

Why energy models should integrate social and environmental factors

Diana Süsser,

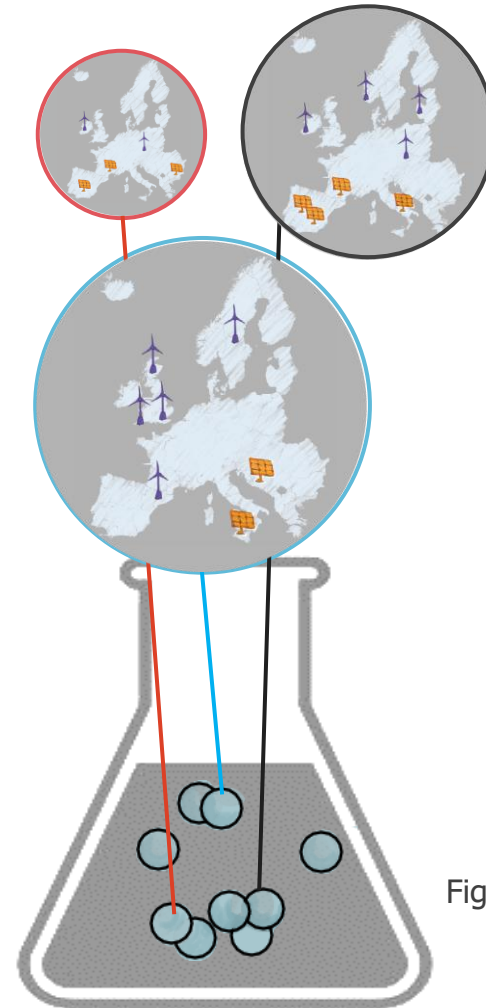
Institute for European Energy and Climate Policy

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Energy models inform policymaking

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

* Pickering, B., Lombardi, F., Pfenninger, S. (2022). **Diversity of options to eliminate fossil fuels and reach carbon neutrality across the entire European energy system.** Joule. Doi: <https://doi.org/10.1016/j.joule.2022.05.009>

** Süsser, D., Ceglarz, A., Gaschnig, H., Stavrakas, V., Flamos, A., Giannakidis, G., & Lilliestam, J. (2021). **Model-based policymaking or policy-based modelling? How energy models and energy policy interact.** Energy Research and Social Science, 75: 101984. doi:10.1016/j.erss.2021.101984.

*** Krumm, A., Süsser, D., & Blechinger, P. (2022). **Modelling social aspects of the energy transition: What is the current representation of social factors in energy models?** Energy, 239(Part A): 121706. doi:10.1016/j.energy.2021.121706.

What is the effect of omitting social and environmental aspects?

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



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Original research article

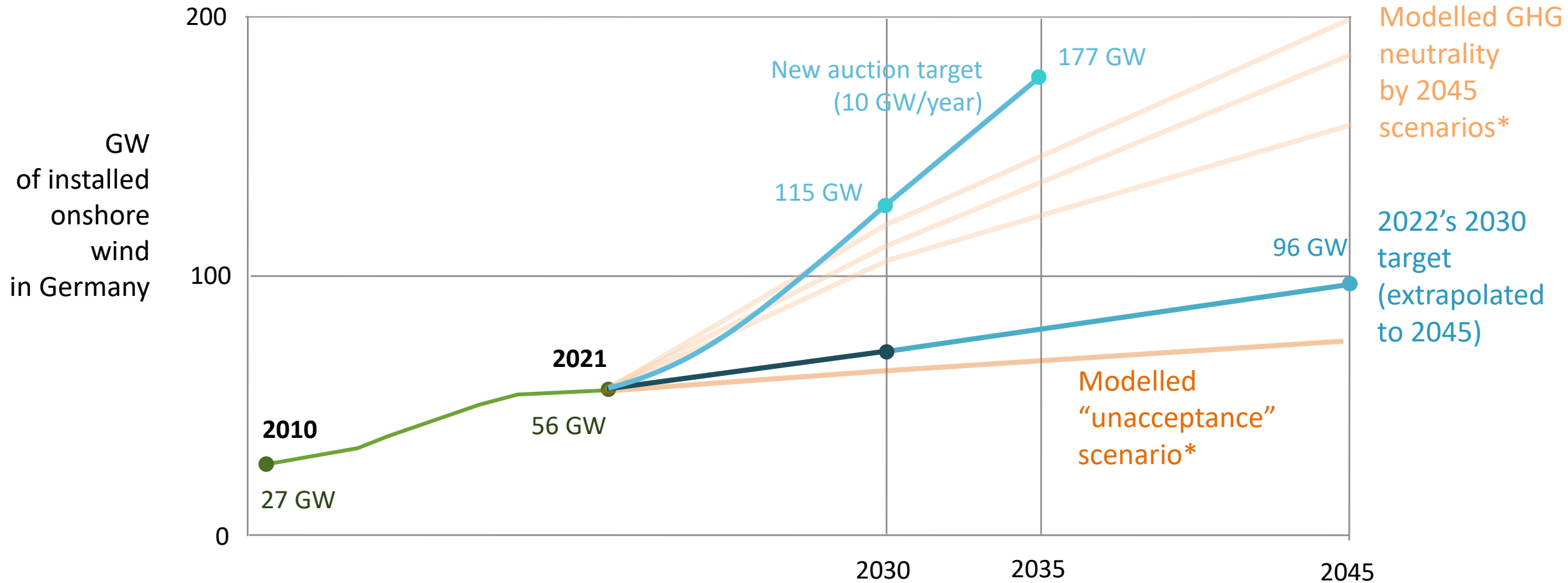
Why energy models should integrate social and environmental factors: Assessing user needs, omission impacts, and real-world accuracy in the European Union

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[Link](#)

Headwind for onshore wind power in Germany?

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



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)

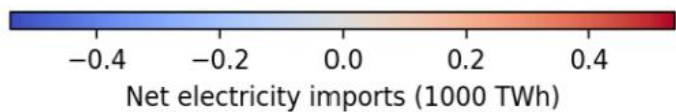
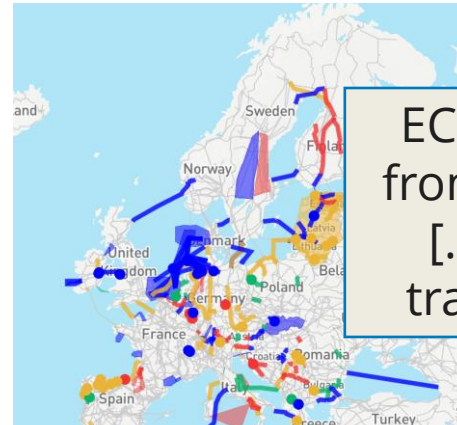


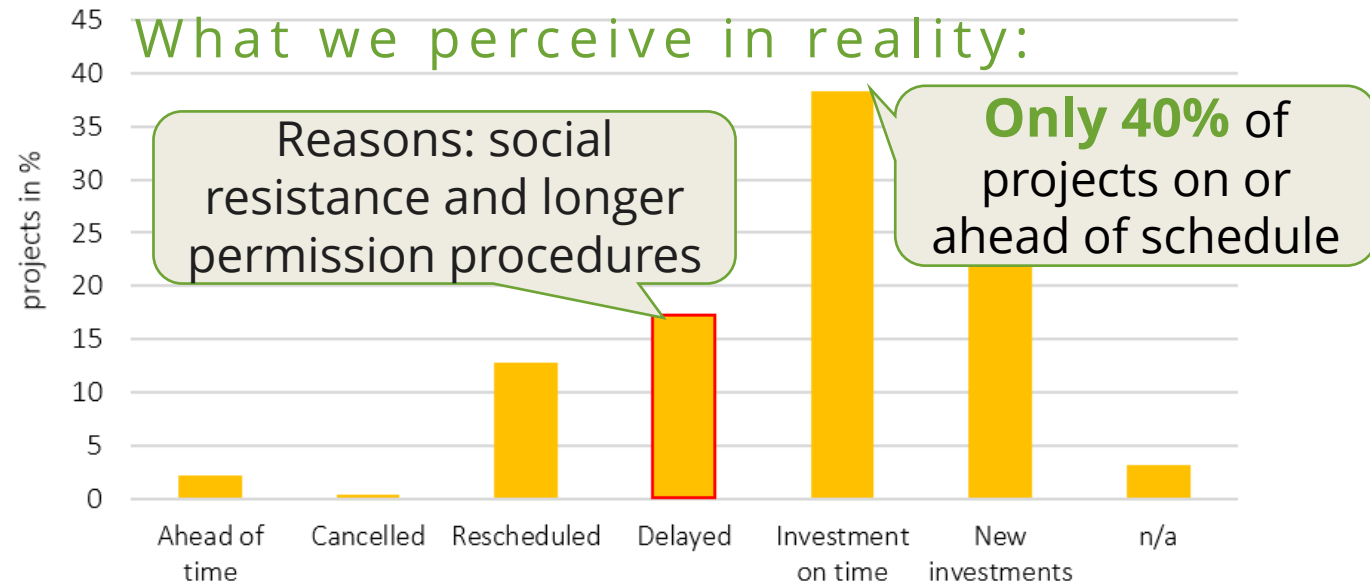
Photo from Euro-Calliope, market-based grid expansion. Michas et al., 2022.

What policy wants:



EC, 2020: “the power sector’s shift away from fossil fuels and towards renewables [...] requires significant investment in transmission and distribution systems”

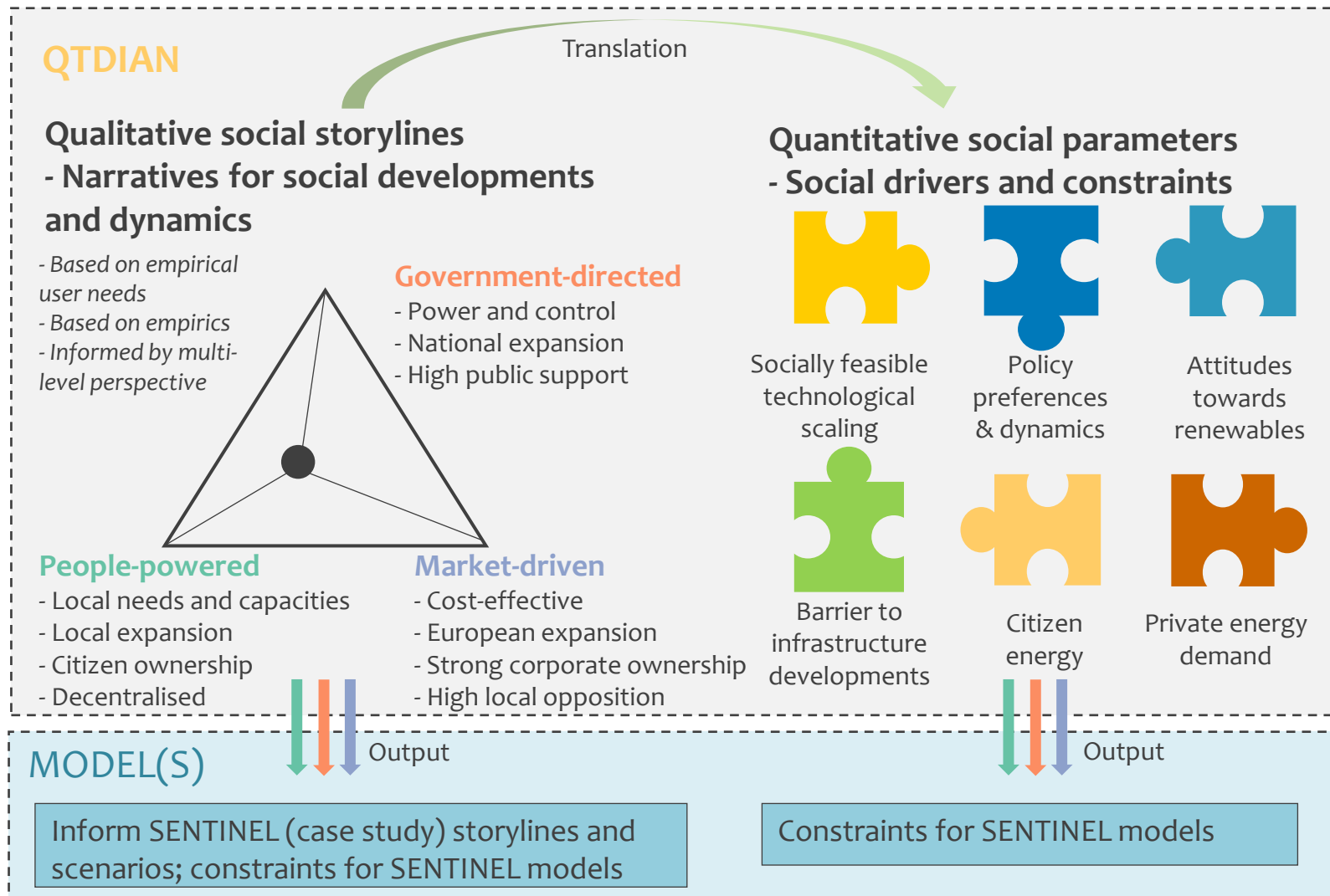
What we perceive in reality:



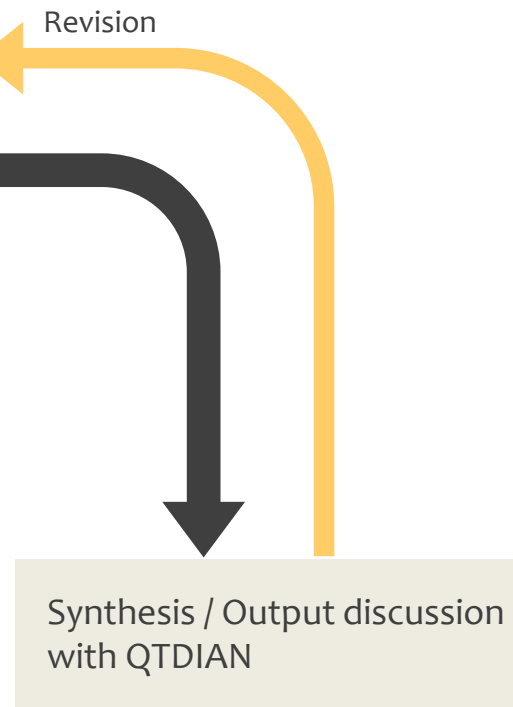
Progress of all transmission investments since TYNDP 2018, n=321 projects. Data source: ENTSO-E, 2021.

Innovative solutions to address social aspects better:

The modelling toolbox QTDIAN



Süsser, D. et al., (2022). The QTDIAN modelling toolbox – Quantification of social drivers and constraints of the diffusion of energy technologies. Deliverable 2.3. Version 2. Sustainable Energy Transitions Laboratory (SENTINEL) project.

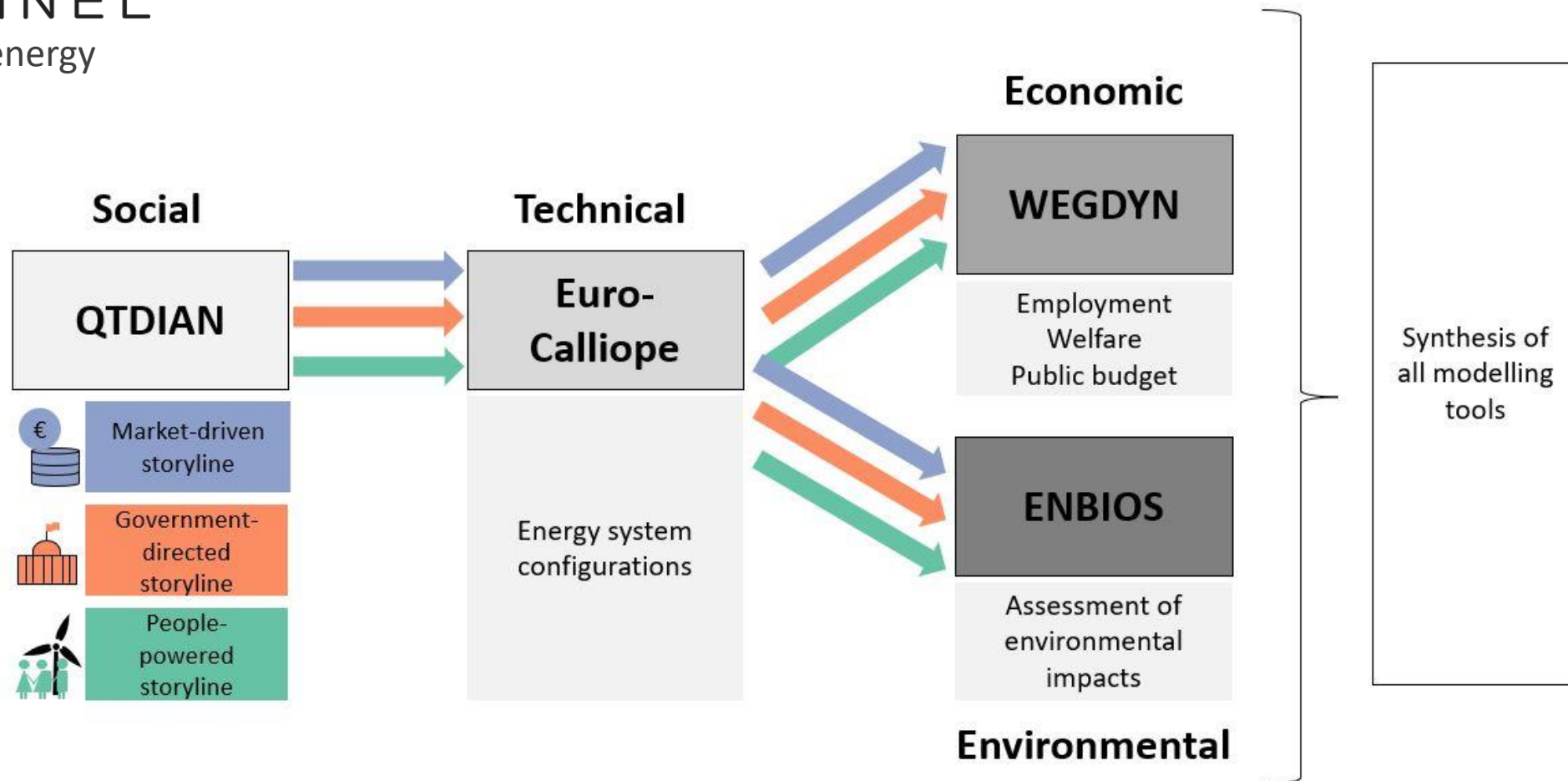


Innovative solutions to address social aspects better:

Linking modelling tools for systemic analysis & more policy relevance



SENTINEL
sentinel.energy



- 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

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