baumschlager eberle
architekten

Offices
Locations

be

22 26

Affordable housing
from a financial perspective

Land price

after 30 years **15** %

Land policy & its impact

Density

Building and operating costs

after 30 years **35** %

Building costs

- Norms and standards
- Ecology and suitability

Operating costs

- Energy costs
- Maintenance costs
- Public fees
- Administrative costs

Financing costs

after 30 years **50** %

Interest rates

Repayment

Public subsidies

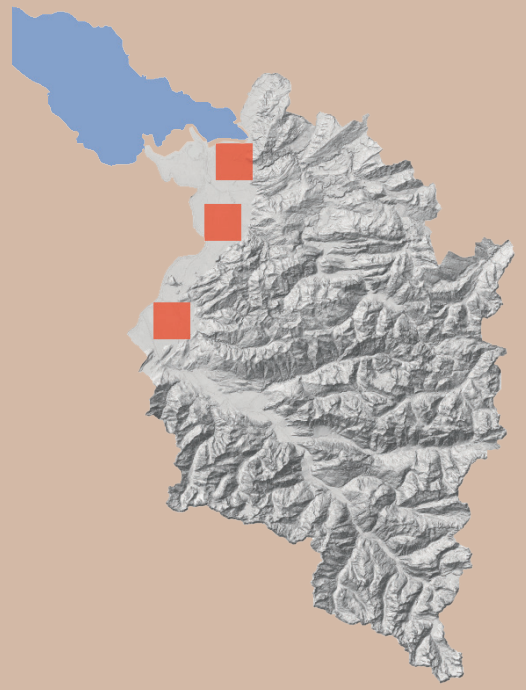
people in Vorarlberg
are living like

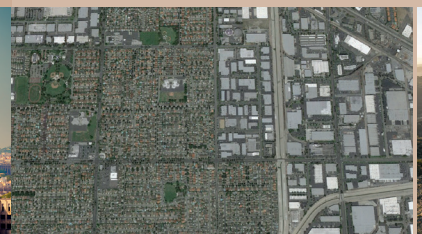
in Paris

~ **42 000** people/ km²

in L.A.

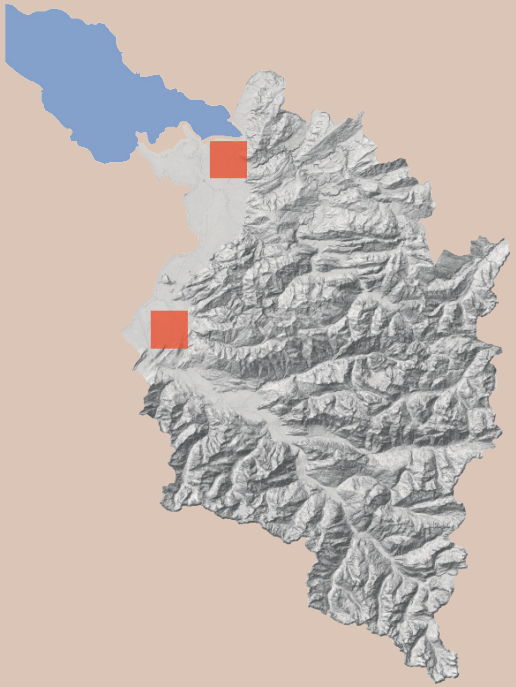
~ **25 000** people/ km²





in Vienna

~ **30 000** people/ km²



Factors influencing comfort & thermal performance of buildings

External influences

Wind

External temperature

Radiation

External influences result in

- heat transmission losses
- heat transmission gains

= **30** % energy loss

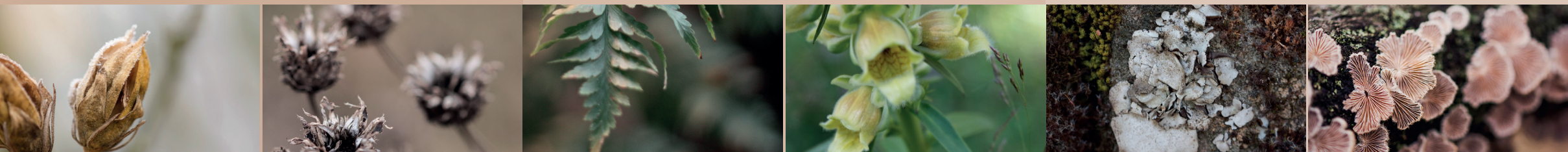
Internal influences caused by human

1 t CO_2 / year through respiration

100 W body heat emissions/ person

1 - 5 l moisture loss/ day

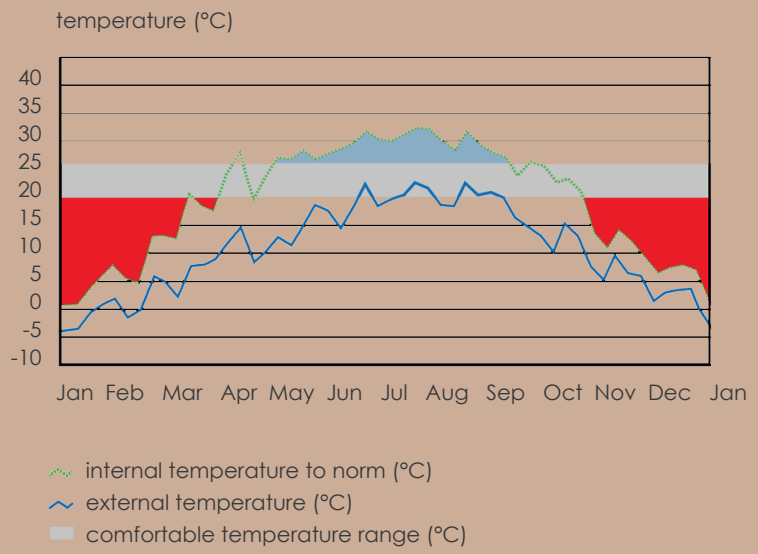
Human activity results in ventilation losses:
~ **15 - 20** m^3 fresh air/ h/ person
= **70** % energy loss



Energy flows
in buildings

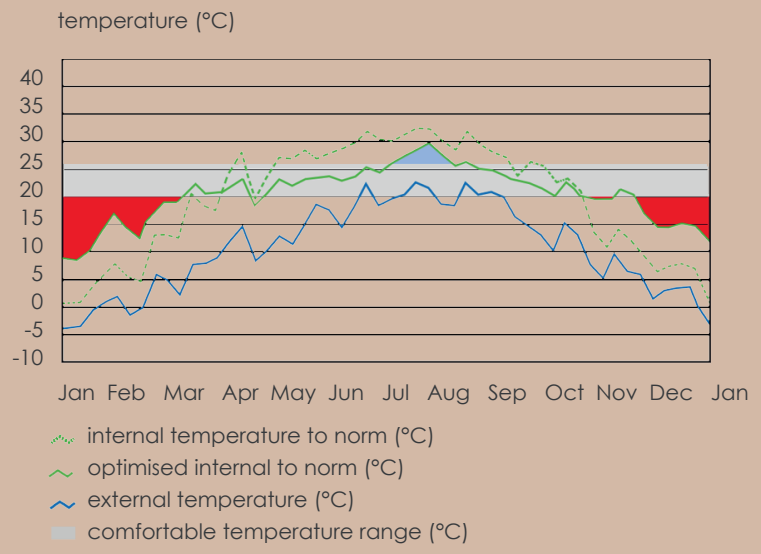
Transmission

Building according to standard



Ventilation losses after optimizing the building

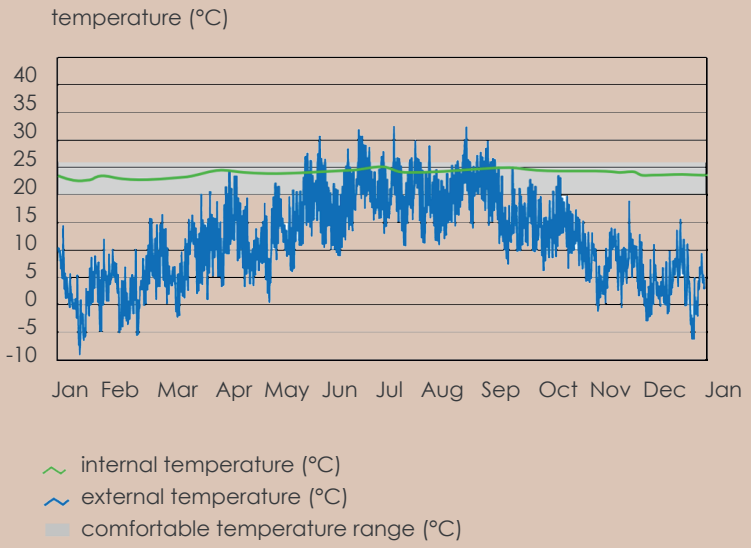
Optimized building



The optimization is only an architectural question.

Heat capacity and the impact of the control system

22 · 26



22 · 26

A strategy to achieve **the following goals**

1. Reduction

1. CO_2 footprint

- Standard property — **30** kg Grey energy, **80** kg Operating energy

2. Energy consumption for heating & cooling

- Existing building stock — ~ **100 - 130** kWh/ m² p.a.
- With building regulations — ~ **60 - 80** kWh/ m² p.a.
- Low-energy house — ~ **30 - 40** kWh/ m² p.a.
- Passive house — ~ **15 - 18** kWh/ m² p.a.

3. Life cycle of building technology

2. Increase

1. Comfort

- Temperature — **22 - 26** °C
- CO_2 — **600 - 800** ppm
- Humidity — **40 - 70** %
- Brightness — **500** lux/ m² (office build.)

2. Sustainability (long lifetime)

- Solidity
- Lifespan
- Flexibility of use
- Cultural and social acceptance

3. Preservation of value

- The most important are cultural value – social acceptance.

3. Reduction

1. Investment costs

- Standard property — ~ **2700 - 3600** €/ m² n.f.

2. Operating costs

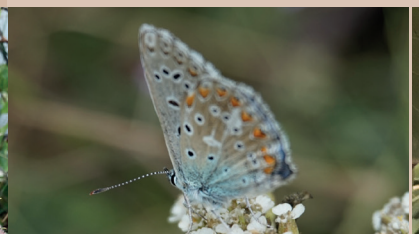
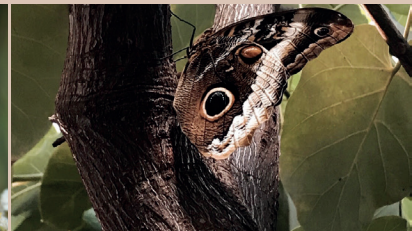
- Standard property — **3.1 - 3.5** €/ m² n.f.

3. Life cycle costs (LCC)

- **50** yrs ~ **6300** €/ m²





22 · 26

Use the things you have

Climate

Temperature
Wind
Air quality (**400** ppm CO_2)
Radiation

People

100 W/ person =
0,1 kWh/ person =
1000 kWh/ person p.a.

Appliances

Lights
White goods
IT equipment
etc.

A set of instruction in **the following areas**

1. Software

- Dynamic building simulation
- Sensor technology
- Control system

2. Architecture

- Geometric proportions

3. Materiality

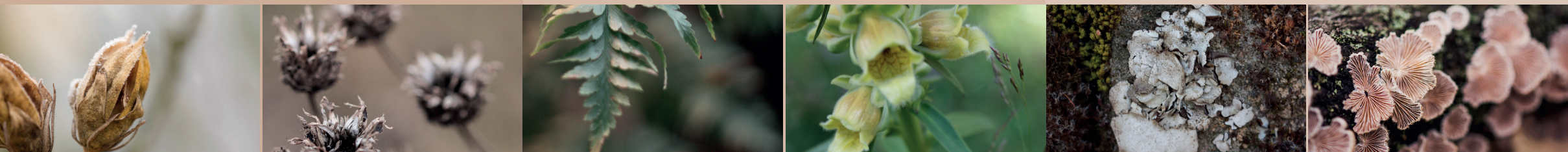
- U - values
- G - values
- Thermal storage capacity

4. Windows

- Shading
- Electrically controlled windows

3. Back-up systems

- Electricity
- Air-handling systems
- Water-handling systems



Software
From simulation to control

Dynamic building simulation

The dynamic building simulation has to include a time period of **1 year** (including **all the changes of** • temperature, • cloud cover, • heat capacity, • the physical value of the building and • the use of the building for people).

Every calculation has to be done **according to norm but in addition** to increase all the values by **30** % and reduce the values by **30** % to control the solidity of the simulation in a wide range including the **expected temperature changes** in the next **50** yrs. The result has to be under **7** kWh/m² p.a. with inner temperature range between **22 and 26** °C.

Sensor technology

In every room sensors have to be installed measuring **the following conditions**:

- Outdoor temperature
- Inside temperature
- CO_2
- Relative humidity
- Brightness

Control System

The control system has to **operate the behaviour of the ...**

- windows
- lights
- back-up system

... according to the measurements of the sensors used in every room.

This control system is developed and owned by the **company** and is protected by an European patent.

Architecture

Geometry - Materiality - Windows

Geometry

- Envelope/ net floor area **0,6 -0,9**
- Windows/ net floor area **15 - 18** %
- Analysis of the sunning and shading circumstances of your building in relation to the context

Materiality

U-values of all the envelope

- Wall **0,2**
- Roof **0,1 - 0,15**
- Ground slab **0,2**
- Windows **0,5 - 0,8**

Thermal storage capacity

> **200** kg/ m^2 n.f.

Airtightness

- Blower - Door - Test < **0,5 air changes/ h**

Windows

Shading

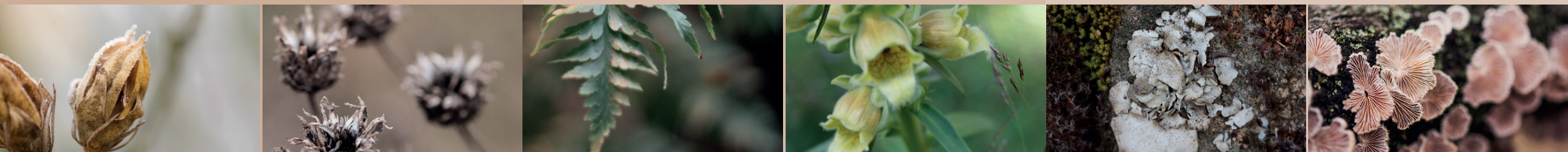
G-value **0,2**
No mechanical stirred shading devices

Ventilation type in the window

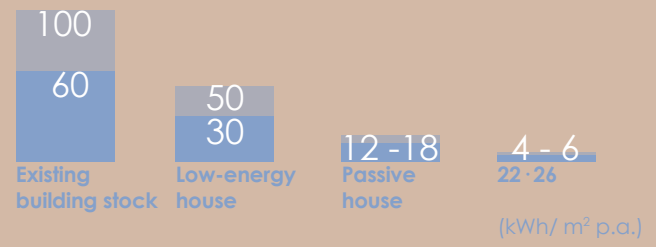
Vertical – **Never** horizontal
Planning the airflow within a room

Electrical motorization

- Chain drive
- Spindle drive (more efficient & longer lifetime than chain drive)



Back-up systems



Electricity

- Infrared lamps
- Infrared panels
- Heating paper

Air-handling systems

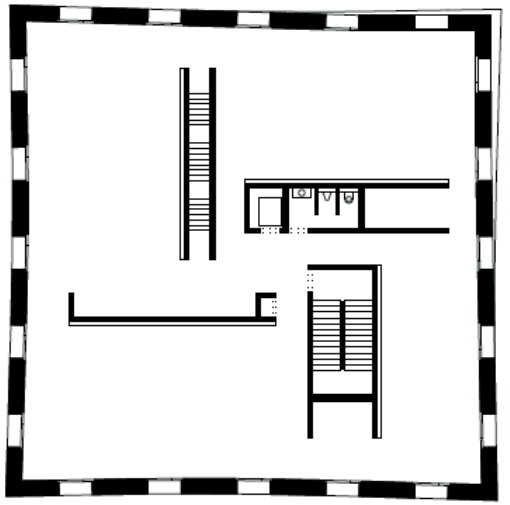
- Decentralized ventilation unit with heat recovery

Water-handling systems

- TABS (Thermally activated building systems)
- Floor heating
- Wall heating

Lustenau, AUT | 2016
Office

Lustenau, AUT | 2016
Office



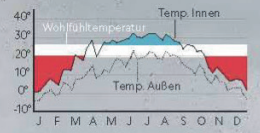
Lustenau, AUT | 2013
Office

EIN HAUS OHNE HEIZUNG

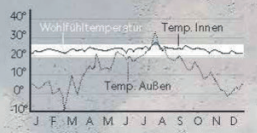
INFOGRAFIK **DANIELA MIEDANER**

WENIGER IST MEHR: Im österreichischen Lustenau, nahe dem Bodensee, steht ein Haus, das von außen monumental, von innen aber mehr als besonders ist: Das Bauwerk hat keine Heizkörper, keine Lüftungsrohre, keine Klimaanlage. Statt auf Technik vertrauten die Architekten auf traditionelles Wissen und natürliche Materialien, um das ganze Jahr über ein angenehmes Klima herzustellen. Nur die Steuerung nutzt Elektronik: Sensoren messen die Luftqualität und regeln das Raumklima. Der jährliche Energieverbrauch liegt ein Drittel unter dem eines Standardgebäudes, auch Bau- und Betriebskosten sind niedriger. Üppig ist nur der Platzbedarf für dicke Mauern und hohe Räume. Mittlerweile entstehen weltweit Wohn- und Bürohäuser nach diesem Prinzip. –JULIA GRAVEN

WOHNEN IN DER KOMFORTZONE
Zwischen 22 und 26 Grad Raumtemperatur sind für den Menschen ideal. So erhielt das Haus von Baumschlager Eberle Architekten seinen Namen: 2226.



HERKÖMMLICHES HAUS
Im Winter läuft die Heizung (rot), im Sommer brauchen viele Häuser Klimatisierung.



HAUS OHNE HEIZUNG
Die Messwerte zeigen: Auch ohne Heizung bleibt das Haus im Wohlfühlbereich.

Worauf das von Architekt Dietmar Eberle entworfene Haus verzichten kann:

- Heizungsanlage
- Lüftungsanlage
- Klimaanlage
- Umweltschädliche Dämmstoffe
- Kaum Technikflächen

Licht und Luft
Im Sommer schützen die tiefen Laibungen vor direkter Sonneneinstrahlung, im Winter gelangt die tief stehende Sonne ins Haus und wärmt.

Dick verpackt
Die Wände und Decken sind extradick. Mit dem Putz aus traditionell gebranntem Kalk gleichen die Mauern Schwankungen bei Temperatur und Luftfeuchtigkeit aus – ohne umweltbelastende Dämmstoffe.

Wärme frei Haus
Bewohner, Lampen und Elektronik reichen aus als Wärmequellen, eine zusätzliche Heizung ist nicht nötig.

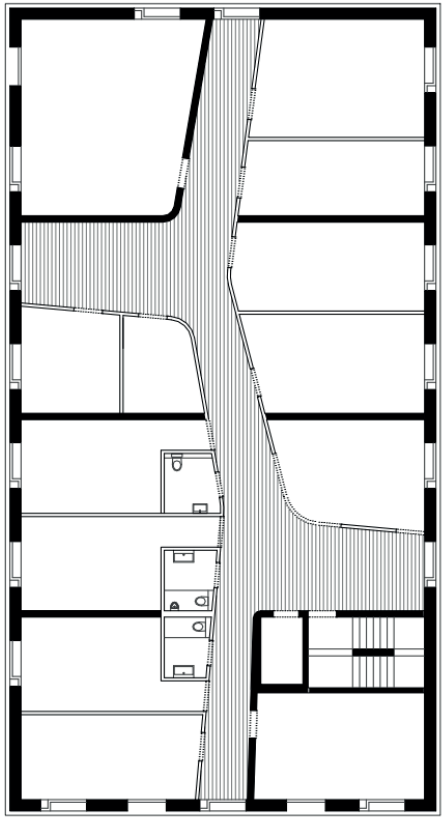
FRISCHLUFTGARANTIE
Zweimal pro Minute werden Luftfeuchtigkeit, CO_2-Gehalt sowie die Temperatur innen und außen gemessen und auf Tablets angezeigt. Mit ihnen lassen sich Lüftung und Licht auch manuell bedienen.

Winterferien
Sollte das Haus in der kalten Jahreszeit mehrere Tage leer stehen, geht kurzzeitig das Licht an, um die Temperatur zu

QUELLE: WWW.2226.EU

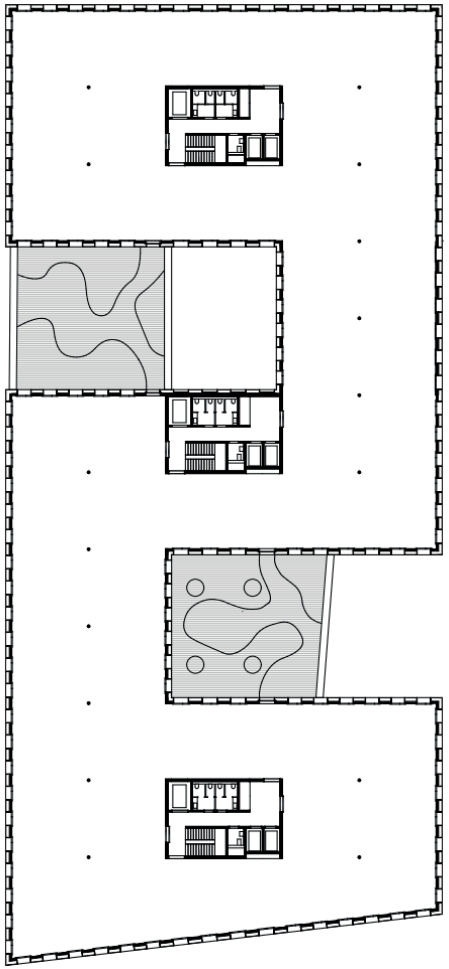
Lingenau, AUT | 2016
Office

Lingenau, AUT | 2016
Office



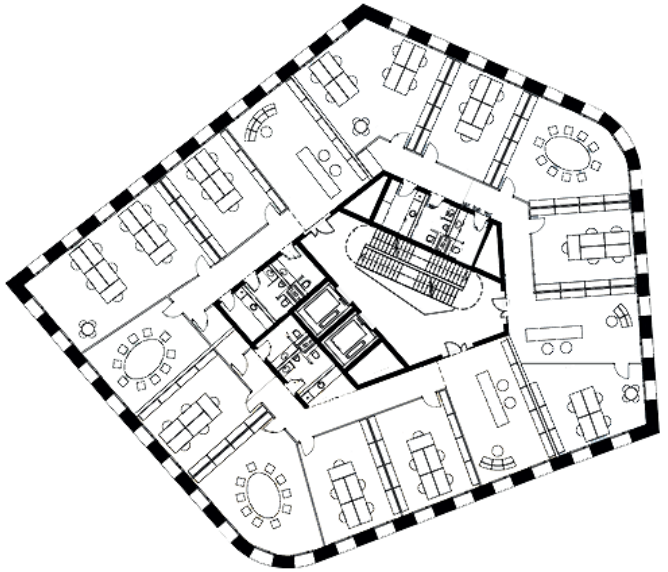
Schlieren, CH | 2018
JED
Office

Schlieren, CH | 2018
JED
Office



Wien, AUT | 2019
Seeparkquartier Robin
Office

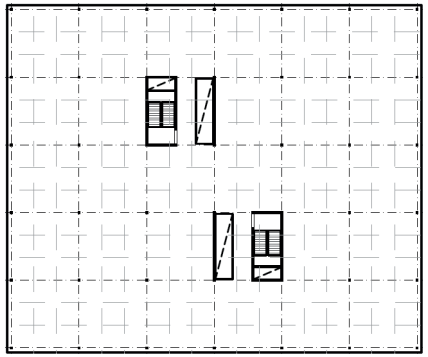
Wien, AUT | 2019
Seeparkquartier Robin
Office



Kriens, CH | 2020
Office
Gigon Guyer Architeken

Kriens, CH | 2020
Office
Gigon Guyer Architeken

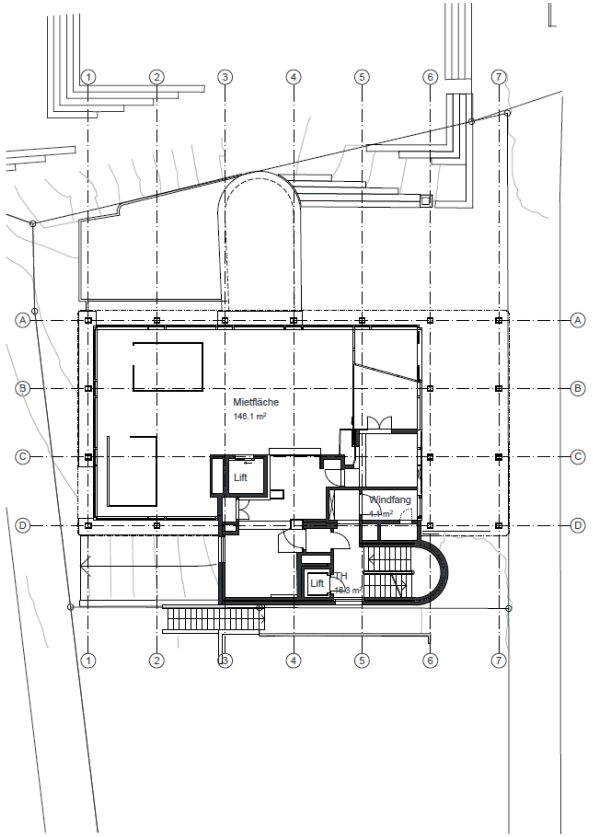
Berlin, DE
Havelwerke
Office



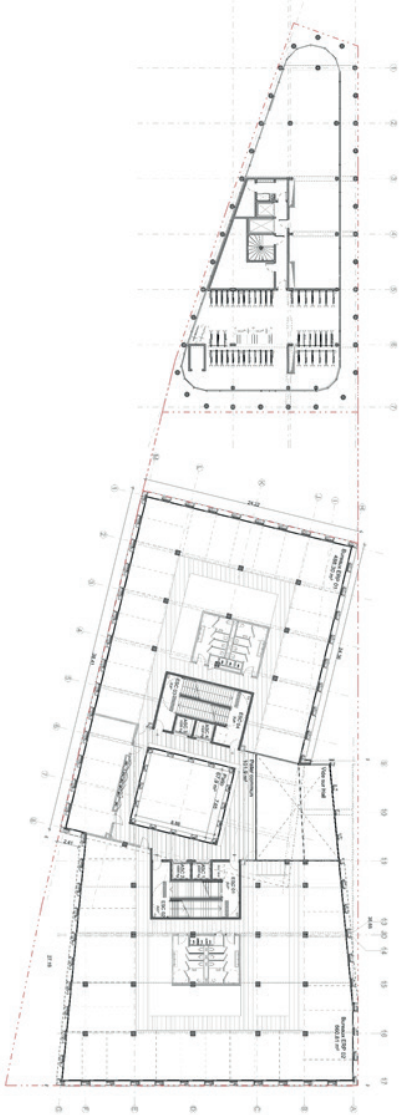
Zürich, CH | 2022

Sanierung Universitätsstraße Amber

Office

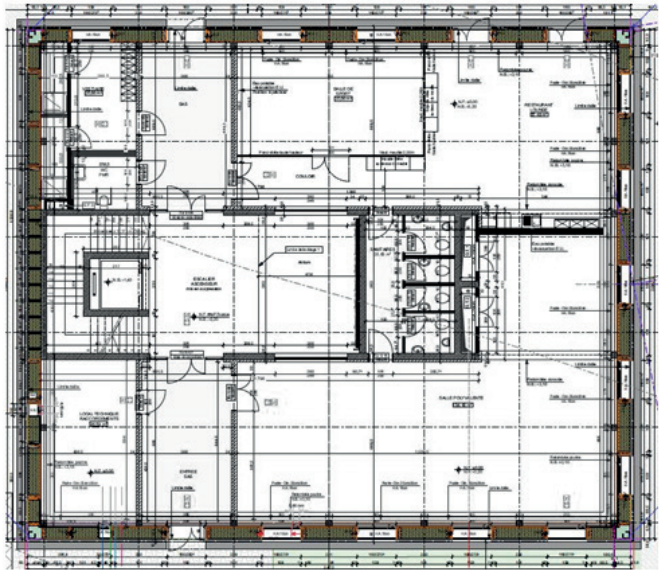


Bordeaux, FR | 2022
Amédée Sud SNCF
Office

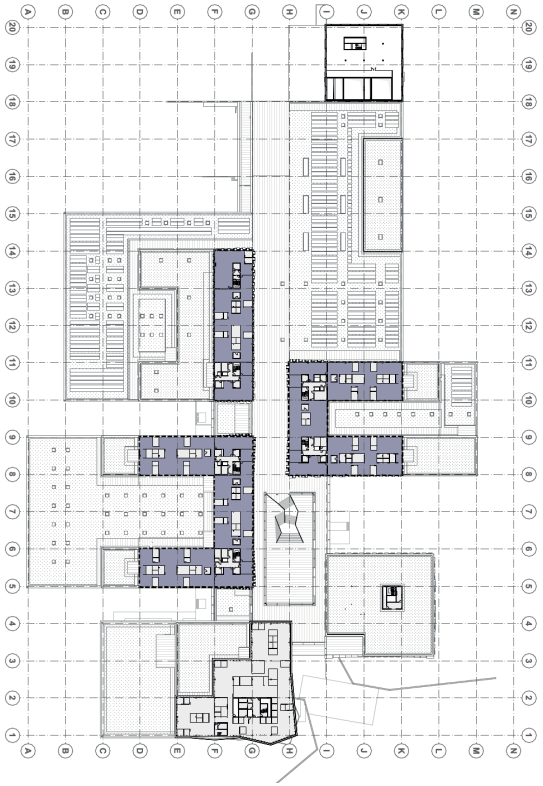


Bettembourg, LU | 2023
Office

Bettembourg, LU | 2023
Office

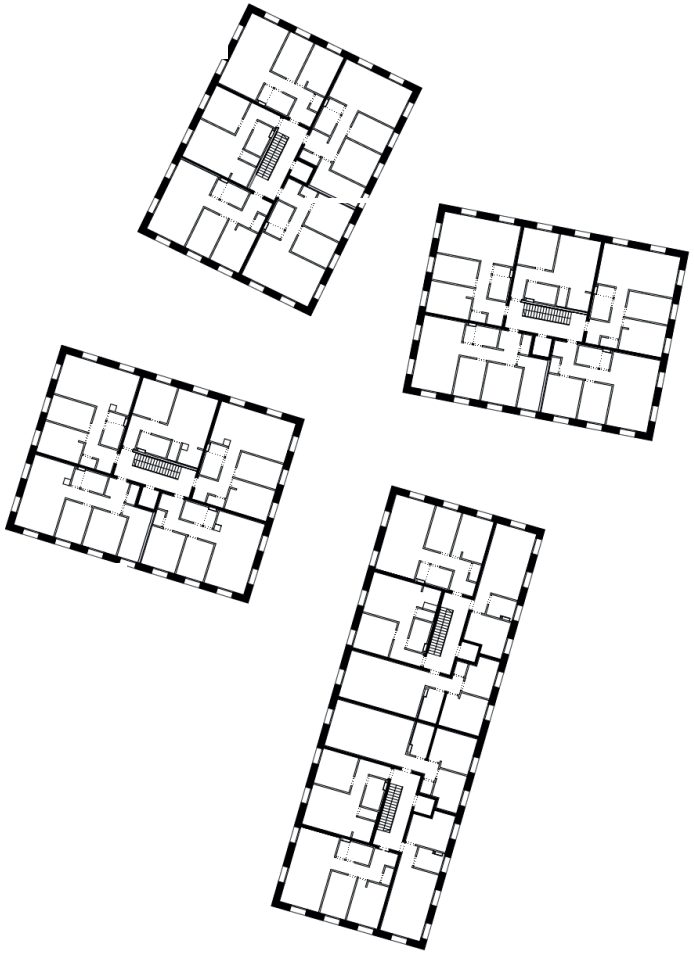


Aalen, DE
Carl Zeiss Annecy
Office

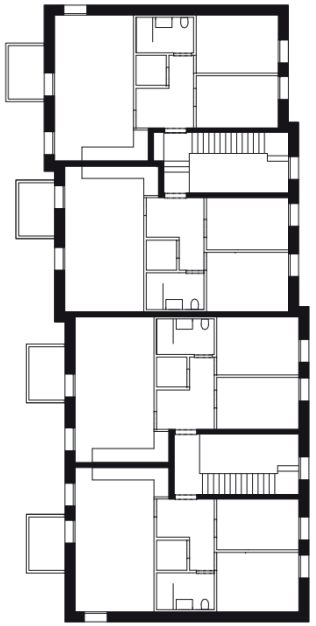


Amsterdam, NL
Office
OZ Architects

Lustenau, AUT
Housing

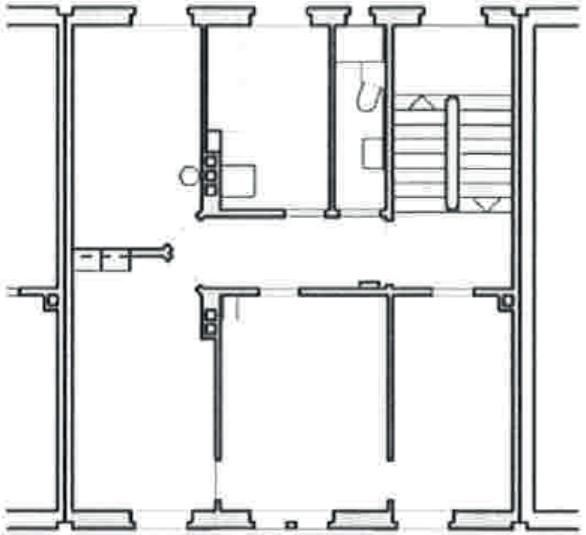


Dornbirn, AUT | 2019
Housing



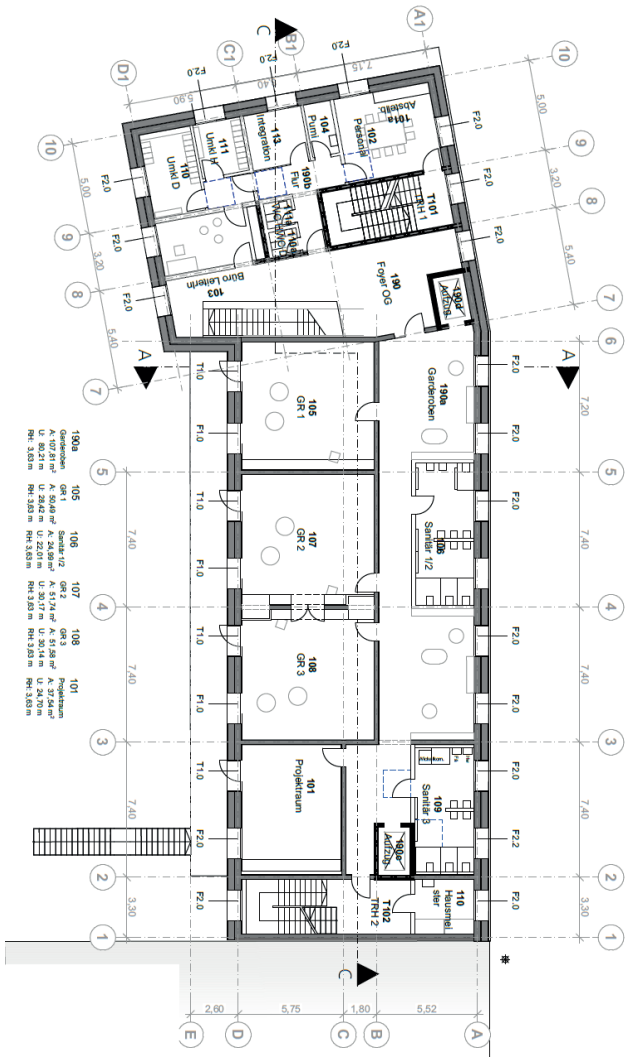
Tirol, AUT
Neue Heimat Tirol Navis
Housing

Oerlikon, CH | 2022
Housing
Atelier M Architects



Ingoldstadt, DE
Housing
NB und M Architects

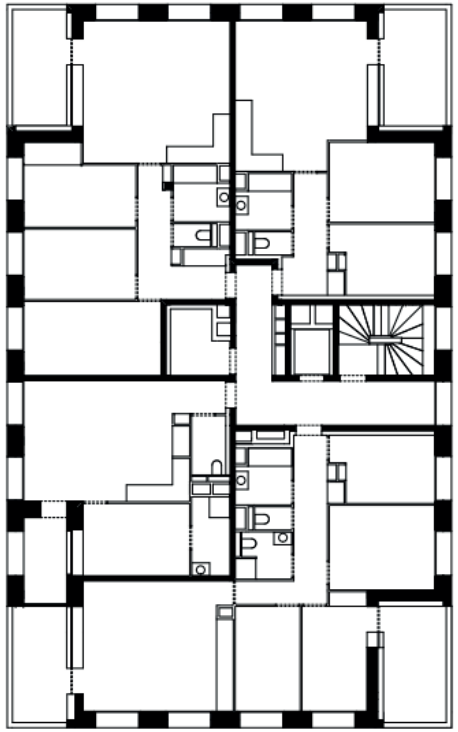
Leipzig, DE
Housing, Kindergarden



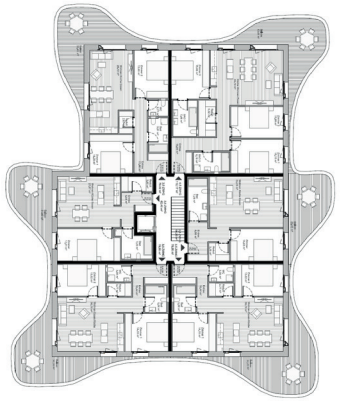
Lyon, FR

Confluence Lyon C1

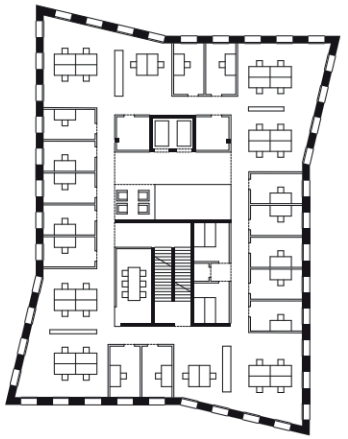
Mixed-use



Zuchwil, CH
Riverside B2
Mixed-use



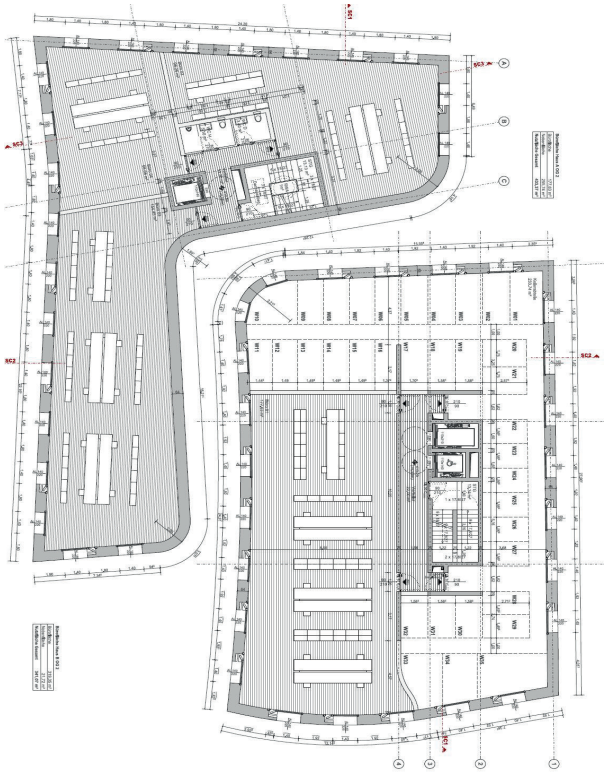
Berlin, DE
Neubau Kirchliches Verwaltungsamt
Mixed-use



Lustenau, AUT | 2016

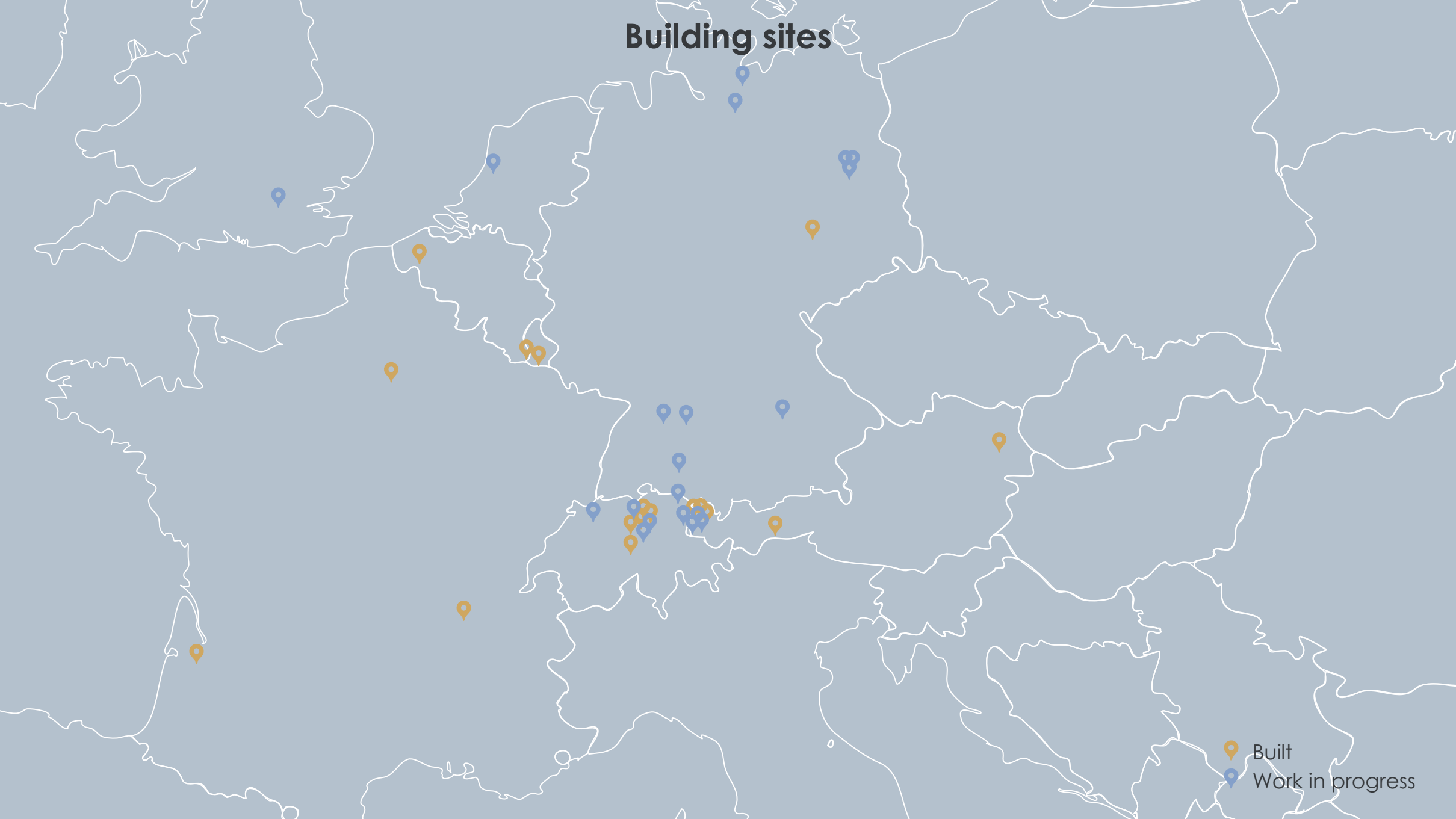
Bürohaus Lustenau Turm

Mixed-use



Romanshorn, CH
Stadthaus
Mixed-use

Building sites



22 · 26

A strategy to achieve **the following goals**

1. Reduction

1. CO_2 footprint

- Standard property — **30** kg Grey energy, **80** kg Operating energy
- **22 · 26** — **8** kg Grey energy, **20** kg Operating energy

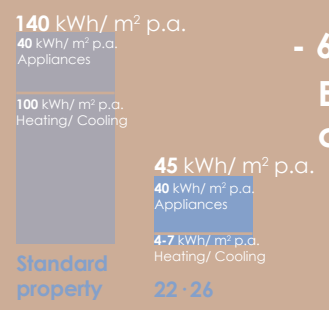
- 93 %

2. Energy consumption for heating & cooling

- Existing building stock — ~ **100 - 130** kWh/ m² p.a.
- With building regulations — ~ **60 - 80** kWh/ m² p.a.
- Low-energy house — ~ **30 - 40** kWh/ m² p.a.
- Passive house — ~ **15 - 18** kWh/ m² p.a.
- **22 · 26** — ~ **4 -7** kWh/ m² p.a.

- 75 %

3. Life cycle of building technology



- 67 %

Energy consumption

2. Increase

1. Comfort

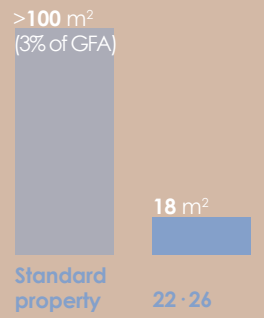
- Temperature — **22 - 26** °C
- CO_2 — **600 - 800** ppm
- Humidity — **40 - 70** %
- Brightness — **500** lux/ m² (office build.)

2. Sustainability (long lifetime)

- Solidity
- Lifespan
- Flexibility of use
- Cultural and social acceptance

3. Preservation of value

- The most important are cultural value – social acceptance.



- 80 %

Required area for building technology

3. Reduction

1. Investment costs

- Standard property — ~ **2700 - 3600** €/ m² n.f.
- **22 · 26** — ~ **2450 - 3250** €/ m² n.f.

- 10 %

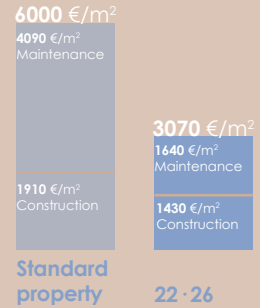
2. Operating costs

- Standard property — **3.1 - 3.5** €/ m² n.f.
- **22 · 26** — ~ **2.1 - 2.4** €/ m² n.f.

- 31 %

3. Life cycle costs (LCC)

- **50** yrs ~ **6300** €/ m²



- 49 %

Life cycle costs

Thank you!