Why energy models should integrate social and environmental factors

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Computer-based models = virtual ‘laboratories’, that allow ‘thought experiments’ to explore different decarbonisation options and implications

We have a diversity of options to reach a climate neutral energy system.*

Models have an effect on policymaking!**
...but they have been often criticised for ignoring social and environmental aspects***.

Figure elements from Pickering et al., 2022

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Recent study: we explored and illustrated the impact of ignoring such factors by comparing model results to model user needs and real-world observations.

What is the effect of omitting social and environmental aspects?
Headwind for onshore wind power in Germany?

What we perceive in reality vs. what policy wants vs. what models say

- GW of installed onshore wind in Germany

- Modelled GHG neutrality by 2045 scenarios
- 2022's 2030 target (extrapolated to 2045)
- New auction target (10 GW/year)
- Modelled “unacceptance” scenario

*Fraunhofer ISE study (J. Brandes, M. Haun, D. Wrede, P. Jürgens, C. Kost, H.-M. Henning Wege zu einem klimaneutralen Energiesystem – Update Klimaneutralität 2045) using the REMod model
EU electricity grid plan without people and nature?

What models say:

Cost-minimum expansion $5x$ as of today (Rodríguez et al., 2014)

Fully renewable electricity supply would require $2x$ the present transmission grid (Tröndle et al., 2020)

What we perceive in reality:

Progress of all transmission investments since TYNDP 2018, $n=321$ projects.


Photo from Euro-Calliope, market-based grid expansion. Michas et al., 2022.

EC, 2020: “the power sector’s shift away from fossil fuels and towards renewables [...] requires significant investment in transmission and distribution systems”
Innovative solutions to address social aspects better:
The modelling toolbox QTDIAN

Innovative solutions to address social aspects better:
Linking modelling tools for systemic analysis & more policy relevance

Social

QTDIAN
Market-driven storyline
Government-directed storyline
People-powered storyline

Technical

Euro-Calliope
Energy system configurations

Economic

WEGDYN
Employment Welfare Public budget

ENBIOS
Assessment of environmental impacts

Environmental

Synthesis of all modelling tools
• Considering social and environmental impacts in modelling are important because...

• Otherwise, models risk generating **overly optimistic and potentially misleading results** by neglecting social (and environmental) factors, e.g. by suggesting transition speeds far exceeding any speeds observed, or pathways facing hard-to-overcome land conflicts
Get in touch!

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