NET ZERO CITIES

Online Planning Lab

EU MISSION PLATFORM

CLIMATE NEUTRAL AND SMART CITIES

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Check out the overall Program Here

MODULE 1	**Core** The NetZeroCities program, service offering, systemic approach, what works for Mission Cities	**Spotlight 1** NetZeroCities Orientation	**Spotlight 2** Shaping Climate Narratives	**Spotlight 3** Climate City Contracts		
MODULE 2	**Core** Developing a transition team, mapping and activating the ecosystem	**Spotlight 1** Transition team & climate leadership	**Spotlight 2** Engaging the private sector	**Spotlight 3** Citizen engagement for systemic climate action		
MODULE 3	**Core** Developing the city's action plan for climate neutrality	**Spotlight 1** Portfolio Co-design and future scenarios	**Spotlight 2** Climate Action Plan in the urban planning system	**Spotlight 3** Reporting and MEL		
MODULE 4	**Core** Levers of change: Tech and multi-actor collaborations	**Spotlight 1** Passive solutions to reduce energy demand in buildings	**Spotlight 2** Systemic energy transition at buildings, districts and city level	**Spotlight 3** Data-driven approaches to energy transition in buildings and districts	**Spotlight 4** Mobility	**Spotlight 5** Scope 3 and other emission domains
MODULE 5	**Core** Increase finance knowledge of the public administration & learn about options to finance projects	**Spotlight 1** Preparing a pipeline of projects with necessary data and information	**Spotlight 2** Different investor groups and the key priorities and returns profiles for each and instruments	**Spotlight 3** Financing the ambition: Learning from Mission Cities		
MODULE 6	**Core** Multilevel governance, national platforms and policy strategies	**Spotlight 1** Policy and regulations innovation	**Spotlight 2** Public procurement – national specificities	**Spotlight 3** Just transition		

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30/10/2025

MOOC 4 - Spotlight 1

Passive solutions to reduce energy demand in buildings

Passive Solutions: Brief overview

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Session Expert Panel

Ana Quijano
Energy researcher
[CARTIF]

Ana Belén Gómez
Architect & Urban researcher
[CARTIF]

Cecilia Sanz Montalvillo
NeutralPath coordinator
[CARTIF]

Jonatan Viejo Rodríguez
Energy researcher & PassiveHouse architecture
[CARTIF]

What is CARTIF?: you could find more information at https://www.cartif.es/

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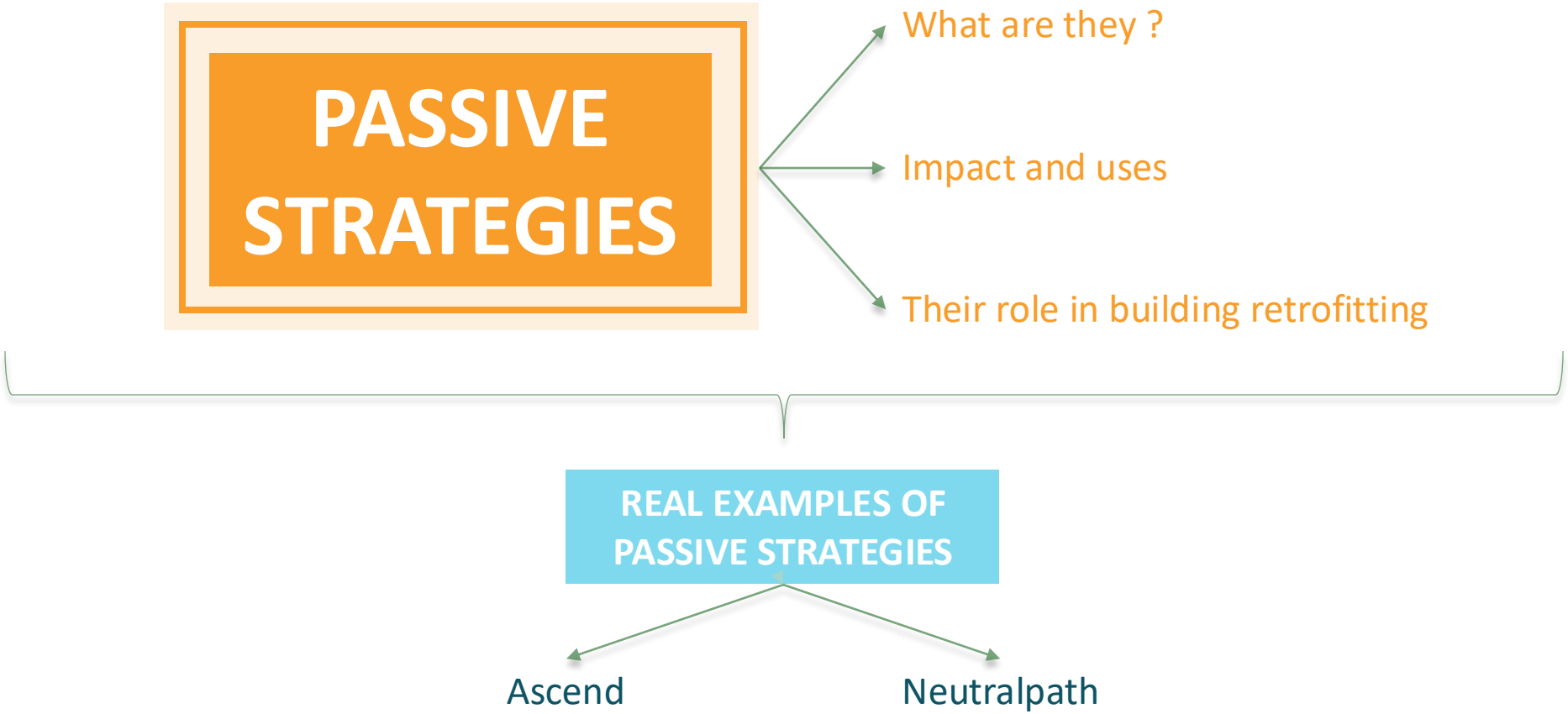
Session goal



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Session format

Session block

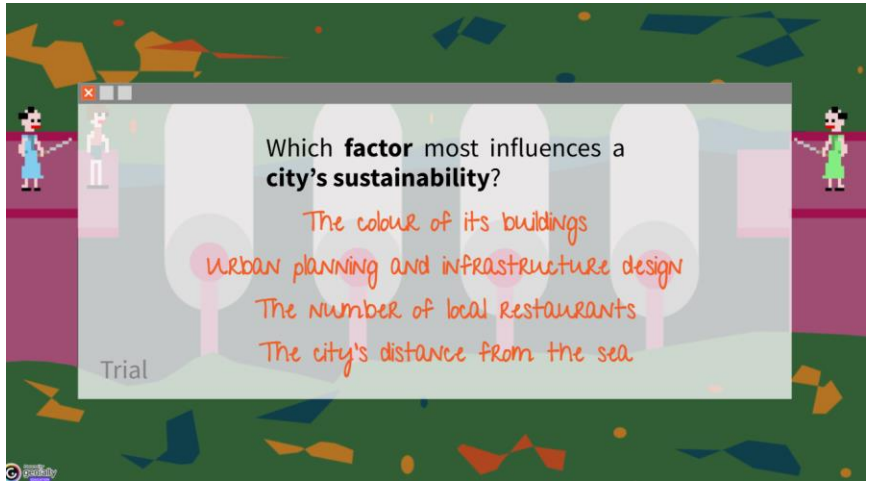
INTRODUCTION PART

THEORY PART

Interactive Exercise

Genially Exercise

TYPE 1_PIXEL rolls



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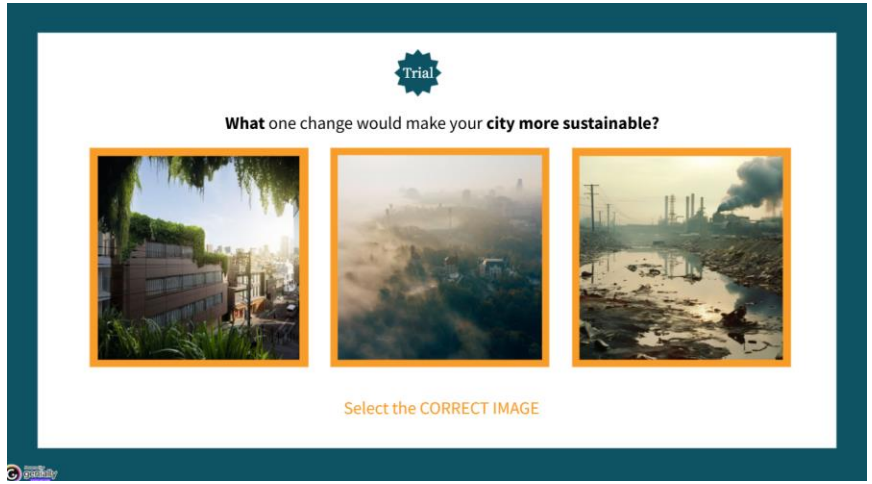

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30 min

PASSIVE STRATEGIES

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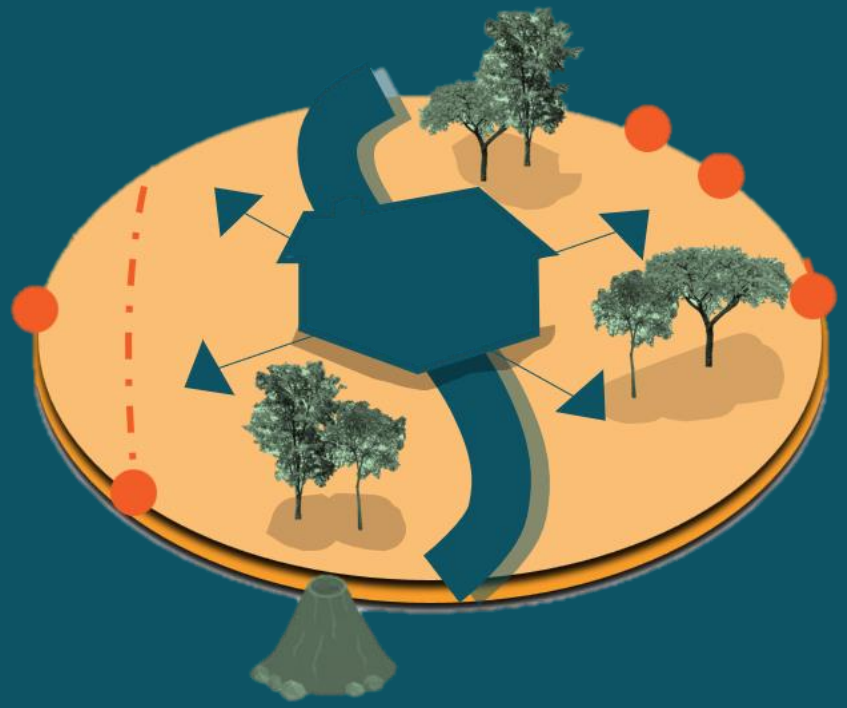
WHAT are they?



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WHAT are they?

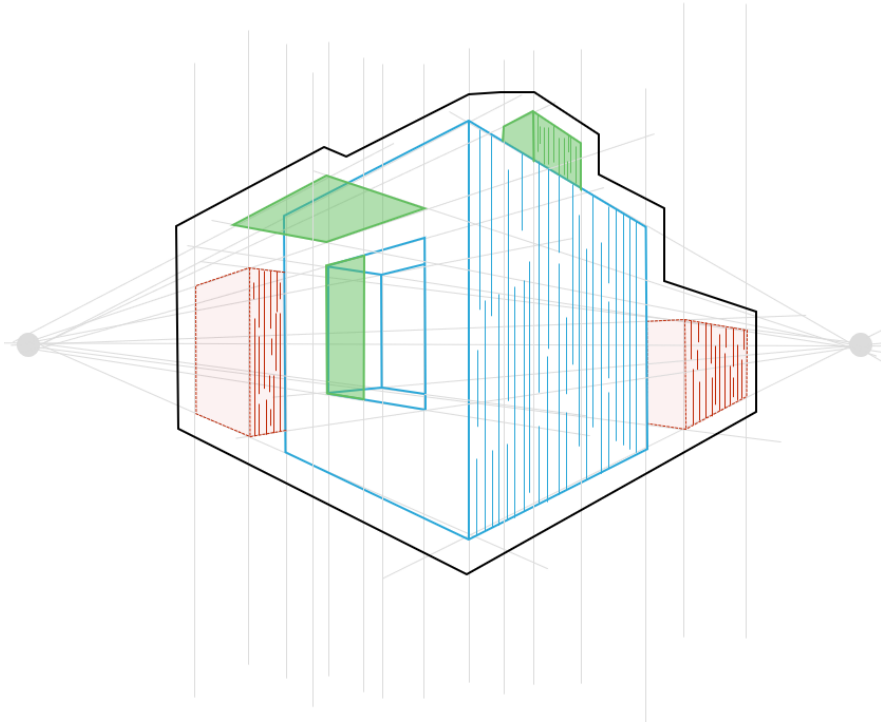
DEFINITION

Passive strategies are **design actions** that do not use mechanical systems.

They take advantage of the **local climatic conditions**; especially temperature, solar radiation, and wind; to reach thermal comfort levels and provide good living conditions inside buildings.

These **strategies use** the building's orientation, form, materials, and **architectural design** to control how heat, light, and air behave indoors.

They aim to **reduce the need for mechanical heating**, cooling, and lighting systems, improving energy efficiency and indoor comfort in a natural way.



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WHAT are they?

THREE TECHNICAL CONCEPTS

LOCAL CLIMATE CONDITIONS ▶ **Local climate conditions** define the types of strategies that can be used

GIVONI PSYCHROMETRIC CHART ▶ The **Givoni Chart** helps identify which strategies are most suitable for each climate context

COMFORT TEMPERATURE ▶ The **comfort temperature** is used to check how effective these strategies are and shows how well the building stays comfortable naturally

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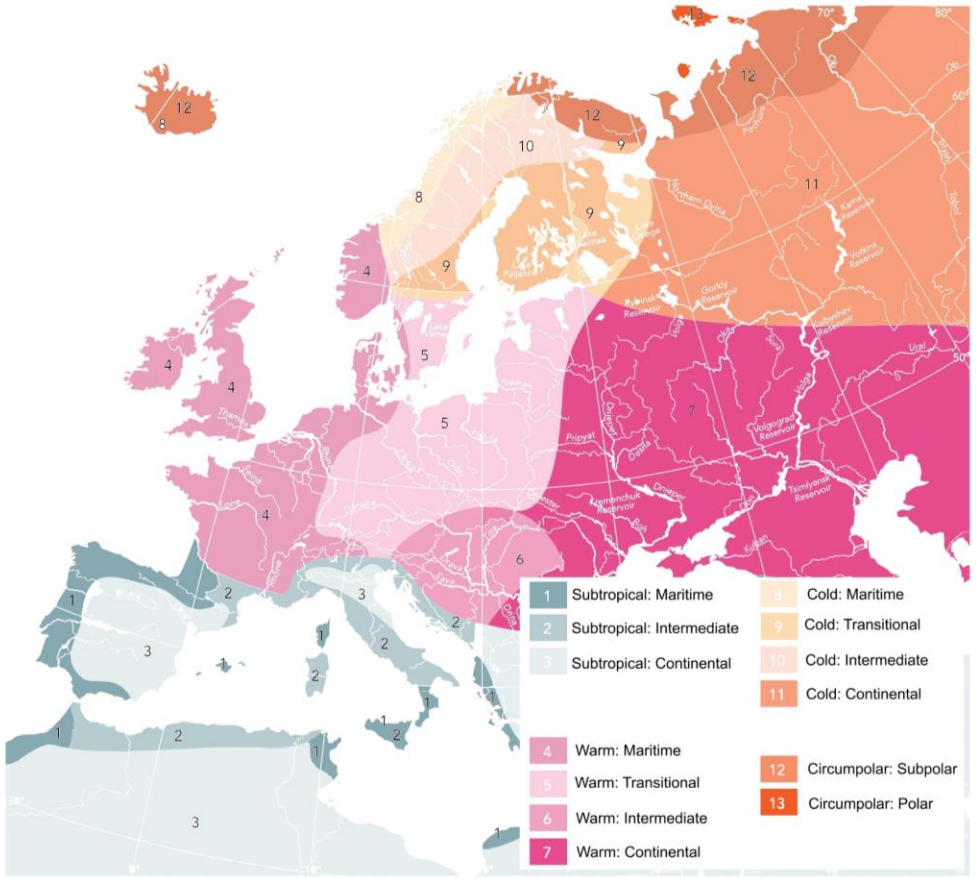
WHAT are they?

Local climate conditions

Local climate conditions describe the typical weather characteristics of a specific place over a long period of time; temperature, humidity, solar radiation, wind direction and speed, and precipitation levels.

These conditions **determine how heat, light, and air behave in a certain area**, which is essential for designing effective passive strategies.

This **information can be obtained from national meteorological agencies**, international **climate databases** such as Meteonorm, as well as from European platforms, EUROSTAT, or PVGIS, which provide detailed data for different cities and regions.



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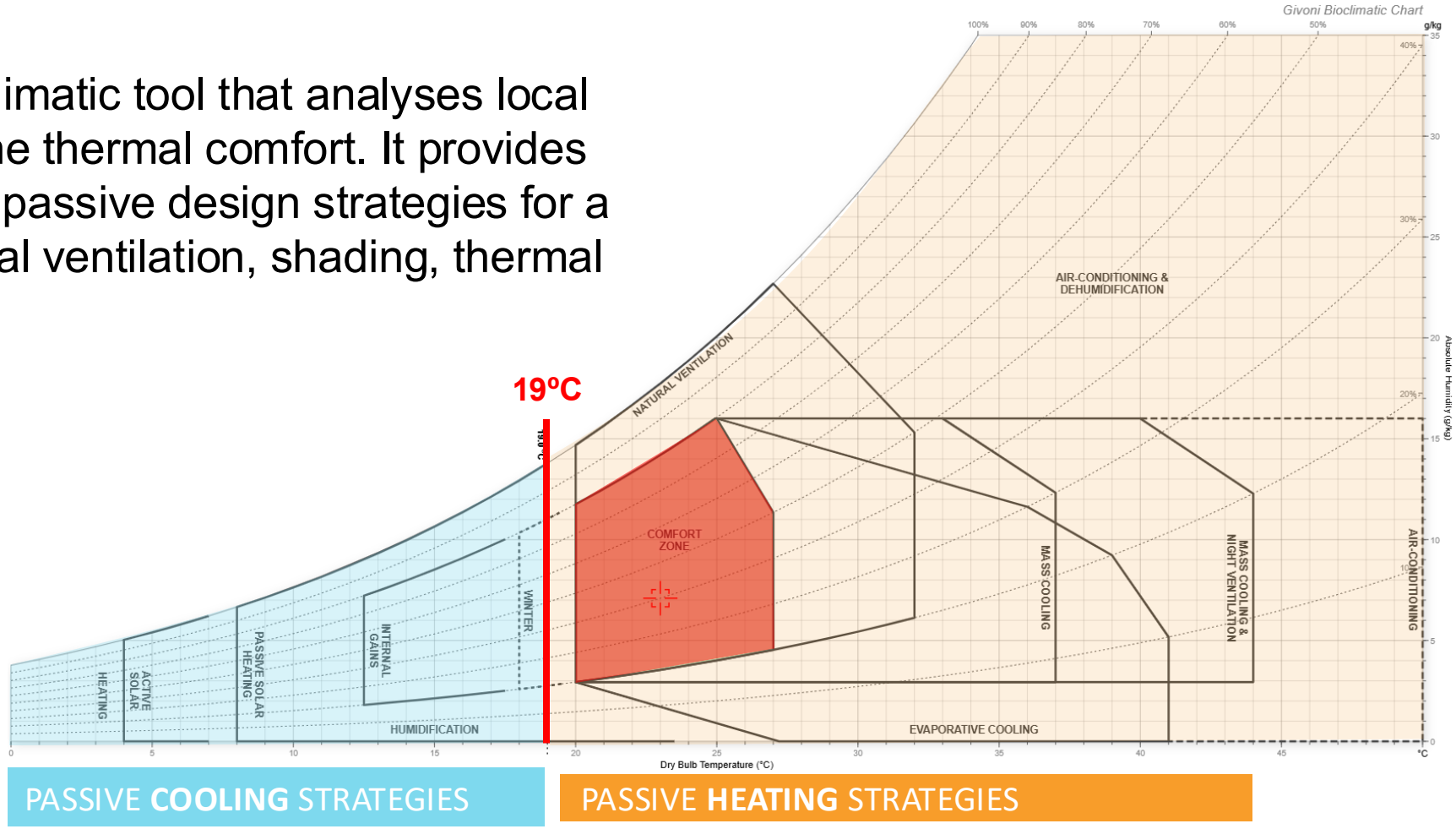
WHAT are they?

Givoni Chart usage

The **Givoni Diagram** is a bioclimatic tool that analyses local weather conditions to determine thermal comfort. It provides guidance on the most suitable passive design strategies for a specific climate (such as natural ventilation, shading, thermal mass, or evaporative cooling)

By interpreting the diagram, designers can identify how environmental parameters influence human comfort and select passive actions best adapted to local climatic conditions



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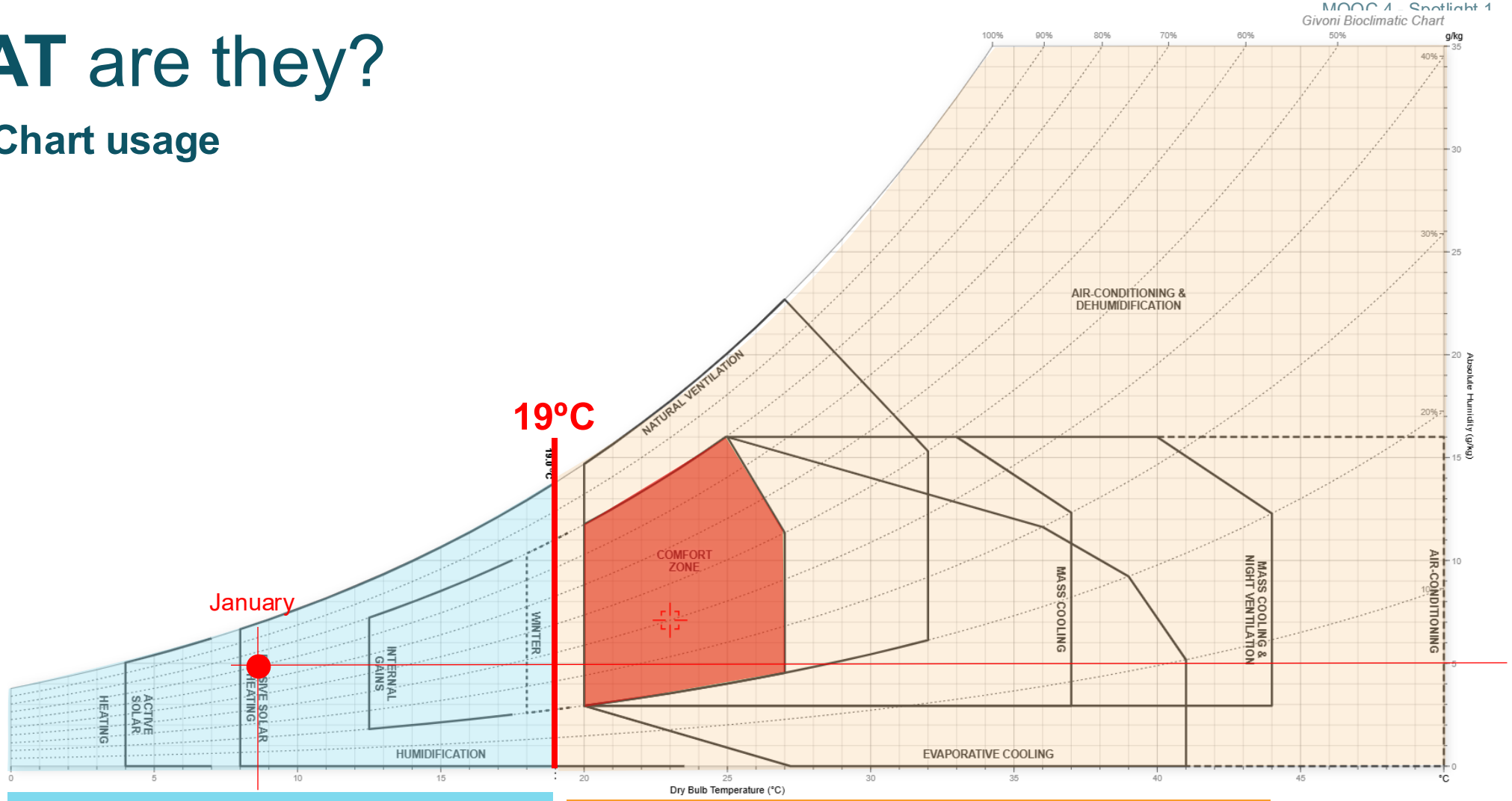
WHAT are they?

Givoni Chart usage



PASSIVE **COOLING** STRATEGIES

PASSIVE **HEATING** STRATEGIES

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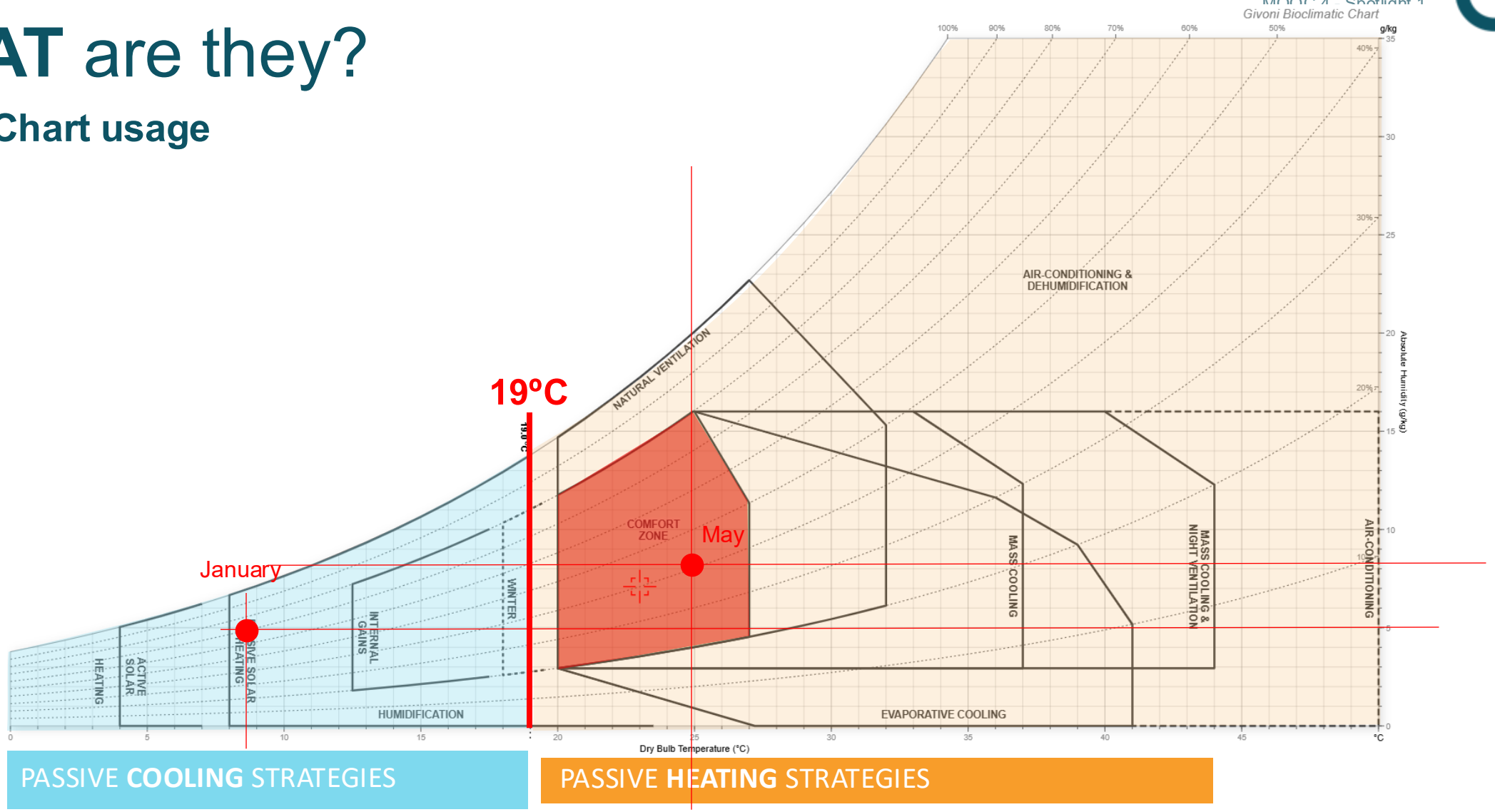
WHAT are they?

Givoni Chart usage



PASSIVE **COOLING** STRATEGIES

PASSIVE **HEATING** STRATEGIES

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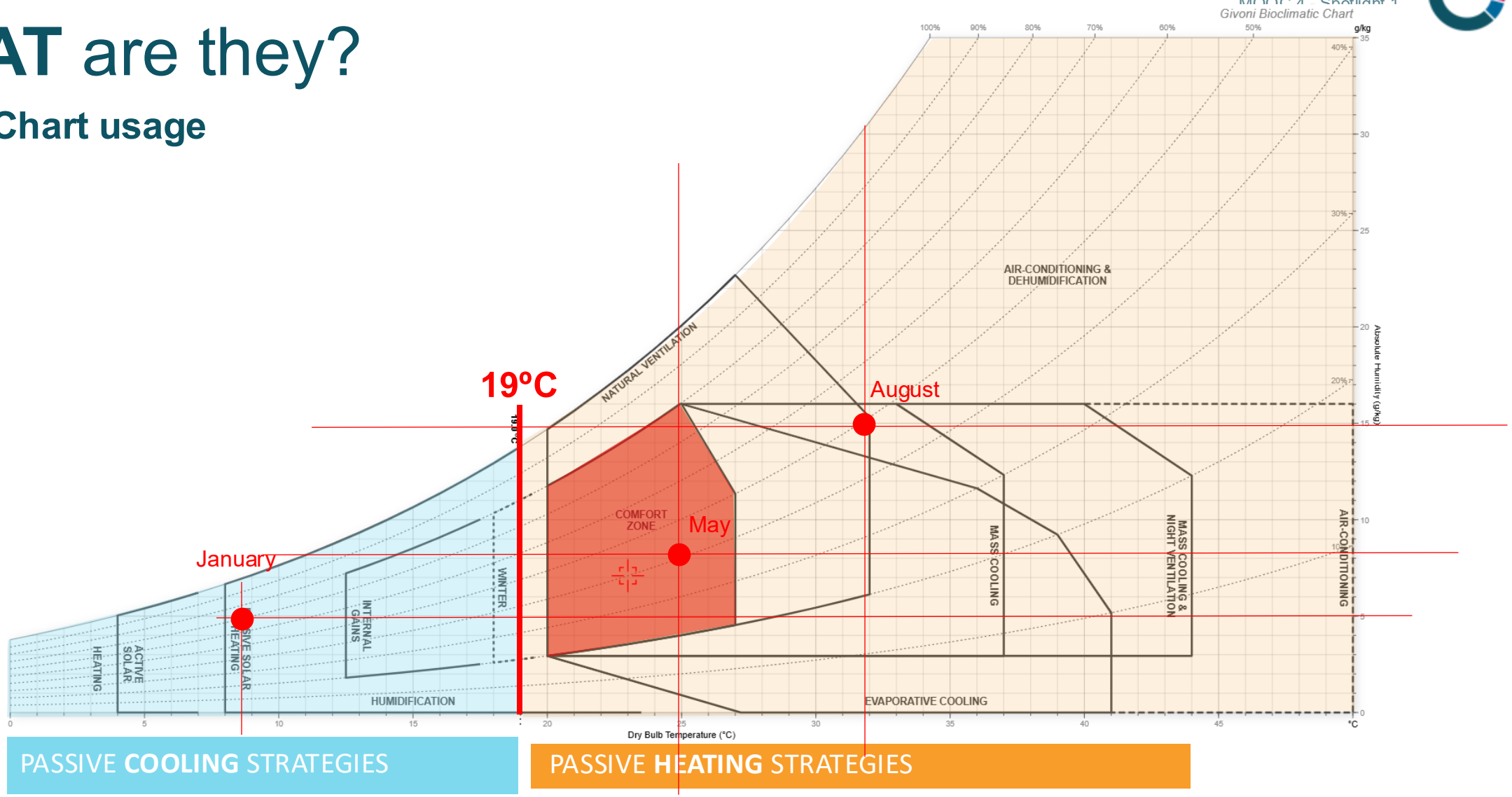
WHAT are they?

Givoni Chart usage



PASSIVE **COOLING** STRATEGIES

PASSIVE **HEATING** STRATEGIES

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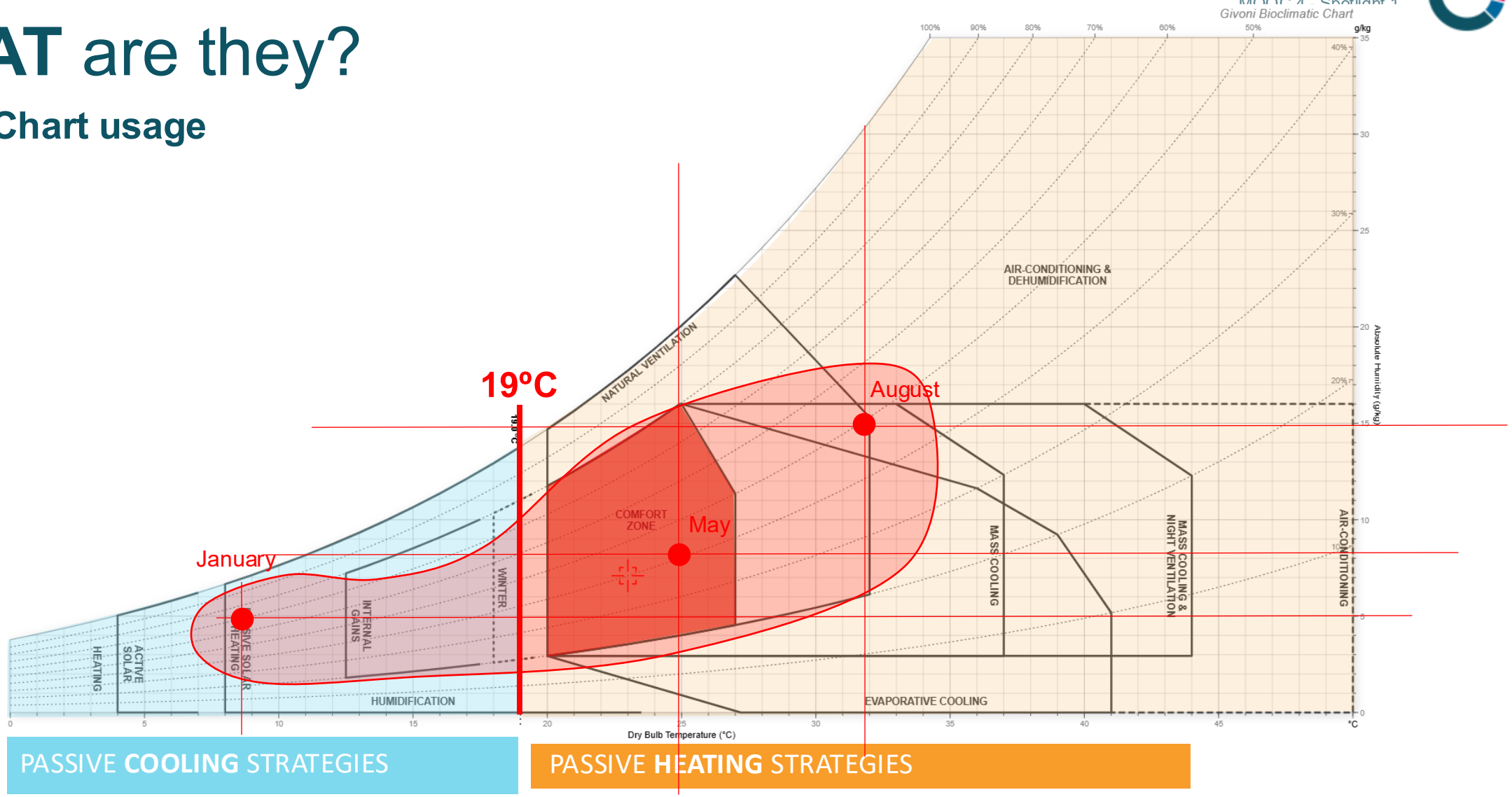
WHAT are they?

Givoni Chart usage



PASSIVE **COOLING** STRATEGIES

PASSIVE **HEATING** STRATEGIES

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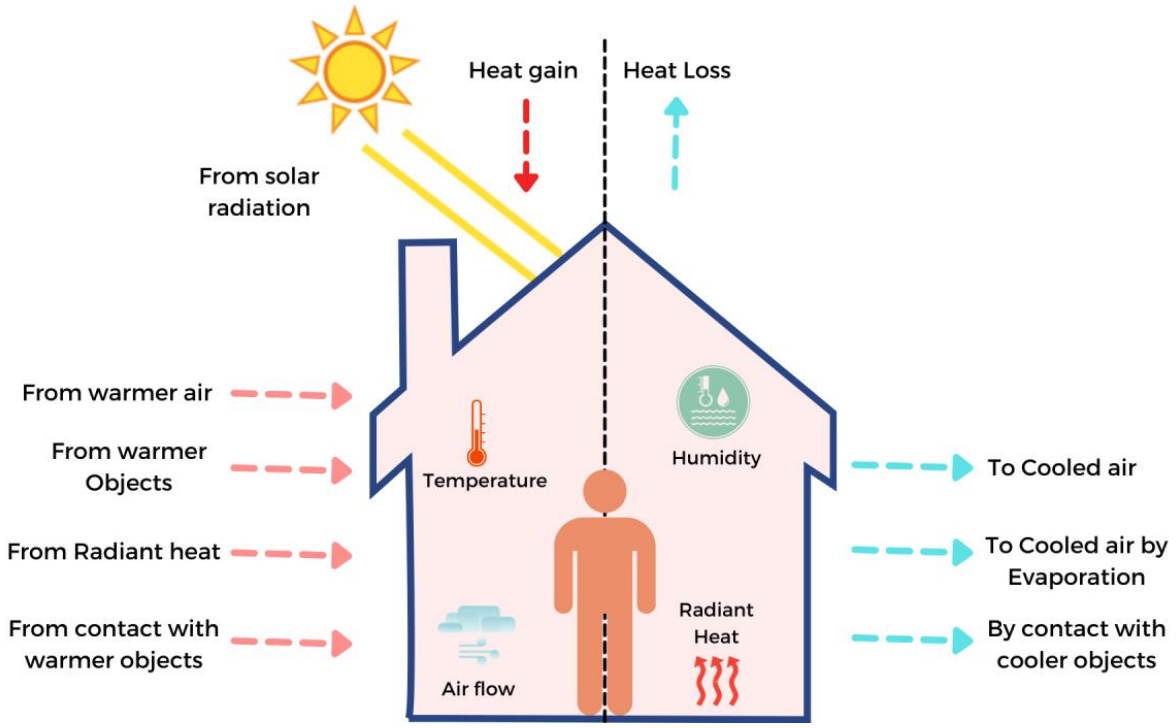
WHAT are they?

Comfort temperature



RDT Corp., Why is Thermal Comfort Analysis Important Today?
https://rdt-corp.com/thermal-comfort-analysis/

Thermal comfort means feeling good with the temperature around you.

The **comfort temperature** is the range in which most people feel comfortable, usually between **20°C and 26°C.**

It depends on things like:

- Air temperature
- Sunlight
- Humidity
- Wind
- Activity
- Clothing

Even though **comfort is subjective**, there is a comfort zone where small changes in temperature, humidity, or air movement don´t make people feel uncomfortable.

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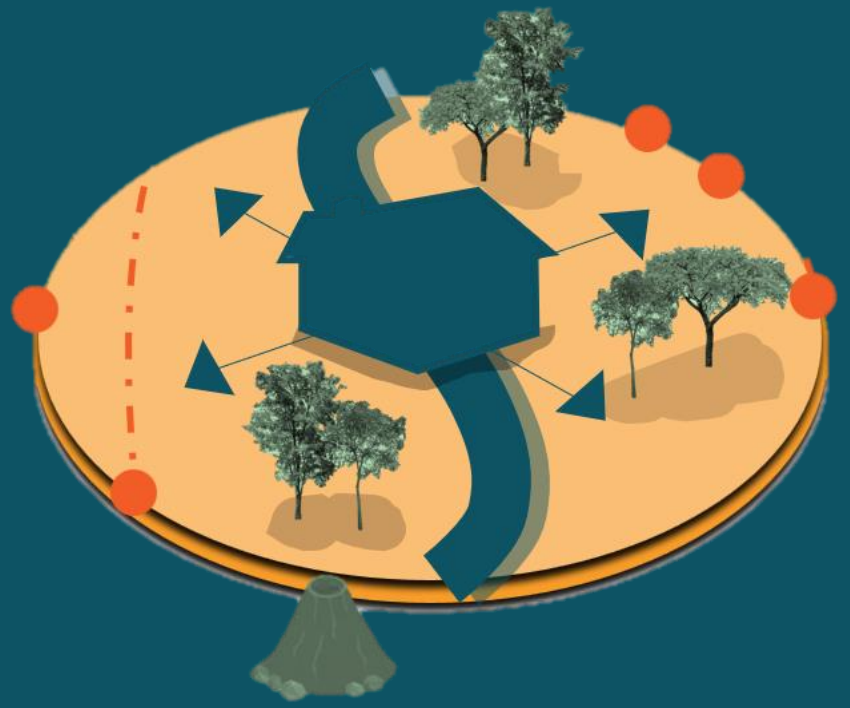
HOW are they applied?



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HOW are they applied?

TYPES OF PASSIVE STRATEGIES

WINTER ACTIONS

GIVONI CATEGORY	PASSIVE ACTIONS	OBJECTIVE
Active Solar Heating	Thermal Mass	Store and release solar heat
Passive Solar Heating	Solar Gains	Capture solar radiation
Internal Gains	Thermal Insulation	Conserve internal heat
Humidification	Humidification Systems	Improve indoor comfort

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HOW are they applied?

TYPES OF PASSIVE STRATEGIES

SUMMER ACTIONS

GIVONI CATEGORY	PASSIVE ACTIONS	OBJECTIVE
Natural ventilation	Cross ventilation	Warm air is removed and airflow is promoted
Evaporative cooling	Evaporative cooling	Air temperature is lowered through evaporation
Mass cooling	Thermal mass	Indoor temperature is stabilised
Mass cooling + Night ventilation	Night ventilation	Heat is stored at night
Shading devices	Solar protection	Overheating and glare are prevented

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HOW are they applied?

TYPES OF PASSIVE STRATEGIES

RETROFITTING ACTIONS

RETROFITTING STRATEGIES	PASSIVE ACTIONS	OBJECTIVE
Improve the building envelope	Replace windows and doors	Thermal bridge are reduce
	Improve façade insulation	Minimise heat energy transfer

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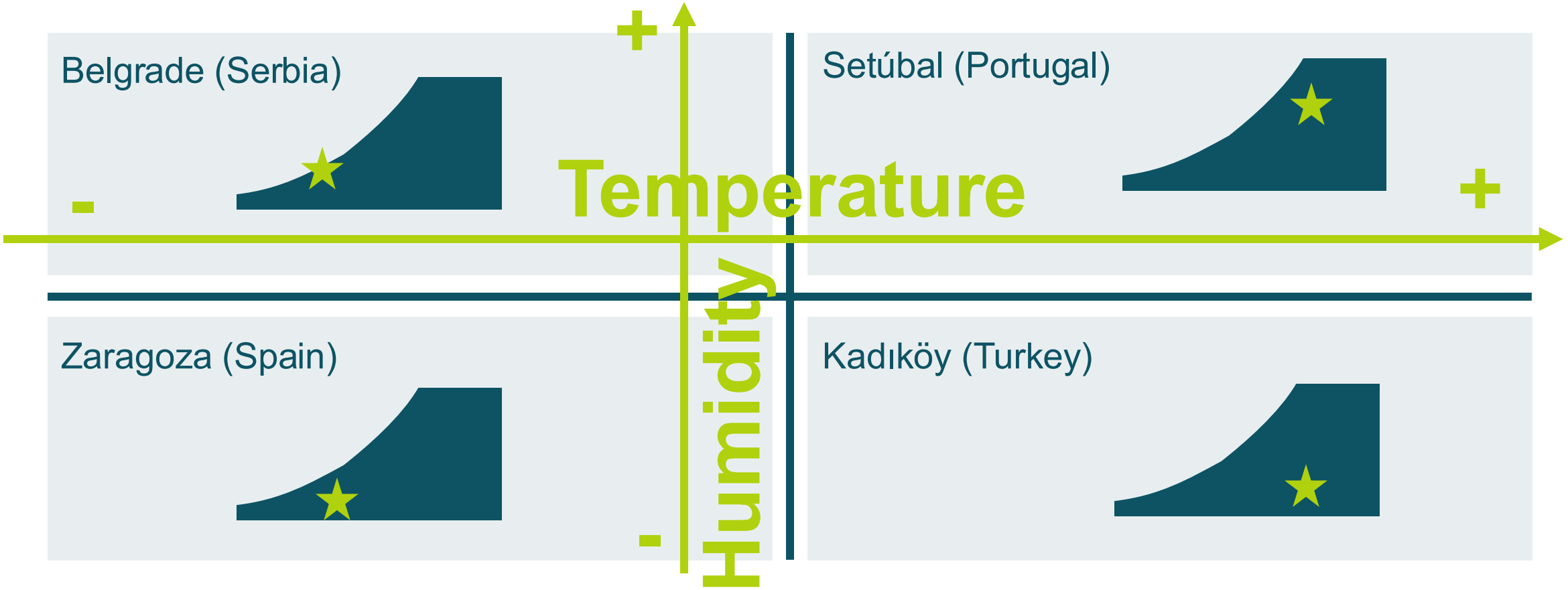
HOW are they applied?

PASSIVE STRATEGIES BY VALUES



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HOW are they applied?

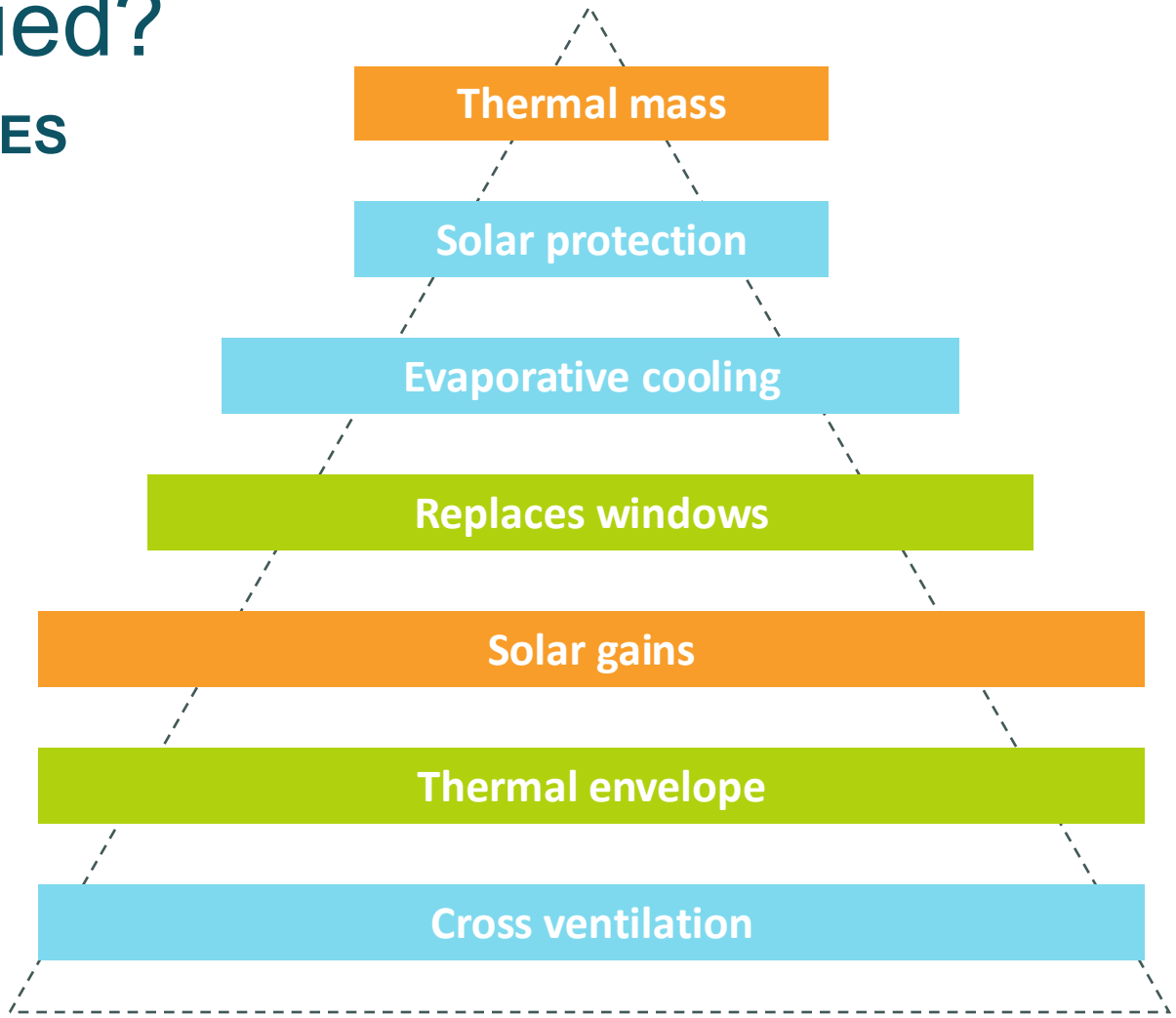
PASSIVE STRATEGIES BY VALUES

	HEATING PASSIVE STRATEGIES				RETROFITTING ACTIONS		COOLING PASSIVE STRATEGIES				
	Thermal Mass	Solar Gains	Thermal Insulation	Humidification	Replace Windows and Doors	Thermal Envelope	Cross Ventilation	Evaporative Cooling system	Thermal Mass	Night Ventilation	Solar Protection
	Active Solar Heating	Passive Solar Heating	Internal Gains	Humidification Systems	Improve envelope	Thermal envelope	Natural Ventilation	Evaporative Cooling	Mass Cooling	Mass Cooling + Night Ventilation	Shading Devices
Zaragoza (Spain)	X	X			O	O	X	X	X		O
Setúbal (Portugal)		X	X		O	O	X		X		O
Kadikoy (Turkey)	X	X	X		O	O	X		X		O
Belgrade (Serbia)	X	X			O	O	X	X	X		O

HOW are they applied?

PASSIVE STRATEGIES BY VALUES

Belgrade (Serbia)



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HOW are they applied?

PASSIVE STRATEGIES BY VALUES

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Setúbal (Portugal)		X	X		O	O	X		X		O
Kadikoy (Turkey)	X	X	X		O	O	X		X		O
Belgrade (Serbia)	X	X			O	O	X	X	X		O

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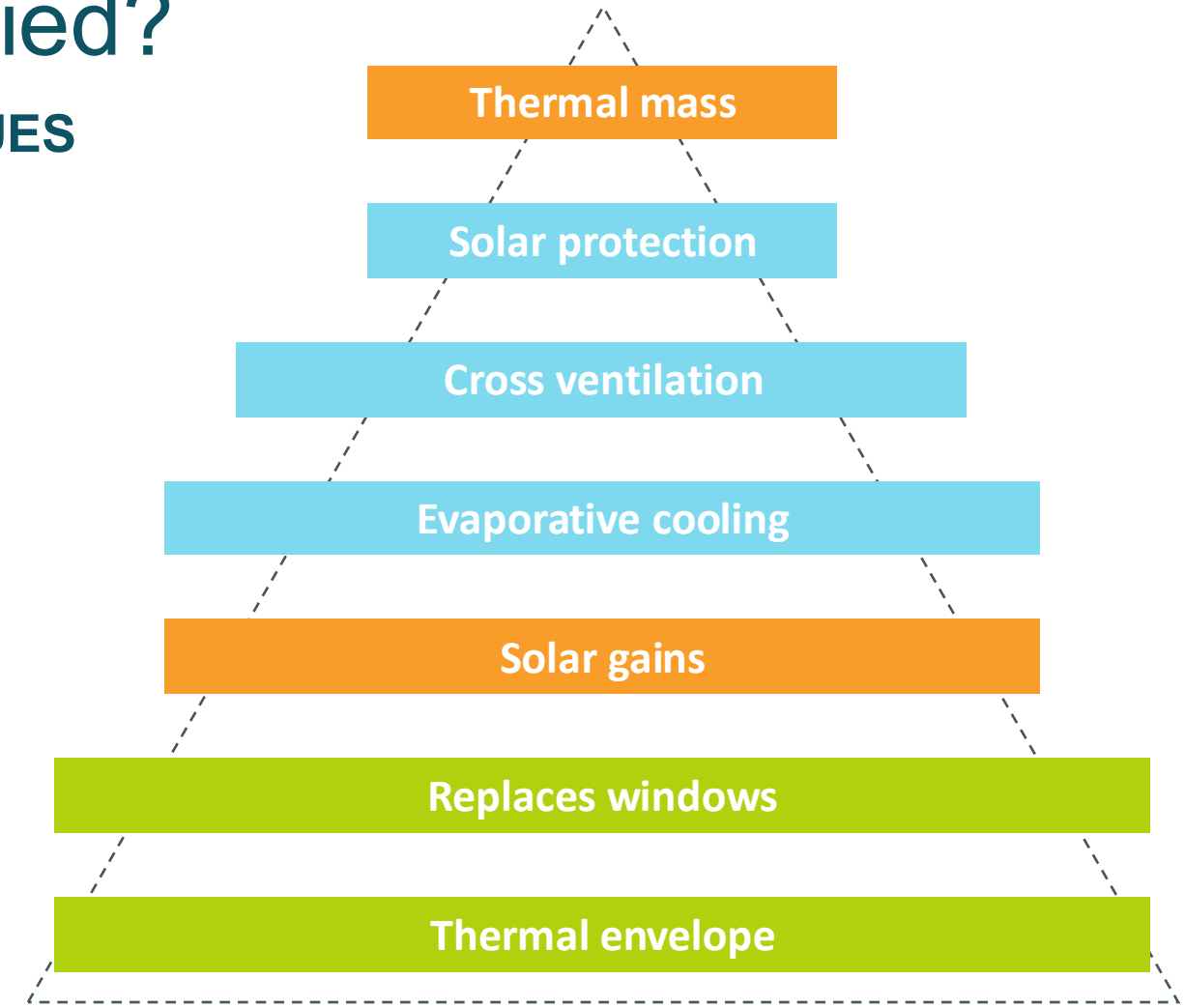
HOW are they applied?

PASSIVE STRATEGIES BY VALUES

Zaragoza (Spain)



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HOW are they applied?

PASSIVE STRATEGIES BY VALUES

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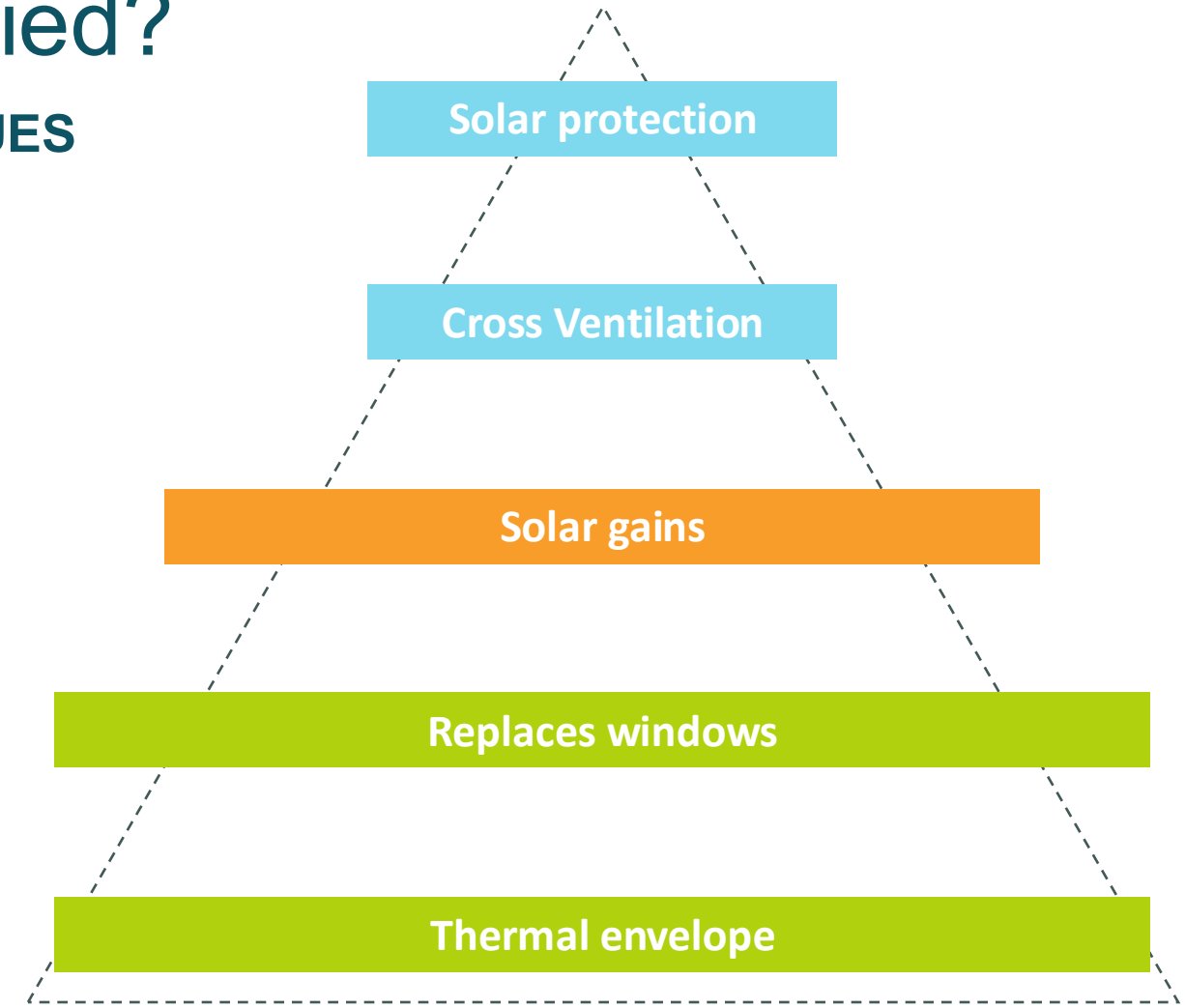
Zaragoza (Spain)	X	X			O	O	X	X	X		O
Setúbal (Portugal)		X	X		O	O	X		X		O
Kadıköy (Turkey)	X	X	X		O	O	X		X		O
Belgrade (Serbia)	X	X			O	O	X	X	X		O

HOW are they applied?

PASSIVE STRATEGIES BY VALUES

Setubal (Portugal)



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HOW are they applied?

PASSIVE STRATEGIES BY VALUES

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Setúbal (Portugal)		X	X		O	O	X		X		O
Kadikoy (Turkey)	X	X	X		O	O	X		X		O
Belgrade (Serbia)	X	X			O	O	X	X	X		O

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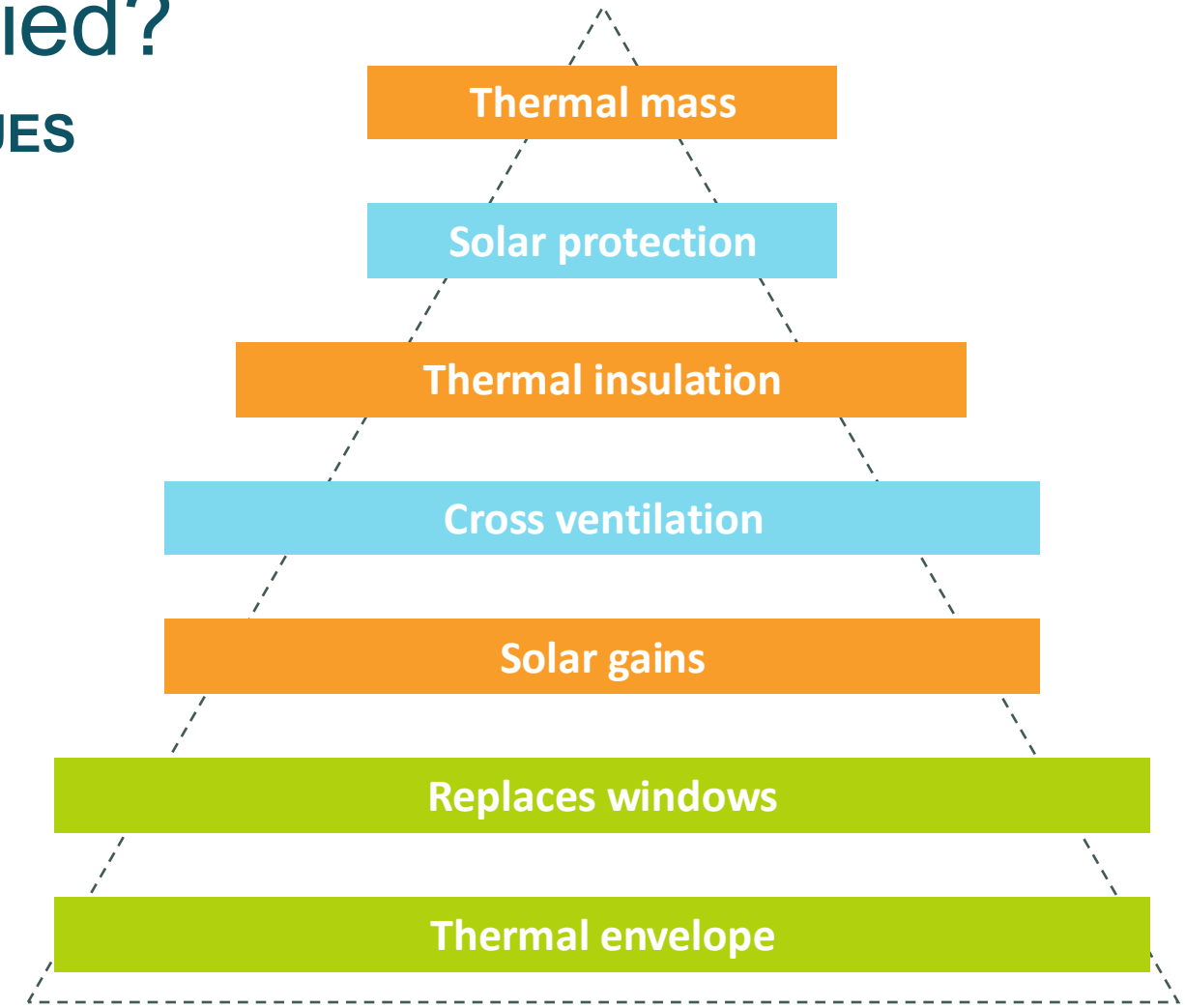
HOW are they applied?

PASSIVE STRATEGIES BY VALUES

KadikÖy (Turkey)



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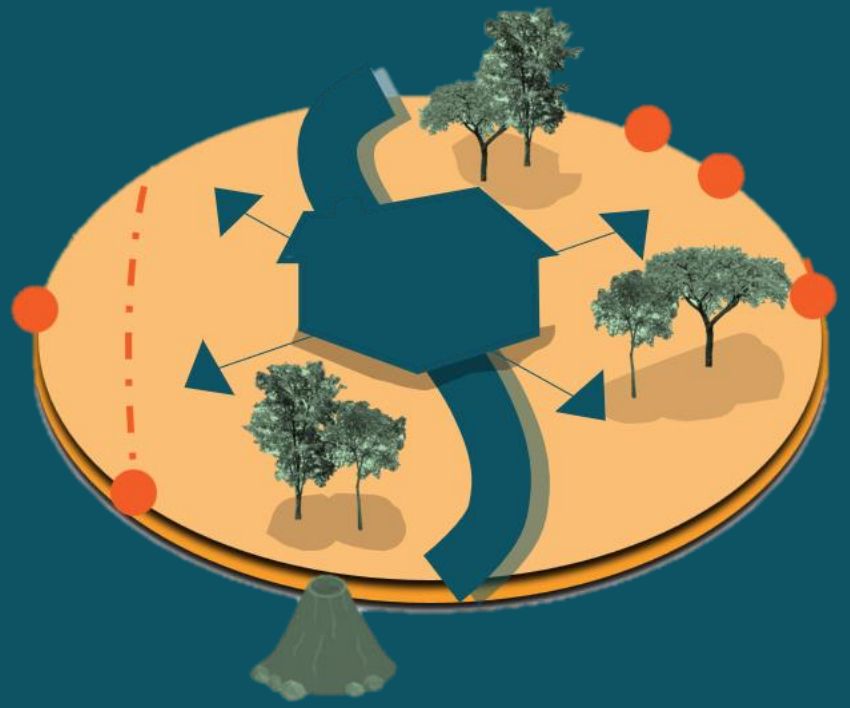
HOW are they financed?



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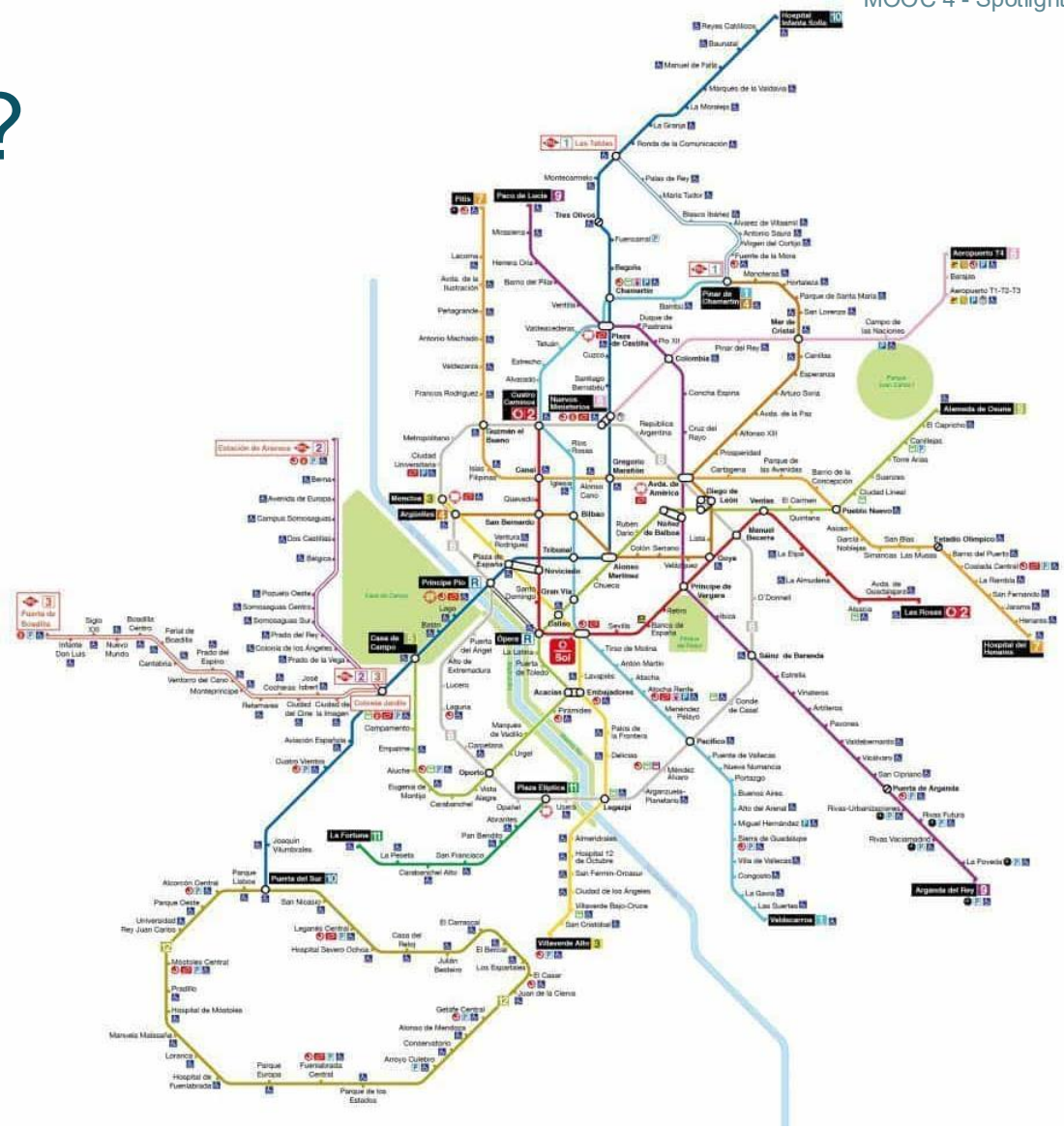
HOW are they financed?

PRICE OF THE URBAN LAND

The **main idea** is to increase the **building capacity** of some buildings in certain areas so that the economic gains can finance the rest of the retrofitting work across the city.

Taking Madrid as an example, there are significant differences in land prices between northern urban areas such as Chamartín and Vallecas.



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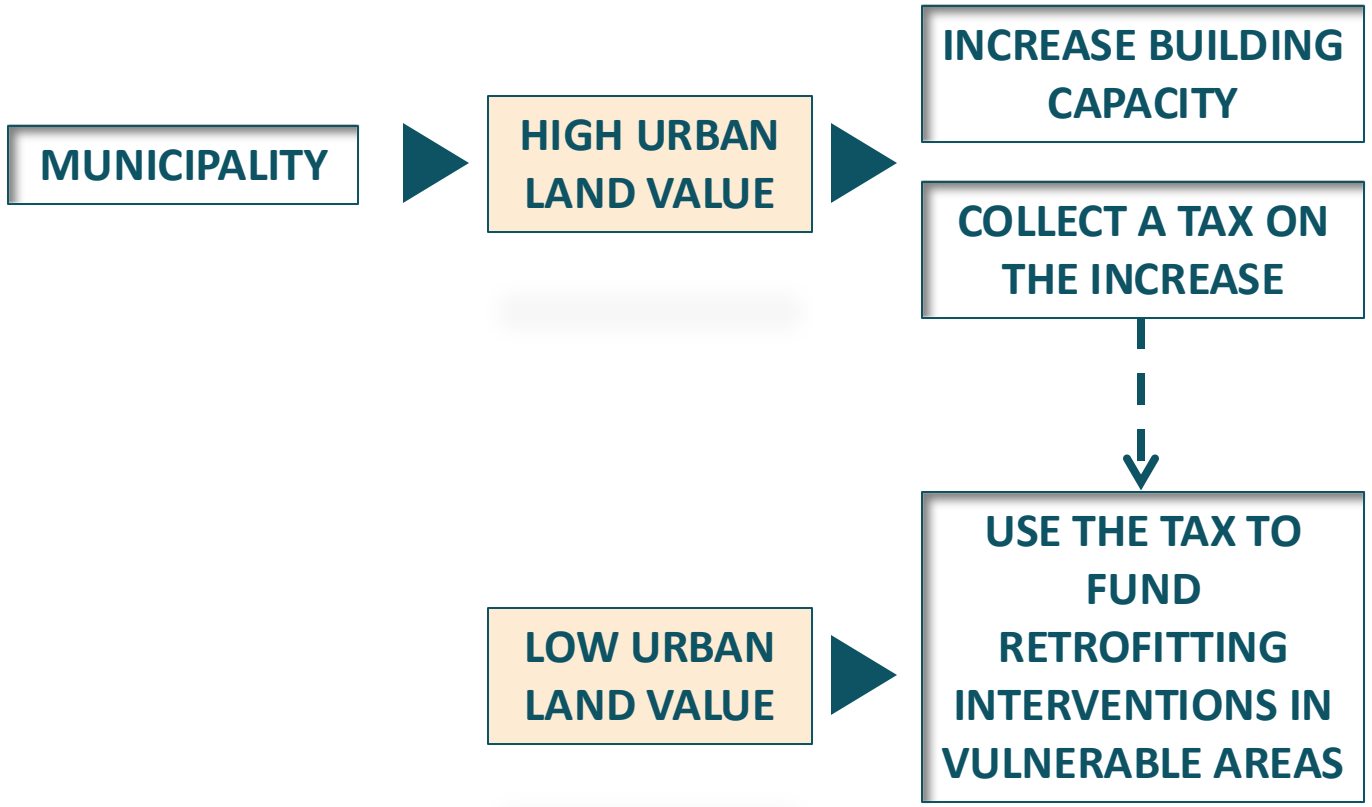
HOW are they financed?

ECONOMY MODEL

Passive retrofitting actions can be financed through an urban redistribution model, in which economic gains from areas with **high land values** are reinvested into retrofitting interventions in more vulnerable neighbourhoods



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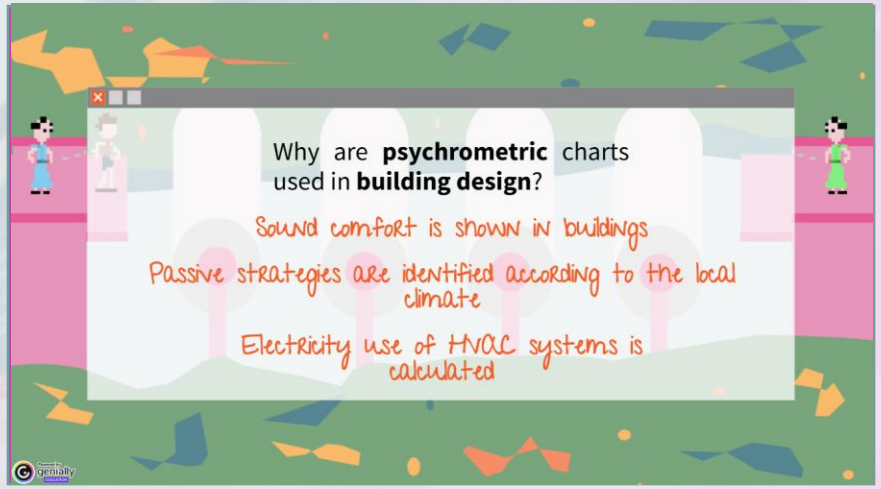
Interactive Exercise

Block structure

- INTRODUCTION PART
- THEORY PART
- Interactive Exercise

Genially Exercise

TYPE 1_PIXEL rolls



The link has been shared in the chat

https://view.genially.com/6900c2f6b54f83cbce1ea2d8/interactive-content-mooc-4-spotlight-1passive-strategies

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Real projects

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ASCEND

ASCEND project:

Accelerate poSitive Clean ENergy Districts

Jonatan Viejo, Ana Quijano,

CARTIF Technology Centre

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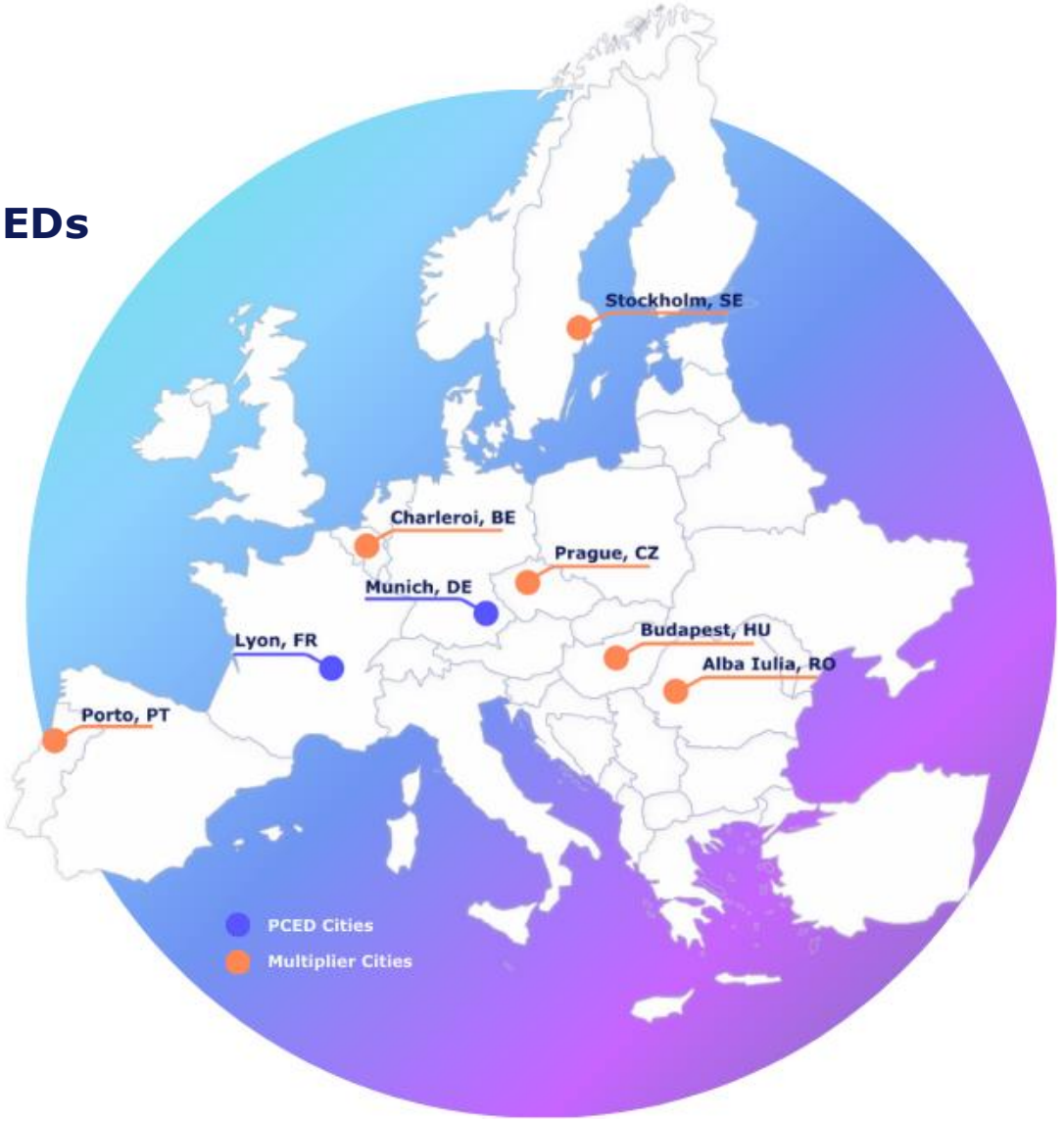
ASCEND in a nutshell

Duration: 2023 – 2028

8 demonstration areas for PCEDs

39 partners all over Europe



Coordination team

Lighthouse cities and their local consortia

Multiplier cities and their local consortia

Cross-cutting experts supporting implementation and dissemination

European SMEs

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What are Positive Clean Energy Districts?

PCEDs make cities:

Healthier **Smarter** **Sustainable** **Inclusive** **Resource efficient**

Positive Energy Districts are **energy-efficient** and **flexible urban areas** gathering connected buildings producing more energy than they consume with **net zero** greenhouse gas emissions balance

Clean: from mitigation to adaptation, including circular economy strategies

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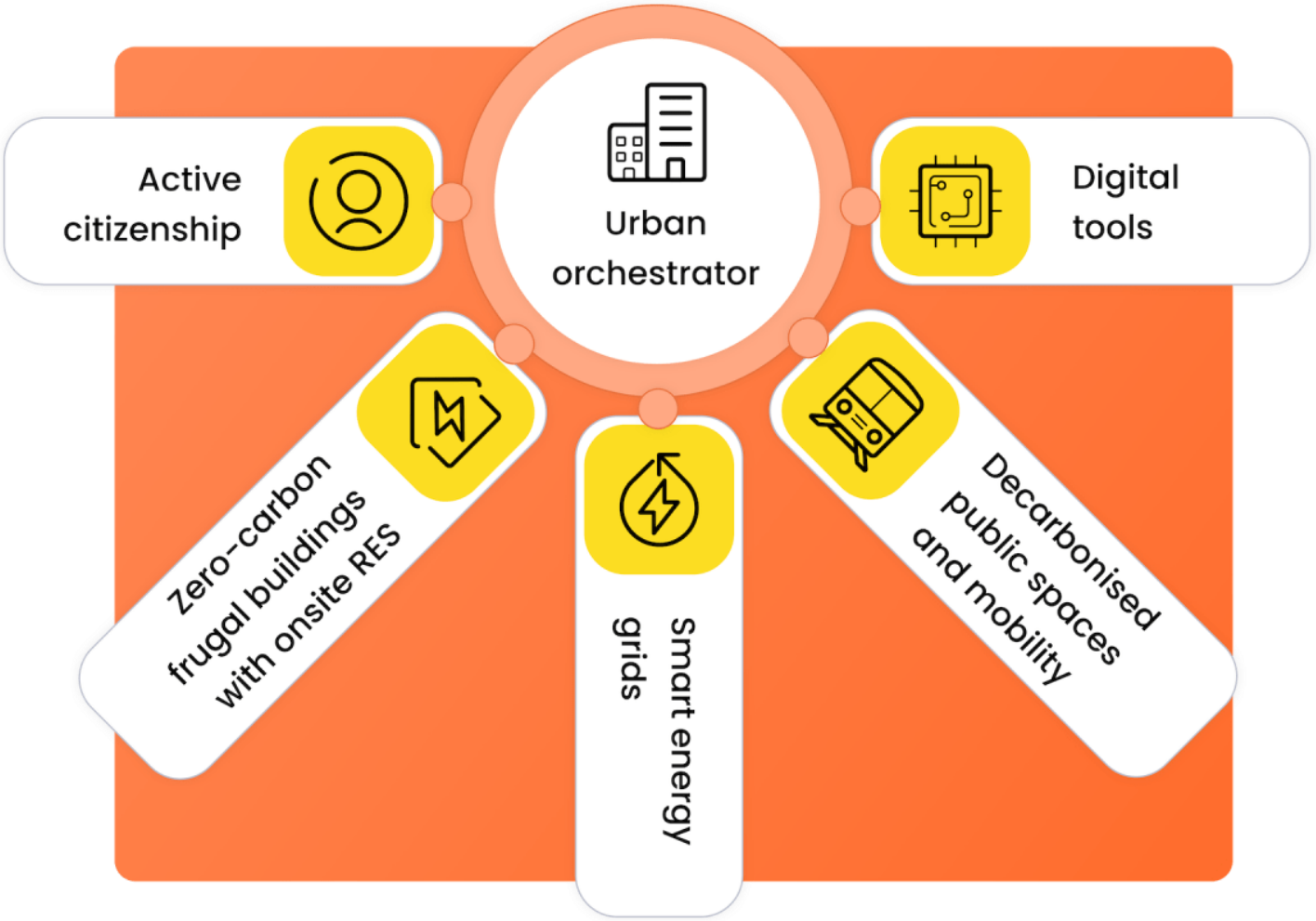
How to deliver PCEDs?



PCEDs stand on **5 main pillars** connected to a public entity called the **Urban Orchestrator** that aggregates all components and services implementing a long-lasting change at district level.

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Lyon demonstrator - La Confluence

In 2028, the PCED area will host more than 19,000m² of retro-fitted buildings and 170,000m² of new buildings with different uses including 55% of social or affordable housing, offices,or shops.

The planned investment for constructing buildings is €379M, while an additional 6M€ will be allocated to renewable energy production systems.

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Munich demonstrator - Harthof

The area spans 56 hectares and is home to 6,000 individuals. The project aims to transform Harthof into a clean, CO2-neutral positive energy district.

The city's ambition is to scale this transformation to 100 structurally similar districts in Munich by 2035, covering more than 43% of the city and providing a large share of the population with a CO2-neutral, healthier environment.

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Successful stories

ASCEND

Standard 2226

Baumschlager Eberle Architekten

> Lyon Case Study

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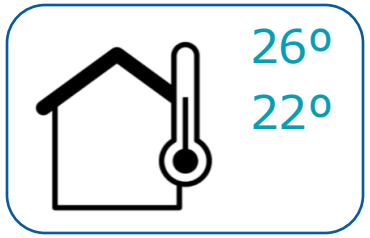
Concept: Standard 2226

- Constant temperature between 22 and 26 ºC
- Heat sources: lighting, computers, machines, and also, the occupants!
- No additional heating, ventilation or cooling systems
- Lower construction costs, lower energy costs
- More natural climate, greater well-being



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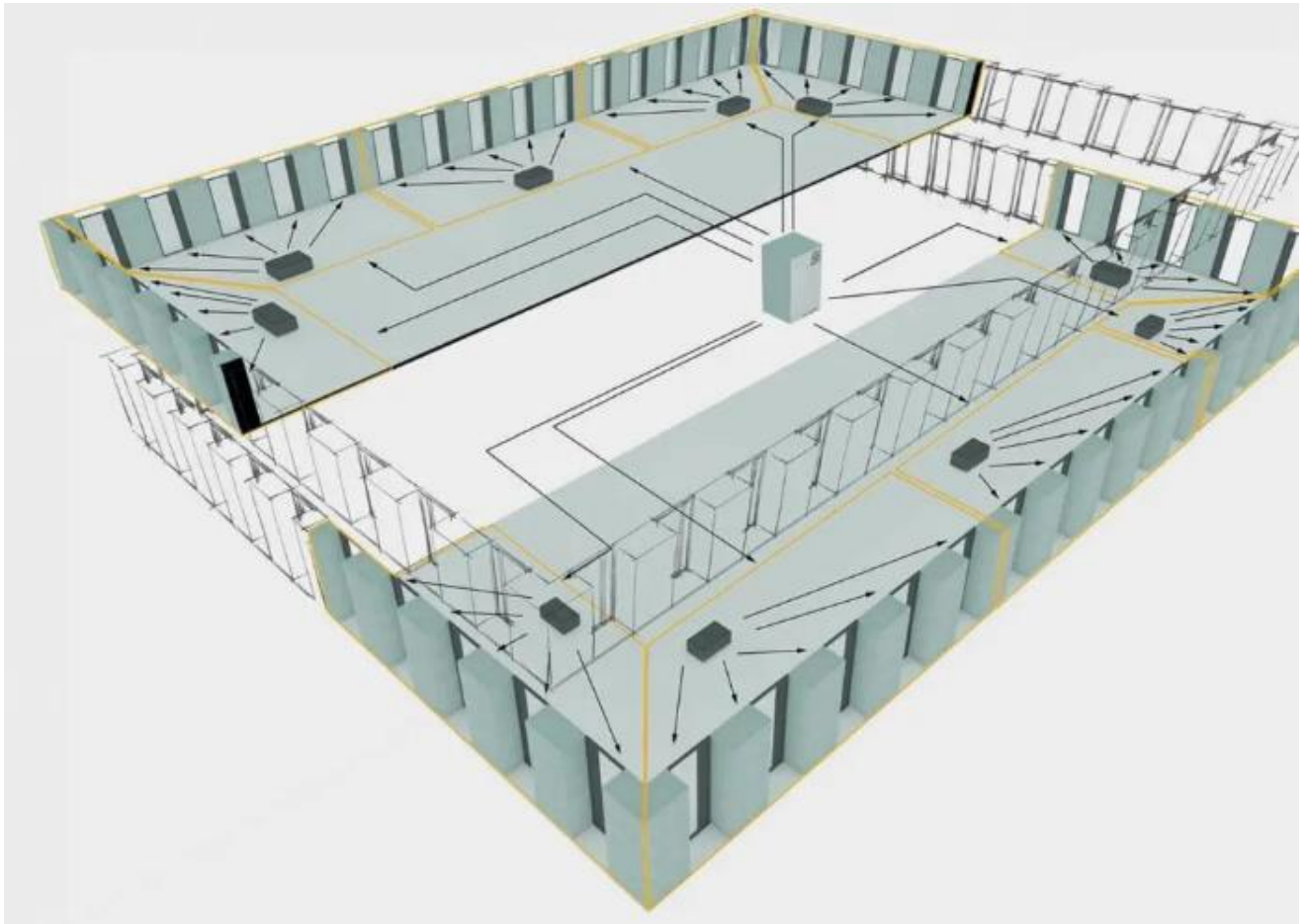
Standard 2226, Passive design:

- Façade design calculated according to the angle of the sun’s rays
- Taking advantage of the thermal inertia of materials
- 38cm static + 38cm insulating brickwork

Funded by the European Union

Standard 2226, Passive design:

- High-ceilinged rooms (air convention)
- Internal wind flow controller (intelligent system: Tº, CO_2)



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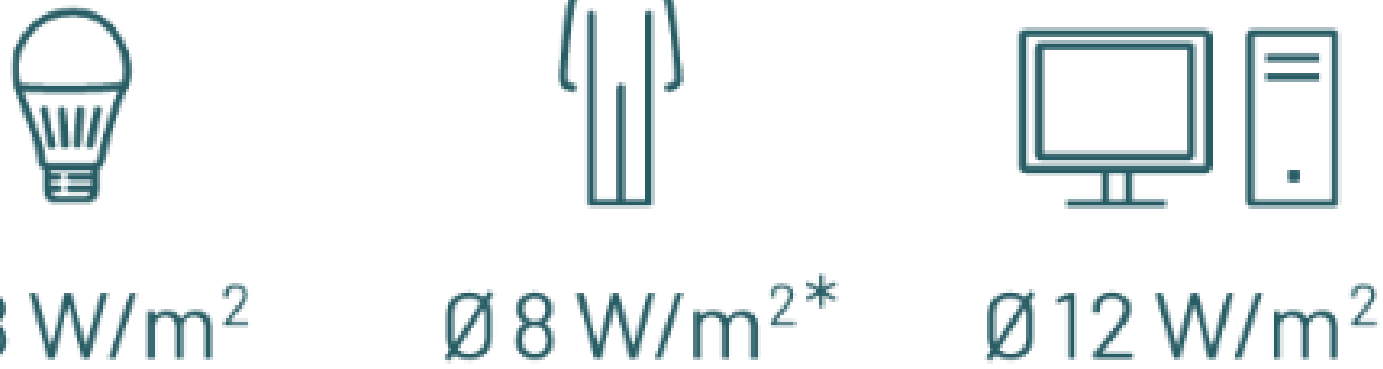
Standard 2226: Energy contributions

- Residual heat from lighting, computers, machines
- ~80W/person/10m² irradiated



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ASCEND

Prefabricated Façade Refurbishment

> Munich Case Study

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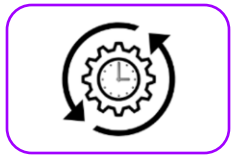
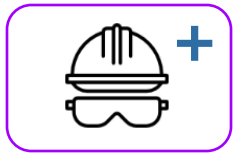
Concept

- Increase replicability



- Construction time reduction: fast and clean installation



- Maximize safety, reduce risks in the construction sites

- Reduce inconvenience to residents

- Cost optimisation

- Circular systems: reutilisation

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Demo application:

- Residential building: Weyprechtstraße 15-19, Munich, Germany

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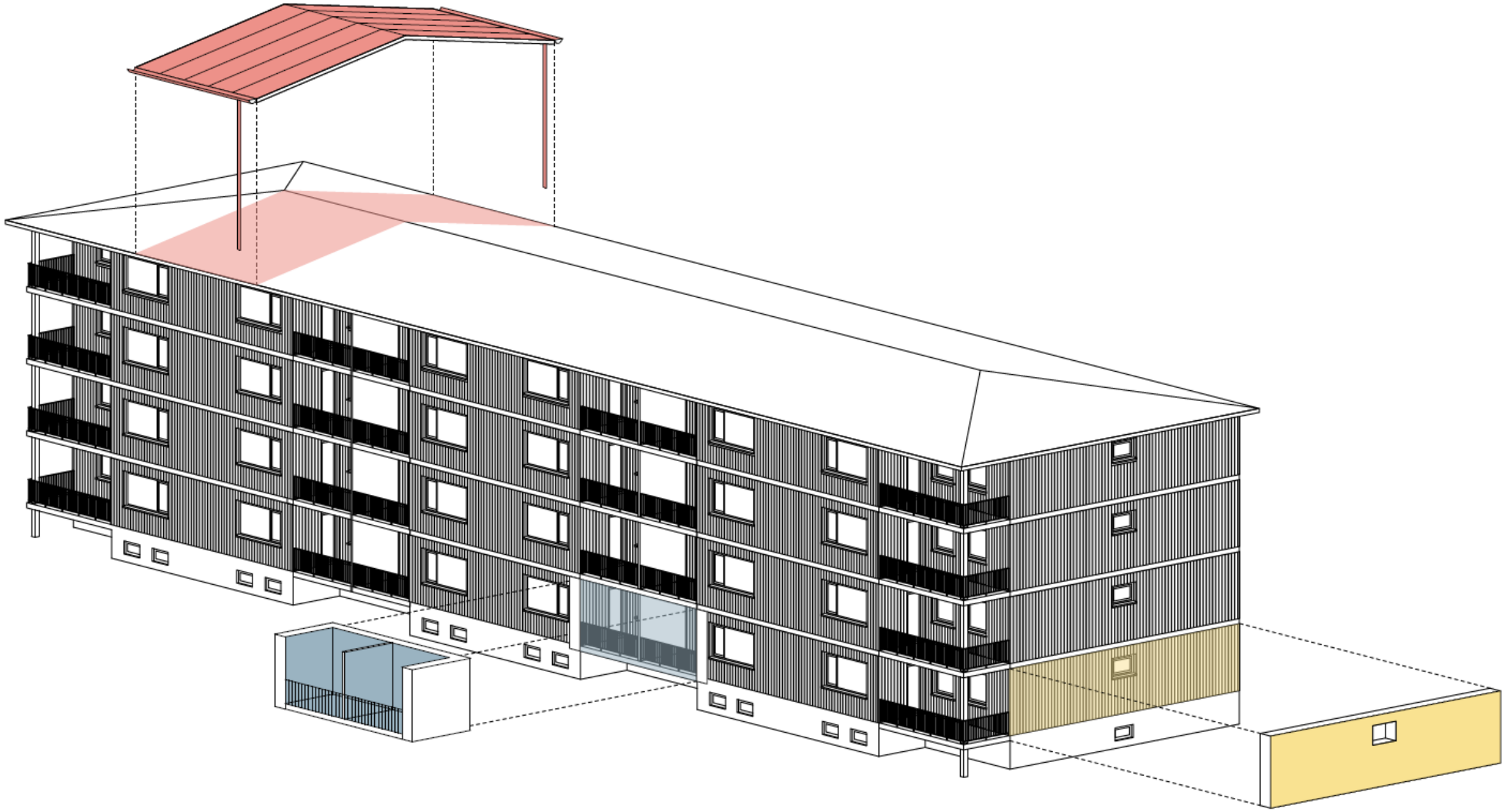
Prefabricated serial refurbishment



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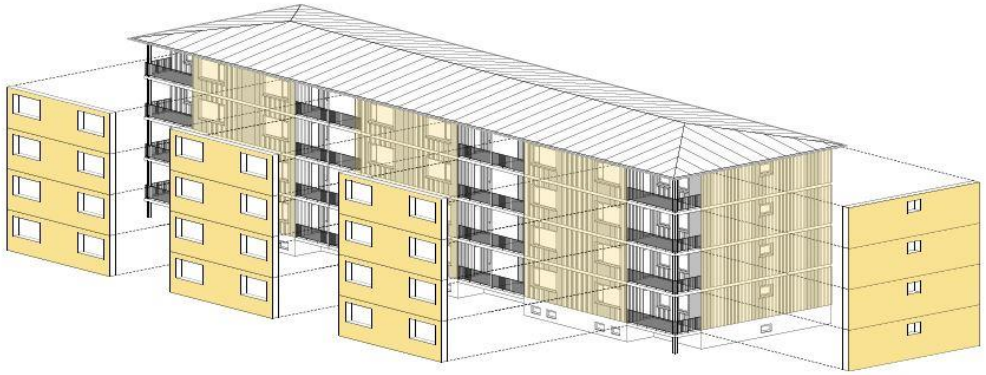
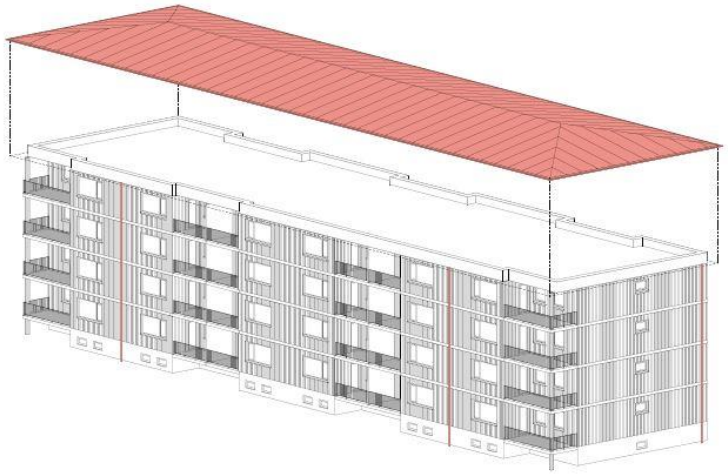
System details

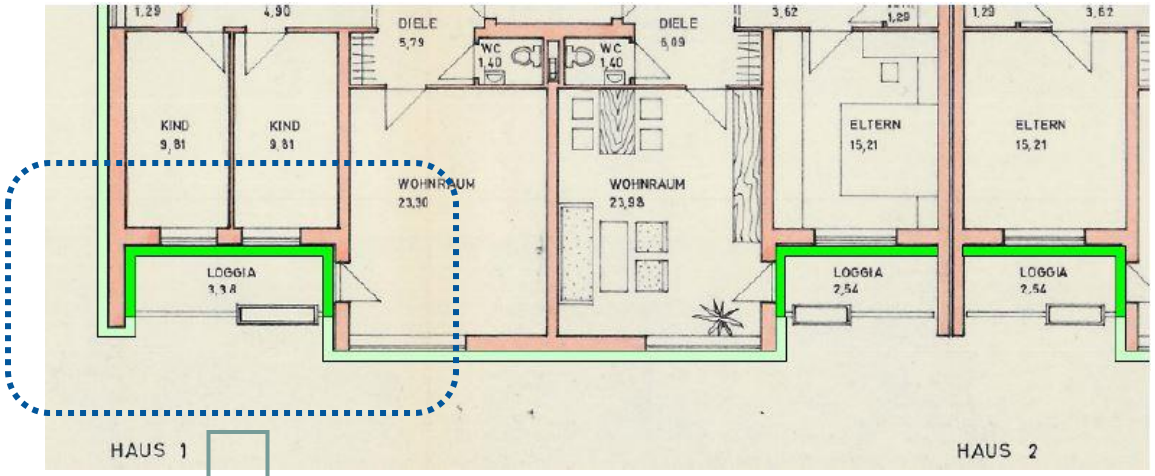
- Façade modules

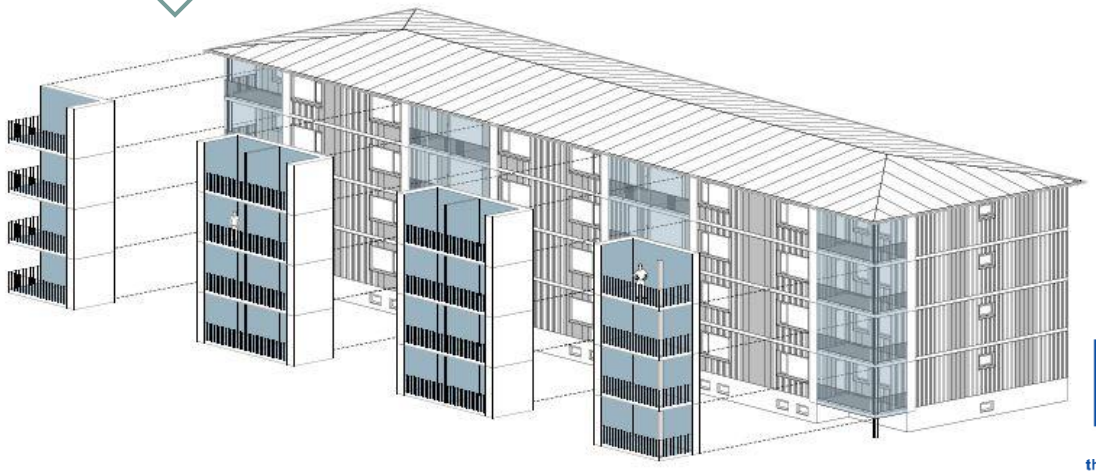


- Prefabricated roof



- Balcony modules





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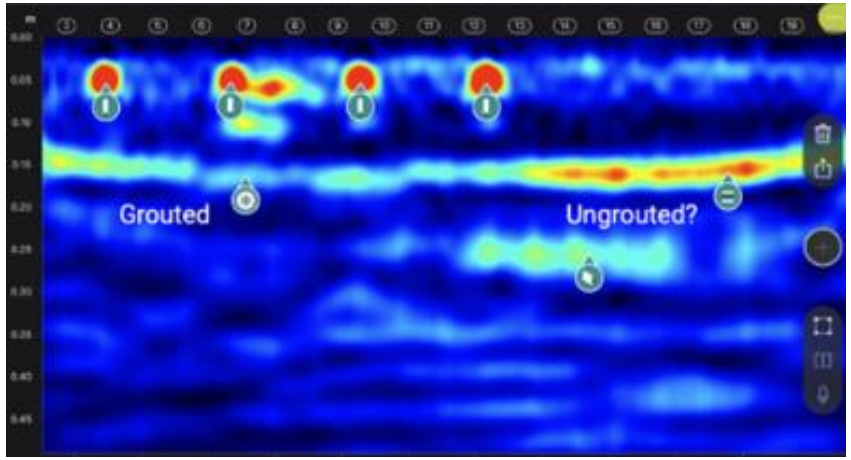
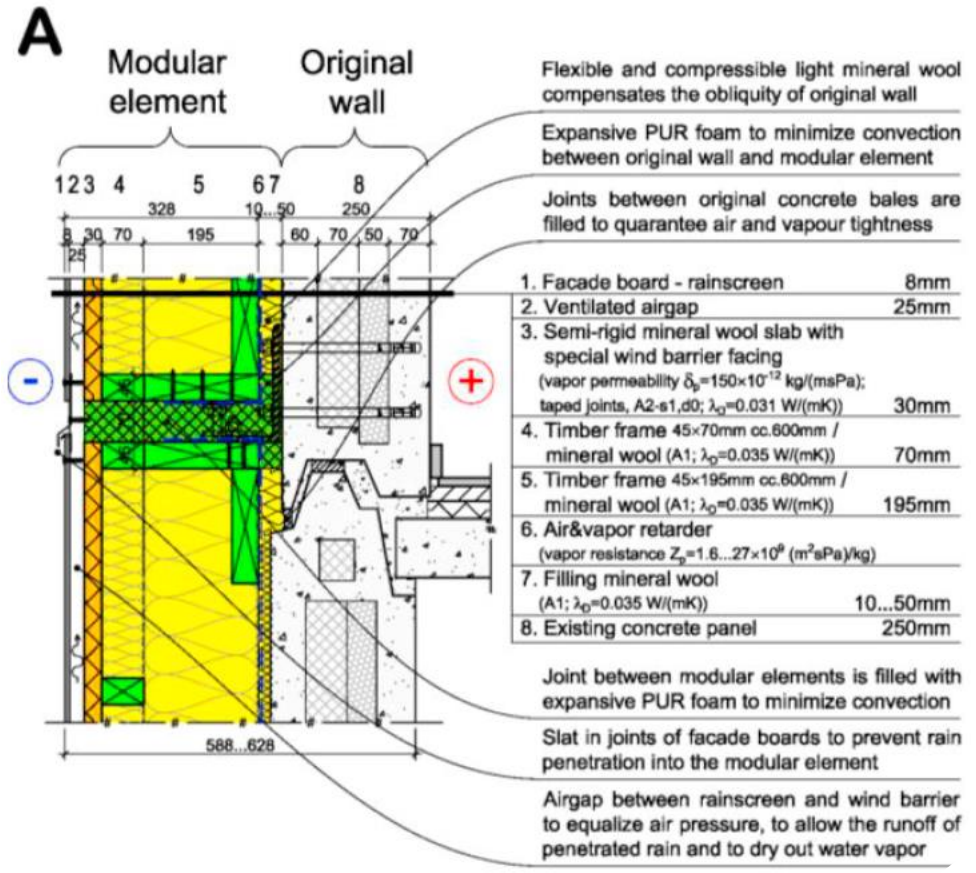
Feasibility study

- From non invasive studies (Ultrasound)
- To tailored technical details (make by construction company)





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Energy efficiency: Passivhaus Standard

GMC021-Wand EH55

Außenwand
erstellt am 18.11.2024

Wärmeschutz

U = 0,15 W/(m²K)

GEG 2020/24 Bestand*: U<0,24 W/(m²K)

sehr gut — mangelhaft

Feuchteschutz

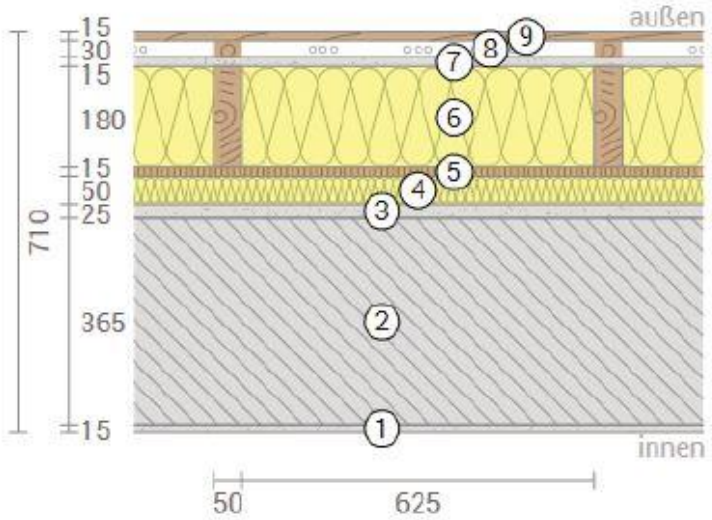
Tauwasser: 133 g/m²
Trocknet 8 Tage
Trocknungsreserve: 1405 g/m²a

sehr gut — mangelhaft

Hitzeschutz

Temperaturamplitudendämpfung: >100
Phasenverschiebung: nicht relevant
Wärmekapazität innen: 545 kJ/m²K

sehr gut — mangelhaft



1. 1.1.2 Kalk-Gips-Putzmörtel (15 mm)
2. 4.1.2 Voll-, Hochloch-, Füllziegel 1400 kg/m³ (365 mm)
3. 1.1.1 Kalk-Kalkzement-Putzmörtel (25 mm)
4. 5.1 Mineralwolle 035 (50 mm)
5. OSB-Platten (15 mm)
6. Gutex Thermofibre (180 mm)
7. Fermacell Powerpanel HD (15 mm)
8. Hinterlüftung (30 mm)
9. Profilholz (15 mm)

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Lessons learned and Challenges

Existing structure

- Reliable documentation of the existing building
- Pollutants in existing structure (not in our case)
- Load bearing structure verification

Finances

- Relatively higher costs than conventional insulation layer (Polyestirene)
- Upfront investment during prefabrication

Process (differently to standard operating procedure)

- Exhaustive planning (residents living during the renovation)
- Reinforcement during works, specially demolition
- Delimitation of responsibilities

Burocracy

- Tendering process (legal framework) > exceptions to individual contracting by craft / technical details made by construction company

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Other successful stories

You can find more examples and detailed information in the following link:

ASCEND

Practice

Learnings, challenges and site-specific solutions

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Interactive Exercise

Block structure

- INTRODUCTION PART
- THEORY PART
- Interactive Exercise

Genially Exercise

TYPE 2_Select the correct image

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https://view.genially.com/68e62589eee8e3c163931c9c/interactive-content-untitmooc-4-spotlight-1ascend

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2030 NEUTRALPATH

NEUTRALPATH project: efficient buildings for PCEDs

Cecilia Sanz-Montalvillo, CARTIF Technology Centre

Funded by
The European Union

REN+HOMES project webinar
30th October 2025

About NEUTRALPATH

25 PARTNERS

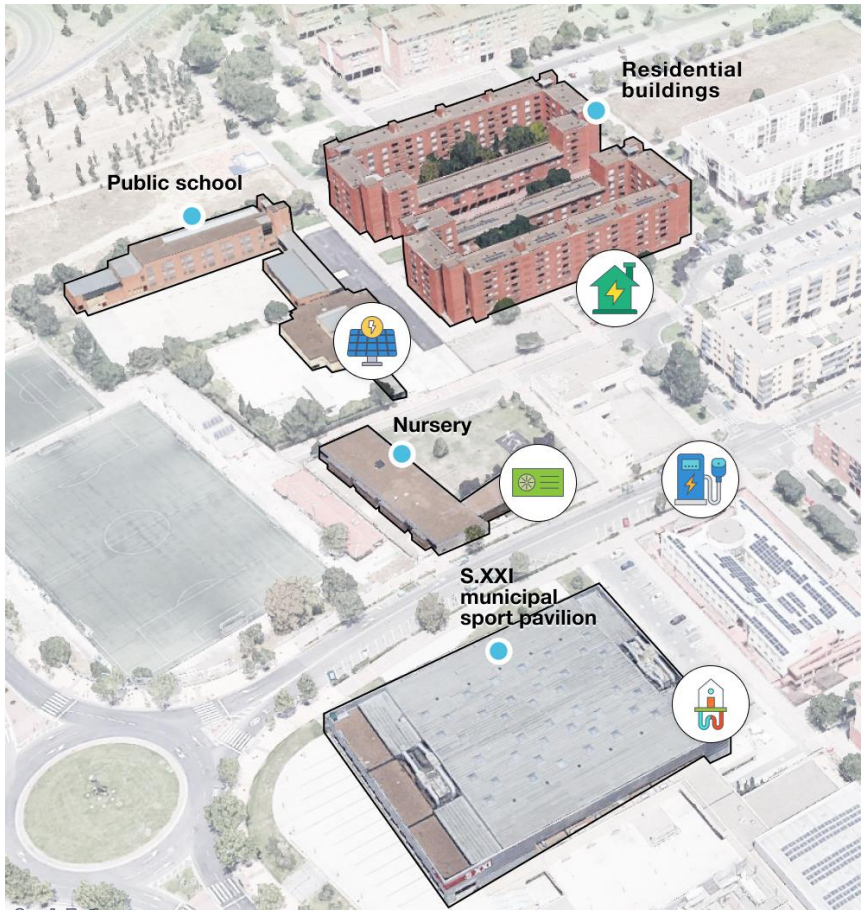
60
Months
2023-2027

7
Countries

Cecilia Sanz-Montalvillo - cecsan@cartif.es - CARTIF Technology Centre

PCED implementation in Lighthouse Cities

- ZARAGOZA



- DRESDEN

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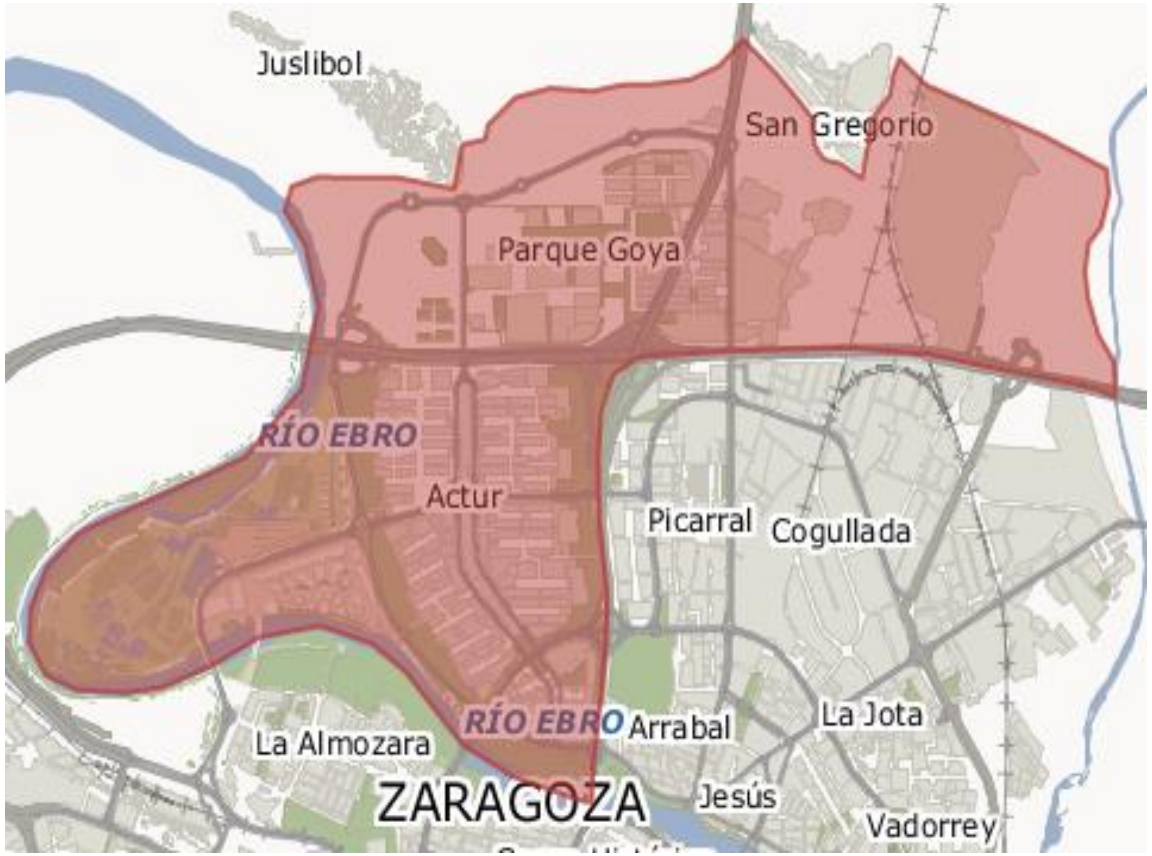
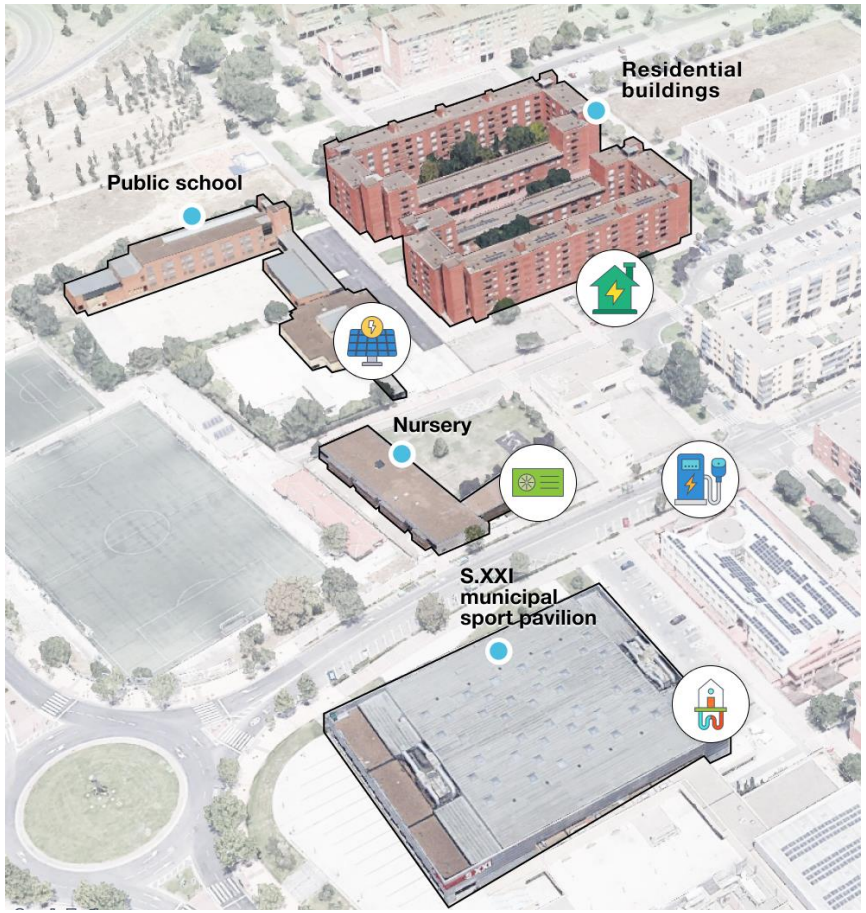
PED for Climate Neutrality

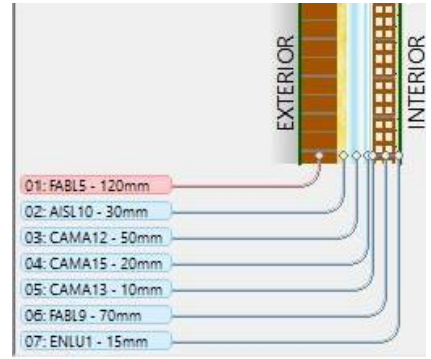
- ZARAGOZA demo PCED



Building Retrofitting for high efficiency

- **Façade** insulation with blowing granules of recycled polyurethane foam from recycled refrigerators





A2	Baseline	Refurbished	Improvement [%]
Thermal transmittance of façades U [W/m²k]	0,585	0,319	56%

The existing façade is composed of 1/2-foot masonry of exposed brick on the outside with interior cement plaster, thermal insulation of sprayed polyurethane foam, 7 cm air chamber and double hollow brick partition of 7 cm, trimmed and plastered inside the houses.

Rehabilitation of all the facades of the residential buildings to improve the insulation of the existing chambers by blowing granules of recycled polyurethane foam from recycled refrigerators. This insulation is suitable for high-capacity thermal insulation.

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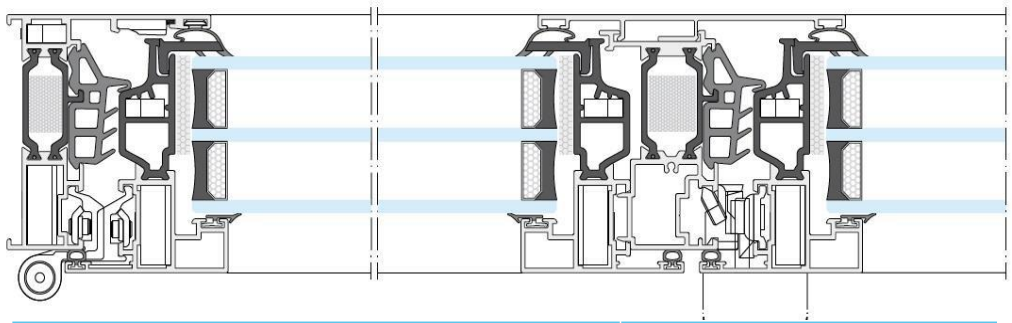
Building Retrofitting for high efficiency

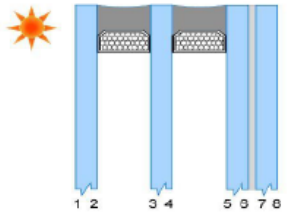
- Improvement of **window carpentry**



A3	Baseline	Refurbished	Improvement [%]
Thermal transmittance of windows U [W/m²k]	2,8	0,88	318 %

- Original windows are hinged, some with a fixed part, made of wood and double glass, with interior wooden shutters
- Improvement through a hidden profile window with great glazing capacity.

- DAG75 for window **glass**



Composición

Vidrio exterior:	MidIron de 6mm, ARIPLAK DAG-75(#2)
Cámara:	16mm, Argón
Vidrio intermedio:	MidIron de 4mm
Cámara:	16mm, Argón
Vidrio interior:	Laminado MidIron 4+MidIron 4 (1,52 PVB), ARIPLAK Super-E(#5)

A3	Baseline	Refurbished	Improvement [%]
Thermal transmittance of glass U [W/m²k]	3,3	0,6	550 %

- A high-performance coating with higher visible transmission, ideal for residential applications has been developed
- The new windowpane will also include “warm edge” technology, using special glass spacers to achieve a low linear thermal bridge between the glass and the window frame.

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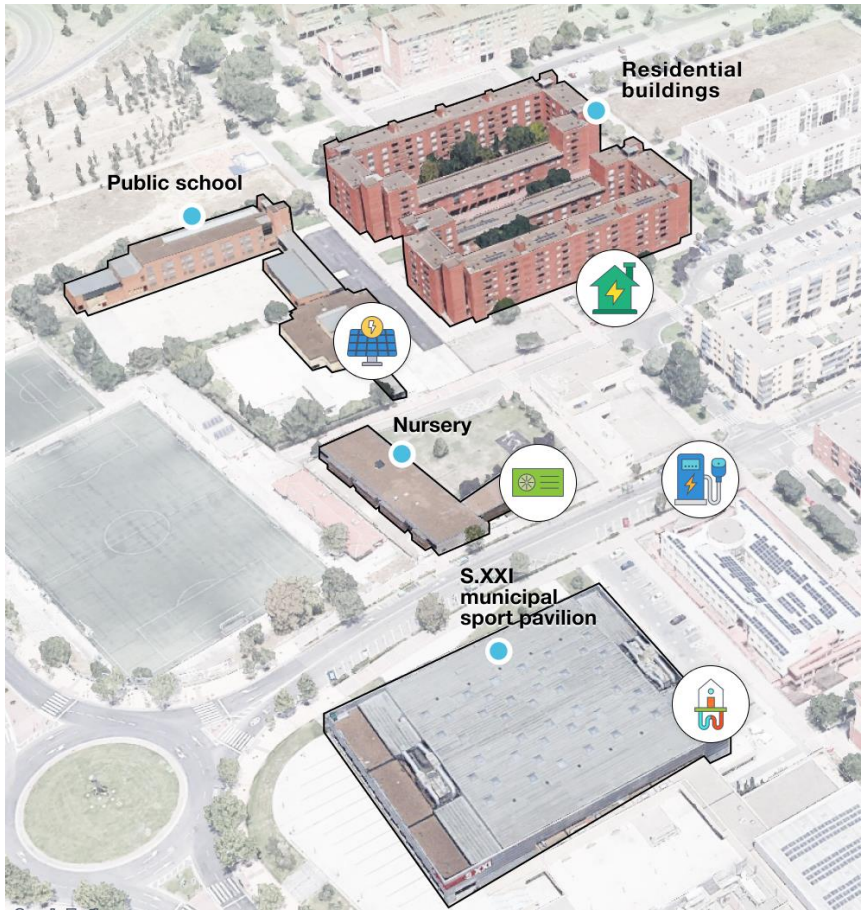
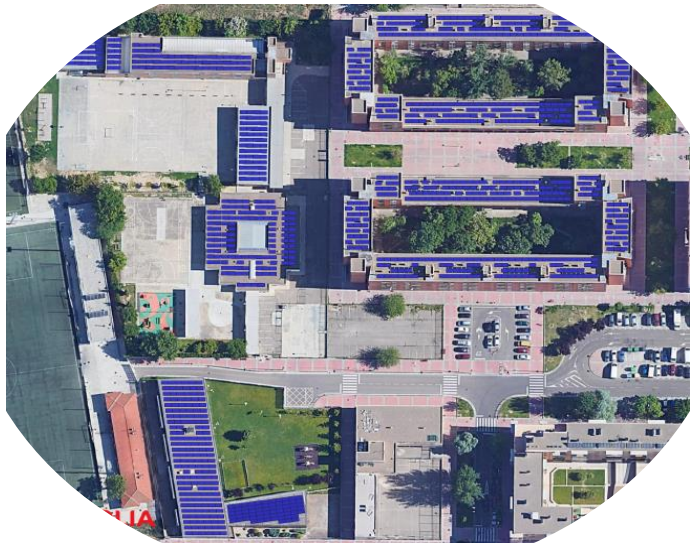
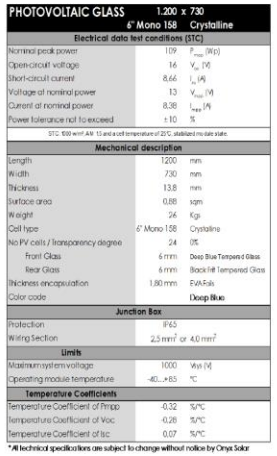
Energy solution for our PCED

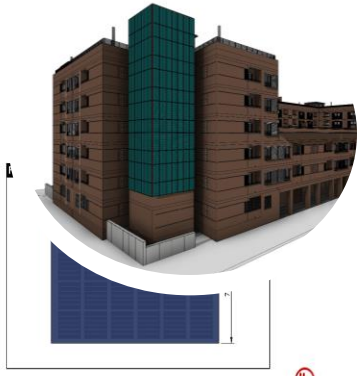
- Geothermal ring + Water to water heat pumps for **heating electrification**

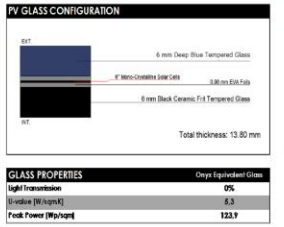




Low temperature (LowEx) geothermal ring that circulates water from a nearby existing well to provide a stable source of heat (15ºC approx.) for six water-to- water heat pumps that will be installed in the buildings that are part of the district.







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Thank you!

2030 NEUTRALPATH

Interactive Exercise

Block structure

- INTRODUCTION PART
- THEORY PART
- Interactive Exercise

Genially Exercise

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https://view.genially.com/68e62281eee8e3c1639094e0/interactive-content-mooc-4-spotlight-1neutralpath

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Ana Belén Gómez

NetZeroCities Help Desk

- anamin@cartif.es (PASSIVE STRATEGIES)
- jonvie@cartif.es (ASCEND)
- anaqui@cartif.es (ASCEND)
- cecsan@cartif.es (NEUTRALPATH)

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