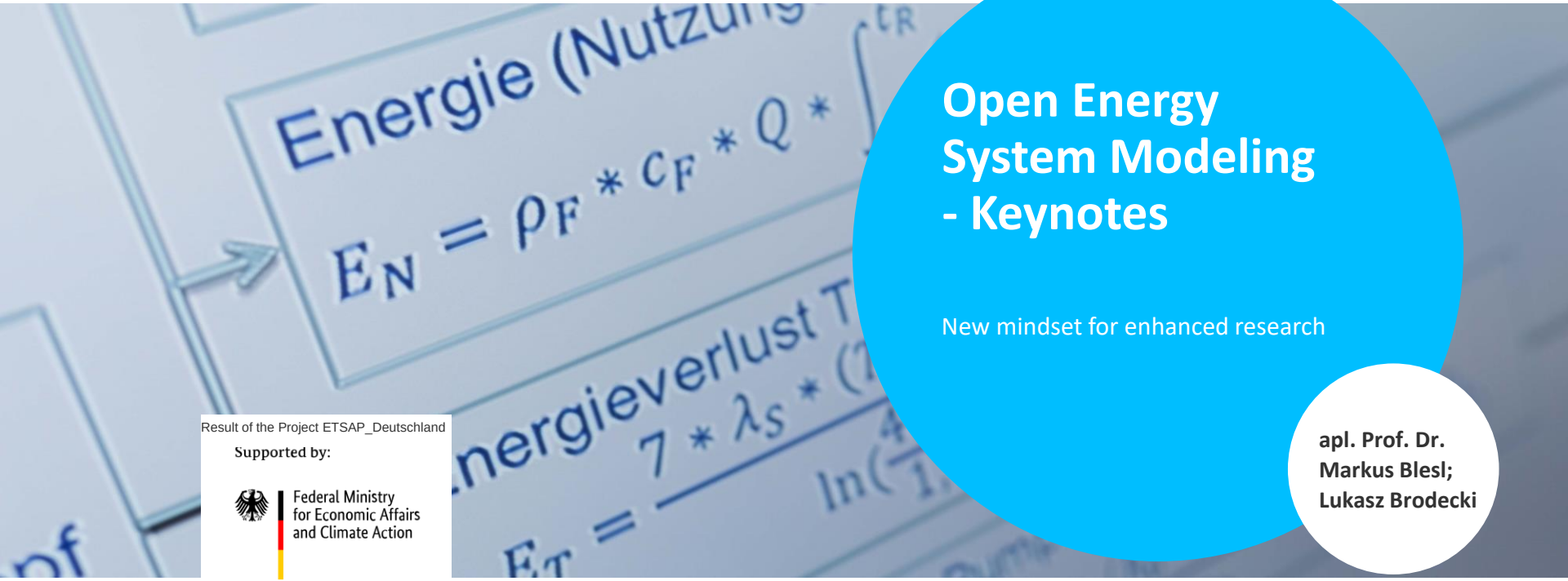
University of Stuttgart
IER Institute of Energy Economics
and Rational Energy Use



Open Energy System Modeling - Keynotes

New mindset for enhanced research

apl. Prof. Dr. Markus Blesl; Lukasz Brodecki

Result of the Project ETSAP_Deutschland

Supported by:

Federal Ministry for Economic Affairs and Climate Action

on the basis of a decision by the German Bundestag

Comparison

Advantages of “OPEN”

- **New research** projects can fully build on the results of the previous ones
- Increased **efficiency** in the use of research funds
- Further developments are always based on an existing **reference**
- Efficient **review, extensions and quality improvements** for data sets and model structures
- Automatic and **continuous validation** process

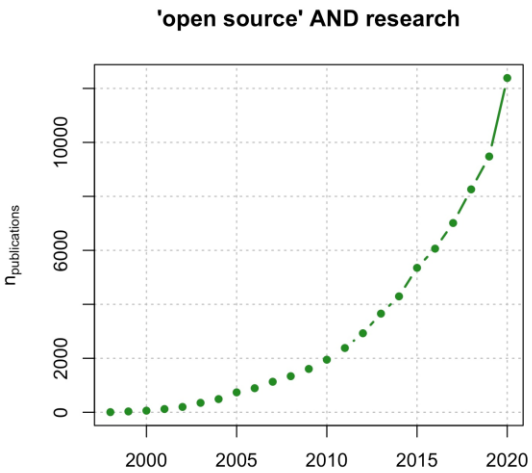
Downsides of “OPEN”

- Necessity for **trust** within the community
- Overlooked **inconsistencies** might be buried under new research
- Open modeling and open data sets without proper **documentation** offer marginal benefit
- Cost and time for additional **administration** of data
- Abandoning or reduction of built up **competitive advantages**

Hypothesis „open and no way back“

Once a field of research becomes open source there is no turning back

- There will be no turning back from the advantages that accrue from collective open development beyond some indeterminate tipping point
- Increasing popularity in open source among researchers
- Previous proprietary projects are becoming open incrementally
  - Knowledge bases from the World Bank Group (e.g.energydata.info).
  - The European Commission (EC) is continously migrating from closed models like PRIMES to open models like Dispa-SET 1.
  - EC funding “open book” METIS suite of models whereby external parties are responsible for core development and provide the EC with the source code to run in-house



Source: ScienceDirect; keywordsearch open spurce and research; https://forum.openmod.org/t/quantifying-the-benefits-of-open-energy-modelling/2346/6

Hypothesis „No payoff without effort“

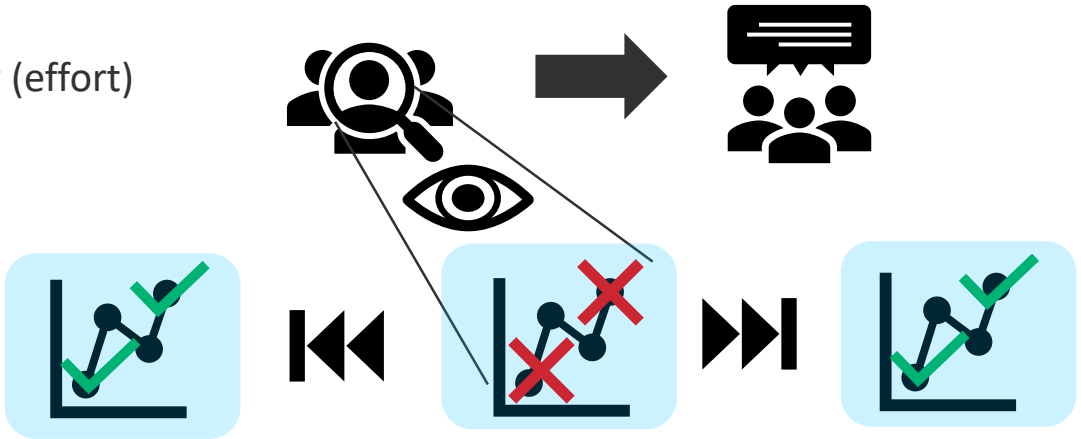
Open source modeling allows for **collaborative work,** more efficient **development lifecycles** and **transparency** (comparability and reproducibility) but **require continous maintenance**

- Additional work required for documentation and data provision
- Depending on variant of open modeling different workscopes are necessary
  - **open description models**: concise methodological summary, outline documentation, and link to outputs and applications
  - **open access models**: as above plus full documentation, data sets, and a user group for access and shared responsibility for model development
  - **open source models**: fully transparent and accessible models available for any user to download and apply

Source: Strachan, Neil and Pei-Hao Li (9 December 2020). Energy models and transparency 3. *United Kingdom Energy Research Centre (UKERC)*. London, United Kingdom. Blog

Hypothesis „Potential for concealed and forgotten bugs or shortcomings“

- Shared workload of discussions, testing, and iterative development often requires trust and a shared (project) background
- With time / ongoing development **overlooked inconsistencies** may be buried under new research
- Detected bugs or shortcomings need to be consulted/discussed and data is either restored to „older“ version or errors are corrected
- Accentuates importance of community (effort) and good communication



Hypothesis: Community adopt a central role in open energy system modeling

- Tasks organized by platform for search of existing projects and models (e.g. GitHub)
  - Get in contact, run tests and exchange examples
  - Provide and read the documentation
  - Coordination of future developments
  - Continuation of existing work, contribution to the community
- Active community within open modeling framework provide better and more responsive support for ideas, as for now such services are provided e.g. via **VedaSupport Forum** or **IEA-ETSAP Forum**
- Integrated interaction and communication between the user community and developer community
- Open-source structure is expected to bring a better project and community governance structure but moderation is needed by someone (admin, lead developer…) or somehow (regular workshops)

Hypothesis „Don‘t forget the infrastructure“

Fully Open Science can only be achieved, if competitive optimization solvers and infrastructure are available

- One area where open source development is lagging well behind is optimization solvers
  - source GLPK and cbc solvers are clearly inferior to their commercial counterparts, such as Gurobi and CPLEX, by a wide margin.
- Access to sufficiently powerful computational resources not necessarily extensively available
- Often the trend towards “open” is used for marketing purposes; often tempered by withholding or overpricing necessary workflow tooling, post-processing software, databases, and other essential components

➔ The questions arises: What is the underlying motivation for moving towards “open”?

Conclusions

Once open source there is no turning back

➔ Incrementally implement model sharing and gradually increase scope of openness

Additional work required for documentation and data provision

➔ Establishing a **Wiki** as a form of efficient documentation and **shared knowledge offer good transparency and provide credibility**

Community and community effort take significant share in success of open energy system modeling

➔ Trust, credibility, good communication need to be established for an effective and sustainable open energy system modeling

Underlying motivation for publishing “open”?

➔ Promotion of enhanced research in the field of energy transformation

OPEN IS A CHANCE BUT IS NOT FREE OF CHARGE