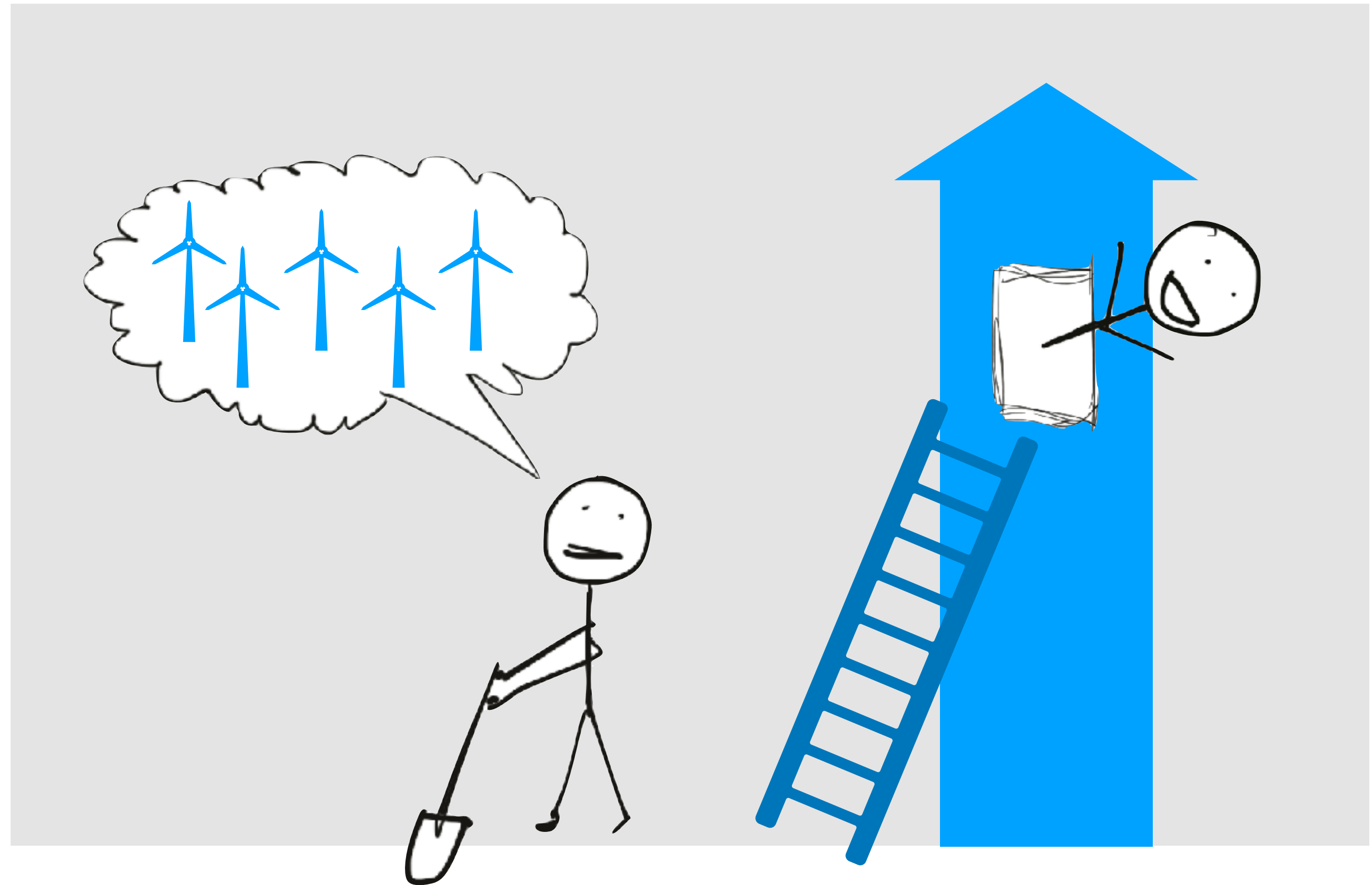


# Models: what are they [good for] anyway?

Stefan Pfenninger  
Assistant Professor  
Faculty of Technology, Policy  
and Management

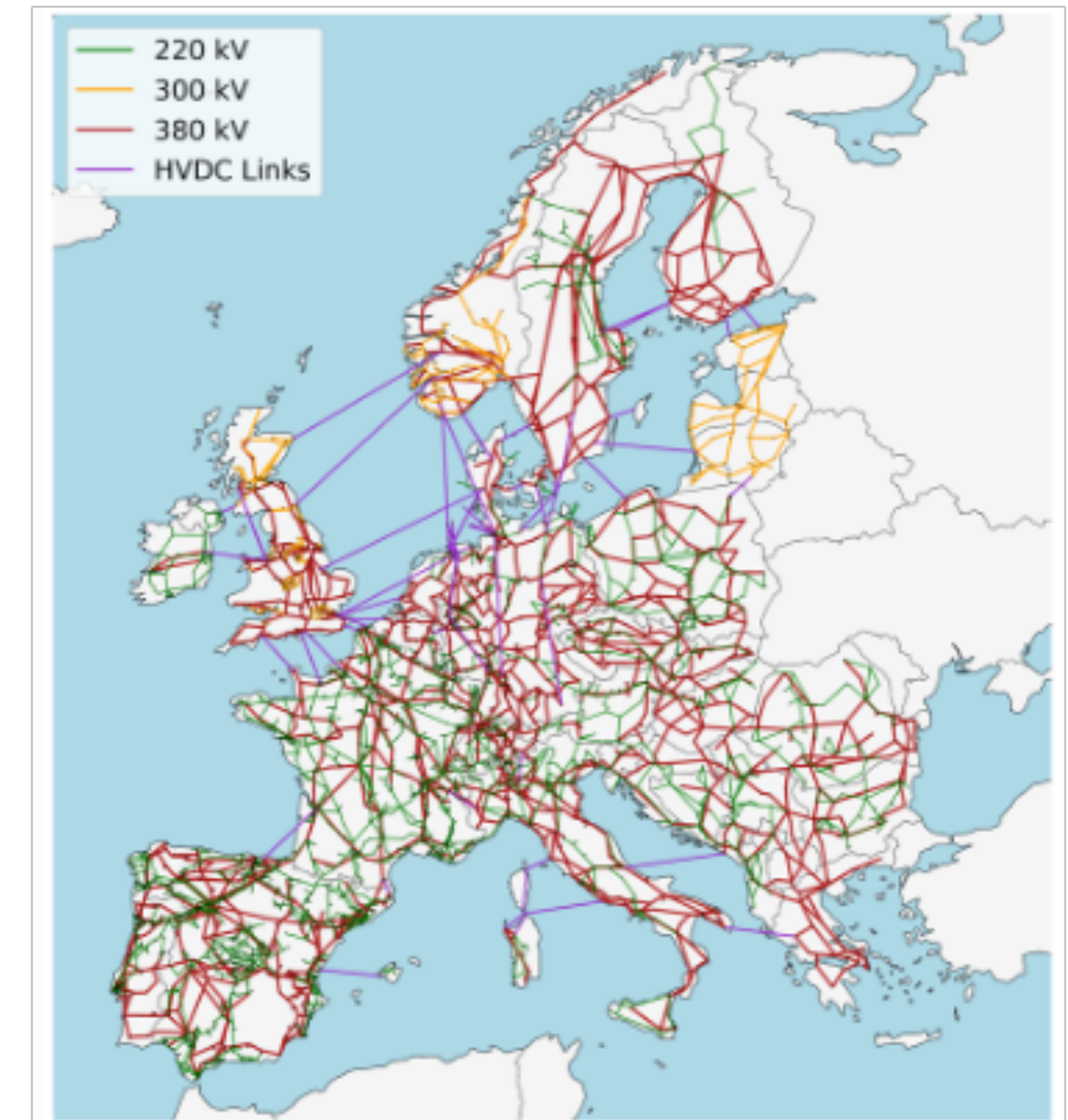
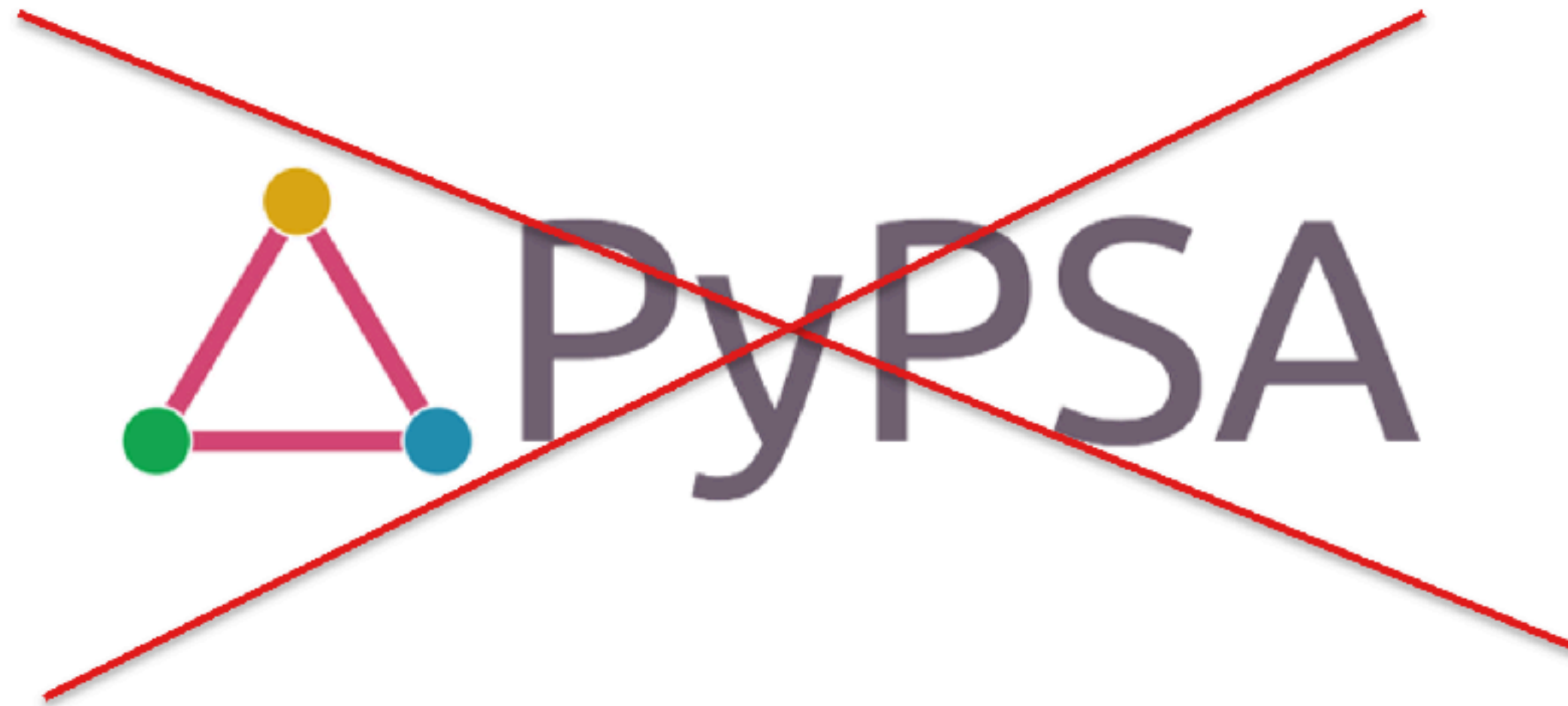


TU Delft Power Rangers Seminar  
5 November 2021

# Remco two weeks ago:

## The best decision in the project

- Discard PyPSA



# Others have the same issue

“PhDs [...] often invest large amounts of effort to get a full picture of the model. Probably this also relates to stepwise model developments over longer periods of time, each adding additional layers of complexity, whereby the senior scientist(s) and/or group leaders are the only ones who still have (or are still able to keep) an overview.”

“PhD students reported lower ratings for model usability and documentation standards than more senior researchers. This may highlight the difficulties of young researchers applying models.”

# What models

Used for decision support in the planning and implementing the energy transition, e.g.:

- produce pathways for a 100% renewable energy supply
- inform capacity expansion of the power grid
- examine trade-offs between different generation capacity deployment strategies

Energy system models

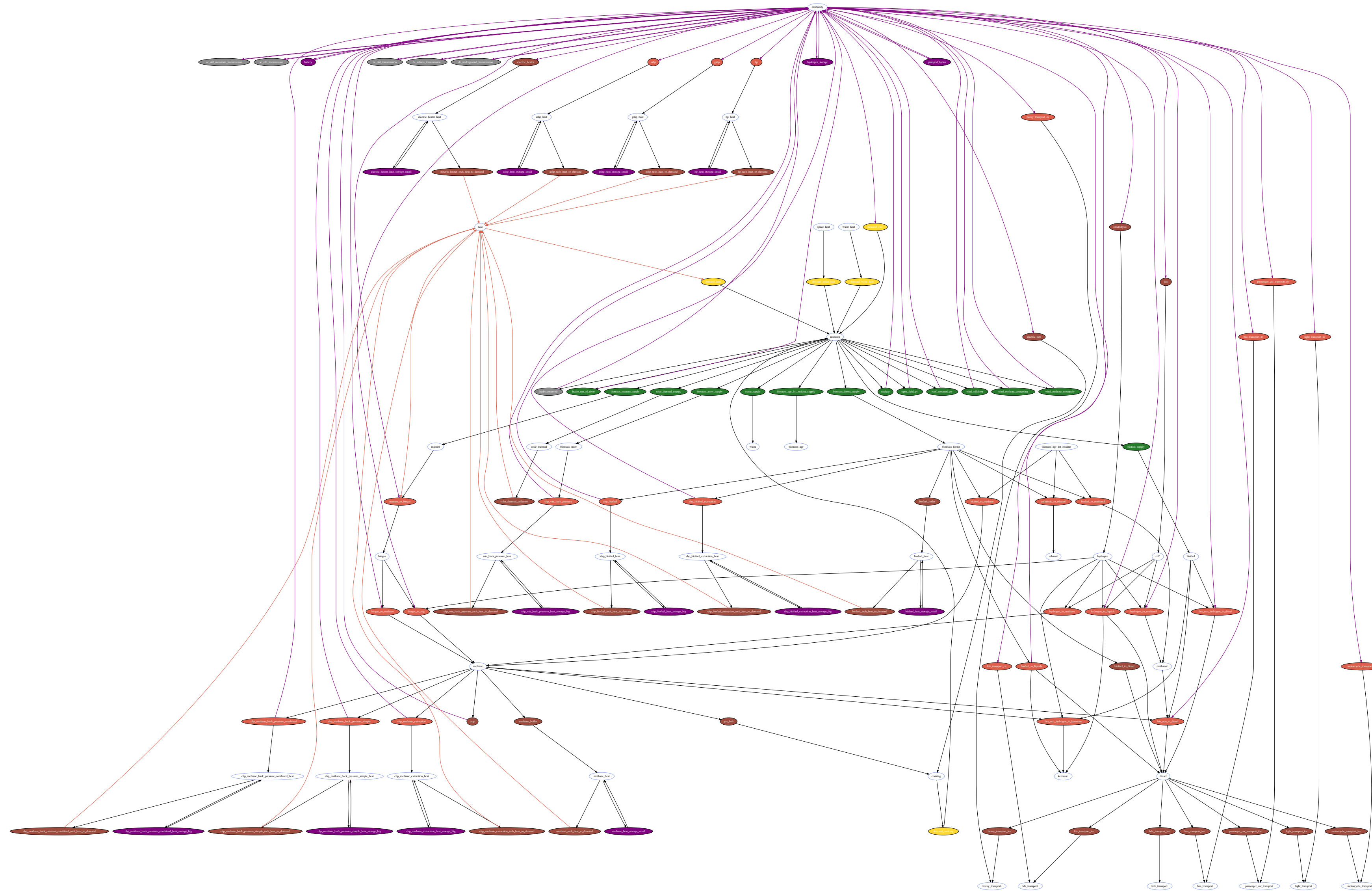
Power system models

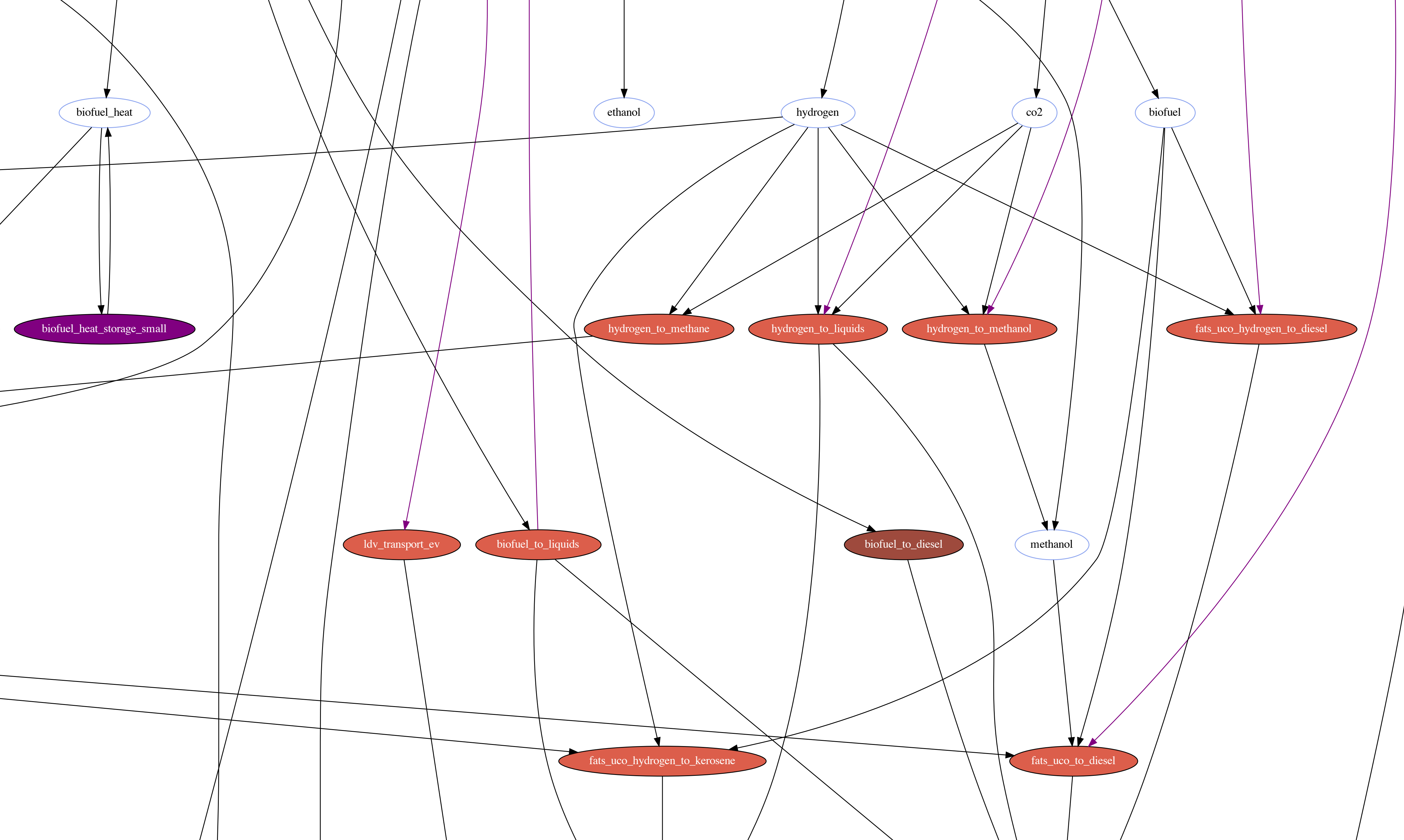
Power market models

Large optimisation problems



# Energy conversion pathways in a simplified European energy system model





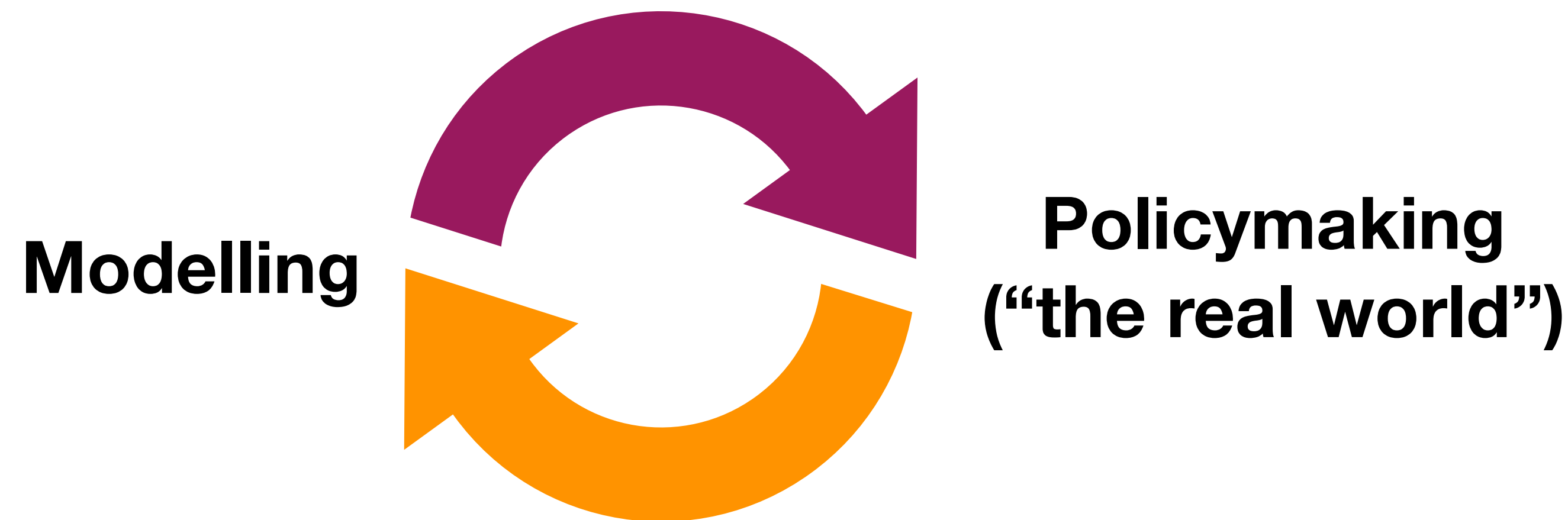
# Story so far

- The larger and more complicated the model, the harder it is to understand and use (whether open source or not)

# How are models made and used?

- Assessing impacts of policies
- Setting policy targets
- Designing policy options

**e.g.: there needs to be a price on CO<sub>2</sub> of x EUR/t**

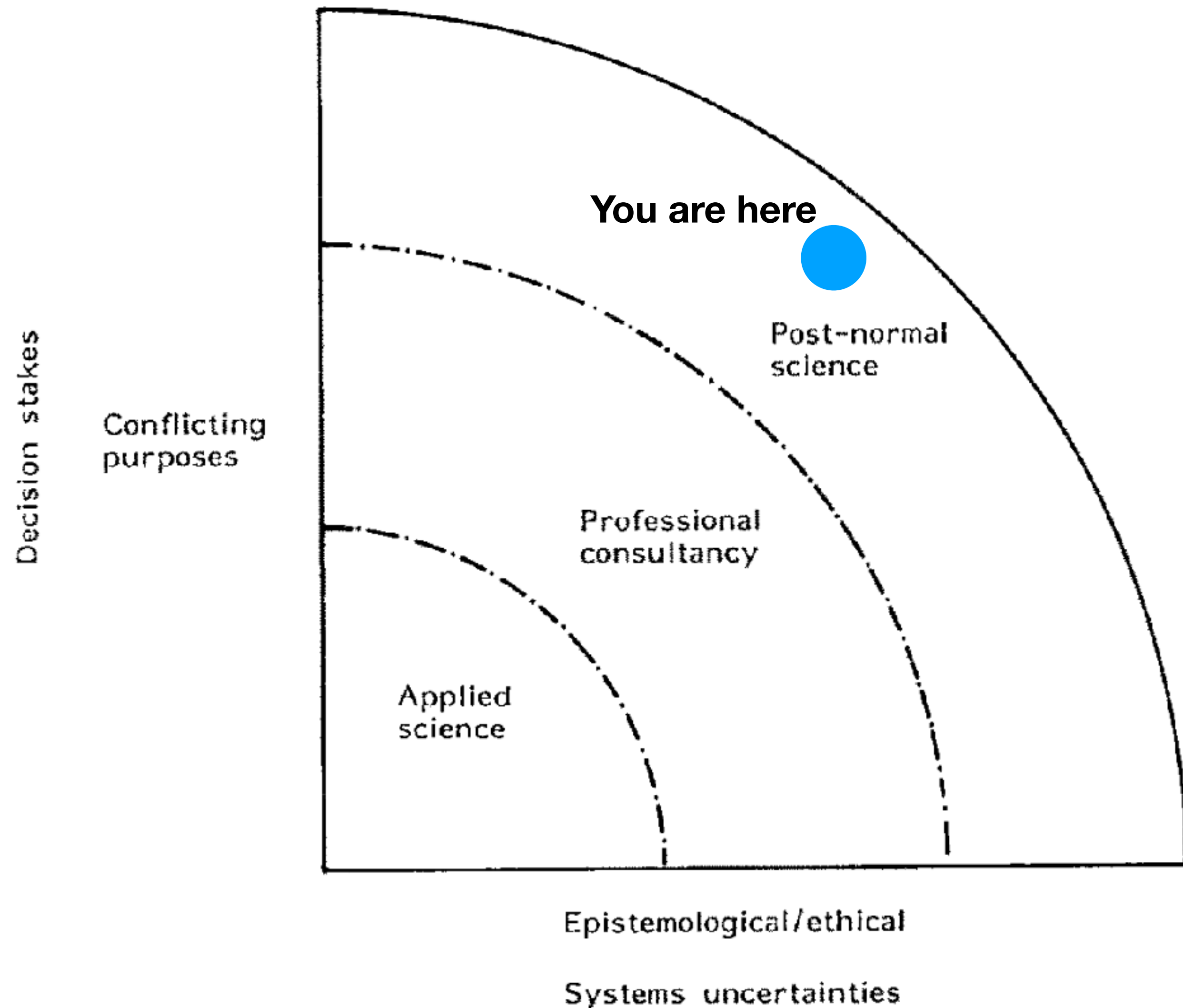


- Data and assumptions
- Study scope

**e.g.: nuclear or coal+CCS is/is not acceptable**



# What matters is not (just) “truth”



**When using models, you should not just ask: “Are the assumptions correct?” but “what do the assumptions represent?”**

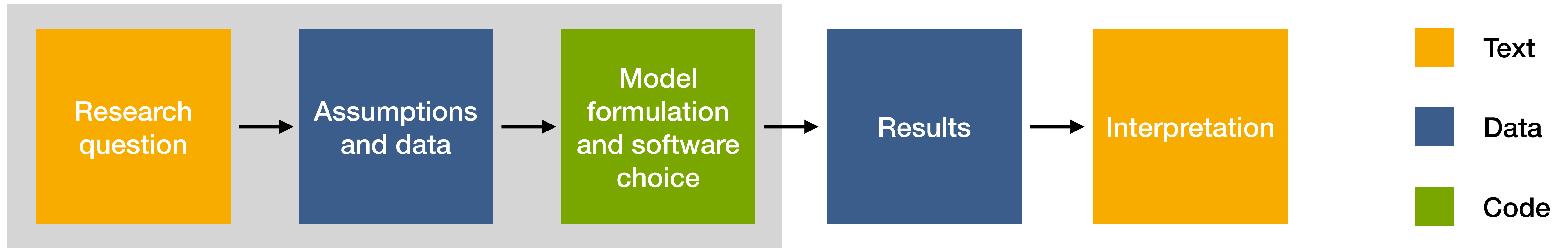
# Story so far

- The larger and more complicated the model, the harder it is to understand and use (whether open source or not)
- The models we are talking about here are not objective depictions of reality but embed modellers' values and often unacknowledged uncertainties

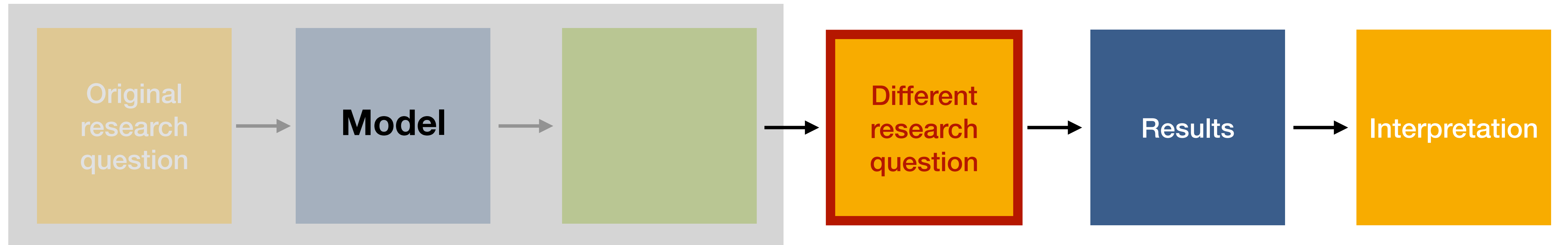
# Theory and practice

Theory

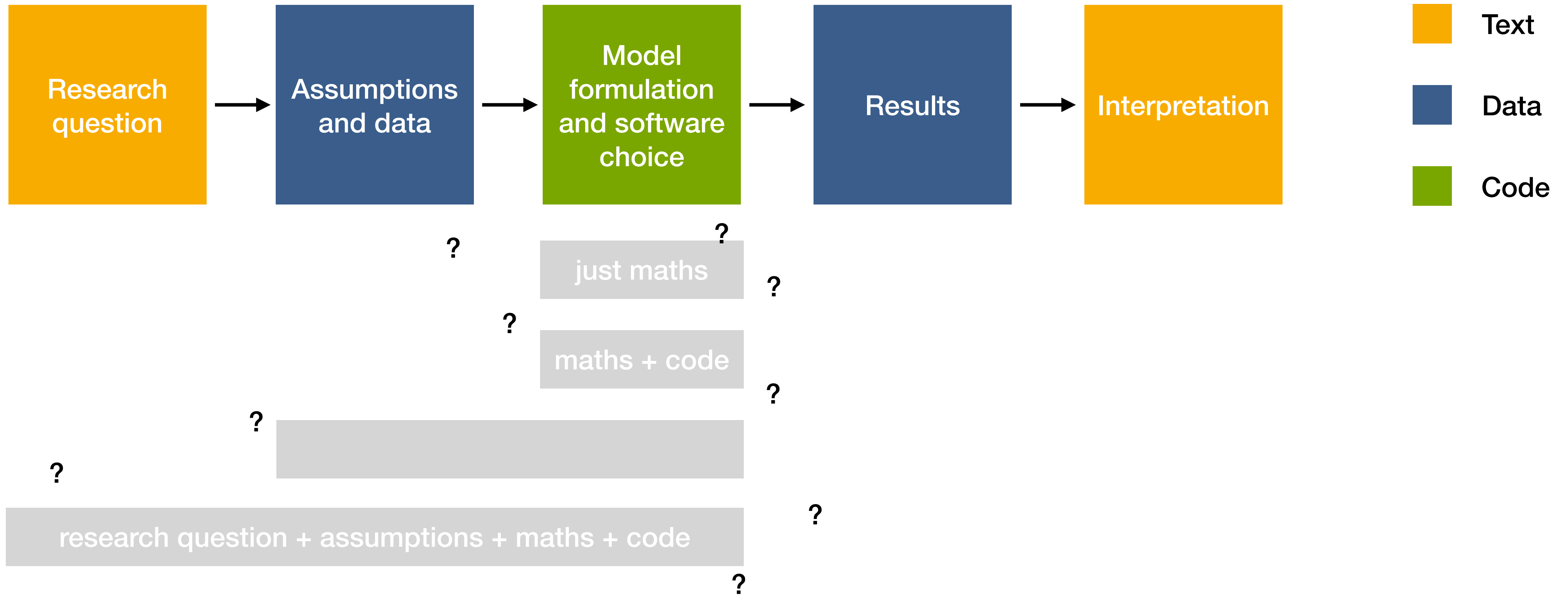
**Model**



Practice



# What is a model?

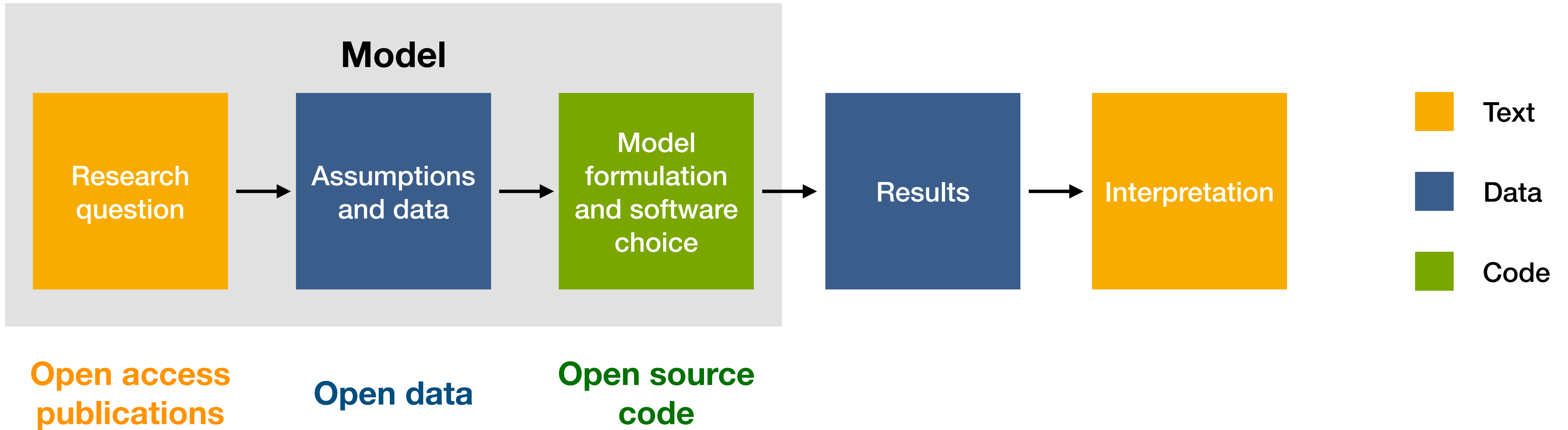




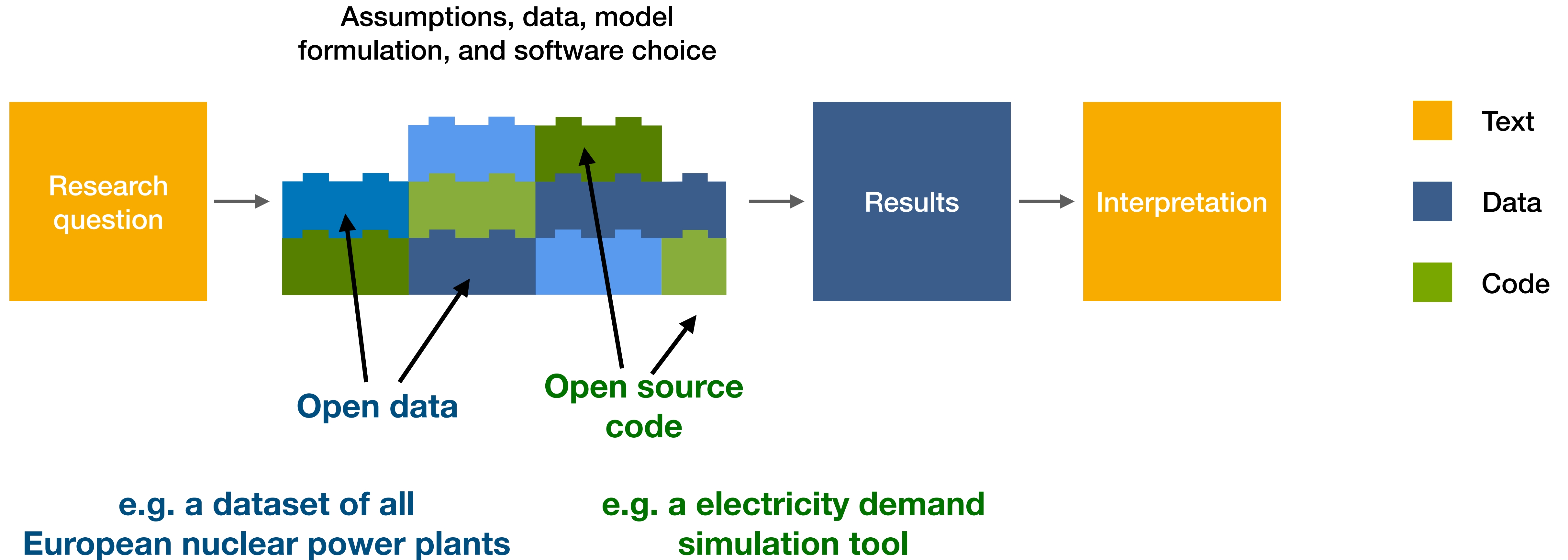
# Story so far

- The larger and more complicated the model, the harder it is to understand and use (whether open source or not)
- The models we are talking about here are not objective depictions of reality but embed modellers' values and often unacknowledged uncertainties
- “Model” can mean many different things - applying a “model” without understanding embedded values is dangerous

# What is a model?



# Understandable models: made up of understandable parts



# Story so far

- The larger and more complicated the model, the harder it is to understand and use (whether open source or not)
- The models we are talking about here are not objective depictions of reality but embed modellers' values and often unacknowledged uncertainties
- “Model” can mean many different things - applying a “model” without understanding embedded values is dangerous
- “Composing” models from simpler building blocks could improve trustworthiness and understandability



# Discussion

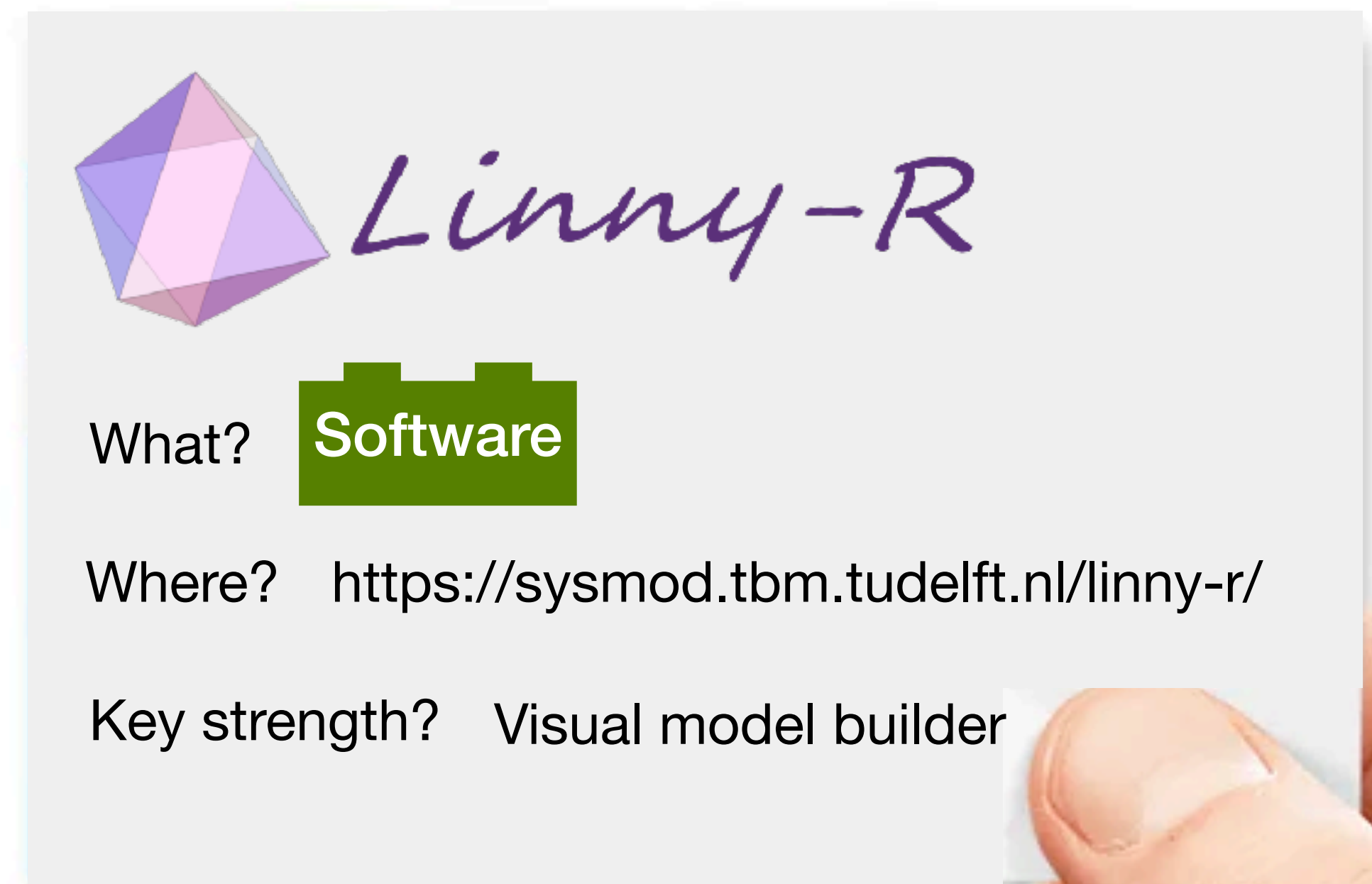
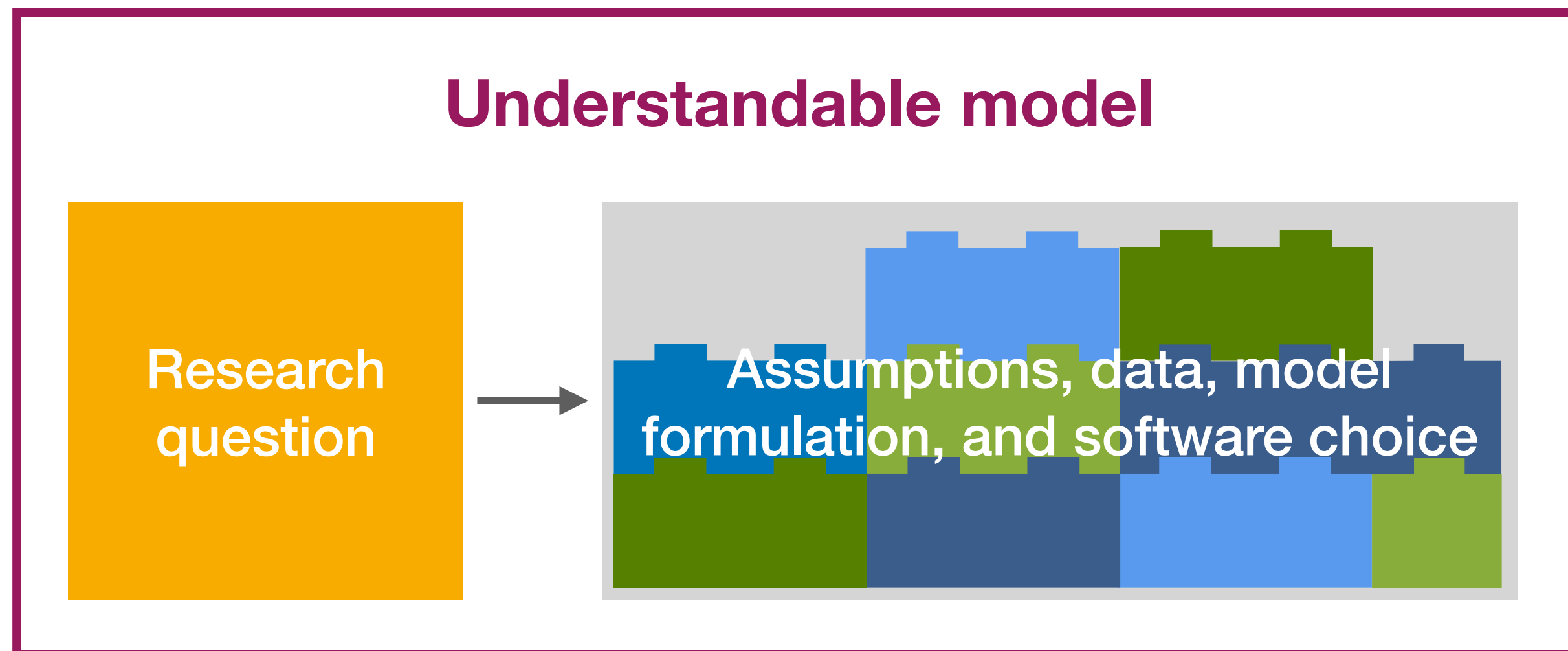
# Has Covid killed off business cards for good?

By Adrienne Murray  
Business reporter

🕒 6 September

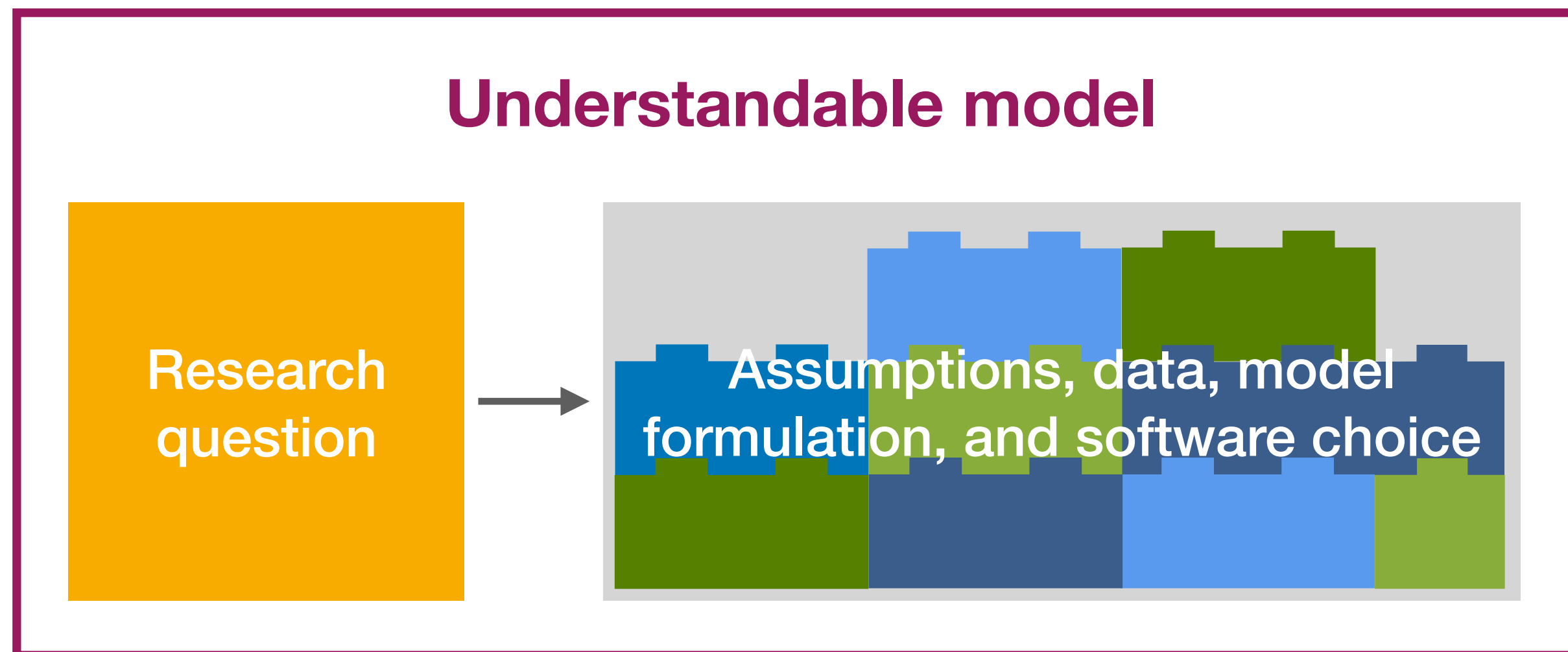


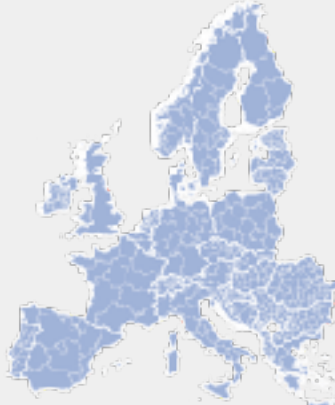
# Business cards for modelling resources





# Business cards for modelling resources



 **Euro-Calliope**

What? **Data / assumptions**

Where? <https://euro-calliope.readthedocs.io/>

Key strength? Data to build Europe-wide energy system model



# HELLO

My name is:

Renewables.ninja

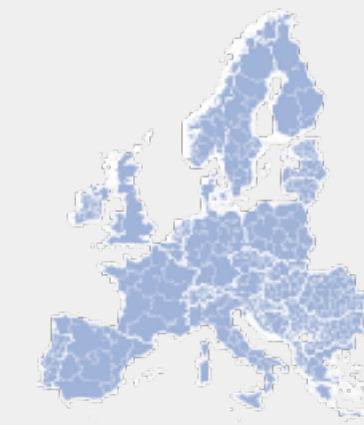
I can make wind and solar power  
generation time series for you



What? **Software**

Where? <https://sysmod.tbm.tudelft.nl/linny-r/>

Key strength? Visual model builder



## Euro-Calliope

What? **Data / assumptions**

Where? <https://euro-calliope.readthedocs.io/>

Key strength? Data to build Europe-wide energy system model



## EMLab-Generation

# Discussion

