Introducing POMMES

A cosmos for modelling
the German power sector
using oemof.solph
–
pommesdata | *pommesdispatch* | *pommesinvest*

pommesdata

A full-featured transparent data preparation routine from raw data to POMMES model inputs

Overview

https://github.com/pommes-public/pommesdata

- Aim
  - Prepare data for *pommesdispatch* or *pommesinvest*
  - Dispatch: historical 2017-2021; projections until 2030
  - Investment: 2020-2045 (development)
- Main data sources
  - OPSD, BNetzA, FRESNA, ENTSO-E for **power plants**
  - BNetzA: tenders; ÜNB: Stamm- & Bewegungsdaten for **RES**
  - DESTATIS, BMWK, ISE, IEA, PIK et al. for **costs**
- Main assumptions / estimates
  - Efficiencies (DIW), minimum loads (demand regio + historical)
  - Future power plant development (TYNDP, BDEW, ISE)

Strengths / Weak Spots

- Strengths
  - Full **transparency** from raw data to model inputs
  - Near-term future **power plant development**
  - High detail for **RES** (& demand response; other scripts)
- Weak spots
  - Maintainanace / maintanability
  - Time series data so far based only on 2017

pommesdispatch

A bottom-up fundamental model for the German electricity sector

Overview

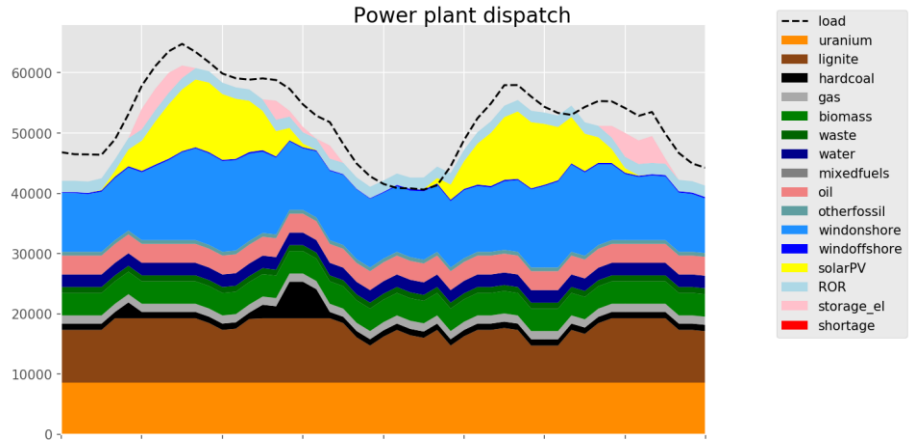
https://github.com/pommes-public/pommesdispatch

https://pommesdispatch.readthedocs.io/en/latest/index.html

Criterion	Manifestation
Spatial coverage	• DE + electrical neighbours (NTC approach) • Spatial resolution: bidding zones
Time	• Typically one year in hourly resolution • Run time on desktop machine ~2 hours
Implementation	• Optimization using oemof.solph • Data management using pandas / .csv

Strengths / Weak Spots

- Strengths
  - detailled RES & power sector modelling
  - well-tested (coverage > 90 %) & well documented
  - pip installable & executable from console
  - easily configurable via .yaml config file
- Weak spots
  - No spatial resolution & missing some European countries
  - No unit commitment



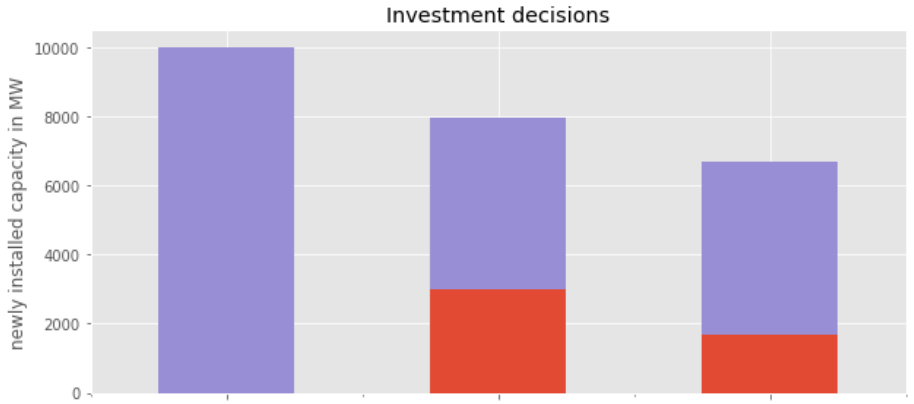
pommesinvest

A bottom-up fundamental investment model for the German electricity sector

Overview

https://github.com/pommes-public/pommesinvest

- In short
  - Determine power sector investments from 2020 to 2045
  - Exogenous RES development (EEG 2023)
  - Determine annual investments in power plants, storages and demand response
  - Building on recent scenario data (Ariadne & Prognos)



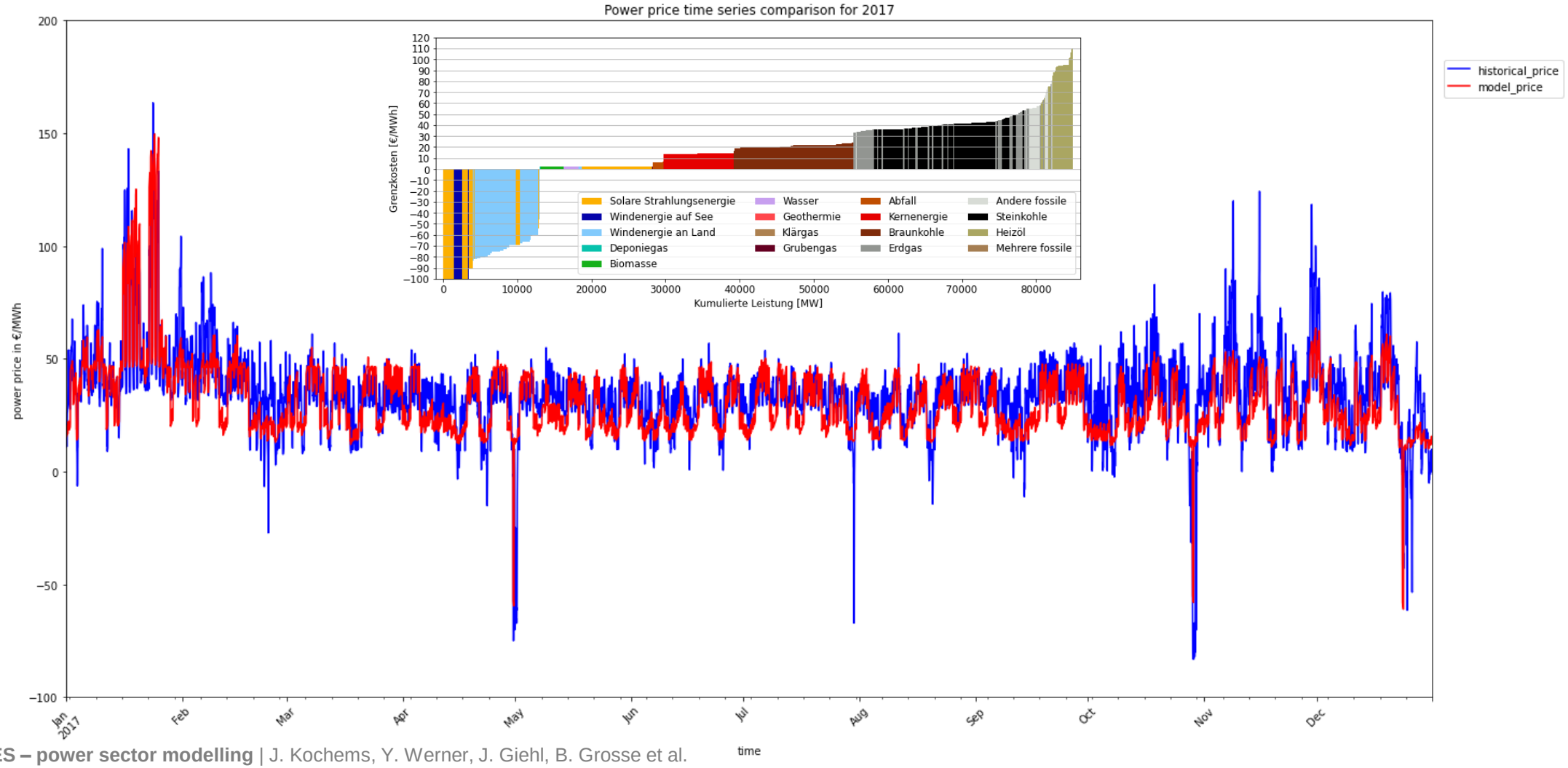
Strengths / Weak Spots

- Strengths
  - Multi-period modelling approach + „classical“ myopic horizon alternative
  - Investments in all relevant power sector flexibility options (power plants, storage, demand response)
  - (will also be) tested, pip installable, documented etc.

- Weak spots
  - Still under development
  - Germany only; No endogenous RES investments

pommesevaluation

An evolving collection of ex post analyses for POMMES



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Introducing POMMES

BACKUP

pommesdispatch – RES in the market premium scheme

Depicting RES opportunity costs to simulate negative prices

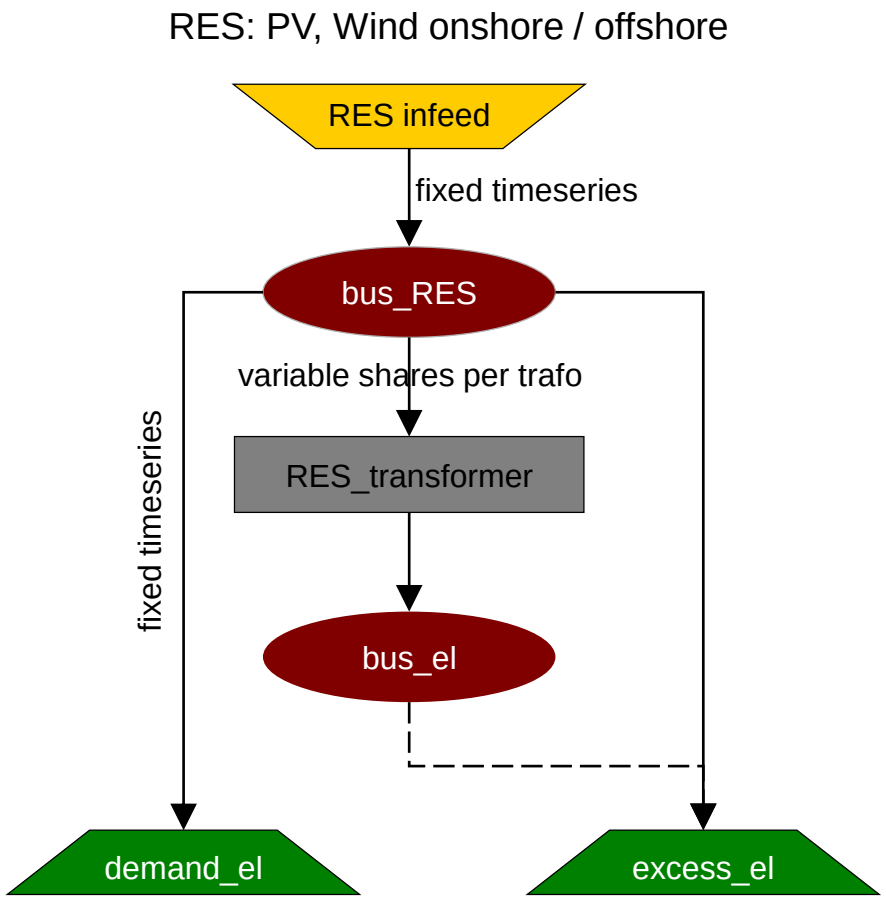
- Background
  - Modelling RES at 0 costs not sufficient
  - Consequence: no negative prices

- Approach
  - Empirical evaluation of RES values applicable using the „EEG-Bewegungsdaten“ from the German TSOs
  - Assumption: RES in the market premium model bid at (opportunity) costs* of

$$-VA + E[MV]$$

  - Clustering RES by AW and type to reduce complexity and model negative price steps
  - One residual cluster for all RES in FIT

VA: *Value to be applied*
$E[MV]$: *Expectation of market value; historical or estimate from previous iterations*



pommesinvest – Modelling capacity expansion

Distinguish exogenous and endogenous development

- Problem
  - Units are clustered
  - → Approach for handling different lifetimes within cluster needed

- Grouping of units
  - **Exogenous** decommissioning or commissioning
  - **Endogenous** investments

- Approach for exogenous developments
  - **Determine** likely **commission / decommission date**
  - Decommissionings: Force min and max output of plant to zero if it will be decommissioned by **decreasing min / max output**
  - Commissionings: **Increase min / max output** of cluster and add exogenous (investment-related) costs term in pos processing

individual unit

label	year	min_load_factor	max_load_factor
old_coal_plant_1	**2020**	0.4	1.0
old_coal_plant_1	**2025**	0.4	1.0
old_coal_plant_1	**2030**	0	0

power plant cluster

label	year	min_load_factor	max_load_factor
old_coal_cluster_1	**2020**	0.1	1.0
old_coal_cluster_1	**2025**	0.1	1.0
old_coal_cluster_1	**2030**	0.1	0.9

plant going offline accounted
for 10% of overall cluster capacity