Challenges of System Analyses for Sector coupling

- A first discussion along the three dimensions of sociotechnical problems

Bert Droste-Franke

1. Definition of Sector Coupling
2. Control („factual“ dimension) – System (and Environment)
3. Change (temporal dimension) – Positioning Analyses
4. Action (social dimension) – Capturing behaviour
5. IQIB Approaches to deal with the Challenges
6. Conclusions

Definition of Sector Coupling

Definition of Sector Coupling

Sector Coupling (Ausfelder et al. 2017 (project „Energiesysteme der Zukunft“)):

- Connecting areas in an energy system which were not connected before
- Aims particularly on
  using electricity from renewable energies (especially wind power and photovoltaics) to a large extent
  in the sectors of **heat** and **transport** as well as in **industry**
- Conversion chains using hydrogen and synthetic gases play an important role

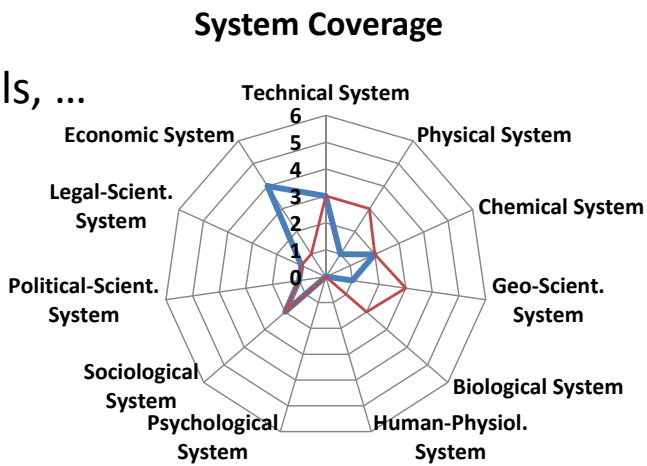
Control („factual“ dimension) – System (and Environment)

Challenges of energy system analyses

- Analyses and underlying knowledge needs to **fit to the purpose**
  - Considering relevant technical, professional, scientific and local, experience based knowledge
  - Setting normative/non-epistemic elements right (e.g. preferences for „false-positives/negatives“)
- Analyses need to follow a **large spectrum of options**, and acquainting decision makers with the **underlying uncertainties**
- **Exploring the option space** via Meta- and reflective analyses (transparency, implicit commitments, vary/exchange premises)
- Selecting those options which do **not contradict major societal values** and fit well with respect to evaluations by interest groups
- Concentrate on analysing **decisive issues and correlations**

Increase of intentions / elements and necessary perspectives – need for multiple studies and meta-analyses

- **Technologies**: functionalities, process interlinkages, interfaces, …
- **Economics**: costs, revenues, prices, markets, discount rates, labour, …
- **Legal frame**: contracts, permissions, standards, …
- **Politics**: institutions, organisations, individuals, multi-levels, …
- **Society**: communication, co-operation, acceptance, …
- **Psychology**: perception, opinion formation, psychological impacts, …
- **Human-Physiologic**: physiological impacts, …
- **Biology**: organisms, ressources, …
- **Geo Sciences**: topology, ressource availability, weather, climate, …
- **Chemistry**: substances, reactions, energy conversion, enthalpy, …
- **Physics**: energy conversion, material characteristics, environmental characteristics, …

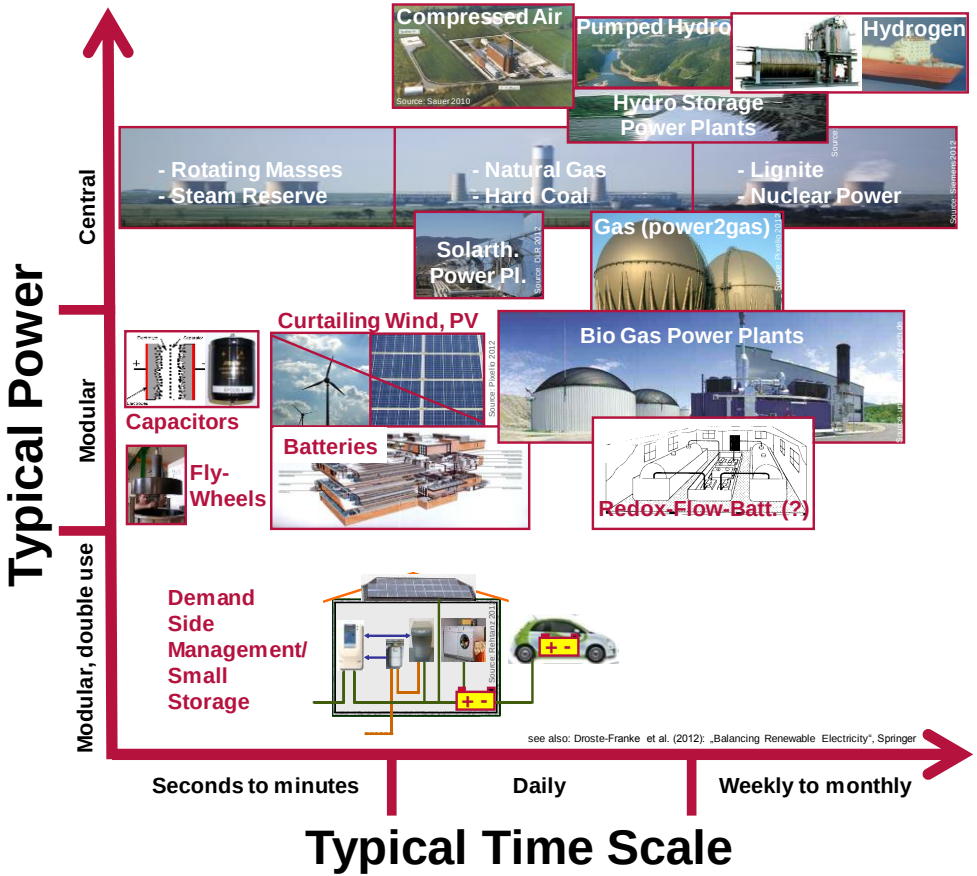


Scientific experts dealing with real world problems: Caution needed in combining means and ends!

1. Application to **real world problems** → helpful answers are not readily available → combining various general „truths“ + practical demands → **unavoidable incoherencies**
2. Challenges selected by **urgency** → potential difficulty in tractability, non-laboratory conditions → **much higher uncertainty**
3. New expert scientific knowledge produced under **close scrunity of the public** → internal controversies, contrasting conceptual frameworks become visible → **distrust may be caused**
4. Bringing **scientific generalisations to bare on specific practical problems** → additional **local knowledge/lay participation needed**
5. Practical **impact of** science-based **recommendations** → appropriateness partly assessed by **non-epistemic (normative) criteria which are not part of academic research** (efficiency, economic benefit, environmental impacts, social issues)

Change (temporal dimension) – Positioning Analyses

Manifold time scales in balancing supply and demand need to be synchronised with time scales in other sectors

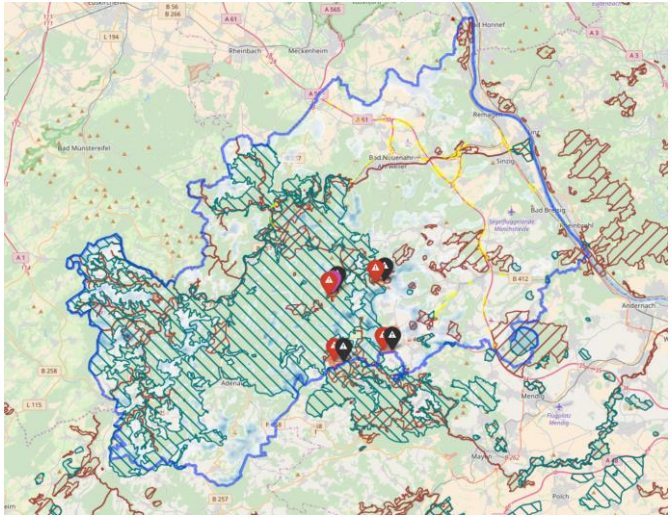


Scales, resolution, and coverage also need to be synchronised in the spatial dimension

Individual decisions

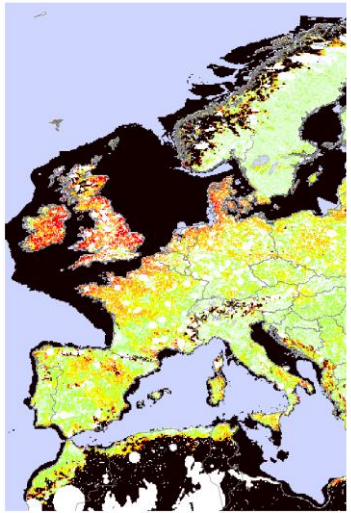
Source: http://www.solarkataster-ahrweiler.de/karte

Regional restrictions and conflicts



Source: https://www.enahrgie.de/szenarien/karte.html

National scenarios



Source: SRU 2010

Action (social dimension) – Capturing behaviour

Capturing social heterogeneity

- Heterogeneity in actors needs to be considered:
  - various actor characteristics and resources,
  - various actor environments,
  - various purposes in energy supply, transport tasks etc.
- For modelling systems and for evaluating options

IQIB Approaches to deal with the Challenges

Co-Design as deliberative-discursive connection of ends and means (Innovation-Lab and „Lab-Workflow“)

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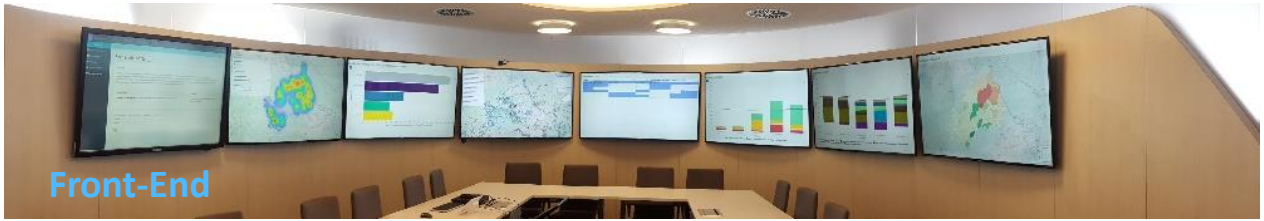

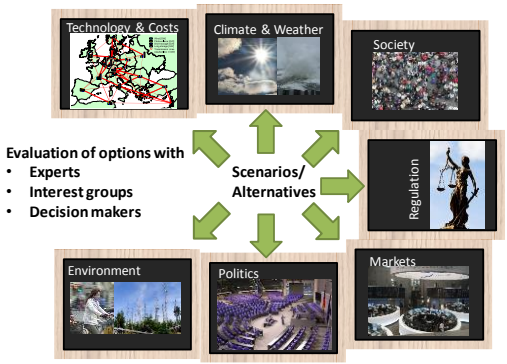

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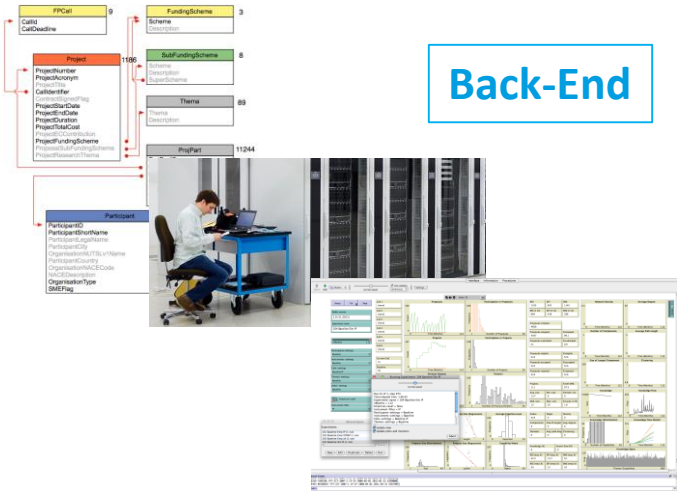
1. Identification of **challenges / aims / targets (concrete ends)** (with experts, interest groups, decision makers)
2. Identification / development of **relevant models, data, analyses**
3. Identification and formulation of **„experiments“/„scenarios“** and adequate **analyses/visualisierung of the option space**
4. First/reviewed **results / answers**, discussion of uncertainties/options/limits
5. Final **presentation, publication and communication of results**

Back-End



Small groups for enabling mutual deliberative exchange

Considering relevant expertise with respect to

- Relevant content aspects
- Kind of knowledge: scientific and practical expertise

Enabling problem-related reflexive discussions

- Working problem-related
- Analysis of the whole option space including uncertainties
- Considering known substantial societal evaluations
- Mutual recognition of validity of arguments

Example “EnAHRgie”: energy concept and sustainable land use

- “Innovation group” with scientists and practitioners + Scientific expert group
- Multiple participatory elements + knowledge management (s. www.enahrgie.de)

EnAHRgie

Bundesministerium für Bildung und Forschung

FONA

Innovationsgruppen Nachhaltiges Landmanagement

ahrtal-werke

dlfu

evm

ffu Forschungszentrum für Umweltpolitik

Handwerkskammer Koblenz

Institut für Energiesysteme, Energieeffizienz und Energiewirtschaft

IfaS

KREIS AHRWEILER

BAD NEUENAHR AHRWEILER

DIALOGIK

RUR

Fraunhofer UMSICHT

EA EUROPEAN ACADEMY OF TECHNOLOGY AND INNOVATION ASSESSMENT

Transparency by interactively displaying important correlations with simplified models – Example: the Regio-Scenario-Tool

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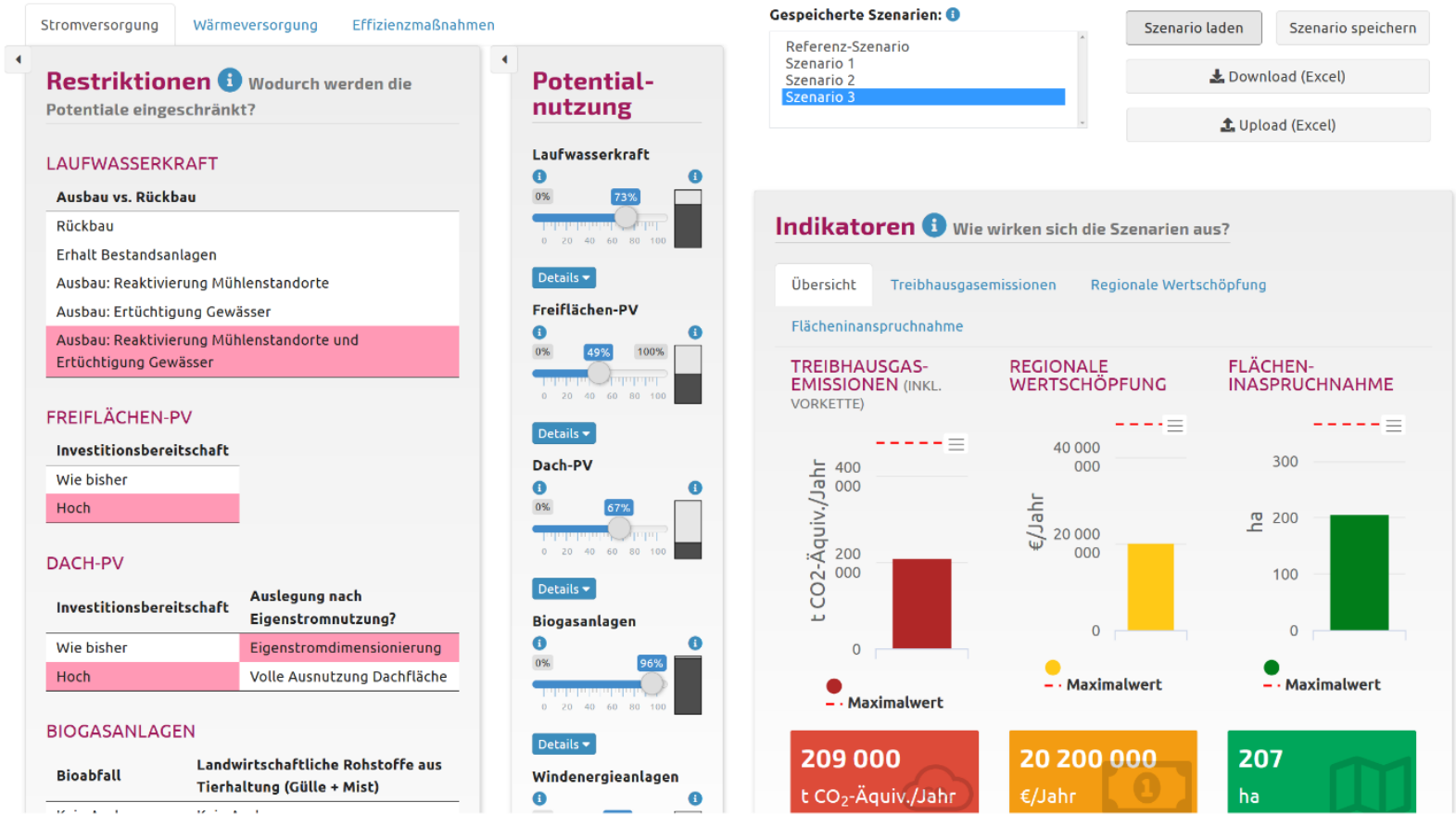
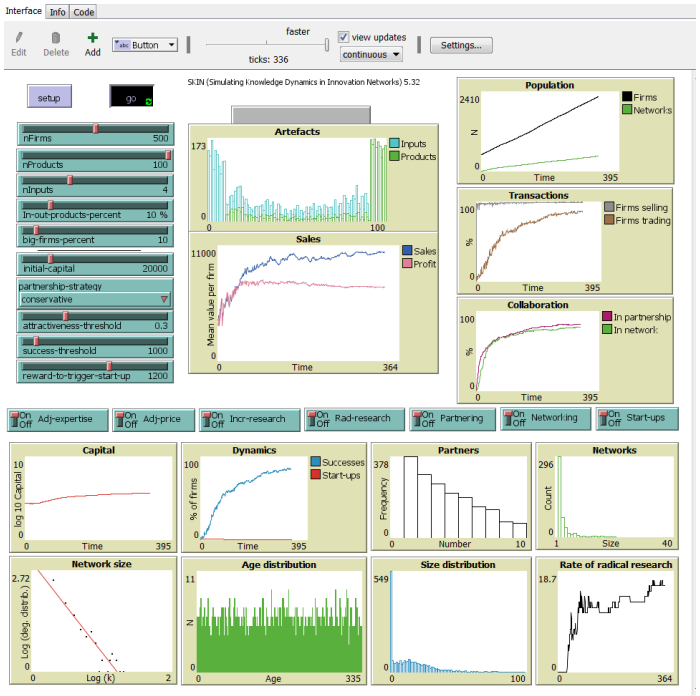


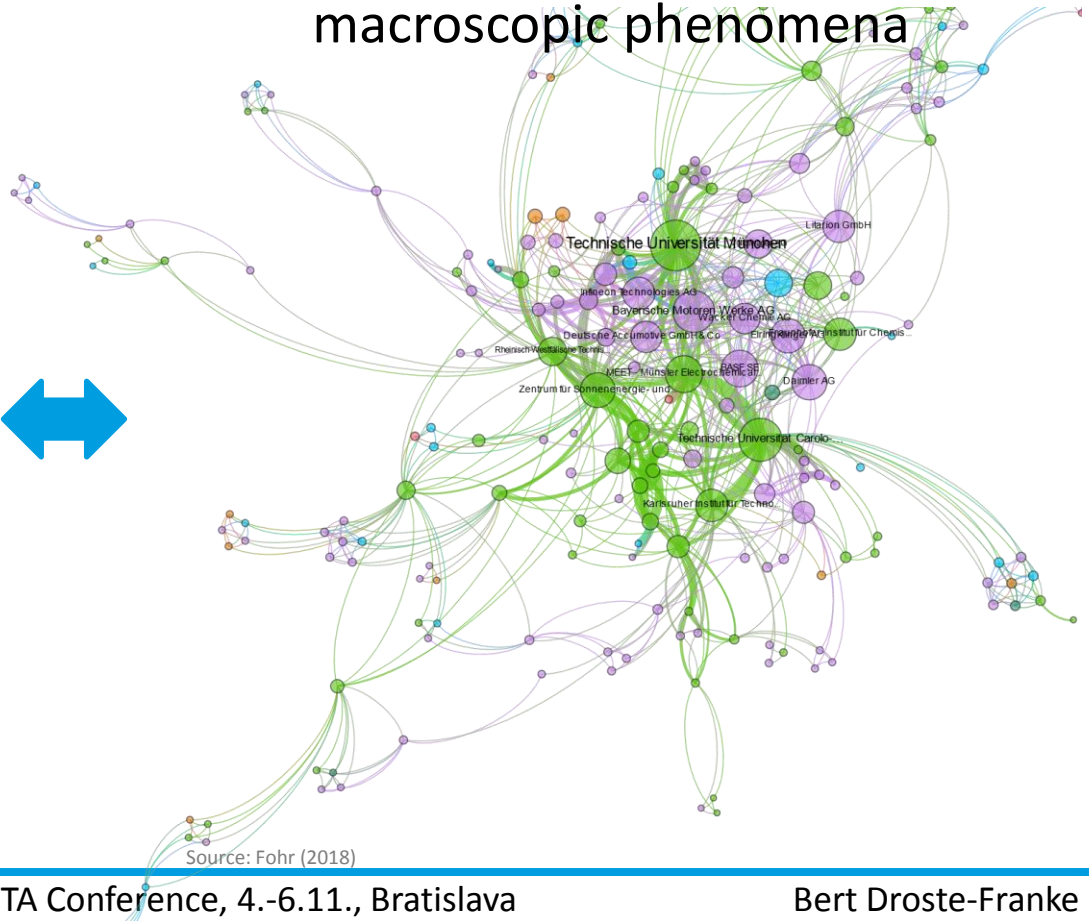
Capturing social heterogeneity in action and evaluation, e.g. by agent-based modelling

Modelling basic behaviour on micro level



Source: SKIN model

macroscopic phenomena



Source: Fohr (2018)

Conclusions

Conclusions

- Challenges of system analyses increase with sector coupling :
  - Dimension 1 (Control):
    - Increase of disciplinary aspects through new purposes / intentions
    - Increase of elements in the systems
  - Dimension 2 (Change):
    - More framework conditions need to be considered
    - Temporal (and spatial) settings need to be synchronised
  - Dimension 3 (Action):
    - Heterogeneity of actors needs to be considered in the analysis and for the evaluation
- Approaches need to be further developed and tested for sector coupling

References:

Droste-Franke B, Carrier M, Kaiser M, Schreurs M, Weber C, Ziesemer T (2015) Improving Energy Decisions. Towards Better Scientific Policy Advice for a Safe and Secure Future Energy System, Ethics of Science and TA, Volume 42, Springer, Berlin

Regio-Scenario-Tool: www.enahrgie.de/tools

Globisch J, Droste-Franke B, Fohr G, Wassermann S (2019 to be published) Beratungsorientierte Verbindung von Empirie und sozialwissenschaftlichen Simulationsmodellen. TATuP 03/19

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