BuiltHub

BuiltHub Platform

General introduction and functionalities

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

Table of Content

BuiltHub

Introduction

Introduction

We are in a slow decarbonization process. Currently the EU building stock consumes 40% of the EU's energy and accounts for 36% of the EU's CO2 emissions.

The overall objective of the BuiltHub project is to define the roadmap and vision for a durable data flow to determine the EU housing stock.

Some specific objectives of this project will be:

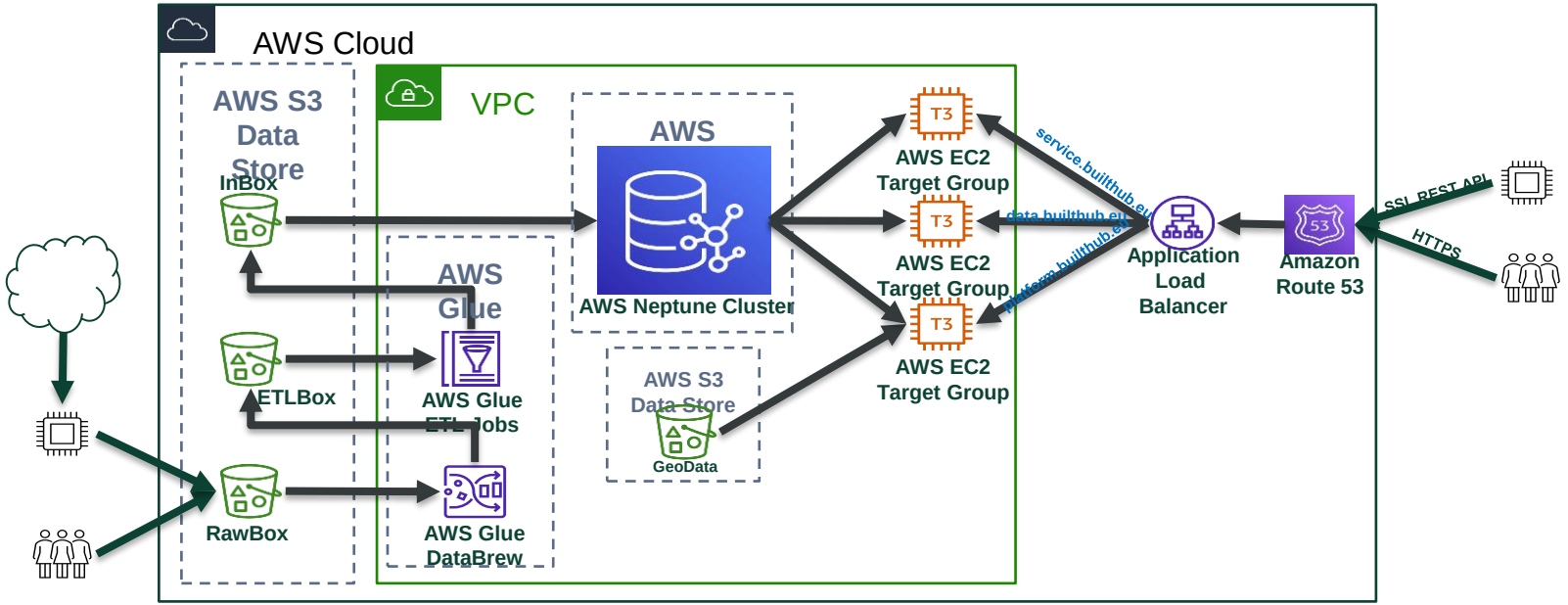
- Definition of a standardized data management approach for a reliable analysis of the building stock.
- Establishment of a community commitment and a sustainable ecosystem to ensure durable data flows.
- Definition of a robust and resilient web-based IT infrastructure, governance and corresponding measures to ensure durability and sustainability.
- Assessment of the progress of the EU building stock towards decarbonization.
- Transformation of data into information and knowledge to develop specific uses/services for stakeholders: market players and policy makers (EU, national and local authorities).

BuiltHub

Infrastructure

Infrastructure (prototype)

This section describes the infrastructure that supports the BuiltHub platform. To do it more understandable, it will be compared with the infrastructure of the prototype.

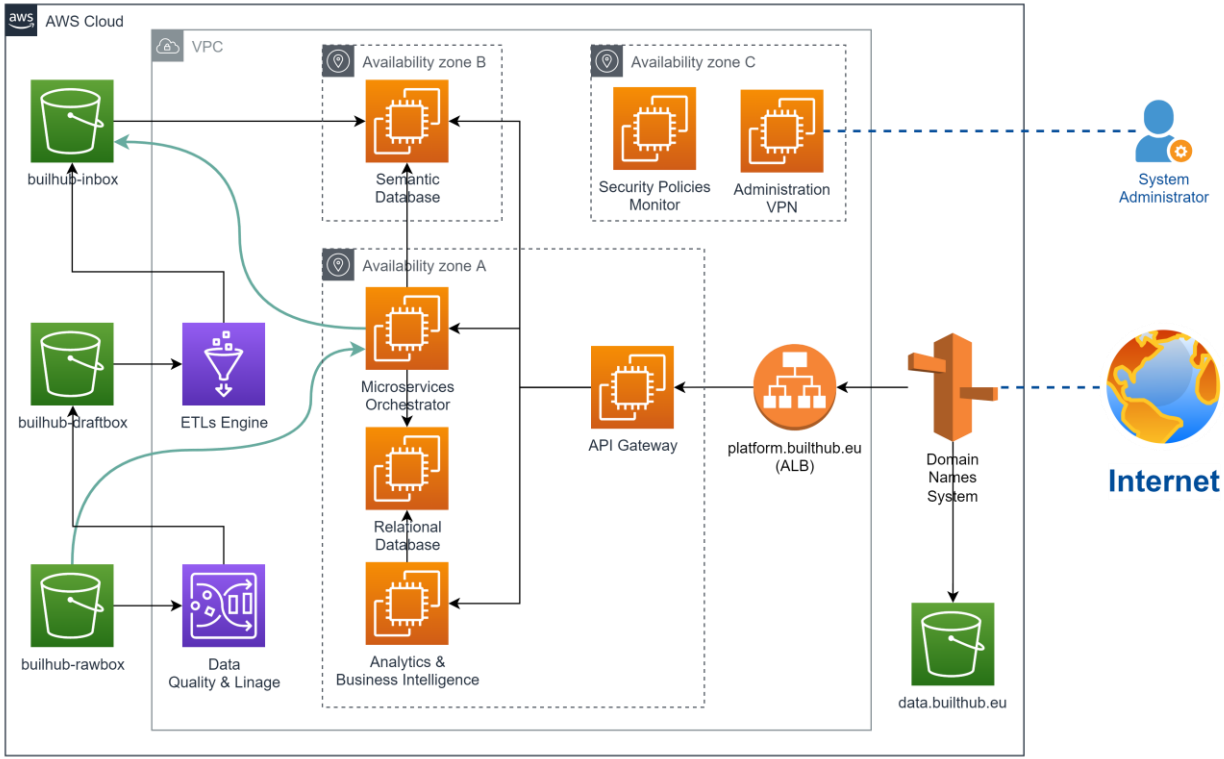


The overall architecture of the BuiltHub prototype

Infrastructure (Current)

BuiltHub has adapted its architecture to support the requirements of privacy, high availability, workload and efficiency of a modern data-intensive platform.

This changes allowed the platform to maintain the data ingestion workflow and improve the security and performance of the platform, as it now runs layers of specific microservices and a more dedicated database.



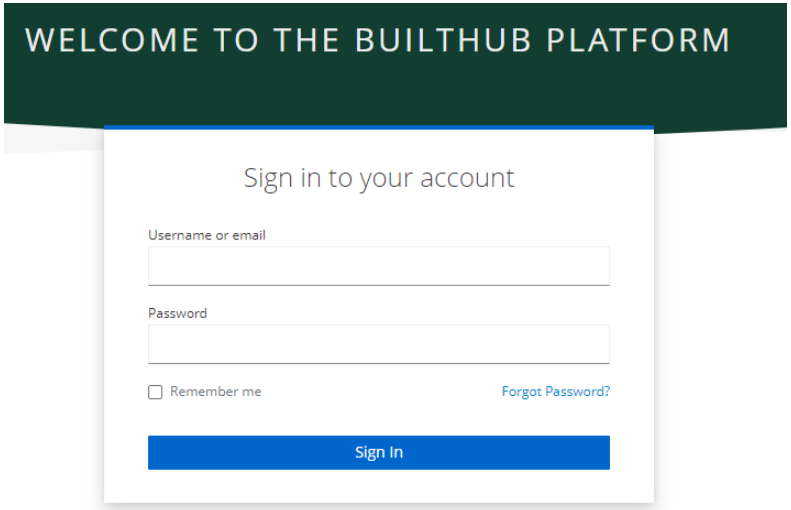
The building-blocks architecture of BuiltHub

BuiltHub

Security

Security: Platform authentication

The entry page to the platform has been replaced by a customized version of the Keycloak login form:



The first time that you try to access to the platform you will have to register and receive an email asking you for change your password.

Security: Role-based access control

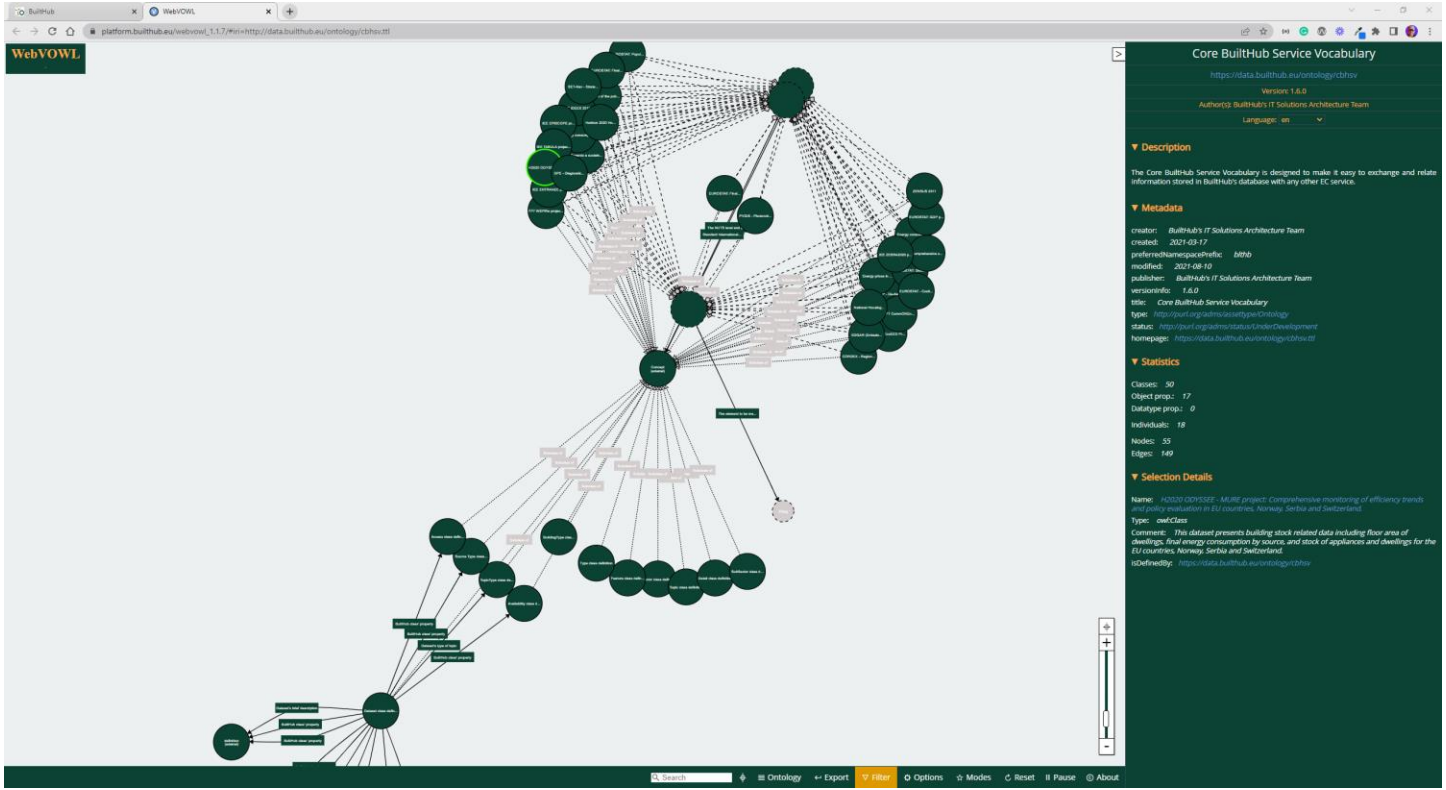
A user can access the platform with different roles. These roles classify the user and allow/forbid some functionalities of the platform. Nowadays, the platform support the following roles:

Role	Capabilities
Contributor	They can use the dashboards, the OWL viewer, the Data Catalog and perform SPARQL queries. They also can upload datasets, save SPARQL queries and use those queries from the integration API. A contributor cannot watch or manage the queries of other contributors.
Manager	In addition to the capabilities of the Guest role, they can watch all the queries in BuiltHub. This role has been thought of for administration purposes only.

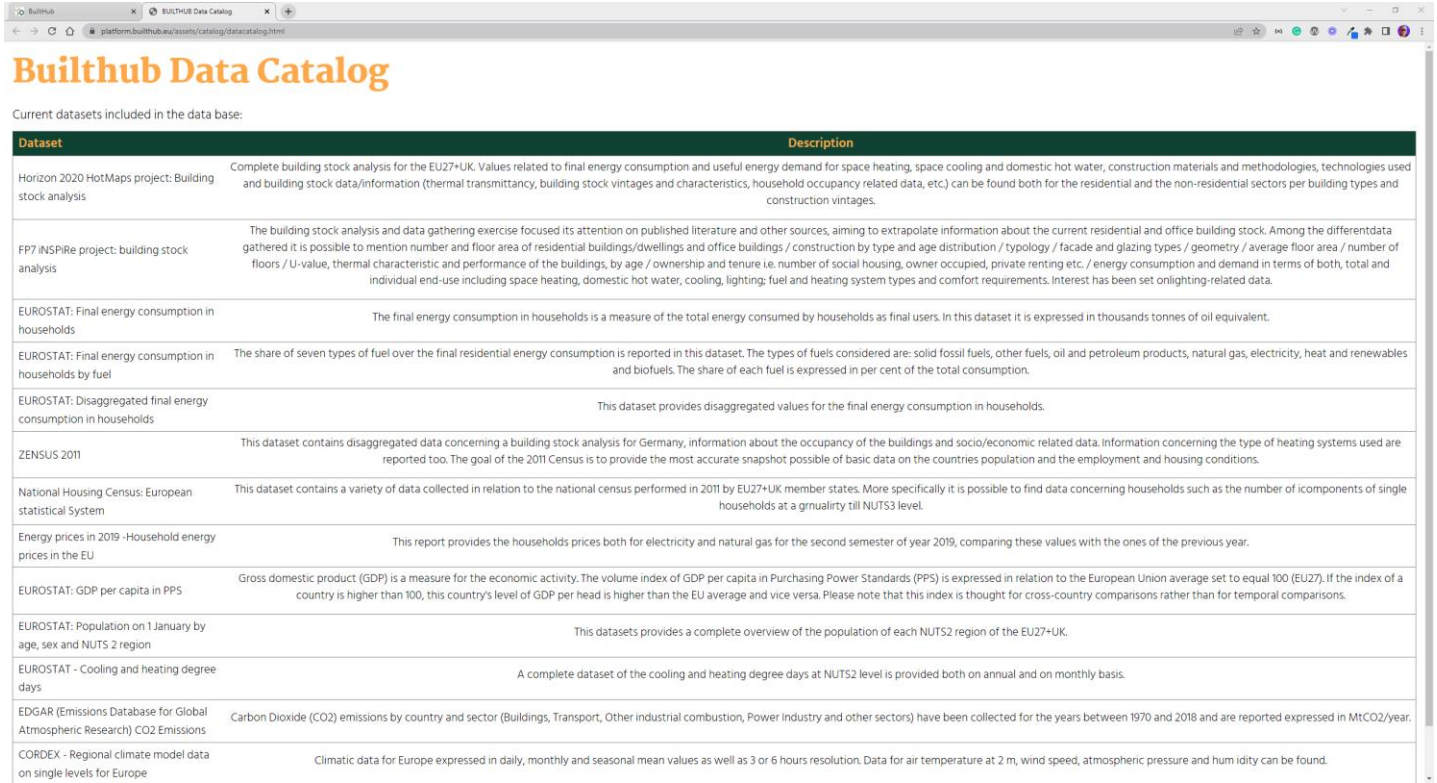
BuiltHub

Functionalities

Functionalities: The ontology viewer



Functionalities: The data catalog



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 grnualirty 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.

Data Sources

Currently, the BuiltHub platform ingests and exploits data from the following datasets:

Dataset	Title
001	Horizon 2020 HotMaps project: Building stock analysis
005	IEE ENTRANZE project: Policies to Enforce the TRAnsition to Nearly Zero Energy buildings in the EU27
011	FP7 iNSPiRe project: building stock analysis
014	EUROSTAT: Final energy consumption in households
015	EUROSTAT: Final energy consumption in households by fuel
016	EUROSTAT: Disaggregated final energy consumption in households
017	ZENSUS 2011
023	National Housing Census: European statistical System
024	Energy prices in 2019 -Household energy prices in the EU

Dataset	Title
025	EUROSTAT: GDP per capita in PPS
026	EUROSTAT: Population on 1 January by age, sex and NUTS 2 region
027	EUROSTAT - Cooling and heating degree days
028	EDGAR (Emissions Database for Global Atmospheric Research) CO2 Emissions
029	CORDEX - Regional climate model data on single levels for Europe (GIS)
030	PVGIS - Photovoltaic Geographical Information System
444	EUROSTAT: Disaggregated final energy consumption in households - quantities
501	EUROSTAT: Households by size (persons)
526	CensusHub2
555	BeReel

Functionalities: The data catalog

EUROSTAT: Final energy consumption in households

Dataset description

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.

Dataset metadata

Geo Info	NUTS	Measured Elements	Units	Time Ranges	SIEC (Standard International energy product classification)	Periodicity
Countries from europe	NUTS 0 Level	Energy consumption in households	TOE	Divided by years starting in 1990 until 2019	Total	Annual

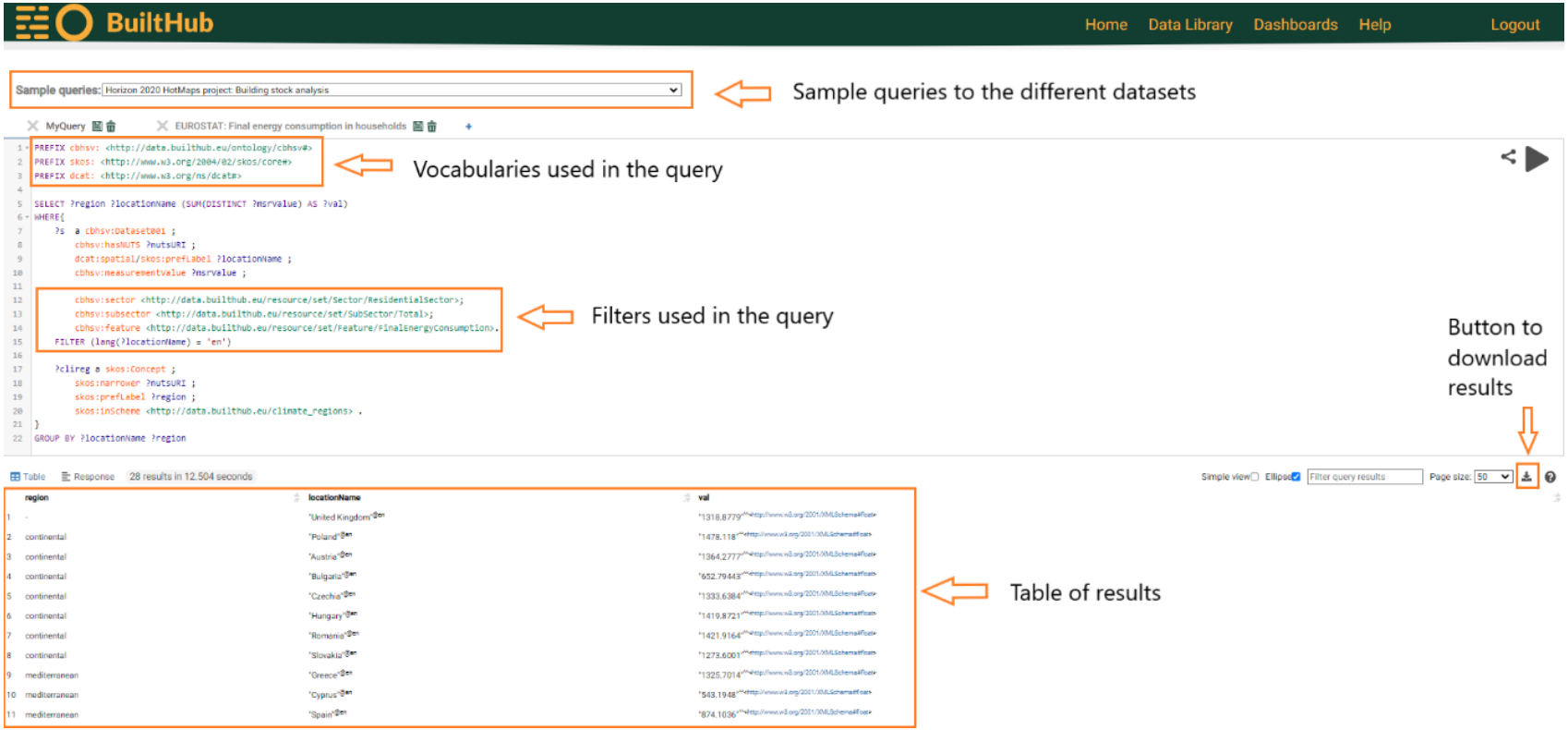
Detailed metadata

Detailed content description and ontologies used

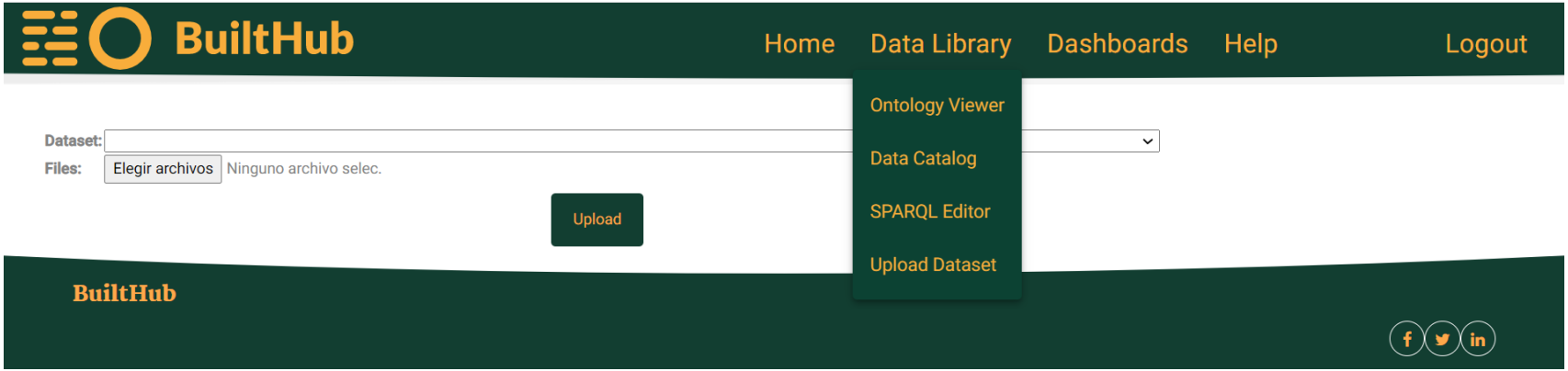
Dataset database predicates

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:Dataset014
Record Key	The primary key of the record.	dc:identifier / skos:notation	rdfs:Literal (xsd:string)	1..1	"Denmark20154481767578125"
Frecuency	This property refers to the frequency at which the Dataset is updated.	dct:accrualPeriodicity	dct:Frequency	1..1	http://purl.org/cld/freq/annual
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..1	"2015-01-01"^^xsd:date
	This property contains the end of the period.	dcat:endDate	rdfs:Literal (xsd:date)	1..1	"2015-12-31"^^xsd:date
Belongs to Dataset	The dataset of this record	skos:broader	IRI	1..1	https://data.builthub.eu/resource/Dataset/14
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	dct:Location (One location) / co:Set (A group of locations, places, countries)	1..1	atold:DNK
Inside NUTS boundaries	Indicates if the information is inside a NUTS boundaries.	blthb:hasNUTS	skos:Concept / co:Set (A group of NUTSs)	0..1	nuts:DK

Functionalities: The SPARQL Editor



Functionalities: The Upload Dataset



BuiltHub

Integration

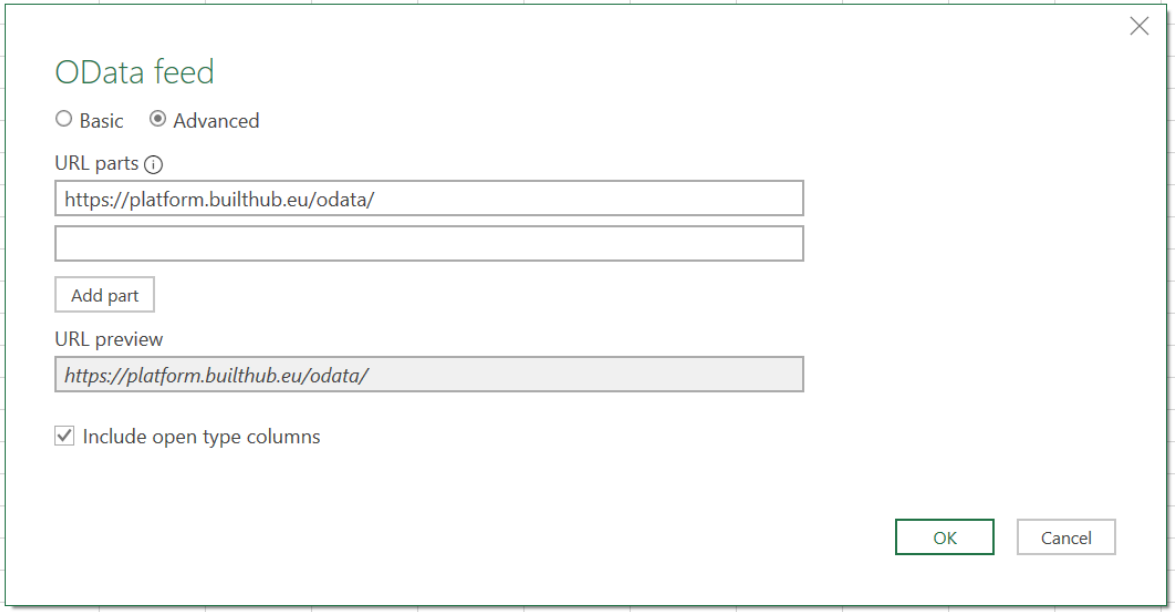
Integration

Data can be retrieved using a machine-machine system. For BuiltHub platform, an Application Programming Interface (API) Restful web service has been developed. This system allows to retrieve the desired data in different formats: JSON, CSV or TSV.

It is necessary to build and save the desired query in the SPARQL Editor so this service can retrieve that data. There are two ways to obtain this data from a business intelligence software such as excel. These two ways are either with OData or directly using a web url.

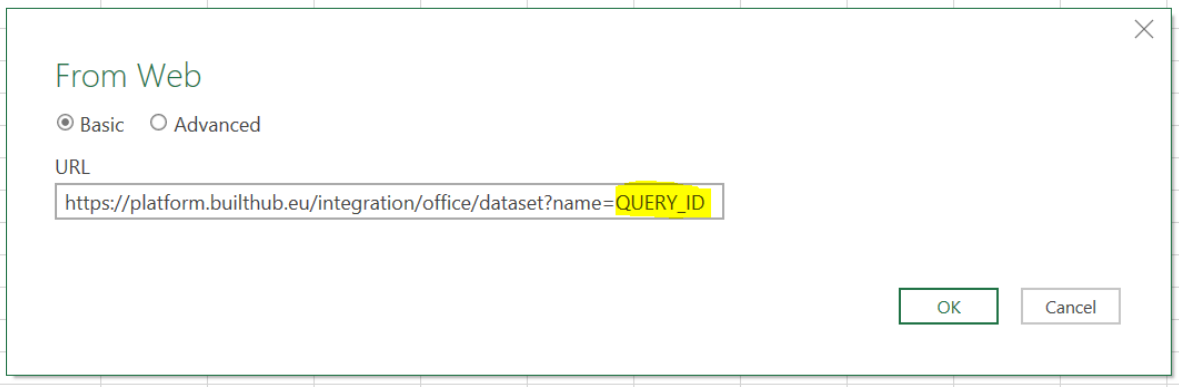
Integration (OData)

The first form we are going to cover is using OData. First, go to “Data” in excel and select “Get Data”, next click on “From Other Sources” and finally “From OData Feed”. A window will pop up. Go to “Advanced” and introduce the following url https://platform.builthub.eu/odata/ and check the last option (include open type columns).



Integration (Web URL)

The process will be similar, “Data”, “Get Data”, “From Other Sources” and in this case “From Web”. In the popped-up window you need to introduce this url https://platform.builthub.eu/integration/office/dataset?name= . Here you need to indicate at the end the name of the query of the data you want to import. Remember to include the id of the query which will be showed on the tooltip when going through the list of the sample queries.



BuiltHub

Dashboards

Dashboards & Storylines

Nowadays, the BuiltHub platform allows working with the following dashboards:

- European Union CO2 Emissions
- European Union Energy Consumption
- European Union Building Areas (Advanced)
- European Union Space Heating Comparison
- European Union Geoinformation Sample
- Renovation Graphs
- BeReel
- European Union Territorial-Unit Consumption
- Swedish Case
- ML Method

Dashboards: European Union CO2 Emissions

Country *
Austria, Belgium, Bulgaria

Groups *

Years *
2015, 2016, 2017, 2018

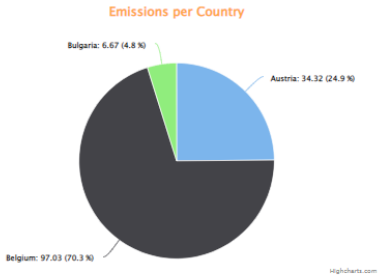
Indicator Name *
CO2bySector

Sector *
Buildings

Country	NUTS	Sector	Indicator Name	Period	Value
Austria	AT	Buildings	CO2bySector	2015	8.31
Austria	AT	Buildings	CO2bySector	2016	8.42
Austria	AT	Buildings	CO2bySector	2017	8.84
Austria	AT	Buildings	CO2bySector	2018	8.75
Belgium	BE	Buildings	CO2bySector	2015	24.42
Belgium	BE	Buildings	CO2bySector	2016	23.92
Belgium	BE	Buildings	CO2bySector	2017	24.10
Belgium	BE	Buildings	CO2bySector	2018	24.59
Bulgaria	BG	Buildings	CO2bySector	2015	1.57
Bulgaria	BG	Buildings	CO2bySector	2016	1.68
Bulgaria	BG	Buildings	CO2bySector	2017	1.76
Bulgaria	BG	Buildings	CO2bySector	2018	1.66

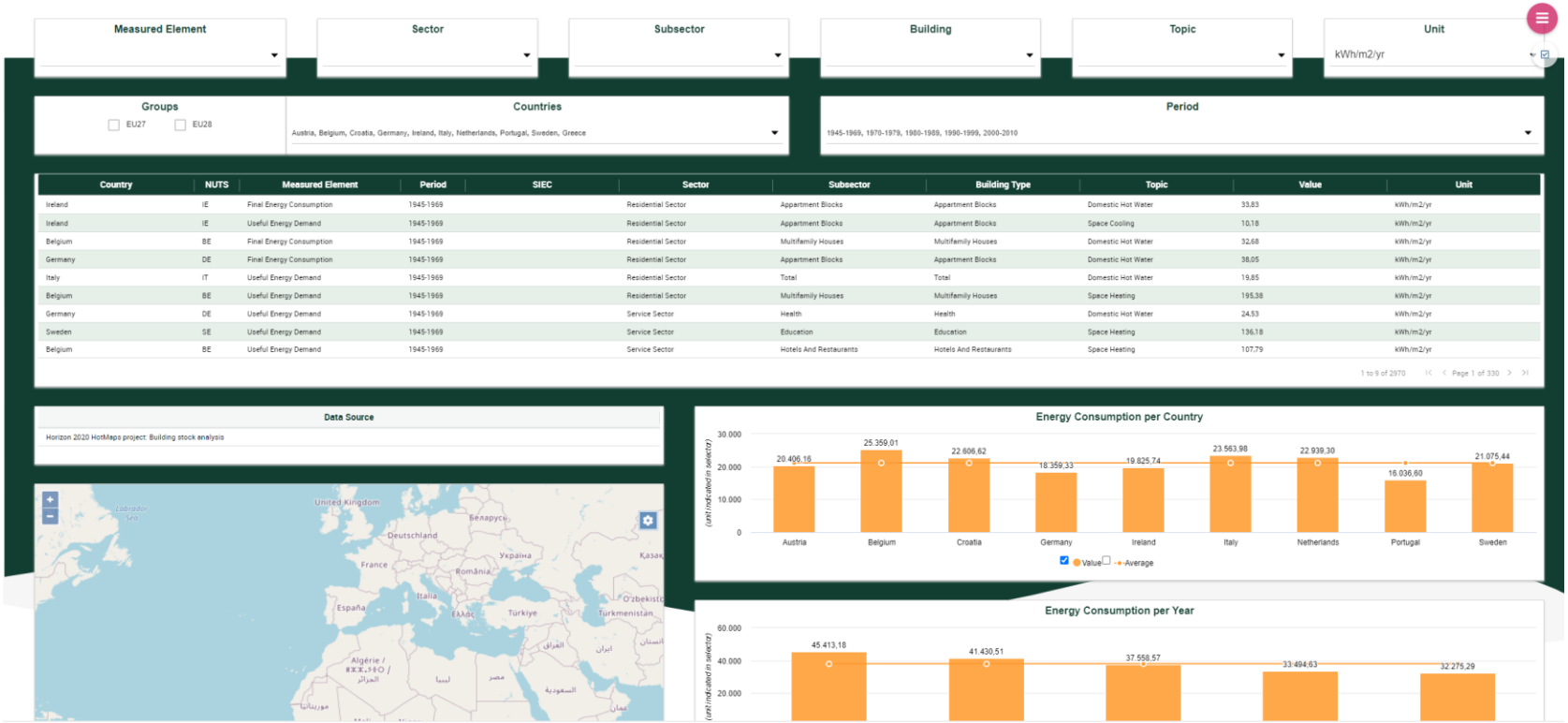
« Previous 1 Next »

Data Soruce
EDGAR (Emissions Database for Global Atmospheric Research) CO2 Emissions

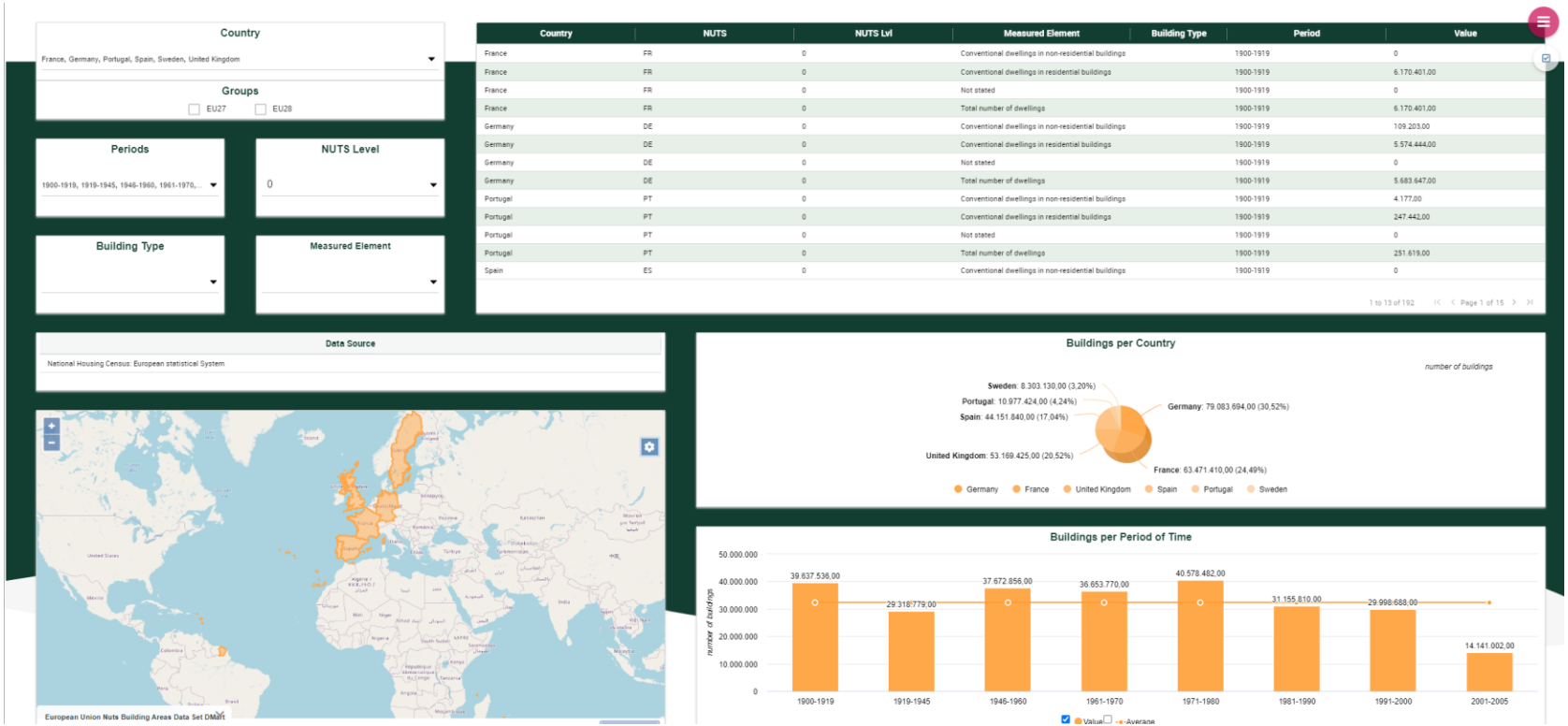


Emissions per Year and Sector

Dashboards: European Union Energy Consumption



Dashboards: European Union Building Areas (Advanced)



Country	NUTS	NUTS Lvl	Measured Element	Building Type	Period	Value
France	FR	0	Conventional dwellings in non-residential buildings		1900-1919	0
France	FR	0	Conventional dwellings in residential buildings		1900-1919	6.170.401,00
France	FR	0	Not stated		1900-1919	0
France	FR	0	Total number of dwellings		1900-1919	6.170.401,00
Germany	DE	0	Conventional dwellings in non-residential buildings		1900-1919	109.203,00
Germany	DE	0	Conventional dwellings in residential buildings		1900-1919	5.574.444,00
Germany	DE	0	Not stated		1900-1919	0
Germany	DE	0	Total number of dwellings		1900-1919	5.683.647,00
Portugal	PT	0	Conventional dwellings in non-residential buildings		1900-1919	4.177,00
Portugal	PT	0	Conventional dwellings in residential buildings		1900-1919	247.442,00
Portugal	PT	0	Not stated		1900-1919	0
Portugal	PT	0	Total number of dwellings		1900-1919	251.619,00
Spain	ES	0	Conventional dwellings in non-residential buildings		1900-1919	0

1 to 13 of 192 Page 1 of 15

Dashboards: European Union Space Heating Comparison

Country	NUTS	Measured Element	Sector	Year	Value	Unit
Austria	AT	Space heating unit consump	TOTAL	2008	4.994,79	kWh/individual
Belgium	BE	Space heating unit consump	TOTAL	2008	5.755,20	kWh/individual
Bulgaria	BG	Space heating unit consump	TOTAL	2008	1.677,11	kWh/individual
Cyprus	CY	Space heating unit consump	TOTAL	2008	1.223,34	kWh/individual
Denmark	DK	Space heating unit consump	TOTAL	2008	6.065,77	kWh/individual
Estonia	EE	Space heating unit consump	TOTAL	2008	4.036,50	kWh/individual
Finland	FI	Space heating unit consump	TOTAL	2008	5.602,60	kWh/individual
France	FR	Space heating unit consump	TOTAL	2008	5.245,85	kWh/individual
Hungary	HU	Space heating unit consump	TOTAL	2008	3.444,35	kWh/individual
Ireland	IE	Space heating unit consump	TOTAL	2008	4.126,32	kWh/individual
Italy	IT	Space heating unit consump	TOTAL	2008	2.615,90	kWh/individual
Latvia	LV	Space heating unit consump	TOTAL	2008	4.533,37	kWh/individual
Lithuania	LT	Space heating unit consump	TOTAL	2008	4.000,72	kWh/individual
Netherlands	NL	Space heating unit consump	TOTAL	2008	3.927,26	kWh/individual
Poland	PL	Space heating unit consump	TOTAL	2008	3.445,21	kWh/individual

1 to 15 of 21 | Page 1 of 2

Country	NUTS	Measured Elem...	Sector	Topic	Year	Value	Unit
Austria	AT	Final Energy Consumptio	Residential Sector	Space Heating	1945-1969	748,58	kWh/m2/yr
Austria	AT	Final Energy Consumptio	Residential Sector	Space Heating	1970-1979	699,80	kWh/m2/yr
Austria	AT	Final Energy Consumptio	Residential Sector	Space Heating	1980-1989	574,70	kWh/m2/yr
Austria	AT	Final Energy Consumptio	Residential Sector	Space Heating	1990-1999	510,63	kWh/m2/yr
Austria	AT	Final Energy Consumptio	Residential Sector	Space Heating	2000-2010	468,44	kWh/m2/yr
Belgium	BE	Final Energy Consumptio	Residential Sector	Space Heating	1945-1969	1.257,06	kWh/m2/yr
Belgium	BE	Final Energy Consumptio	Residential Sector	Space Heating	1970-1979	1.096,66	kWh/m2/yr
Belgium	BE	Final Energy Consumptio	Residential Sector	Space Heating	1980-1989	947,95	kWh/m2/yr
Belgium	BE	Final Energy Consumptio	Residential Sector	Space Heating	1990-1999	522,63	kWh/m2/yr
Belgium	BE	Final Energy Consumptio	Residential Sector	Space Heating	2000-2010	606,06	kWh/m2/yr
Bulgaria	BG	Final Energy Consumptio	Residential Sector	Space Heating	1945-1969	400,16	kWh/m2/yr
Bulgaria	BG	Final Energy Consumptio	Residential Sector	Space Heating	1970-1979	369,45	kWh/m2/yr
Bulgaria	BG	Final Energy Consumptio	Residential Sector	Space Heating	1980-1989	275,72	kWh/m2/yr
Bulgaria	BG	Final Energy Consumptio	Residential Sector	Space Heating	1990-1999	313,39	kWh/m2/yr
Bulgaria	BG	Final Energy Consumptio	Residential Sector	Space Heating	2000-2010	240,65	kWh/m2/yr

1 to 15 of 135 | Page 1 of 9

Sector

TOTAL

IEE ENTRANZE data originally had a measurement unit of kWh/dw. To archive the new data and measurement unit (kWh/individual) a calculation is needed to be performed. This new calculation is made dividing the space heating consumption of IEE ENTRANZE by the averague number of persons in a household provided by EUROSTAT.

M. Element

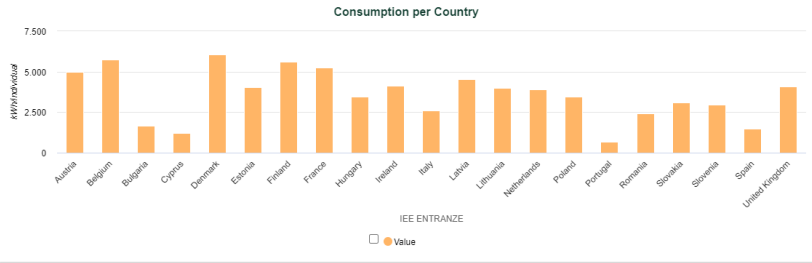
Final Energy Consumption

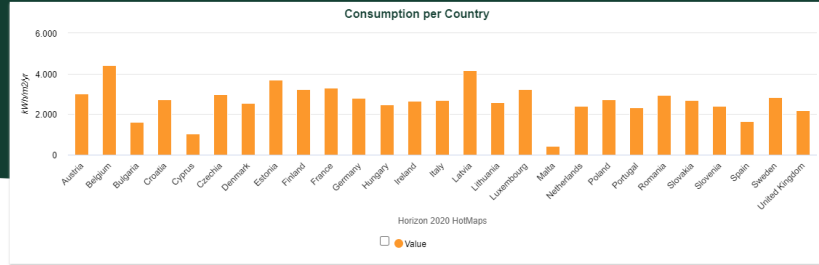
Sector

Residential Sector

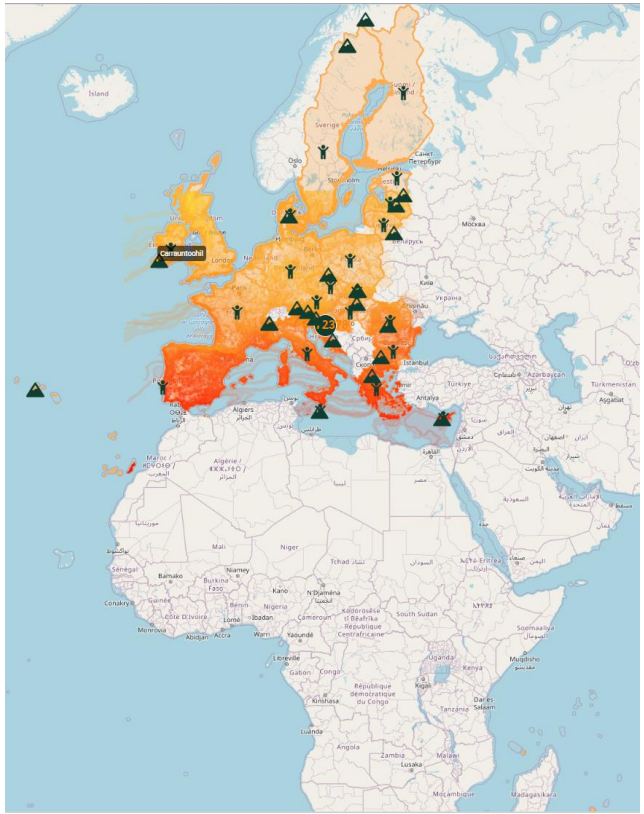
Topic

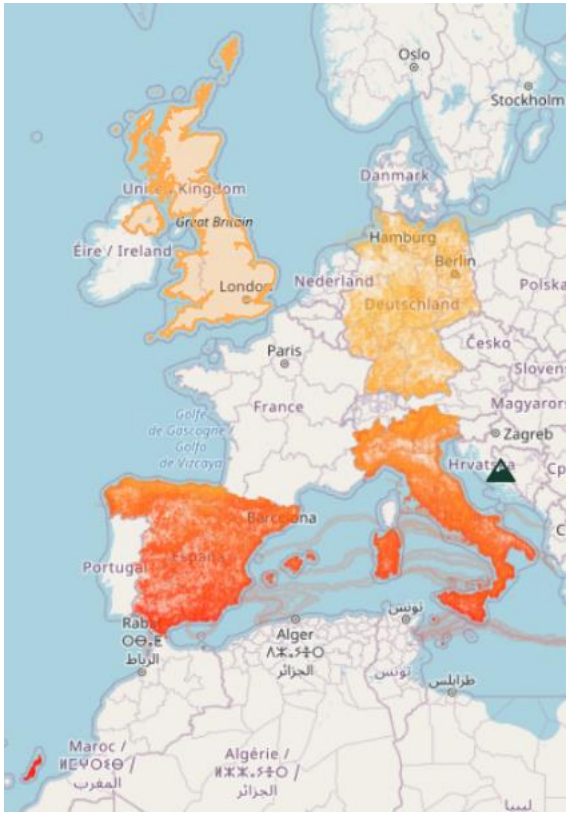
Space Heating



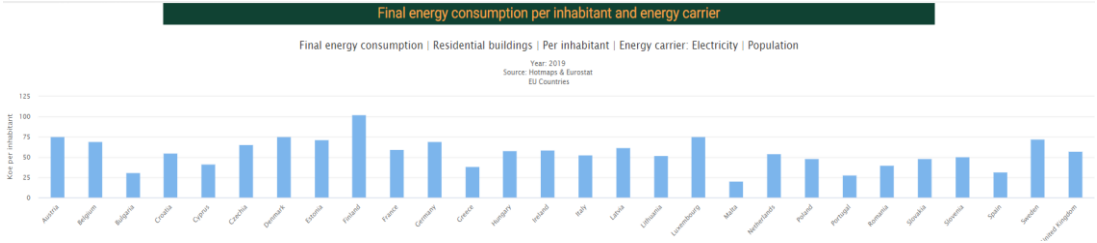


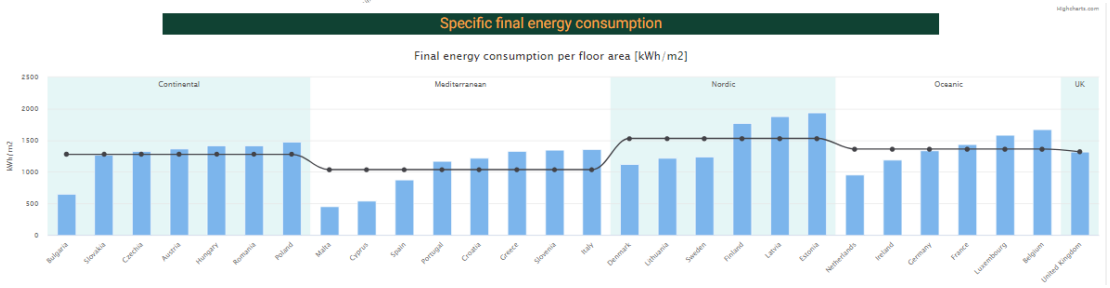
Dashboards: European Union Geoinformation Sample

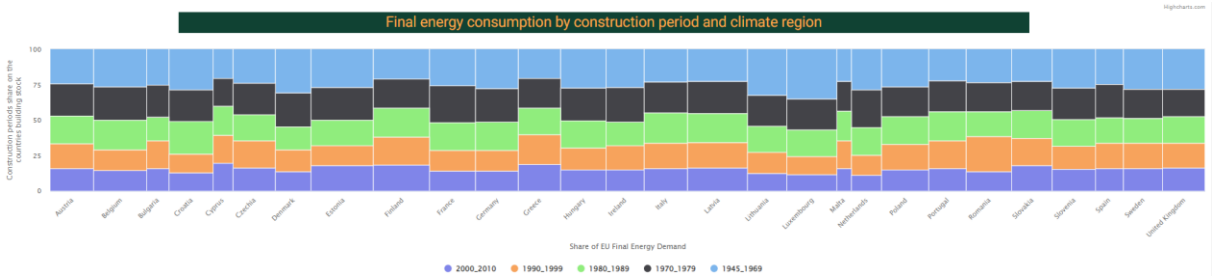




Storylines: Renovation Graphs



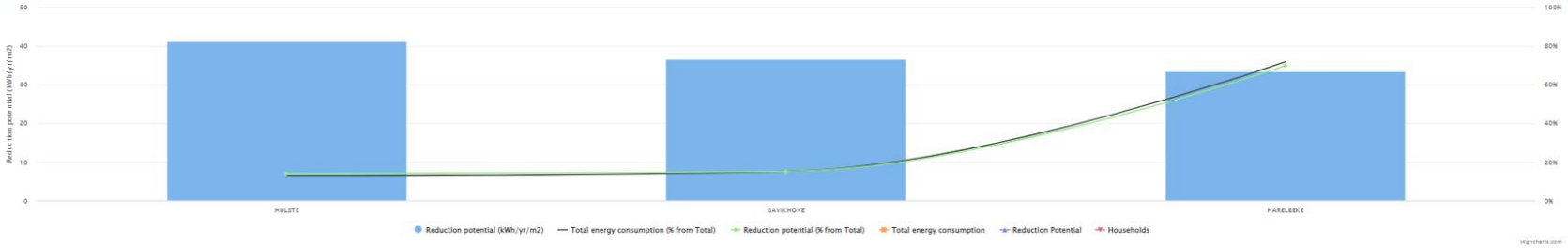




Storylines: BeReel

1.2 Number of housing units, average floor area, energy consumption and reduction potential per district

District	Houses	Average floor area (m2)	Total floor area (m2)	Specific energy consumption (kWh/m2)	Total adjusted energy consumption (MWh/yr)	Total calibrated energy consumption (MWh/yr)	Reduction potential (MWh/yr)
BAVIKHOVE	1631	157	270431	142	36936	48385	9931
HULSTE	1496	156	233212	145	32890	47476	9618
HARELBEKE	10006	144	1372744	138	182914	222587	46064
Total	**13133**	**148**	**1876387**	**140**	**252740**	**318448**	**65613**



1.3 Energy consumption and reduction potential by district (cartographic representation)

Select sectors or districts to visualize them on the map

Sectors Districts

Storylines: European Union Territorial-Unit Consumption

Country	Sector	Building Type	Feature	Topic Type	Consumption	Unit	Territorial-Unit Consumpti...	Region/country	NUTS Lvl Region	Population	Country Population	Year
Austria	Residential Sector	Appartment Blocks	Total Final Energy Consumption	Space Heating+Domestic Hot Water	9.2449	TWh/yr	0.3077	Burgenland (AT)	2	NaN.000000000000000000	NaN.000000000000000000	2017
Austria	Residential Sector	Appartment Blocks	Total Final Energy Consumption	Space Heating+Domestic Hot Water	9.2449	TWh/yr	0.3067	Burgenland (AT)	2	NaN.000000000000000000	NaN.000000000000000000	2018
Austria	Residential Sector	Appartment Blocks	Total Final Energy Consumption	Space Heating+Domestic Hot Water	9.2449	TWh/yr	0.3062	Burgenland (AT)	2	NaN.000000000000000000	NaN.000000000000000000	2019
Austria	Residential Sector	Appartment Blocks	Total Final Energy Consumption	Space Heating+Domestic Hot Water	9.2449	TWh/yr	0.3058	Burgenland (AT)	2	NaN.000000000000000000	NaN.000000000000000000	2020
Austria	Residential Sector	Appartment Blocks	Total Final Energy Consumption	Space Heating+Domestic Hot Water	9.2449	TWh/yr	0.3064	Burgenland (AT)	2	NaN.000000000000000000	NaN.000000000000000000	2021
Austria	Residential Sector	Appartment Blocks	Total Final Energy Consumption	Space Heating+Domestic Hot Water	9.2449	TWh/yr	0.5913	Kärnten	2	NaN.000000000000000000	NaN.000000000000000000	2017
Austria	Residential Sector	Appartment Blocks	Total Final Energy Consumption	Space Heating+Domestic Hot Water	9.2449	TWh/yr	0.5878	Kärnten	2	NaN.000000000000000000	NaN.000000000000000000	2018
Austria	Residential Sector	Appartment Blocks	Total Final Energy Consumption	Space Heating+Domestic Hot Water	9.2449	TWh/yr	0.5854	Kärnten	2	NaN.000000000000000000	NaN.000000000000000000	2019
Austria	Residential Sector	Appartment Blocks	Total Final Energy Consumption	Space Heating+Domestic Hot Water	9.2449	TWh/yr	0.5830	Kärnten	2	NaN.000000000000000000	NaN.000000000000000000	2020
Austria	Residential Sector	Appartment Blocks	Total Final Energy Consumption	Space Heating+Domestic Hot Water	9.2449	TWh/yr	0.5817	Kärnten	2	NaN.000000000000000000	NaN.000000000000000000	2021

1 to 10 of 495 Page 1 of 50

Country: Austria

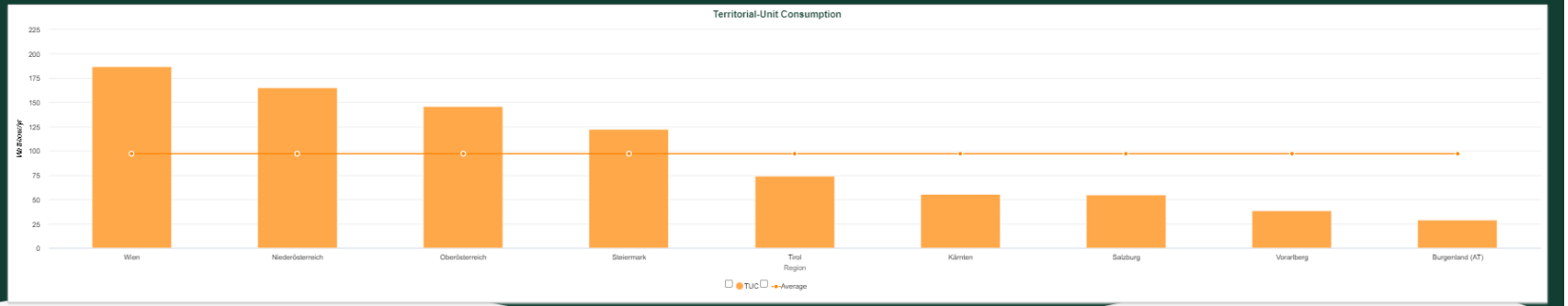
Feature: Total Final Energy Consumption

Consumption Type: Space Heating+Domestic Hot Water

Region:

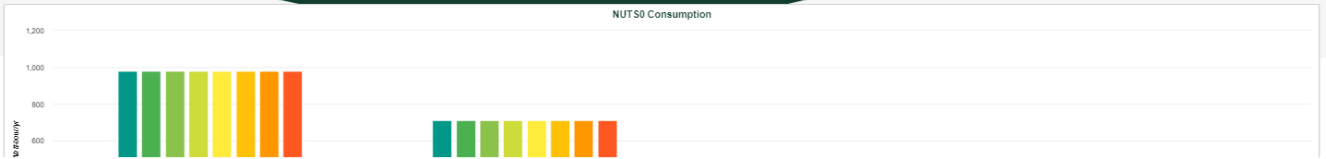
NUTS Lvl Region: 2

Year: 2017, 2018, 2019, 2020, 2021



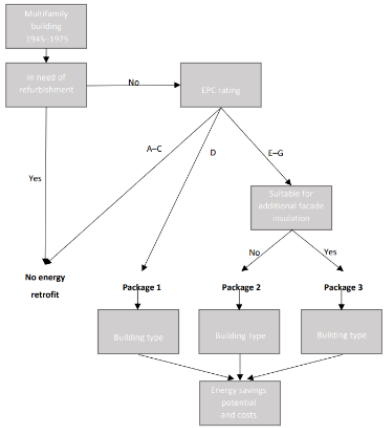
Country: Belgium, France, Italy, Spain

Feature: Total Final Energy Consumption



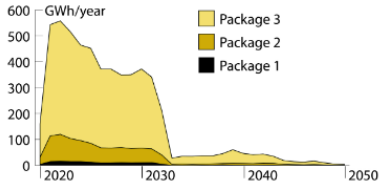
Dashboards: Swedish case

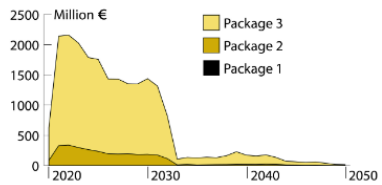
Decision tree showing how four building characteristics can help determine a tailored energy



This image provides an example of how enriched building databases can be applied to generate more accurate energy retrofitting strategies that can be used for policy purposes such as in the long-term renovation strategy, and also showcases how building-specific information can be used in decision trees for different energy retrofitting packages.
This decision tree is based on the notions that energy retrofitting should be carried out along with other planned refurbishment measures in a "window of opportunity", and that the overall objective is to transform existing buildings into nearly zero-energy buildings, in accordance with the objective of the long-term renovation strategy.
Based on these notions, it can be seen in the model that recently renovated buildings cases where the window of opportunity has been missed, are excluded from energy retrofitting. Likewise, buildings that already fulfil the requirements of nearly zero-energy buildings (EPC rating A–C) are also excluded from energy retrofitting. Buildings that have not been recently renovated and with the EPC rating D are allocated energy retrofitting package 1.
Finally, buildings that have not been recently renovated and with an EPC rating between E–G are allocated energy retrofitting package 2 or 3 depending on their suitability for additional facade insulation, which is part of energy retrofitting package 3.

The figure shows yearly, cumulative: (a) Energy savings potential from the different energy retrofitting packages and (b) The associated cost





ML Method

Please select at least one training dataset

Training dataset *
Weather data

Objective areas	Description	Aggregation level / Building category	Algorithm	Algorithm description	Streangth	Weakness	Reference
Climatic conditions	Predicting multiple building energy loads and BIPV power production	General buildings	Support vector machine (SVM)	Linear and non-linear classifiers that projected the categorical data in space and determined their categories based on the gap	Capable to handle high dimensional data	Hard to choose the penalty variable. Hard to choose the kernel	Luo XJ Oyedele LO Ajayi AO Akinade OO. Comparative study of machine learning-based multi-objective prediction framework for multiple building energy loads. Sustainable Cities and Society. 2020;61(May):102283
Climatic conditions	Predicting multiple building energy loads and BIPV power production	General buildings	Artificial Neural Network (ANN)	An interconnected linear and non-linear neuron-like structure that classifies continuous and categorical variables	Deal with missing data. Parallel processing. Apply to various types of problems	i.e.	image and sound recognition text time seriesRequire strong computation power. Difficult to tune the model. Hard to understand the behavior of the networkLuo XJ Oyedele LO Ajayi AO Akinade OO. Comparative study of machine learning-based multi-objective prediction framework for multiple building energy loads. Sustainable Cities and Society. 2020;61(May):102283

Training dataset *
Reinforcement learning

Objective areas	Description	Aggregation level / Building category	Algorithm	Algorithm description	Streangth	Weakness	Reference
Hourly weather data	Comfort	Achieving optimal control of HVAC and window systems for natural ventilation	Citywide/ Residential buildings	Optimal control for the closed-loop problems	Consider the whole problem and prevent local optimization	Trade-off between exploration and exploitation	Chen Y Norford LK Samuelson HW Malkawi A. Optimal control of HVAC and window systems for natural ventilation through reinforcement learning. Energy and Buildings. 2018;169:195-205
Building parameters	Comfort	Achieving optimal control of HVAC and window systems for natural ventilation	Citywide/ Residential buildings	Optimal control for the closed-loop problems	Consider the whole problem and prevent local optimization	Trade-off between exploration and exploitation	Chen Y Norford LK Samuelson HW Malkawi A. Optimal control of HVAC and window systems for natural ventilation through reinforcement learning. Energy and Buildings. 2018;169:195-205

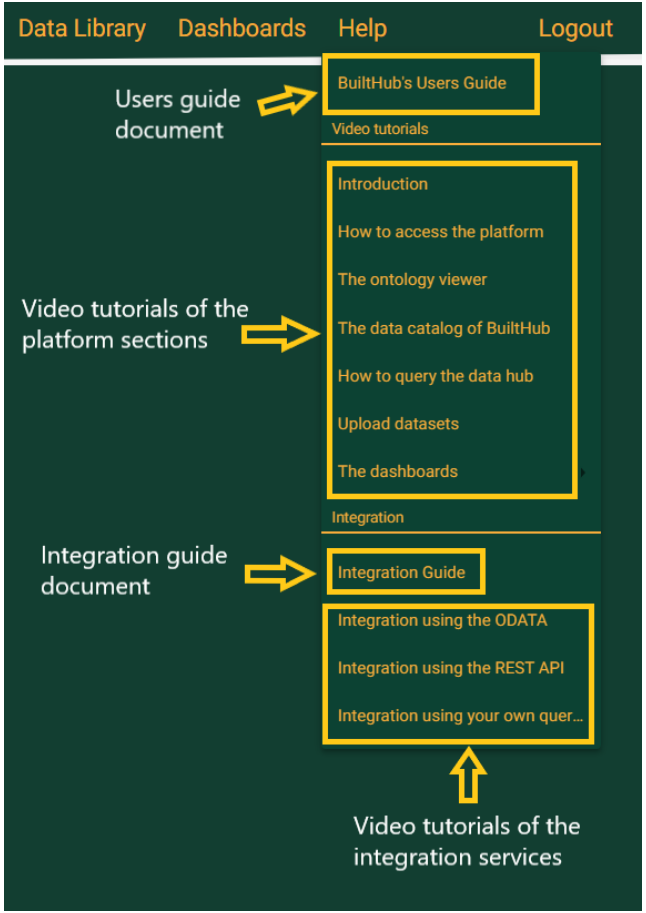
BuiltHub

Documentation and Guides

Documentation and Guides

We have created the first drafts of the Users Guide, Integration Guide as well as some video tutorials to help the user navigate through the platform.

This documents and video tutorials are easily findable in the Help section of the menu of the platform.




BPIE


CARTIF


NTT DATA


eurac
research


ICLEI
Local Governments
for Sustainability
EUROPE


RI.
SE


TEAM
sympraxis


TU
WIEN
TECHNISCHE
UNIVERSITÄT
WIEN
Vienna | Austria

BuiltHub

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