Footprint

Energy & CO_2 Energy calculator – Background & Specs

Description

Footprint Energy & CO_2 calculator is a web-based tool for performing early-stage energy calculations to estimate potential energy, CO_2 emission and financial savings. It can be used for both new and existing buildings and estimates how energy performance is impacted by BACS (Building Automation and Control Systems) in general, and Swegon product, system and optimization functionality in particular.

The tool is based on an independent European ISO standard (ISO 52120-1:2021) that is included in the Energy Performance of Buildings Directive (EPBD). This standard defines how to calculate potential energy savings based on the level of automation and control systems that are used in a building. The standard includes two methods, a factor based, and a detailed method. The Footprint calculation tool uses the factor-based method. The tool is to be used in an early stage, it does not consider the building envelope or geographical location and should not be mistaken for an indoor climate and energy simulation software.

As a user you simply select the building application, type and size in sqm. In addition, you also select the heating and cooling production source and based on this the tool will calculate the energy usage of the building as well as potential savings in kWh. CO_2 (operational carbon footprint) is calculated by multiplying the energy usage and savings with the carbon footprint of the selected energy source (kg CO_2 equivalents) with a given energy mix. Financial savings are calculated by multiplying kWh with the average cost per kWh in your selected country. All data is based on independent sources and databases and editable in the tool.

With this data the calculator will estimate the total energy consumption needed to reach C-class, which is the reference level, and the minimum required energy level for new buildings today (read more about energy efficient buildings and EPBD here: https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings_en).

By selecting from Swegon's product, system and optimization functionalities the tool calculates additional energy savings compared to C-class energy performance of the building.

Savings calculation - new building:
The Footprint calculator assumes that a new building is C-class and displays savings based on C-class energy performance (e.g. 70 kWh/sqm* for Sweden). By using Swegon's product, system and optimization functionalities additional savings can be made, in addition to C-class.

Savings calculation - existing building (renovation):
The Footprint calculator assumes that an existing building has D-class energy performance (e. g. 329 kWh/sqm* for Sweden) and that a renovation, at least, upgrades the building from D to C-class. Savings are thus displayed based on D-class energy performance.

*) Sqm refers to the Swedish term A_{temp} and is the area enclosed by the inside of the building envelope of all storeys including cellars and attics for temperature-controlled spaces are intended to be heated to more than 10°C. The area occupied by interior walls, openings for stairs, shafts, etc., are included. The area for garages, within residential buildings or other building premises other than garages, are not included.

Building Automation and Controls Systems (BACS)

BACS refers to centralized systems that monitor, control, optimize and record the functions of building services systems. Building facilities that are monitored and controlled by a reliable BACS tend to maintain the building environment more efficiently and so reduce the building's environmental impact and energy costs.

The core functions of BACS are as follows:

- Maintain control of the building's environment
- Operate systems according to occupancy and energy demand
- Monitor and correct the performance of systems

The facilities that can be controlled by BACS include:

- Mechanical systems
- Plumbing
- Electrical systems
- Heating, ventilation and air-conditioning (HVAC)
- Lighting
- Security and surveillance
- Alarms
- Lifts

ISO 52120-1:2021

Energy performance of buildings —Contribution of building automation, controls and building management

This standard belongs to the family of standards aimed at international harmonization of the methodology for the assessment of the energy performance of buildings. Throughout, this group of standards is referred to as a set of called "EPB set of standards". The standard specifies:

- A structured list of control, building automation and technical building management functions which contribute to the energy performance of buildings; functions have been categorized and structured according to building disciplines (heating, domestic hot water, cooling, ventilation and air conditioning, lightning, blinds, technical home and building management) and building automation and control (BAC).
- A method to define minimum requirements or any specification regarding the control, building automation and technical building management functions contributing to energy efficiency of a building to be implemented in building of different complexities.
- A factor-based method to get a first estimate of the effect of these functions on typical building types and use profiles.
- Detailed methods to assess the effect of these functions on a given building.

The calculation method includes a list of automation controls for each discipline: heating, domestic hot water, cooling, ventilation and air conditioning, lightning, blinds and technical home and building equipment.

Each function may have different saving potential depending on the application. Included applications are offices, lecture halls, education buildings (incl. schools), hospital, hotel, restaurant, and wholesale/retail.

Buildings are divided into four different energy classes
D – Non energy efficient BAC, in this calculation equivalent to an existing building
C – Standard BAC, in this calculation equivalent to a new building
B – Advanced BAC
A – High energy performance BAC

Energy, cost and environmental impact – Default values and database sources

Footprint energy & CO_2 calculator is using the ISO 52120-1:2021 standard to calculate potential savings for both thermal and electrical energy. To be able to calculate energy savings in kWh, CO_2 emission savings (kg CO_2 equivalents) and financial savings (local currency) it uses default values (shown below) which are editable in the tool.

Energy use new building

Bought energy, excluding business electricity
Legal minimum demand (kWh/sqm/year)

Data source:
Using Swedish demand of max energy use of a new built commercial building according to BBR.

Energy use existing building

Bought energy, excluding business electricity
Suggestion based on EU average (kWh/sqm/year)

Data source:
Using the average of EU countries presented in ENTRANZE database

Energy cost

- Electricity, €/kWh (converted to local currency)
- Gas, €/kWh (converted to local currency)
- Oil, €/kWh (converted to local currency)
- Distr. Heat, €/kWh (converted to local currency)
- Distr. Cooling, €/kWh (converted to local currency)

Data sources:
Electricity, gas, oil: Using the average of EU countries presented in EUROSTAT database

District heating: Using the median value from the average of Sweden, Germany and Denmark respectively

District cooling: Using the average of 5 large Swedish suppliers

Energy efficiency factor

• SCOP (Seasonal Heating coefficient)	3,2	kW/kW
• SEER (Seasonal Cooling coefficient)	4,1	kW/kW
• Electricity	1	kW/kW
• Gas	1	kW/kW
• Oil	1	kW/kW
• District heating	1	kW/kW
• District Cooling	1	kW/kW

Green House Gas equivalent

- Electricity (kg CO2e/kWh)
- Gas (kg CO2e/kWh)
- Oil (kg CO2e/kWh)
- Distr. Heating (kg CO2e/kWh)
- Distr. Cooling (kg CO2e/kWh)

Data sources:

Electricity: Using the database carbonfootprint.com, individual value for each country

Gas & Oil: Using statistics from UK Government GHG Conversion factors for company reporting

District heating: Using value from Swedish VMK (Värmemarknadskommiten)

District cooling: Using values from Göteborg Energi, Stockholm exergi and Norrenergi

Energy division

Heating	50%
Cooling	15%
DHW	5%
Building Electricity	30%
Sum needs to be	100%

Data sources:

Due to a lack of comprehensive and relevant data sources, the energy division is based on estimates for a typical Northern European context. As the energy consumption mix will differ between countries as well as building types (office, hospital etc.), it is recommended that the user of the calculation tool review and edit these values.