BuiltHub workshop 25 May 2022

Supporting building stock transformation and a circular economy

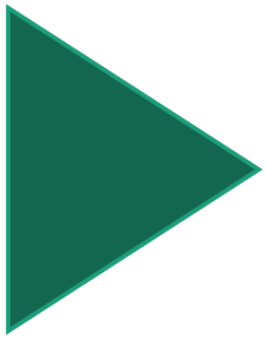
News from BuiltHub

Ulrich Filippi Oberegger, project coordinator (EURAC)

This project has received funding from the EU's Horizon 2020 program under grant agreement no 957026.

Before we get started…

- All participates will remain muted during presentations
- Participants are encouraged to keep their cameras on
- If you have a question, please ask it in the chat and we will follow up on it or rise the hand after the session and we will discuss it
- Meeting will be recorded



slido

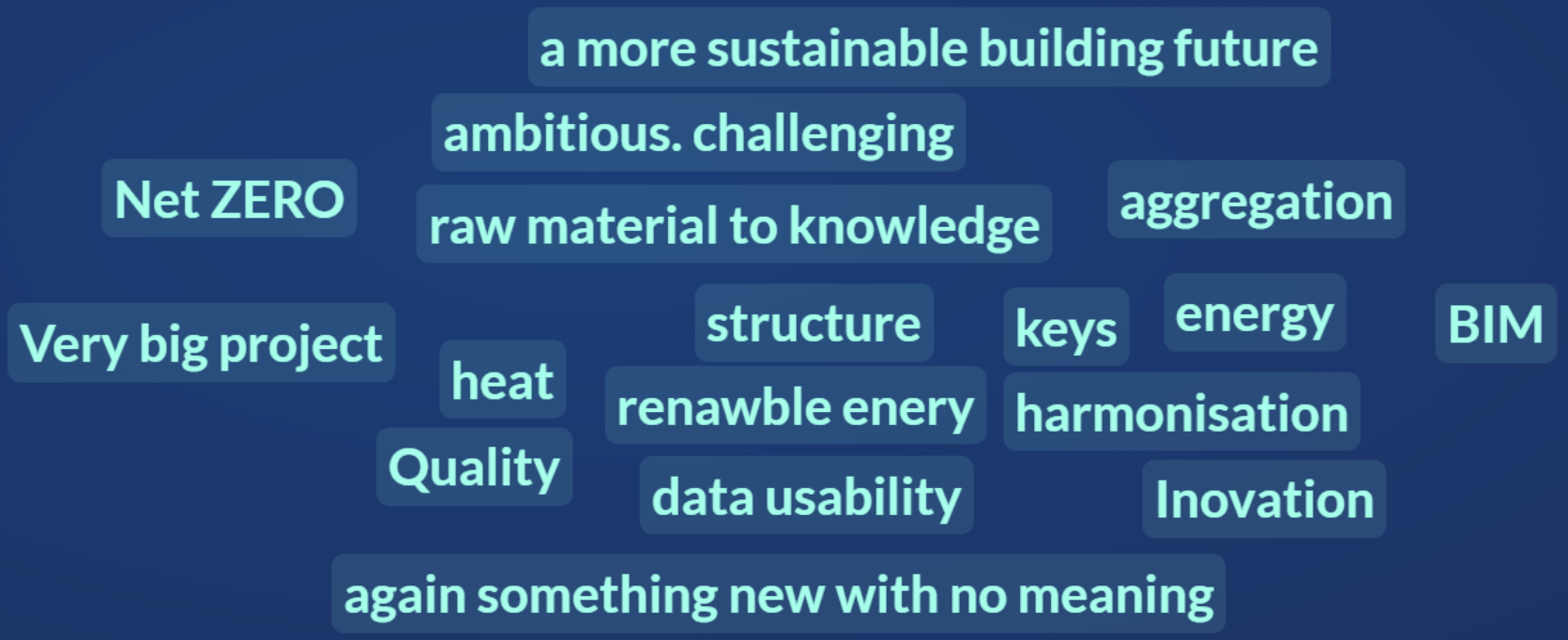
Join at

slido.com

#BuiltHub

Where do you join from today?

BUILDING DATA TRNSFORMATION -what is your first thought when you read it?



How would you explain circular economy concept to your grandma?

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Sessions

10:45 – 10:55 **10 min**

Welcome and icebreaker

Ulrich Filippi Oberegger (EURAC)

Nazie Amisulashvili (EURAC)

10:55 – 11:10 **15 min**

News from BuiltHub

Ulrich Filippi Oberegger (EURAC)

11:10 – 11:40 **30 min**

Machine learning methods to predict building data

Mikael Mangold, Tim Johansson and Pei-Yu Wu from the Research Institutes of Sweden (RISE)

11:40 – 12:10 **30 min**

Construction & demolition waste data analysis to support a circular economy

Gianluca Grazieschi and Simon Pezzutto from Eurac Research, Institute for Renewable Energy (EURAC)

12:10 – 12:25 **15 min**

Q&A and wrap-up

Nazie Amisulashvili (EURAC)

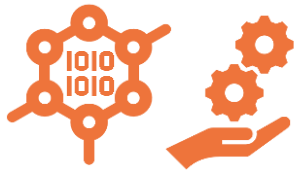
BuiltHub in a nutshell

Coordination and Support Action (CSA)

4 year-project, October 2020 - September 2024

BuiltHub's main goals

- Develop **roadmap for sustained dataflow** to EU Building Stock Observatory (BSO)
- **Build and engage community** for data collection, exchanges, data-to-knowledge processes
- **Standardized data governance and services** – offered, tested, demonstrated **through web-based BuiltHub platform**
- **Coordinated action** among associated projects



BuiltHub platform datasets

Legend	
A	Building stock related datasets
B	Socio-economic datasets
C	Climatic datasets

Dataset number	Topic type	Name	Content
1	A	Horizon 2020 HotMaps project: Building stock analysis	Complete building stock analysis for the EU27+UK. Values related to final energy consumption and useful energy demand for space heating, space cooling and domestic hot water, construction materials and methodologies, technologies used and building stock data/information (thermal transmittancy, building stock vintages and characteristics, household occupancy related data, etc.) can be found both for the residential and the non-residential sectors per building types and construction vintages.
2	A	IEE TABULA project: Typology Approach for Building Stock Energy Assessment	Building stock data and data focused on technical systems for heating, cooling and domestic hot water production in different buildings types are the main outputs of this dataset. Final energy consumption and envelope performance data are available as well.
…	…	…	…
28	C	EDGAR (Emissions Database for Global Atmospheric Research) CO2 Emissions	Carbon Dioxide (CO_2) emissions by country and sector (Buildings, Transport, Other industrial combustion, Power Industry and other sectors) have been collected for the years between 1970 and 2018 and are reported expressed in $MtCO_2$/year.
29	C	CORDEX - Regional climate model data on single levels for Europe	Climatic data for Europe expressed in daily, monthly and seasonal mean values as well as 3 or 6 hours resolution. Data for air temperature at 2 m, wind speed, atmospheric pressure and hum idity can be found.
30	C	PVGIS - Photovoltaic Geographical Information System	This GIS dataset contains data related to the solar radiation. It takes into account both day and night-time periodsexpressing the solar radiation raster map in W/m2.
…	…	…	…

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BuiltHub building data platform

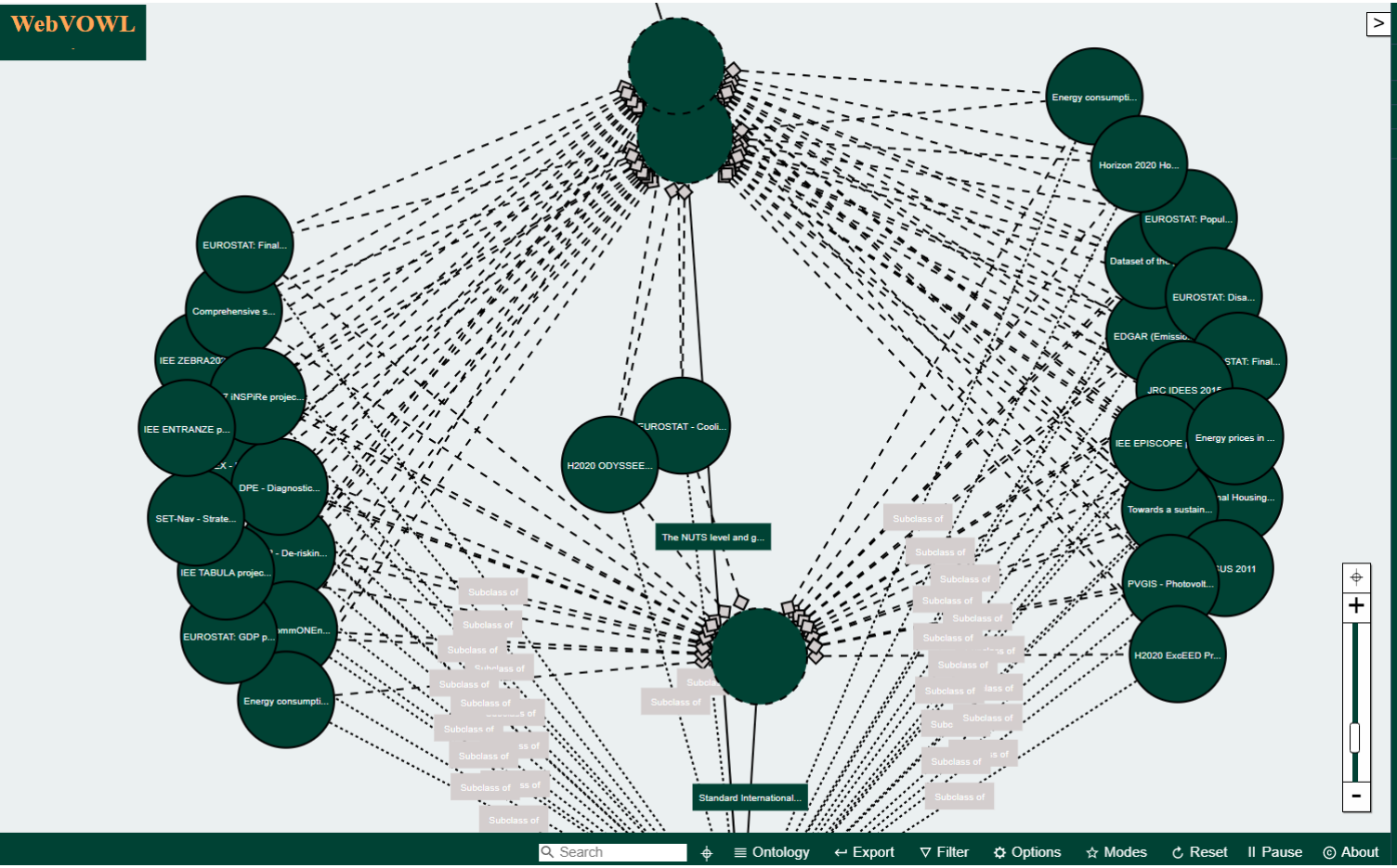
BuiltHub web-based building data platform

- **Under development** ➔ not yet fully functional and subject to change
- **Pre-release coming soon, stay tuned!**

➔ To be tested by pioneer users for their feedback

BuiltHub web-based building data platform

Standardised ontology (controlled vocabolary) and viewer ➔ for experts



BuiltHub web-based building data platform

Data catalog (datasets currently included in the database)

Builthub Data Catalog

Current datasets included in the data base:

Dataset	Description
Horizon 2020 HotMaps project: Building stock analysis	Complete building stock analysis for the EU27+UK. Values related to final energy consumption and useful energy demand for space heating, space cooling and domestic hot water, construction materials and methodologies, technologies used and building stock data/information (thermal transmittancy, building stock vintages and characteristics, household occupancy related data, etc.) can be found both for the residential and the non-residential sectors per building types and construction vintages.
FP7 iNSPiRe project: building stock analysis	The building stock analysis and data gathering exercise focused its attention on published literature and other sources, aiming to extrapolate information about the current residential and office building stock. Among the differentdata gathered it is possible to mention number and floor area of residential buildings/dwellings and office buildings / construction by type and age distribution / typology / facade and glazing types / geometry / average floor area / number of floors / U-value, thermal characteristic and performance of the buildings, by age / ownership and tenure i.e. number of social housing, owner occupied, private renting etc. / energy consumption and demand in terms of both, total and individual end-use including space heating, domestic hot water, cooling, lighting; fuel and heating system types and comfort requirements. Interest has been set onlighting-related data.
EUROSTAT: Final energy consumption in households	The final energy consumption in households is a measure of the total energy consumed by households as final users. In this dataset it is expressed in thousands tonnes of oil equivalent.
EUROSTAT: Final energy consumption in households by fuel	The share of seven types of fuel over the final residential energy consumption is reported in this dataset. The types of fuels considered are: solid fossil fuels, other fuels, oil and petroleum products, natural gas, electricity, heat and renewables and biofuels. The share of each fuel is expressed in per cent of the total consumption.
EUROSTAT: Disaggregated final energy consumption in households	This dataset provides disaggregated values for the final energy consumption in households.
ZENSUS 2011	This dataset contains disaggregated data concerning a building stock analysis for Germany, information about the occupancy of the buildings and socio/economic related data. Information concerning the type of heating systems used are reported too. The goal of the 2011 Census is to provide the most accurate snapshot possible of basic data on the countries population and the employment and housing conditions.
National Housing Census: European statistical System	This dataset contains a variety of data collected in relation to the national census performed in 2011 by EU27+UK member states. More specifically it is possible to find data concerning households such as the number of icomponents of single households at a grnuality till NUTS3 level.
Energy prices in 2019 -Household energy prices in the EU	This report provides the households prices both for electricity and natural gas for the second semester of year 2019, comparing these values with the ones of the previous year.
EUROSTAT: GDP per capita in PPS	Gross domestic product (GDP) is a measure for the economic activity. The volume index of GDP per capita in Purchasing Power Standards (PPS) is expressed in relation to the European Union average set to equal 100 (EU27). If the index of a country is higher than 100, this country's level of GDP per head is higher than the EU average and vice versa. Please note that this index is thought for cross-country comparisons rather than for temporal comparisons.
EUROSTAT: Population on 1 January by age, sex and NUTS 2 region	This datasets provides a complete overview of the population of each NUTS2 region of the EU27+UK.
EUROSTAT - Cooling and heating degree days	A complete dataset of the cooling and heating degree days at NUTS2 level is provided both on annual and on monthly basis.
EDGAR (Emissions Database for Global Atmospheric Research) CO2 Emissions	Carbon Dioxide (CO2) emissions by country and sector (Buildings, Transport, Other industrial combustion, Power Industry and other sectors) have been collected for the years between 1970 and 2018 and are reported expressed in MtCO2/year.
CORDEX - Regional climate model data on single levels for Europe	Climatic data for Europe expressed in daily, monthly and seasonal mean values as well as 3 or 6 hours resolution. Data for air temperature at 2 m, wind speed, atmospheric pressure and hum idity can be found.
PVGIS - Photovoltaic Geographical Information System	This GIS dataset contains data related to the solar radiation. It takes into account both day and night-time periodsexpressing the solar radiation raster map in W/m2.

BuiltHub web-based building data platform

Metadata and database predicates for each dataset ➔ for experts

PVGIS – Photovoltaic Geographical Information System

This GIS dataset contains data related to the solar radiation. It takes into account both day and night-time periodsexpressing the solar radiation raster map in W/m2.

Dataset metadata

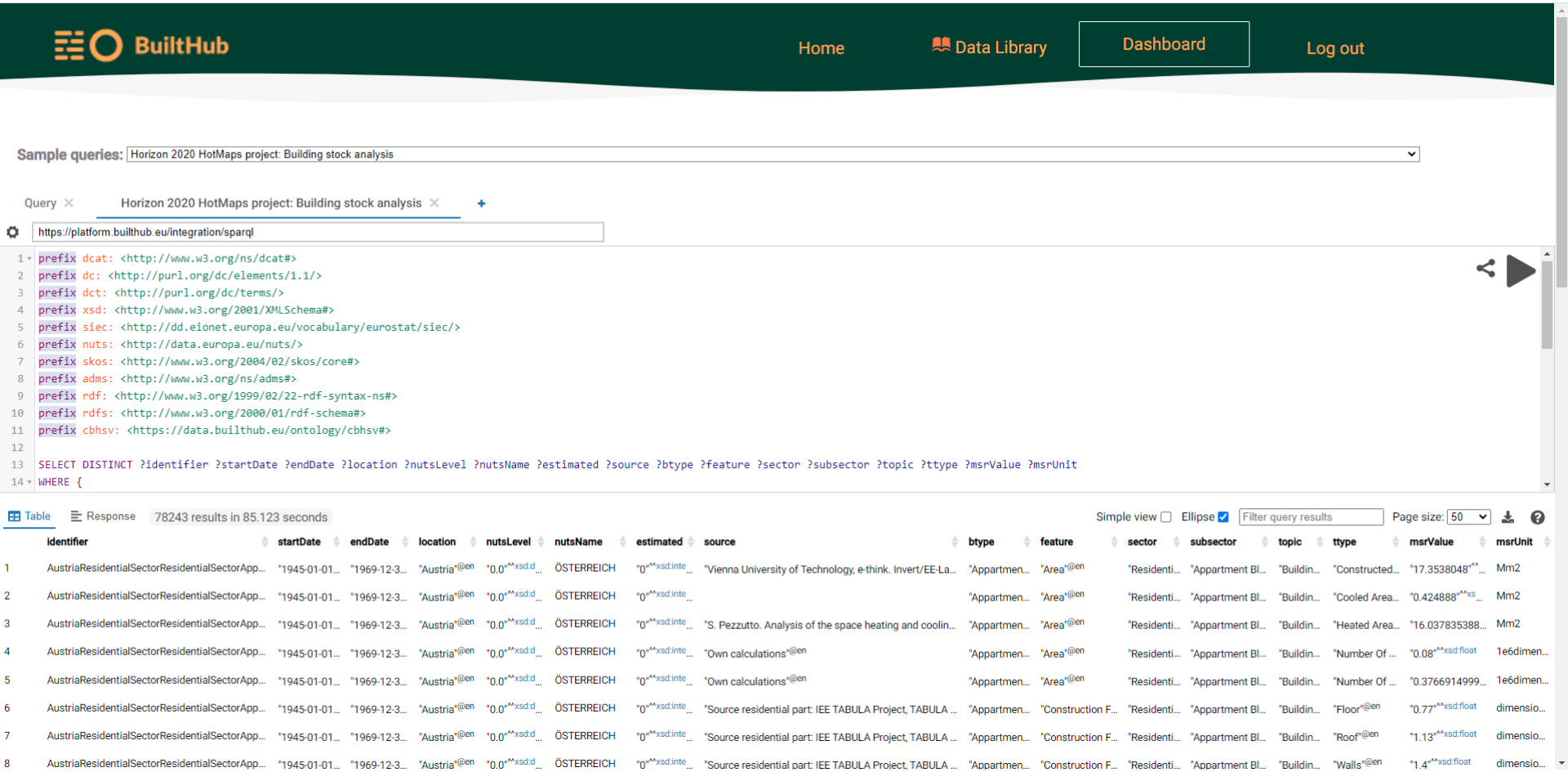
Geo Info	NUTS	Measured Elements	Units	Time Ranges
Countries European Union	NUTS 0 Level	Average global irradiance on a horizontal surface	W/m2	Period from 2005 to 2015

Dataset database predicates

Title	Description	Predicate (Fields' name)	Range/Data Type	Cardinality	Content
Record Type	Defines the type of the record. This type must be defined in a known ontology. Usually, the ontology is specified with a prefix.	rdf:type	IRI	1..1	blthb:Dataset030
Record Key	The primary key of the record.	dc:identifier / skos:notation	rdfs:Literal (xsd:string)	1..1	"al4averageglobalirradianceonahorizontalsurfacewm200114bd98ab3bb6ab20e23197c9e750b"
Frecuency	This property refers to the frequency at which the Dataset is updated.	dct:accrualPeriodicity	dct:Frequency	1..1	http://purl.org/cld/freq/monthly
Temporal Coverage	Refers to a temporal period that the Dataset covers. It is defined as an interval of time that is defined by its start and end dates.	dcterms:temporal	dcterms:PeriodOfTime	1..n	
	This property contains the start of the period.	dcat:startDate	rdfs:Literal (xsd:date)	1..n	"2015-04-01"^^xsd:date
	This property contains the end of the period.	dcat:endDate	rdfs:Literal (xsd:date)	1..n	"2015-04-30"^^xsd:date
Belongs to Dataset	The dataset of this record	skos:broader	IRI	1..1	https://data.builthub.eu/resource/Dataset/30
Spatial Coverage	This property refers to a geographic region that is covered by the Dataset. The EU Vocabularies Name Authority Lists must be used for continents, countries and places that are in those lists.	dcat:spatial	geo:hasGeometry geo:asWKT	1..1	"POLYGON ((19.6 42.325,19.6 42.3,19.625 42.3,19.625 42.325,19.6 42.325))"^^geo:wktLiteral
Inside NUTS boundaries	Indicates if the information is inside a NUTS boundaries.	blthb:hasNUTS	skos:Concept / co:Set (A group of NUTSs)	0..1	https://data.builthub.eu/resource/nuts/NAP
Measured Element	The element/indicator which has been measured.	blthb:measuredElement	rdfs:Literal (xsd:string)	1..1	"Average global irradiance on a horizontal surface"^^xsd:string
QUDT Measurement	The magnitude and kind of the measurement expressed using the QUDT specification.	blthb:measurementQUDT	qudt:QuantityValue	1..1	
	The magnitude of the measurement expressed using a decimal number.	qudt:numericValue	rdfs:Literal (xsd:float)	1..1	"183.0"^^xsd:float
	The kind of the measurement (measurement unit) expressed using the QUDT specification.	qudt:unit	qudt:unit	0..1	
UCUM Measurement	The magnitude and kind of the measurement expressed using the UCUM specification.	blthb:measurementUCUM	rdfs:Literal (ucum:ucum)	1..1	"183.0 "^^cdt:ucum
Literal Measurement Unit	The kind of measurement expressed using natural language.	blthb:measurementUnit	rdfs:Literal (xsd:string)	1..1	"W/m2"^^xsd:string
Literal Measurement					

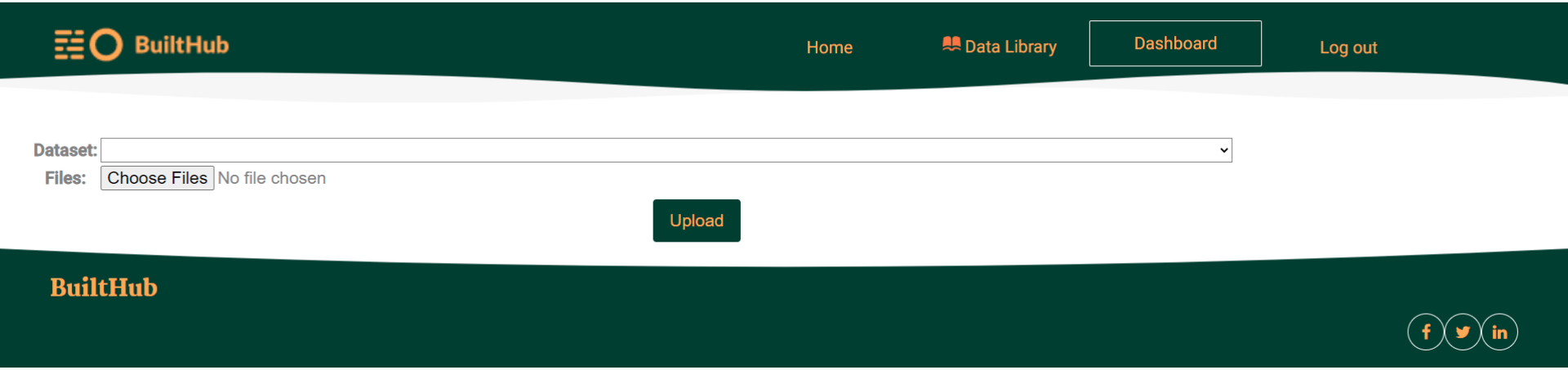
BuiltHub web-based building data platform

SPARQL editor with sample queries ➔ for experts



BuiltHub web-based building data platform

Upload of datasets ➔ for data providers



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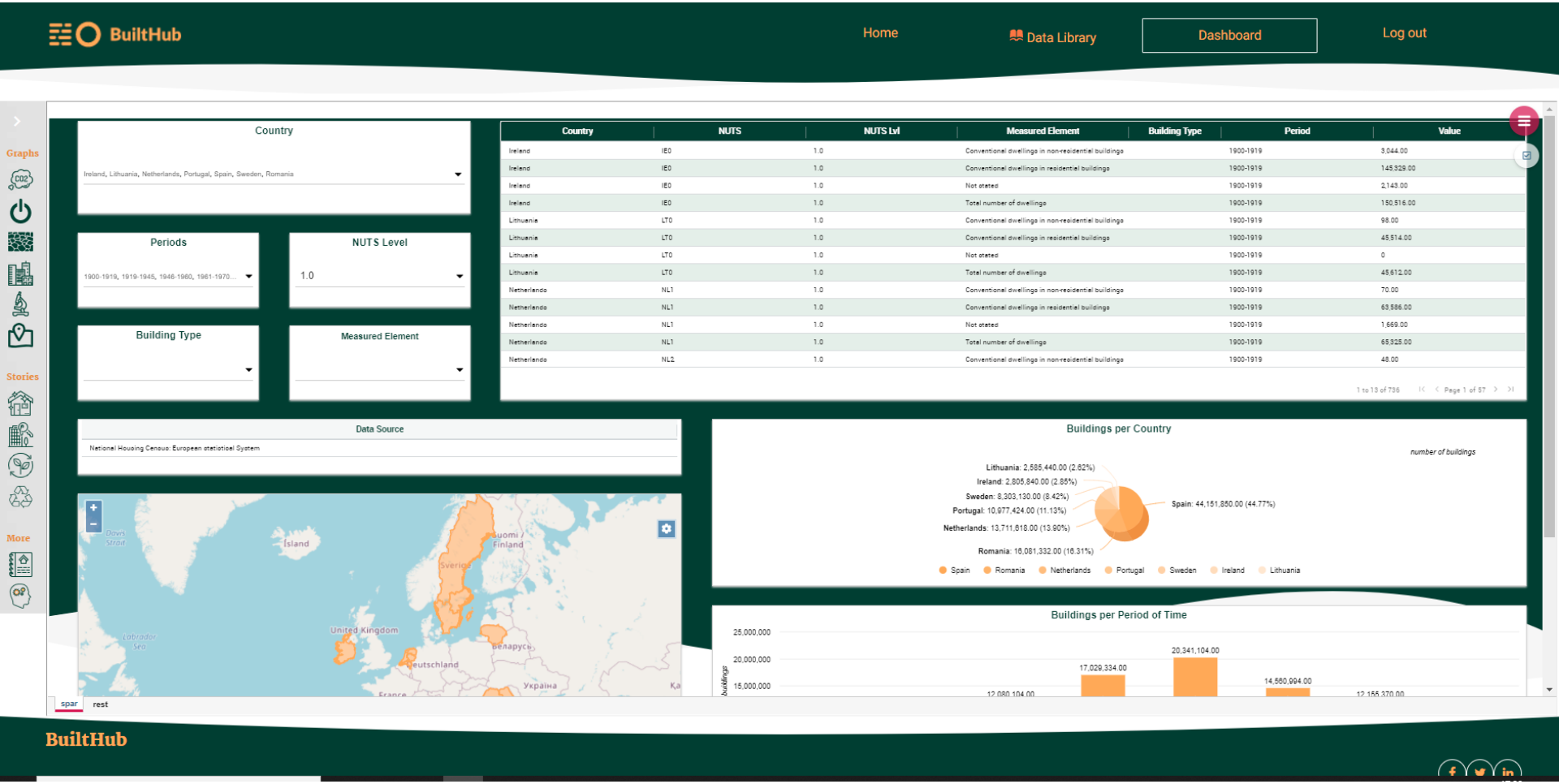
Dashboard – main entry point for most users



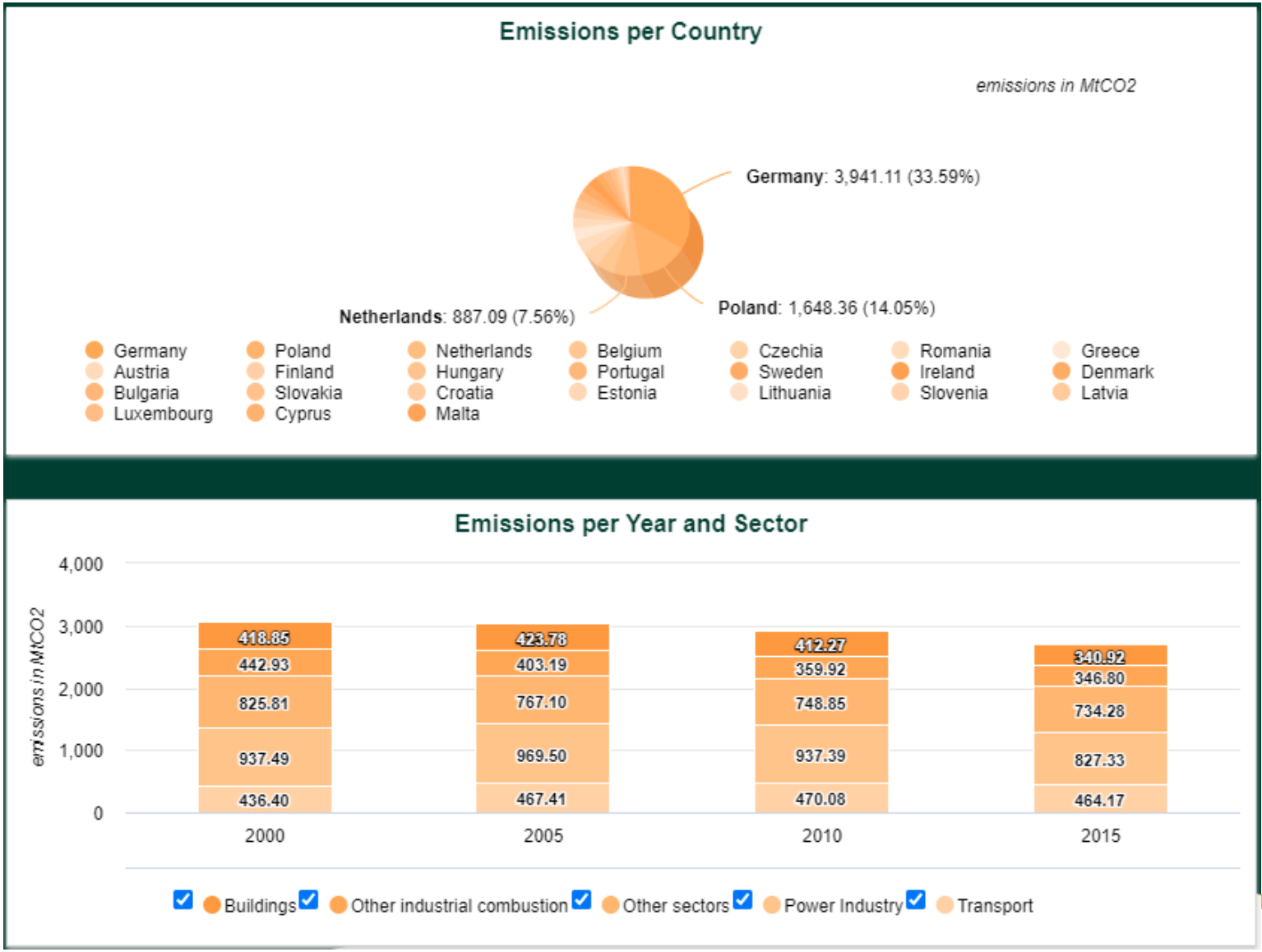
BuiltHub web-based building data platform

Dashboard menu allows focused access to sectoral information

- Emissions
- Energy
- Census
- ...

Emissions

Data source: EDGAR – Emissions Database for Global Atmospheric Research



Emissions

Data source: EDGAR – Emissions Database for Global Atmospheric Research

Filtering

Country

Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Esto...

Groups

EU27 EU28

Year

2000, 2005, 2010, 2015

Measured element

GHGbySector

Sector

Buildings, Other sectors, Other industrial combustion, Power Industry...

Sector

Search

- Buildings
- Other industrial combustion
- Other sectors
- Power Industry
- Transport

Census

➔ Different NUTS levels

Country	NUTS	NUTS Lvl	Measured Element	Building Type	Period	Value
Germany	DE22C	3.0	Total number of dwellings		1900-1919	3,066.00
Germany	DE231	3.0	Total number of dwellings		1900-1919	2,088.00
Germany	DE232	3.0	Total number of dwellings		1900-1919	9,036.00
Germany	DE233	3.0	Total number of dwellings		1900-1919	1,669.00
Germany	DE234	3.0	Total number of dwellings		1900-1919	3,497.00
Germany	DE235	3.0	Total number of dwellings		1900-1919	4,225.00
Germany	DE236	3.0	Total number of dwellings		1900-1919	2,008.00
Germany	DE237	3.0	Total number of dwellings		1900-1919	3,588.00
Germany	DE238	3.0	Total number of dwellings		1900-1919	3,759.00
Germany	DE239	3.0	Total number of dwellings		1900-1919	3,164.00
Germany	DE23A	3.0	Total number of dwellings		1900-1919	4,007.00
Germany	DE241	3.0	Total number of dwellings		1900-1919	8,176.00
Germany	DE242	3.0	Total number of dwellings		1900-1919	3,530.00

Data source: National housing census: European statistical system

Solar irradiance

Data source: PVGIS – Photovoltaic Geographical Information System

➔ GIS data

Data analysis

EU building stock characteristics

The book is freely available on the BuiltHub website, Section Resources

RESIDENTIAL SECTOR

Historical period	Walls	Windows	Roof	Floor
Before 1945	2.18	5.34	1.98	1.63
1945 - 1969	1.86	4.70	1.58	1.46
1970 - 1979	1.32	4.26	1.19	1.23
1980 - 1989	0.85	3.70	0.79	0.99
1990 - 1999	0.63	3.20	0.61	0.74
2000 - 2010	0.48	2.78	0.42	0.53
Post 2010	0.36	2.39	0.28	0.36

SERVICE SECTOR

Historical period
Before 1945
1945 - 1969
1970 - 1979
1980 - 1989
1990 - 1999
2000 - 2010
Post 2010

Table 62. Thermal transm

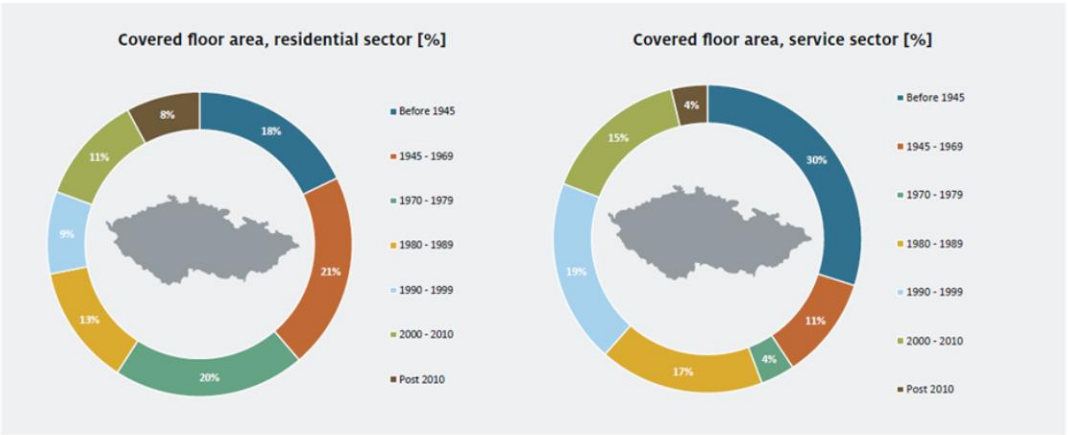
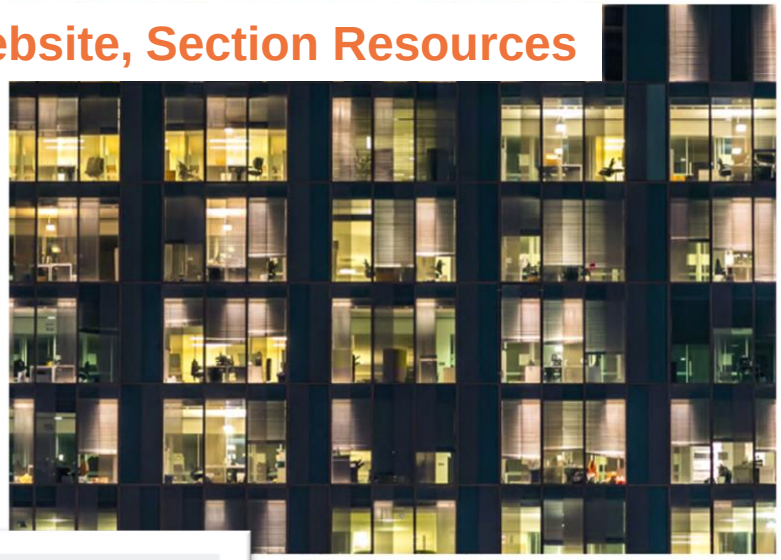


Figure 21. Split of the residential and service building stock raised per construction periods [%] (Czech Republic).



European Building Stock Analysis

A country by country descriptive and comparative analysis of the energy performance of buildings

A. Gevorgian, S. Pezzutto, S. Zambotti, S. Croce, U. Filippi Oberegger, R. Lollini (Eurac), L. Kranzl (Technische Universität Wien), A. Müller (e-think)

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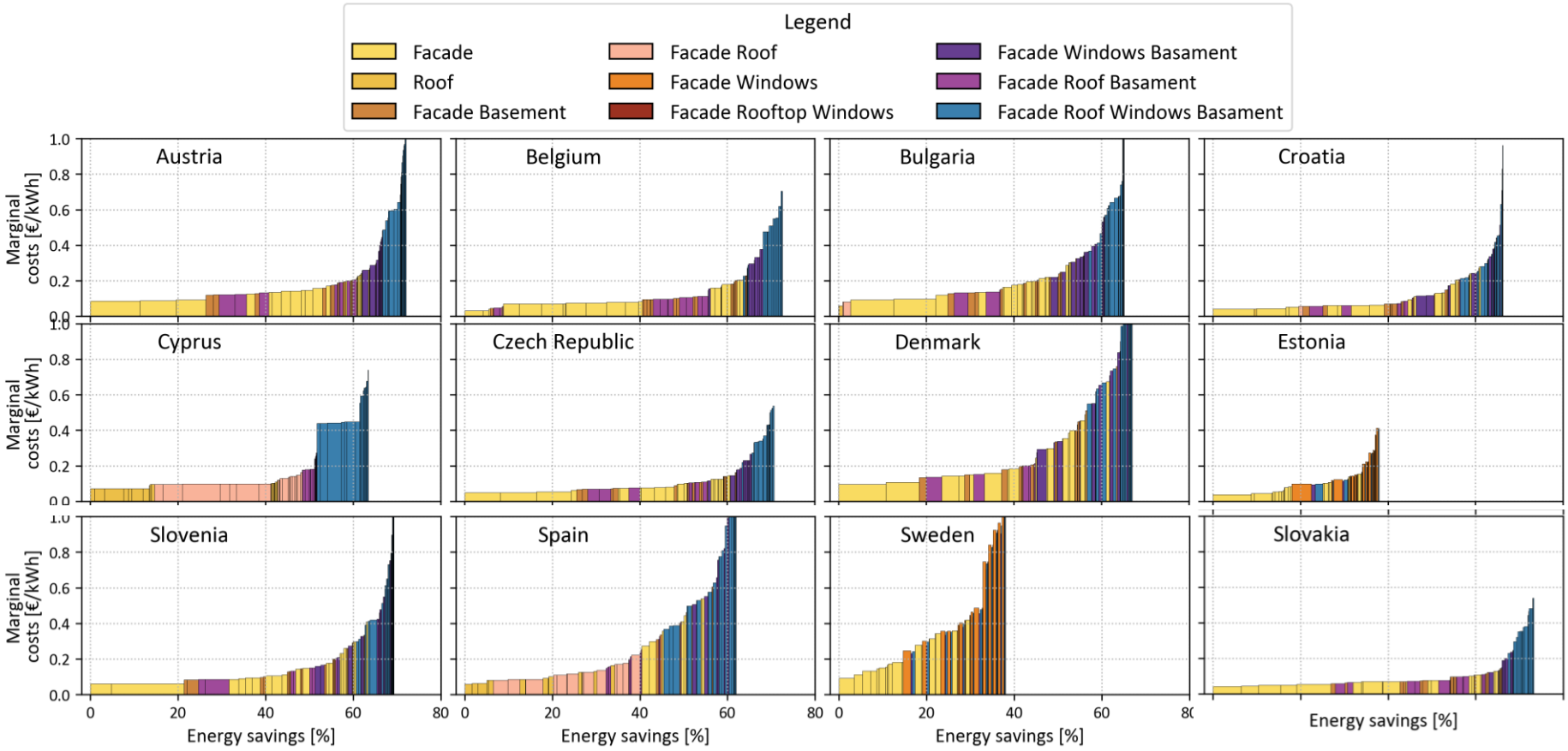
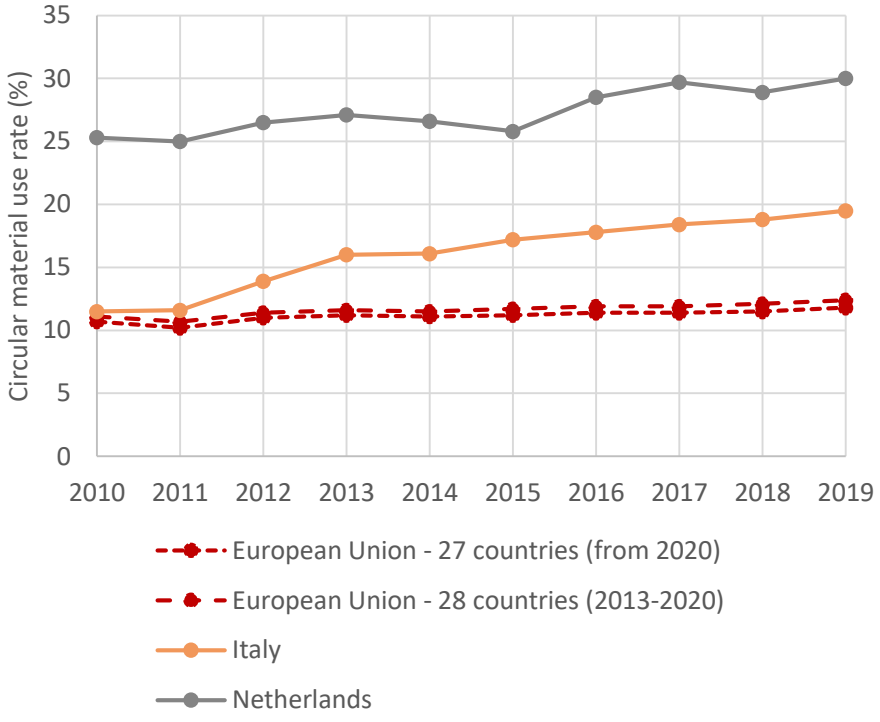
Data source: HotMaps project. https://gitlab.com/hotmaps/building-stock/-/tree/master/data

Renovation plans



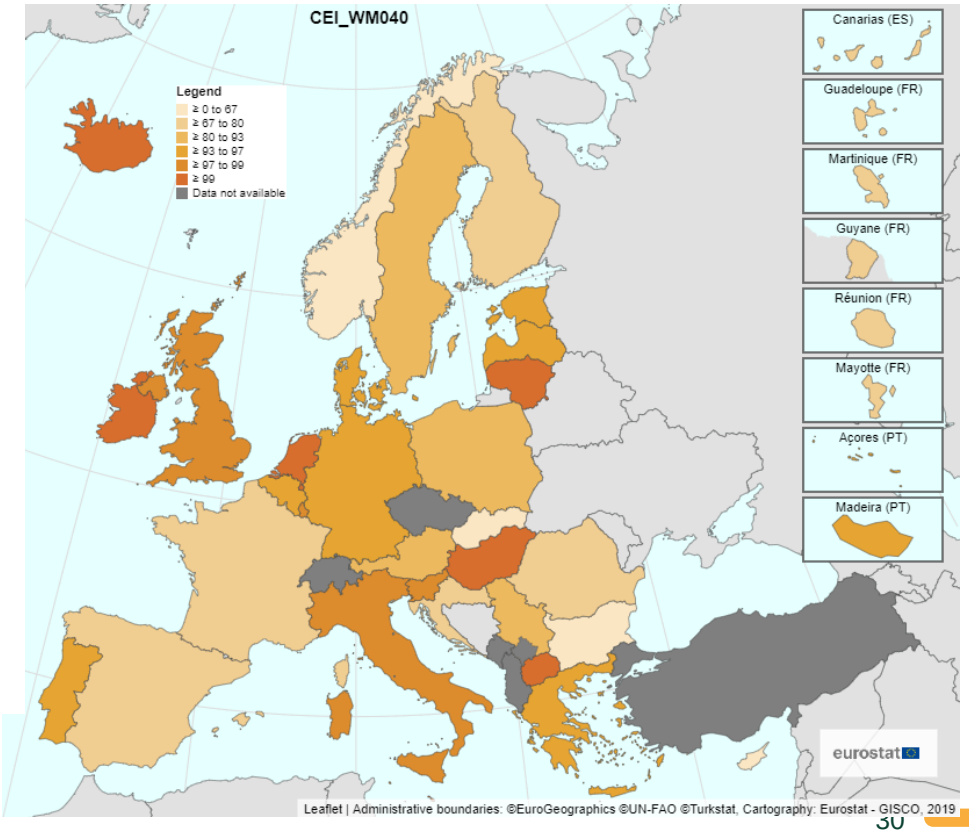
Data sources: HotMaps project. https://gitlab.com/hotmaps/building-stock/-/tree/master/data
Bottom-up building stock retrofit based on levelized cost of saved energy.
https://doi.org/10.1016/j.enbuild.2020.109757

Construction & demolition waste data

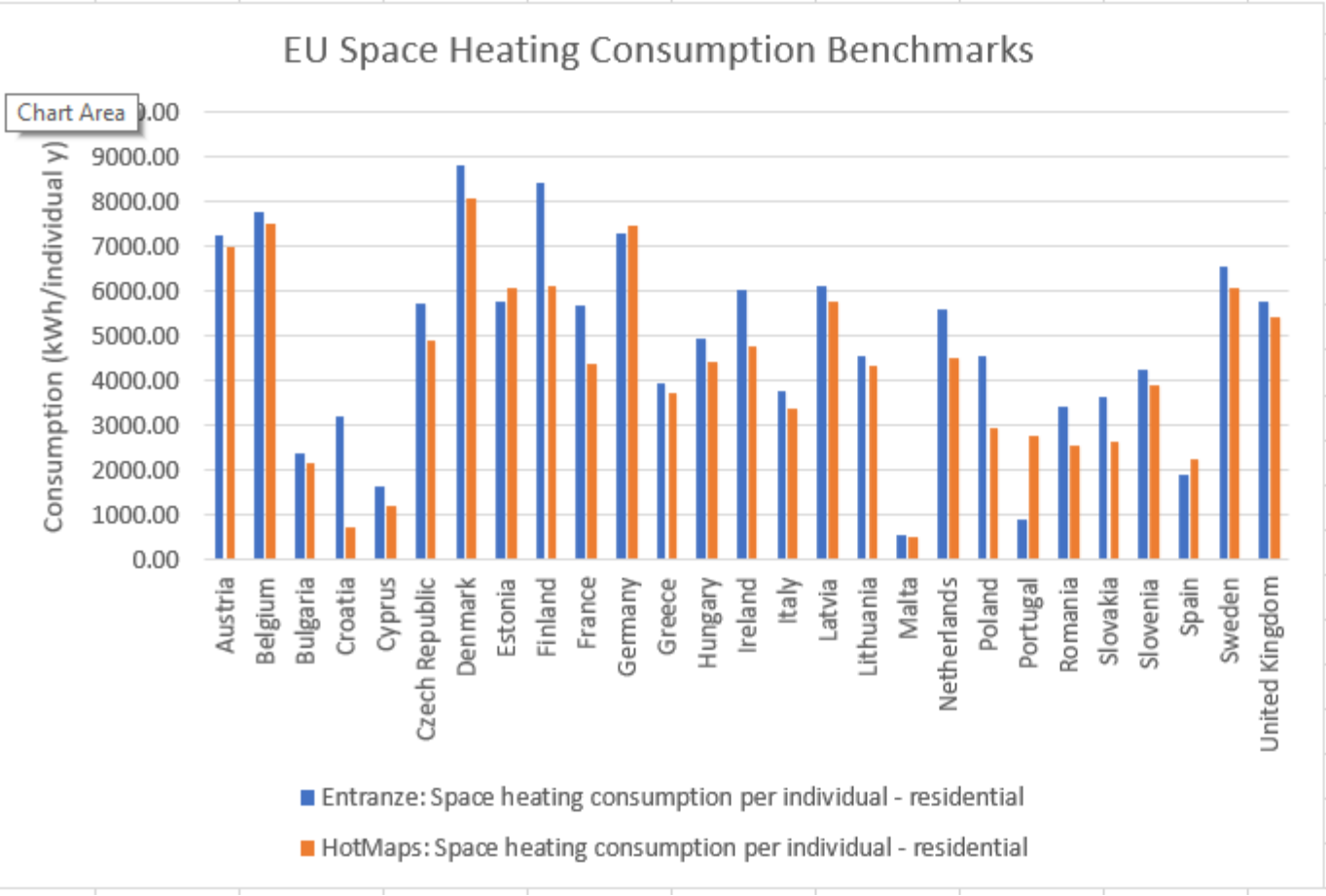


Data source: https://ec.europa.eu/eurostat/web/environment/material-flows-and-resource-productivity

Recovery rates 2018



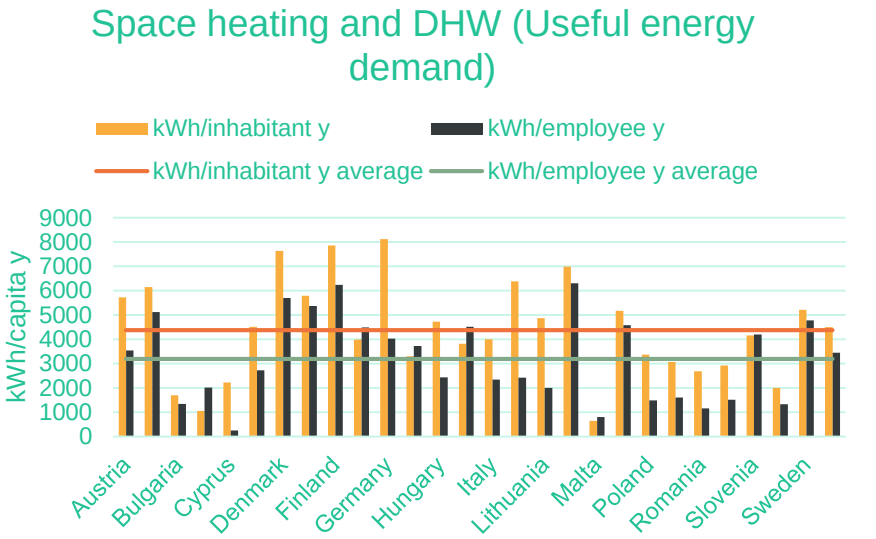
Comparison combining several datasets

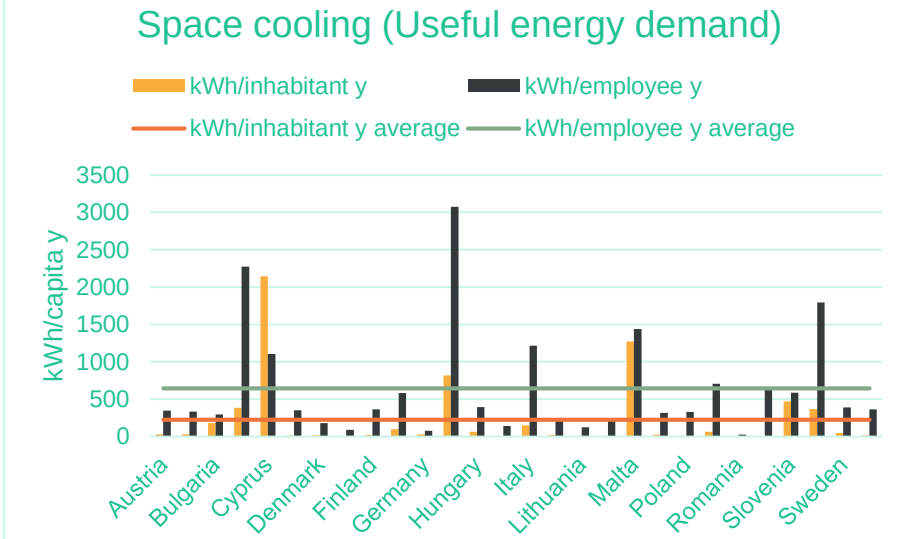


Reference year	
HotMaps	2016
Entranze	2008

Data sources: HotMaps project. https://gitlab.com/hotmaps/building-stock/-/tree/master/data
Statistische Ämter des Bundes und der Länder 2020. Zensus 2011. 2011 https://ergebnisse.zensus2011.de/#
EUROSTAT. Demography, Population Stock & Balance. 2016 https://ec.europa.eu/eurostat/web/population-demography/demography-population-stock-balance/database?p_p_id=NavTreeportletprod_WAR_NavTreeportletprod_INSTANCE_YHU3YVInXvtt&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view
World Bank. Labor force, total. 2016 https://data.worldbank.org/indicator/SL.TLF.TOTL.IN

Comparison combining several datasets





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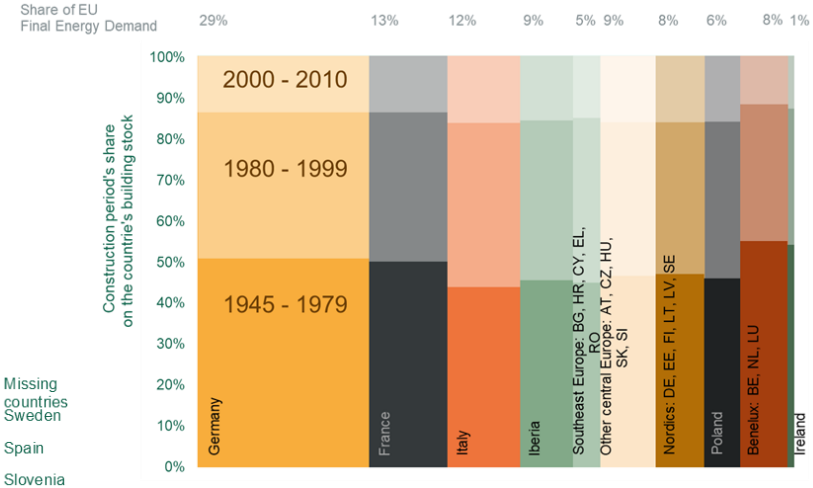
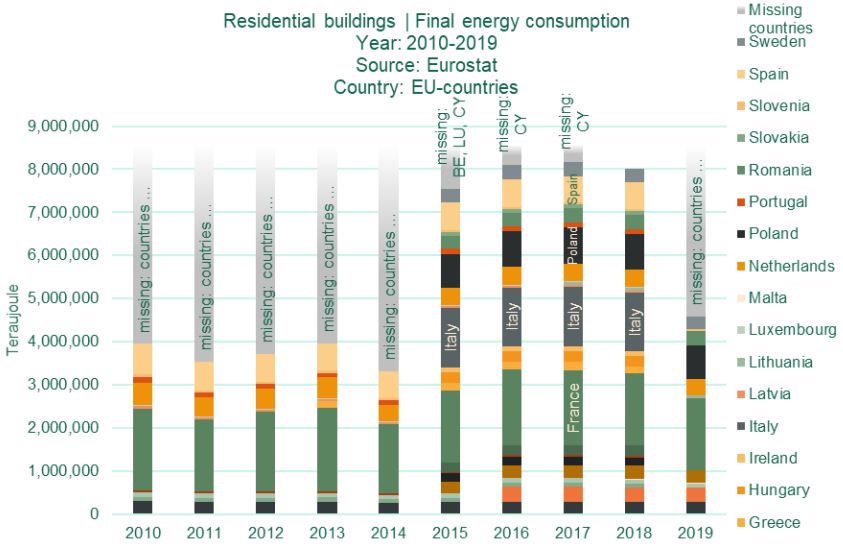
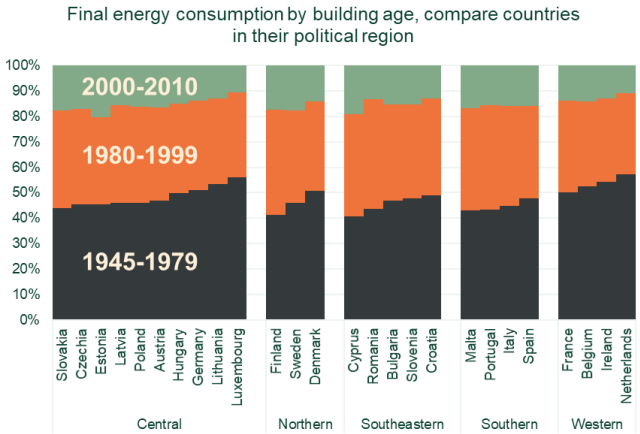
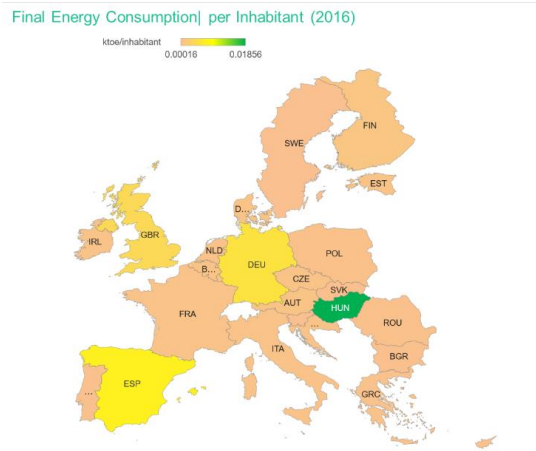
Statistische Ämter des Bundes und der Länder 2020. Zensus 2011. 2011 https://ergebnisse.zensus2011.de/#
EUROSTAT. Demography, Population Stock & Balance. 2016 https://ec.europa.eu/eurostat/web/population-demography/demography-population-stock-balance/database?p_p_id=NavTreeportletprod_WAR_NavTreeportletprod_INSTANCE_YHU3YVInXvtt&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view
World Bank. Labor force, total. 2016 https://data.worldbank.org/indicator/SL.TLF.TOTL.IN

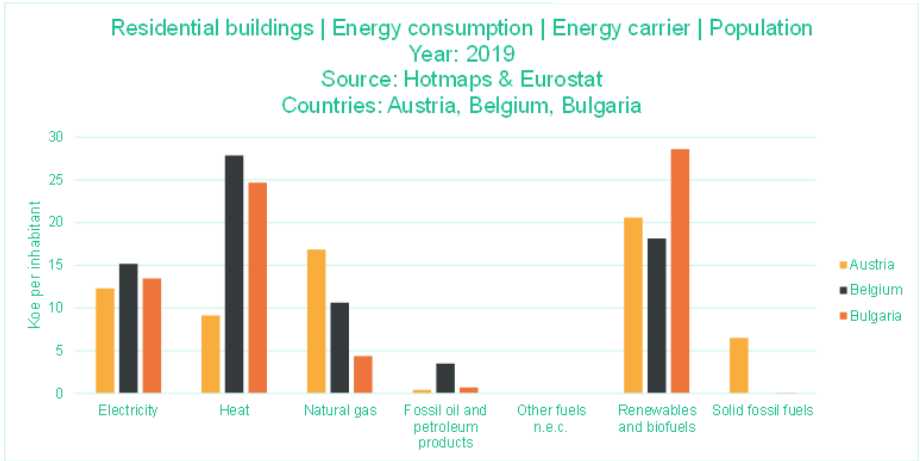
Data visualization concepts











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