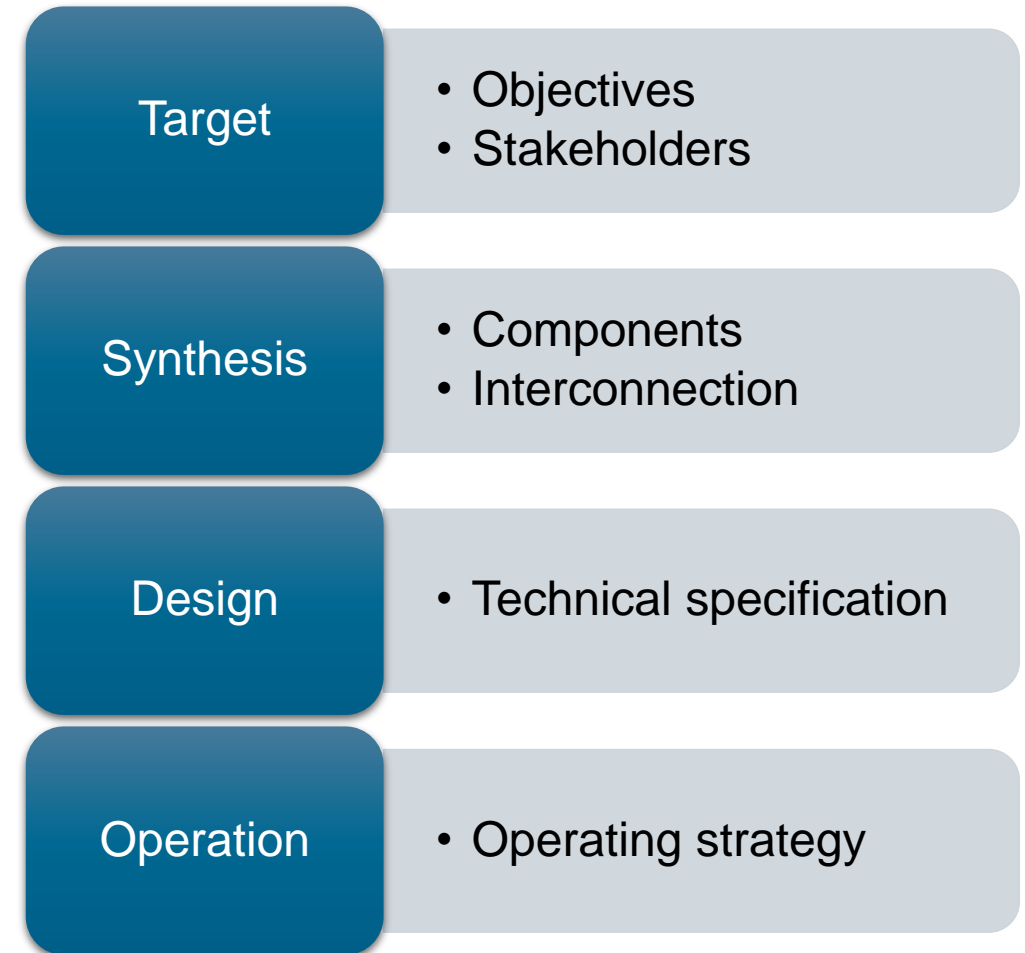
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Motivation



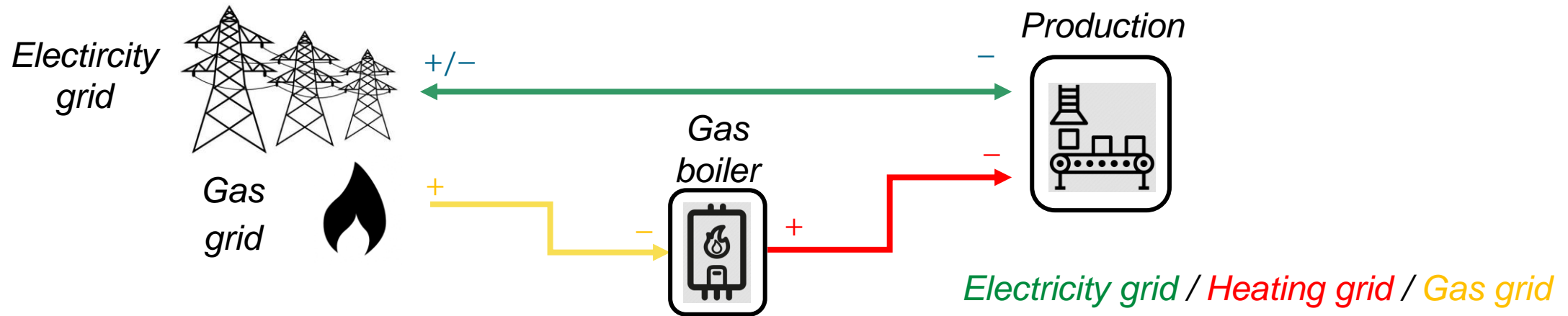
- Electrification of industry
 - Energy and process related CO₂ emission - 25%^[1]
 - Emission reduction
 - Energy security
 - Increasing availability of low carbon electricity
 - Process improvement
- Challenges
 - Replacing existing technologies with new technologies
 - Integrating new technologies into existing system
 - Economical, ecological and social objectives



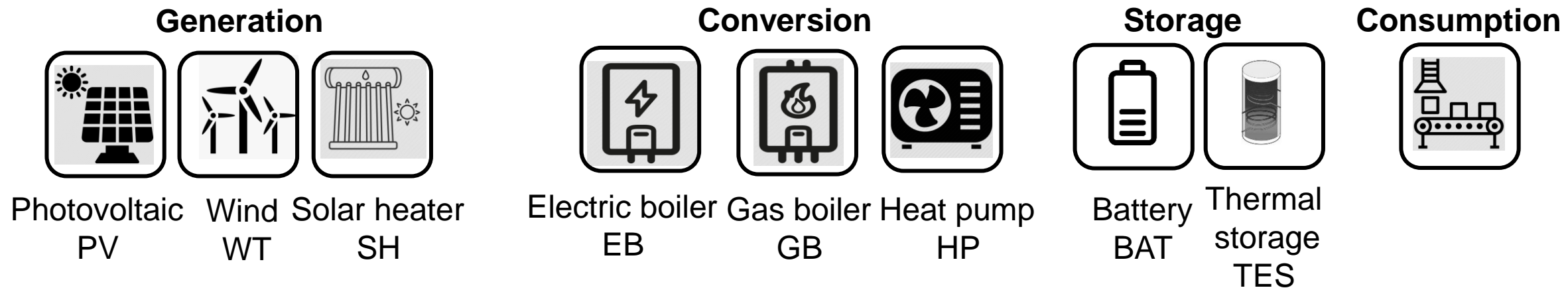
^[1]IPCC 1,5 Report chapter 2

Case study

- Heat (steam generation) and electricity demand

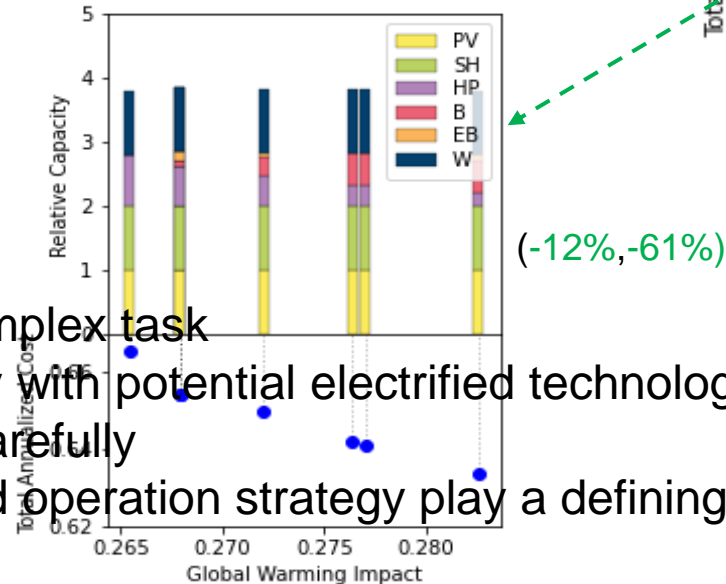
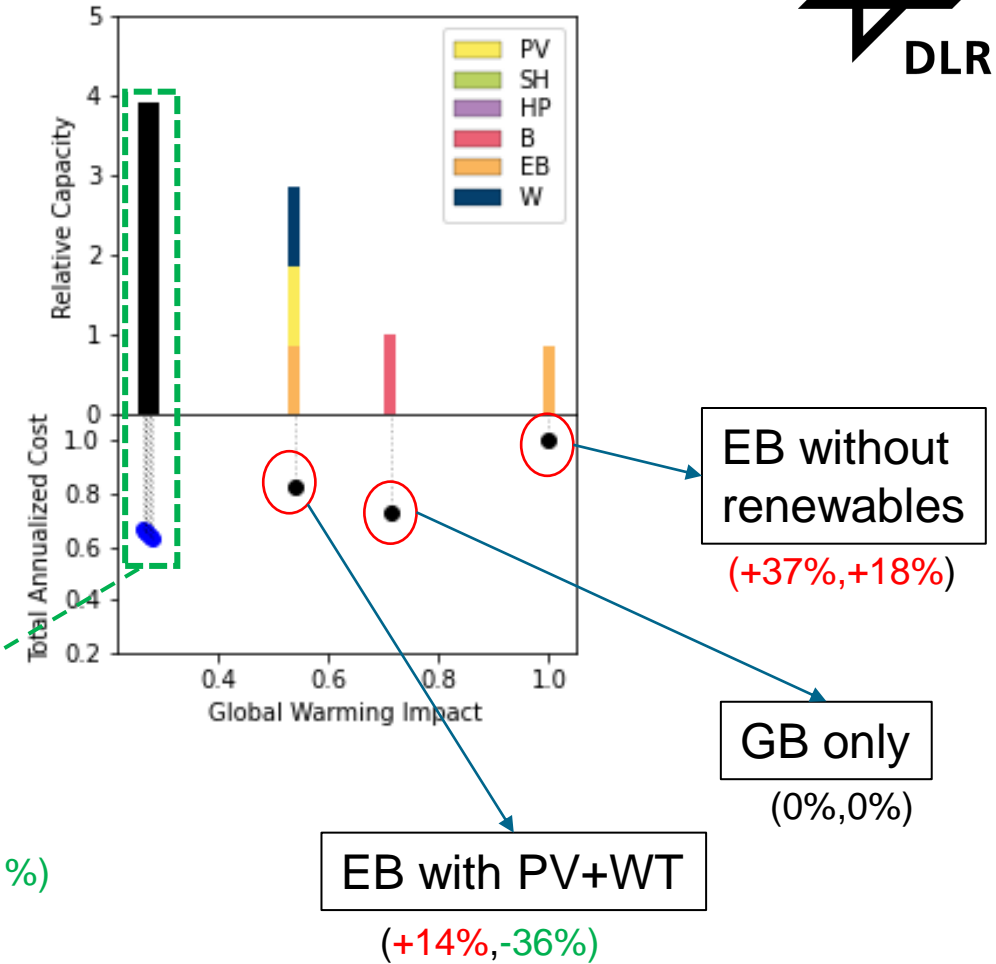
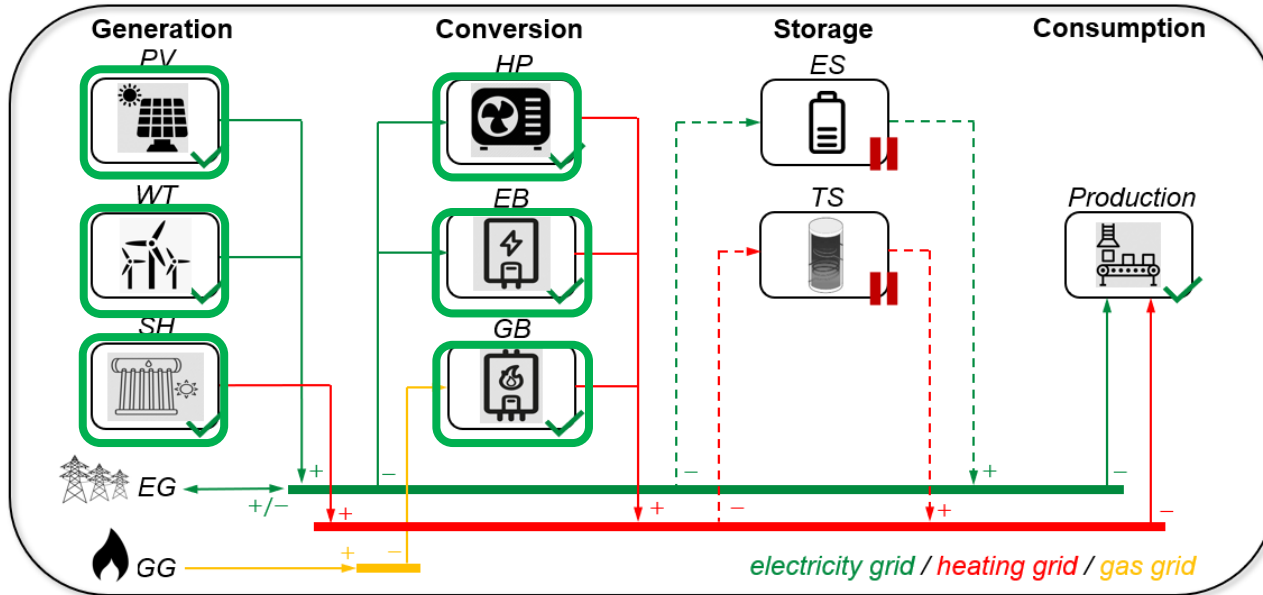


- Electrification with renewable sources

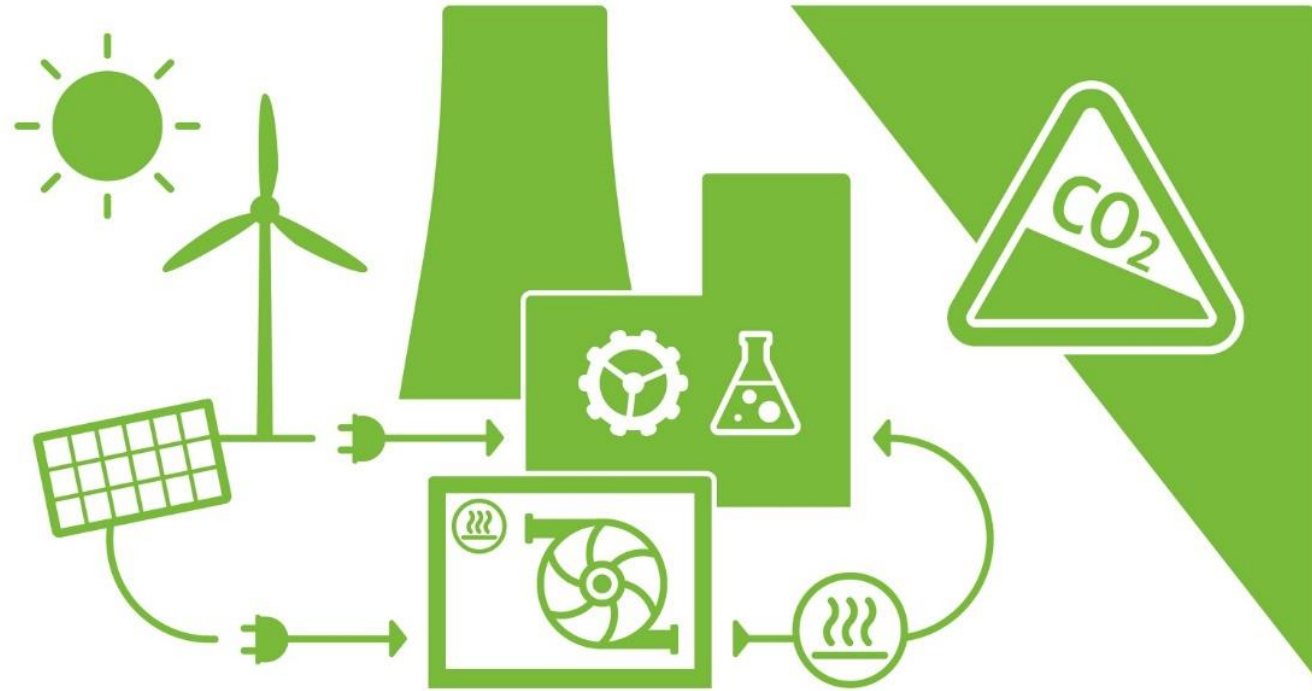


- Challenges:** Optimal structure, design and operation considering cost and emission

Result and conclusion



- Optimal electrification is a complex task
- Replacing existing technology with potential electrified technology does not necessarily reduce emission
- Objectives must be chosen carefully
- Optimal synthesis, design and operation strategy play a defining role



Thank you for your attention

Literature



- [1] S. Sass, T. Faulwasser, D.E. Hollermann, C.D. Kappatou, D. Sauer, T. Schütz, D.Y. Shu, A. Bardow, L. Gröll, V. Hagenmeyer, D. Müller and A. Mitsos: *Model Compendium, Data and Optimization Benchmarks for Sector-Coupled Energy Systems*. Computers and Chemical Engineering, Volume 135, 106760, 2020.
- [2] R. Debulac, S. Serra, S. Sochard and J.-M. Reneaume: *A Dynamic Optimization Tool to Size and Operate Solar Thermal District Heating Networks Production Plants*. Energies, Volume 14, 8003, 2021.
- [3] F. Schlosser, M. Jesper, J. Vogelsang, T.G. Walmsley, C. Arpagaus and J. Hesselbach: *Large-scale Heat pumps: Applications, Performance, Economic Feasibility and Industrial Integration*. Renewable and Sustainable Energy Reviews, Volume 133, 110219, 2020.