Transparency of modelling -- Agenda

- Opening up energy system models - lessons learned and remaining challenges (Frauke Wiese, DTU)

- Counterpoint to full transparency (Maria Rosa Virdis, ENEA)

- Statements:
  - Can and should full transparency be reached in modelling?
  - How transparent is the model you are working with?
  - What are the crucial challenges from your point of view for increasing transparency in energy modelling?
  - What needs to be done and who can do that?

- Joint discussion

Opening up energy system models - lessons learned and remaining challenges

Climate Recon 2050 – Technical Dialogue 2

October 9th 2018 - Warsaw

Frauke Wiese

Why should ESM be open?

Openness

- enables transparency and credibility
- enables reproducibility of results
- reduces duplication of effort and thus frees time to develop new ideas
- allows for broad collaboration

Thus

- No more black boxes: not acceptable in research and policy advice
- Only open source models comply with scientific standards

NATURE | COLUMN: WORLD VIEW

Energy scientists must show their workings

Public trust demands greater openness from those whose research is used to set policy, argues Stefan Pfenninger.

"Black-box simulations cannot be verified, discussed or challenged."

Energy Policy

Volume 101, February 2017, Pages 211-215

The importance of open data and software: Is energy research lagging behind?

http://doi.org/doi:10.1038/542393a

https://doi.org/10.1016/j.enpol.2016.11.046

Advantages for …

- Modellers
  - Treating your users as co-developers is your least-hassle route to rapid code improvement and effective debugging.
  - Time for the interesting questions
- Science
  - Openness is a precondition for scientific standards
- Policy Maker
  - Possibility to scrutinize assumptions and results
- Society
  - Higher efficiency in spending research money

History open energy models

Electricity and energy system models:

- *First wave (3):* 2001 Balmorel, 2004 deco, 2005 GnuAE
- *Second wave (+3):* 2010 OSeMOSYS, 2012 TEMOA, 2013 NEMO

Reference: Tom Brown, Robbie Morrison, The Open Energy Modelling Initiative Community. Open Power System Data 4th Workshop, DIW Berlin, 10 July 2017

Initiative started in 2014

openmod open energy modelling initiative

Home Wiki

About

We are a grass root initiative of modellers from various universities and research institutes across Europe.

Aim

Open models and open data will advance knowledge and lead to better energy policies. Open up energy models improves quality, transparency, and credibility, leading to better research and policy advice.

View manifesto »

Activities

The openmod initiative is a network, an interest group, and a platform. We exchange ideas and source code, lobby for policy support for open projects, and actively share data, code and knowhow.

View Projects »

Connect!

- Come to our next workshop: 6-8 June 2018 at ETH Zürich
- Join our mailing list
- Join our discussion forum
- Add/find open-data and open models on the wiki
- Write us an e-mail: mail[at]openmod-initiative.org

http://openmod-initiative.org/

Open energy models

Electricity and energy system models:

- *First wave (3):* 2001 Balmorel, 2004 deco, 2005 GnuAE
- *Second wave (+3):* 2010 OSeMOSYS, 2012 TEMOA, 2013 NEMO
- *As of 2017 (+24):* Calliope, CREST, DESSTinEE, DIETER, Dispa-SET, Einstein, EMLab-Generation, EMMA, Energy Transition Model, EnergyPATHWAYS, ETEM, ficus, GENESYS, oemof, OnSSET, pandapower, PowerMatcher, PyPSA, renpass, SIREN, StELMOD, SWITCH, URBS, WWS project

Reference: Tom Brown, Robbie Morrison, The Open Energy Modelling Initiative Community. Open Power System Data 4th Workshop, DIW Berlin, 10 July 2017

Open grid models and data

Transmission and distribution grid models:

- *As of 2017 (8):* DINGO, GridKit, GridLAB-D, Hutcheon and Bialek dataset, OpenDSS, OpenGridMap, osmTGmod, SciGRID

Energy database projects:

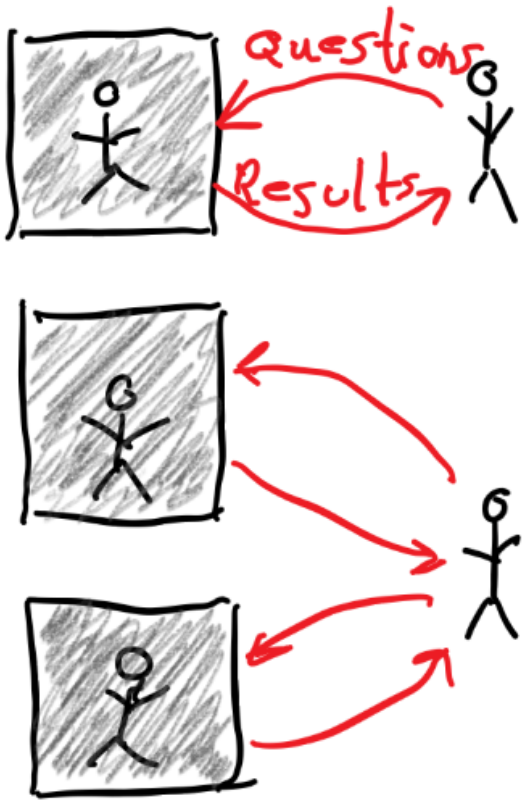
- *First wave (4):* 2004 OpenStreetMap, 2009 OpenEI, 2011 Enipedia, 2011 reegle

- *As of 2017 (+6):* Energy Research Data Portal for South Africa, energydata.info, oedb, Open Power System Data, OpenGridMap, Renewables.ninja

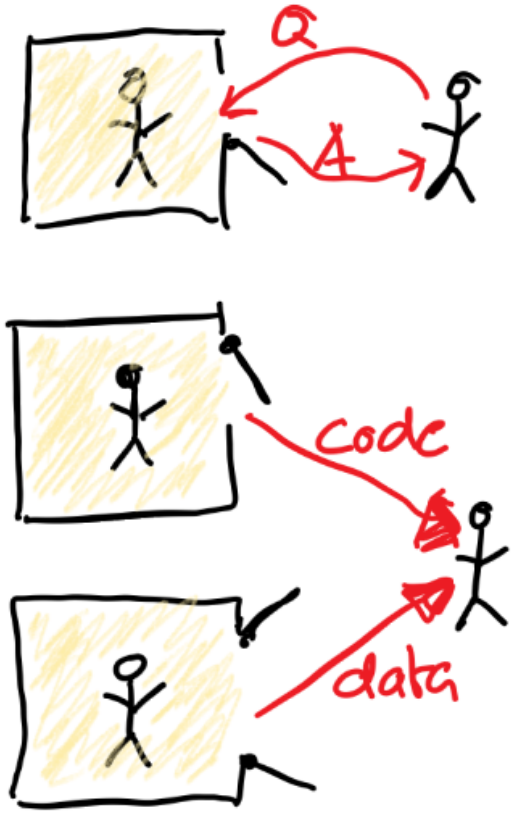
Reference: Tom Brown, Robbie Morrison, The Open Energy Modelling Initiative Community. Open Power System Data 4th Workshop, DIW Berlin, 10 July 2017

Energy System Modelling 3.0

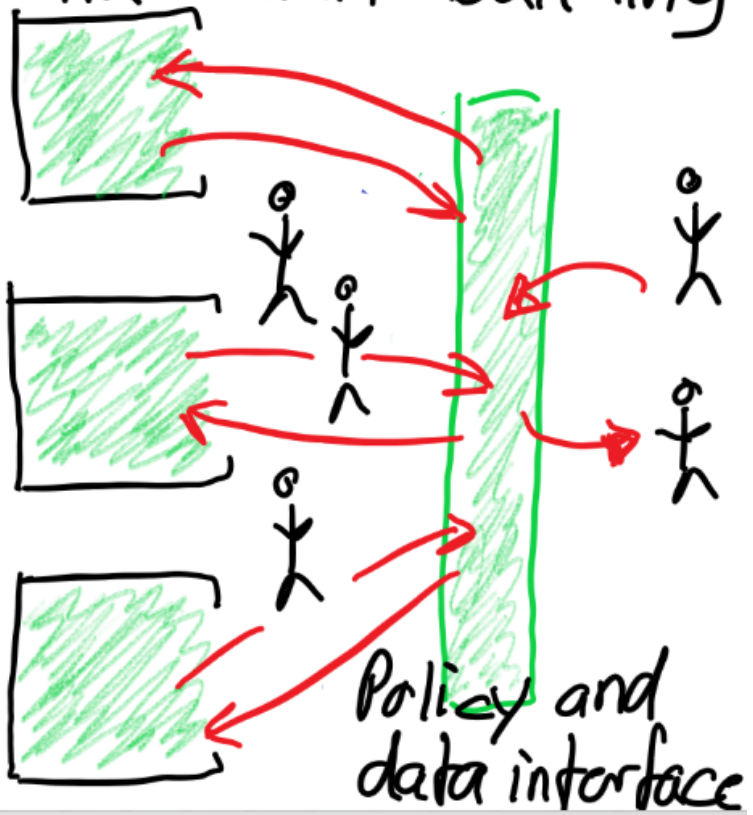
VER 1.0
Black box models



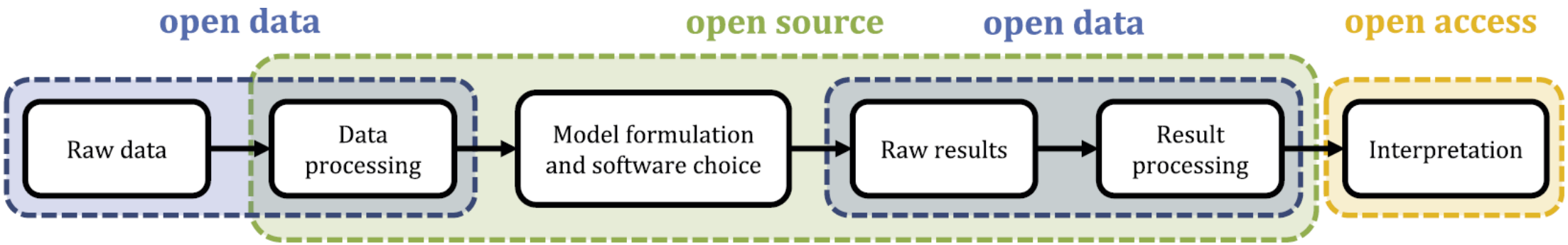
VER 2.0
Open models



VER 3.0
Shared development and scenario building



Open Energy System Modelling Process

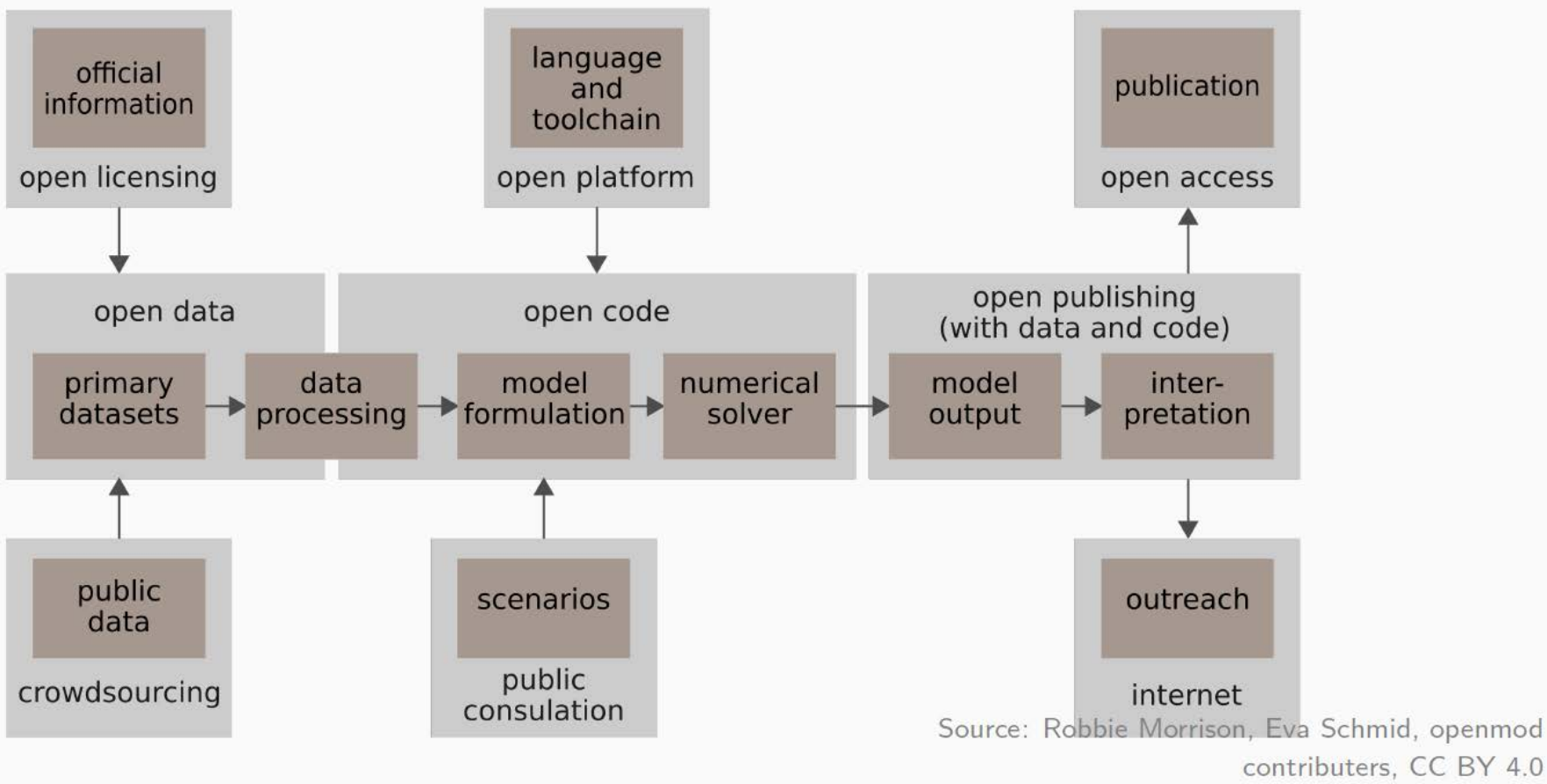


Reference: Pfenninger et al. 2018, Opening the black box of energy modelling: Strategies and lessons learned. Energy Strategy Reviews 19, 63-71.

What should be open?

The whole process:

- Raw data
- Processed data
- Model code
- Programming Language
- Solver
- Raw output
- Processed Output
- Result publication



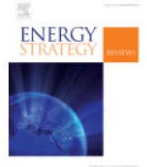
Reference: Tom Brown, Robbie Morrison, The Open Energy Modelling Initiative Community. Open Power System Data 4th Workshop, DIW Berlin, 10 July 2017

Reality: Aim at “best practice” but don’t shy away from small steps

- It is still valuable to open **only parts** of the model, data or data processing steps
- **Every bit of information** can be supportive when researchers try to reproduce or reuse the work of others
- Researchers should not shy away from sharing code, **even if** they believe it is **not yet comprehensive** enough to result in fully replicable science

Energy Strategy Reviews

Volume 19, January 2018, Pages 63-71



Opening the black box of energy modelling: Strategies and lessons learned

Stefan Pfenninger [a] ✉, Lion Hirth [b, c, d], Ingmar Schlecht [e], Eva Schmid [f, g], Frauke Wiese [h], Tom Brown [i], Chris Davis [j], Matthew Gidden [k], Heidi Heinrichs [l], Clara Heuberger [m], Simon Hilpert [n], Uwe Krien [o], Carsten Matke [p], Arjuna Nebel [q], Robbie Morrison [r], Berit Müller [o], Guido Pleßmann [o], Matthias Reeg [s] … Clemens Wingenbach [n]

https://doi.org/10.1016/j.esr.2017.12.002

What is an Open License?

A set of **conditions applied to an original work**

…granting permission for anyone to make use of that work

…as long as they follow the conditions of the license

- Can be applied to an original creation e.g.
  - written works
  - song
  - visual and other artistic expressions
  - piece of software
  - data
  - Energy System Models

You can choose the conditions

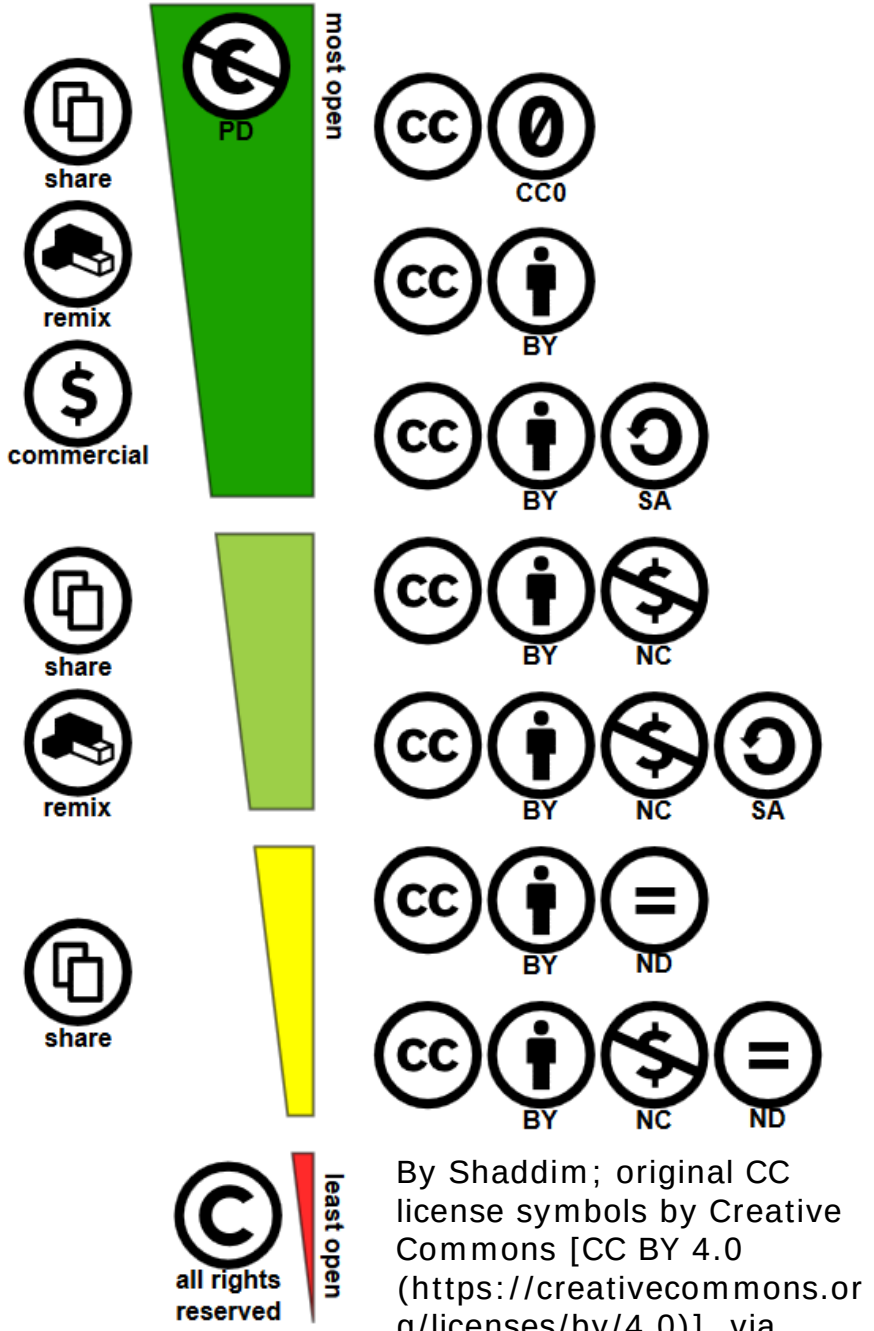
CC – Creative Commons

BY - Attribution: Credit the original creator

SA - ShareAlike: License new creations under identical terms - ***COPYLEFT***

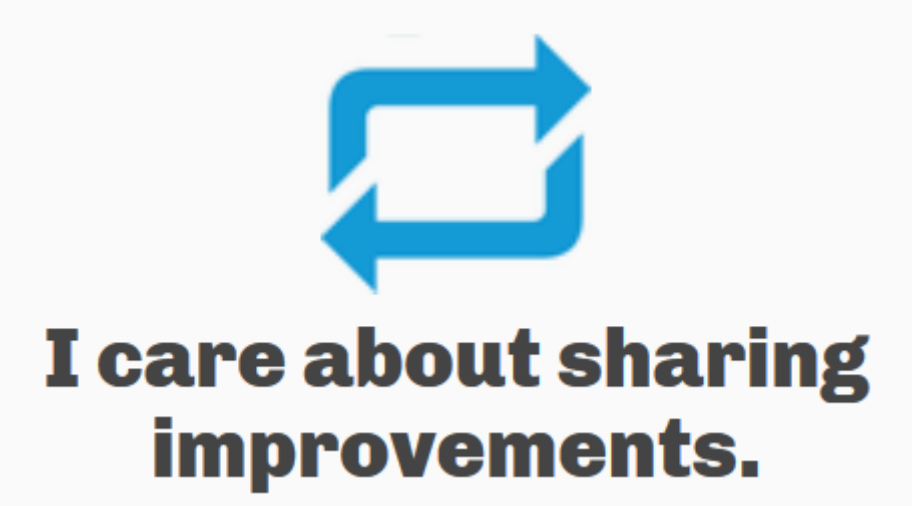
NC: NonCommercial: only non-commercial usage

ND: NoDerivs: passed along unchanged and in whole



By Shaddim; original CC license symbols by Creative Commons [CC BY 4.0 (https://creativecommons.org/licenses/by/4.0)], via Wikimedia Commons

Open licenses for software – main difference



MIT License

ISC License

COPYLEFT

GPL - 3.0

GNU General Public License, version 3

Reference: https://choosealicense.com/

Data sharing is a general challenge

Reference:

Stuart, D. et al. 2018. **Practical challenges for researchers in data sharing.**

Whitepaper

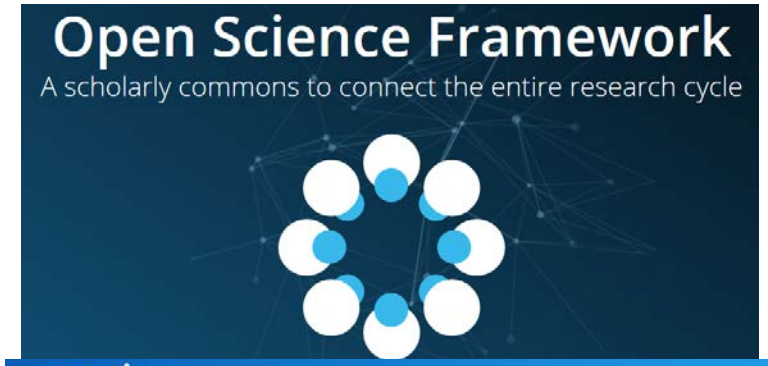
Why is data in ESM a huge challenge?

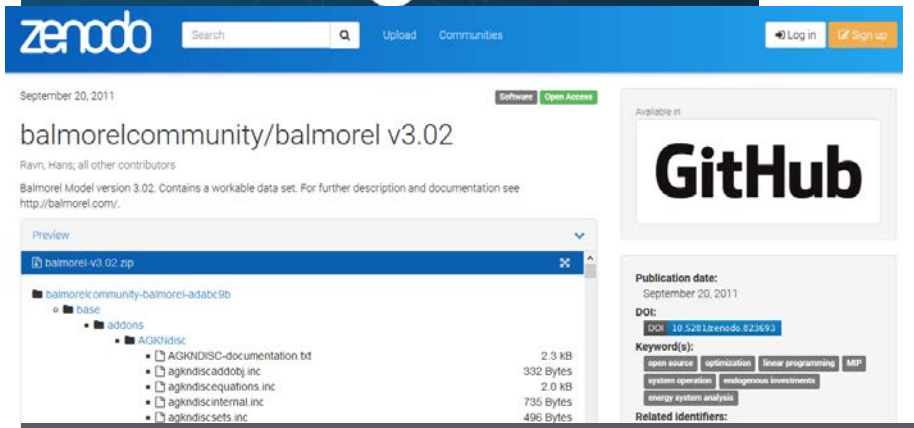
- Huge amounts of input data
- Organisation of data is difficult

- Mix of original sources that are
  - neither well described
  - nor correctly licensed

- Lack of data science education
  - energy system modelers
  - original data owners (e.g. ENTSO-E)

- Confusing database law





"Smart data structures and dumb code works a lot better than the other way around."

Summary of remaining challenges

- Model **complexity** reduces **accessibility**

⇒ Every modeller building an own model

⇒ Difficult to understand for politicians

⇒ collaborative code development

- **Result communication**:

⇒ Contexts instead of numbers

⇒ ”[w]hat modelers consider “results” and what decision makers deem useful information may not overlap.” Mai et al. (2013, p.9)

- Make the original data owners use **open licenses**

(e.g ENTSO-E)

- Structure of **research funding**:

⇒ few continuous “model-responsible” across institutions

⇒ open license as precondition for funding

- **Education in data management**

Questions?

Transparency of modelling
What models do and what they don't do

- Opening up energy system models - lessons learned and remaining challenges (Frauke Wiese, DTU)

- Counterpoint to full transparency (Maria Rosa Virdis, ENEA)

- Statements:
  - Can and should full transparency be reached in modelling?
  - How transparent is the model you are working with?
  - What are the crucial challenges from your point of view for increasing
  - transparency in energy modelling?
  - What needs to be done and who can do that?

- Joint discussion