

Dataset information for:

BECCS - Bremen Energy Consumption Catalogue for Six Years

Short description

We provide a first of its kind dataset with anonymized annual space heating and domestic hot water energy consumption for close to 90,000 residential and non-residential buildings in the city of Bremen, Germany. The dataset covers the years 2016 to 2021 and contains real measurements of natural gas, district heating, electricity for heating, and electricity for heat pumps. The energy consumption per building was linked to additional parameters like living space, number of floors, construction year and building type. The dataset is available as nested Python Dictionary (json) with English and German keys and values. A detailed description of the methods by which the dataset was generated, and the content of the dataset itself can be found in the linked article.

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See also:

This repository is completed by a scientific article. It covers in detail the source of the (anonymized) raw data as well as the process for its filtering, the calculation of an estimate for the number of residents, data correction and conservation of anonymity. The features of the dataset are also explained in detail. In a technical validation step, a subset of the energy consumption measurements are combined with additional dataset features (living space, number of building residents, and building type) and compared against publicly available data.[1]

We also provide information in form of weather data [2] and historical records of political actions in context of the SARS-CoV-2 pandemic.[3]

Please note that a complete description of the dataset can only be guaranteed if the article is considered.

The article is linked in the metadata of this repository on Fordatis under the key “is supplemented by”.

Content of this repository:

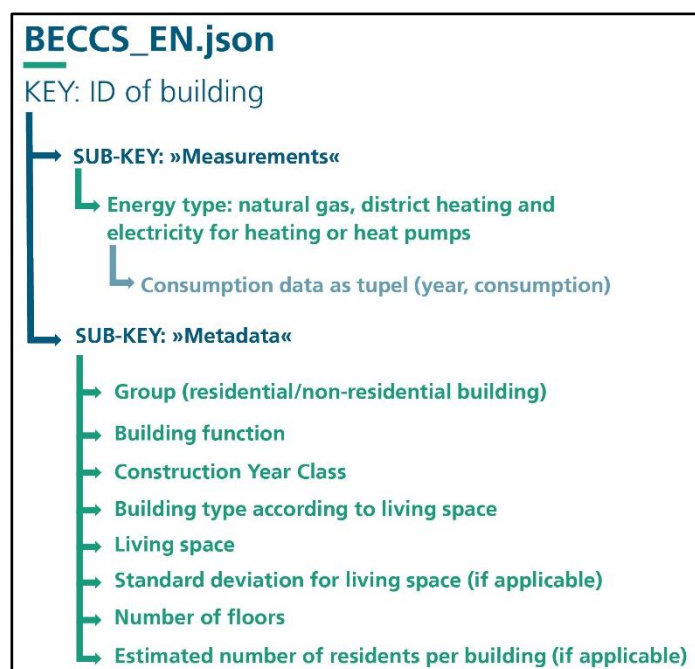
Nr	Name	Type	Description
1	BECCS_EN.json	Python nested dictionary	BECCS – Bremen Energy Consumption Catalogue for Six Years, Dictionary containing all building related data, English version
2	BECCS_DE.json	Python nested dictionary	BECCS – Bremen Energy Consumption Catalogue for Six Years, Dictionary containing all building related data, German version
3	Dataset_information.pdf	pdf	Supporting document for the repository
4	Supplementary_Information.xlsx	Excel	Groups for the metadata features
5	tageswerte_KL_00691_18900101_20231231_hist.zip	Zip folder	Weather measurements and metadata provided by DWD
6	Translation_list.xlsx	Excel	Summary of all translations for strings in the dictionaries
7	Boxplot_Matrix.png	Picture	Data overview with histograms for consumption per living space for each building type and CYC
8	ugr_destatis_excerpt_sheet_85531-04_fixed_incl_combined.csv	Excel	Excerpt from sheet 85531-04 of the UGR [1] where we fixed an error by Destatis and included our calculation of combined energy consumption for space heating and domestic hot water generation
9	ugr_destatis_per_person_energy_consumption.csv	Excel	Average per person energy consumption for space heating and domestic hot water according to sheet 85531-04 of the UGR [1] (see rows 16 and 28)

Abbreviation

German	English
BAK Baujahrklasse	CYC Construction Year Class
BECCS Bremen Energy Consumption Catalogue for Six Years	BECCS Bremen Energy Consumption Catalogue for Six Years
DWD Deutscher Wetterdienst	DWD Deutscher Wetterdienst
EFH Einfamilienhaus mit maximal 200m ² Nutzfläche	SFH Single-family home with max 200m ² living space
gMFH Großes Mehrfamilienhaus mit einer Nutzfläche von mindestens 750m ²	bMFH Big multi-family home with living area greater than 750m ²
HDD Heating Degree Days	HDD Heating Degree Days
HH Hochhaus, Gebäude mit mehr als 10 Stockwerken	HR High-rise building , Building with more than 10 floors
KF Klimafaktor	CF Climate correction factor
kMFH Kleines Mehrfamilienhaus mit Nutzfläche zwischen 200m ² und 750m ²	sMFH Small Multi-family home with living area between 200m ² and 750m ²
NWG Nicht-Wohngebäude	NRB Non-Residential building
RH Nach den Geodaten mindestens 3 benachbarte EFH ohne Abstand	TH According to the geodata, at least 3 bordering SFH without distance
STAW_NF Standardabweichung für die Nutzfläche	ST_DEV Standard deviation for living space
UGR Umwelt-ökonomische Gesamtrechnungen	UGR environmental-economic accounting by the Federal Statistical Office of Germany
WG Wohngebäude	RB Residential building

Structure of dictionary:

The structure of the dictionary BECCS_EN is shown below. The German version has the same structure, only using German SUB-KEYS and entries.



Loading the dictionary:

The keys of the dictionary are stored as string (str). For looping through the dictionary, a change from str to integer (int) is recommended. We provide an example code for this change here. Alternatives may also work. If the dictionary is loaded correctly, the structure should be like the picture above and the length should be 88,901.

```
import json

# change type of key from str to int
def dict_int_keys(dict_func):
    rval = dict()
    for key, val in dict_func.items():
        try:
            # Convert key to int
            int_key = int(key)
            # Assign Values to key
            rval[int_key] = val
        except ValueError:
            # if key should be str
            rval[key] = val
    return rval

# open dictionary
File_path_dict = { } #replace "{" with local path
with open(file_path_dict, 'r') as file: #replace "file_path_dict" with local path
    f = file.read()
    dictionary = json.loads(f , object_hook = dict_int_keys)

len_dict = len(dictionary)
print("The dictionary has " + str(len_dict) + " entries")
```

Data overview:

The dictionary contains 88,901 individual building entries. 85,700 buildings are categorized as residential buildings, while the remaining 3,201 buildings are in the group "non-residential". Our dataset distinguishes between four different functions of residential buildings indicating whether they serve purely residential purposes or otherwise. The non-residential buildings in the dataset have 22 different function-descriptions. The consumption data for natural gas, district heating and electricity for heating and heat pumps covers the years 2016 to 2021 for the application space heating and domestic hot water. For the energy type "natural gas" we assume that in general both applications are covered in nearly all buildings. Regarding the other energy types, we cannot guarantee that domestic hot water is also provided by the same energy type for space heating.

The dataset was extended with metadata for the group of building, nature of usage, Construction Year Class (CYC), living space, type of building according to living space, number of floors. This metadata was derived from 3D building data of "GeoPortal Bremen", a service of Bremen state office for geo-information.[4] The CYC follows the classifications of the "German Residential Building Typology" derived from Loga, Stein, et al.[5]

A general overview of the data is given in the Boxplot-Matrix. It covers all residential buildings in the dataset. One boxplot represents the selection for a CYC and building type. For each diagram, the energy consumption per living space is displayed for each year as boxplot. In the upper left corner, the total number of buildings for the selection, the buildings with consumption values and the number of outliers is displayed. Within each box, the median is marked as horizontal line. The overall X-axis of the Matrix shows the different building types, while the overall Y-axis shows the CYC.

References:

- [1] Statistisches Bundesamt (2023) Statistischer Bericht - UGR - Private Haushalte und Umwelt: Berichtszeitraum 2000 - 2021. <https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Umwelt/UGR/private-haushalte/Publikationen/Downloads/statistischer-bericht-haushalte-umwelt-5851319217005.html?nn=409924>. Accessed 22.05.2026
- [2] Deutscher Wetterdienst (2024) Tägliche Stationsbeobachtungen (Temperatur, Druck, Niederschlag, Sonnenscheindauer, etc.) für Deutschland: Version: v24.3 (2024), Station 00691 - Bremen. https://opendata.dwd.de/climate_environment/CDC/observations_germany/climate/daily/kl/historical/. Accessed 06.10.2025
- [3] Doll S (2021) Corona in Bremen: Eine Chronologie der Ereignisse. <https://www.weser-kurier.de/bremen/corona-in-bremen-eine-chronologie-der-ereignisse-doc7es7qjgetbmnq26chz2>. Accessed 30.06.2025
- [4] Landesamt Geoinformation Bremen (2019) GeoPortal Bremen: 3D Gebäudemodell und Liegenschaftsdaten. Landesamt Geoinformation Bremen
- [5] Loga T, Stein B, Diefenbach N et al. (2015) Deutsche Wohngebäudetypologie: Beispielhafte Maßnahmen zur Verbesserung der Energieeffizienz von typischen Wohngebäuden. https://www.iwu.de/fileadmin/publikationen/gebaeudebestand/episcopes/2015_IWU_LogaEtAl_Deutsche-Wohngeb%C3%A4udetypologie.pdf. Accessed 10.05.2026