

Oemof  
Workshop Week

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# Component Models

**oemof v0.3.1**

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*Session 3*

*RLI, 17.09.2019*



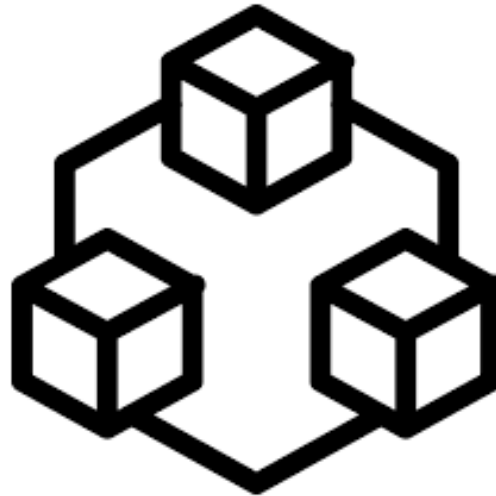
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# Agenda

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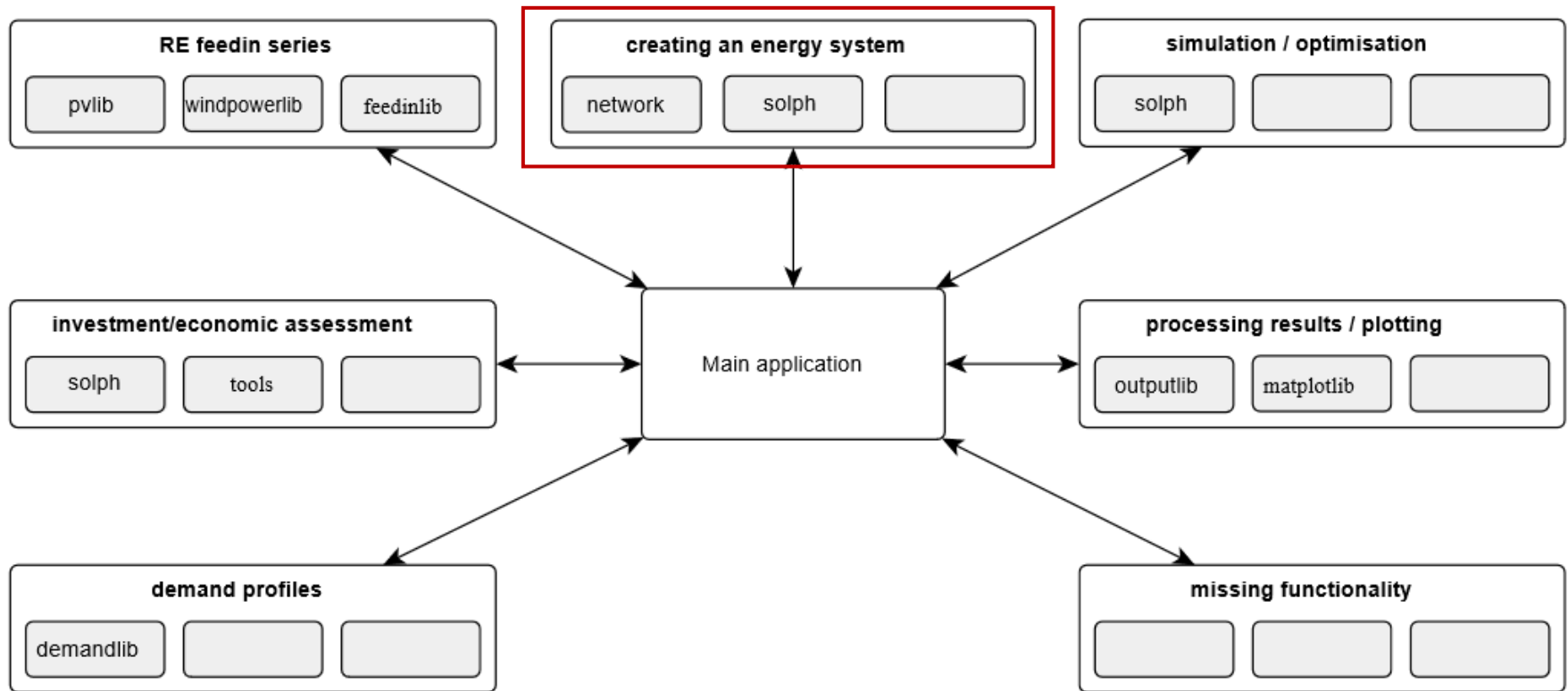


We define all technologies (e.g. power plants), energy carriers (e.g. diesel) and demands (e.g. electricity demand) of the physical energy system as components. A component model describes an abstract representation of a component in the physical system.



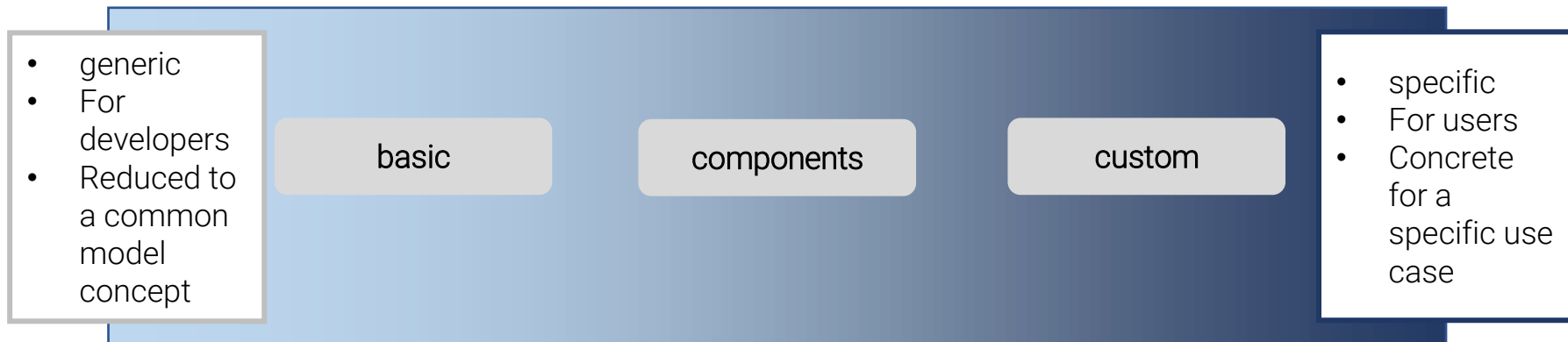
Modularity and generalization have been key principles behind oemof

# Intro: oemof Package Structure



## Relevant modules that contain components:

- ▶ network (basic components)
- ▶ components
- ▶ custom



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# Reminder: oemof Modelling Principles

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- ▶ (Mixed Integer) Linear Programming + Graph Theory
- ▶ Models composed of Nodes and Edges
  - ▶ Node / Bus or Component (oemof)
  - ▶ Edge / Flow (oemof)
- ▶ 2 Components can't be directly connected, Bus required in between
- ▶ Bus balance (example)

# Overview Basic Components

Sink

Module: `oemof.solph.network`

API-Documentation:

<https://oemof.readthedocs.io/en/stable/api/oemof.solph.html#module-oemof.solph.network>

Source

**Note!** See example and further information here:

Transformer

[https://github.com/smartie2076/oemof\\_workshop/tree/master/Day\\_2\\_Components\\_Oemof/03\\_oemof\\_basic\\_component.ipynb](https://github.com/smartie2076/oemof_workshop/tree/master/Day_2_Components_Oemof/03_oemof_basic_component.ipynb)



# Overview Components

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GenericStorage

Module: `oemof.solph.components`

GenericCHP

API-Documentation:

<https://oemof.readthedocs.io/en/stable/api/oemof.solph.html#module-oemof.solph.components>

ExtractionTurbineCHP

OffSetTransformer

# Components.GenericStorage

Description	Model class to model basic characteristics of (energy) storages
Input(s)/Output(s)	n/m
Bases	Transformer
Balance	Linear
Parameterization (not complete)	nominal_storage_capacity, initial_storage_level, balanced, loss_rate, inflow_conversion_factor, outflow_conversion_factor, min_storage_level, max_storage_level
Examples	Battery Energy System, Pumped Hydro Storage, etc

# Components.GenericCHP

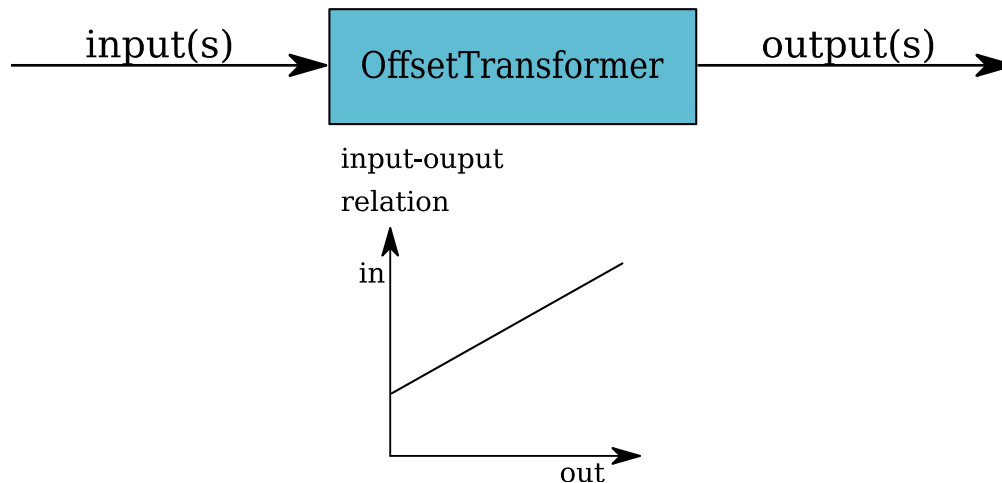
Description	Component GenericCHP to model combined heat and power plants.
Input(s)/Output(s)	n/m
Bases	Transformer
Balance	Mixed Integer Linear
Parameterization (not complete)	fuel_input, électrical_output, heat_output, beta (power loss index) back_pressure
Examples	Combined Cycle, Back pressure turbines

# Components.ExtractionTurbineCHP

Description	Model combined heat and power plant with extraction turbine
Input(s)/Output(s)	n/m
Bases	Transformer
Balance	Linear
Parameterization (not complete)	conversion_factor, conversion_factor_full_condensation (no tapped flow extraction)
Examples	Simplified CHP model, Extraction Turbine

# Components.OffsetTransformer

Description	Model Transformers with an offset
Input(s)/Output(s)	n/m
Bases	Transformer
Balance	Mixed Integer Linear



# Components.OffsetTransformer

Description	Model Transformers with an offset
Input(s)/Output(s)	n/m
Bases	Transformer
Balance	Mixed Integer Linear
Parameterization (not complete)	coefficients (y-intersection and slope)
Examples	Diesel Generator, CAES

Link

Module: oemof.solph.custom

ElectricalLine

API-Documentation:

<https://oemof.readthedocs.io/en/stable/api/oemof.solph.html#module-oemof.solph.customs>

ElectricalBus

GenericCAES

Description	To directly link two nodes Buses
Input(s)/Output(s)	n/m
Bases	Pyomo
Balance	Linear
Parameterization (not complete)	conversion_factors
Examples	Transshipment Link

## Note!

- Experimental
- Needs improvement



Description	To do linear optimal power flow calculations based on angle formulation.
Input(s)/Output(s)	either in or out
Bases	Flow
Balance	Mixed Integer Linear
Parameterization (not complete)	reactance
Examples	Grid model

## Note!

- connected buses need to be of the type ElectricalBus.
- It does not work together with flows that have set the attr.`nonconvex`
- Input and output of this component are set equal, therefore just use either only the input or the output to parameterize.
- Default attribute min of in/outflows is overwritten by -1 if not set differently by the user

Description	Bus object to be used with Electrical Line for LOPF
Input(s)/Output(s)	n/m
Bases	Bus
Balance	Mixed Integer Linear
Parameterization (not complete)	slack max_voltage_angle min_voltage_angle
Examples	Grid model

Description	To model a arbitrary compressed air energy storage
Input(s)/Output(s)	n/m
Bases	Transformer
Balance	Mixed Integer Linear
Parameterization (not complete)	electrical_input, fuel input, electrical_output,
Examples	-

## Note!

- Set of equations can be found in Kaldemeyer, C.; Boysen, C.; Tuschy, I. A Generic Formulation of Compressed Air Energy Storage as Mixed Integer Linear Program – Unit Commitment of Specific Technical Concepts in Arbitrary Market Environments Materials Today: Proceedings 00 (2018)
- experimental

## oemof-tabular.facades

provide energy specific access; provide interface to tabular data sources that models can be created easily. Map technology specific parameterization to energy system model principles in oemof.solph using oemof.tabular.facades

Link: <https://github.com/oemof/oemof-tabular/>

## Project: oemof\_heat

Heat components for oemof e.g. heat pump, solar thermal collector, hot water storage, concentrating solar

Link: [https://reiner-lemoine-institut.de/en/oemof\\_heat/](https://reiner-lemoine-institut.de/en/oemof_heat/)  
<https://github.com/oemof-heat>

## Project: oemof\_mobility

Non-linear Transformer, Timestep approach rather than Perfect Foresight.

Questions?  
Comments?

# THANK YOU FOR YOUR ATTENTION !

## How to follow Oemof's activities?

Website: <https://oemof.org/>

Github: <https://github.com/oemof>

Or join our mailing list!



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