

Towards an Open Austrian Sector-Coupled Energy System Model within a European context

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SEC**
**NETZERO
2040**





Energy at heart of transition

- **Renewable Energies are key for decarbonization**
- Economic relevance – capital intensive
- Social relevance – regional impacts

→ Careful and transparent planning



National energy system planning need for detail

- **Multi-regional scale**
 - Technology roadmaps
 - renewable carrier usage
 - International collaboration

Multi-regional ESM

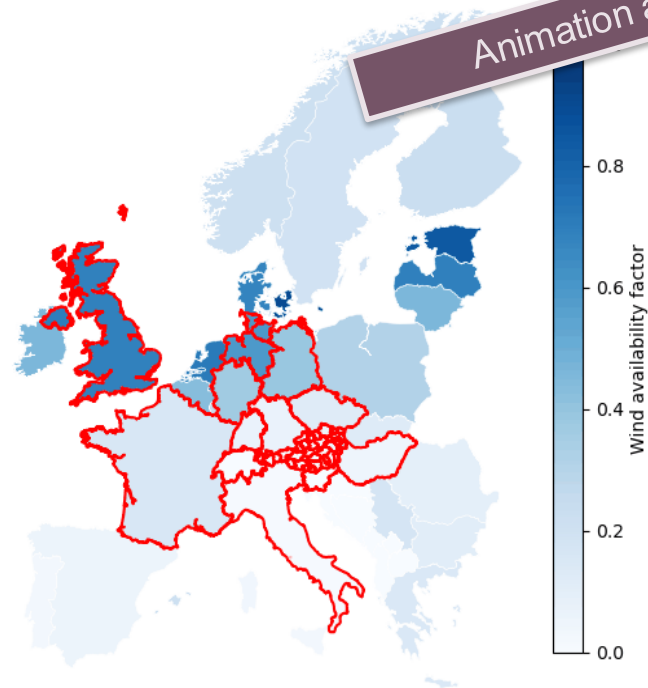
National energy system planning need for detail

- **Multi-regional scale**
 - Technology roadmaps
 - renewable carrier usage
 - International collaboration
- **(Sub-) national scale**
 - Infrastructure needs
 - Generation regionalization

Multi-regional ESM

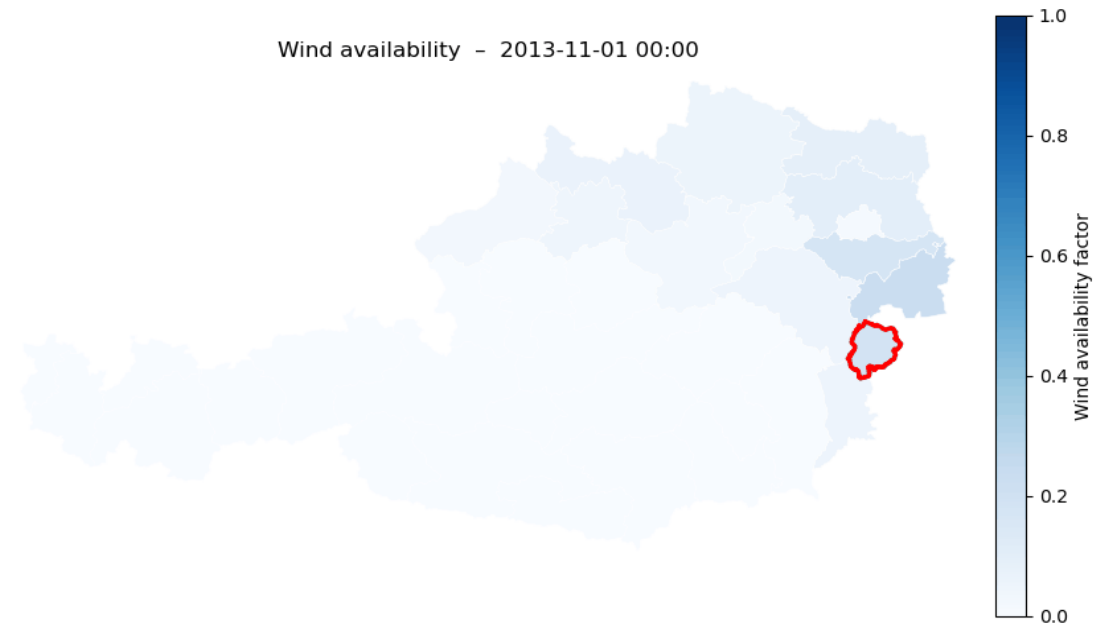
National ESM

Wind availability - 2013-11-01 00:00

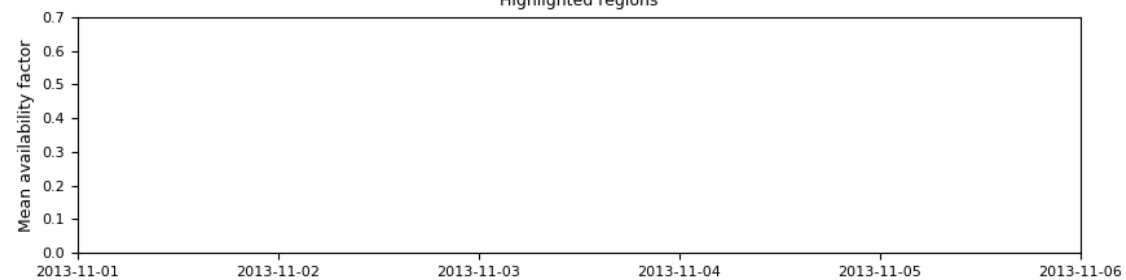


Animation available as supplement

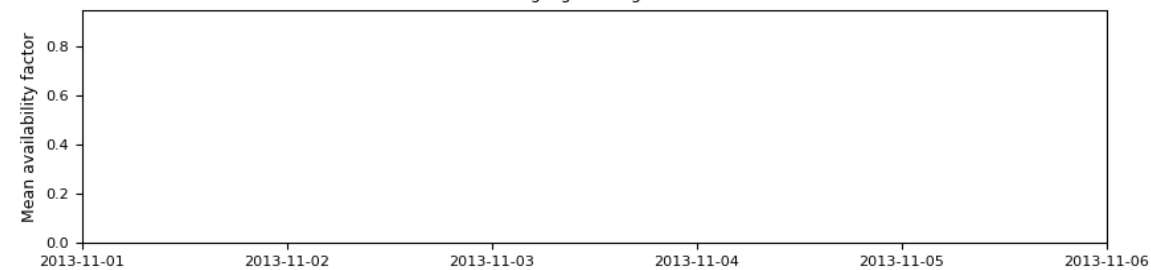
Wind availability - 2013-11-01 00:00



Highlighted regions



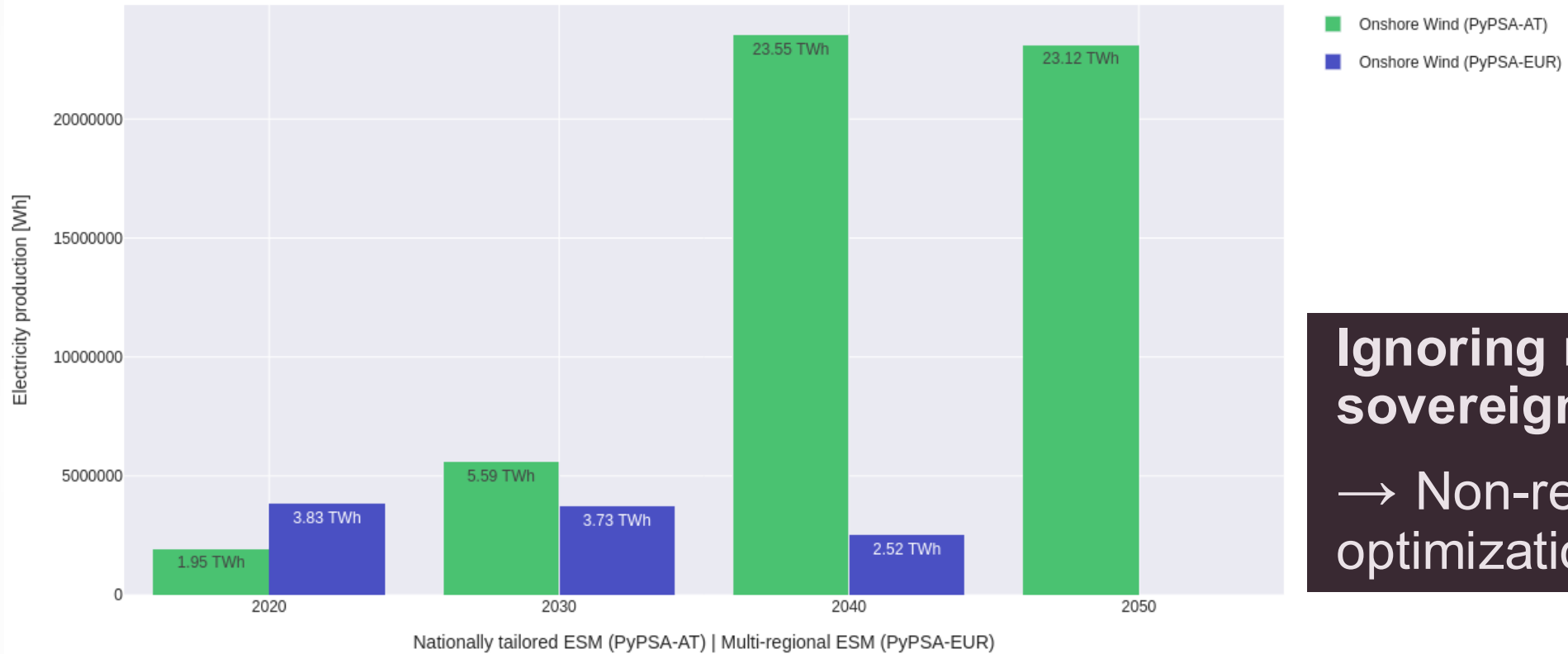
Highlighted regions



International optimization national sovereignty



Wind electricity production in Austria



Ignoring national sovereignty

→ Non-realistic optimization results

Nationally tailored Energy System Models

→ Preserving national planning context ...

spatial
resolution

national policies

national data
and studies

regional
characteristics

National Energy System Modelling in **international** context

Nationally tailored Energy System Models

→ Preserving national planning context ...

spatial
resolution

national policies

national data
and studies

regional
characteristics

National Energy System Modelling in international context

Dynamic international
network and flows

Model validation on
respective country

international policy
goals

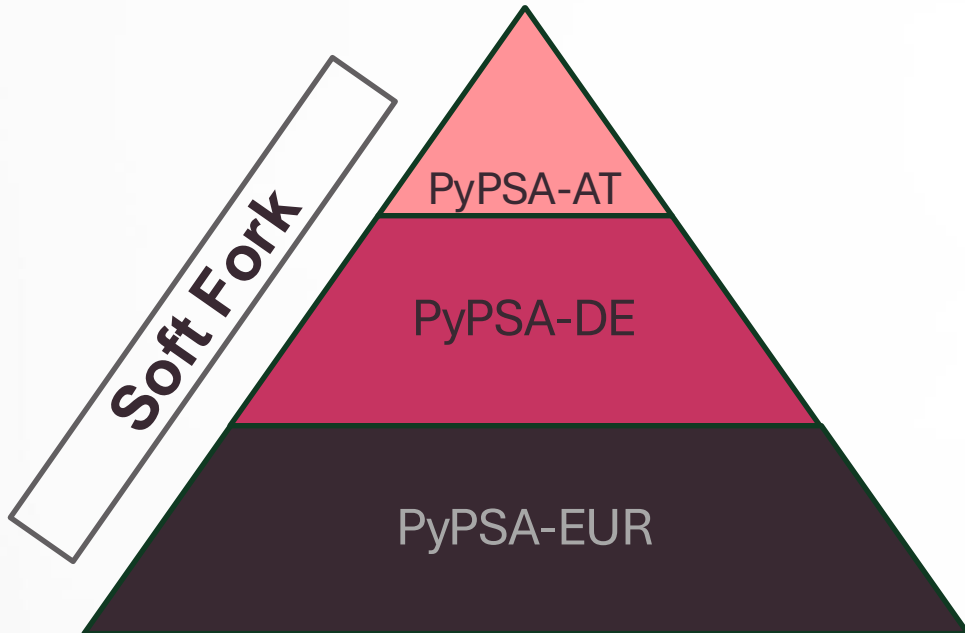
... while enabling international coordination

PyPSA-AT nationally tailored ESM for Austria



[https://github.com/
aggm-ag/pypsa-at](https://github.com/aggm-ag/pypsa-at)

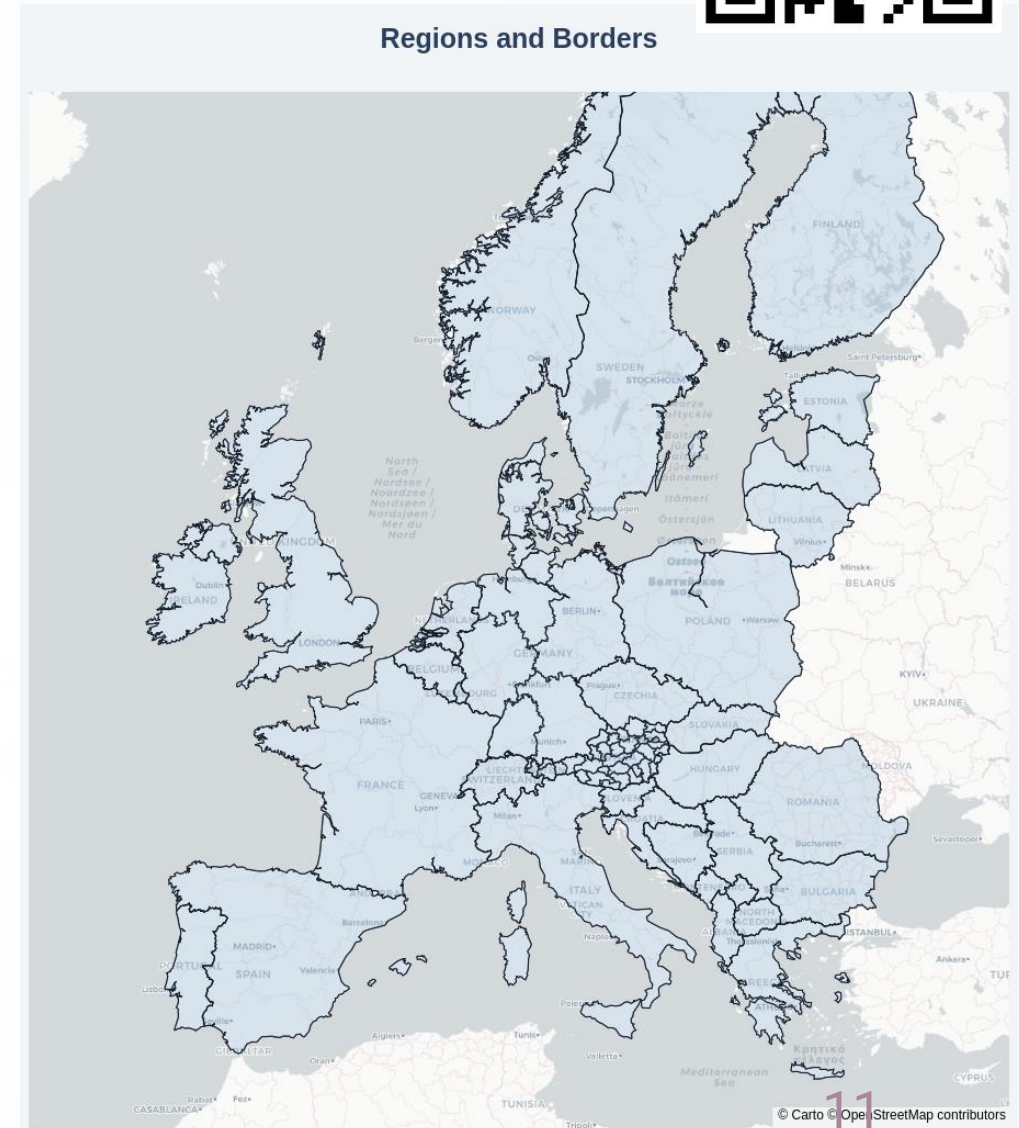
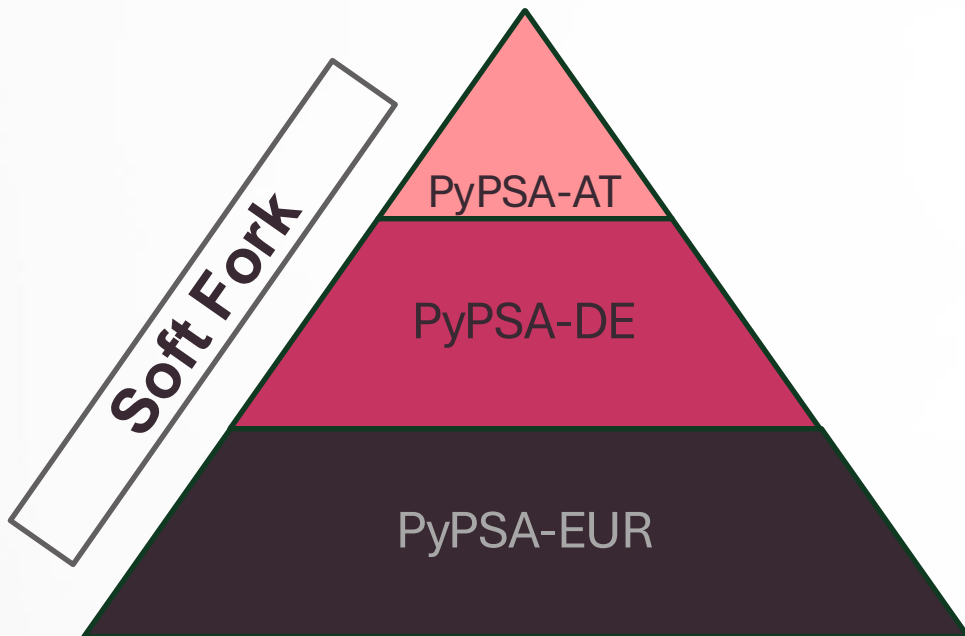
- Open source and open data
- Nationally tailored to Austria



PyPSA-AT nationally tailored ESM for Austria



- Open source and open data
- Nationally tailored to Austria

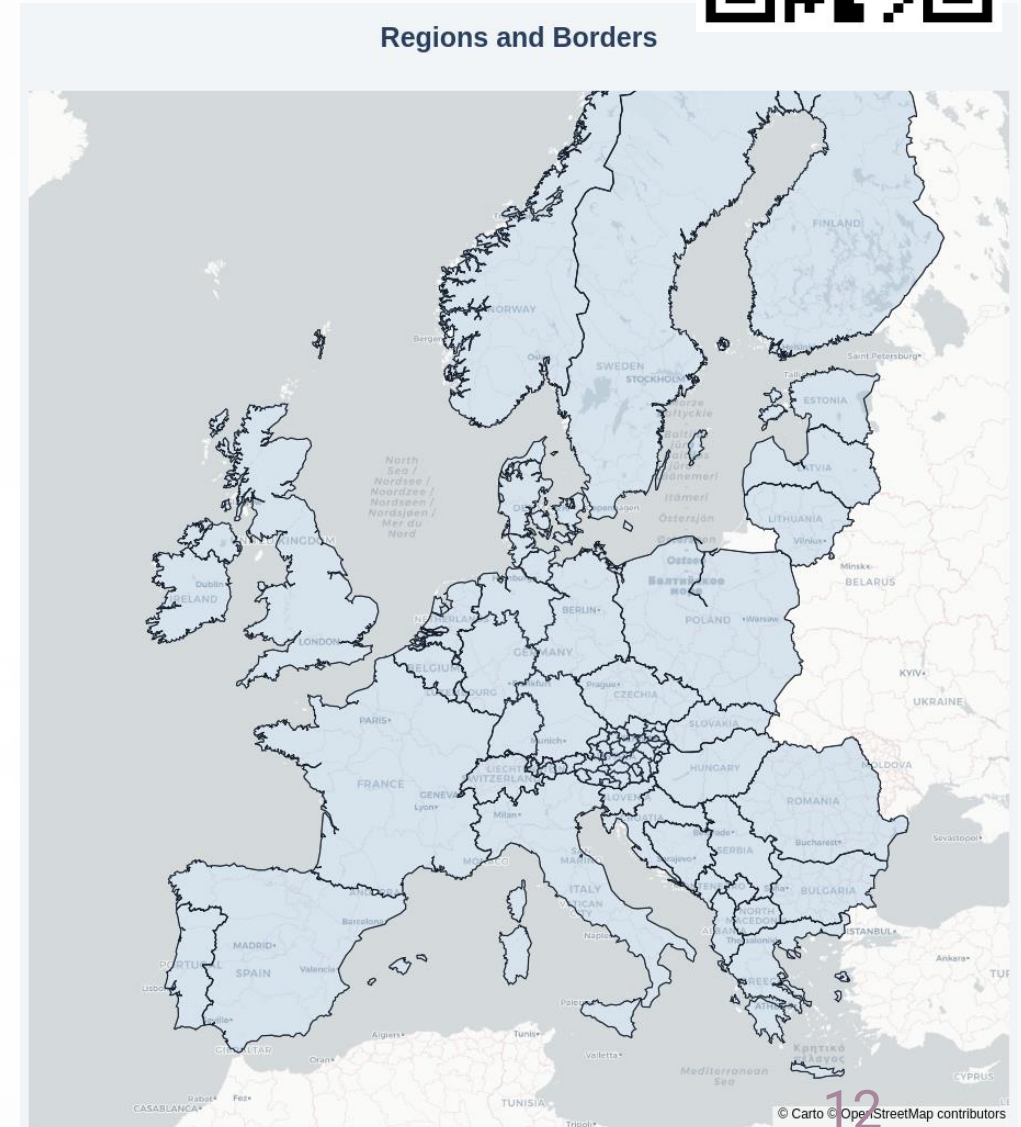




PyPSA-AT nationally tailored ESM for Austria

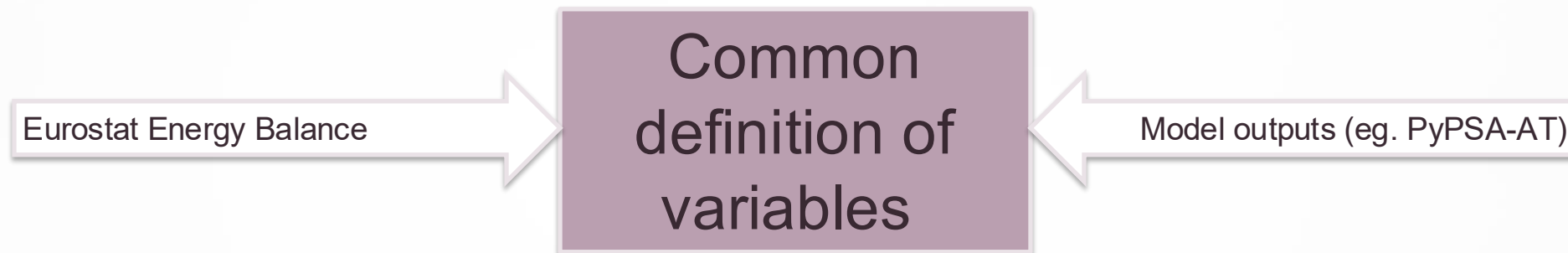
- Open source and open data
- Nationally tailored to Austria

→ brownfield-data
→ policy goals (constraints)
→ local potential studies
→ infrastructure specifics



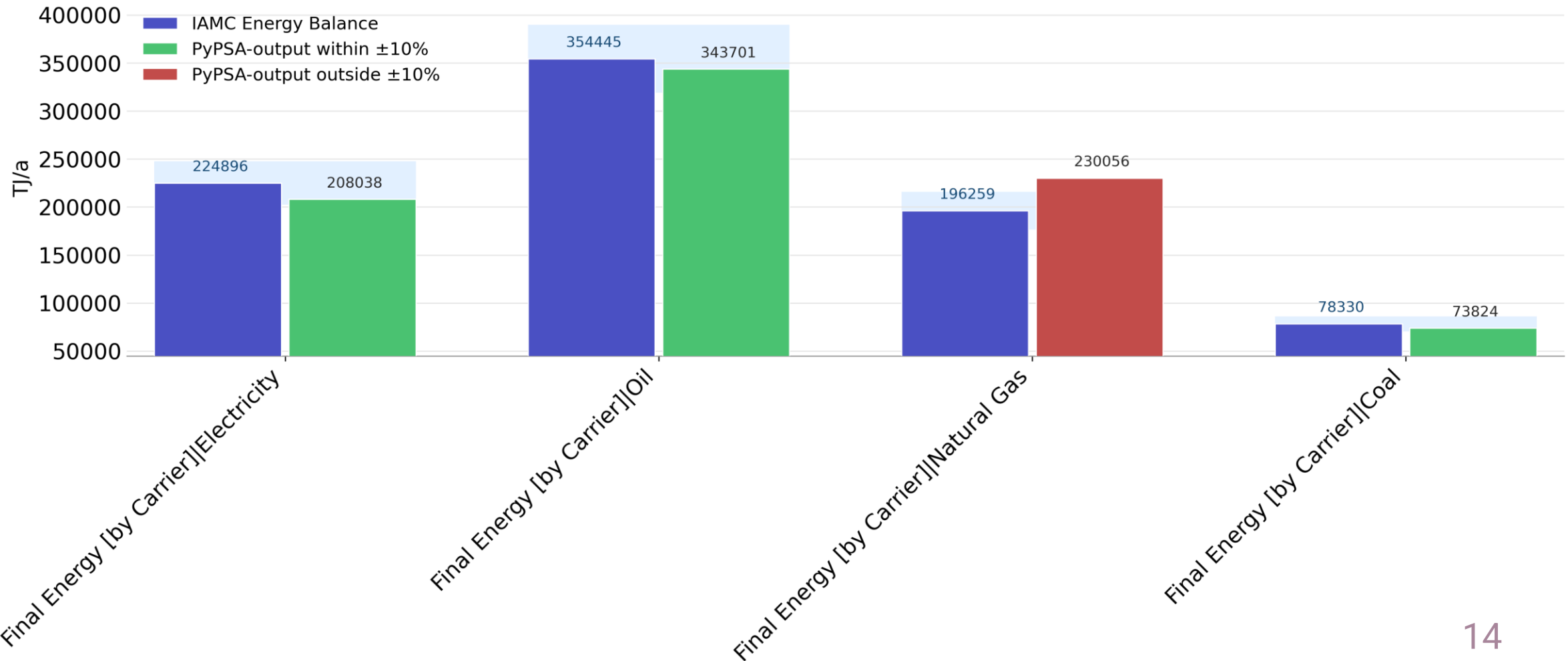
PyPSA-AT nationally tailored ESM for Austria

- Model Validation: Eurostat Energy Balance



PyPSA-AT model validation (validation year 2020)

PyPSA-AT validation against IAMC Energy Balance



Sum up to take away

- **International Context** highly relevant in (national) energy system planning
- **Nationally tailored** Energy System Models
- **PyPSA-AT** - nationally tailored ESM for Austria



[https://github.com/
aggm-ag/pypsa-at](https://github.com/aggm-ag/pypsa-at)

Thank you!



www.linkedin.com/company/cross-sec-2040/
<https://www.linkedin.com/in/max-nutz/>



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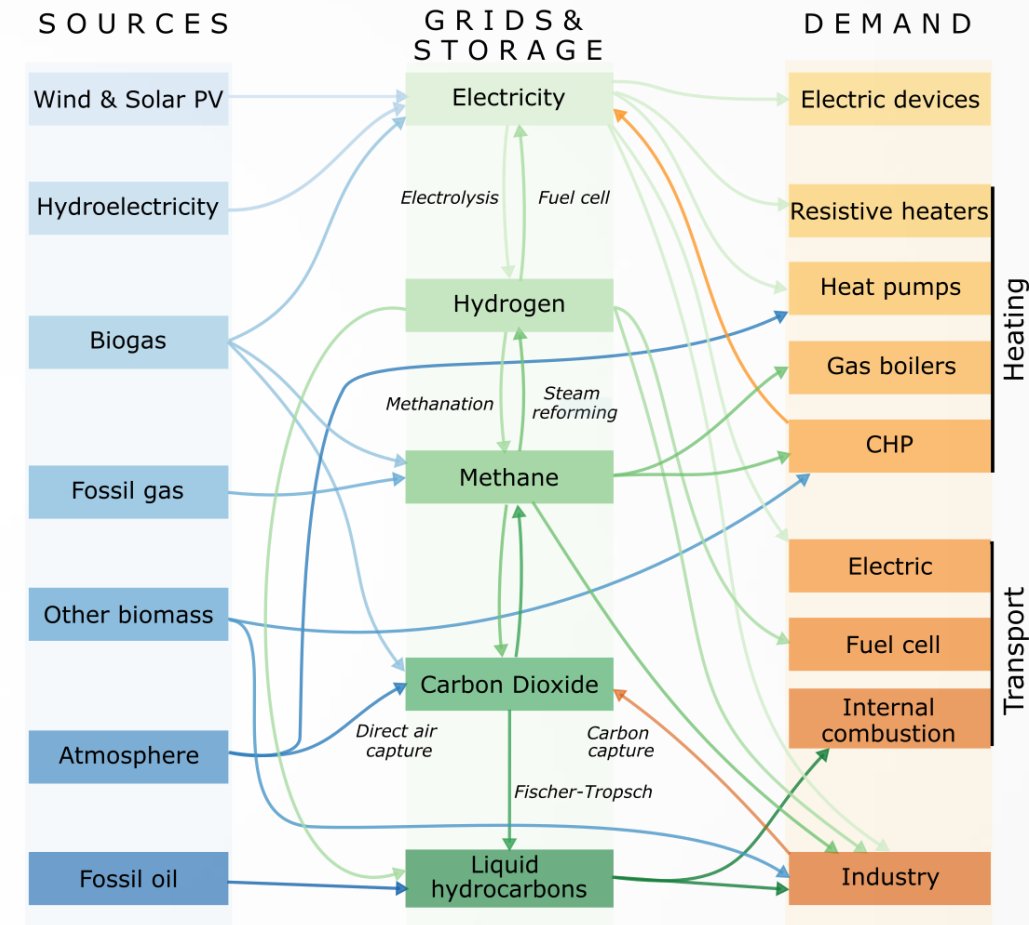
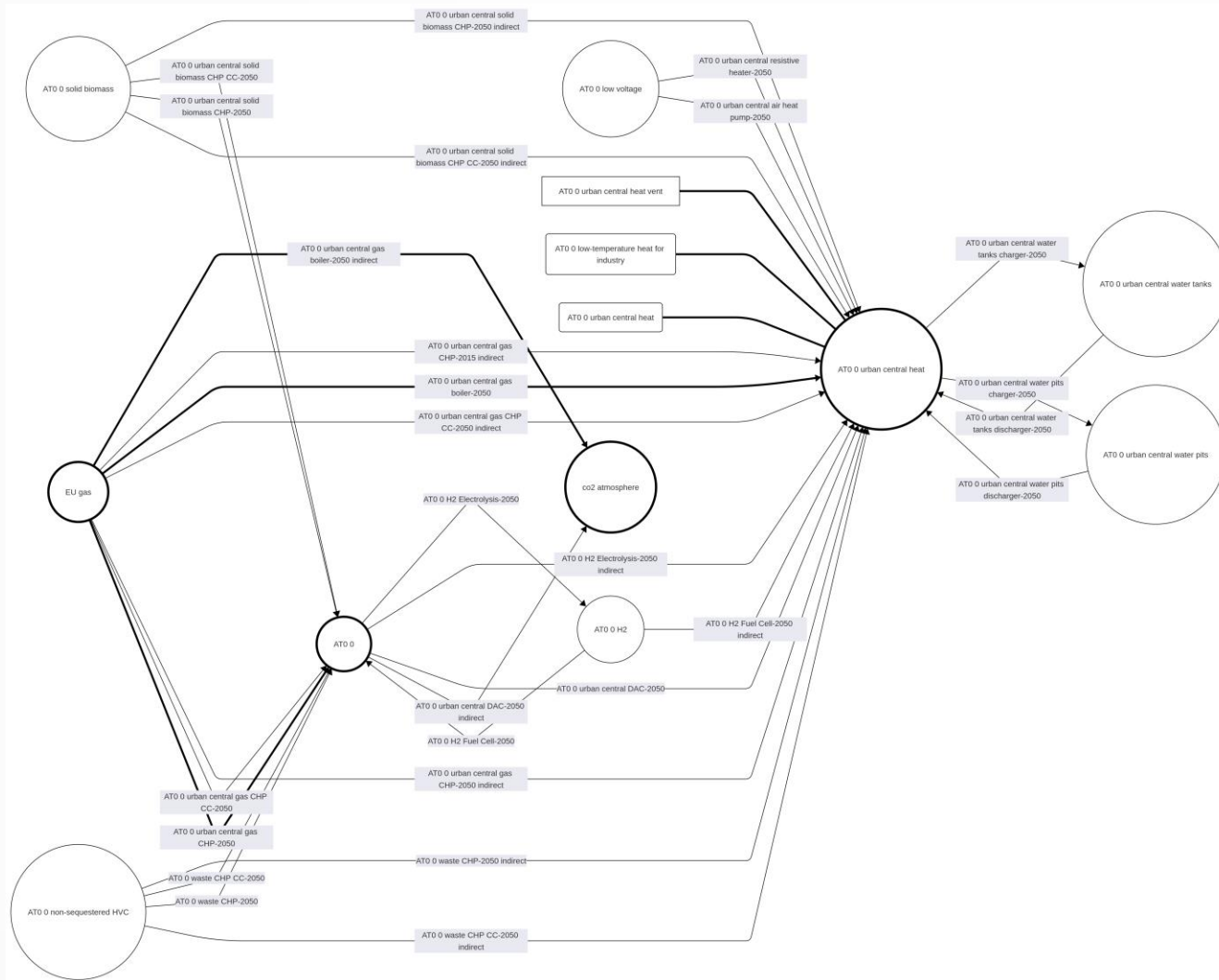
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Resources used directly in presentation

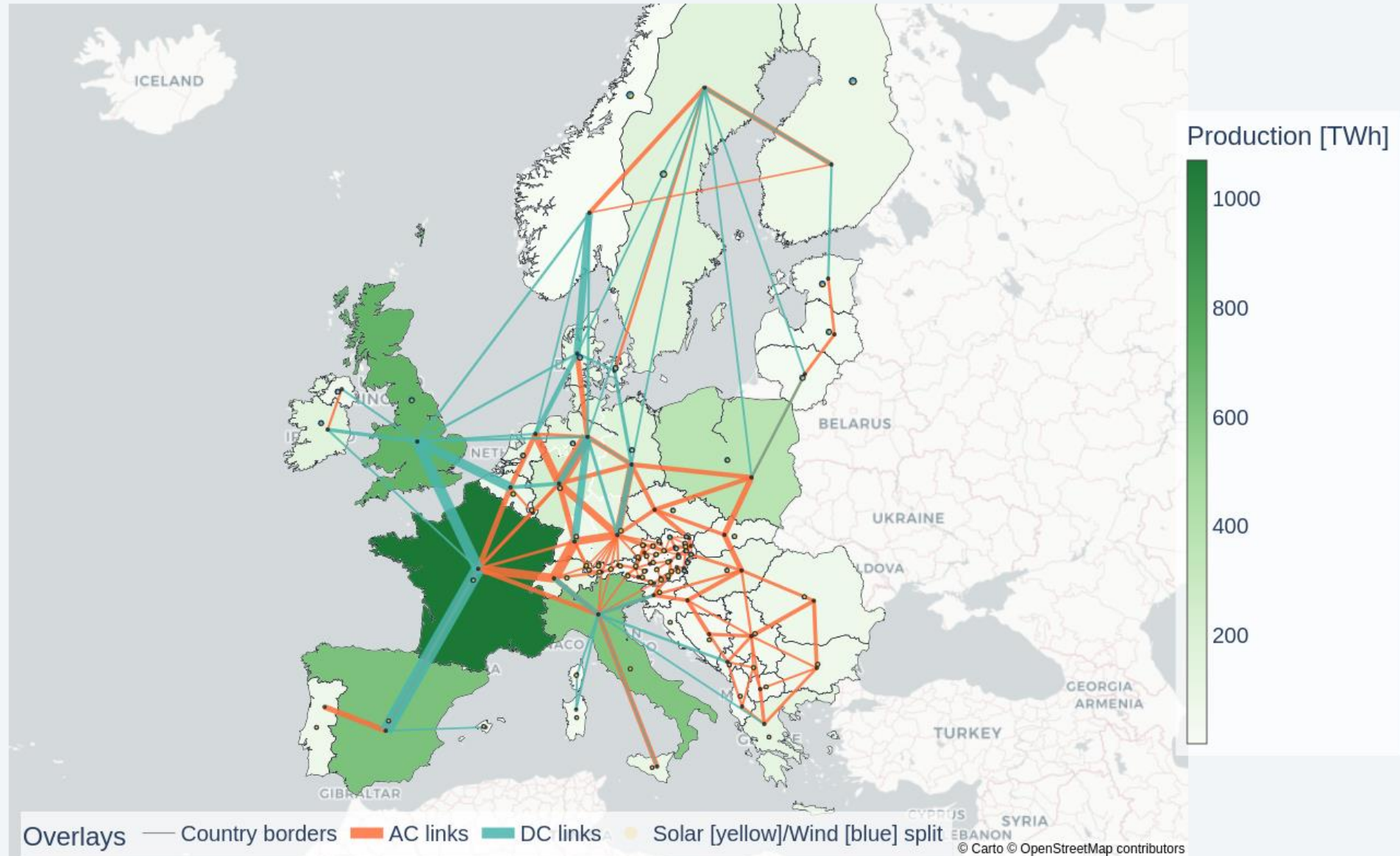
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Sector coupling in PyPSA-AT



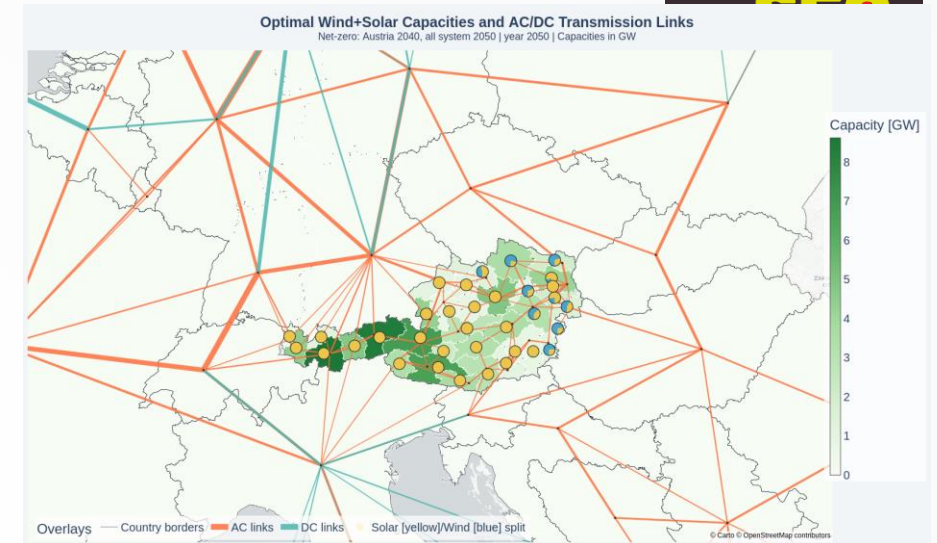
Modeled Wind+Solar Electricity and AC/DC Transmission Links

Net-zero: Austria 2040, all system 2050 | year 2050 | Produced electricity over modeled period in TWh



PyPSA-AT adaptations

- integration of brownfield-data
- policy goals as constraints
- Integrate local potential studies
- Account for infrastructure specifics
- National constraints
- Nation-specific network evaluations



Variable renewable electricity production in Austria

