How do we get (Energy) Justice into our Models?

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Introduction

- Master degree „Regenerative energy systems", Berlin Institute of Technology (TUB), Germany

- 2019-2022: Researcher, Reiner Lemoine Institut

- Since 2022: PhD Student, Reiner Lemoine Foundation

Reiner Lemoine Institut

- Non-profit research institute, founded 2010 (Berlin)

- 100 % subsidiary of Reiner Lemoine-Foundation (RLS)

- Managing Directors:

  Dr. Kathrin Goldammer & Dr. Christine Kühnel

- ≈ 100 researchers and students

- Research Groups:

  - Transformation of Energy Systems,

  - Mobility with Renewable Energy

  - Off-Grid Systems

Reiner Lemoine
Founder of the Reiner Lemoine-Foundation

Agenda

Welcome, Introductions, Challenges (25 min)
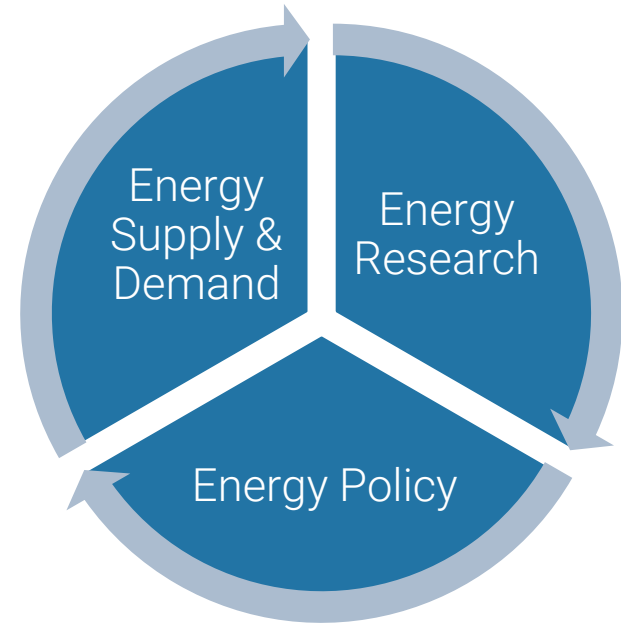
Input part: Literature review & WebApp (20 min)

Breakout groups on paper ideas (30 min)

Feedback (15 min)
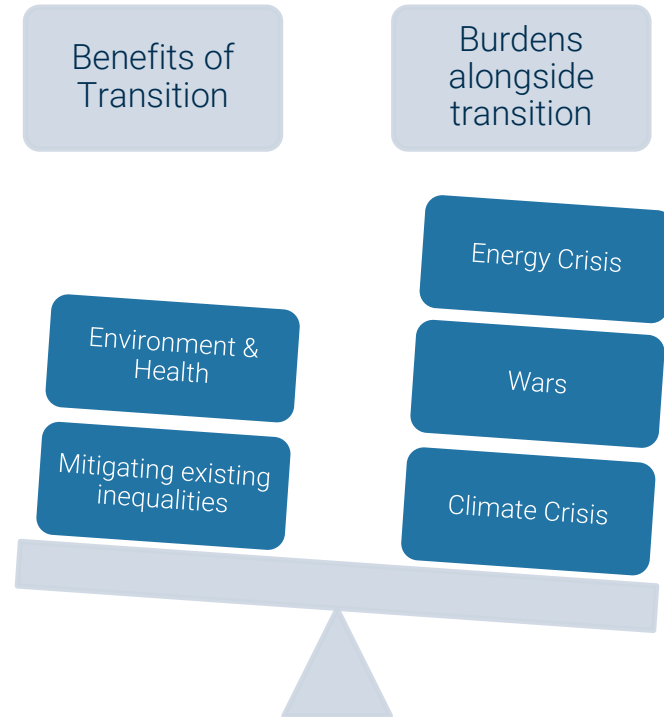
Energy Models Informing Policy

Energy policies are often shaped by energy models

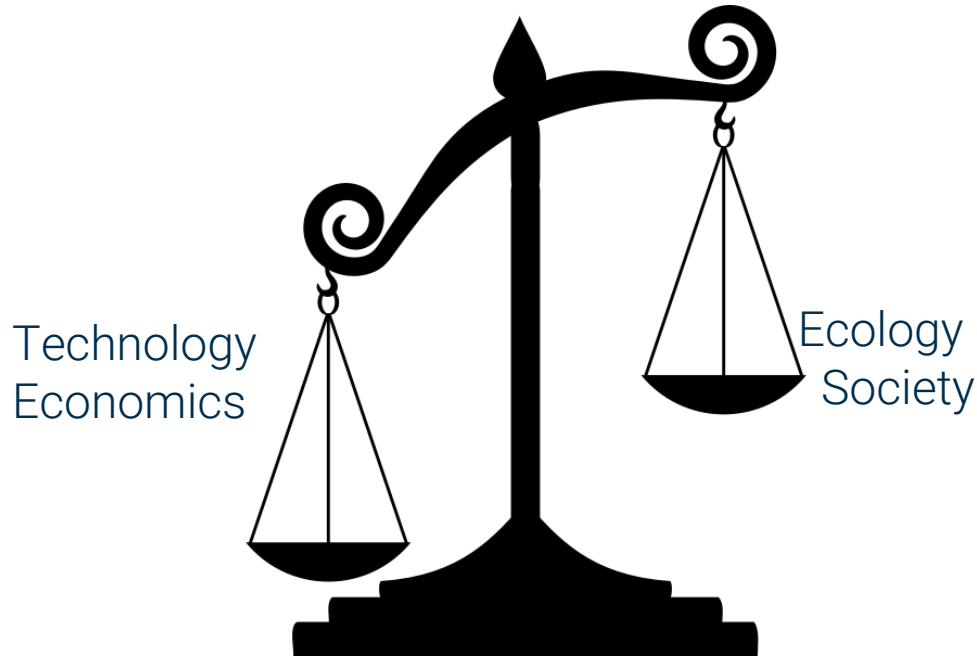→ Linking desired policy outcomes with measures

Recognizing Social Context of Energy Policy

- Crisis alongside transition interplay with public reaction to transition policies

- Possibility of public opposition

- Transition policies can on the other hand ease existing distributional issues
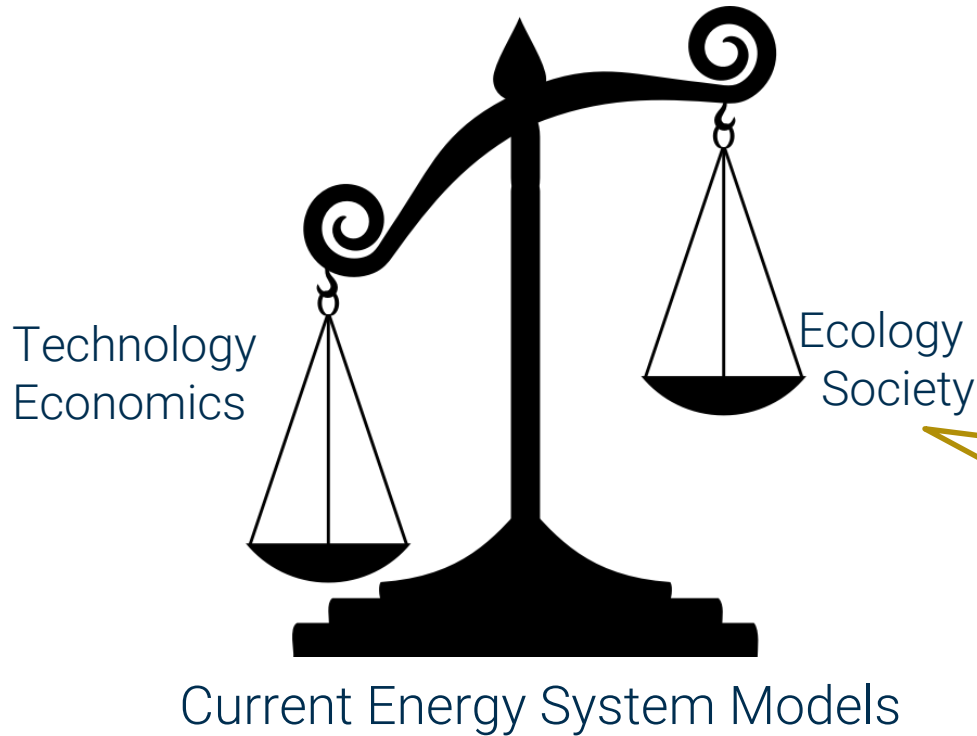

Benefits of Transition

Burdens alongside transition

Energy Crisis

Environment & Health

Wars

Mitigating existing inequalities

Climate Crisis

Energy System Models – Research Questions

Technology
Economics

Ecology
Society

Current Energy System Models

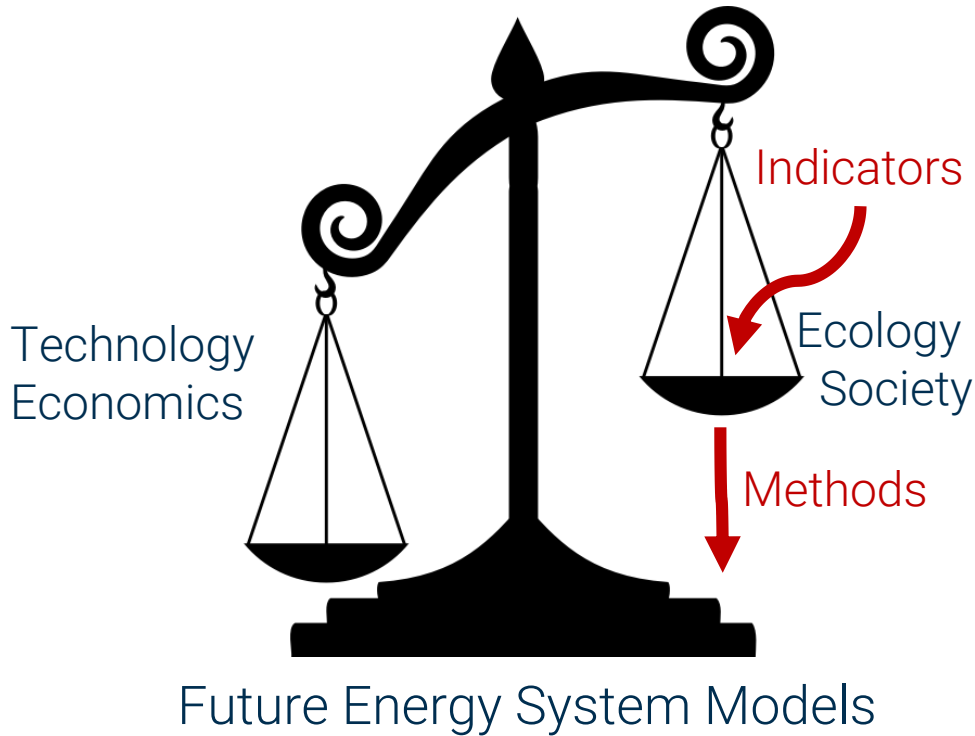# Energy System Models – Research Questions
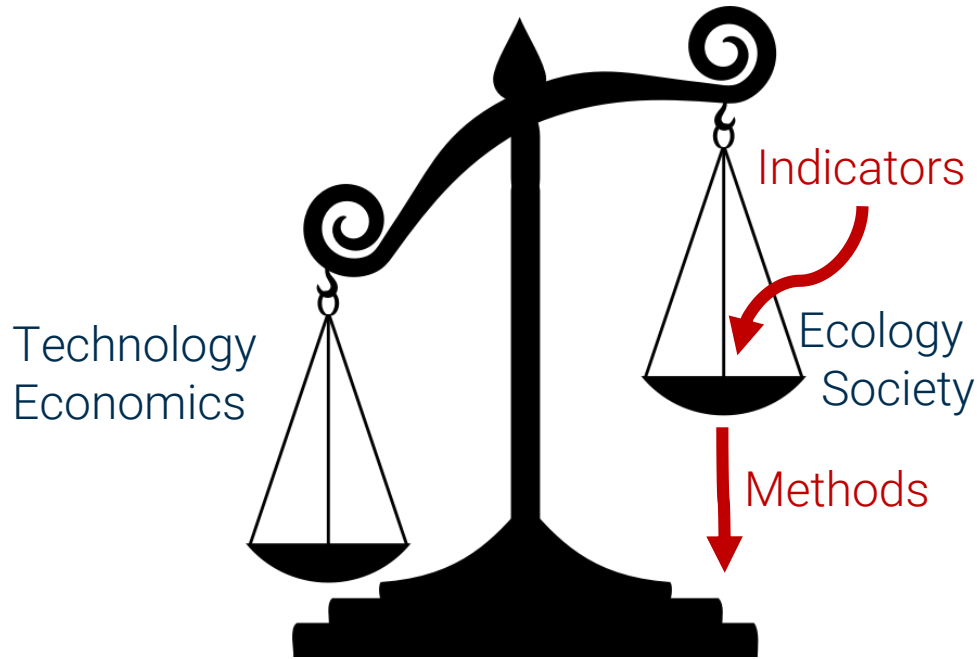
Technology
Economics

Ecology
Society

Current Energy System Models

How can we represent justice implications of the energy transition in energy models?

Energy System Models – Research Questions

Indicators

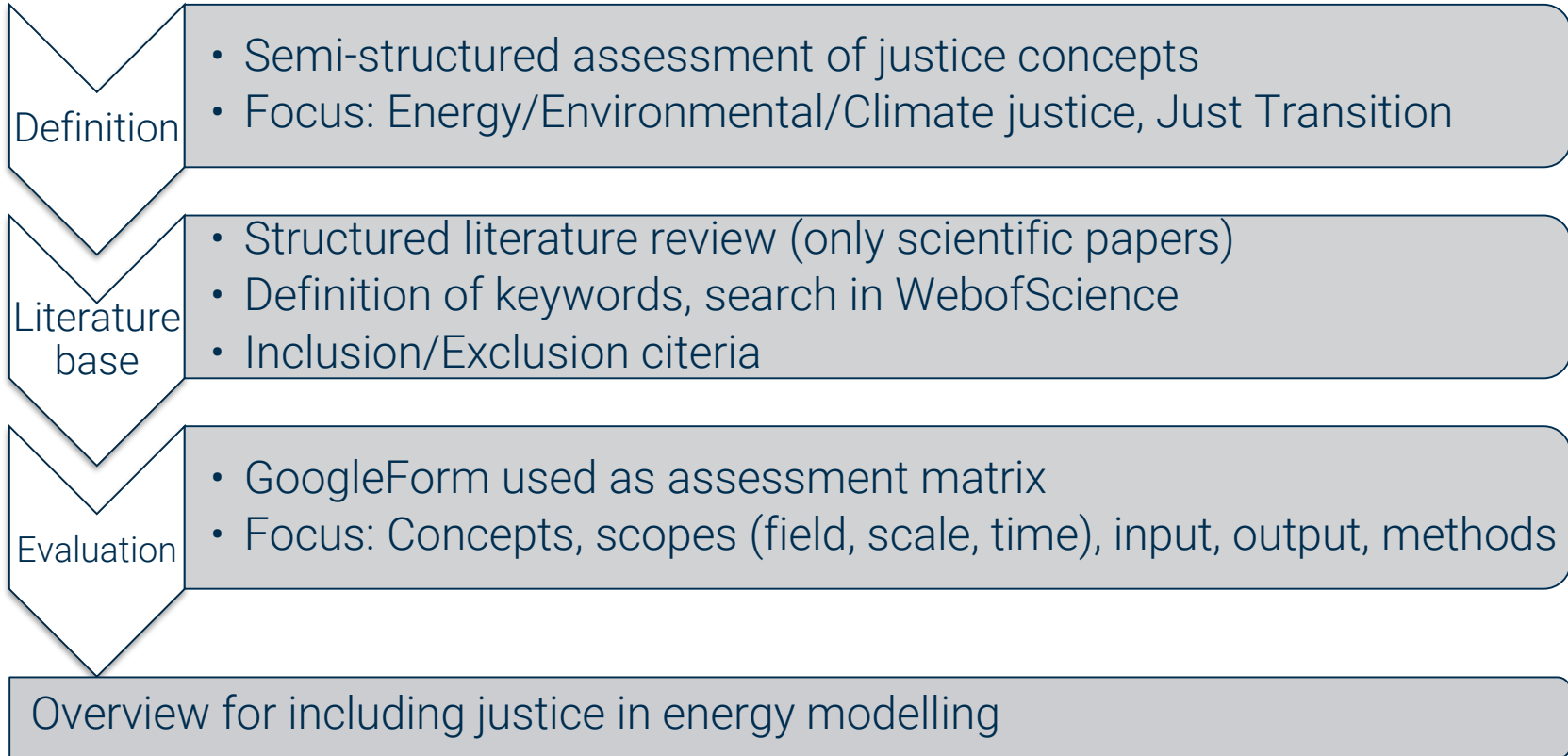Technology
Economics

Ecology
Society
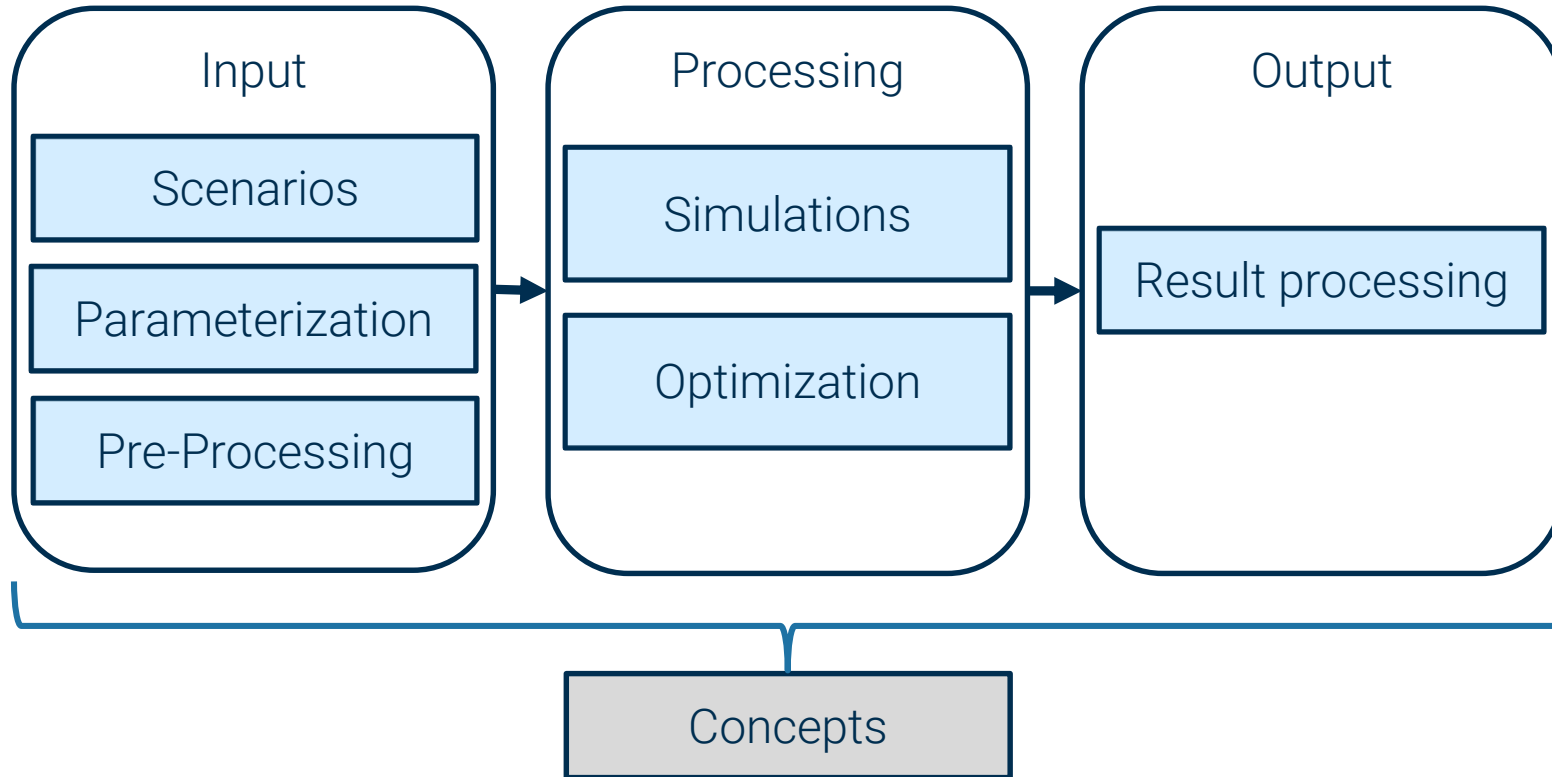
Methods

Future Energy System Models

Energy System Models – Research Questions

- Indicators help to „translate" concept of justice

- Methods integrate these indicators in the modelling process

Methodology

Definition
- Semi-structured assessment of justice concepts
- Focus: Energy/Environmental/Climate justice, Just Transition

Literature base
- Structured literature review (only scientific papers)
- Definition of keywords, search in WebofScience
- Inclusion/Exclusion citeria

Evaluation
- GoogleForm used as assessment matrix
- Focus: Concepts, scopes (field, scale, time), input, output, methods

Overview for including justice in energy modelling

Defining the Search String: Keywords

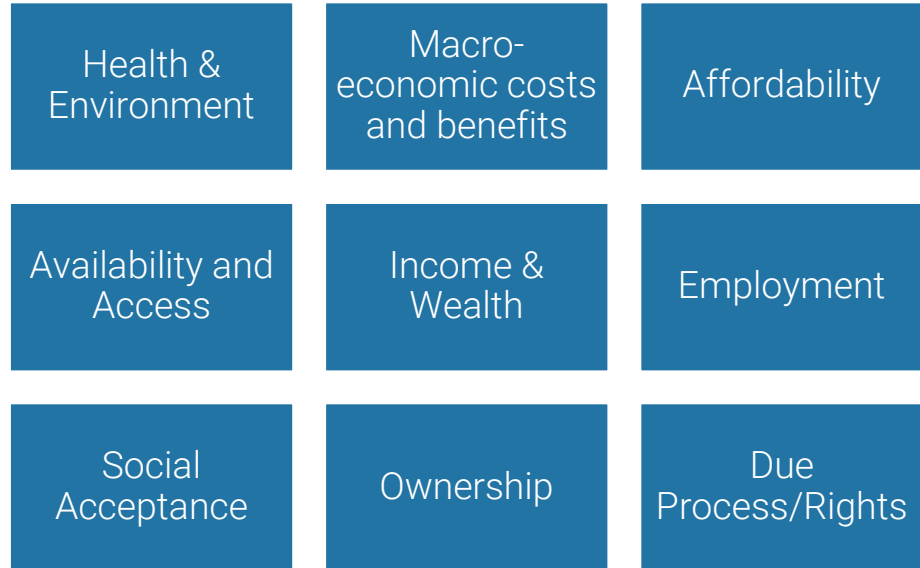| Search term group name	Search terms
Energy service	Energ* OR electricit* OR heat*
Environmental argument	Climate* OR *carbon* OR sustainab* OR renewable* OR environment*
Planned system change	transition* OR transformation* OR pathway* OR strateg* OR polic* OR planning
Methodology	model* OR indicator* OR simulation* OR optimi* OR tool* OR framework* OR scenario*
Justice elements	*justice* OR *equit* OR *equalit*
Representation of consumers	consumer* OR household* OR prosumer* OR soci* OR population OR communit* OR people OR minorit*

Modelling steps as a framework for our results

Indicator Groups

- ~80 assessed papers
- Different energy model types, few IAMS
- Many indicators that can express justice in models!

Health & Environment	Macro-economic costs and benefits	Affordability
Availability and Access	Income & Wealth	Employment
Social Acceptance	Ownership	Due Process/Rights

Examples Indicator Groups

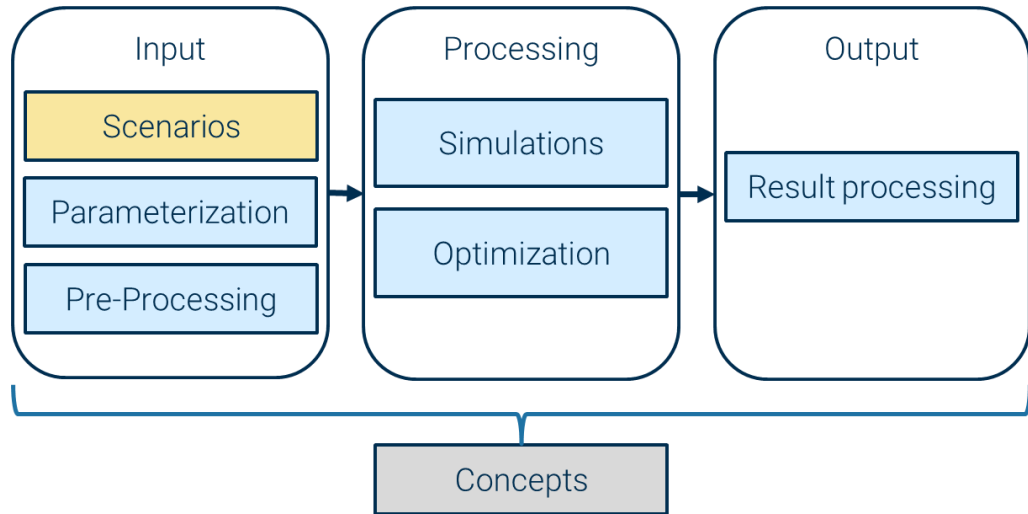|					
Health & Environment	Median health damage benefits of a household	Macro-economic costs and benefits	Subsidy distribution, Inequality aversion	Affordability	Energy burden & Energy Poverty
Availability and Access	Share of Outages	Income & Wealth	Income Inequality / Gini Index	Employment	Distribution of employment by skill
Social Acceptance	Acceptance of transmission lines	Ownership	Adoption rate	Due Process/Rights	Intergenerational equity

Modelling Step: Scenarios

Main Indicators

- Affordability
- Macro-economics
- Social Acceptance

Main Methods

- Scenario approach
- Indices
- Grouping

Input	Processing	Output
Scenarios	Simulations	Result processing
Parameterization	Optimization	
Pre-Processing		

Concepts

Example:
Public health benefits of shutting down two coal-fired power plants, with **pre-post analysis** *of avoided morality and morbidity. [Marteniens et al., 2019]*
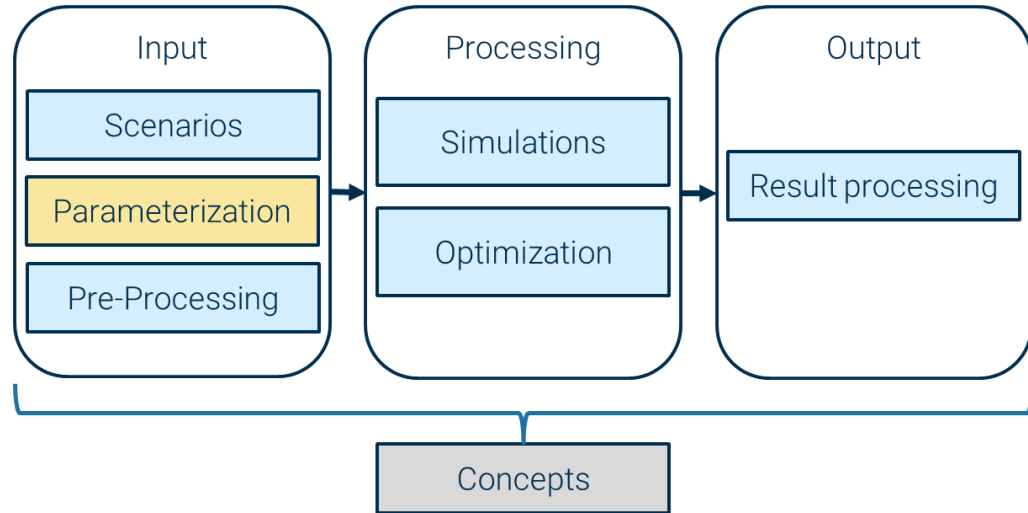
work in progress

Modelling Step: Parameterization

Main Indicators

- Due Process and Human Rights
- Affordability

Main Methods

- Scenario approach
- Concept
- Environmental assessment

Input	Processing	Output
Scenarios	Simulations	Result processing
Parameterization	Optimization	
Pre-Processing		

Concepts

Example:
*Linear programming model estimating potential of proving energy burden and insecurity based on **sensitivity analysis**. [Heleno et al., 2022]*
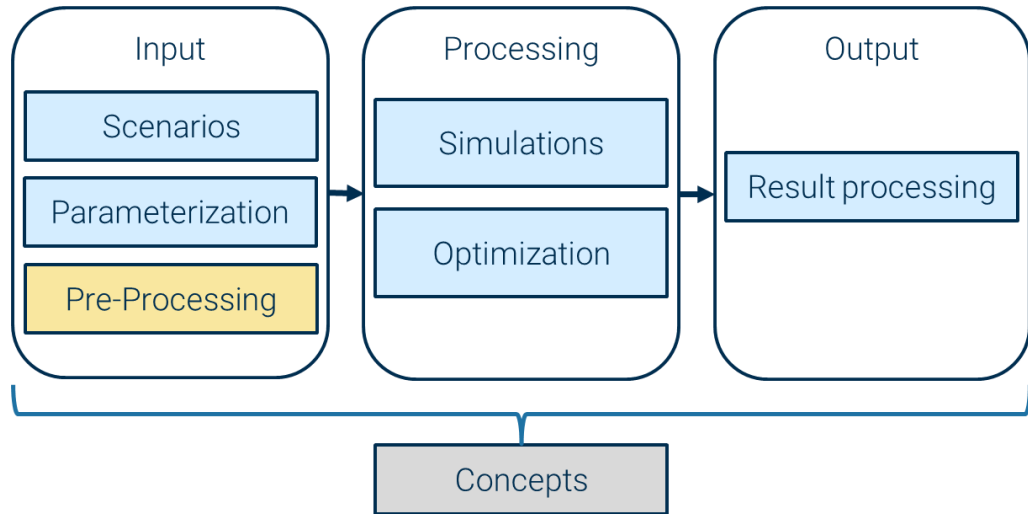
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Modelling Step: Pre-Processing

Main Indicators

- Affordability
- Ownership

Main Methods

- Scenario building
- Thresholds
- Indices

Example:
*Linear programming model estimating potential of proving **energy burden and insecurity pre- and post** policy **intervention**. [Heleno et al., 2022]*
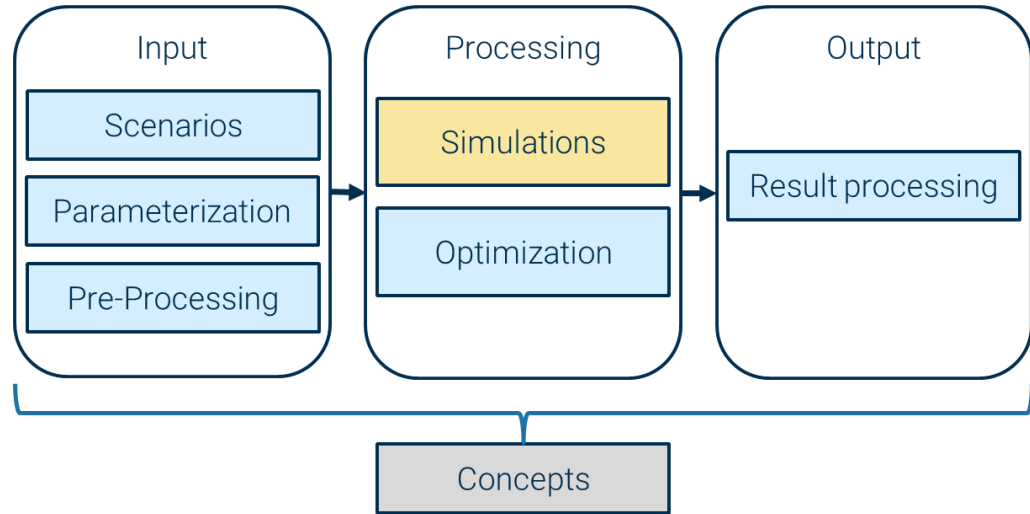
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Modelling Step: Simulation

Main Indicators

- Affordability
- Due process
- Income and Wealth

Main Methods

- Stochastic
- Correlation
- Scenario building

Example:
*Use of **Monte-Carlo simulations** to investigate energy vulnerability in Greece. [Papada et al., 2019]*
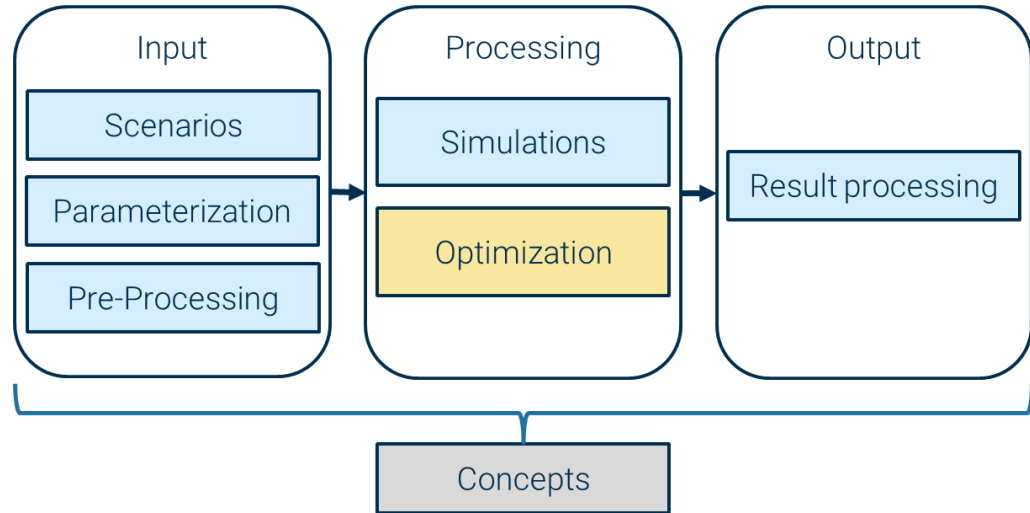
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Modelling Step: Optimization

Main Indicators

- Health & Environment
- Affordability
- Macro-Economics

Main Methods

- Penalty factors
- Constraints
- Objective function

Example:
*Retirement plan of coal plants considering overall benefit, with **Social Costs of Carbon** and **Value of Statistical Life** in an objective. [Sergi, 2020]*
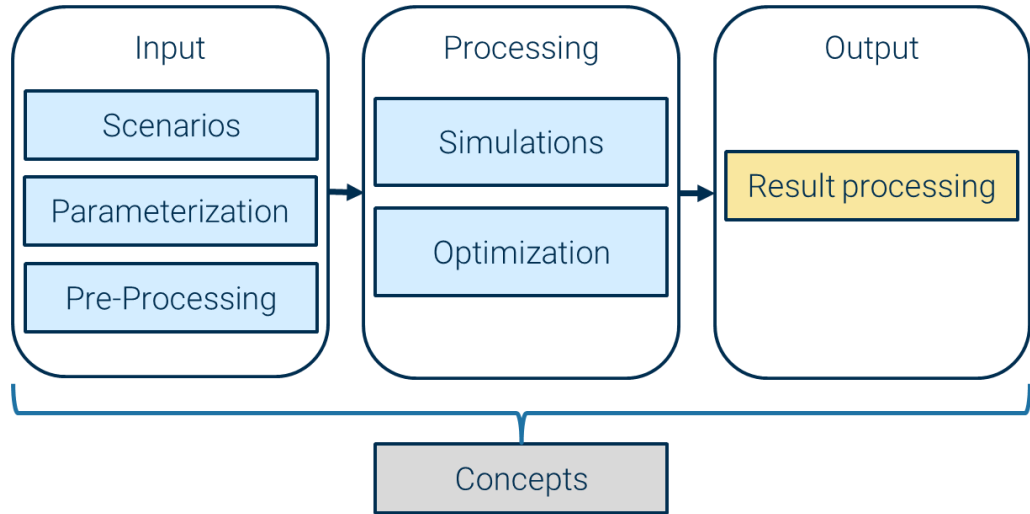
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Modelling Step: Result processing

Main Indicators

- Macro-economics
- Affordability
- Income and Wealth

Main Methods

- Inequality factor
- Scenario building
- Quantiles

Example:
*Equitability of renewable capacities deployment measured via **Gini index**. [Sasse et al., 2019]*

work in progressg

WebApp: Justice in Modelling Database Explorer

Find papers & indicators relevant
for your research:

- Spatial & temporal scale
- Model type
- Research area
- Justice implication type
- Model integration

WebApp: Justice in Modelling Database Explorer

Literature Review Database

Justice in Modelling Database Explorer

Including justice in energy models

...is an ambitious goal, that can not be tackled without the appropriate methods.

To provide Energy Modellers with necessary **Justice Indicators and Methods** we created a literature database which connects them with the respective

How can this database help?

The database provides modellers with a large set of reference literature on the state-of-the art assessment of justice issues in the context of energy research.

PAPERS In total, about 90 papers where which can be explored based

Work in progress!

Thank you for your participation ☺

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