Concept of simulation framework for modelling transformation pathways based on investment decisions

Charlotte Senkpiel
Fraunhofer-Institut für Solare Energiesysteme ISE
Open Energy Modelling Workshop
Frankfurt, 20.04.2017
www.ise.fraunhofer.de
Transformation of the energy system

Defines an optimal technology mix in terms of (costs, sustainability, CO₂-emissions etc.)

Target Sustainable Energy system

Question 1: Which steps have to be taken?

Question 2: How can the target system be achieved?

Simulation of the energy system

Optimization of the energy system

Shows the development of the energy system under framework conditions
Development of Photovoltaics

Photovoltaik

Cumulative Installed Power [GW]

- Installierte Leistung
- Ausbaukorridor
- Min
- Max

600 MW/a

© Fraunhofer ISE
Development of Electric Vehicles

Jährlicher Energieverbrauch [TWh]

Elektrofahrzeuge

Stromverbrauch durch Elektrofahrzeuge Min Max

- Min
- Max

Stromverbrauch durch Elektrofahrzeuge

Fraunhofer ISE
E2S

E2S – Main Characteristics

- Bottom-Up-approach
- Expansion is represented by actor specific investment decisions
- Regional resolution is NUTS 3 level
- Modeling of the overlaying grid and the load flows
- Extendable tool family
E2S - Model
Simulation Framework

Framework Conditions
- Political
  - Incentives
  - Regulations
  - Taxes
- Economic
  - Fuel price development
  - Cost development
- Technical
  - Technology development
  - New Technologies

STAKEHOLDER
- Private
- Utility
- Banks & Funds
- Commercial
- Farmers
- Project Developer

Each Technology has its specific investor constellation

TECHNOLOGIES
- Renewables
  - PV, Wind, Biogas
- Conventional Power Plants
  - Lignite, Hard Coal
  - CCGT, OCGT
- Storage
  - Pump Storage
  - Compressed Air
  - High Voltage
- Grid
  - Residential
- Buildings

REGIONS
- NUTS 3
  - PV
  - Biogas
- NUTS 2
  - Wind
  - Conventional power
  - Storage
  - Grid
- NUTS 1
  - Buildings

TIMEFRAME
- 2012
- 2013
- 2014
- ...
- 2050

Outcome
- Explorative Energy System Development
  - Regional distribution of renewables and power plants
  - What is the impact of a changed framework?
  - Who invests in which technology?
The sozio E2S Model Structure aims to:

- Represent investment decisions
- Clusters of technologies (e.g. niche, regime) are build
- Investment decision will be described based on the level of marked diffusion
- The main factors of a investment decision will be identified and if possible clustered
- Scenarios of changing conditions will be implemented (e.g. stable political situation/ unstable; good level of information/ poor level)
- Be expandable, adaptable, flexible within the structure
Thank you for your kind attention

Fraunhofer-Institut für Solare Energiesysteme ISE

Charlotte Senkpiel

charlotte.senkpiel@ise.fraunhofer.de