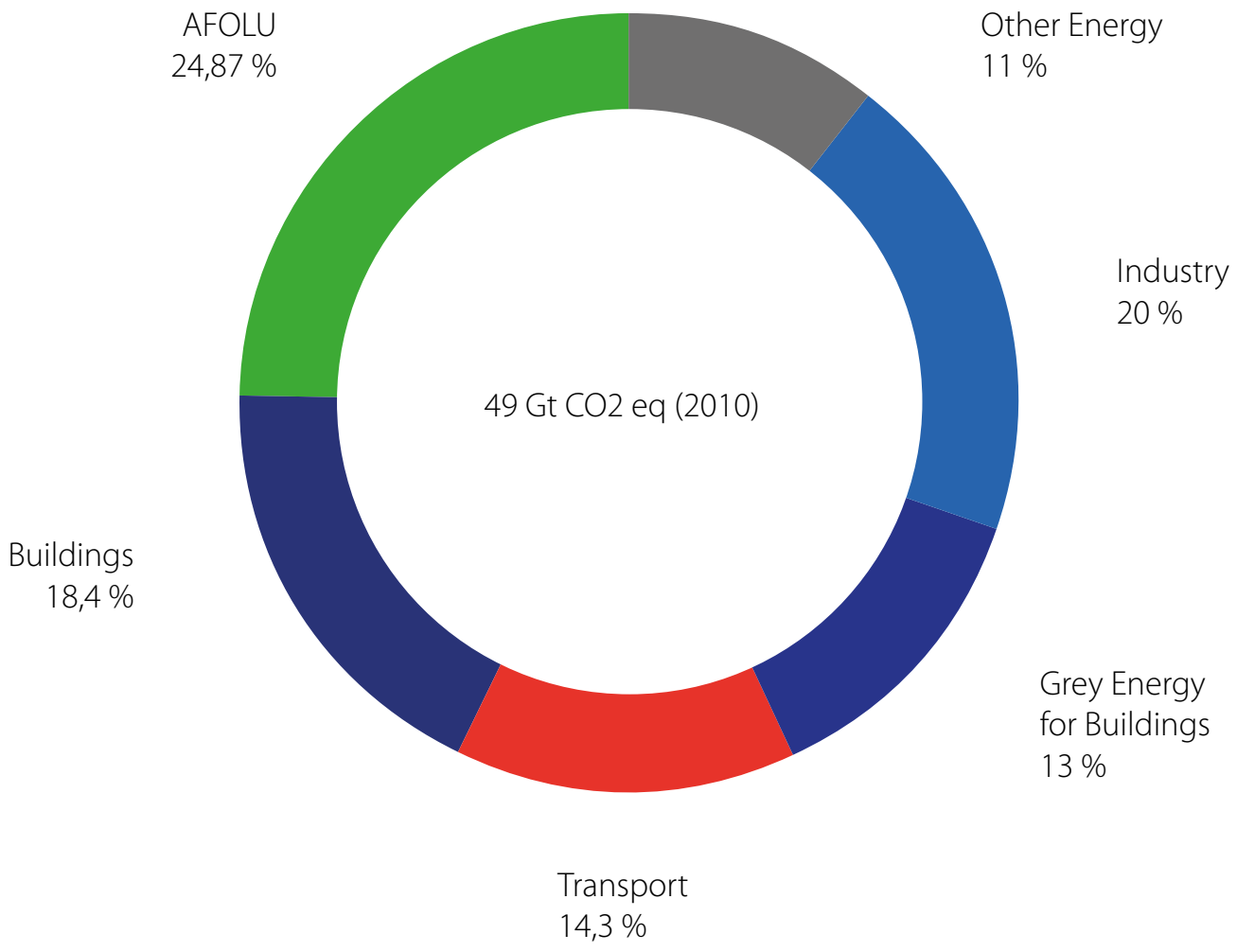
LOW-TECH

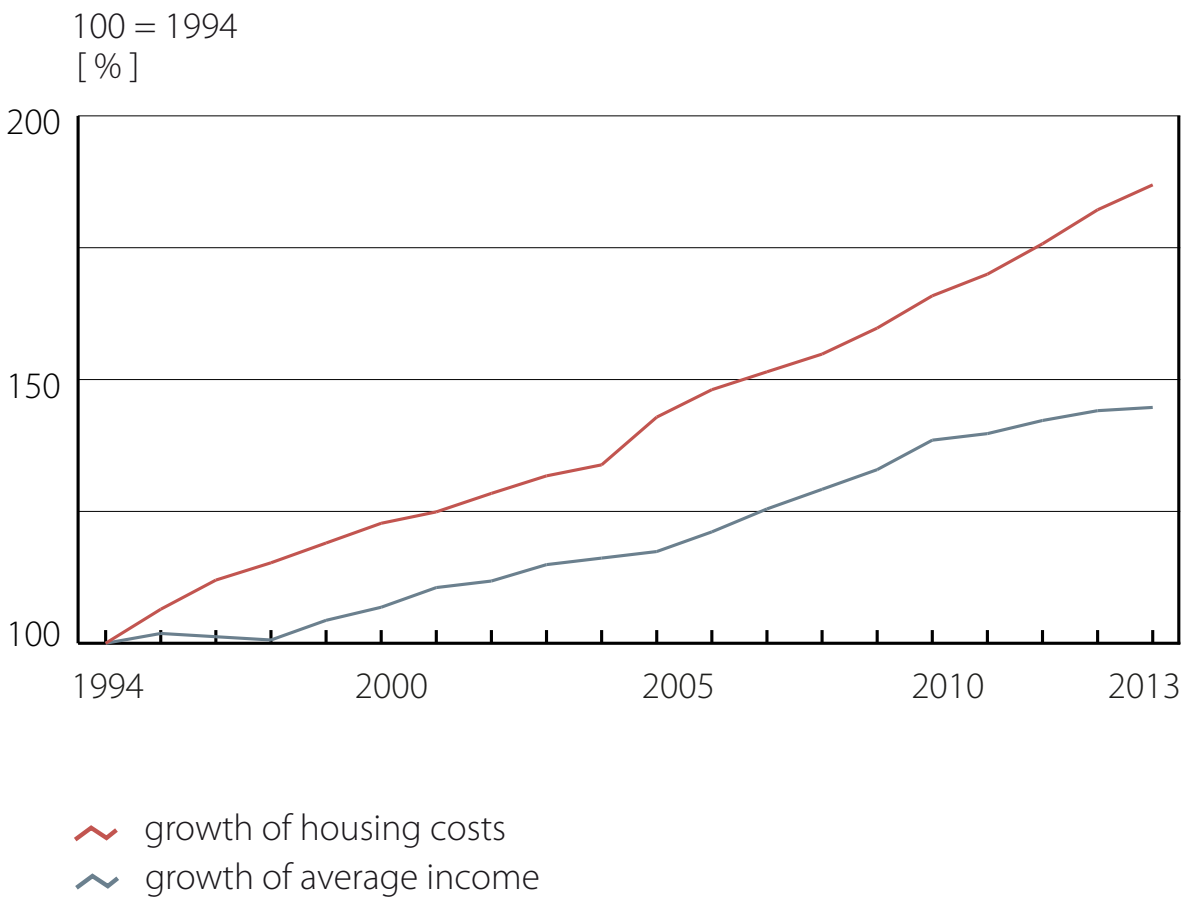
Die neue Einfachhheit

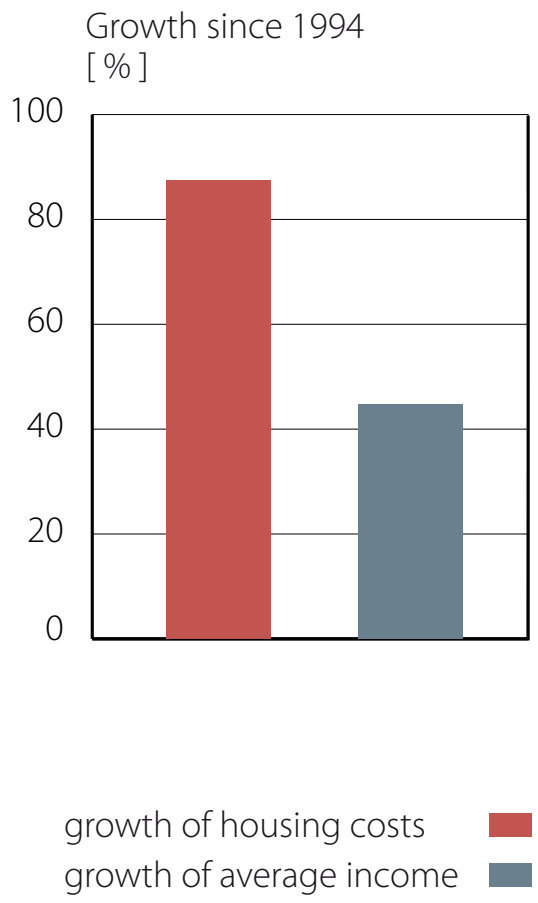
Direct and Indirect CO2 Emissions



IPCC WGIII, AR5 Summary for Policymakers, 2010

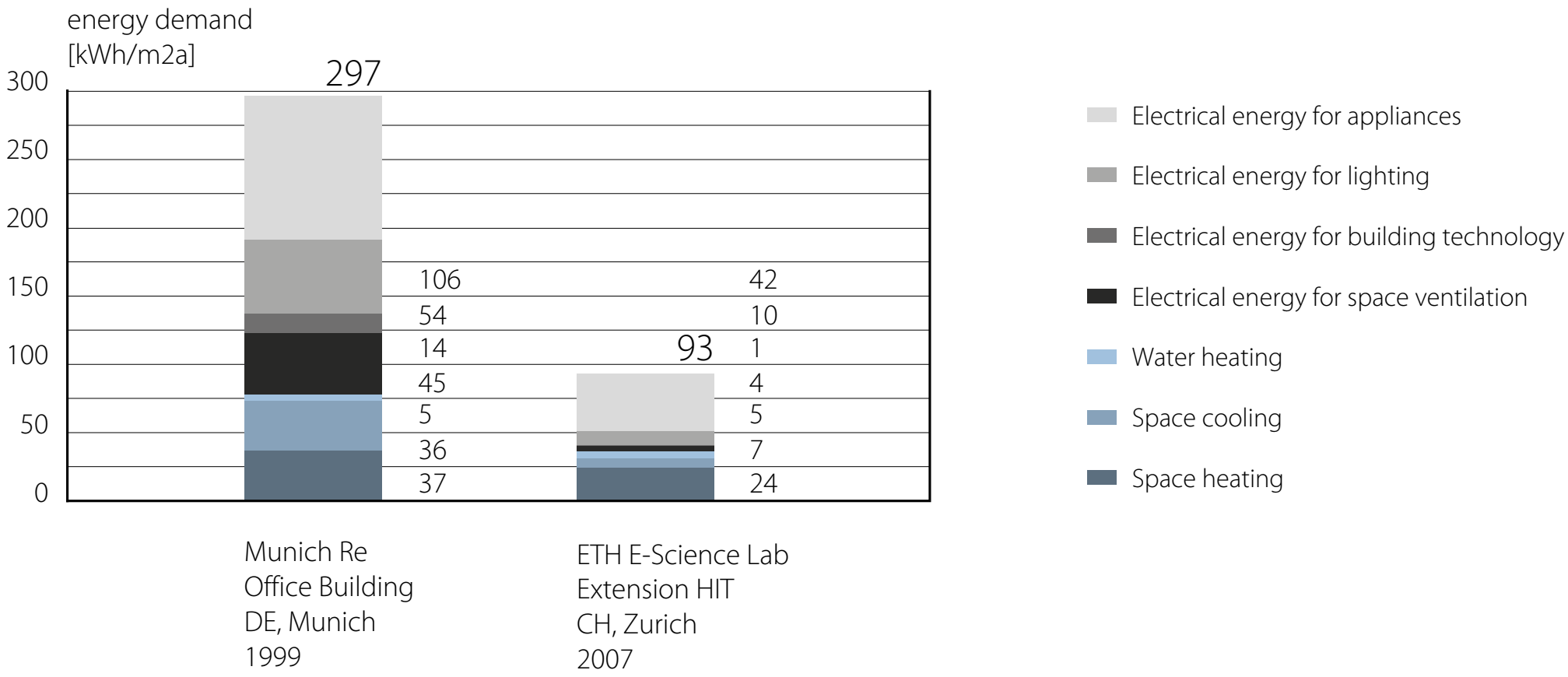
Housing Costs and Average Income



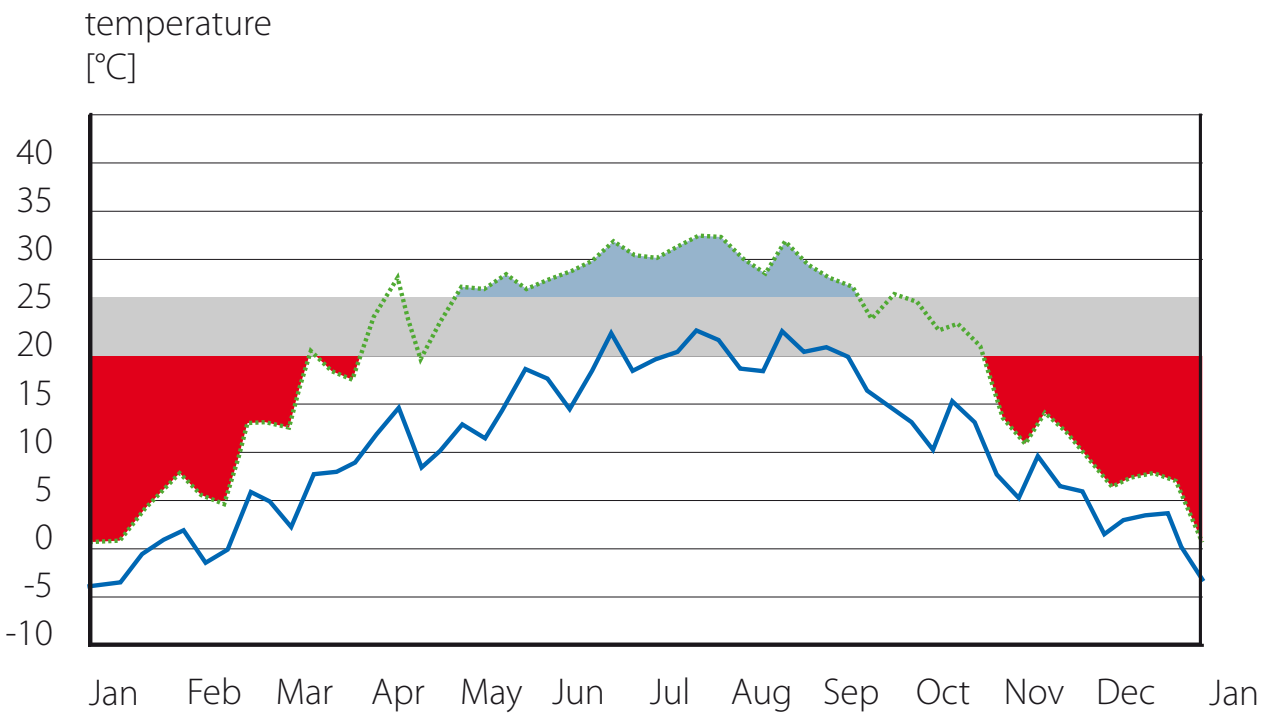


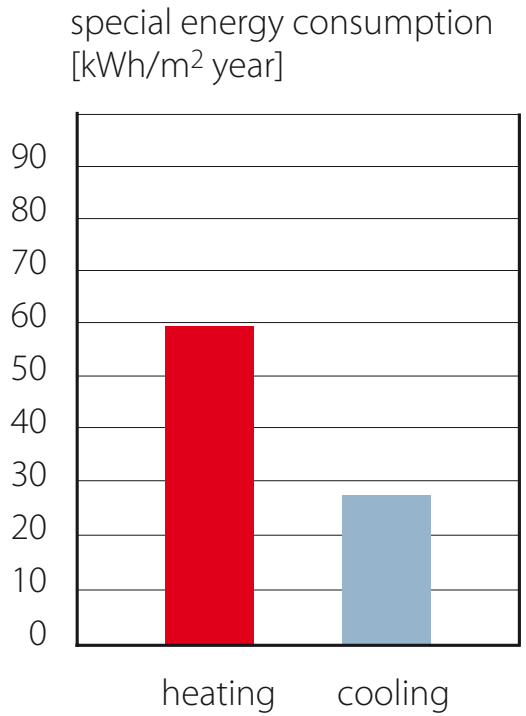
Statistic Austria

Overall Energy Demand



Building According to Standard





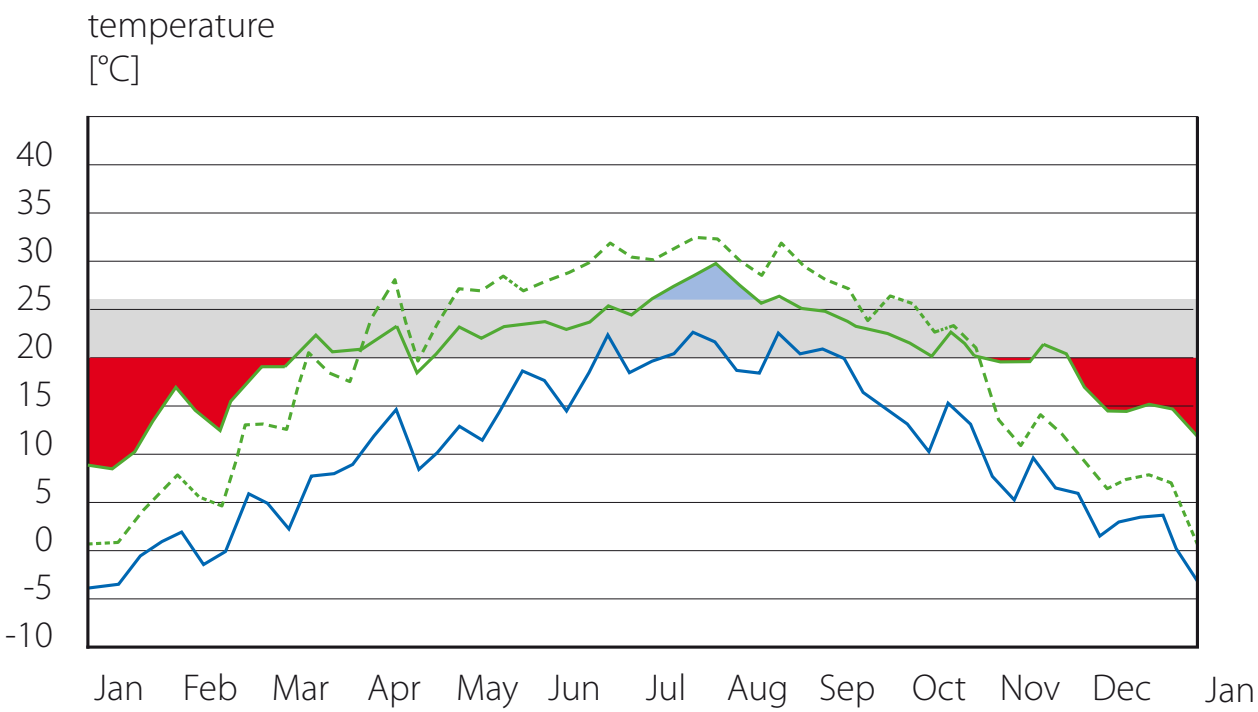
internal temperature to norm [°C]

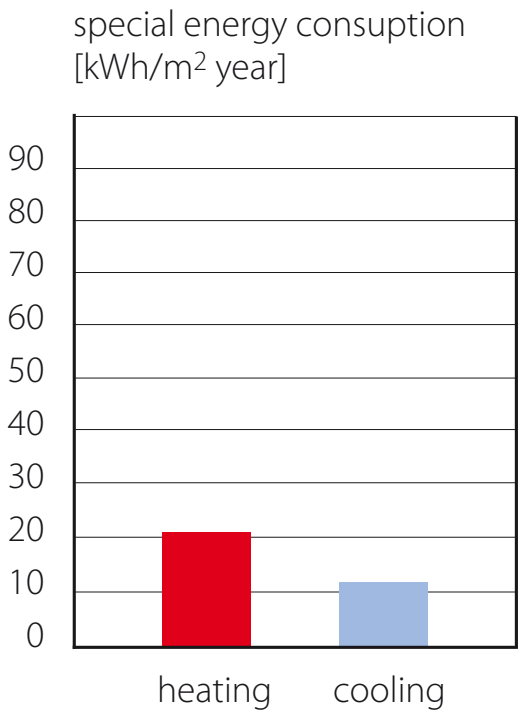
external temperature [°C]

comfortable temperature range [°C]

Prof. Dr. Lars Junghans Dr. ETH Peter Widerin

Optimized Building





internal temperature to norm [°C]

optimised internal temperature [°C]

external temperature [°C]

comfortable temperature range [°C]

Prof. Dr. Lars Junghans Dr. ETH Peter Widerin

Optimization of a Building

Geometric Factors	
Useable Area	/gross floor area
Envelope Area	/gross floor area
Opaque Surfaces	/gross floor area
Glazed Surfaces	/gross floor area
Use of Daylight	/gross floor area
Night Cooling	/gross floor area
Construction Factors	
U-Values	?
G-Values	?
Airtightness	?

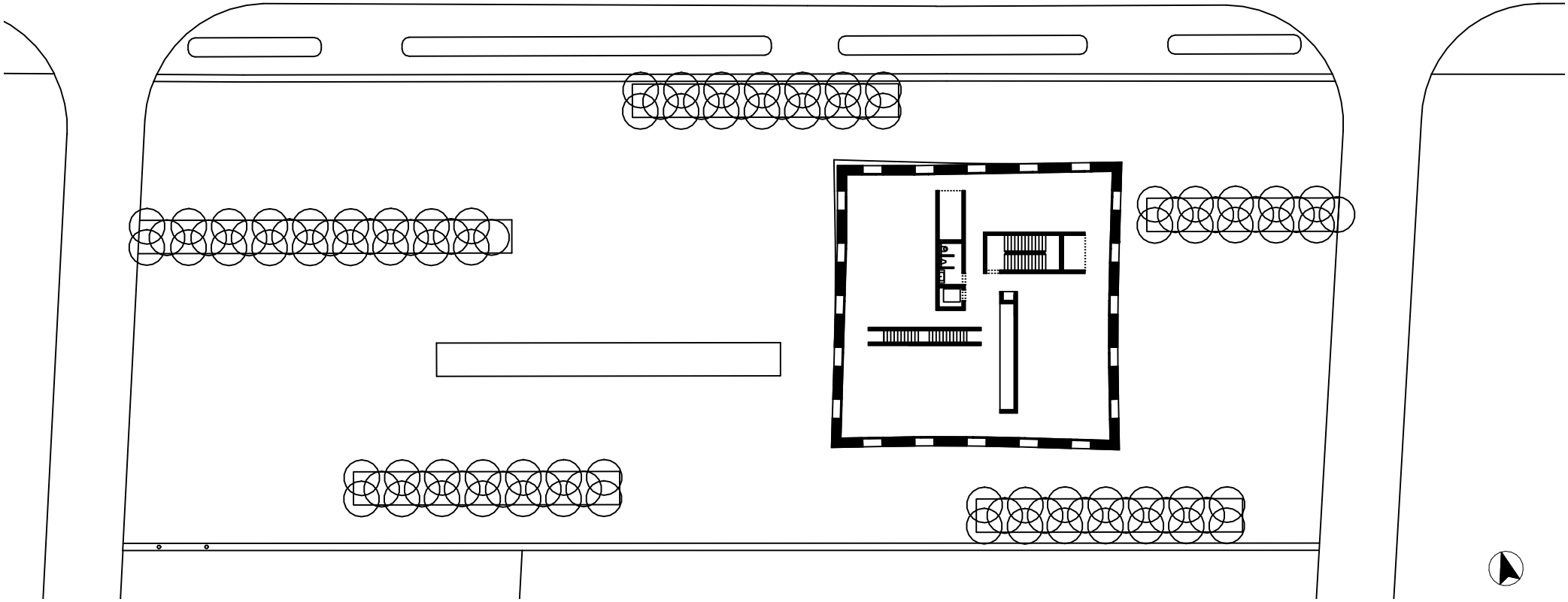
The building is determined by its uses.
Big over small windows
Thick over thin walls
Compact over small buildings

What are the strategies to achieve the objectives

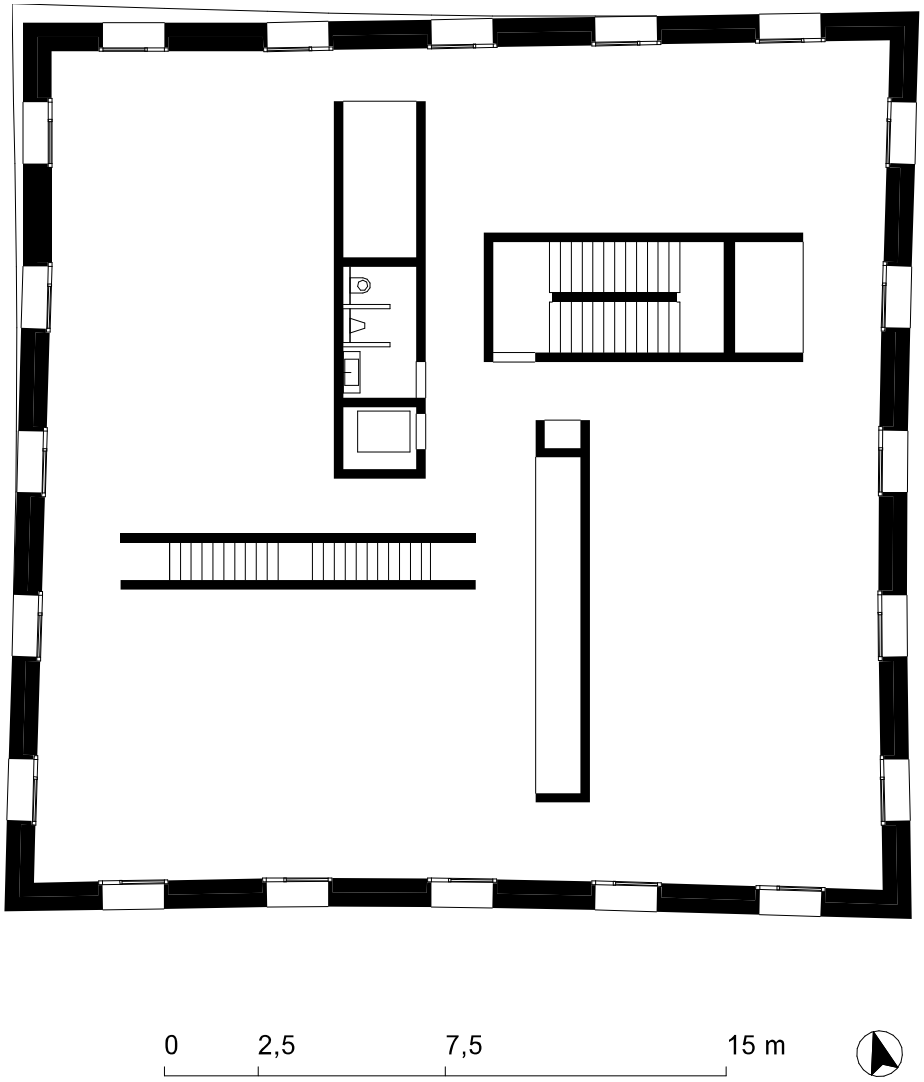
Optimized building
The building responds to the user
The temperature, CO_2 level and movement of the user remain
Keep the Thermal Mass exposed
76% of floors and ceilings, 12% load bearing inner walls, 12% load bearing outer walls
We will replace the hardware (heating, ventilation) by software (control)
Optimize the use of daylight
The building is neutral in use (offices, apartments, gallery, canteen, ..)
The arrangement of ventilation according to fluidic logic
(high simulation effort)
The use of light as a backup system

Use of the available
One person creates 80 Wh
The ventilation requirement of
approximately $20m^3$
($36m^3$) outside air just +1 ° C
just 80 Wh

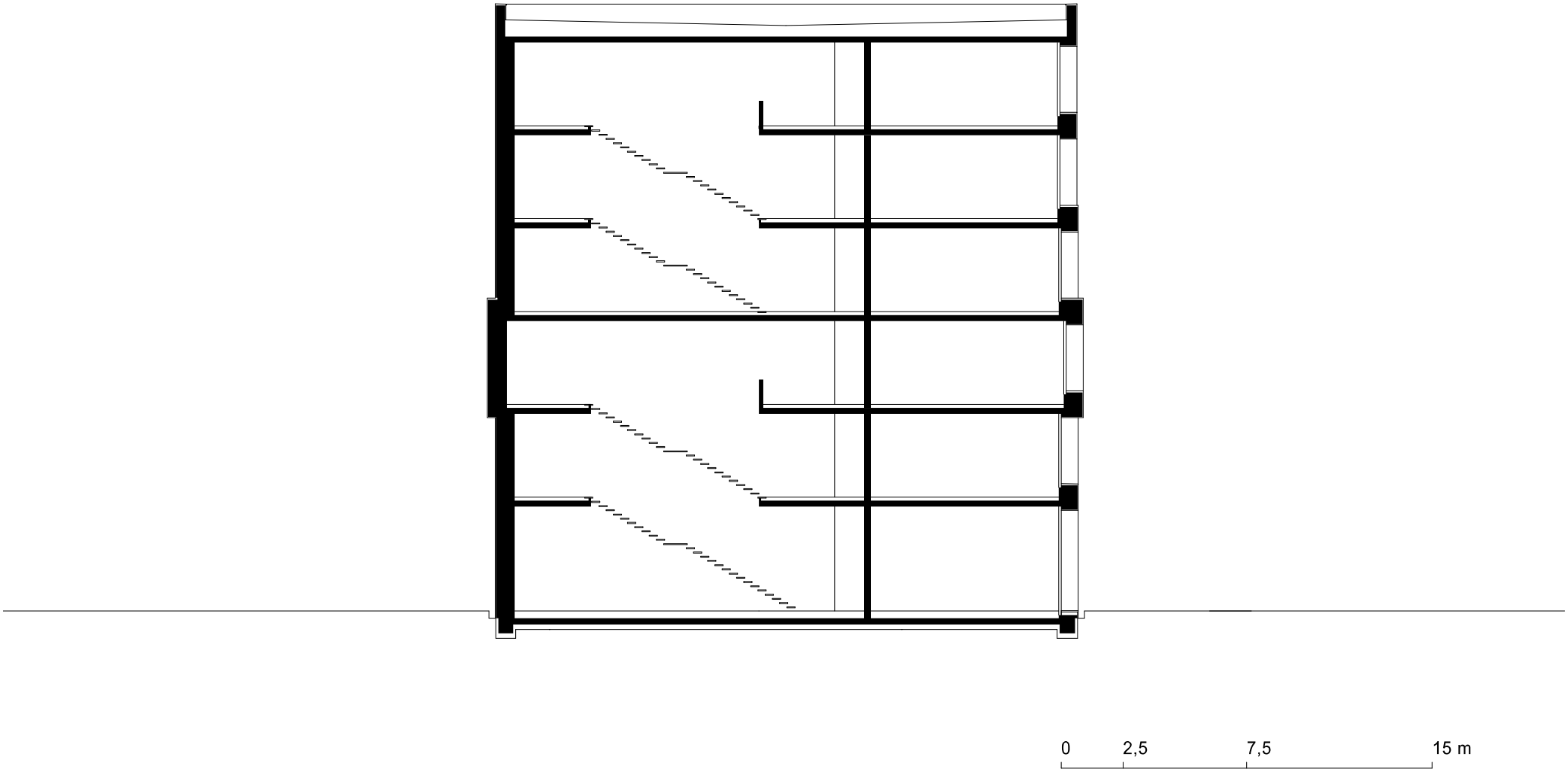
2226, Lustenau, Austria



2226, Lustenau, Austria



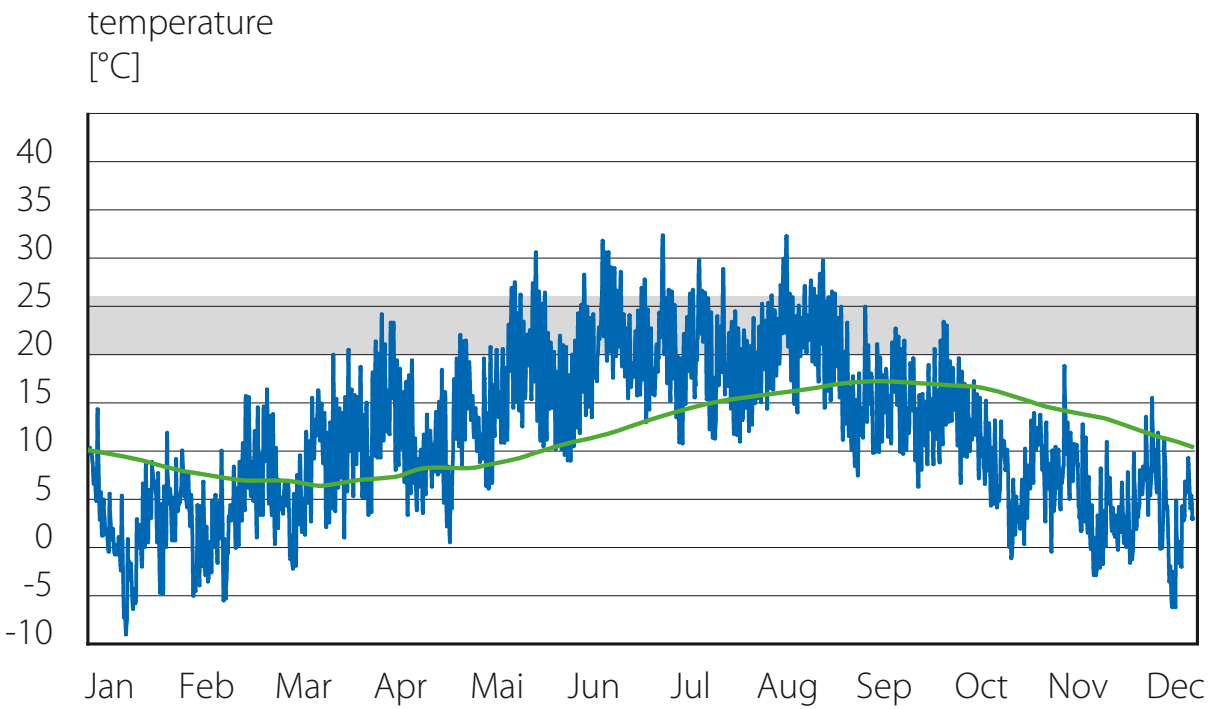
2226, Lustenau, Austria



2226, Lustenau, Austria

Heat Capacity

External and internal temperature of the empty building



The range of variation in the year is max. 8 ° C

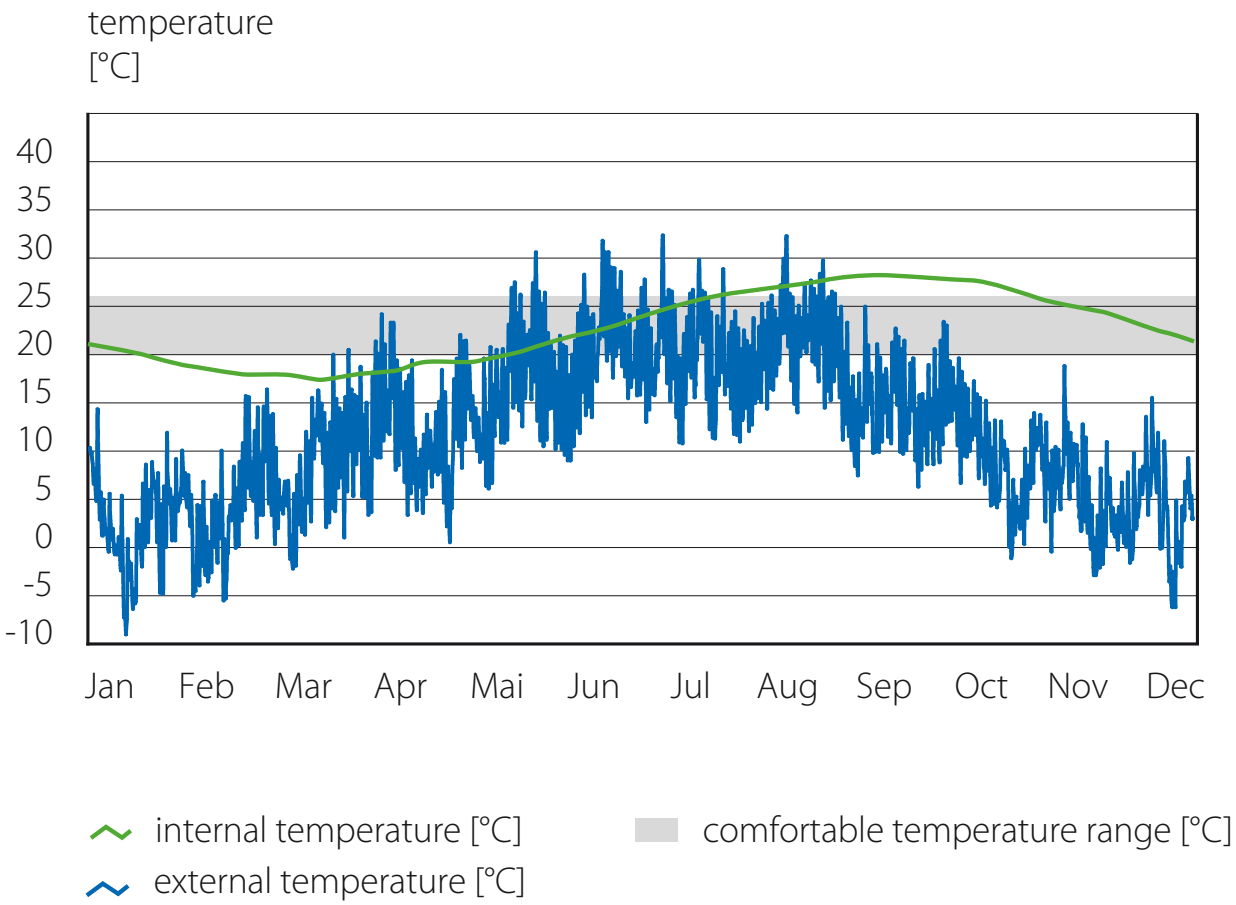
internal temperature [°C]

external temperature [°C]

comfortable temperature range [°C]

Heat Capacity

External and internal temperature of the used building without any control system

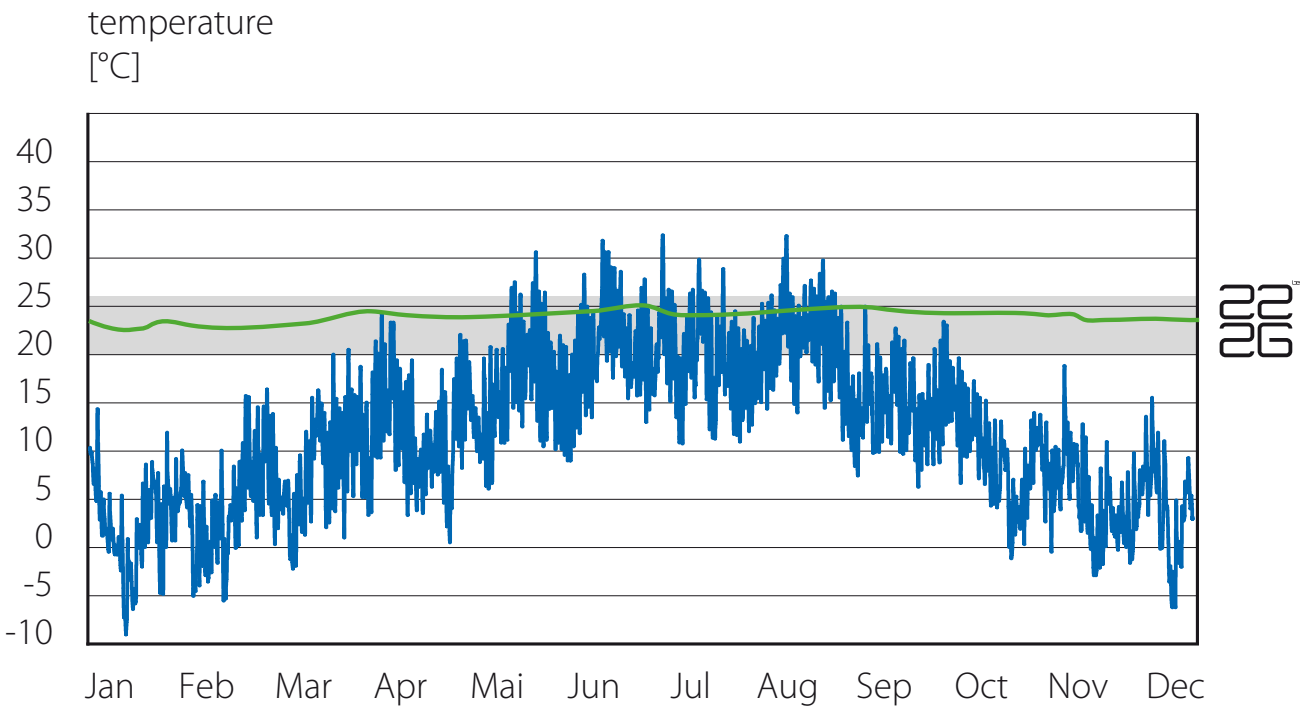


The building without the Control System is cooleded to 18 ° C and heated to 28 ° C

Prof. Dr. Lars Junghans Dr. ETH Peter Widerin

Heat Capacity

External and internal temperature of the used building with control system



Self-Determination
5 Star Hotel
Humidity 40%
Daylight
Natural Fresh Air
Odor

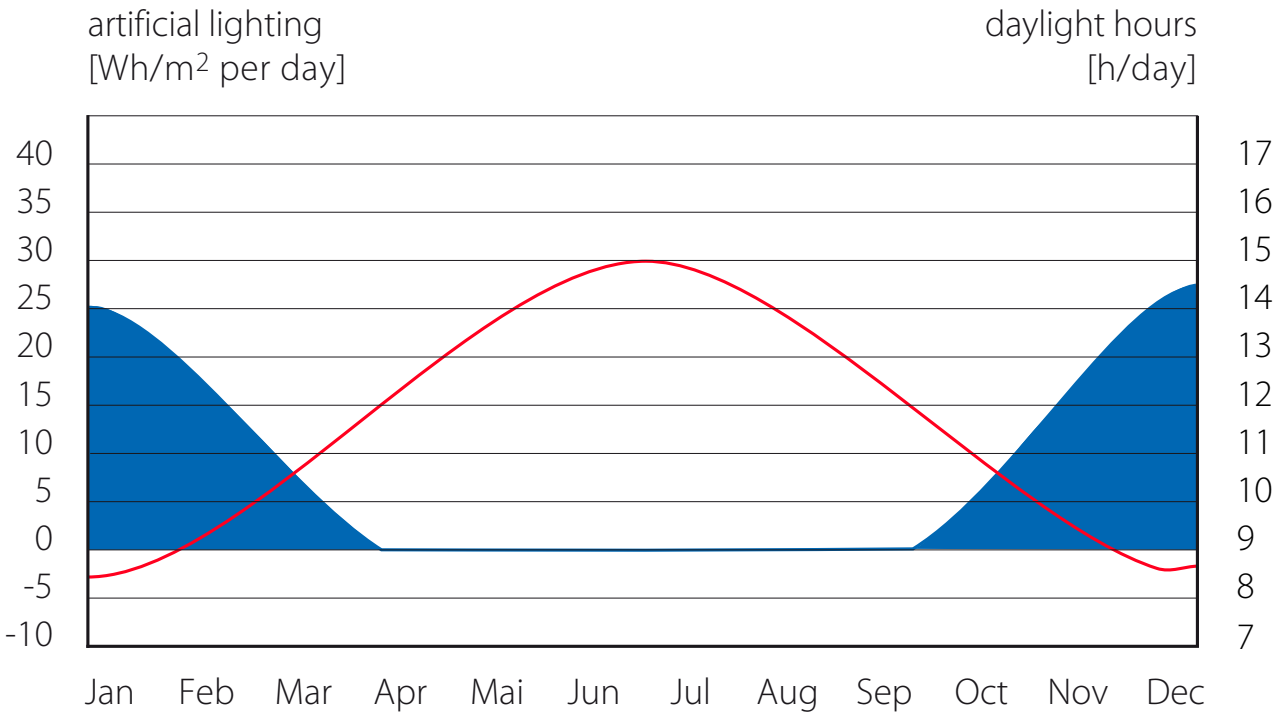
internal temperature [°C]

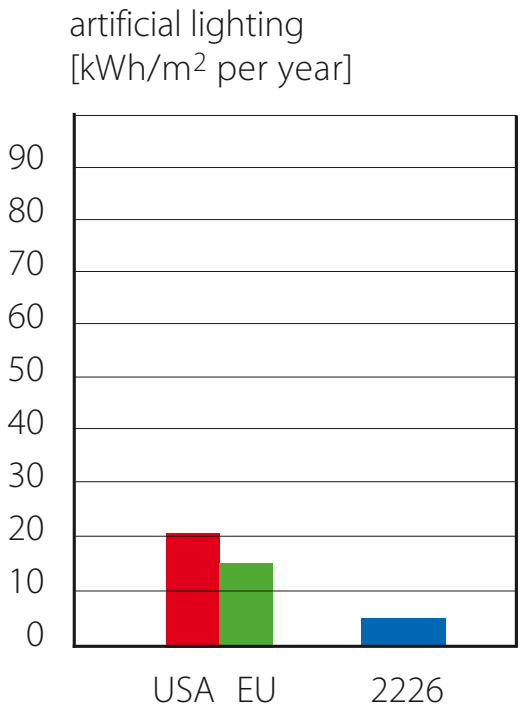
external temperature [°C]

comfortable temperature range [°C]

Prof. Dr. Lars Junghans Dr. ETH Peter Widerin

Artificial Lighting vs. Daylight Hours





artificial lighting [Wh/m^2 per day]

daylight hours [h/day]

similar type of building (north america)

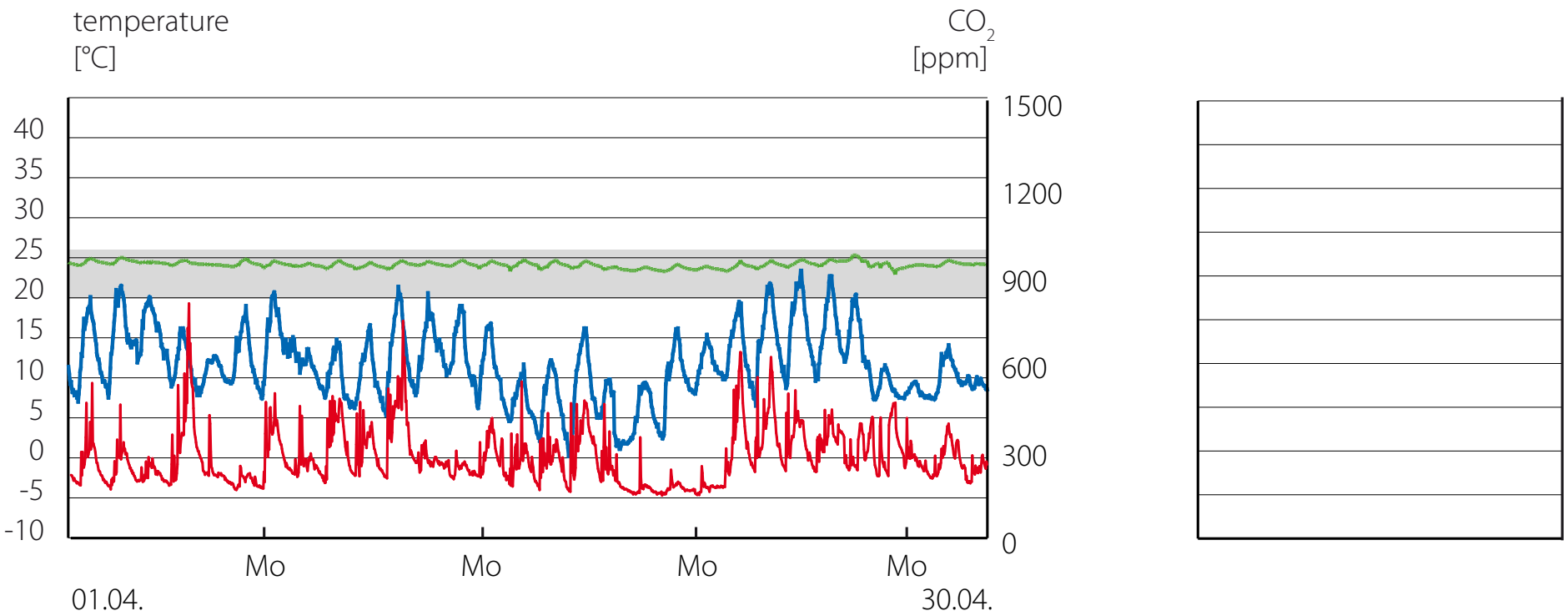
similar type of building (europe)

2226

Prof. Dr. Lars Junghans Dr. ETH Peter Widerin

Top 7, April

1 Person



internal temperature [°C]

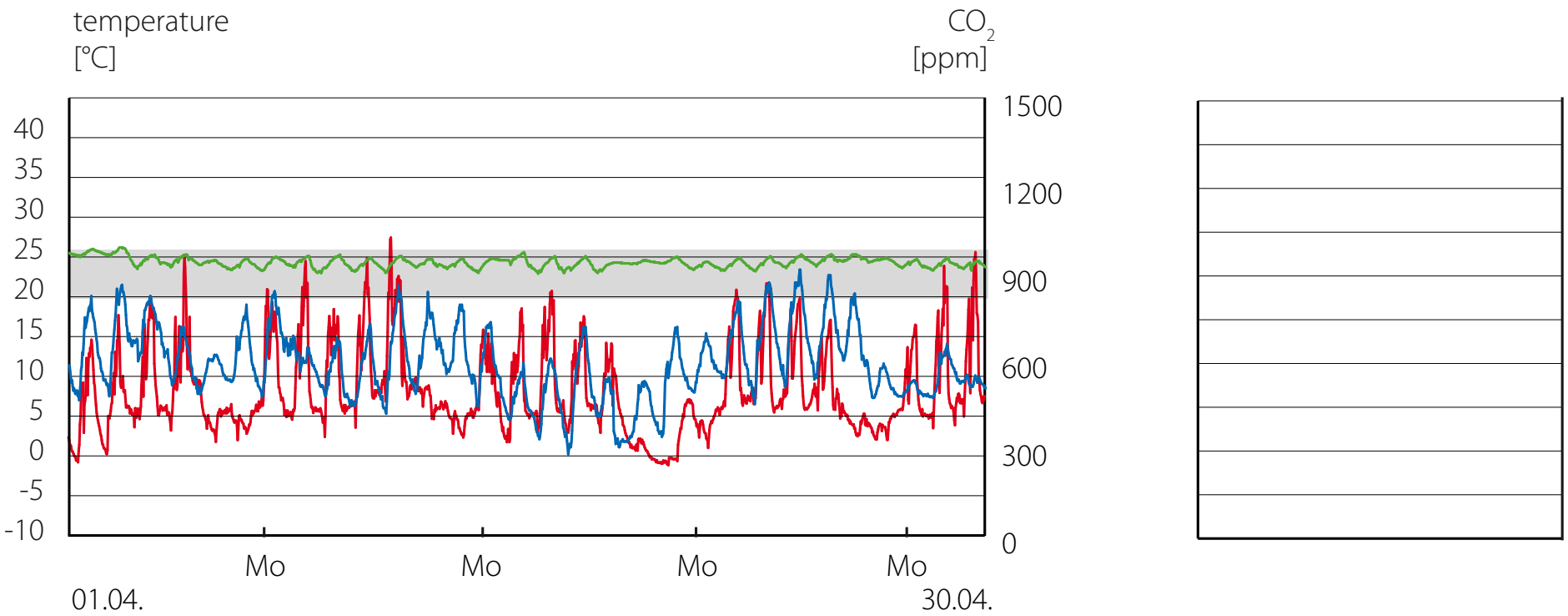
external temperature [°C]

CO_2 [ppm]

comfortable temperature range [°C]

Top 11, April

5-6 People, printer, copier



internal temperature [°C]

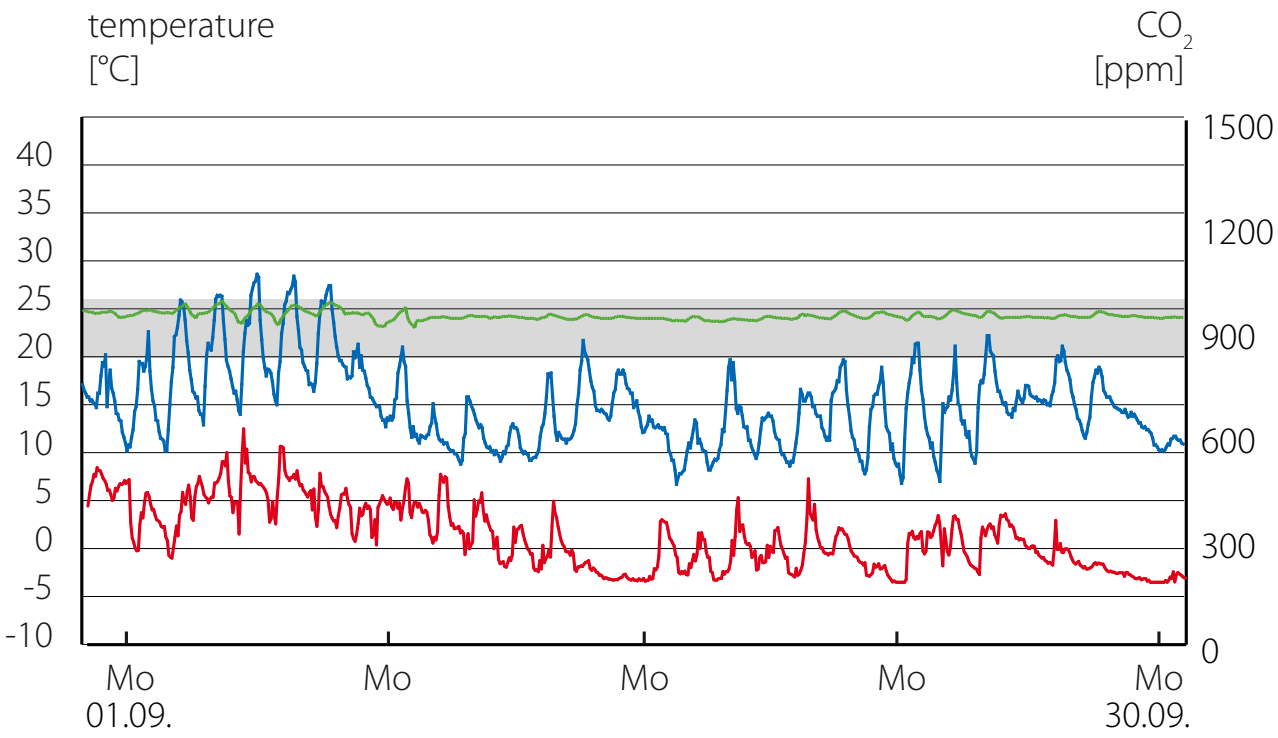
external temperature [°C]

CO_2 [ppm]

comfortable temperature range [°C]

Top 7, September

1 Person



Little Usage
temperature fluctuations
± 0,3 °C
CO2 under ambient air

internal temperature [°C]

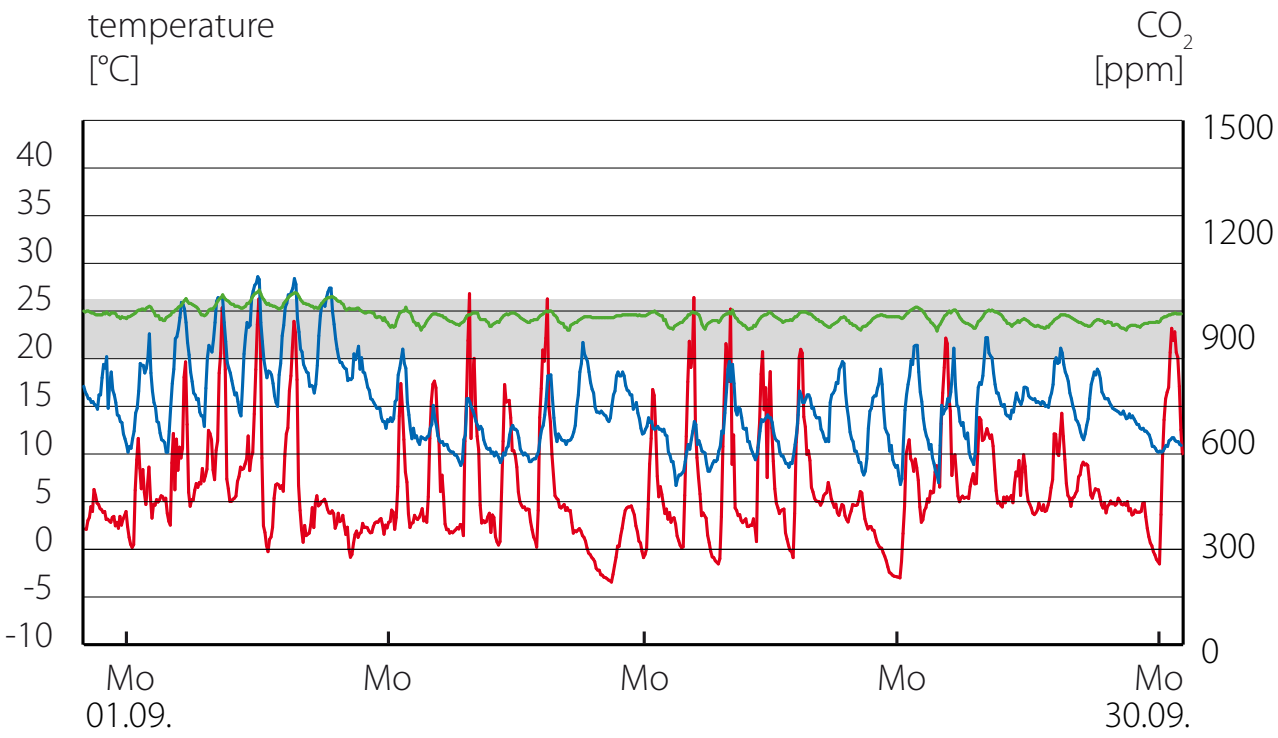
external temperature [°C]

CO_2 [ppm]

comfortable temperature range [°C]

Top 11, September

5-6 People, printer, copier



Much use
See CO2 Levels
Weekend is not working
temperature fluctuations
± 0,7 °C

internal temperature [°C]

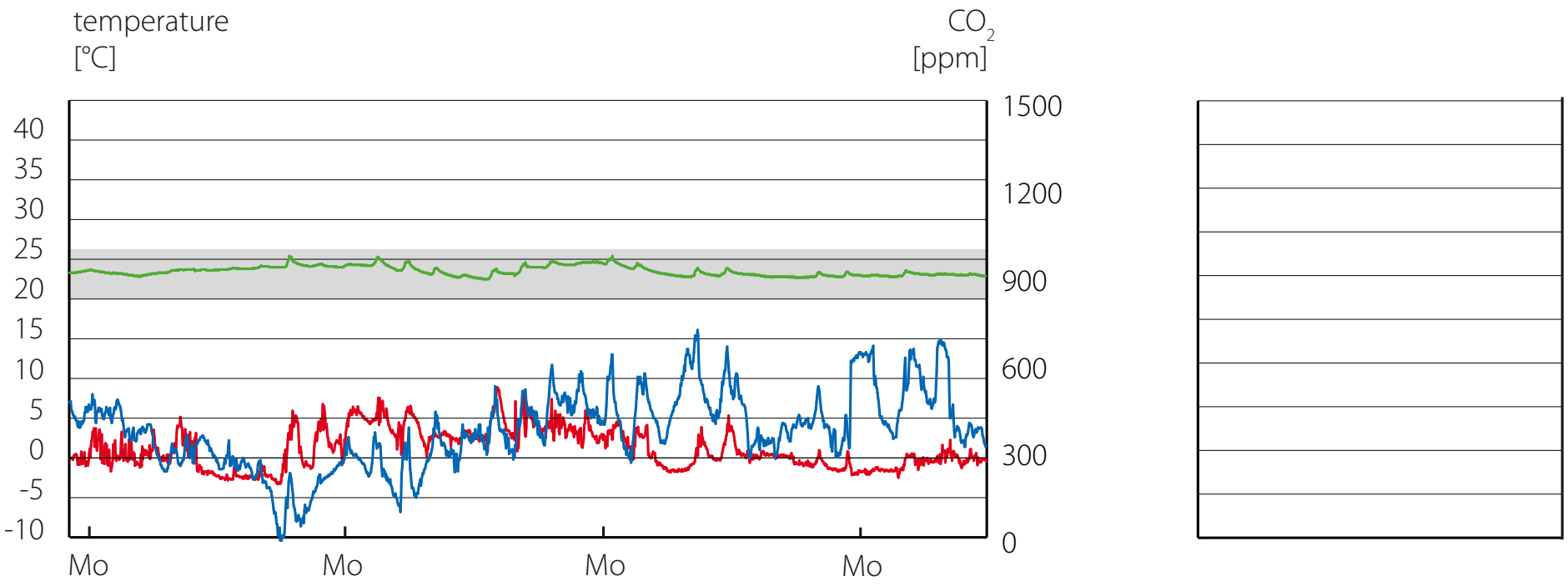
external temperature [°C]

CO_2 [ppm]

comfortable temperature range [°C]

Top 7, January

1 Person



internal temperature [°C]

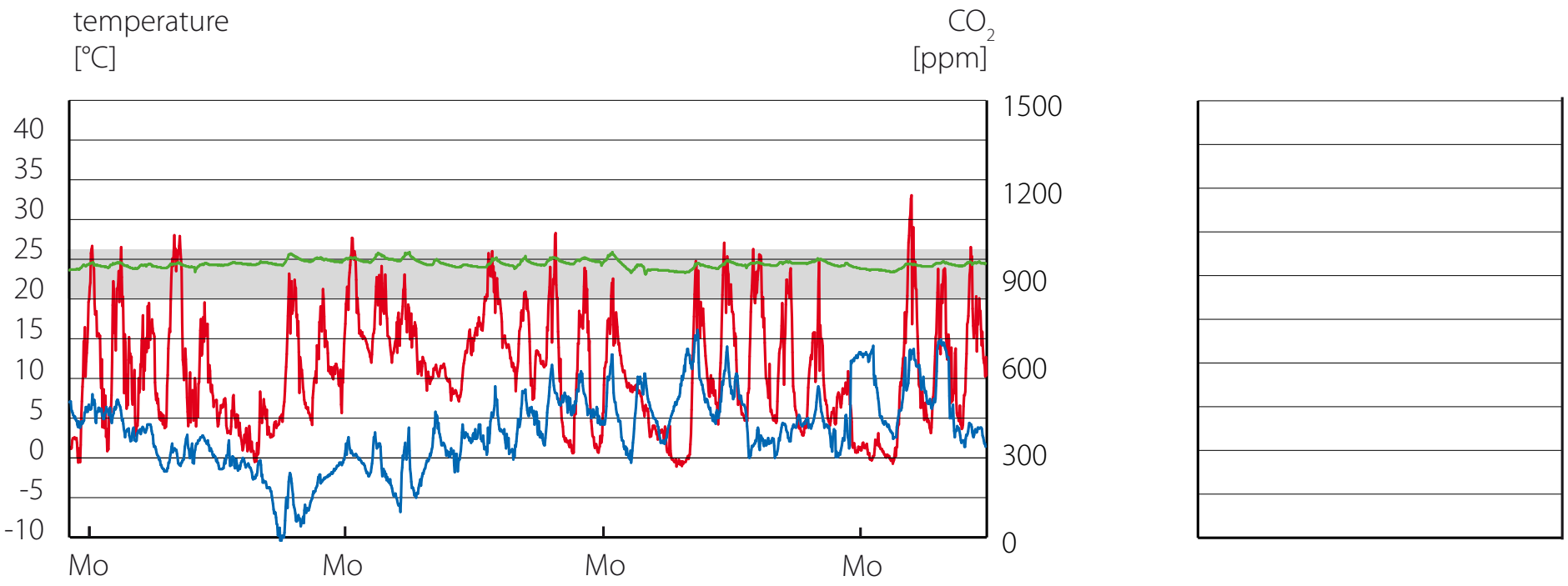
external temperature [°C]

CO_2 [ppm]

comfortable temperature range [°C]

Top 11, January

5-6 People, printer, copier



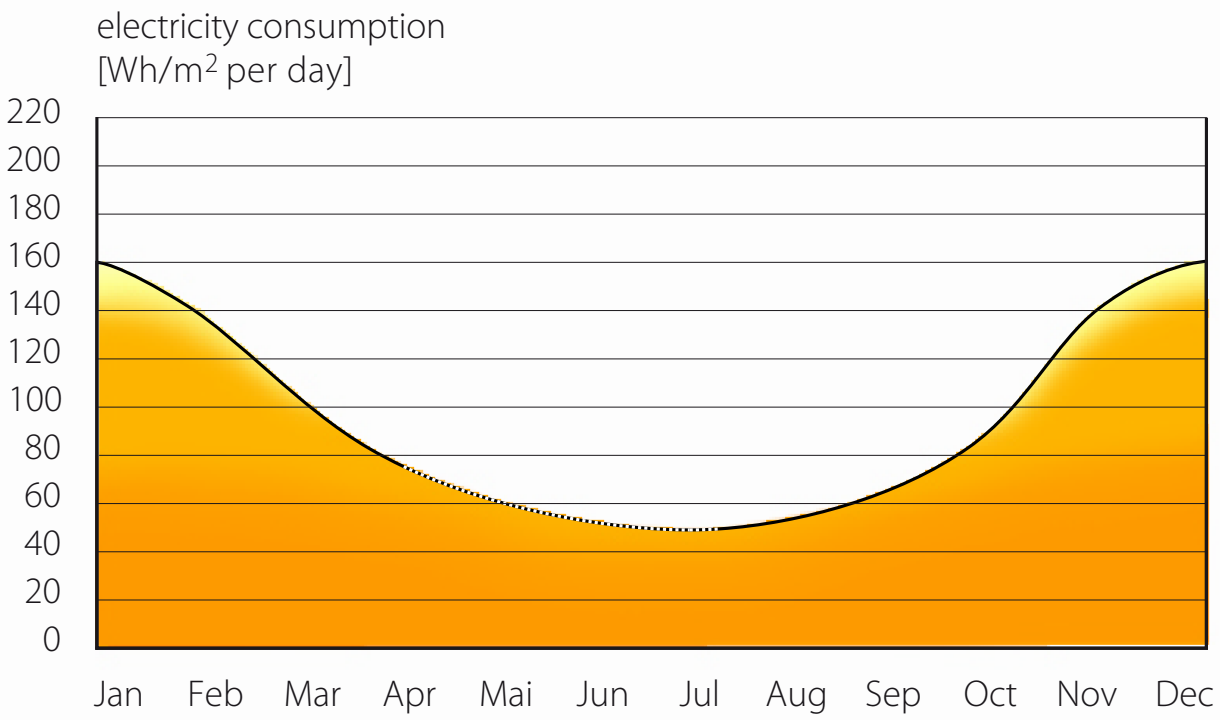
internal temperature [°C]

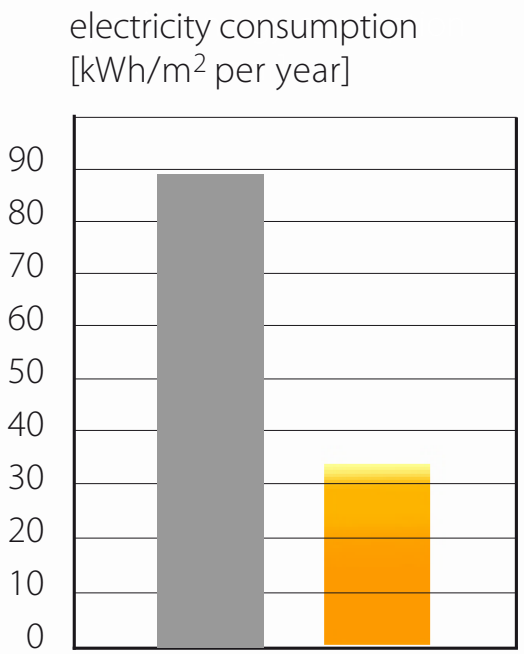
external temperature [°C]

CO_2 [ppm]

comfortable temperature range [°C]

Overall Consumption of Electricity





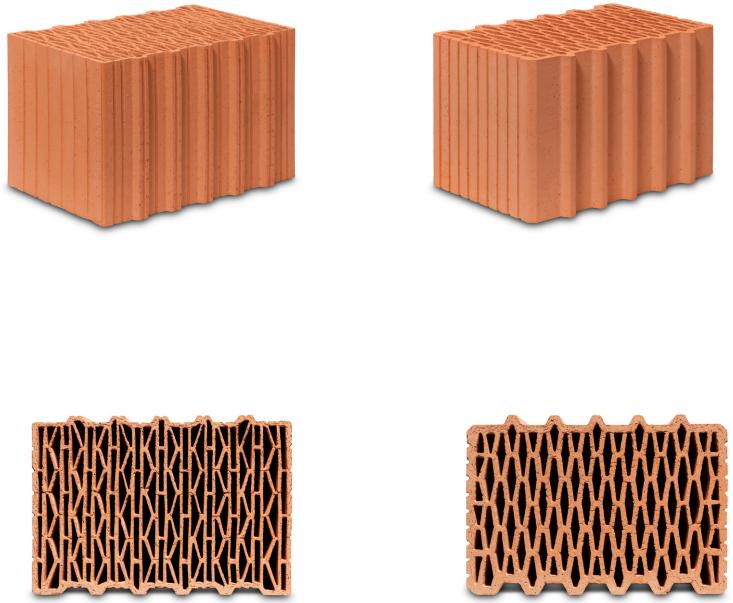
- operation energy (elevator, server, outdoorlight, coffee machine, refrigarator, plotter, copier, artpieces, etc...)
- ec cause to daylight diversification (incl. work at night, dysregulation)
- ec cause to CO_2 and temperature controll

ec [Wh/m2 per day] measuring VKW (08/13 - 03/14)

ec [Wh/m2 per day] calculated (Apr - Jul)

similar type of building

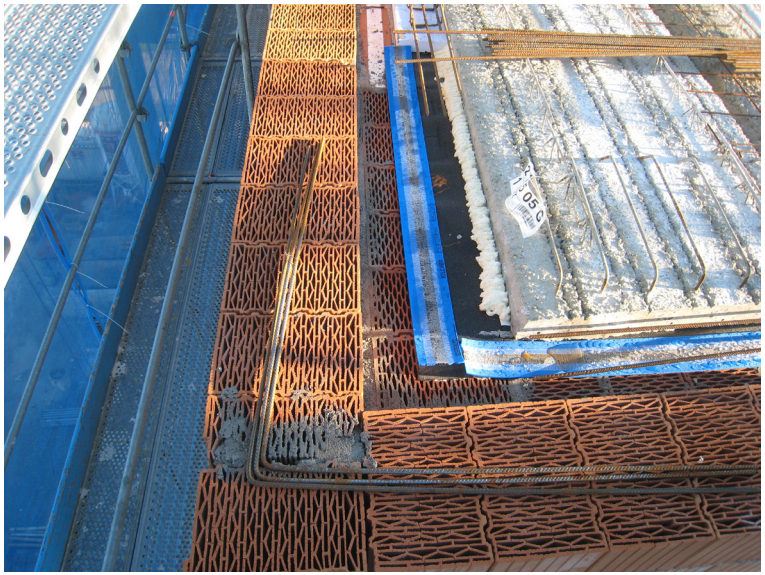
THE BRICK



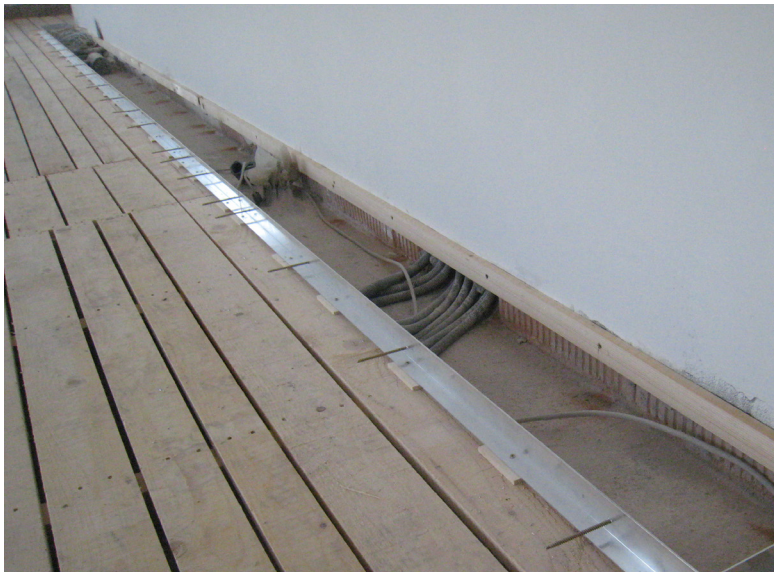
POROTHERM 38 H.i N+F

POROTHERM 38 N+F

THE SLAB



THE FLOOR

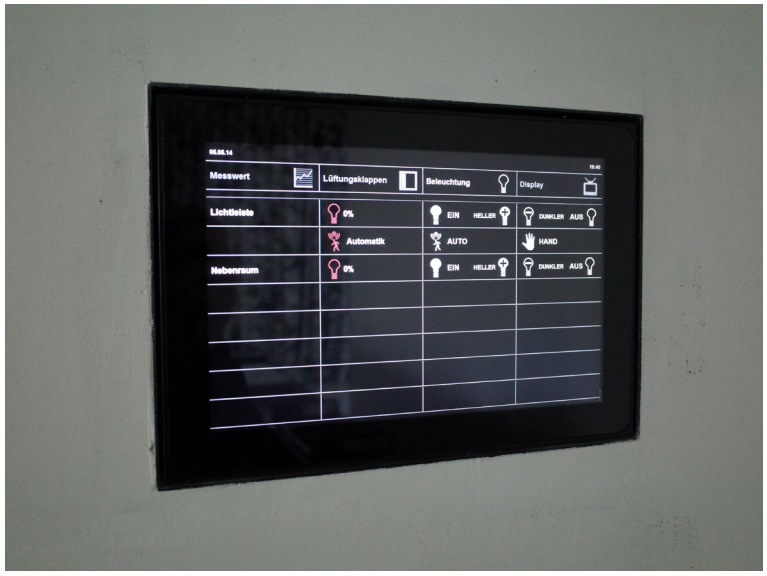


THE WINDOW - THE DOOR

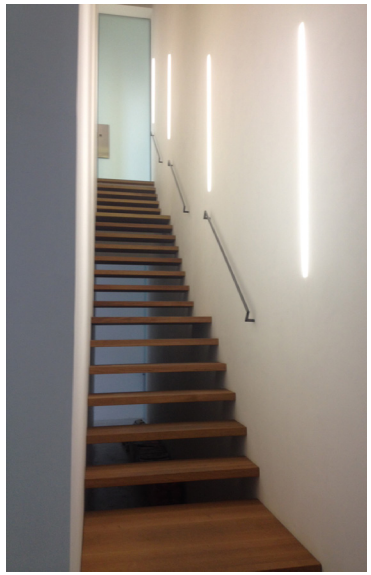
THE PLASTER

THE WINDOW SILL

THE STEERING AND ELECTRICITY

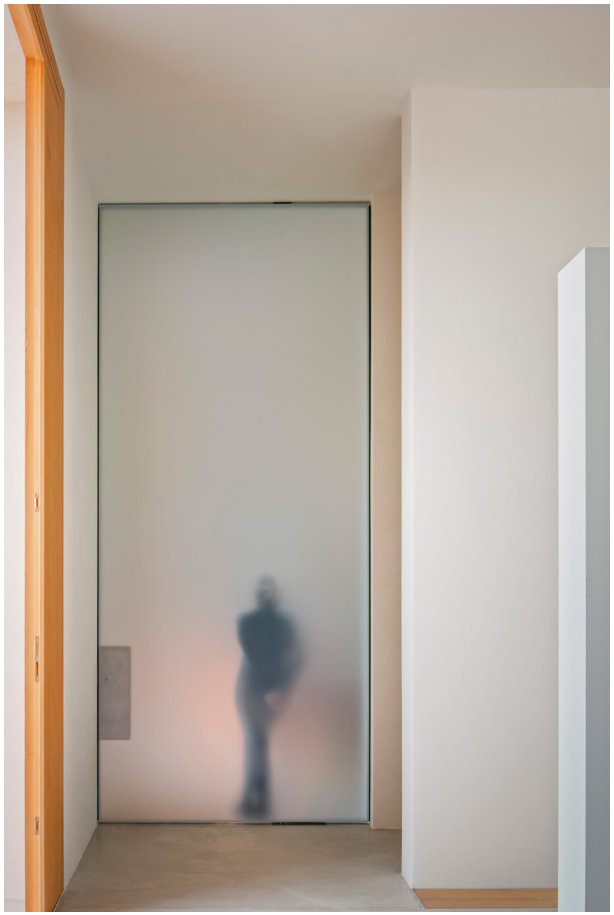


THE LIGHT



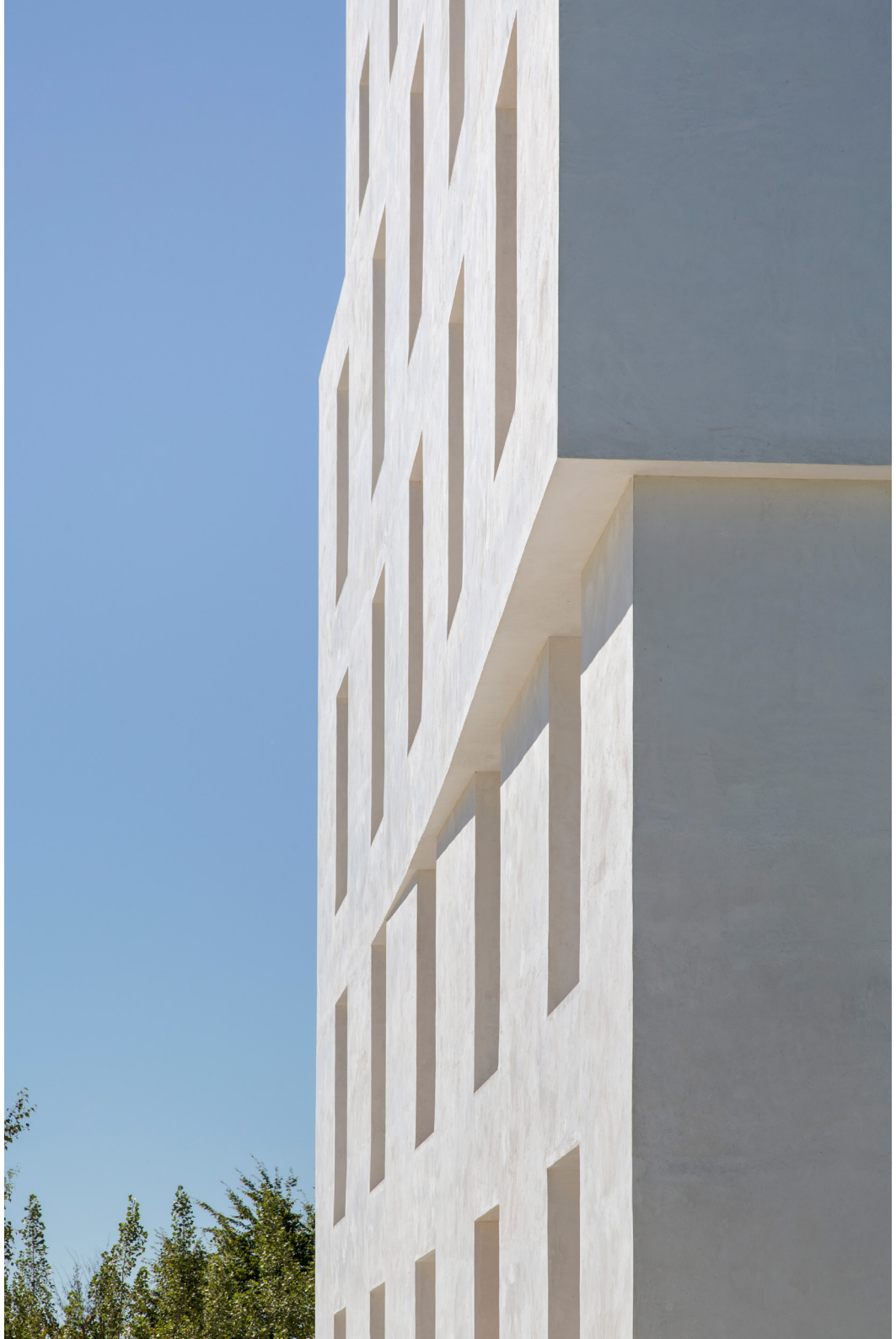
THE CORE

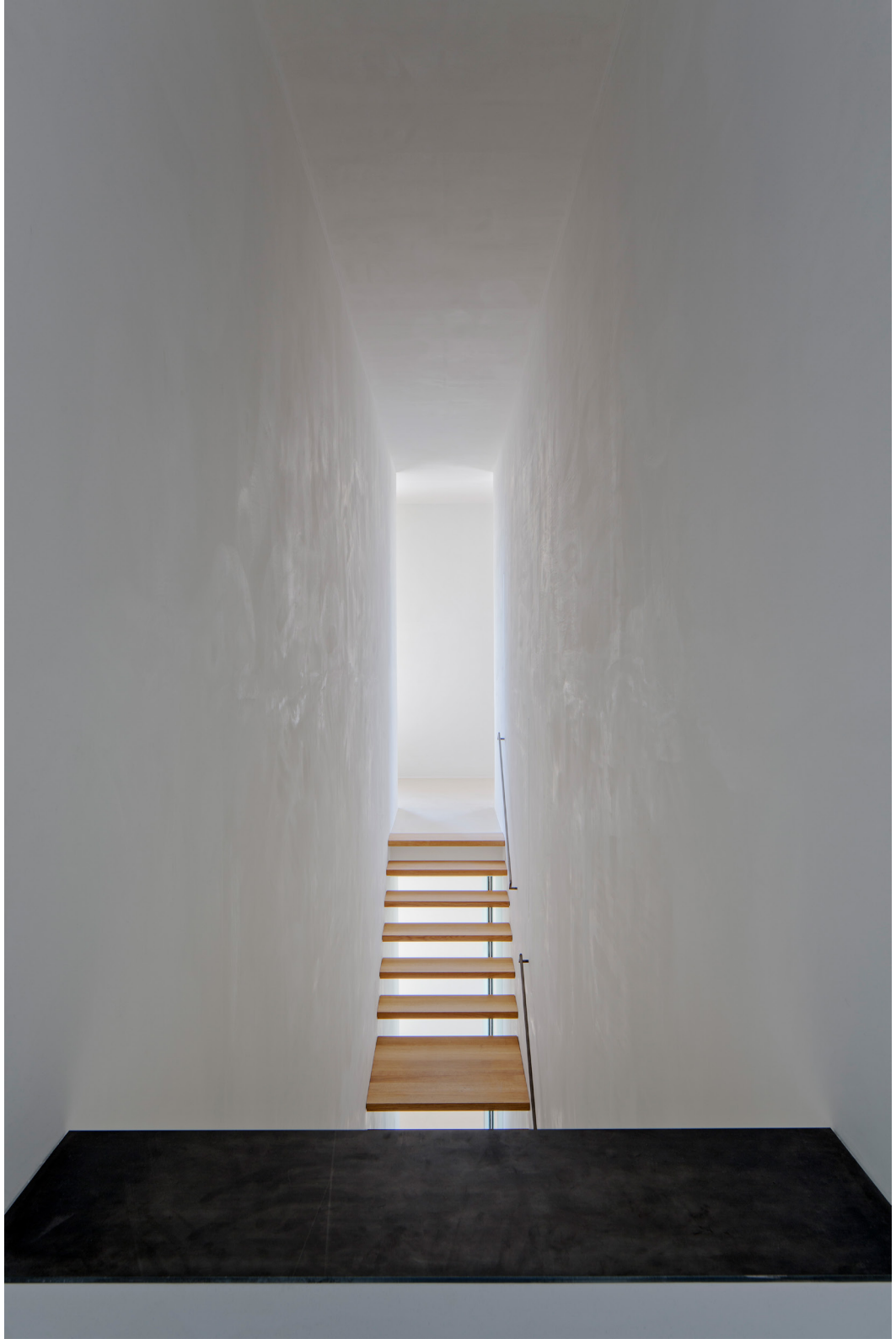
THE GLASS DOOR



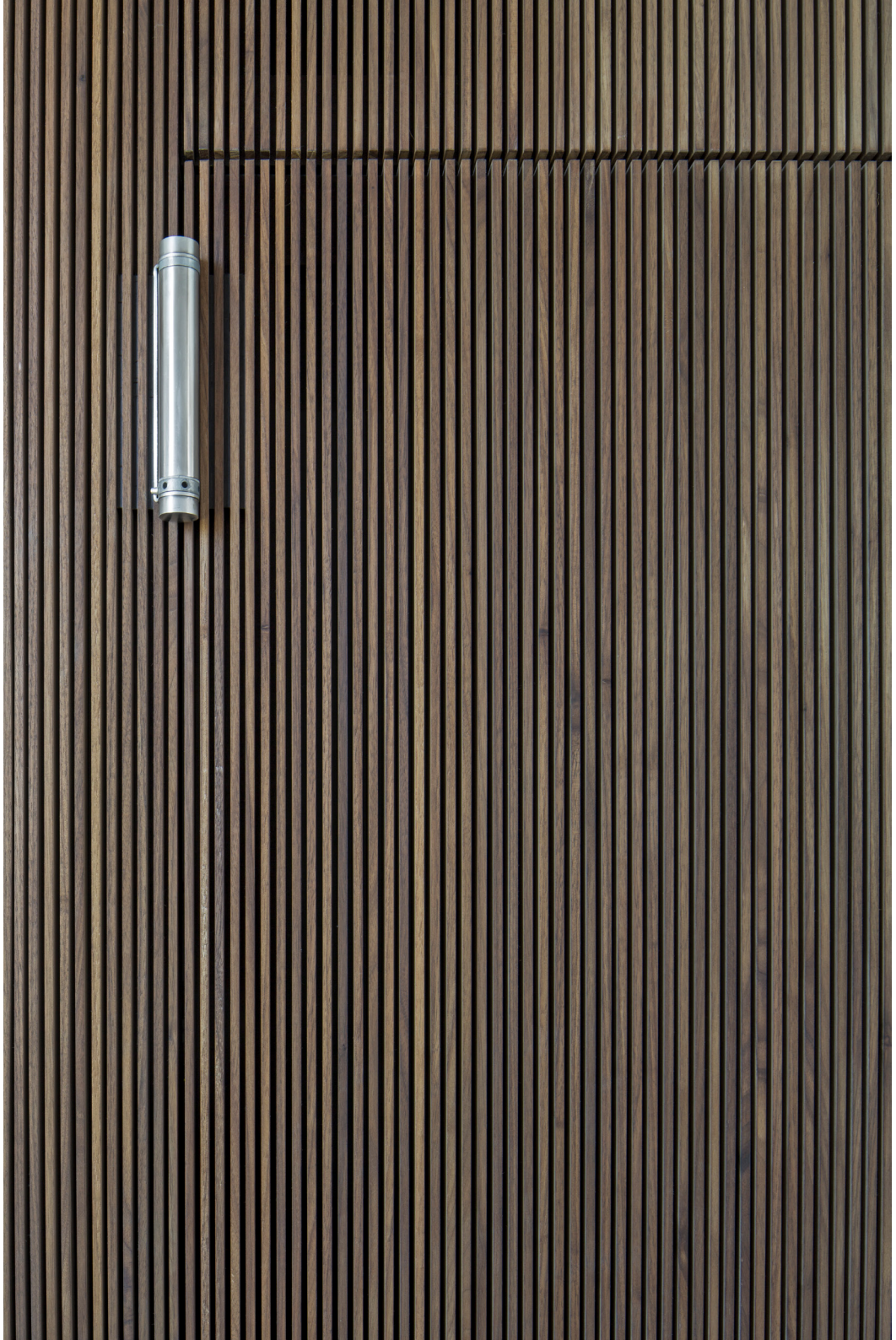
THE FURNITURE

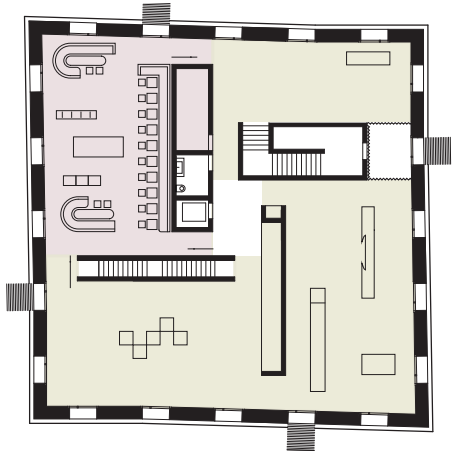
THE GARDEN





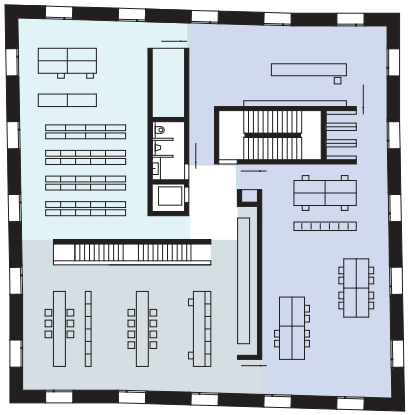
22
26
baumschlager eberle
22
26





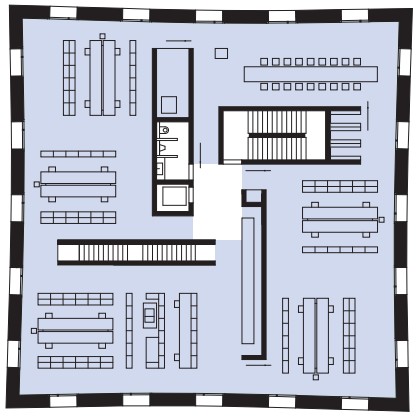
Ground floor

Coffee bar *Public zone*
Gallery



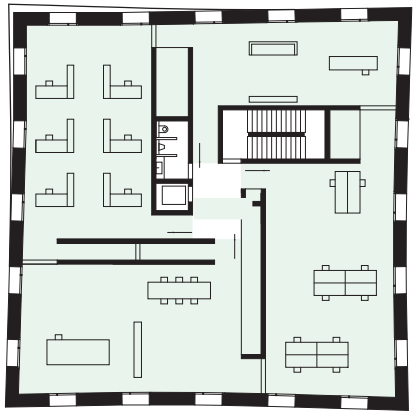
1st floor

Office *Public zone*
Archive
Open plan office



Second floor

Open plan office *Public zone*

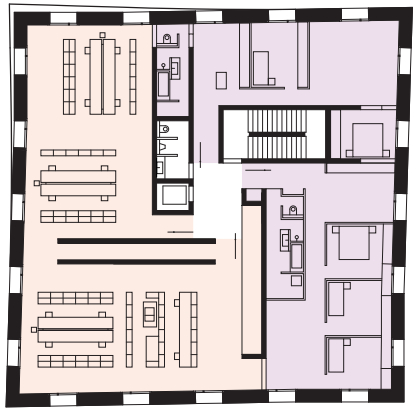


Third floor

Studios *Public zone*

Fourth floor

Studios *Public zone*
Habitation



Fifth floor

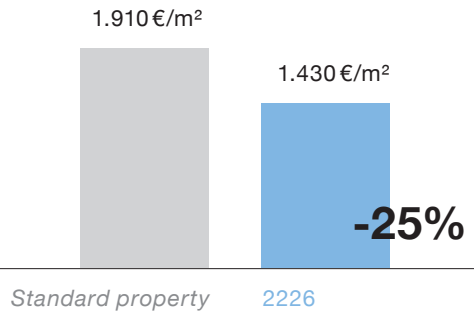
Habitation *Public zone*
Meeting

CONSTRUCTION COSTS

Construction Costs

Quelle:
Vergleich Baukostenindex zu real abgerechneten Kosten von 2226 Lustenau ohne Rabatte, abgerechnete Kosten für 2226 Lustenau inkl. Rabatte 1.240€/m² BGF, je m² BGF und ohne Planungskosten

Comparison of construction cost index for actually billed costs of 2226 Lustenau without deductibles, billed costs for 2226 incl. deductibles of 1,240€/m² of gross floor area, per m² of gross floor area, without planning costs



LIFE CYCLE COSTS

Life Cycle Costs (LCC)

Quelle:
DIN Lebenszyklus-Management, A. Pelzeter

Zusammensetzung Lebenszykluskosten:

Herstellung KG 300	924€
Herstellung KG 400	254€
Instandsetzungen KG 300	59€
Instandsetzungen KG 400	230€
Wartung Inspektion KG 300	52€
Wartung Inspektion KG 400	290€
Reinigung	205€
Energie	974€
Wasser/Abwasser	86€

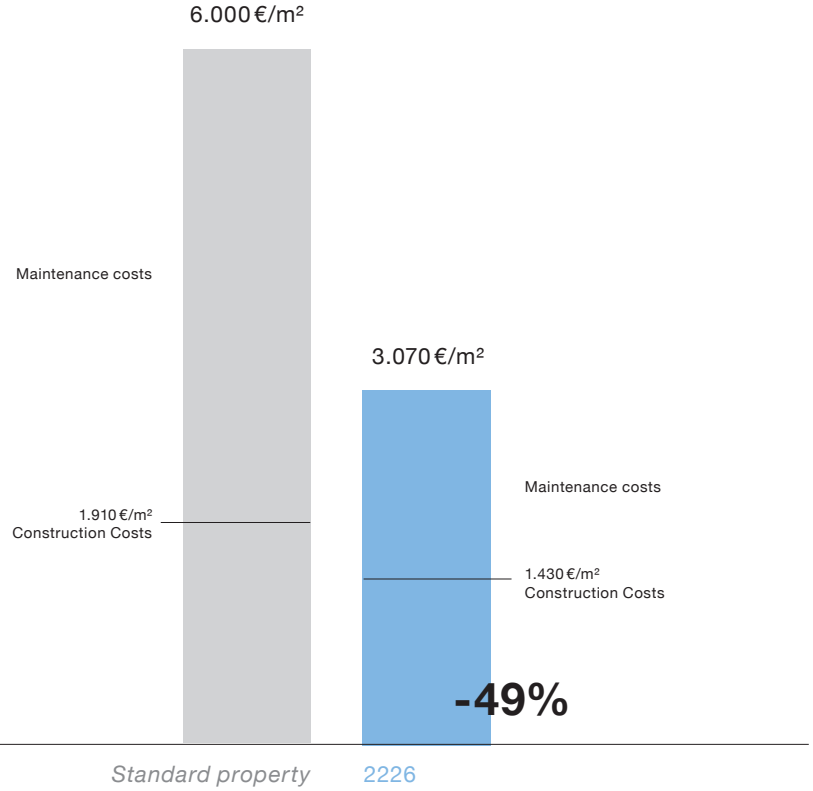
Rechenmodel je m² auf 50 Jahre inkl. 1,5 % Zinsen und 5 % Energiepreisanstieg. KG 300 Baugrube, Gründung, Außenwände, Innenwände, Decken, Dächer, Konstruktive Einbauten
KG 400: Techn. Anlagen, Wärmeanlagen, Lufttechn. Anlagen, Starkstrom, Fernmeldeanlagen, Wasser, Abwasser, Gas, Förderanlagen, Spezifische Anlagen, Automation

Source/ Benchmark:
DIN Lebenszyklus-Management, A. Pelzeter

Composition of life-cycle costs:

Manufacture, type of cost 300	*924€*
Manufacture, type of cost 400	*254€*
Repairs, type of cost 300	*59€*
Repairs, type of cost 400	*230€*
Maintenance/Inspection, type of	*52€*
Maintenance/Inspection, type of	*290€*
Cleaning	*205€*
Power	*974€*
Water/Sewage	*86€*

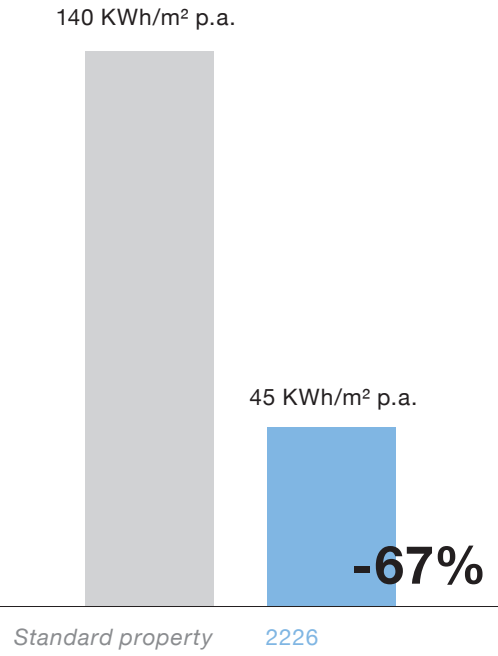
Computational model per m² for 50 years incl. 1.5% interest and 5% increase in energy prices. Type of cost 300: building excavation, foundation, exterior walls, interior walls, floor slabs, roofs, structural installations. Type of cost 400: technical systems, heating systems, ventilation systems, heavy current, telecommunication systems, water, sewage, gas, conveyor systems, specific installations, automation



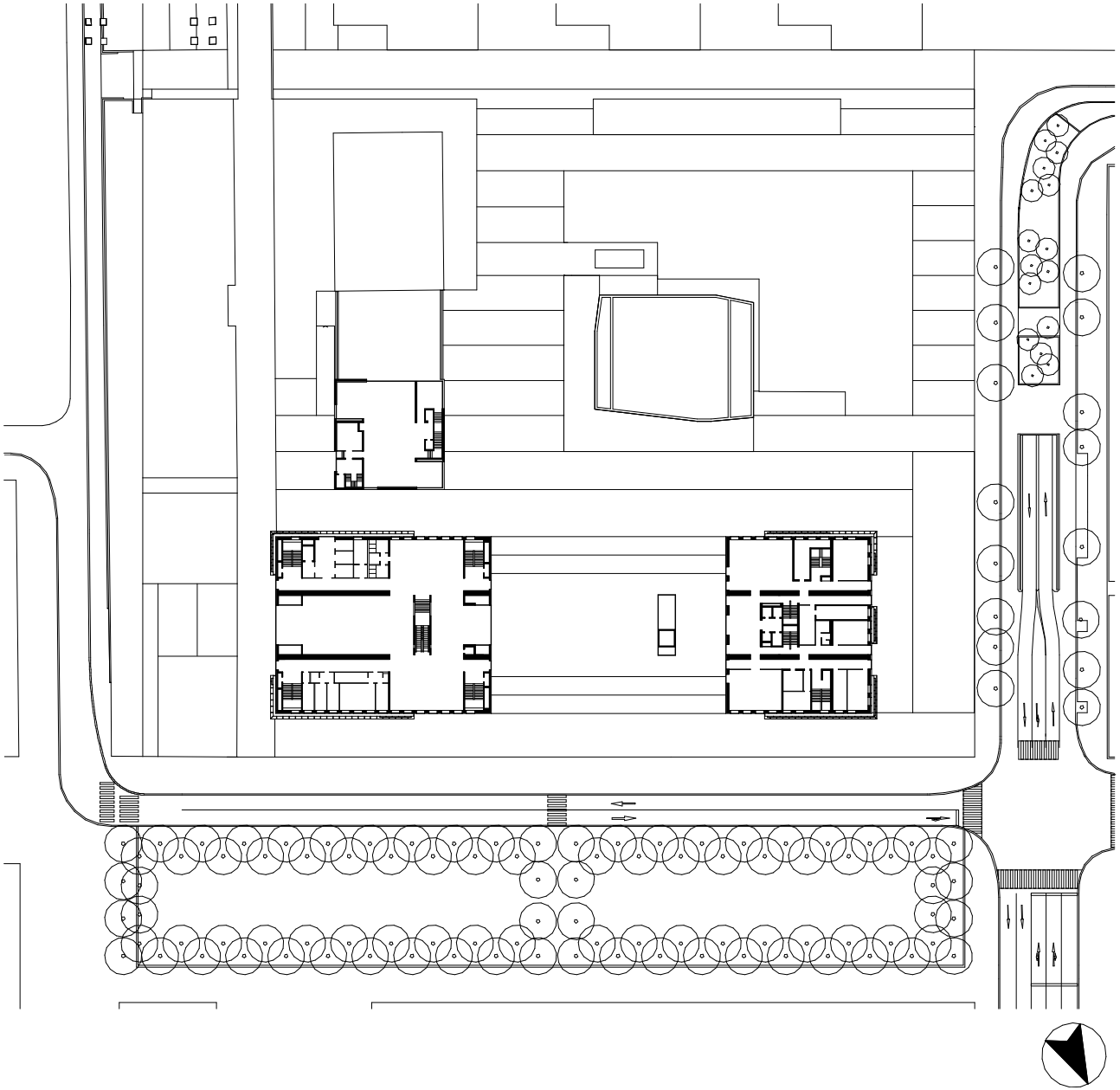
ENERGY CONSUMPTION

Energy Consumption

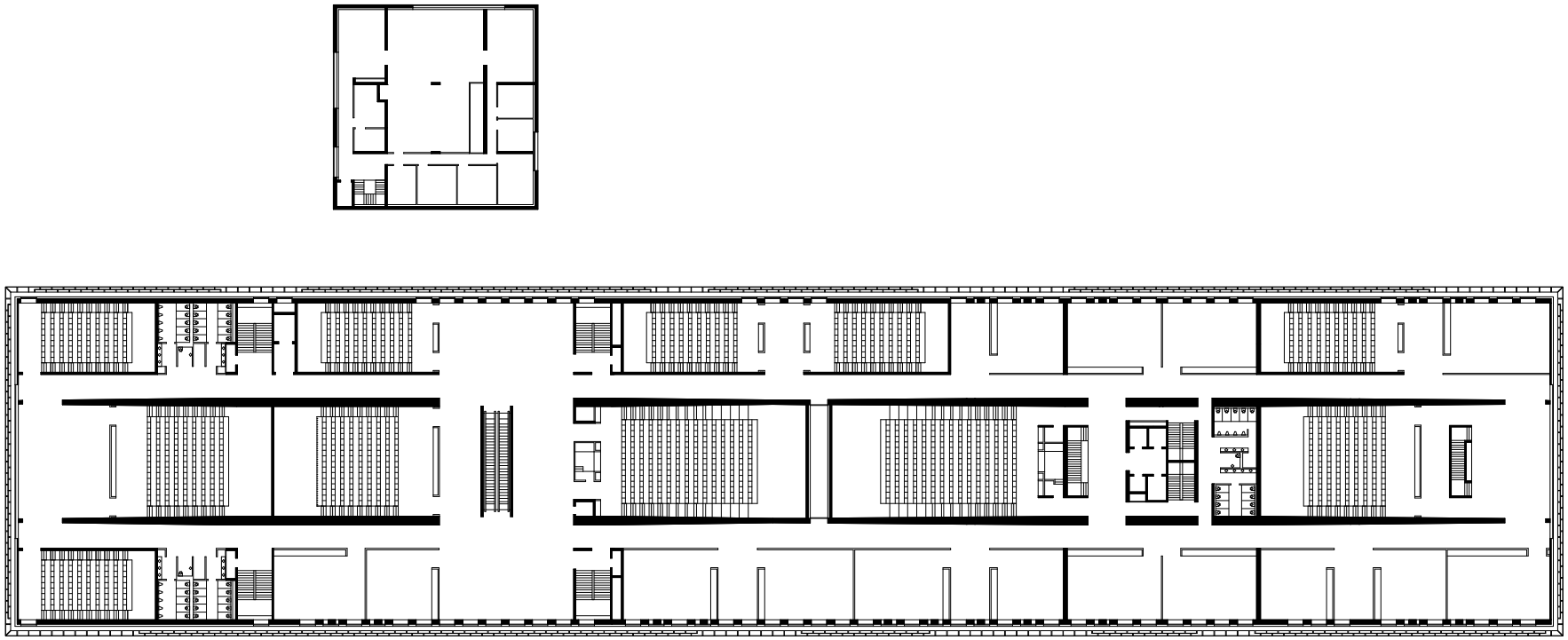
Source/Benchmark: comparison SIA
2024 vs. measured values 2226



Maison du Savoir, Belval, Luxembourg



Maison du Savoir, Belval, Luxembourg



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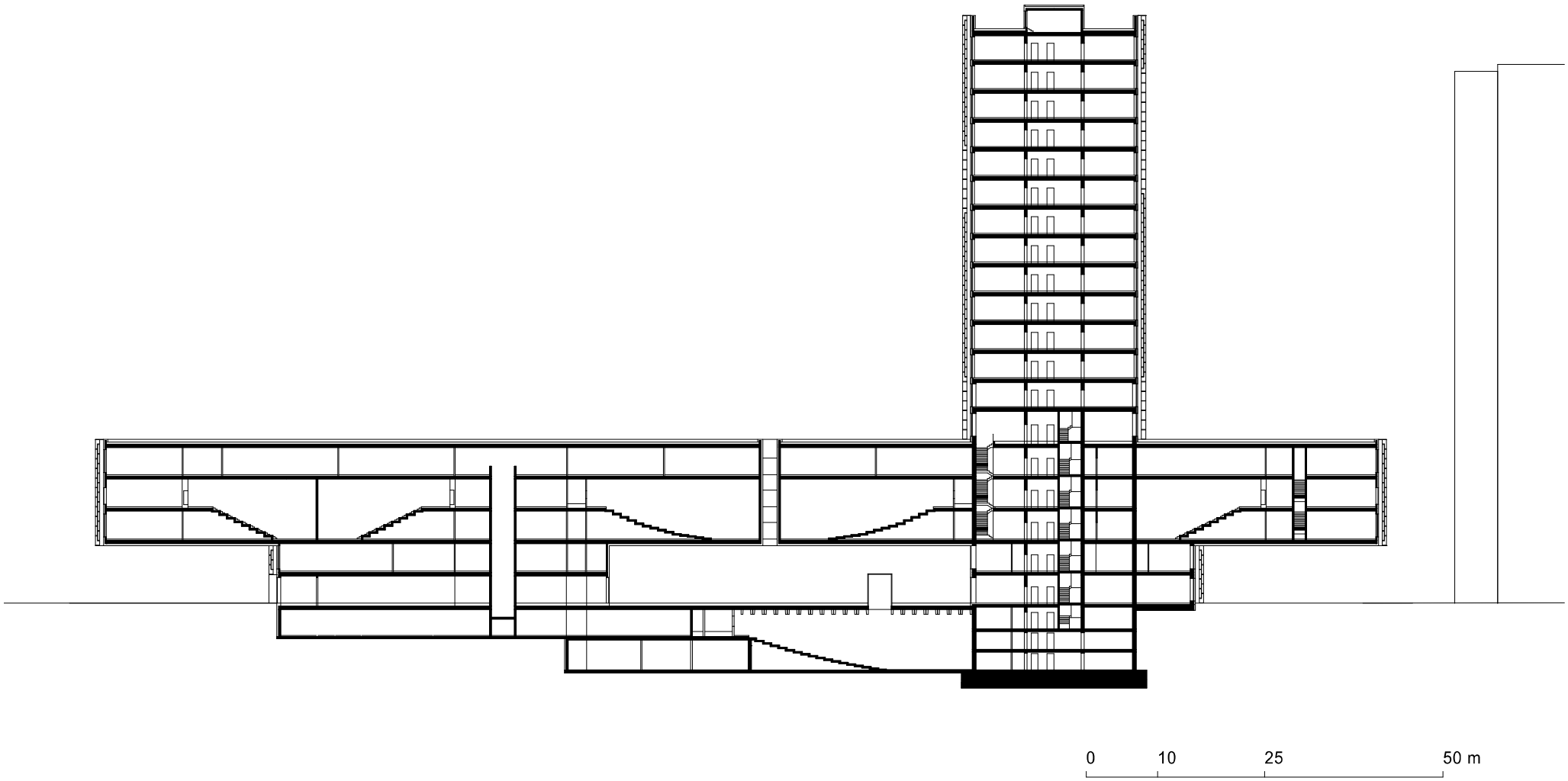
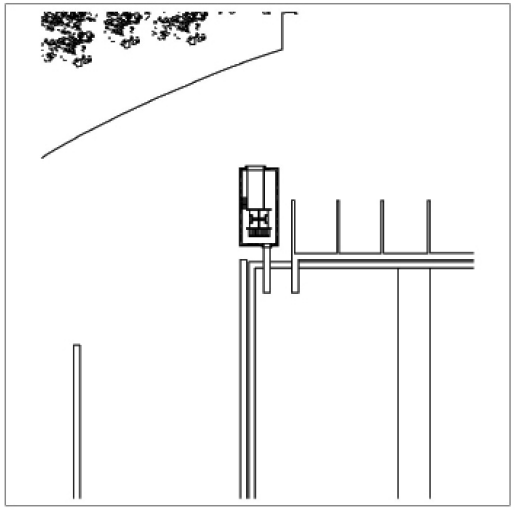
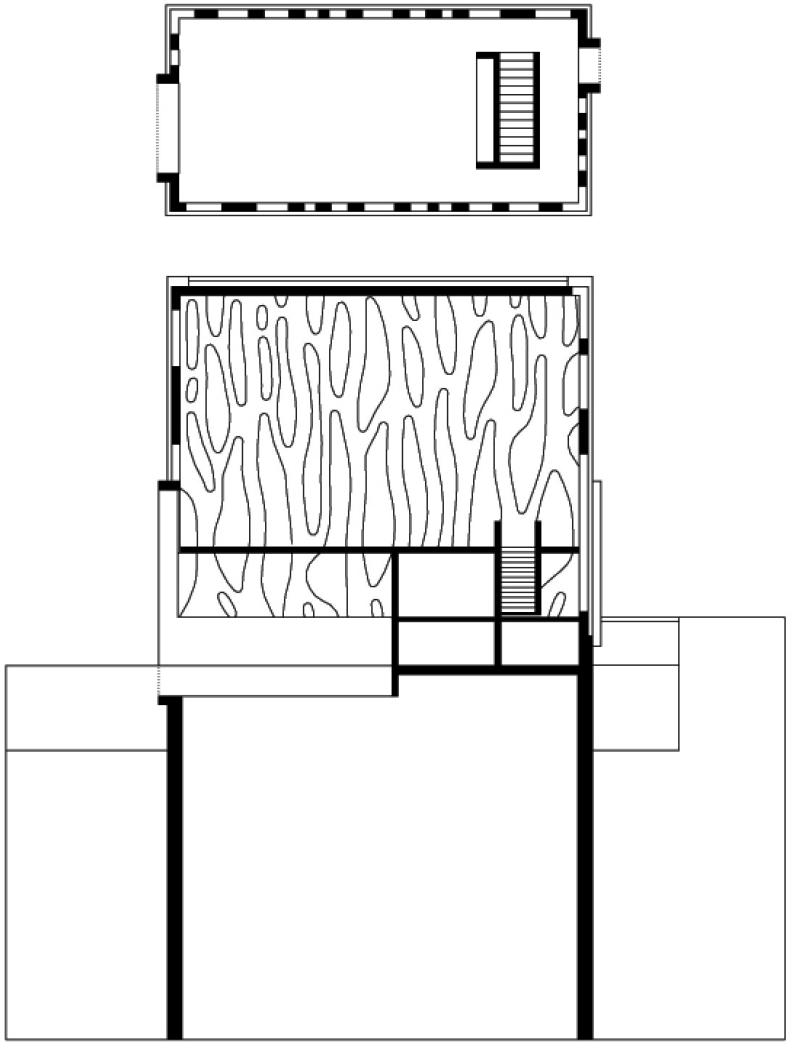
Maison du Savoir, Belval, Luxembourg



Maison du Savoir, Belval, Luxembourg





0 5 10 15 m

Floor and section

Nordwesthaus, Fussach, Austria

baumschlager eberle
architekten

Thank you for your attention.