CI load procurement: PyPSA components

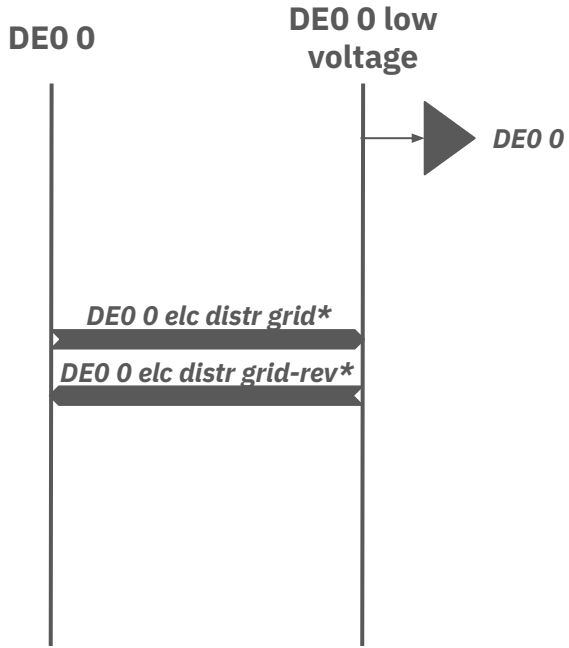
WattTime Impact Metastudy

July 2025

CI loads

Modeling of the CI loads

Traditional PyPSA-Eur loads



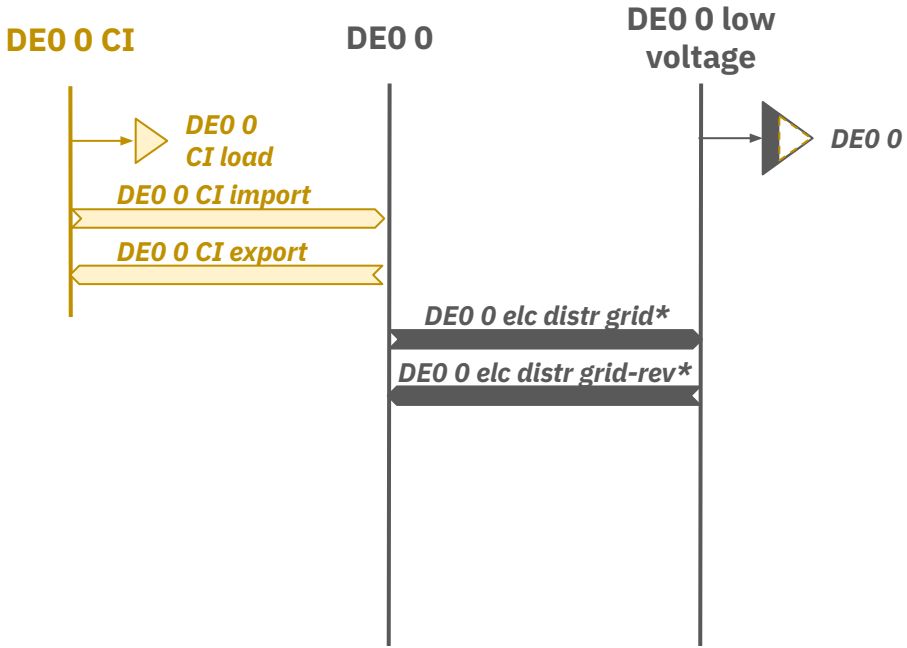
E.g., Germany CI (N.B.: only components that are additional to OS PyPSA-Eur are shown)

Legend: Bus | *load* | *gen* | *link* | *Storage unit*

*** electricity distribution grid (-reversed)**

Modeling of the CI loads

CI loads



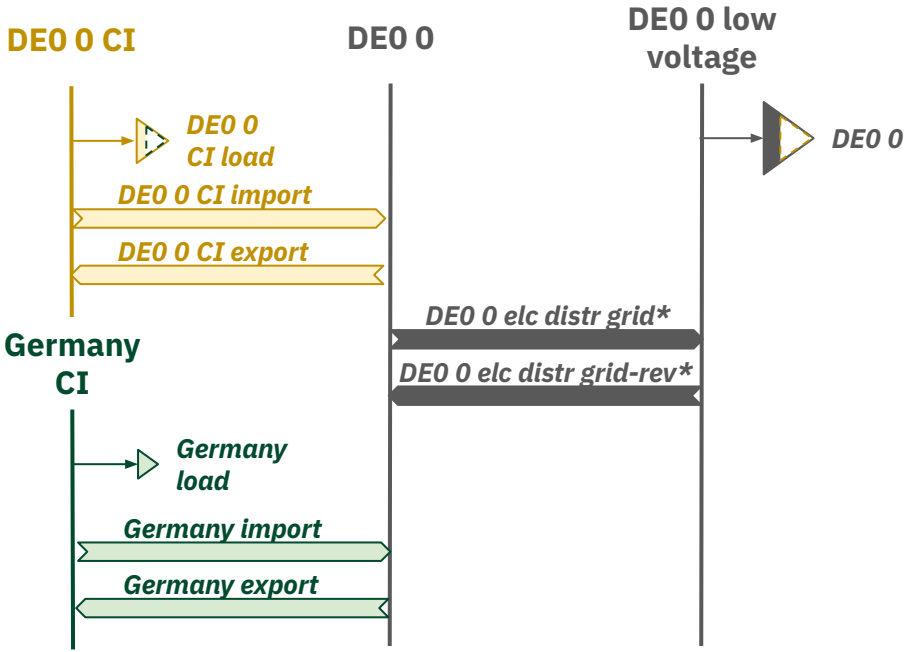
Step 1 - Add CI load

- **CI load = fraction of the CI load** that is moved from low voltage **to** the **high voltage** side
- **Fraction** is retrieved **from dedicated data**
- **Profile** of the CI load is set in the **config**

E.g., Germany CI (N.B.: only components that are additional to OS PyPSA-Eur are shown)

Modeling of the CI loads

CI loads: participating to procurement



Step 1 - Add CI load

- **CI load = fraction of the CI load** that is moved from low voltage **to** the **high voltage** side
- **Fraction** is retrieved **from dedicated data**
- **Profile** of the CI load is set in the **config**

Step 2 - Add participating CI

- **Participating CI = fraction of the CI load** that participates to the procurement
- Participating **countries** are set in the **config**
- **Fraction** is set in the **config**

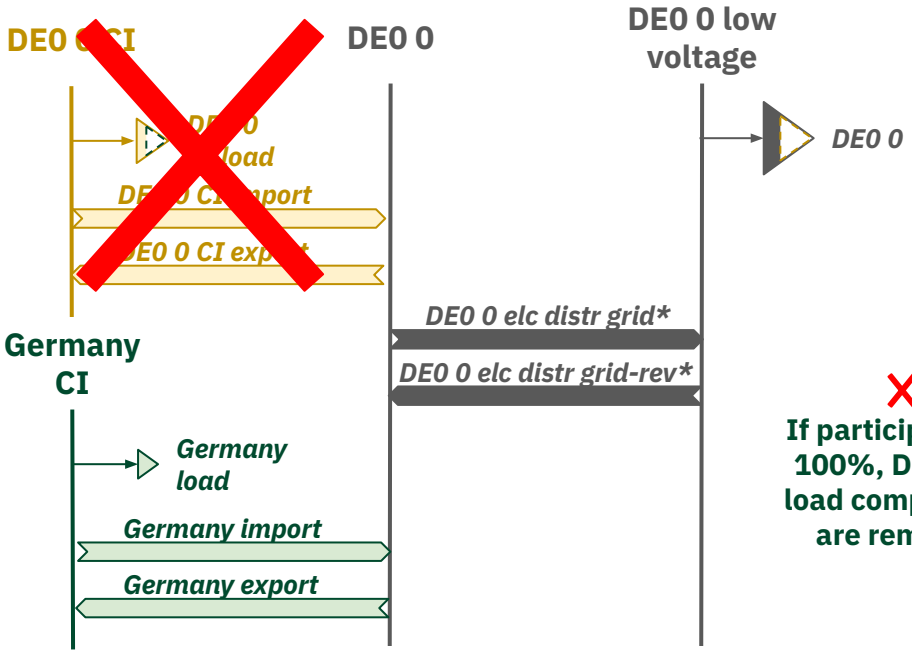
E.g., Germany CI (N.B.: only components that are additional to OS PyPSA-Eur are shown)

Legend: Bus, load, gen, link, Storage unit

* electricity distribution grid (-reversed)

Modeling of the CI loads

CI loads: participating to procurement (100%)



Step 1 - Add CI load

- **CI load = fraction of the CI load** that is moved from low voltage **to** the **high voltage** side
- **Fraction** is retrieved **from dedicated data**
- **Profile** of the CI load is set in the **config**

If participation = 100%, DE0 0 CI load components are removed

Step 2 - Add participating CI

- **Participating CI = fraction of the CI load** that participates to the procurement
- Participating **countries** are set in the **config**
- **Fraction** is set in the **config**

E.g., Germany CI (N.B.: only components that are additional to OS PyPSA-Eur are shown)

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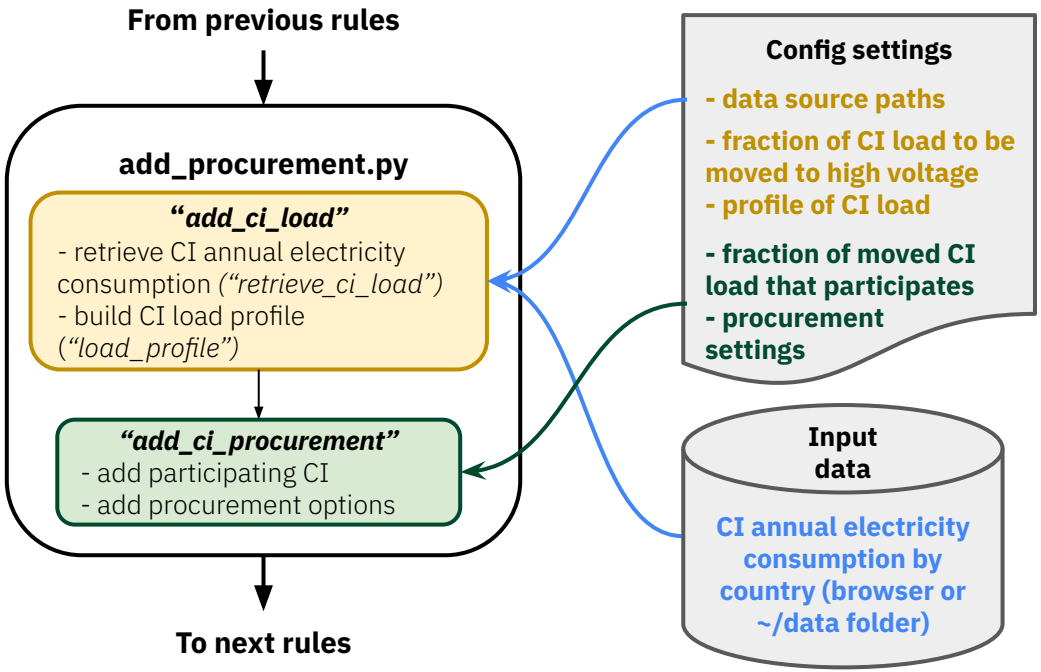
Modeling of the CI loads

PyPSA-Eur workflow



Step 1 - Add CI load

"retrieve_ci_load":
-in: CI annual electricity consumption by country
-out: **share of CI consumption** over the total electricity by country

"load_profile":
-in: share of CI consumption, CI settings
-out: **CI load time series (high voltage) by country**

Step 2 - Add participating CI

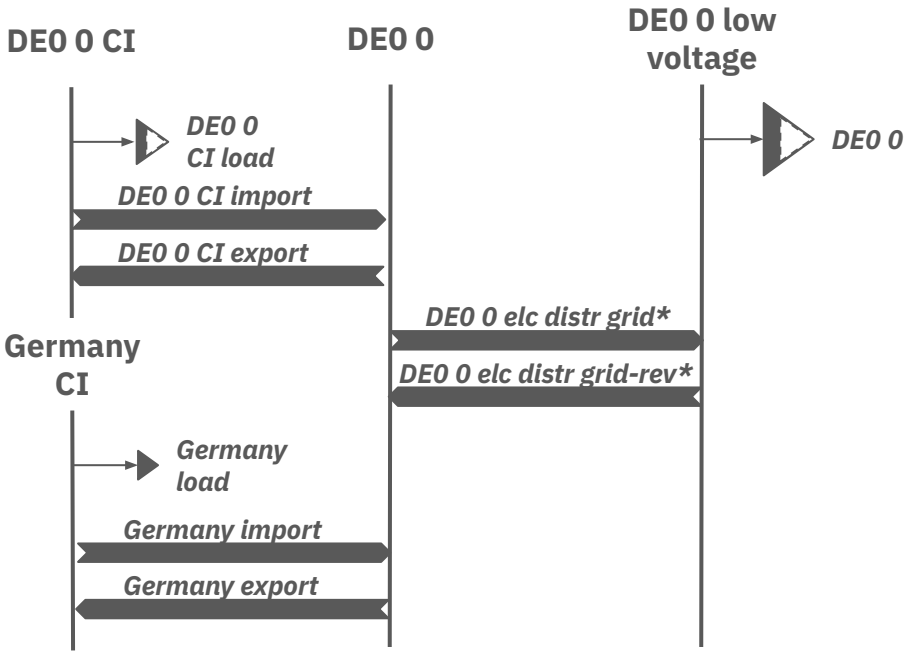
- add participating CI: consider a **fraction of the CI** load from Step 1 in the countries **participating** to the strategies
- add procurement options: model the techs that can supply the participating CI loads

Legend: **Rules** *"functions"* | **Config settings** | **Input data**

CI procurement supply

Modeling of the CI procurement supply

Overview



Step 3 - Add procurement options (part of "*add_ci_procurement*")

- **Procurement options =** supply technologies involving
  - **- generators**
  - **- links**
  - **- storage units**
- Spatial **scope:**
  - **- node:** carbon free energy (CFE) can be only procured at the level of the participating CI load bus
  - **- country:** CFE can be only procured at the level of the participating CI load bus
  - **- all:** CFE can be only procured at the level of the participating CI load bus
  - **- continent:** CFE can be procured anywhere in the system, by aggregating the procured energy as well as the participating CI load.

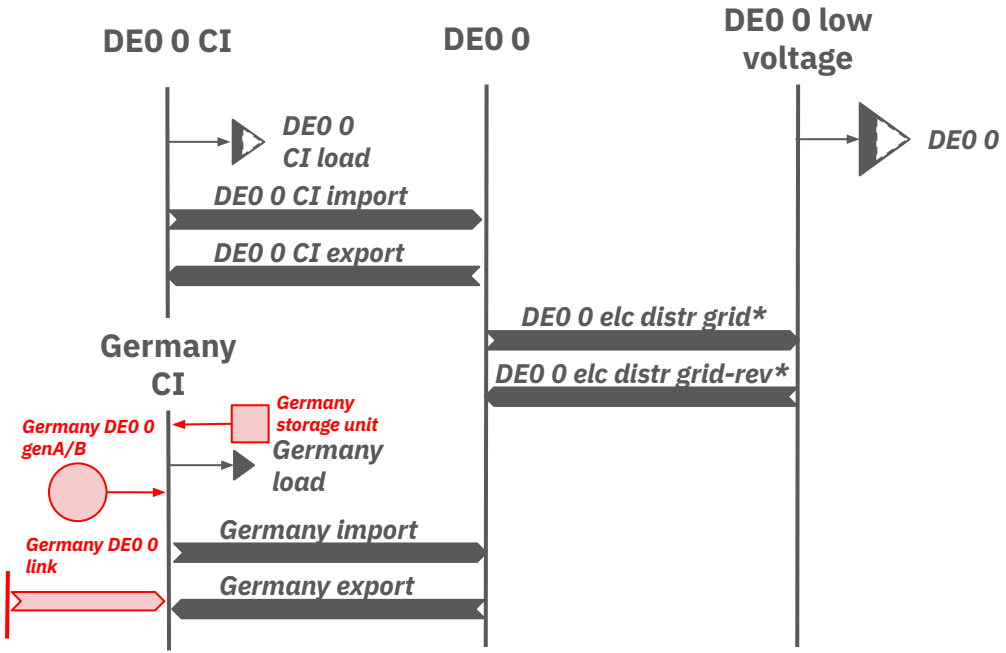
E.g., Germany CI (N.B.: only components that are additional to OS PyPSA-Eur are shown)

Legend: Bus, load, gen, link, Storage unit

* electricity distribution grid (-reversed)

Modeling of the CI procurement supply

Node



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- **Procurement options =** supply technologies involving
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- **Spatial scope:**
  - **node**
  - country
  - all
  - continent
- **Options** are set in the **config.** E.g.,
  - **genA = solar rooftop**
  - **genB = onwind**
  - **link = allam**

E.g., Germany CI (N.B.: only components that are additional to OS PyPSA-Eur are shown)

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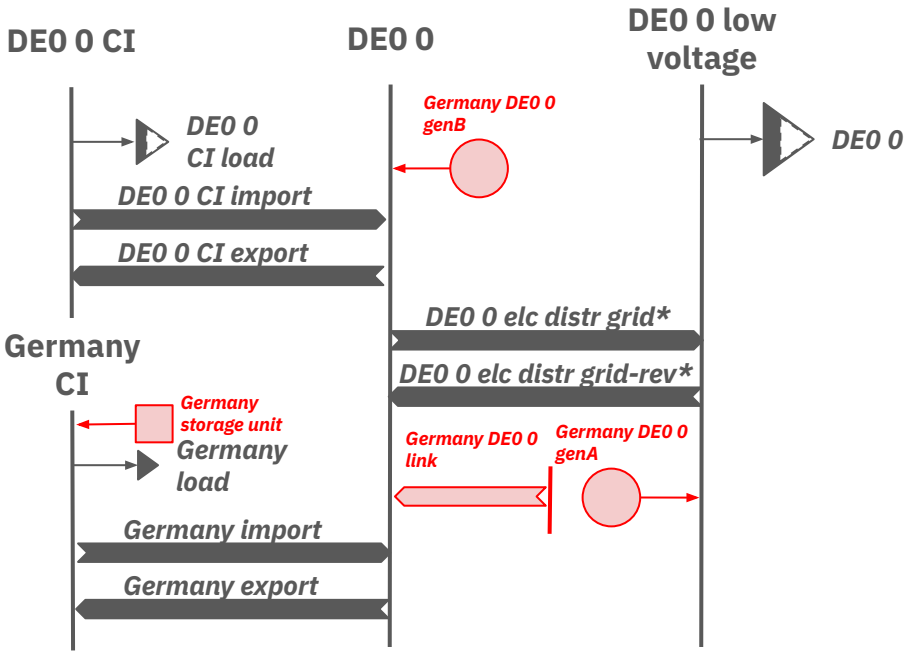
Modeling of the CI procurement supply

Country



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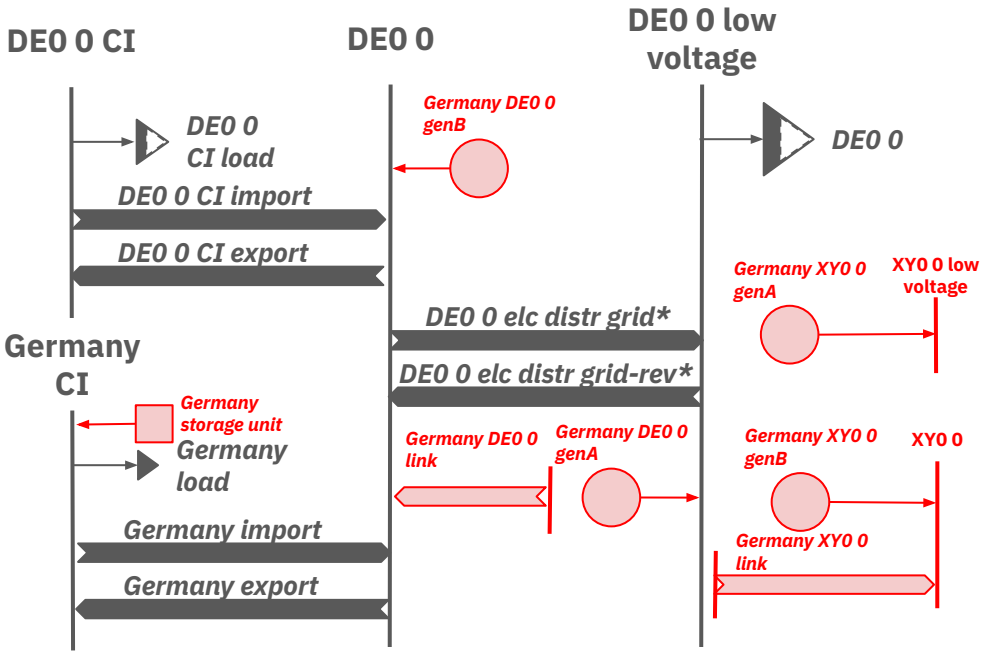
Modeling of the CI procurement supply

All



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  - country
  - **all (N.B., XY = country other than DE)**
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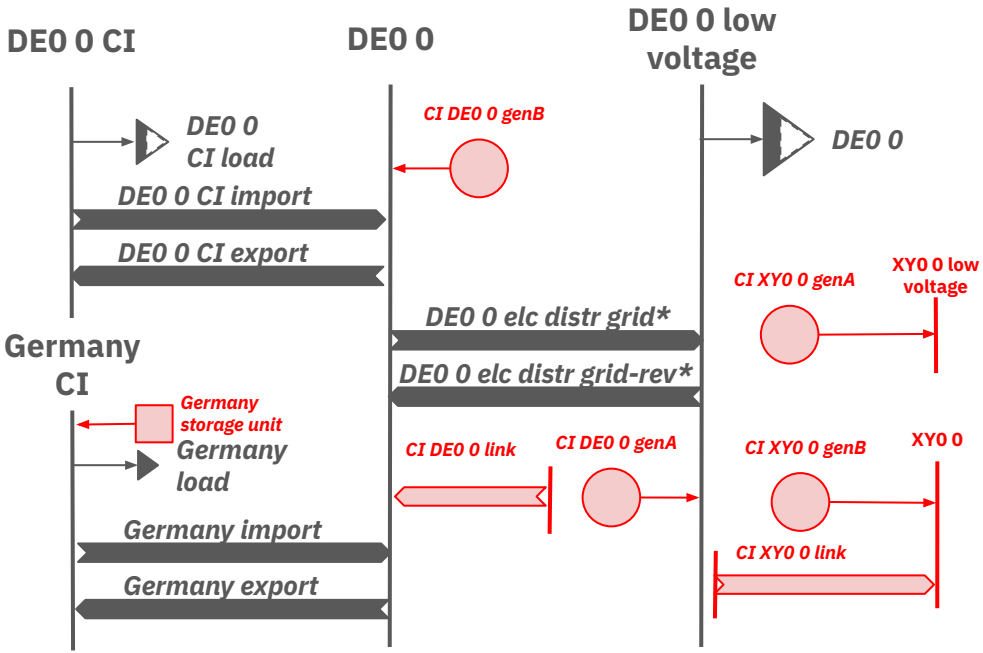
Modeling of the CI procurement supply

Continent



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- **Spatial scope:**
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  - **continent (N.B., XY = country other than DE)**
- **Options** are set in the **config.** E.g.,
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