SEDOS: a sector-integrated, open source RES for Germany

Concepts for model and data structure

What SEDOS is about

The SEDOS project aims to improve sector integration in energy system models (ESMs). Thus, we develop a sector-integrated ESM for Germany by using the frameworks FINE, oemof and TIMES and apply it to analyze selected scenarios. We develop and implement a uniform reference model structure with clearly defined interfaces for the sectors electricity, heat, transport, industry and X2X to significantly improve the robustness and quality of quantitative energy system analysis. The development of an open reference data set and its publication on the Open Energy Platform (OEP) and are central components of the project. As we put a special focus on the utilization of input and result data, an effective data management is developed, which together with an expandable GUI plays a central role in the project. This publication highlights the current work status of the overall model structure of the reference energy system and the data management including data adapter and ontology approaches.

Project duration: 01/2022 – 12/2024

Open Source | **Open Data** | **Ontology** | **Reference Energy System** | **Scenario Study** | **GUI**

Reference Energy System (RES)

- The RES is meant to describe and visualize connections (input-output relations) of system components (energy carriers, processes & demands)
- The underlying reference data set includes all parameters of these components plus their ontological annotation
- The X2X sector is illustrated as module-interface emphasizing the high degree of linkage and interdependency between sectors within the RES
- Exogenous demands are defined as close to useful energy requirements as possible to enable more cross-sectoral & model-endogenous decisions

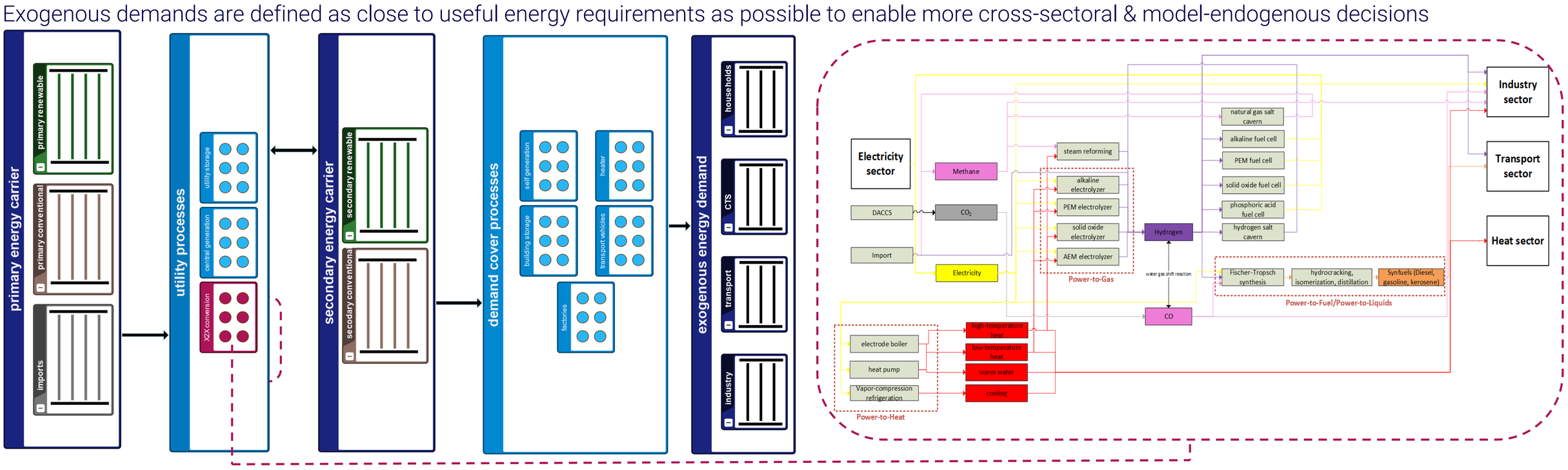


Fig 1: Schematic representation of the reference energy system with focus on the X2X sector

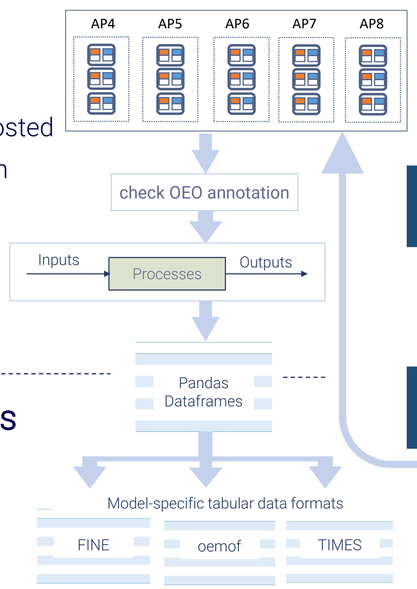
Data Adapters

The data adapters are intended to automate model-specific data pre/post-processing as far as possible. The data adapters are divided into four sub packages:

one **general data adapter**, that

1. pulls data collection from Databus hosted
2. checks correct ontological annotation
3. partially maps data to modelled RES structure
4. passes data as Pandas Dataframes

three **model-specific data adapters**
maps data to model-specific data format
for FINE, oemof, TIMES



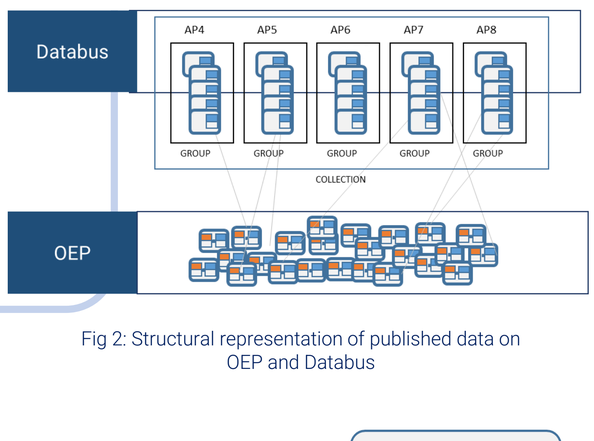


Fig 2: Structural representation of published data on OEP and Databus

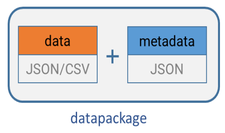


Fig 3: Datapackage overview

Data Management

The data management aims to be comply with FAIR principles for scientific data management. We aim to establish a streamlined data management process with as much automation and transparency as practical (SEDOS docs).

Metadata - OEMetadata v.1.5.1

- realizes **tabular data package** specifications full licensing capabilities

Open License

- Data will be published under an open licence; e.g. CC0-1.0 , PDDL-1.0, dl-de/zero-2-0 , CC-BY-4.0

Datamodel – OEDatamodel-parameter

- ready for exact annotation of tables, parameters and values
- bandwidths, versioning, documentation

id	region	year	technical_lifetime_years	nominal_investment	bandwidth_type	version	method	source	comment
1	Europe	2015	[2.5]	[2.86]	{'technical_lifetime_years':'point','nominal_investment':'point'}	v1	{'technical_lifetime_years':'average'}	{'technical_lifetime_years':[DEA2020, BMWI2022], 'nominal_investment': 'IEA2012'}	
2	Europe	2030	[26,29,31]	[1.92,2.23]	{'technical_lifetime_years':'discrete','nominal_investment':'discrete'}	v1		{'technical_lifetime_years':'BMWI2022','nominal_investment':IEA2012'}	
3	Europe	2040	[33]	[1.93, 2.0]	{'technical_lifetime_years':'point','nominal_investment':'continuous'}	v1		{'technical_lifetime_years':'BMWI2022','nominal_investment':IEA2012'}	

Fig 4: Exemplary representation of scalar data in the OEDatamodel-parameter format

Ontology Development and Annotation

- Formal collection of precisely defined concepts and their relations
- Main advantage: Annotation supports in understanding and reusing the data as well as in improving the comparability of the results
- The development of the OEO and an Open Annotation Tool is brought forward within the SEDOS project to be able to annotate different sectors

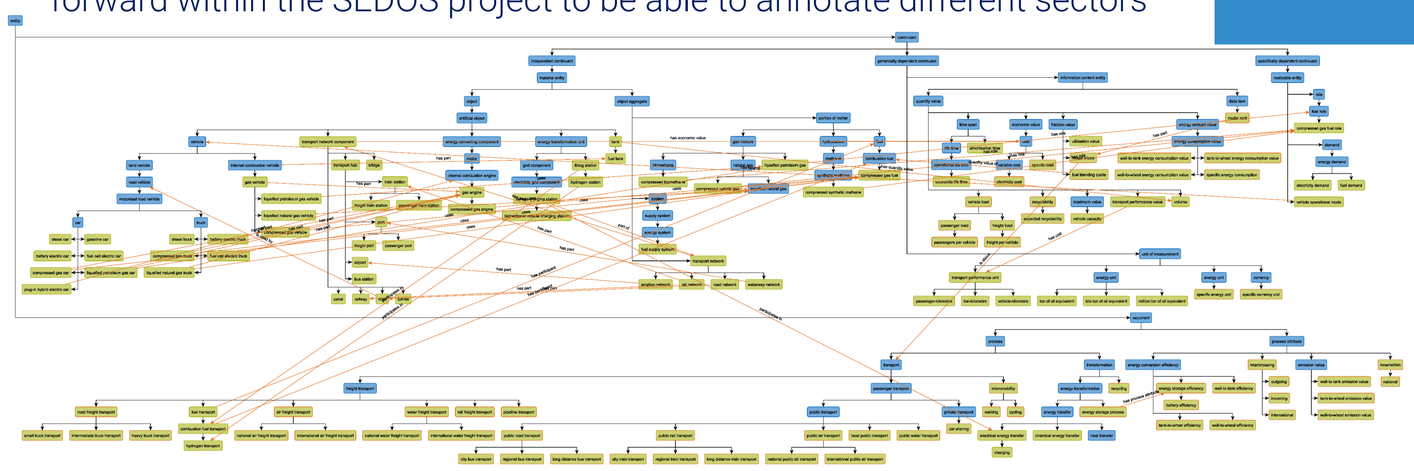


Fig 5: Overview of the additions (green) to previous OEO transport concepts (source: [1])

Contact & Copyright

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Sources:
[1]: Mittermeier2023, Ontology Enhancement of the Transport Sector in the Field of Energy System Modeling

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