Institute of Technical Thermodynamics

Perspectives of electricity storages with respect to high shares of renewable energies in Germany

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Research questions and key issues

(1) Future electricity storage demand for load balancing under different assumptions and constraints (scenarios).
(2) Impacts on the storage portfolio of electricity grid expansion in Germany, European overlay grid, energy demand trends, supply capacities (conventional/renewable, flexible), as well as the spatial distribution of the generation and load units.
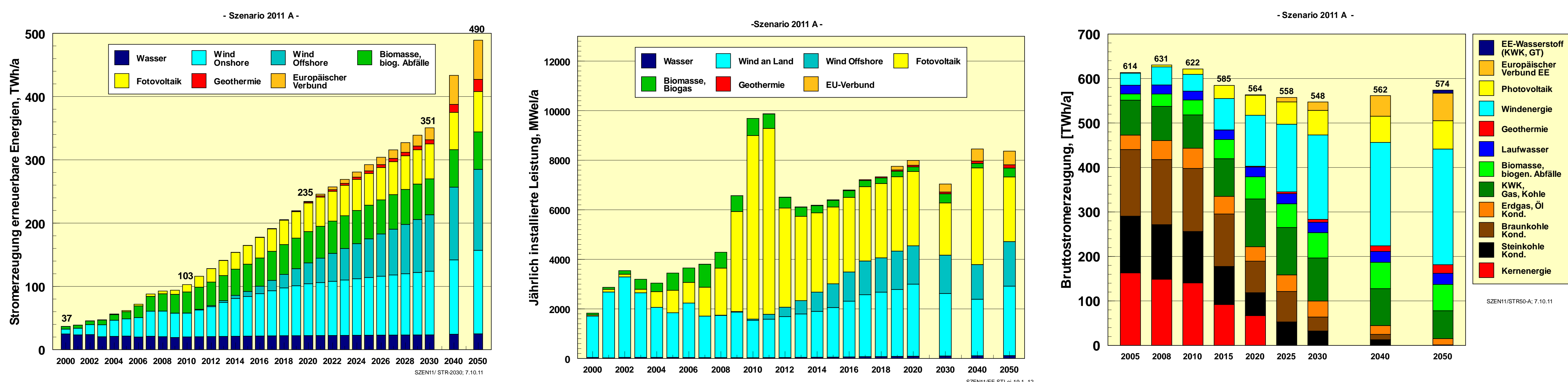

Figure 1: Renewable electricity generation, installed renewable capacity per year, total installed power capacities in Germany [1]

(3) Under which boundary conditions do electricity storage technologies become economic feasible in comparison to other balancing options such as load- and generation management, grid expansion or new mobility concepts (e.g. vehicle to grid)?
(4) Influence of part load, ramping behaviour and costs of conventional power plants on the energy balancing demand.
(5) Implementation of further storage options into the model environment such as different hydrogen options/types of electrolysers, battery types or power to gas technologies.
(6) Calculation and analysis of an optimal capacity of short- and long term storages: high cycle efficiency and low energy capacity vs. low cycle efficiency and high energy capacity.
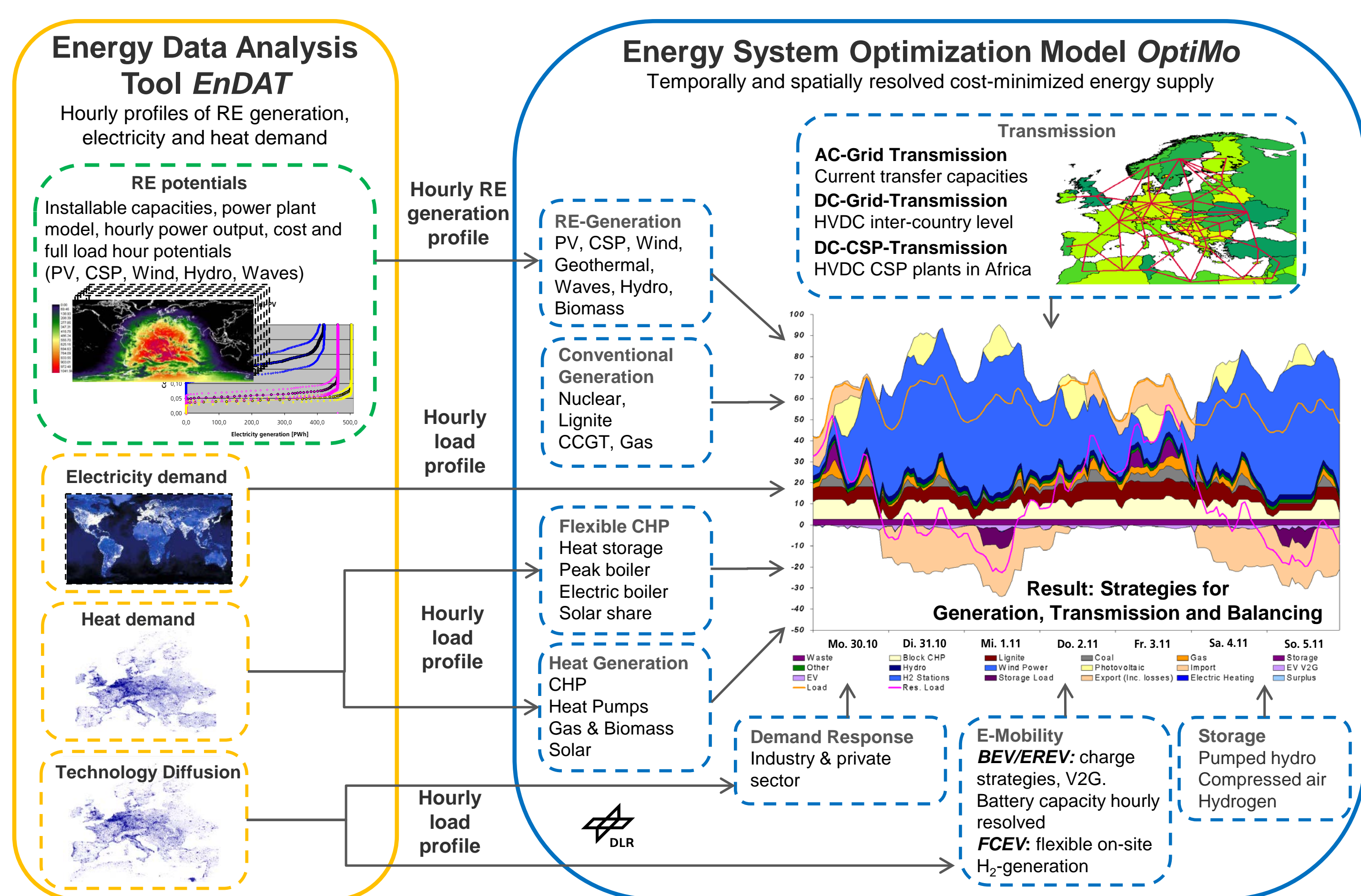
Methodology

Figure 2: Structure of the REMix model

(1) The state of knowledge and existing research- examples:
  a. The existing conventional power plant portfolio is capable of balancing electricity demand and supply up to a share of 40% renewable electricity generation [2].
  b. Economically driven electricity storage expansion until 2020 rather unlikely [3].
(2) Techno-economical characterisation of electricity storages regarding different applications.
(3) Modeling objectives: least cost mix of generation, storage, transmission capacities and their operation.
(4) Modeling approach: GIS supported and GAMS based linear optimisation in the REMix model (**R**enewable **E**nergy **Mix** for Sustainable Electricity Supply) [4].

References: [1] BMU (2012): Langfristszenarien und Strategien für den Ausbau der erneuerbaren Energien
[2] VDE (2012): Energiespeicher für die Energiewende: Speicherungsbedarf und Auswirkungen auf das Übertragungsnetz für Szenarien bis 2050
[3] Dena (2010): dena-Netzstudie II. Integration erneuerbarer Energien in die deutsche Stromversorgung im Zeitraum 2015 - 2020
[4] Scholz (2012): Renewable energy based electricity supply at low costs - Development of the REMix model and application for Europe

Knowledge for Tomorrow

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energy
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