

DRAFT

Dashboard for Microgrids: Formulas

Student project of TU Berlin ISE and Inno2Grid
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General remarks

All formulas are defined for one fixed timestamp. For most use cases aggregation will be necessary.

Scopes

Scope 1-3 are defined by the Greenhouse Gas Protocol.

Scope 1

Description: Direct emissions from sources that are controlled by the company/ grid (energy production, vehicles ...).

Visualization: Stacked area chart.

Variables:

- LocalEnergySource: Local energy production types. (solar and biogas)
- GeneratedEnergy: Energy produced on-site (Production_of_CHP_kW + Production_of_PV_kW)
- EmissionFactor: Emission factors are values that quantify the amount of carbon emissions produced per electricity unit like kW. (tbd)

Formula:

$$S_1 = \sum_{\text{LocalEnergySource } i} (\text{GeneratedEnergy}_i * \text{EmissionFactor}_i) \quad (1)$$

Scope 2

Description: Indirect emissions resulting from the generation of purchased energy (electricity, heat ...).

Visualization: Stacked area chart.

Variables:

- 50H_EnergySource: All types of energy sources of the electricity mix. (column names of SMARD_50Hz.csv)
- PurchasedElectricity: Amount of electricity that was bought from the grid. (Grid_Reference_SMARD_kW)
- ShareInMix: Share of all power generation types in the electricity mix (calculated with SMARD_50Hz.csv)
- EmissionFactor: Emission factors are values that quantify the amount of carbon emissions produced per electricity unit like kW. (tbd)

Formula:

$$S_2 = \sum_{\text{50H_EnergySource } i} (\text{PurchasedElectricity} * \text{ShareInMix}_i * \text{EmissionFactor}_i) \quad (2)$$

KPI's

KPI 1: Self consumption

Description: KPI that measures the proportion of electricity that is on-side generated and consumed.

Visualization: Donut chart that represents percentages (values: 0-100%).

Variables:

- Consumption: Energy consumed on-site (Total_Load_kW).
- GeneratedEnergy: Energy produced on-site (Production_of_CHP_kW + Production_of_PV_kW)

Formula:

$$K_1 = \min\left(\frac{\text{Consumption}}{\text{GeneratedEnergy}}, 1\right) \quad (3)$$

KPI 2: Autarky

Description: A concept closely related to self-consumption. It measures the percentage to which a grid system is self-sufficient in terms of energy production.

Visualization: Donut chart that represents percentages (values: 0-100%).

Variables: See KPI 1

Formula:

$$K_2 = \min\left(\frac{\text{GeneratedEnergy}}{\text{Consumption}}, 1\right) \quad (4)$$

KPI 3: CO₂ Savings

Description:

Visualization: Donut chart that shows CO₂ in kg (tbd)

Variables:

- 50H_EnergySource: All types of energy sources of the electricity mix. (column names of SMARD_50Hz.csv)
- Consumption: Energy consumed on-site (Total_Load_kW).
- ShareInMix: Share of all power generation types in the electricity mix (calculated with SMARD_50Hz.csv)
- EmissionFactor: Emission factors are values that quantify the amount of carbon emissions produced per electricity unit like kW. (tbd)
- GeneratedEnergy: Energy produced on-site (Production_of_CHP_kW + Production_of_PV_kW)
- S_1, S_2 : see scope 1 and 2

Formula: (tbd)

$$K_3 = \sum_{50H_EnergySource\ i} (\text{Consumption} * \text{ShareInMix}_i * \text{EmissionFactor}_i) - S_1 - S_2 \quad (5)$$

$$K_3 = \sum_{50H_EnergySource\ i} (\text{GeneratedEnergy} * \text{ShareInMix}_i * \text{EmissionFactor}_i) - S_1 \quad (6)$$

KPI 4: Cost Savings

Description: Comparing costs with and without the local energy production.

Visualization: Donut chart that shows Euros (tbd)

Variables:

- Consumption: Energy consumed on-site (Total_Load_kW).
- ElectricityPrice: Market price of electricity (ENTSOE api).
- SolarOpCosts: Operational costs of the solar panels. (tbd)
- BiogasOpCosts: Operational costs of the CHP powered by biogas. (tbd)
- PurchasedElectricity: Amount of electricity that was bought from the grid. (Grid_Reference_SMARD_kW)

Formula:

$$\text{CostsWithoutLocalGrid} = \text{Consumption} * \text{ElectricityPrice} \quad (7)$$

$$\text{CostsWithLocalGrid} = \text{PurchasedElectricity} * \text{ElectricityPrice} + \text{SolarOpCosts} + \text{BiogasOpCosts} \quad (8)$$

$$K_4 = \text{CostsWithoutLocalGrid} - \text{CostsWithLocalGrid} \quad (9)$$