Output description

General description of the output files

The simulation outputs multiple files, that are described below. Folders are marked in **bold**.

File name and level	Description
`expansion-matrix-abs-values.csv`	Expansion matrix filled with absolute numbers
`expansion-per-cu.csv`	List the expansion that happens per control unit
`no param vari`	Output directory if no param variation is selected
`| metrics-per-cu.csv`	Computed metrics per control unit (like SSR, SCR, NPV, total grid demand, . . .) including the concrete parameters for the simulated PV, battery and the charging station component
`| XXXX-substation-time-series.csv`	Time series of the load, wind/o.s. PV feedin, etc. aggregated on substation level
`| substation-detailed-time-series.csv`	Time series of the additional details on substation level, like residential load (includes feed-in) and demand (only residential grid demand, no surplus feed-in accumulated)
`| parameter-settings.csv`	Parameter settings for the concrete simulation run (very useful for parameter variations)

File name and level	Description
| `sim-added-roof-sections-per-cu.csv`	A list of all sim. added roof sections per control unit
| `substation-detailed-time-series.csv`	Addition information, aggregated on substation level, that is not contained in the first file
| `build_and_run_info.txt`	Information on the simulation run and the used program
| `metrics-per-ev.csv`	Computed metrics per EV
optional output:	Output of all power flows inside the control units . . .
case single file:	*See command line parameter `--cu-output` for details*
| `XXXX-CU-time-series.csv`	. . . in one file
case seperated files:	
| **`ts-per-cu`**	
| | `YYYY-AllCUs-ts.csv`	. . . in one file per substation YYYY
`param vari XXXX`	Output directory if a parameter variation is selected
| `build_and_run_info.txt`	Information on the simulation run and the used program
| **`variation index XXXX`**	There is one subfolder for every variation combination, the concrete parameters can be found in `parameter-settings.csv`
| | *rest of the content*	see folder `no param vari`

Detailed description per file

metrics-per-cu.csv

Column name	Description
UnitID	The control unit ID of the current record
SCR	The self-consumption rate over the complete simulated time span
SSR	The self-sufficiency rate over the complete simulated time span

Column name	Description
NPV	The net-present value (including installation costs) over the complete simulated time span [not in weekly output]
ALR	Array-to-load ratio (see Nyholm et al., 2016 in Applied Energy, https://doi.org/10.1016/j.apenergy.2016.08.172) [not in weekly output]
BDR	Battery-to-Demand ratio (see Nyholm et al., 2016) [not in weekly output]
RBC	Relative battery capacity (see Nyholm et al., 2016) [not in weekly output]
Sum of demand [kWh]	The demand sum of electricity demand of the real smart meters and all simulated consumers (heat pump and charging station) in kWh
Sum of MU demand [kWh]	The demand sum of the measurement units, i.e., the real smart meters in kWh
Sum of self-consumed e. [kWh]	The sum of locally produced and self-consumed electricity in kWh
Sum of PV-generated e. [kWh]	The sum of locally produced PV energy in kWh
Sum of grid feed-in [kWh]	The sum of electricity that was fed into the grid in kWh
Sum of grid demand [kWh]	The sum of electricity that was demanded from the grid in kWh
BS EFC	The battery equivalent full cycles (if not battery is simulated, this value defaults to 0.0)
BS n_ts_empty	The number of time steps where the battery was empty (if not battery is simulated, this value defaults to 0.0)
BS n_ts_full	The number of time steps where the battery was full (if not battery is simulated, this value defaults to 0.0)
BS total E withdrawn [kWh]	The sum of electricity that was withdrawn from the battery in kWh (if not battery is simulated, this value defaults to 0.0) - Attention: The battery might not be empty at the end of the simulation procedure
Sum of HP demand [kWh]	The sum of demanded electricity of the heat pump in kWh (if no heat pump is simulated, this value defaults to 0.0)
Sum of CS demand [kWh]	The sum of demanded electricity of the EV charging station in kWh (if no EV charging station is simulated, this value defaults to 0.0)
Peak grid demand [kW]	The peak grid demand in kW over the complete simulated time span

Column name	Description
Emissions cbgd [kg CO2eq]	The CO2e emissions caused by grid demand including upstream emissions (but no installation emissions for PV panels, battery storage or heat pumps)
Avoided emissions [kg CO2eq]	The avioded CO2e emissions caused by local production (and possibly storing) of renewable energy
Sim. PV max P [kWp]	The installed power in kW (resp. kWp) of the simulated PV installation, or 0.0 if none is present
Sim. BS P [kW]	The installed power in kW of the simulated battery storage system, or 0.0 if none is present
Sim. BS E [kWh]	The installed capacity in kWh of the simulated battery storage system, or 0.0 if none is present
n EVs	The number of EVs with their home at this given unit
Sim. CS max P [kW]	The installed power in kW of the simulated EV charging station, or 0.0 if none is present

XXXX-substation-time-series.csv

Column name	Description
Timestep	The time step ID of the current record
Per substation YYYY	
YYYY	Active power in kW at substation YYYY
open_space_pv_feedin	Total feed-in of open-space PV installations in kW
wind_feedin	Total wind feed-in at grid level in kW
OverallBatterySOC	Mean SOC over all simulated battery storage systems on control unit level
total_load	Total active power in kW in the grid

substation-detailed-time-series.csv

The columns of this output follows the following nomenclature:

- **load:** Sum of all current virtual smart meter measurements per time step
- **demand:** Sum of the positive current virtual smart meter measurements per time step

Column name	Description
Timestep	The time step ID of the current record
Per substation YYYY	
YYYY_resident_load_kW	Sum of residential load in kW of all residential buildings connected to substation YYYY
YYYY_resident_demand_kW	Sum of residential demand in kW of all residential buildings connected to substation YYYY
total_residential_load	Total residential load in kW
total_residential_demand	Total residential demand in kW

XXXX-CU-time-series.csv or YYYY-AllCUs-ts.csv

Column name	Description
Timestep	The time step ID of the current record
ControlUnitID	The control unit ID of the current record
Load_vSmartMeter_kW	The power at the virtual smart meter in kW (positive values denote a demand, negative values denote a feed-in)
Load_rSmartMeters_kW	The power summed over all real smart meters in kW (positive values denote a demand, negative values denote a feed-in)
Load_self_produced_kW	The self-produced power that is consumed in the current time step in kW at the given unit - Please note: If excess power was fed into the battery in the previous steps, this will only be taken into account at the moment of discharge

Column name	Description
PVFeedin_simulated_kW	The current PV production in kW (if present, else 0.0)
BS_SOC	The state of charge of the connected battery (if present, else 0.0)
BS_load_kW	The current power of the battery storage in kW (if present, else 0.0; positive values denote battery charging, negative values denote discharging)
HP_load_kW	The current power of the heat pump in kW (if present, else 0.0)
CS_load_kW	The current power of the EV charging station in kW (if present, else 0.0)
CS_n_EVs_conn	The number of home-parking vehicles that are currently connected to the charging station
CS_n_EVs_not_conn	The number of home-parking vehicles that are currently not connected to the charging station

metrics-per-ev.csv

Column name	Description
CarID	The ID of the car as defined in the input data
Driving distance [km]	The total distance the EV is driven in the simulation in km
E used for driving [kWh]	The sum of electric energy required by the car in the simulation in kWh
Home-charged E [kWh]	The sum of electric energy that has been charged at home in kWh. Can be higher than `E used for driving [kWh]`, especially in the case of bidirectional charging
Home-discharged E [kWh]	The sum of electric energy that has been discharged from the EV battery at home in kWh (only important for the case of bidirectional charging)