

Go or wait?

The impact of emission pathways on the European energy system transition under myopic planning

Kun Zhu, Aarhus University;
Tom Brown, Karlsruhe Institute of Technology;
Marta Victoria, Aarhus University;
Gorm B. Andresen, Aarhus University;
Martin Greiner, Aarhus University

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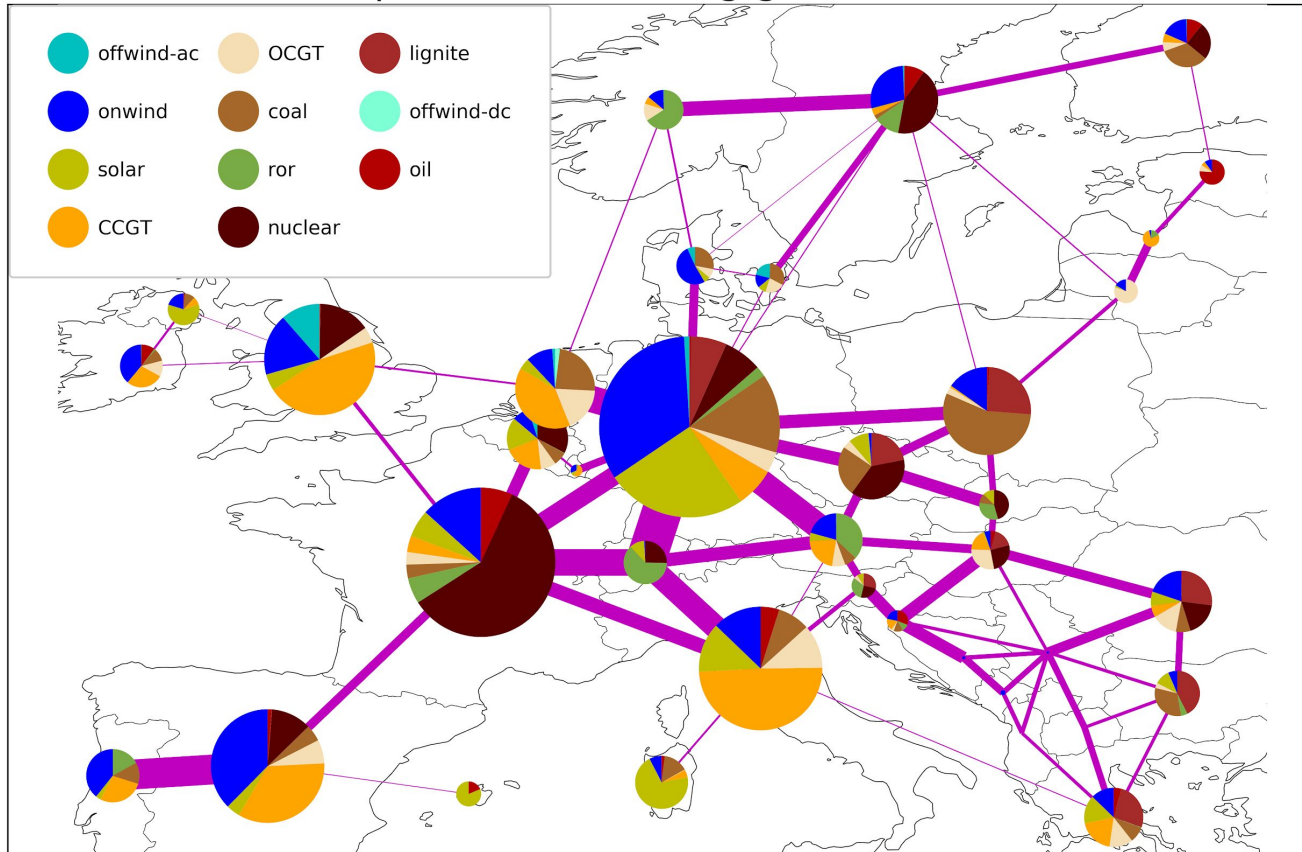


Introduction:

- IPCC: “Global Warming of 1.5 °C”
- European Commission: “A clean planet for all”
- Net-zero emission by 2050
- Electricity, heating and cooling coupled Europe

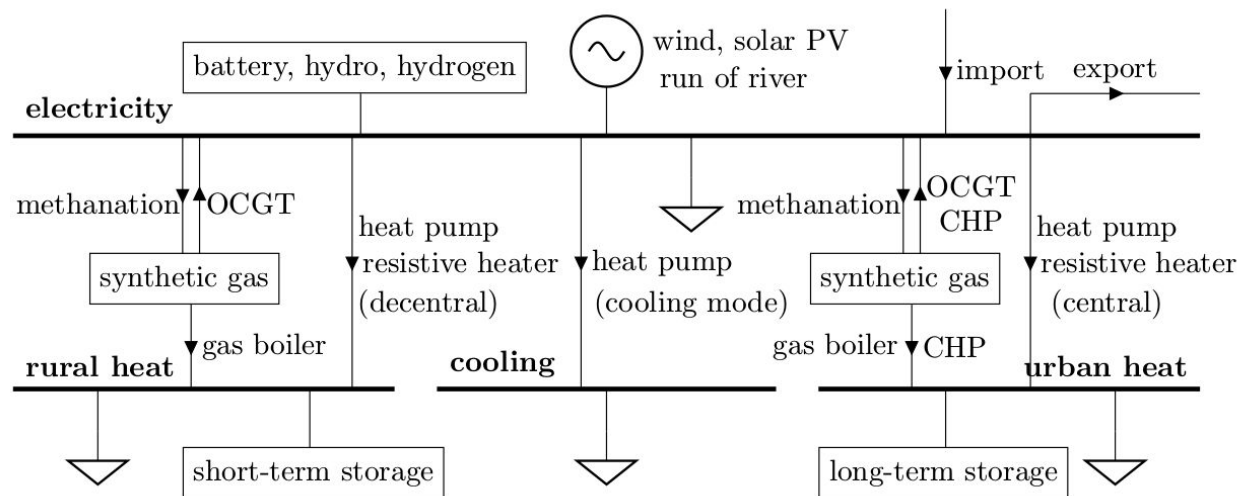
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Power capacities of existing generators in 2015



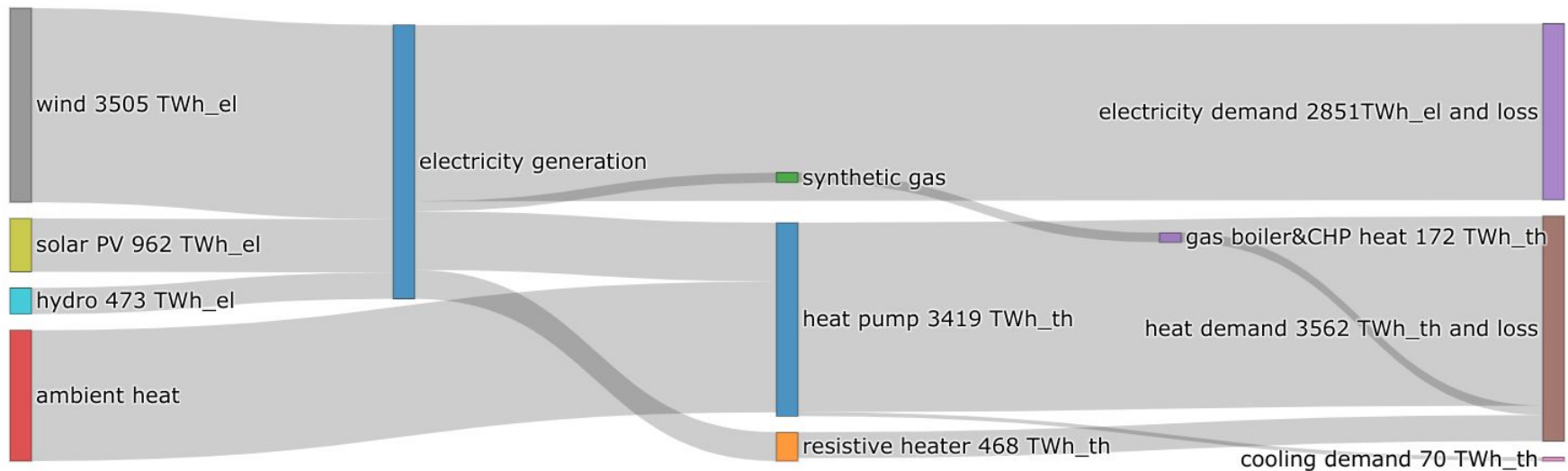
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- Linear techno-economical optimisation in hourly resolution.



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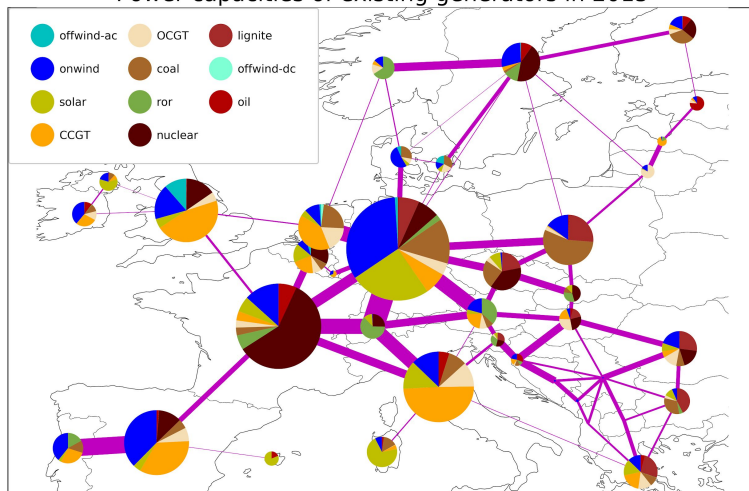
Europe-aggregated energy flow of CO₂-neutral electricity, heating and cooling



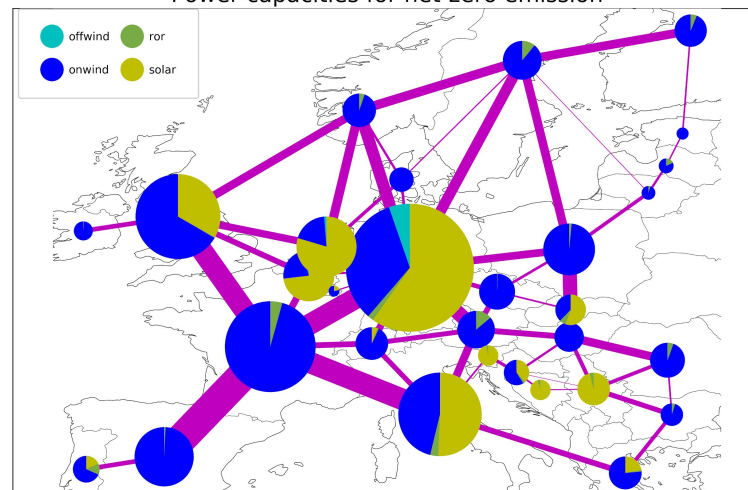
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Copenhagen, 10-11 September 2019
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Power capacities of existing generators in 2015



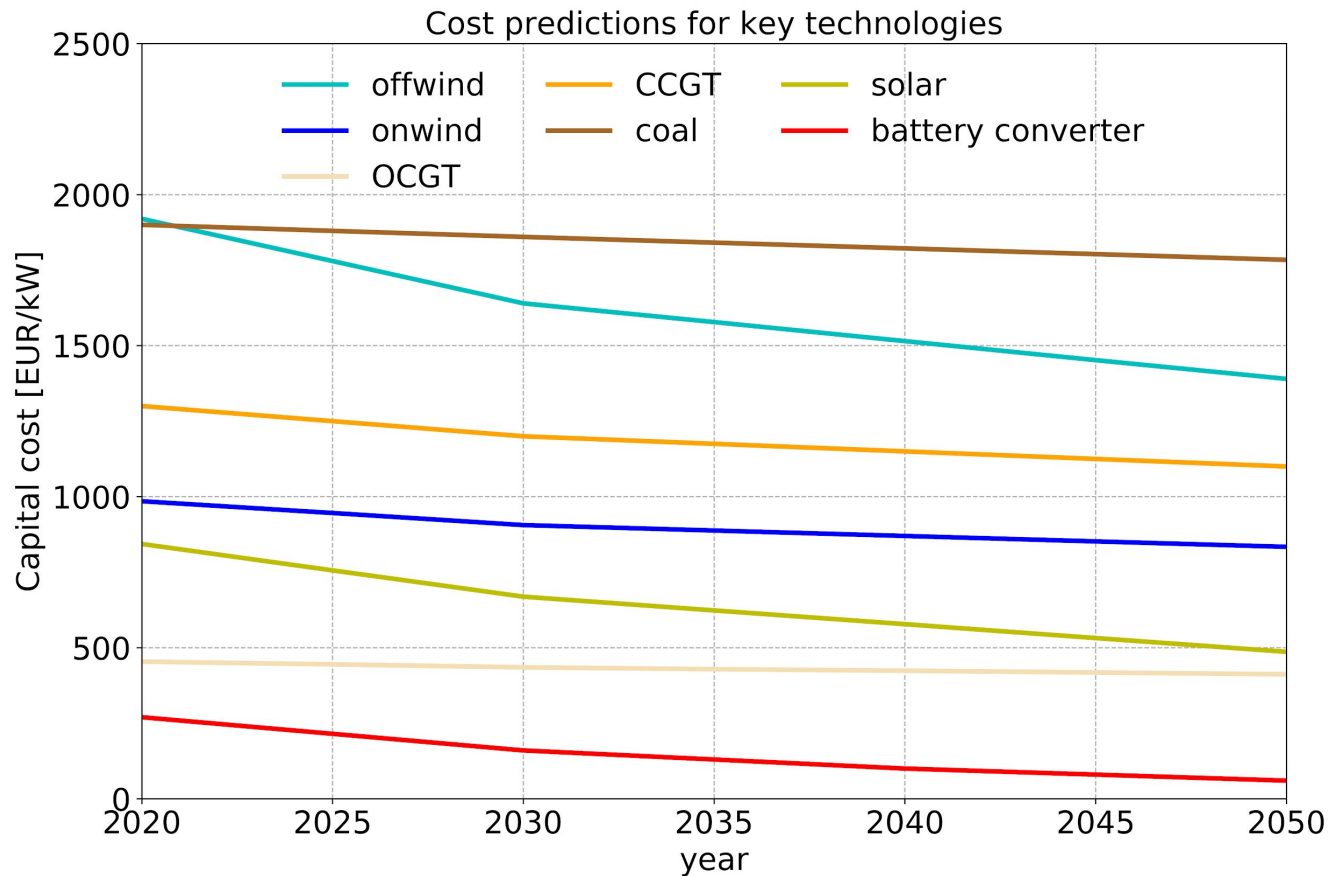
Power capacities for net-zero emission



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Key assumptions of modelling transition pathways:

- Current installed power plants are included (brownfield optimisation), and they stay until the decommission years.
- Cost assumptions vary in five-year interval.

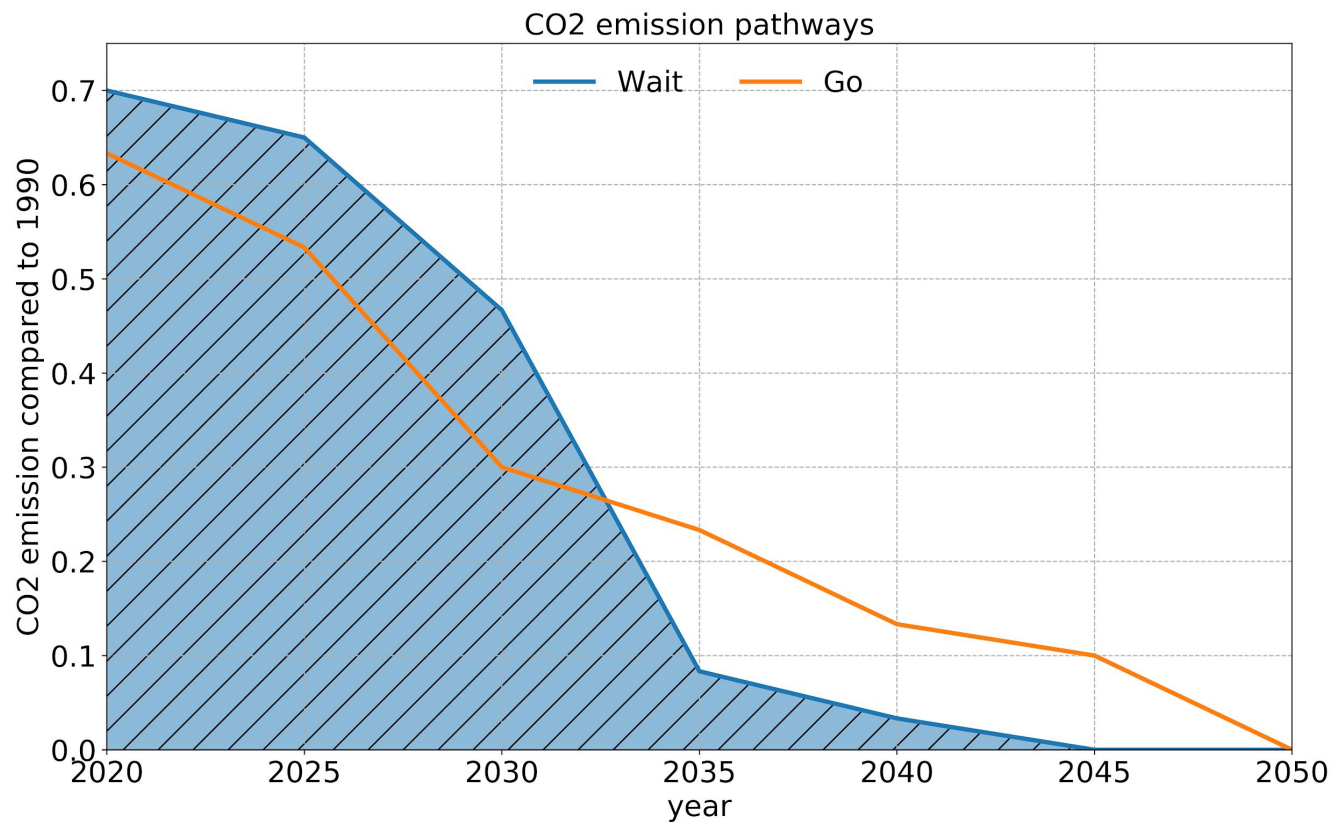


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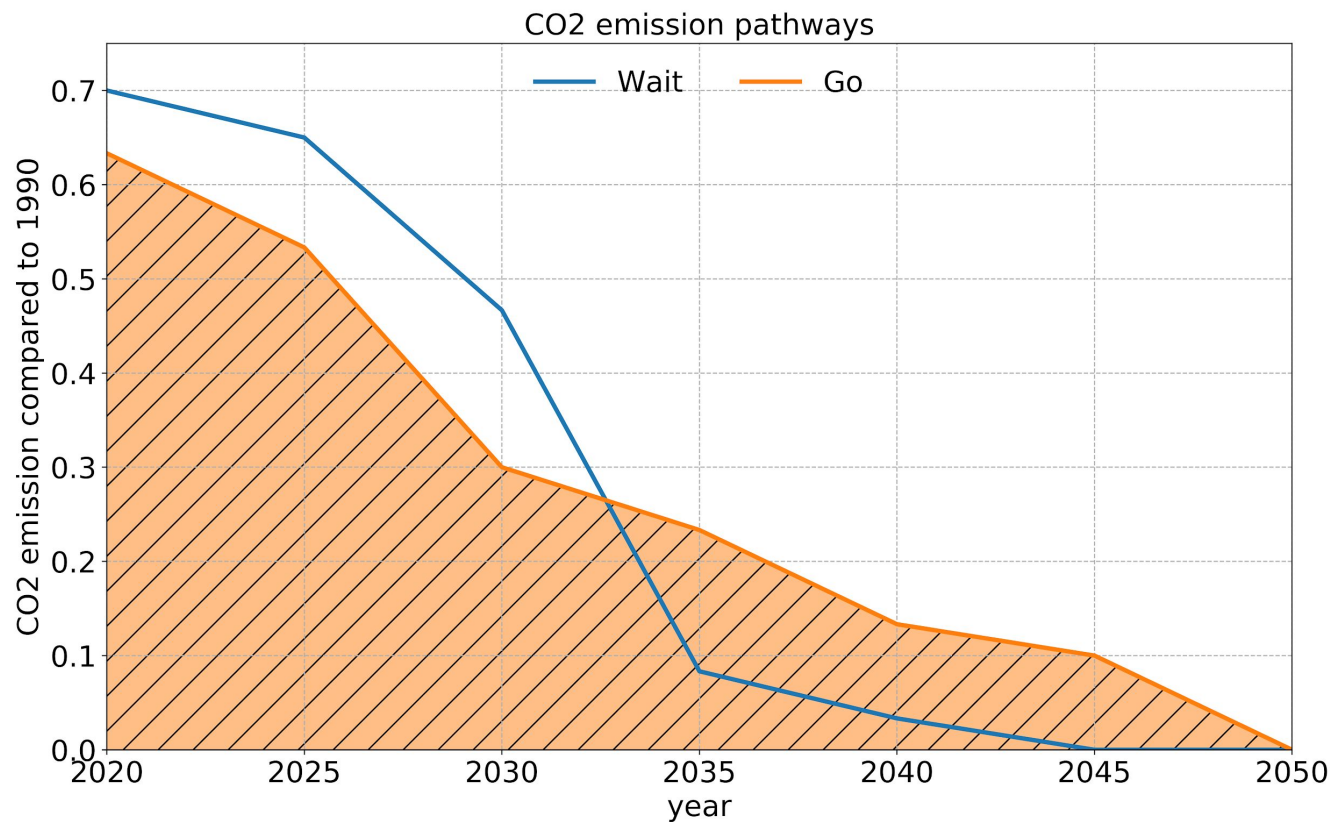
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- Demand and capacity factors are kept as constant.
- The coupled system is optimised every five years from 2020 to 2050, under two different emission pathways, i.e., “Go” and “Wait”, which share the same amount of total emission budget.

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- The coupled system is optimised every five years from 2020 to 2050, under two different emission pathways, i.e., “Go” and “Wait”, which share the same amount of total emission budget.
- The optimisation is carried on top of the previously installed capacities without knowing the future (myopic).

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Research questions:

- Quantify the extra costs or benefits by delaying or accelerating emission reductions.
- Identify the feasibility of technology expansions during the transition.
- Myopic v.s. perfect foresight planning.
- Brownfield v.s. greenfield optimisation.

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Expected findings:

- “Wait” could be more expensive due to lock-in effects in wrong investments.
- The technology expansion rates might be too high if Europe “Wait”.
- Brown/Green-field optimisations may result in different system configurations for 2050, but the discrepancies in terms of key metrics should be relatively small.

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References:

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- Zhu, K., Victoria, M., Brown, T., Andresen, G. B., & Greiner, M. (2019). [Impact of CO2 prices on the design of a highly decarbonised coupled electricity and heating system in Europe](#). Applied energy, 236, 622-634
- Danish Energy Agency and Energinet, [Technology Data](#)
- T. Brown, J. Hörsch, D. Schlachtberger, [PyPSA: Python for Power System Analysis](#), 2018, Journal of Open Research Software, 6(1), arXiv:1707.09913, DOI:10.5334/jors.188

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