ANNEX 74

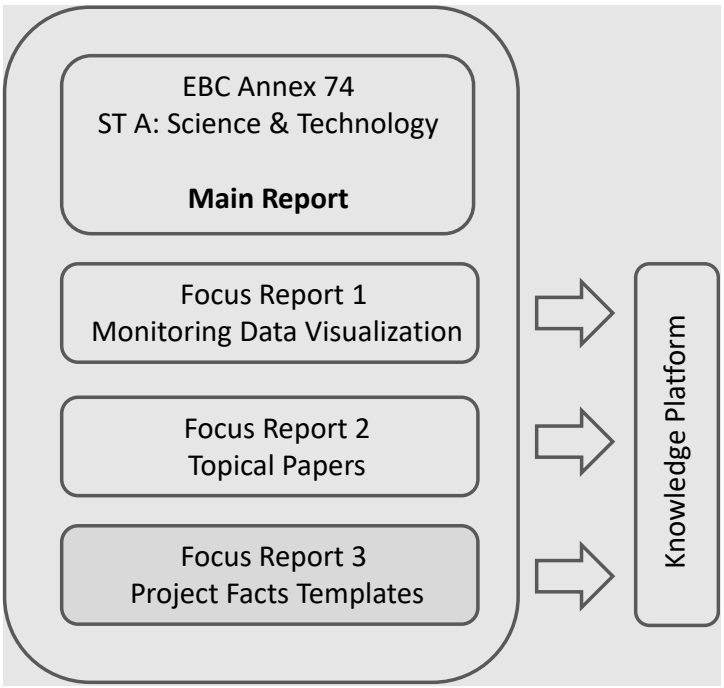
EBC
Energy in Building and Communities Programme

International Energy Agency

Competition and Living Lab Platform (Annex 74) Science & Technology (Subtask A) Focus Report 3: Project Facts Template

Energy in Buildings and Communities Technology Collaboration Programme

November 2021



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Energy in Buildings and Communities Programme

November 2021

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Preface

The International Energy Agency

The International Energy Agency (IEA) was established in 1974 within the framework of the Organisation for Economic Co-operation and Development (OECD) to implement an international energy programme. A basic aim of the IEA is to foster international co-operation among the 30 IEA participating countries and to increase energy security through energy research, development and demonstration in the fields of technologies for energy efficiency and renewable energy sources.

The IEA Energy in Buildings and Communities Programme

The IEA co-ordinates international energy research and development (R&D) activities through a comprehensive portfolio of Technology Collaboration Programmes. The mission of the IEA Energy in Buildings and Communities (IEA EBC) Technology Collaboration Programme is to develop and facilitate the integration of technologies and processes for energy efficiency and conservation into healthy, low emission, and sustainable buildings and communities, through innovation and research. (Until March 2013, the IEA EBC Programme was known as the IEA Energy Conservation in Buildings and Community Systems Programme, ECBCS.)

The R&D strategies of the IEA EBC Programme are derived from research drivers, national programmes within IEA countries, and the IEA Future Buildings Forum Think Tank Workshops. These R&D strategies aim to exploit technological opportunities to save energy in the buildings sector, and to remove technical obstacles to market penetration of new energy efficient technologies. The R&D strategies apply to residential, commercial, office buildings and community systems, and will impact the building industry in five areas of focus for R&D activities:

- Integrated planning and building design
- Building energy systems
- Building envelope
- Community scale methods
- Real building energy use

The Executive Committee

Overall control of the IEA EBC Programme is maintained by an Executive Committee, which not only monitors existing projects, but also identifies new strategic areas in which collaborative efforts may be beneficial. As the Programme is based on a contract with the IEA, the projects are legally established as Annexes to the IEA EBC Implementing Agreement. At the present time, the following projects have been initiated by the IEA EBC Executive Committee, with completed projects identified by (*) and joint projects with the IEA Solar Heating and Cooling Technology Collaboration Programme by (☼):

Annex 1:	Load Energy Determination of Buildings (*)
Annex 2:	Ekistics and Advanced Community Energy Systems (*)
Annex 3:	Energy Conservation in Residential Buildings (*)
Annex 4:	Glasgow Commercial Building Monitoring (*)
Annex 5:	Air Infiltration and Ventilation Centre
Annex 6:	Energy Systems and Design of Communities (*)
Annex 7:	Local Government Energy Planning (*)
Annex 8:	Inhabitants Behaviour with Regard to Ventilation (*)
Annex 9:	Minimum Ventilation Rates (*)
Annex 10:	Building HVAC System Simulation (*)
Annex 11:	Energy Auditing (*)
Annex 12:	Windows and Fenestration (*)
Annex 13:	Energy Management in Hospitals (*)

Annex 14:	Condensation and Energy (*)
Annex 15:	Energy Efficiency in Schools (*)
Annex 16:	BEMS 1- User Interfaces and System Integration (*)
Annex 17:	BEMS 2- Evaluation and Emulation Techniques (*)
Annex 18:	Demand Controlled Ventilation Systems (*)
Annex 19:	Low Slope Roof Systems (*)
Annex 20:	Air Flow Patterns within Buildings (*)
Annex 21:	Thermal Modelling (*)
Annex 22:	Energy Efficient Communities (*)
Annex 23:	Multi Zone Air Flow Modelling (COMIS) (*)
Annex 24:	Heat, Air and Moisture Transfer in Envelopes (*)
Annex 25:	Real time HVAC Simulation (*)
Annex 26:	Energy Efficient Ventilation of Large Enclosures (*)
Annex 27:	Evaluation and Demonstration of Domestic Ventilation Systems (*)
Annex 28:	Low Energy Cooling Systems (*)
Annex 29:	Daylight in Buildings (*)
Annex 30:	Bringing Simulation to Application (*)
Annex 31:	Energy-Related Environmental Impact of Buildings (*)
Annex 32:	Integral Building Envelope Performance Assessment (*)
Annex 33:	Advanced Local Energy Planning (*)
Annex 34:	Computer-Aided Evaluation of HVAC System Performance (*)
Annex 35:	Design of Energy Efficient Hybrid Ventilation (HYBVENT) (*)
Annex 36:	Retrofitting of Educational Buildings (*)
Annex 37:	Low Exergy Systems for Heating and Cooling of Buildings (LowEx) (*)
Annex 38:	Solar Sustainable Housing (*)
Annex 39:	High Performance Insulation Systems (*)
Annex 40:	Building Commissioning to Improve Energy Performance (*)
Annex 41:	Whole Building Heat, Air and Moisture Response (MOIST-ENG) (*)
Annex 42:	The Simulation of Building-Integrated Fuel Cell and Other Cogeneration Systems (FC+COGEN-SIM) (*)
Annex 43:	Testing and Validation of Building Energy Simulation Tools (*)
Annex 44:	Integrating Environmentally Responsive Elements in Buildings (*)
Annex 45:	Energy Efficient Electric Lighting for Buildings (*)
Annex 46:	Holistic Assessment Tool-kit on Energy Efficient Retrofit Measures for Government Buildings (EnERGo) (*)
Annex 47:	Cost-Effective Commissioning for Existing and Low Energy Buildings (*)
Annex 48:	Heat Pumping and Reversible Air Conditioning (*)
Annex 49:	Low Exergy Systems for High Performance Buildings and Communities (*)
Annex 50:	Prefabricated Systems for Low Energy Renovation of Residential Buildings (*)
Annex 51:	Energy Efficient Communities (*)
Annex 52:	Towards Net Zero Energy Solar Buildings (*)
Annex 53:	Total Energy Use in Buildings: Analysis and Evaluation Methods (*)
Annex 54:	Integration of Micro-Generation and Related Energy Technologies in Buildings (*)
Annex 55:	Reliability of Energy Efficient Building Retrofitting - Probability Assessment of Performance and Cost (RAP-RETRO) (*)
Annex 56:	Cost Effective Energy and CO2 Emissions Optimization in Building Renovation (*)
Annex 57:	Evaluation of Embodied Energy and CO2 Equivalent Emissions for Building Construction (*)
Annex 58:	Reliable Building Energy Performance Characterisation Based on Full Scale Dynamic Measurements (*)
Annex 59:	High Temperature Cooling and Low Temperature Heating in Buildings (*)
Annex 60:	New Generation Computational Tools for Building and Community Energy Systems (*)
Annex 61:	Business and Technical Concepts for Deep Energy Retrofit of Public Buildings (*)
Annex 62:	Ventilative Cooling (*)
Annex 63:	Implementation of Energy Strategies in Communities (*)
Annex 64:	LowEx Communities - Optimised Performance of Energy Supply Systems with Exergy Principles (*)
Annex 65:	Long-Term Performance of Super-Insulating Materials in Building Components and Systems
Annex 66:	Definition and Simulation of Occupant Behavior in Buildings (*)

Annex 67:	Energy Flexible Buildings (*)
Annex 68:	Indoor Air Quality Design and Control in Low Energy Residential Buildings (*)
Annex 69:	Strategy and Practice of Adaptive Thermal Comfort in Low Energy Buildings
Annex 70:	Energy Epidemiology: Analysis of Real Building Energy Use at Scale
Annex 71:	Building Energy Performance Assessment Based on In-situ Measurements
Annex 72:	Assessing Life Cycle Related Environmental Impacts Caused by Buildings
Annex 73:	Towards Net Zero Energy Resilient Public Communities
Annex 74:	Competition and Living Lab Platform
Annex 75:	Cost-effective Building Renovation at District Level Combining Energy Efficiency and Renewables
Annex 76:	Deep Renovation of Historic Buildings towards Lowest Possible Energy Demand and CO2 Emissions
Annex 77:	Integrated Solutions for Daylight and Electric Lighting
Annex 78:	Supplementing Ventilation with Gas-phase Air Cleaning, Implementation and Energy Implications
Annex 79:	Occupant Behaviour-Centric Building Design and Operation
Annex 80:	Resilient Cooling of Buildings
Annex 81:	Data-Driven Smart Buildings
Annex 82:	Energy Flexible Buildings towards Resilient Low Carbon Energy Systems
Annex 83:	Positive Energy Districts
Annex 84:	Demand Management of Buildings in Thermal Networks
Annex 85:	Indirect Evaporative Cooling
Annex 86:	Energy Efficient Indoor Air Quality Management in Residential Buildings

Working Group - Energy Efficiency in Educational Buildings (*)
Working Group - Indicators of Energy Efficiency in Cold Climate Buildings (*)
Working Group - Annex 36 Extension: The Energy Concept Adviser (*)
Working Group - HVAC Energy Calculation Methodologies for Non-residential Buildings (*)
Working Group - Cities and Communities (*)
Working Group - Building Energy Codes

Summary

The Annex 74 „Competition and Living Lab Platform“ ran between January 2018 und June 2021 within the Energy in Buildings and Communities Technology Collaboration Programme (EBC) of the International Energy Agency[1]. Annex 74 was intended as a platform mapping and linking the building competition and living lab experiences worldwide and working towards further improving existing as well as developing new formats. Annex 74 should stimulate the technological knowledge, the scientific level and the architectural quality within future competitions and living labs based on the development of a systematic knowledge platform as well as on the link to expertise from previous and current IEA activities[2]. A total of eleven experts from nine countries participated in this small Annex with varying degrees of intensity.

Four documents were produced as a result of subtask A "Science and Technology". This report is the main deliverable. This document is supplemented by three so-called focus reports:

- The focus report "Monitoring Data Visualization" contains for a better overview the graphical processing of the measurement data collected within four past Solar Decathlon competitions.
- The report under the title "Topical Papers" contains a set of thematic in-depth papers that link typical topics of the Solar Decathlon with research and practice issues, pointing out connections to IEA research networks.
- The documentation "Project Facts Template" presents a newly developed data collection structure for the quantitative data of buildings in a competition.

The focus report “Project Facts Template” contains a series of templates designed for summarizing quantitative information on competition buildings. Design, planning and implementation of the contributions to a building competition such as the Solar Decathlon are a continuous process during the whole competition. A number of characteristic facts and indicators of the buildings are created, which identify in detail their properties and expectations. It is target of the template to systematically record and update the project facts and indicators for the buildings and technical systems. The template is linked to a systematic structure of all relevant data sheets of the products applied.

In SDE 21/22 teams are working on the level of the Design Challenge (DC, level of overall building, not to be built) as well as the House Demonstration Unit (HDU, built on-site). Data are separately required for both levels within separate tables. The requested information for the House Demonstration Unit is more in-depth. With each deliverable, the level of information on project facts increases and corrections can be applied. The latest version is valid. In particular with the last deliverable, the built status of the demonstration unit is recorded, while at the beginning the focus is more on the design challenge.

The templates shown in this report are printed based on a MS Excel application and use exemplary data entries. The empty template is made downloadable for adaptation for future competitions via the knowledge platform[2].

[1] https://annex74.iea-ebc.org/

[2] www.building-competition.org

Table of content

1. Overview Templates

Introduction

SDE21 Project Facts V 2.0 16.02.2021

Collection and management of SDE21 Project Facts

Introduction

Design, planning and implementation of the contributions to the Solar Decathlon Europe 2021 (SDE21) are a continuous process during the Competition. A number of characteristic facts and indicators of the buildings are created, which identify in detail their properties and expectations.
The template "Project Facts" is part of all Deliverables, starting with Deliverable #2. It adds to the manual and drawings. It is targeted to systematically record and update the Project Facts and indicators, for the buildings and the technical systems level.
With each Deliverable, the level of information with the Project Facts template increases and corrections can be applied. The latest version is valid. In particular with Deliverable #7 the built status of the House Demonstration Unit is recorded, while at the beginning the focus is more on the Design Challenge.

Note: The template is relevant for the Contests 'Architecture', 'Engineering & Construction', 'Affordability & Viability', 'House Functioning' and 'Urban Mobility'. The input will be checked in all REVIEW reports. The final version will be made available for the Jury process.

Background

In the context of international projects, researchers have investigated the documentation and analysis of previous Competitions. The 'Knowledge Platform' (building-competition.org) is one of the essential results. The work turned out to be complex, especially because quantitative information on Competition houses was hidden in extensive Project Manuals. Due to the lengthy work-package, some contradictions in the information have occurred.
The template created for the SDE21 is an outcome of common investigation and discussion within Annex 74 of the Energy in Buildings and Communities Programme of the International Energy Agency (IEA): annex74.iea-ebc.org. The template should assist the Teams in their systematic and continous documentation work. It asisits the SDE21 Organisers and the Jury toward a clear and objective understanding of the project.

After the SDE21, cross-sectional analyses can be performed based on a consistant information sampling structure. This might be subject of student seminars, journal papers or doctoral theses. The House Demonstration Units are very suitable as examples for education and training in the field of building simulation and as case studies for BIM.

Structure

In the SDE21 Teams are working on the level of the Design Challenge (DC, level of overall building, not to be built) as well as the House Demonstration Unit (HDU, built on-site). Specific data sets within distinct tables are required for both levels. In all urban situations except "closing gaps" the information for the DC covers the existing building as well. The requested information for the HDU is more in-depth and is connected to product sheets for each of the technical systems applied with more detailed information. These product sheets will be part of a platform with uniform document descriptions and file denomination. For better readability, some detailed sections are hidden but can be opened on demand to finalise the input. Integrated, automaticaly updated graphs allow for a quick visual check of the inputs. All fields except the white input fileds are password protected to maintain consistency.

Instruction

	Yellow sheets concern the whole project
	Pink sheets concern the Design Challenge
	Blue sheets concern the House Demonstration Unit
	Insert information or use dropdown
0	No input necessary: automatic calculation results or data transfer
▼	Further lines can be folded out

Note: Please contact us in the case of failures or problems with the template.

Authors

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Existing building or site

Source: Google Earth

Design challenge

Source: Universität der Künste Berlin

House Demonstration Unit

Source: Universität der Künste Berlin

Project overview

Team information

Deliverable No.	D#3	dropdown
Team ID	ROF	dropdown
City	Berlin	
Team name	Team ROOFTOP	
Project name	ROOFTOP	
Urban situation	Renovation & addition of storey	dropdown

Design Challenge - Profile

Country		Germany	
City		Berlin	
Street, house number		Waldenserstraße 15	dropdown
Geotag (Lat, Long)		52.528983, 13.332403	dropdown
Net floor area	m²	1056	
Conditioned net floor area	m²	856	

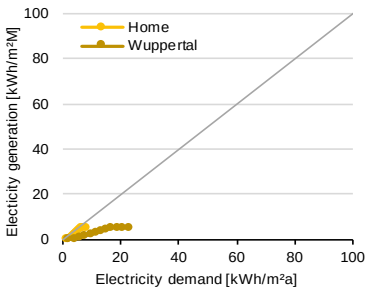
Area distribution

Fraction of conditioned net floor area refurbished/new

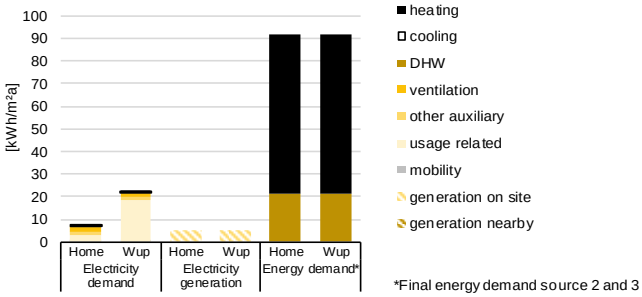
Utilization distibution based on conditioned net floor area

Energy Balance

Cumulative electricity Balance



Final energy balance



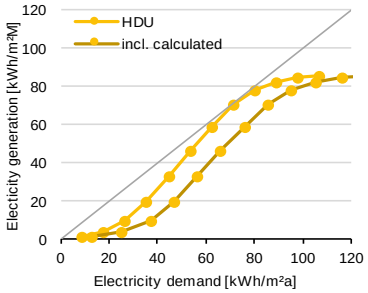
*Final energy demand source 2 and 3

House Demonstration Unit - Profile

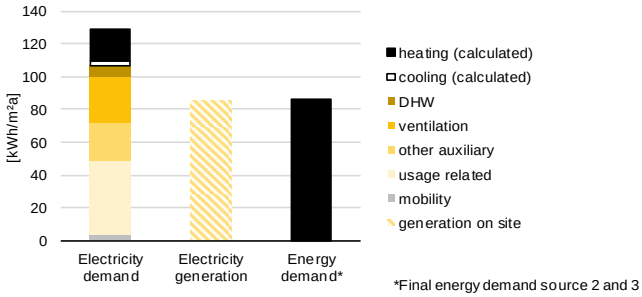
Location (City, Country)		Wuppertal, Germany
Location in the full building		Rooftop
Conditioned net floor area	m²	53,404

Energy Balance

Cumulative electricity Balance



Final energy balance



*Final energy demand source 2 and 3

2. Design Challenge Templates

Design Challenge • Existing Building

IEA EBC

Note: This sheet only deals with the entry of the **existing building** of the Design Challenge. If there is no existing building (urban situation: closing gaps), no entries are necessary here.

Urban Situation:		Renovation & addition of storey	

Specifications

Main typology		MFH - multi family house	dropdown
Building age class		before 1918	dropdown
Main geometry		L-form	dropdown
No. of storeys	#	6	
Main roof shape		Flat roof	dropdown

Dimensions

Area

Gross floor area	m²	1000
Net floor area	m²	800
Conditioned net floor area	m²	800
Footprint	m²	200

Volume

Conditioned gross volume	m³	3200

Residential occupation

Total Living space (WoFlV)*	m²	700
No. of occupants	#	28
No. of residential units	#	12
Living space / occupants	m²/person	25

*The living space is to be determined according to the German living space regulation ("Wohnflächenverordnung (WoFlV)"). Further information is available on the SDE21 WAT.

▼ Utilisation split

Note: The subdivision according to utilisation is based on rough utilisation types. The aim is not to record individual zones or rooms. Traffic areas etc. are to be assigned to the individual utilisations.

		Utilisation 1	Utilisation 2	Utilisation 3	Utilisation 4	Total	
Type of main utilisation		residential					dropdown
Net floor area	m²	800				800	
Ratio	%	100%	0%	0%	0%		

▼ Building envelope (conditioned volume only)

Note: Please sort roughly by main orientations.

		North	East	West	South	Horizontal	Total
Facades	m²	200	250	1000	650		2100
Windows	m²	40	50	200	0	0	290
Walls	m²	160	200	800	650		1810
Walls to unheated / ground	m²	50	20	20	30		120
Roof to ambient air	m²					300	300
Roof to unheated space	m²					0	0
Floor to ambient air	m²					0	0
Floor to unheated / ground	m²					200	200
Window Ratio	%	20%	20%	20%	0%	0%	

Indicators

External envelope	m²	2720,00
form factor A/V	1/m	0,85
Opaque area / CFA	m^2/m_{cfa}^2	3,04
Window area / CFA	m^2/m_{cfa}^2	0,36

▼ Thermal properties

		U-Value [W/m²K]	U x A x f_x * [W/K]
Walls			
to ambient air	f_x* = 1	1,25	2263
to ground/unheated space	f_x* = 0,5	1,1	66
Roof			
to ambient air	f_x* = 1	1,25	375
to unheated space	f_x* = 0,8	2	0
Floor			
to ambient air	f_x* = 1		0
to ground/unheated space	f_x* = 0,5	1,1	110
Windows			
total window U-value	f_x* = 1	3	870
		total	3684

Average U-value

Existing building

Σ(U x A x f_x) / A	W/m²K	1,35

*By the temperature correction factor f_x the heat flows of the different components are weighted.
f_x (walls; windows; roof to ambient air; floor to ambient air) = 1,0 | f_x (roof to unheated space) = 0,8 | f_x (walls to unheated space; floor to ground/unheated space) = 0,5

▼ Installations

	main energy source	main distribution system	
Space heating	natural gas	central heating, water based	dropdown
Space cooling	none	none	dropdown
Domestic hot water	natural gas	central without circulation	dropdown
Ventilation		windows only	dropdown

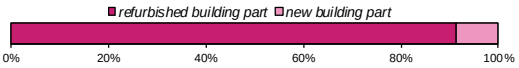
Note: This sheet refers to the planned building design in the course of the **Design Challenge**. Here, entries for all three urban situations are required. The overall building is recorded here. However, the data of the refurbished part and the new part of the building are often collected individually.

Project specification

Main typology		MFH - multi family house	dropdown
Main geometry		L-form	dropdown
No. of storeys	#	6	
Main roof shape		Flat roof	dropdown
Type of prefabrication		elements	dropdown

Project dimensions

		Refurbished building part	New building part	Overall building
Area				
Gross area	m²	1130	70	1200
Net floor area	m²	982	74	1056
Conditioned net floor area	m²	782	74	**856**
Ratio of conditioned floor area				
Property size	m²			500
Building footprint	m²			200
Volume				
Conditioned gross volume	m³	3200	150	3350
Residential occupation				
Living space (WoFlV)*	m²	700	82	782
No. of occupants	#	27	3	30
No. of residential units	#	12	1	13
Living space / occupants	m²/person	26	27	26



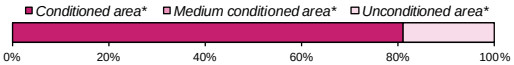
*The living space is to be determined according to the German living space regulation ("Wohnflächenverordnung (WoFlV)"). A document with information is available on the SDE21 WAT.

▼ Conditioned floor area (calculation)

Note: The conditioned net floor area (**CFA**) represents the energy reference area of the building. This is determined in the following, taking into account the intensity of thermal conditioning, similar to the procedure of the Passive House Standard. **Fully conditioned areas** are included in the calculation at **100%**, **medium conditioned areas** at **60%** and **unconditioned areas** at **0%**.

		Refurbished building part	New building part	Overall building
Fully conditioned area*				
All rooms that are fully conditioned, e.g. living spaces, corridors within appartments, office spaces, retail spaces, cafés etc.				
Area	m²	782	74	856
100% creditable	m²	782	74	856
Medium conditioned area*				
All areas that are indirectly or medium conditioned, but within the thermal envelope, e.g. ancillary rooms, corridors and stairs outside of appartments or in the basement.				
Area	m²			0
60% creditable	m²	0	0	0
Unconditioned area*				
All rooms outside the thermal envelope, e.g. some types of wintergardens and basements, garages, etc.				
Area	m²	200		200
0% creditable	m²	0	0	0
Total Net Floor Area	m²	982	74	1056
Total creditable **CFA**	m²	**782**	**74**	**856**

Chart: Ratio of thermal conditions



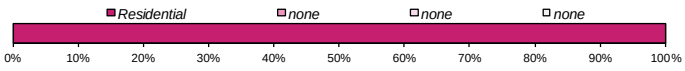
* net floor area

▼ Utilisation

Note: The subdivision according to utilisation is based on rough utilisation types. The aim is not to record individual zones or rooms. Traffic areas etc. are to be assigned to the individual utilisations.

		Utilisation 1	Utilisation 2	Utilisation 3	Utilisation 4	
Name of utilisation		Residential	none	none	none	dropdown
Net Floor Area	%	100%				
	m²	1056	0	0	0	
Ø Net room height	m	3,5				

Chart: Utilization distibution based on net floor area



▼ Building envelope (conditioned volume only)

Note: The areas determined here must be **gross areas** with external reference. If there are windows in the building facing unheated space (not to ambient air!), these must be included in walls to ground/unheaded space.

▼ Refurbished building part		North	East	West	South	Horizontal	Total
Facades	m²	200	250	1000	650		2100
Windows	m²	40	50	200	0	0	290
Walls	m²	160	200	800	650		1810
Walls to unheated / ground	m²	50	20	20	30		120
Roof to ambient air	m²					220	220
Roof to unheated space	m²					0	0
Floor to ambient air	m²					0	0
Floor to unheated / ground	m²					200	200
Window Ratio	%	20%	20%	20%	0%	0%	

▼ New building part		North	East	West	South	Horizontal	Total
Facades	m²	16,4	26,9	26,9	16,4		86,6
Windows	m²	0	26,9	26,9	0	0	53,8
Walls	m²	16,4	0	0	16,4		32,8
Walls to unheated / ground	m²	0	0	0	0		0
Roof to ambient air	m²					63,68	63,68
Roof to unheated space	m²					0	0
Floor to ambient air	m²					0	0
Floor to unheated / ground	m²					0	0
Window Ratio	%	0%	100%	100%	0%	0%	

▼ Overall building (results)		North	East	West	South	Horizontal	Total
Facades	m²	216,4	276,9	1026,9	666,4		2186,6
Windows	m²	40	76,9	226,9	0	0	343,8
Walls	m²	176,4	200	800	666,4		1842,8
Walls to unheadet / ground	m²	50	20	20	30		120
Roof to ambient air	m²					283,68	283,68
Roof to unheated space	m²					0	0
Floor to ambient air	m²					0	0
Floor to unheadet / ground	m²					200	200
Window Ratio	%	18%	28%	22%	0%	0%	

Indicators		Refurbished building part	New building part	Overall building
External envelope	m²	2640,00	150,28	2790,28
Form factor A/V	1/m	0,83	1,00	0,83
Opaque area / CFA	m^2/m^2_{cfa}	3,01	1,30	2,86
Window area / CFA	m^2/m^2_{cfa}	0,37	0,73	0,40

▼ Envelope thermal properties (conditioned volume only)

Note: If there are windows in the building facing the unheated space (not to ambient air!), their U-value must be calculated into the average U-value of the walls to the floor/unheated space. Accordingly, these windows should not be entered under "Windows".

Opaque

Building elements		Refurbished building part U-Value W/m²K	Refurbished building part U x A x f_x* W/K	New building part U-Value W/m²K	New building part U x A x f_x* W/K	Overall building U-Value W/m²K	Overall building U x A x f_x* W/K
Walls							
to ambient air	f_x* = 1	1	1810,00	0,1	3,28	0,98	1813,28
to ground/unheated space	f_x* = 0,5	1,1	66,00		0,00	1,10	66,00
Roof							
to ambient air	f_x* = 1	1	220,00	0,1	6,37	0,80	226,37
to unheated space	f_x* = 0,8	2	0,00		0,00	0,00	0,00
Floor							
to ambient air	f_x* = 1	0	0,00		0,00	0,00	0,00
to ground/unheated space	f_x* = 0,5	1,1	110,00		0,00	1,10	110,00
		total	2206,00	total	9,65	total	2215,65
Ø U value opaque	W/m²K	0,94		0,10		0,91	

Windows

▼ Refurbished building part		North	East	West	South	Horizontal	
Area	m²	40	50	200	0	0	
Glass type		standard insulation gla	standard insulation gla	standard insulation glazing			dropdown
Frame Material		wood	wood	wood			dropdown
Window U-value	W/m²K	1	1	1			total
U x A	W/K	40,00	50,00	200,00	0,00	0,00	290,00
Ø U value windows	W/m²K	1,00					

▼ New building part		North	East	West	South	Horizontal	
Area	m²	0	26,9	26,9	0	0	
Glass type			standard insulation gla	standard insulation glazing			dropdown
Frame Material			aluminium	aluminium			dropdown
Window U-value	W/m²K		0,7	0,7			total
U x A	W/K	0,00	18,83	18,83	0,00	0,00	37,66
Ø U value windows	W/m²K	0,70					

▼ Overall building (results)		North	East	West	South	Horizontal	
Σ Area	m²	40	76,9	226,9	0	0	total
Σ U x A	W/K	40,00	68,83	218,83	0,00	0,00	327,66
Ø U value windows	W/m²K	0,95					

Summary (opaque and windows)

Ø U value total		Refurbished building part	New building part	Overall building
$\Sigma(U \times A \times f_x)$	W/K	2496,00	47,31	2543,31
$\Sigma(U \times A \times f_x) / A$	W/m²K	0,95	0,31	0,91

*By the temperature correction factor f_x the heat flows of the different components are weighted.
f_x (walls; windows; roof to ambient air; floor to ambient air) = 1,0 | f_x (roof to unheated space) = 0,8 | f_x (walls to unheated space; floor to ground/unheated space) = 0,5

▼ Shading and sun protection

▼ Refurbished building part		North	East	West	South	Horizontal	
Glass curtain wall		no	no	no	no	no	dropdown
Fixed sun protection (overhang)		no	no	no	no	no	dropdown
Moveable sun protection		none	none	none	none	none	dropdown
Postion							dropdown
Shading factor (0 to 100%)*	%	0%	0%	0%	0%	0%	
Control							dropdown

▼ New building part		North	East	West	South	Horizontal	
Double glass façade		no	no	no	no	no	dropdown
Fixed sun protection (overhang)		no	no	no	no	no	dropdown
Moveable sun protection		none	others	others	none	none	dropdown
Postion			external	external			dropdown
Shading factor (0 to 100%)*	%	0%	100%	100%	0%	0%	
Control			manual	manual			dropdown

▼ Overall building (result)		North	East	West	South	Horizontal
shading factor (0 to 100%)	%	0%	35%	12%	0%	0%

*see manufacturer's information

▼ Installations (Overall building)

Heating

		System 1	System 2 (if existing)	System 3 (if existing)	Total	
Energy source		ambient heat	natural gas			dropdown
Heat generation		compression heat pur	boiler			dropdown
CHP* fraction	%					
Capacity	kW	4,2			4,2	
spec. Capacity	W/m²$_{CFA}$	4,9	0,0	0,0	4,9	
Distribution		radiant heating - floor	radiators			dropdown
Control		thermostats, room bas	thermostats, room based			dropdown

*CHP = Combined heat and pow er (generation based on combustion engines)

▼ Space cooling

		System 1 (if existing)	System 2 (if existing)	Total	
Energy source		water cooled, absorption			dropdown
Cold generation		absorption chiller			dropdown
Capacity	kW	4,5		4,5	
spec. capacity	W/m²$_{CFA}$	5,3	0,0	5,3	
Distribution		radiant cooling panels			dropdown
Control		thermostats, room based			dropdown

▼ Domestic hot water

	System 1	System 2 (if existing)	System 3 (if existing)	
Type	central without circulat	central without circulation		dropdown
Form of legionella protection	thermal	thermal		dropdown
Energy source	ambient heat	natural gas		dropdown
Heat generation	compression heat pur	boiler		dropdown

▼ Solar thermal system

		System 1 (if existing)	System 2 (if existing)	System 3 (if existing)	Total	
Application		DHW and/or heating				dropdown
Collector design		serial				dropdown
Collector Type		vacuum tube collector				dropdown
Location		flat roof				dropdown
Azimuth (0° = north)	°	5				
Tilt (0° = horisontal)	°	0				
Number of collectors	#	12			12	
Overall gross area	m²	30			30	
Collector area per floor area	m²/m²$_{CFA}$	0,035	0,000	0,000	0,035	
Thermal storage Type		water				dropdown
Storage volume, water	m³	1,5			1,5	
Storage location		Basements	[please specify]	[please specify]		
spezified storage volume	litre/m²$_{Coll}$	50,00	#DIV/0!	#DIV/0!	50,00	

▼ Photovoltaics

		System 1	System 2 (if existing)	System 3 (if existing)	System 4 (if existing)	System 5 (if existing)	Total	
Module design		serial	serial	object specific	object specific			dropdown
Cell Type		thin film	thin film	thin film	thin film			dropdown
Location		flat roof	flat roof	facade	sloped roof			dropdown
Additional functions				shading	shading			dropdown
Azimuth (0° = north)	°	0	90	0	90			
Tilt (0° = horisontal)	°	5	-5	variable	variable			
Number of modules	#	24	32	12	16		84	
Overall gross area of modules	m²	22,56	30,08	11,28	15,04		78,96	
Nominal power	kWp	3	2	1,5	0,5		7	
Power density per PV area	Wp/m²$_{PV}$	133	66	133	33	#DIV/0!	89	
Power density per floor area	Wp/m²$_{CFA}$	4	2	2	1	0	8	

▼ Battery storage

		Type 1 (if existing)	Type 2 (if existing)	Total	
Type		lithiun-ion			dropdown
Location (in the building)		technical room	[please specify]		
Total capacity, effective	kWh	5		5	
Number of units	#	2		2	

▼ Ventilation

	Utilisation:	Residential	none	none	none	
Type of ventilation		mechanical ventilation with heat recovery				dropdown
For mechanical system only:						
Heat recovery		central				dropdown
Efficiency of heat recovery	%	40%				
Electric power	W	200				
Design air flow rate	m³/h	1300				
Specific fan power	W/(m³/h)	0,15	#DIV/0!	#DIV/0!	#DIV/0!	
Control		CO2 control				dropdown

▼ Water

		Grey water	Rain water	
Water reuse		yes	yes	dropdown
Heat recovery		none		dropdown
Efficiency of heat recovery	%	0		
Usage 1		garden	garden	dropdown
Usage 2		none	none	dropdown
Storage volume	m³	1	1	

Note: Please enter the results from your calculation tools into this sheet. The calculations should refer to the **overall building**.

kWh/M = Kilowatt hour per month **| kWh/m_{cfa}^2M** = Kilowatt hour per square meter (conditioned floor area) and month

kWh/a = Kilowatt hour per year **| kWh/m_{cfa}^2a** = Kilowatt hour per square meter (conditioned floor area) and year

Calculation methods

Calculation tools applied	Calculation tool	Tool website	Calculation time step	
Tool 1	IDA ICE	https://www.equa.se/en/ida-ice	10 minutes	dropdown
Tool 2				dropdown
Tool 3				dropdown
Tool 4				dropdown

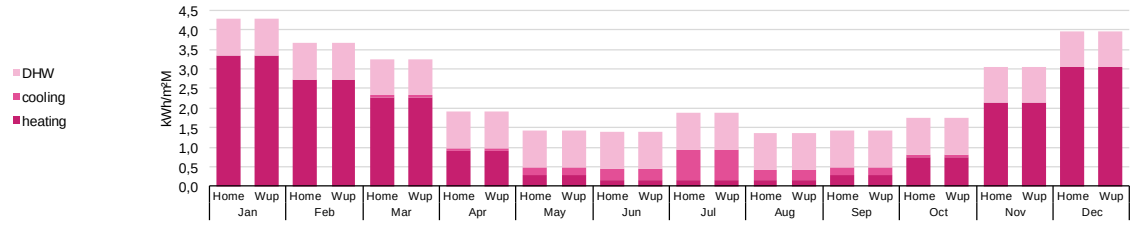
Wheather data sets applied		Data set	Link (URL / file name)
Home location	Berlin	Potsdam	energyplus.net/weather-location/europe_wmo_region_X/DEU//DEU_Potsdam.
.epw file name			weather_potsdam.epw
SDE location	Wuppertal	Düsseldorf	energyplus.net/weather-location/europe_wmo_region_6/DEU//DEU_Dusseldorf.104000_IWEC

Useful energy demand (heat/cold demand)

Location:	**Berlin**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating	kWh/M	2860	2340	1950	780	260	130	130	130	260	650	1820	2600	13910	kWh/a
	kWh/m_{cfa}^2M	3,34	2,73	2,28	0,91	0,30	0,15	0,15	0,15	0,30	0,76	2,13	3,04	16	kWh/m_{cfa}^2a
Cooling	kWh/M	0	0	39	65	156	260	676	234	156	39	0	0	1625	kWh/a
	kWh/m_{cfa}^2M	0,00	0,00	0,05	0,08	0,18	0,30	0,79	0,27	0,18	0,05	0,00	0,00	2	kWh/m_{cfa}^2a
DHW	kWh/M	800	800	800	800	800	800	800	800	800	800	800	800	9600	kWh/a
	kWh/m_{cfa}^2M	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	11	kWh/m_{cfa}^2a

▼ Location:	**Wuppertal**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating	kWh/M	2860	2340	1950	780	260	130	130	130	260	650	1820	2600	13910	kWh/a
	kWh/m_{cfa}^2M	3,34	2,73	2,28	0,91	0,30	0,15	0,15	0,15	0,30	0,76	2,13	3,04	16	kWh/m_{cfa}^2a
Cooling	kWh/M	0	0	39	65	156	260	676	234	156	39	0	0	1625	kWh/a
	kWh/m_{cfa}^2M	0,00	0,00	0,05	0,08	0,18	0,30	0,79	0,27	0,18	0,05	0,00	0,00	2	kWh/m_{cfa}^2a
DHW	kWh/M	800	800	800	800	800	800	800	800	800	800	800	800	9600	kWh/a
	kWh/m_{cfa}^2M	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	0,93	11	kWh/m_{cfa}^2a

Graphical evaluation



▼ Final energy demand

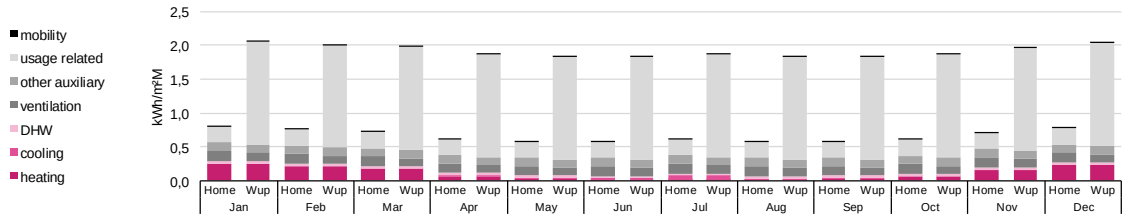
Note: Please fill in the energy sources of the building. For source 1, electricity has already been filled in.

Source 1 **Electricity**

Location:	**Berlin**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating	kWh/M	220	180	150	60	20	10	10	10	20	50	140	200	1070	kWh/a
	kWh/m_{cfa}^2M	0,257	0,2103	0,1752	0,0701	0,0234	0,0117	0,0117	0,0117	0,0234	0,0584	0,1636	0,2336	1	kWh/m_{cfa}^2a
Cooling	kWh/M	0	0	3	5	12	20	52	18	12	3	0	0	125	kWh/a
	kWh/m_{cfa}^2M	0	0	0,0035	0,0058	0,014	0,0234	0,0607	0,021	0,014	0,0035	0	0	0	kWh/m_{cfa}^2a
DHW	kWh/M	30	30	30	30	30	30	30	30	30	30	30	30	360	kWh/a
	kWh/m_{cfa}^2M	0,035	0,035	0,035	0,035	0,035	0,035	0,035	0,035	0,035	0,035	0,035	0,035	0	kWh/m_{cfa}^2a
Ventilation fan consumption	kWh/M	125	125	125	125	125	125	125	125	125	125	125	125	1500	kWh/a
	kWh/m_{cfa}^2M	0,146	0,146	0,146	0,146	0,146	0,146	0,146	0,146	0,146	0,146	0,146	0,146	2	kWh/m_{cfa}^2a
Other auxiliary pumps, controls…	kWh/M	105,08	105,08	105,08	105,08	105,08	105,08	105,08	105,06	105,08	105,08	105,08	105,08	1261	kWh/a
	kWh/m_{cfa}^2M	0,1228	0,1228	0,1228	0,1228	0,1228	0,1228	0,1228	0,1227	0,1228	0,1228	0,1228	0,1228	1	kWh/m_{cfa}^2a
Usage related incl. lighting, household, offce equipment…	kWh/M	200	200	200	200	200	200	200	200	200	200	200	200	2400	kWh/a
	kWh/m_{cfa}^2M	0,2336	0,2336	0,2336	0,2336	0,2336	0,2336	0,2336	0,2336	0,2336	0,2336	0,2336	0,2336	3	kWh/m_{cfa}^2a
Mobility	kWh/M	15	15	15	15	15	15	15	15	15	15	15	15	180	kWh/a
	kWh/m_{cfa}^2M	0,0175	0,0175	0,0175	0,0175	0,0175	0,0175	0,0175	0,0175	0,0175	0,0175	0,0175	0,0175	0	kWh/m_{cfa}^2a
Total	kWh/M	695,08	655,08	628,08	540,08	507,08	505,08	537,08	503,06	507,08	528,08	615,08	675,08	6896	kWh/a
	kWh/m_{cfa}^2M	0,812	0,7653	0,7337	0,6309	0,5924	0,59	0,6274	0,5877	0,5924	0,6169	0,7185	0,7886	8	kWh/m_{cfa}^2a
	cumulative	1	2	2	3	4	4	5	5	6	7	7	8		

▼ Location:	**Wuppertal**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating	kWh/M	220	180	150	60	20	10	10	10	20	50	140	200	1070	kWh/a
	kWh/m_{cfa}^2M	0,257	0,2103	0,1752	0,0701	0,0234	0,0117	0,0117	0,0117	0,0234	0,0584	0,1636	0,2336	1	kWh/m_{cfa}^2a
Cooling	kWh/M	0	0	3	5	12	20	52	18	12	3	0	0	125	kWh/a
	kWh/m_{cfa}^2M	0	0	0,0035	0,0058	0,014	0,0234	0,0607	0,021	0,014	0,0035	0	0	0	kWh/m_{cfa}^2a
DHW	kWh/M	30	30	30	30	30	30	30	30	30	30	30	30	360	kWh/a
	kWh/m_{cfa}^2M	0,035	0,035	0,035	0,035	0,035	0,035	0,035	0,035	0,035	0,035	0,035	0,035	0	kWh/m_{cfa}^2a
Ventilation fan consumption	kWh/M	100	100	100	100	100	100	100	100	100	100	100	100	1200	kWh/a
	kWh/m_{cfa}^2M	0,1168	0,1168	0,1168	0,1168	0,1168	0,1168	0,1168	0,1168	0,1168	0,1168	0,1168	0,1168	1	kWh/m_{cfa}^2a
Other auxiliary pumps, controls…	kWh/M	105,06	105,06	105,06	105,06	105,06	105,06	105,06	105,06	105,06	105,06	105,06	105,06	1261	kWh/a
	kWh/m_{cfa}^2M	0,1227	0,1227	0,1227	0,1227	0,1227	0,1227	0,1227	0,1227	0,1227	0,1227	0,1227	0,1227	1	kWh/m_{cfa}^2a
Usage related incl. lighting, household, offce equipment…	kWh/M	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	15600	kWh/a
	kWh/m_{cfa}^2M	1,5187	1,5187	1,5187	1,5187	1,5187	1,5187	1,5187	1,5187	1,5187	1,5187	1,5187	1,5187	18	kWh/m_{cfa}^2a
Mobility	kWh/M	15	15	15	15	15	15	15	15	15	15	15	15	180	kWh/a
	kWh/m_{cfa}^2M	0,0175	0,0175	0,0175	0,0175	0,0175	0,0175	0,0175	0,0175	0,0175	0,0175	0,0175	0,0175	0	kWh/m_{cfa}^2a
Total	kWh/M	1755,1	1715,1	1688,1	1600,1	1567,1	1565,1	1597,1	1563,1	1567,1	1588,1	1675,1	1735,1	19616	kWh/a
	kWh/m_{cfa}^2M	2,0503	2,0036	1,972	1,8692	1,8307	1,8283	1,8657	1,826	1,8307	1,8552	1,9568	2,0269	23	kWh/m_{cfa}^2a
	cumulative	2	4	6	8	10	12	13	15	17	19	21	23		

Graphical evaluation



▼ Source 2 — Gas

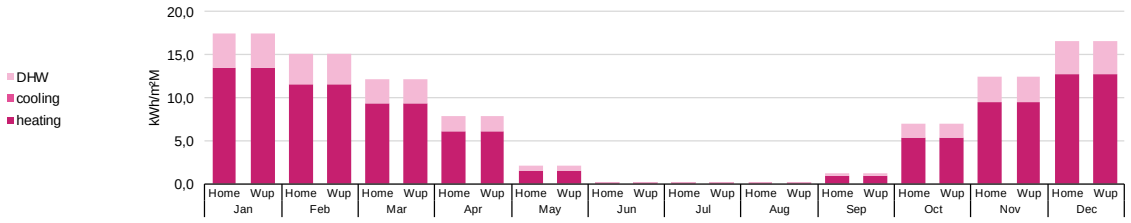
Location: Berlin

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating	kWh/M	11520	9920	8000	5200	1360	80	5	5	800	4560	8160	10880	60490	kWh/a
	kWh/m$_{cfa}^2$M	13,46	11,59	9,35	6,07	1,59	0,09	0,01	0,01	0,93	5,33	9,53	12,71	71	kWh/m$_{cfa}^2$a
Cooling	kWh/M													0	kWh/a
	kWh/m$_{cfa}^2$M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0	kWh/m$_{cfa}^2$a
DHW	kWh/M	3456	2976	2400	1560	408	24	1,5	1,5	240	1368	2448	3264	18147	kWh/a
	kWh/m$_{cfa}^2$M	4,04	3,48	2,80	1,82	0,48	0,03	0,00	0,00	0,28	1,60	2,86	3,81	21	kWh/m$_{cfa}^2$a

▼ Location: Wuppertal

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating	kWh/M	11520	9920	8000	5200	1360	80	5	5	800	4560	8160	10880	60490	kWh/a
	kWh/m$_{cfa}^2$M	13,46	11,59	9,35	6,07	1,59	0,09	0,01	0,01	0,93	5,33	9,53	12,71	71	kWh/m$_{cfa}^2$a
Cooling	kWh/M													0	kWh/a
	kWh/m$_{cfa}^2$M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0	kWh/m$_{cfa}^2$a
DHW	kWh/M	3456	2976	2400	1560	408	24	1,5	1,5	240	1368	2448	3264	18147	kWh/a
	kWh/m$_{cfa}^2$M	4,04	3,48	2,80	1,82	0,48	0,03	0,00	0,00	0,28	1,60	2,86	3,81	21	kWh/m$_{cfa}^2$a

Graphical evaluation



▼ Source 3 — [insert name]

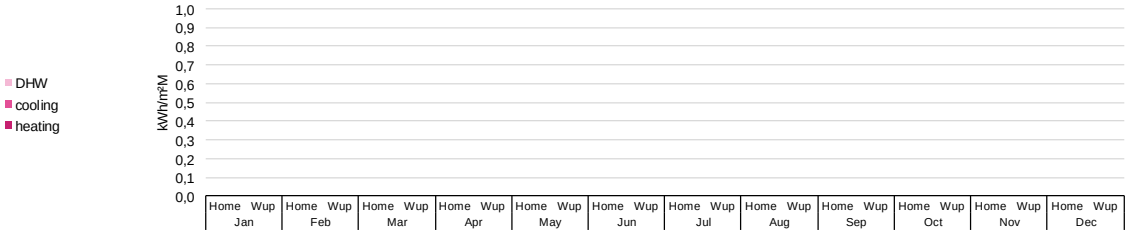
Location: Berlin

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating	kWh/M													0	kWh/a
	kWh/m$_{cfa}^2$M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0	kWh/m$_{cfa}^2$a
Cooling	kWh/M													0	kWh/a
	kWh/m$_{cfa}^2$M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0	kWh/m$_{cfa}^2$a
DHW	kWh/M													0	kWh/a
	kWh/m$_{cfa}^2$M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0	kWh/m$_{cfa}^2$a

▼ Location: Wuppertal

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating	kWh/M													0	kWh/a
	kWh/m$_{cfa}^2$M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0	kWh/m$_{cfa}^2$a
Cooling	kWh/M													0	kWh/a
	kWh/m$_{cfa}^2$M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0	kWh/m$_{cfa}^2$a
DHW	kWh/M													0	kWh/a
	kWh/m$_{cfa}^2$M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0	kWh/m$_{cfa}^2$a

Graphical evaluation



▼ Electricity generation

Note: The self consumption (see below) should indicate the proportion of energy that can be used directly by the building/users without being fed into the grid. For the self consumption, the calculation time step must be hourly or smaller. If the time step is larger than hourly (eg. daily), the data should not be inserted because they are not reliable.

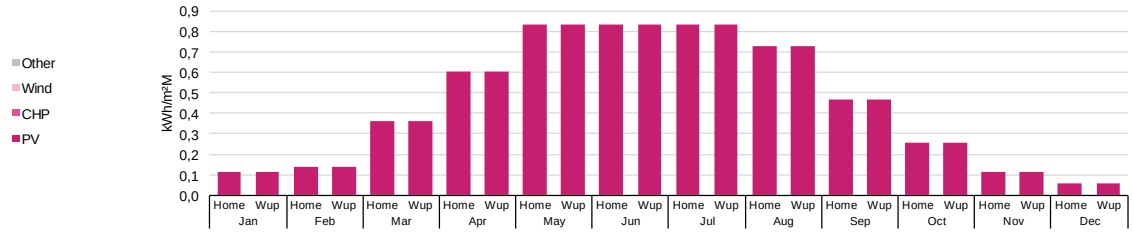
CHP: combined heat & power generation based on combustion engines.

Generation on site

Location:	**Berlin**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
PV + PVT	kWh/M	95	120	310	515	710	710	710	620	400	220	100	50	4560	kWh/a
	kWh/m_{cfa}^2M	0,11	0,14	0,36	0,60	0,83	0,83	0,83	0,72	0,47	0,26	0,12	0,06	5	kWh/m_{cfa}^2a
Self consumption	%														%
CHP	kWh/M													0	kWh/a
	kWh/m_{cfa}^2M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0	kWh/m_{cfa}^2a
Self consumption	%														%
Wind	kWh/M													0	kWh/a
	kWh/m_{cfa}^2M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0	kWh/m_{cfa}^2a
Self consumption	%														%
Other	kWh/M													0	kWh/a
	kWh/m_{cfa}^2M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0	kWh/m_{cfa}^2a
Self consumption	%														%
Total	kWh/M	95	120	310	515	710	710	710	620	400	220	100	50	4560	kWh/a
	kWh/m_{cfa}^2M	0,11	0,14	0,36	0,60	0,83	0,83	0,83	0,72	0,47	0,26	0,12	0,06	5	kWh/m_{cfa}^2a
	cumulative	0,11	0,25	0,61	1,21	2,04	2,87	3,70	4,43	4,89	5,15	5,27	5,33		
Self consumption	%														%

▼ Location:	**Wuppertal**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
PV	kWh/M	95	120	310	515	710	710	710	620	400	220	100	50	4560	kWh/a
	kWh/m_{cfa}^2M	0,11	0,14	0,36	0,60	0,83	0,83	0,83	0,72	0,47	0,26	0,12	0,06	5	kWh/m_{cfa}^2a
Self consumption	%														%
CHP	kWh/M													0	kWh/a
	kWh/m_{cfa}^2M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0	kWh/m_{cfa}^2a
Self consumption	%														%
Wind	kWh/M													0	kWh/a
	kWh/m_{cfa}^2M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0	kWh/m_{cfa}^2a
Self consumption	%														%
Other	kWh/M													0	kWh/a
	kWh/m_{cfa}^2M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0	kWh/m_{cfa}^2a
Self consumption	%														%
Total	kWh/M	95	120	310	515	710	710	710	620	400	220	100	50	4560	kWh/a
	kWh/m_{cfa}^2M	0,11	0,14	0,36	0,60	0,83	0,83	0,83	0,72	0,47	0,26	0,12	0,06	5	kWh/m_{cfa}^2a
	cumulative	0,11	0,25	0,61	1,21	2,04	2,87	3,70	4,43	4,89	5,15	5,27	5,33		
Self consumption	%														%

Graphical evaluation

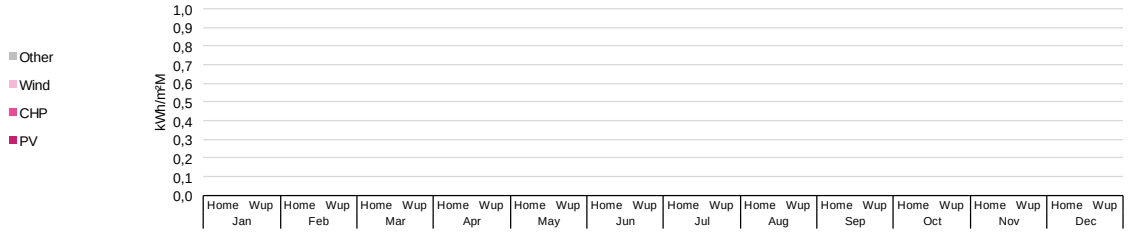


▼ Generation nearby

Location:	Berlin	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
PV + PVT	kWh/M													0	kWh/a
	kWh/m_{cfa}^2M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0	kWh/m_{cfa}^2a
Self consumption	%														%
CHP	kWh/M													0	kWh/a
	kWh/m_{cfa}^2M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0	kWh/m_{cfa}^2a
Self consumption	%														%
Wind	kWh/M													0	kWh/a
	kWh/m_{cfa}^2M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0	kWh/m_{cfa}^2a
Self consumption	%														%
Other	kWh/M													0	kWh/a
	kWh/m_{cfa}^2M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0	kWh/m_{cfa}^2a
Self consumption	%														%
Total	kWh/M	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh/a
	kWh/m_{cfa}^2M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0	kWh/m_{cfa}^2a
	cumulative	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00		
Self consumption	%														%

▼ Location:	Wuppertal	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
PV	kWh/M													0	kWh/a
	kWh/m_{cfa}^2M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0	kWh/m_{cfa}^2a
Self consumption	%														%
CHP	kWh/M													0	kWh/a
	kWh/m_{cfa}^2M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0	kWh/m_{cfa}^2a
Self consumption	%														%
Wind	kWh/M													0	kWh/a
	kWh/m_{cfa}^2M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0	kWh/m_{cfa}^2a
Self consumption	%														%
Other	kWh/M													0	kWh/a
	kWh/m_{cfa}^2M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0	kWh/m_{cfa}^2a
Self consumption	%														%
Total	kWh/M	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh/a
	kWh/m_{cfa}^2M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0	kWh/m_{cfa}^2a
	cumulative	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00		
Self consumption	%														%

Graphical evaluation



District level specifications (existing situation)

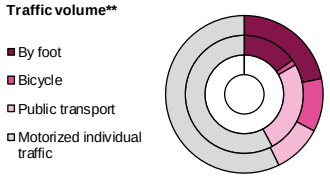
Size of the district	km²	0,63	
Population	#	8600	
Population density	#/km²	13651	
Location within the city		north	dropdown
Main urban type of use		mixed use	dropdown
Number of cars registered	#	2456	

Mobility specifications (existing situation)

Modal Split

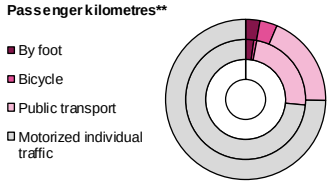
Traffic volume (routes) per day		National level	City level (if available)	District level (if available)
By foot	%	21,8%	15,2%	
Bicycle	%	10,9%	1,5%	
Public transport	%	10,1%	25,5%	
Motorized individual traffic	%	57,2%	57,8%	
Total (sum must be 100% each)	%	100,0%	100,0%	0,0%
Total (absolute number)	[mio.#/d]	257	0,959679	

Traffic volume**



Passenger kilometres (mio. km) per day		National level	City level (if available)	District level (if available)
By foot	%	2,9%	2,2%	
Bicycle	%	3,5%	0,8%	
Public transport	%	18,8%	23,5%	
Motorized individual traffic	%	74,8%	73,5%	
Total (sum must be 100% each)	%	100,0%	100,0%	0,0%
Total (absolute number)	[mio.Pkm/d]	3214	no data	

Passenger kilometres**



General characteristics		National level	City level (if available)	District level (if available)
Routes*	#/Pd	3,1	3,34	
Daily distance*	km/Pd	39		
Travelling per person	hh:min	01:25		

Source of the data	Year of data	URL / book / etc.
National level	2017	Source: MID 2019
City level (if aviable)	2011	Hoppe, R.; Woschei, K.: Verkehrsbefragung 2011 Stadt Wuppertal. Planungsge
District level (if aviable)		

*per person and day

**Outer circle = national level | middle circle = city level | inner circle = district level

Level of motorisation

	National level	City level (if available)	District level (if available)
Car/1,000 inhabitants	450	420	285

Source of the data	Year of data	URL / book / etc.
National level	2016	Schmied, Martin; Dziekan, Katrin: Die Stadt für Morgen: Umweltfreundlich mobi
City level (if aviable)	2016	Reutter, Oscar et. Al. (2017): Autofreie Innenstadt Wuppertal Elberfeld - Ein Leit
District level (if aviable)	2018	Written source from the Statistical Office of the City of Wuppertal, retrieved Nove

▼ Parking spaces on the property (planned situation)

		Passenger car	Disabled parking	others*	Total
No. of parking spaces	#	2	1	12	15
No. of electric charging stations	#	0	0	2	2
No. of households in the building	#				13
Parking spaces per household	#	0,15	0,08	0,92	
Typical parking space (width)	m	2,5	3	1	
Typical parking space (length)	m	5	5	2	
Area of one parking space	m²	12,5	15	2	
Area of parking spaces	m²	25	15	24	64

* Bicycles / pedelec / cargo bike / miniature electric vehicles etc.

▼ Infrastructure nearby the property

Within a radius of 300 m		Existing situation	Planned situation
Pedestrian traffic			
Share of roads with footpaths	%	100	100
Share of roads with footpaths (side room width) < 2m	%	80	90
Net length			
Street with one-sided footpath	m	300	100
Street with two-sided footpath	m	4800	5000
Cycle paths			
separate from motor traffic	m	500	500
routed with motor vehicle traffic	m	0	600
Roadway (motor vehicle traffic)			
with a maximum speed of up to 30 km/h	m	4000	4600
with a maximum speed of up to 50 km/h	m	600	0
Car parking spaces			
Car parking spaces (public)	#	600	400
Car parking spaces (private)	#	200	150

▼ Offers of the ecomobility

Note: "Ecomobility" is a term for foot, bicycle, public and taxi traffic, as well as rental systems such as car, bike and cargo bike sharing.

		Existing situation		Planned situation	
		Within a radius of 300 m	Within the district	Within a radius of 300 m	Within the district
Public transport stops	#	4	9	8	12
Sharing offers / mobilty station					
Car sharing	#	3	2	6	5
(E-)bike sharing	#			4	3
E-scooter sharing	#			8	7
Carpooling	#				
Bundled journeys	#				
Passenger transport services (e.g. Uber)	#			10	15
park-and-ride	#			1	1
Taxi	#		1		1
Bicycle parking facilities					
No. of bicycle parking racks	#	20	15	80	70
No. of bicycle boxes	#	0	0	40	30
Others					
[fill in category]	#				

▼ Frequency of departures

Note: Please select the most relevant lines (e.g. the line to the main station etc.).

Existing situation Frequency (nearest) public transport stop		Frequency of rush hour (6:00-9:00 and 16:00-19:00)	Frequency of secondary traffic time (9:00-16:00)	Frequency of off-peak hours*
Bus 1	#/h	3	3	2
Bus 2	#/h	3	3	2
Bus 3	#/h	3	3	2
Bus 4	#/h	3	3	2
Bus 5	#/h	3	3	2
Tram 1	#/h			
Tram 2	#/h			
Metro 1	#/h			
Metro 2	#/h			
Schwebebahn**	#/h	18	12	6
Others	#/h			

Planned situation Frequency (nearest) public transport stop		Frequency of rush hour (6:00-9:00 and 16:00-19:00)	Frequency of secondary traffic time (9:00-16:00)	Frequency of off-peak hours*
Bus 1	#/h	6	6	4
Bus 2	#/h	6	6	4
Bus 3	#/h	6	6	4
Bus 4	#/h	3	3	2
Bus 5	#/h	3	3	2
Tram 1	#/h			
Tram 2	#/h			
Metro 1	#/h			
Metro 2	#/h			
Schwebebahn**	#/h	18	12	6
Others	#/h			

*weekdays 20:00-6:00 , Sat. 16:00-9:00 and Sundays and holidays all day **Schwebebahn = suspension railway

▼ Distance and time criteria

Footpaths	**Existing situation**		**Planned situation**	
Distance from the building to…	Distance [m]	Walking time [minutes]	Distance [m]	Walking time [minutes]
Public transport stop (bus, tram, metro…)	200	3	100	2
Local railway station	1400	17	1400	17
Sharing Stations	200	3	50	1
Shopping facilities	200	3	200	3
Educational institution	200	3	200	3
Further POIs* in the district	400	6	400	6
The proposed mobility solution				

Accessibility to the main station…	**Existing situation**		**Planned situation**	
	Distance [m]	Travel time [minutes]	Distance [m]	Travel time [minutes]
By foot	1400	17	1400	17
By bicycle	1400	6	1400	6
By public transport	1800	11	1500	7
By motorized individual traffic	1400	4	1400	4
From the proposed mobility solution				

*POI = points of interests

3. House Demonstration Unit Templates

House Demonstration Unit • Envelope

Note: This sheet refers to the design of the **House Demonstration Unit**.

Project specification

Main geometry		compact	dropdown
No. of storeys	#	1	
Main roof shape		Flat roof	dropdown
Type of prefabrication		elements	dropdown

Project dimensions

Area

Gross area	m²	78
Net floor area	m²	54,34
Conditioned net floor area	m²	**53,404**
Property size	m²	324
Building footprint	m²	254,5

Volume

Conditioned gross volume	m³	150

Residential occupation

Living space (WoFlV)	m²	58
No. of occupants	#	2
No. of residential units	#	1
Living space / occupants	m²/person	29

*The living space is to be determined according to the German living space regulation ("Wohnflächenverordnung (WoFlV)"). A document with information is available on the SDE21 WAT.

▼ Conditioning

Note: The conditioned net floor area (**CFA**) represents the energy reference area of the building. This is determined in the following, taking into account the intensity of thermal conditioning, similar to the procedure of the Passive House Standard. **Fully conditioned areas** are included in the calculation at **100%**, **medium conditioned areas** at **60%** and **unconditioned areas** at **0%**.

Fully conditioned area*

All rooms that are fully conditioned, e.g. living spaces, corridors within appartments, office spaces, retail spaces, cafés etc.

Area	m²	52
100% creditable	m²	52

Medium conditioned area*

All areas that are indirectly or medium conditioned, but within the thermal envelope, e.g. ancillary rooms, corridors and stairs outside of appartments or in the basement.

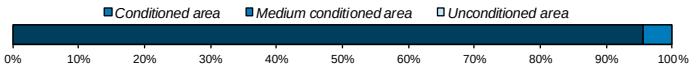
Area	m²	2,34
60% creditable	m²	1,404

Unconditioned area*

All rooms outside the thermal envelope, e.g. some types of wintergardens and basements, garages, etc.

Area	m²	0
0% creditable	m²	0

Total Net Floor Area	m²	54,34
Total creditable **CFA**	m²	**53,404**



* net floor area

▼ Building envelope (conditioned volume only)

Note: The areas determined here must be **gross areas** with external reference. If there are windows in the building facing unheated space (not to ambient air!), these must be included in walls to ground/unheaded space.

		North	East	West	South	Horizontal	Total
Facades	m²	26,9	16,4	16,4	26,9		86,6
Windows	m²	26,9	0	0	26,9		53,8
Walls	m²	0	16,4	16,4	0		32,8
Walls to unheated	m²	0	0	0	0		0
Roof to ambient air	m²					63,68	63,68
Roof to unheated space	m²					0	0
Floor to ambient air*	m²					63,68	63,68
Floor to unheated / ground**	m²					0	0
Window Ratio	%	100%	0%	0%	100%	0%	

Indicators CFA related

External envelope	m²	213,96
Form factor A/V	1/m	1,43
Opaque area / CFA	m^2/m_{cfa}^2	3,00
Window area / CFA	m^2/m_{cfa}^2	1,01

*ventilated air gap

**non ventilated air or direct contact to ground

▼ Envelope thermal properties (conditioned volume only)

Note: If there are windows in the building facing the unheated space (not to ambient air!), their U-value must be calculated into the average U-value of the walls to the floor/unheated space. Accordingly, these windows should not be entered under "Windows".

Opaque

		U-Value W/m²K	U x A x f_x* W/K
Walls			
to ambient air	f_x* = 1	0,1	3,28
to ground/unheated space	f_x* = 0,5		0,00
Roof			
to ambient air	f_x* = 1	0,1	6,37
to unheated space	f_x* = 0,8		0,00
Floor			
to ambient air	f_x* = 1	0,1	6,37
to ground/unheated space	f_x* = 0,5		0,00
		total	16,02
Ø U value opaque	W/m²K	0,10	

Windows

		North	East	West	South	Horizontal	
Area	m²	26,9	0	0	26,9	0	
Glass type		standard insulation glazing			standard insulation glazing		dropdown
No. of panes	#	3			3		
Frame Material		aluminium			aluminium		dropdown
Window U-value	W/m²K	0,7			0,7		total
U x A	W/K	18,83	0,00	0,00	18,83	0,00	37,66
Ø U value windows	W/m²K	0,70					

Summary (opaque and windows)

Ø U value total

Σ(U x A x f_x)	W/K	53,68
Σ(U x A x f_x) / A	W/m²K	0,25

*By the temperature correction factor f_x the heat flows of the different components are weighted.
f_x (walls; windows; roof to ambient air; floor to ambient air) = 1,0 | f_x (roof to unheated space) = 0,8 | f_x (walls to unheated space; floor to ground/unheated space) = 0,5

▼ Shading and sun protection

		North	East	West	South	Horizontal	
Glass curtain wall		yes			yes		dropdown
Fixed sun protection							dropdown
Type of fixed sun protection		[please specify]	[please specify]	[please specify]	[please specify]	[please specify]	
Moveable sun protection		shutters			shutters		dropdown
Postion		external			external		dropdown
Shading factor (0 to 100%)*	%	100%			100%		
Control		combined			combined		dropdown

*see manufacturer's information

Note: This sheet refers to the **House Demonstration Unit**. In addition to the information requested here, the data sheets of the systems used shall be submitted. For a better overview, the names of the pdf-files should be given under "**Data sheets (file name)**".

Heating (distribution only)

Note: In the House Demonstration Units, conditioning by heating systems is prohibited during the Competition weeks. The heat delivery component of the system must be installed (radiators, floor heating panels, air-to-air head exchangers etc.) to visualise the approach (see Rule 7).

		System 1	System 2 (if existing)	
Distribution		radiant heating - floor		dropdown
Capacity	W/m²	60		
Control		thermostats, zone based		dropdown

Data sheets (file name)

System 1	pdf	data-sheet.pdf
System 2	pdf	

Space cooling (distribution only)

Note: In the House Demonstration Units, cooling systems are not allowed (see Rule 7).

		System 1 (if existing)	System 2 (if existing)	
Distribution		radiant cooling panels		dropdown
Capacity	W/m²	30		
Control		thermostats, room based		dropdown

Data sheets (file name)

System 1	pdf	data-sheet.pdf
System 2	pdf	

Domestic hot water

Note: The domestic hot water (DHW) delivery may not be fully compatible with the Design Challenge, as active space heating or cooling is not part of the investigation in the monitoring Contest (see Rule 7).

		System 1	System 2 (if existing)	
Type		central with circulation		dropdown
Form of legionella protection		thermal		dropdown
Heat generation		heat pump (waste air)		dropdown

Data sheets (file name)

System 1	pdf	data-sheet.pdf
System 2	pdf	

▼ Solar thermal system

		System 1 (if existing)	System 2 (if existing)	System 3 (if existing)	Total	
Application		DHW and/or heating				dropdown
Collector design		serial				dropdown
Collector Type		vacuum tube collector				dropdown
Location		flat roof				dropdown
Azimuth (0° = north)	°	0				
Tilt (0° = horisontal)	°	0				
Number of collectors	#	1			1	
Overall gross area	m²	4			4	
Collector area per floor area	m^2/m^2_{CFA}	0,075	0,000	0,000	0,075	
Thermal storage Type		water				dropdown
Storage volume, water	m³	2			2	
Storage location		technical room	[please specify]	[please specify]		
spezified storage volume	$litre/m^2_{Coll}$	500,00	#DIV/0!	#DIV/0!	500,00	
pump power demand	W	10			10	
controler power demand	W	5			5	

Data sheets (file name)

System 1	pdf	data-sheet.pdf
System 2	pdf	
System 3	pdf	
Pump 1	pdf	data-sheet.pdf
Pump 2	pdf	
Pump 3	pdf	
Controller 1	pdf	data-sheet.pdf
Controller 2	pdf	
Controller 3	pdf	

▼ Photovoltaics

		System 1	System 2 (if existing)	System 3 (if existing)	System 4 (if existing)	System 5 (if existing)	Total	
Module design		serial						dropdown
Cell Type		thin film						dropdown
Location		flat roof						dropdown
Additional functions								dropdown
Azimuth (0° = north)	°	180						
Tilt (0° = horisontal)	°	3						
Number of modules	#	36					36	
Overall gross area of modules	m²	36					36	
Nominal power	kWp	4,32					4,32	
Power density per PV area	Wp/m^2_{PV}	120	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	120	
Power density per floor area	Wp/m^2_{CFA}	81	0	0	0	0	81	
Inverter nominal power	W	5000					5000	

Data sheets (file name)

System 1	pdf	data-sheet.pdf
System 2	pdf	
System 3	pdf	
System 4	pdf	
System 5	pdf	
Inverter 1	pdf	data-sheet.pdf
Inverter 2	pdf	
Inverter 3	pdf	
Inverter 4	pdf	
Inverter 5	pdf	

▼ Battery storage

		Type 1 (if existing)	Type 2 (if existing)	Total	
Type		lithiun-ion			dropdown
Location		technical room			
Total capacity, effective	kWh	4000		4000	
Number of units	#	2		2	

Data sheets (file name)

Type 1	pdf	data-sheet.pdf
Type 2	pdf	

▼ Ventilation

Note: The ventilation infrastructure in the House Demonstration Unit may not be fully compatible with the Design Challenge in cases such as central ventilation heat recovery etc. (see Rule 7).

		Type 1	Type 2 (if existing)	
Type of ventilation		mechanical ventilation with heat recovery		dropdown
For mechanical system only:				
Heat recovery		central		dropdown
Efficiency of heat recovery	%	99%		
Electric power	W	200		
Design air flow rate	m^3/h	1300		
Specific fan power	$W/(m^3/h)$	0,15	#DIV/0!	
Control		CO2 control		dropdown

Data sheets (file name)

Type 1	pdf	data-sheet.pdf
Type 2	pdf	

▼ Lighting

		Type 1	Type 2 (if existing)	Type 3 (if existing)	Type 4 (if existing)	Type 5 (if existing)	
Average installed power	W/m²	1,6	2,3	1,1	0,6	0	
Average design illuminance	Lux	314	685	310	303	0	
Lighting efficiency (100 Lux)	W/m²	0,5	0,33	0,35	0,2	0	
Control	dimming	none	none	none	none		dropdown
	presence	none	none	none	none		dropdown

Data sheets (file name)

Type 1	pdf	data-sheet.pdf
Type 2	pdf	data-sheet.pdf
Type 3	pdf	data-sheet.pdf
Type 4	pdf	data-sheet.pdf
Type 5	pdf	data-sheet.pdf

▼ Water

		Grey water	Rain water	
Water reuse		yes	yes	dropdown
Heat recovery		none		dropdown
Efficiency of heat recovery	%	0%		
Usage 1		garden	garden	dropdown
Usage 2		toilets		dropdown
Storage volume	m³	2	2	

Note: Please enter the results from your calculation tools into this sheet. The calculations should refer to the **House Demonstration Unit**.
kWh/M = Kilowatt hour per month **| kWh/m$_{cfa}^2$M** = Kilowatt hour per square meter (conditioned floor area) and month
kWh/a = Kilowatt hour per year **| kWh/m$_{cfa}^2$a** = Kilowatt hour per square meter (conditioned floor area) and year

Calculation methods

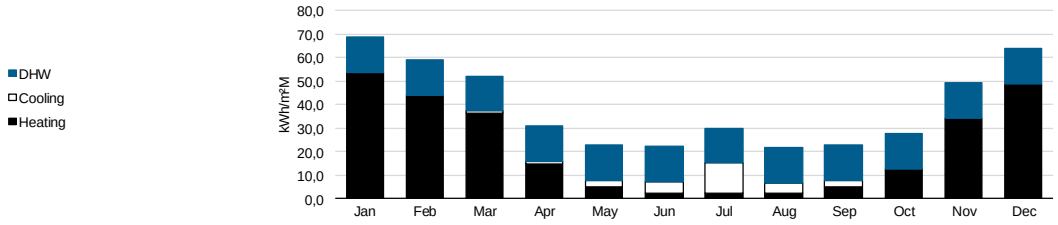
Calculation tools applied	Calculation tool	Tool website	Calculation time step	
Tool 1	IDA ICE	https://www.equa.se/en/ida-ice	10 minutes	dropdown
Tool 2				dropdown
Tool 3				dropdown
Tool 4				dropdown

Wheather data sets applied		Data set	Link (URL / file name)
SDE location	Wuppertal	Düsseldorf	energyplus.net/weather-location/europe_wmo_region_6/DEU//DEU_Dusseldorf.104000_IWEC

Useful energy demand (heat/cold demand)

Location:	Wuppertal	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating	kWh/M	2860	2340	1950	780	260	130	130	130	260	650	1820	2600	13910	kWh/a
	kWh/m$_{cfa}^2$M	53,55	43,82	36,51	14,61	4,87	2,43	2,43	2,43	4,87	12,17	34,08	48,69	260,47	kWh/m$_{cfa}^2$a
Cooling	kWh/M	0	0	39	65	156	260	676	234	156	39	0	0	1625	kWh/a
	kWh/m$_{cfa}^2$M	0,00	0,00	0,73	1,22	2,92	4,87	12,66	4,38	2,92	0,73	0,00	0,00	30,43	kWh/m$_{cfa}^2$a
DHW	kWh/M	800	800	800	800	800	800	800	800	800	800	800	800	9600	kWh/a
	kWh/m$_{cfa}^2$M	14,98	14,98	14,98	14,98	14,98	14,98	14,98	14,98	14,98	14,98	14,98	14,98	179,76	kWh/m$_{cfa}^2$a

Graphical evaluation

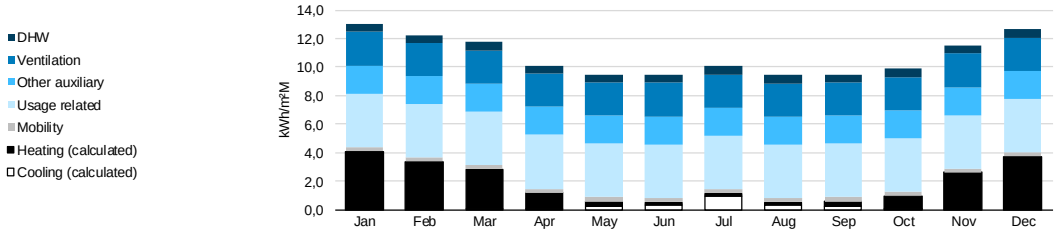


▼ Final energy demand

Source 1 **Electricity**

Location:	Wuppertal	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
DHW	kWh/M	30	30	30	30	30	30	30	30	30	30	30	30	360	kWh/a
	kWh/m_{cfa}^2M	0,56	0,56	0,56	0,56	0,56	0,56	0,56	0,56	0,56	0,56	0,56	0,56	6,74	kWh/m_{cfa}^2a
Ventilation	kWh/M	125	125	125	125	125	125	125	125	125	125	125	125	1500	kWh/a
fan consumption	kWh/m_{cfa}^2M	2,34	2,34	2,34	2,34	2,34	2,34	2,34	2,34	2,34	2,34	2,34	2,34	28,09	kWh/m_{cfa}^2a
Other auxiliary	kWh/M	105	105	105	105	105	105	105	105,06	105	105	105	105	1260	kWh/a
pumps, controls…	kWh/m_{cfa}^2M	1,97	1,97	1,97	1,97	1,97	1,97	1,97	1,97	1,97	1,97	1,97	1,97	23,59	kWh/m_{cfa}^2a
Usage related	kWh/M	200	200	200	200	200	200	200	200	200	200	200	200	2400	kWh/a
incl. lighting, household, offce equipment…	kWh/m_{cfa}^2M	3,75	3,75	3,75	3,75	3,75	3,75	3,75	3,75	3,75	3,75	3,75	3,75	44,94	kWh/m_{cfa}^2a
Mobility	kWh/M	15	15	15	15	15	15	15	15	15	15	15	15	180	kWh/a
	kWh/m_{cfa}^2M	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28	0,28	3,37	kWh/m_{cfa}^2a
Total	kWh/M	475	475	475	475	475	475	475	475,06	475	475	475	475	5700	kWh/a
	kWh/m_{cfa}^2M	8,89	8,89	8,89	8,89	8,89	8,89	8,89	8,90	8,89	8,89	8,89	8,89	106,73	kWh/m_{cfa}^2a
	cumulative	9	18	27	36	44	53	62	71	80	89	98	107		

Graphical evaluation



Calculated values based on the Design Challenge energy supply system

Note: No heating or cooling is allowed for the House Demonstration Unit (HDU) during the competition period (see Rule 7). Therefore, the following values for heating and cooling are calculated based on the ratio of useful energy demand (heat/cold demand) to final energy demand of the Design Challenge. The conversion factor determined is used to calculate a proportional final energy demand from the useful energy demand (heat/cold demand) of the HDU.

Calculation:

[DC_final energy demand] / [DC_useful energy demand (heat/cold demand)] = Factor

[HDU_useful energy demand (heat/cold demand)] · Factor = [HDU_final energy demand]

Location:	Wuppertal	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating (electricity)	kWh/M	220	180	150	60	20	10	10	10	20	50	140	200	1070	kWh/a
	kWh/m_{cfa}^2M	4,12	3,37	2,81	1,12	0,37	0,19	0,19	0,19	0,37	0,94	2,62	3,75	20,04	kWh/m_{cfa}^2a
Cooling (electricity)	kWh/M	0	0	3	5	12	20	52	18	12	3	0	0	125	kWh/a
	kWh/m_{cfa}^2M	0,00	0,00	0,06	0,09	0,22	0,37	0,97	0,34	0,22	0,06	0,00	0,00	2,34	kWh/m_{cfa}^2a

▼ Calculation:

Heating

DC_final energy demand	kWh/M	220	180	150	60	20	10	10	10	20	50	140	200
DC_usable energy demand	kWh/M	2860	2340	1950	780	260	130	130	130	260	650	1820	2600
Factor		0,0769	0,0769	0,0769	0,0769	0,0769	0,0769	0,0769	0,0769	0,0769	0,0769	0,0769	0,0769

Cooling

DC_final energy demand	kWh/M	0	0	3	5	12	20	52	18	12	3	0	0
DC_usable energy demand	kWh/M	0	0	39	65	156	260	676	234	156	39	0	0
Factor		#DIV/0!	#DIV/0!	0,0769	0,0769	0,0769	0,0769	0,0769	0,0769	0,0769	0,0769	#DIV/0!	#DIV/0!

▼ Source 2 | Gas

Note: No heating or cooling is allowed for the House Demonstration Unit (HDU) during the competition period (see Rule 7). Therefore, the following values for heating and cooling are calculated based on the ratio of usable energy demand to final energy demand of the Design Challenge. The conversion factor determined is used to calculate a proportional final energy demand from the usable energy demand of the HDU.

Calculation: [DC_final energy demand] / [DC_usable energy demand] = Factor
[HDU_usable energy demand] · Factor = [HDU_final energy demand]

Location:	**Wuppertal**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating (source 2)	kWh/M	422,94	445,13	430,77	700	549,23	64,615	4,0385	4,0408	323,08	736,62	470,77	439,38	4591	kWh/a
	kWh/m_{cfa}^2M	7,92	8,34	8,07	13,11	10,28	1,21	0,08	0,08	6,05	13,79	8,82	8,23	85,96	kWh/m_{cfa}^2a
Cooling (source 2)	kWh/M	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh/a
	kWh/m_{cfa}^2M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	kWh/m_{cfa}^2a

▼ Calculation:

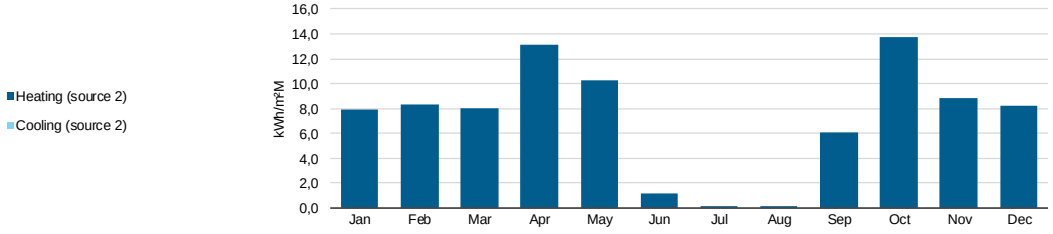
Heating

DC_final energy demand	kWh/M	11520	9920	8000	5200	1360	80	5	5	800	4560	8160	10880
DC_usable energy demand	kWh/M	2860	2340	1950	780	260	130	130	130	260	650	1820	2600
Factor		4,028	4,2393	4,1026	6,6667	5,2308	0,6154	0,0385	0,0385	3,0769	7,0154	4,4835	4,1846

Cooling

DC_final energy demand	kWh/M	0	0	0	0	0	0	0	0	0	0	0	0
DC_usable energy demand	kWh/M	0	0	39	65	156	260	676	234	156	39	0	0
Factor		#DIV/0!	#DIV/0!	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!

Graphical evaluation



▼ Source 3 | 0

Note: No heating or cooling is allowed for the House Demonstration Unit (HDU) during the competition period (see Rule 7). Therefore, the following values for heating and cooling are calculated based on the ratio of usable energy demand to final energy demand of the Design Challenge. The conversion factor determined is used to calculate a proportional final energy demand from the usable energy demand of the HDU.

Calculation: [DC_final energy demand] / [DC_usable energy demand] = Factor
[HDU_usable energy demand] · Factor = [HDU_final energy demand]

Location:	**Wuppertal**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
Heating (source 3)	kWh/M	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh/a
	kWh/m_{cfa}^2M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	kWh/m_{cfa}^2a
Cooling (source 3)	kWh/M	0	0	0	0	0	0	0	0	0	0	0	0	0	kWh/a
	kWh/m_{cfa}^2M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	kWh/m_{cfa}^2a

▼ Calculation:

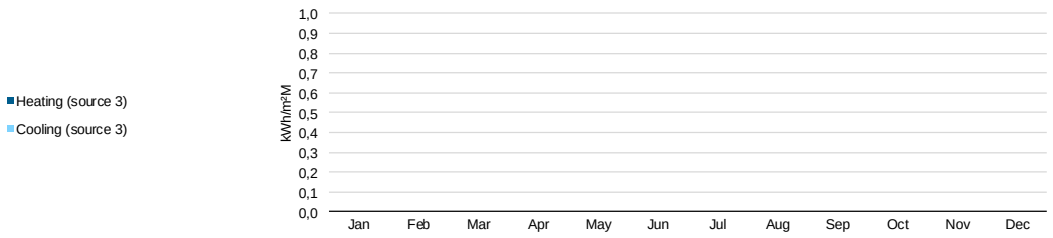
Heating

DC_final energy demand	kWh/M	0	0	0	0	0	0	0	0	0	0	0	0
DC_usable energy demand	kWh/M	2860	2340	1950	780	260	130	130	130	260	650	1820	2600
Factor		0	0	0	0	0	0	0	0	0	0	0	0

Cooling

DC_final energy demand	kWh/M	0	0	0	0	0	0	0	0	0	0	0	0
DC_usable energy demand	kWh/M	0	0	39	65	156	260	676	234	156	39	0	0
Factor		#DIV/0!	#DIV/0!	0	0	0	0	0	0	0	0	#DIV/0!	#DIV/0!

Graphical evaluation



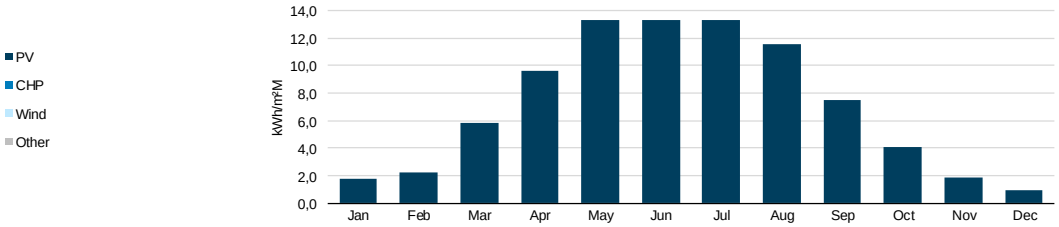
▼ Electricity generation

Note: The self consumption (see below) should indicate the proportion of energy that can be used directly by the building/users without being fed into the grid. For the self consumption, the calculation time step must be hourly or smaller. If the time step is larger than hourly (eg. daily), the data should not be inserted because they are not reliable.

CHP: combined heat & power generation based on combustion engines.

Location:	**Wuppertal**	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	
PV + PVT	kWh/M	95	120	310	515	710	710	710	620	400	220	100	50	4560	kWh/a
	kWh/m_{cfa}^2M	1,78	2,25	5,80	9,64	13,29	13,29	13,29	11,61	7,49	4,12	1,87	0,94	85,39	kWh/m_{cfa}^2a
Self consumption	%														%
CHP	kWh/M													0	kWh/a
	kWh/m_{cfa}^2M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	kWh/m_{cfa}^2a
Self consumption	%														%
Wind	kWh/M													0	kWh/a
	kWh/m_{cfa}^2M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	kWh/m_{cfa}^2a
Self consumption	%														%
Other	kWh/M													0	kWh/a
	kWh/m_{cfa}^2M	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	kWh/m_{cfa}^2a
Self consumption	%														%
Total	kWh/M	95	120	310	515	710	710	710	620	400	220	100	50	4560	kWh/a
	kWh/m_{cfa}^2M	1,78	2,25	5,80	9,64	13,29	13,29	13,29	11,61	7,49	4,12	1,87	0,94	85,39	kWh/m_{cfa}^2a
	cumulative	1,78	4,03	9,83	19,47	32,77	46,06	59,36	70,97	78,46	82,58	84,45	85,39		
Self consumption	%														%

Graphical evaluation



Note: This sheet refers to the design of the **House Demonstration Unit**. Devices and furniture that do not belong to the building (e.g. household appliances such as washing machines and refrigerators) and lighting are not part of the building life cycle assessment.

kg CO_2e = kg CO2-equivalents [Global Warming Potential (**GWP**)]

Calculation methods

Calculation period	a	50

Calculation tools applied	Calculation tool	Tool website
Tool 1		
Tool 2		
Tool 3		

▼ Energy consumption during use (calculation)

Note: The pre-filled emission factors for the natural gas and power grid correspond to the data of Table 4 in Rule 7.

Energy purchase

Note: When entering the data, it is important to note that only the additional energy purchased for the building must be considered for the carbon footprint! Also, mobility and appliances are not included in the simplified analysis. This value can be determined by SimRoom, for example.
Grid electricity = [Final energy demand (electricity)] - [Self consumption (electricity)] - [Mobility (electricity)] - [Appliances (electricity)]

	Final energy demand kWh/a	kWh over 50a	**Emisssion factor** g CO_2e/kWh	**Emissions, 50a** kg CO_2e
Grid electricity	3700	185000	200	37000
Natural gas	0	0	241	0
Others*				
		0		0
		0		0
			Sum:	37000

*In the case of other energy carriers, the applied carbon factors must be **communicated to the SDE21 Organisers** for general consistency (see Rule 7).

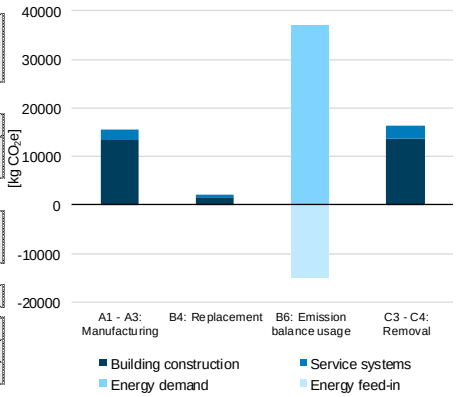
Feed-in electricity (generated and not self-consumed)

	Feed-in electricity kWh/a	kWh per 50a	**Emisssion factor** g CO_2e/kWh	**Emission credits, 50a** kg CO_2e
AC power grid	1504	75200	200	-15040

Emission balance usage phase, 50a	**Total:**	21960

Life cycle analysis

		Building construction	Service systems	Total
A: Manufacturing phase				
A1 - A3: (A1: Sourcing of raw materials; A2: Transportation; A3: Production)	kg CO_2e	13500	2000	15500
B: Usage phase (50a)				
B4: Replacement	kg CO_2e	1500	500	2000
B6: Emission balance usage	kg CO_2e			21960
C: Removal phase				
C3 - C4: (C3: Waste processing; C4: Disposal)	kg CO_2e	13750	2500	16250
Total	kg CO_2e	28750	5000	55710
per gross floor area	/m^2_{gfa}	368,6	64,1	714,2
per net floor area	/m^2_{nfa}	529,1	92,0	1025,2
per net conditioned floor area	/m^2_{cfa}	538,3	93,6	1043,2



Note: This sheet shall include all appliances and equipment intended for the operation for Contest 8 **House Functioning**, indicating compliance with the requirements stated in Rule 22. For the energy class, we refer to the **European Union energy label**, which ranges from A to G since 2021.

Appliances specifications

Appliances	Name	Capacity / volume litre	Power W	Energy consumption kWh/a	Energy class (label) A - G
Refrigeration	Bauknecht KGLF 182 IN 2	228	160	243	B
Freezing	integrated in fridge	111			
Clothes Washing	Siemens WU14Q420	58	2300	135	A
Clothes Drying	Siemens iQ500	112	2300	616	E
Dishwashing	NEFF GV 360	120	2200	76	A
Oven	BEKO BUM 260	66	3700	288	C
Cooking	BEKO EH 9610		1700	288	C

Data sheet / user manual (file name)

Refrigeration	pdf	data-sheet.pdf
Freezing	pdf	data-sheet.pdf
Clothes Washing	pdf	data-sheet.pdf
Clothes Drying	pdf	data-sheet.pdf
Dishwashing	pdf	data-sheet.pdf
Oven	pdf	data-sheet.pdf
Cooking	pdf	data-sheet.pdf

▼ Home electronic equipment

Audivisual equipment	Name	Display size inch	Power W	Energy consumption kWh/a	Energy class (label) A - G
Computer	Laptop	15	80	45	
TV	LG 32LM6300PLA	32	36	50	D
Video Player	BP250 Bluray Player		17	1,9	

Data sheet / user manual (file name)

Computer	pdf	data-sheet.pdf
TV	pdf	data-sheet.pdf
Video Player	pdf	data-sheet.pdf

▼ Smart home systems

Appliances	Name	Power W	Energy consump. kWh/a	Scope of functions
System 1				[please insert]
System 2				[please insert]
System 3				[please insert]

Data sheet / user manual (file name)

System 1	pdf	
System 2	pdf	
System 3	pdf	

Mobility vehicle

Type		E-cargo bike	dropdown
Name		e-Muli ST Lastenrad	
Manufacturer name		muli-cycles GmbH	
Costs (gross)	€	4820	
Subject to registration	yes/no	yes	dropdown

Dimensions

Length	cm	195
Width	cm	60
Height	cm	75
Weight	kg	32
Max. payload	kg	170

Engine

Maximum Speed	km/h	25
Engine Power	W	250
Battery capacity	Wh	504

Data sheet / user manual (file name)

Mobility vehicle	pdf	data-sheet.pdf

ANNEX 74

EBC

Energy in Building and Communities Programme

www.iea-ebc.org

Technology Collaboration Programme
by iea