

District Level Solutions From modelling to 100 buildings monitoring How to tackle energy poverty

Ilektra Mancini

Architect

Certified Passive House Designer

Dimitris Pallantzas

Building Physicist

PhD Candidate,
Mechanical Engineering NTUA,
Head of Education at HPHI

**28TH INTERNATIONAL PASSIVE
HOUSE CONFERENCE 2026**



DTERBIM



HELLENIC
PASSIVE HOUSE
INSTITUTE



Our approach:

- **Part A: Theoretical investigation**
- **Part B: Field research & monitoring**

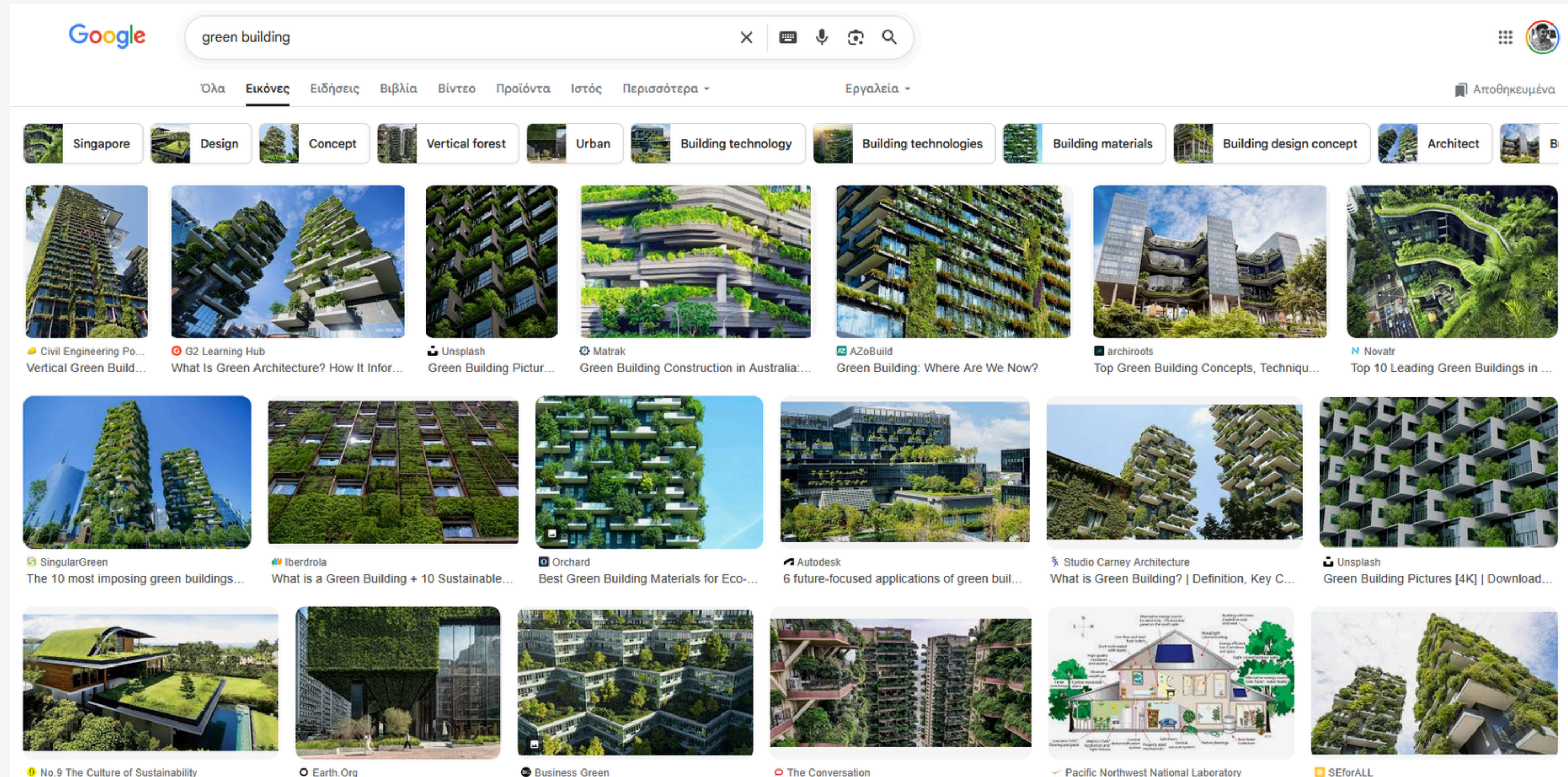


A1. Foundational Questions/Data



What is a 'green' building?

Do we need a **gardener** or an engineer?



What is nZEB?



28TH INTERNATIONAL PASSIVE
HOUSE CONFERENCE 2026

Data Analysis GR

Existing building stock ~ **6.500.000** dwellings

Subsidy programmes 2013-2026 ~ 2.000.000.000€ ~
100.000 dwellings → **1,5% of the building stock** →
0,3% is considered "deep renovation"

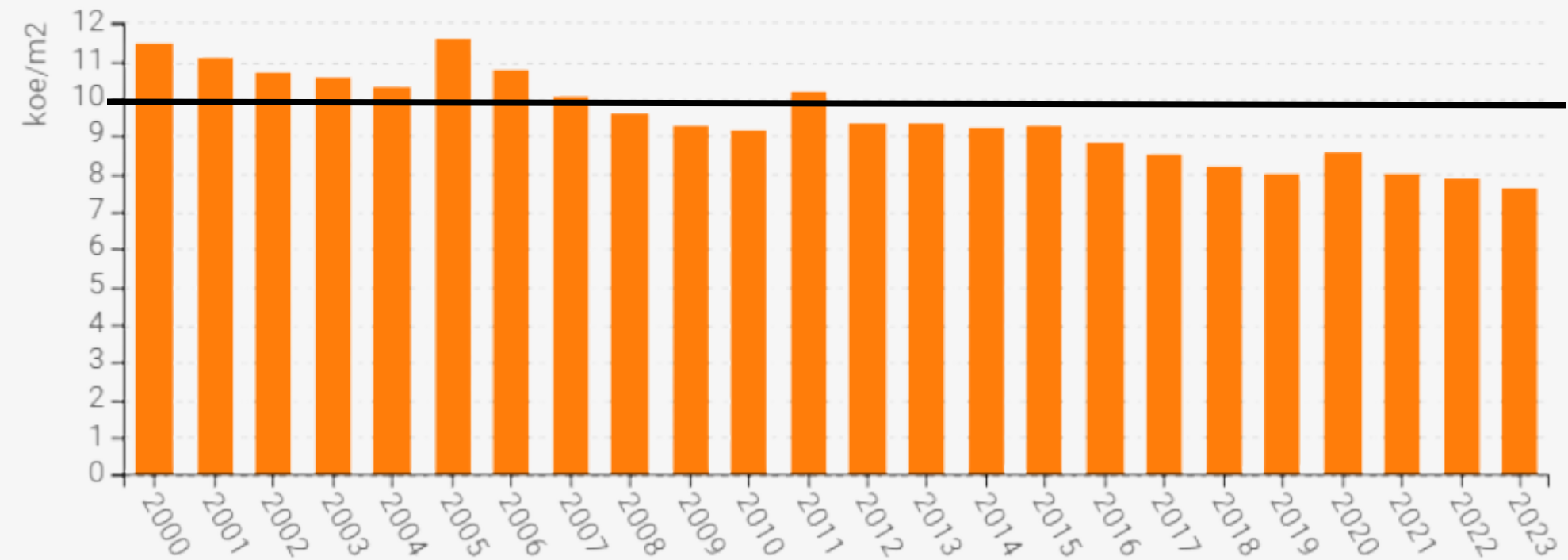
Renovation budget ~ 250€/m² → **300€/m²**
reached PH 

Multifamily houses in Athens → 120.000 to 140.000
Subsidised in the programm of 2021 → **less than 100**
Multiownership & airbnb issues

RESULT → 2 billion Euro for votes, not buildings

SWEDEN

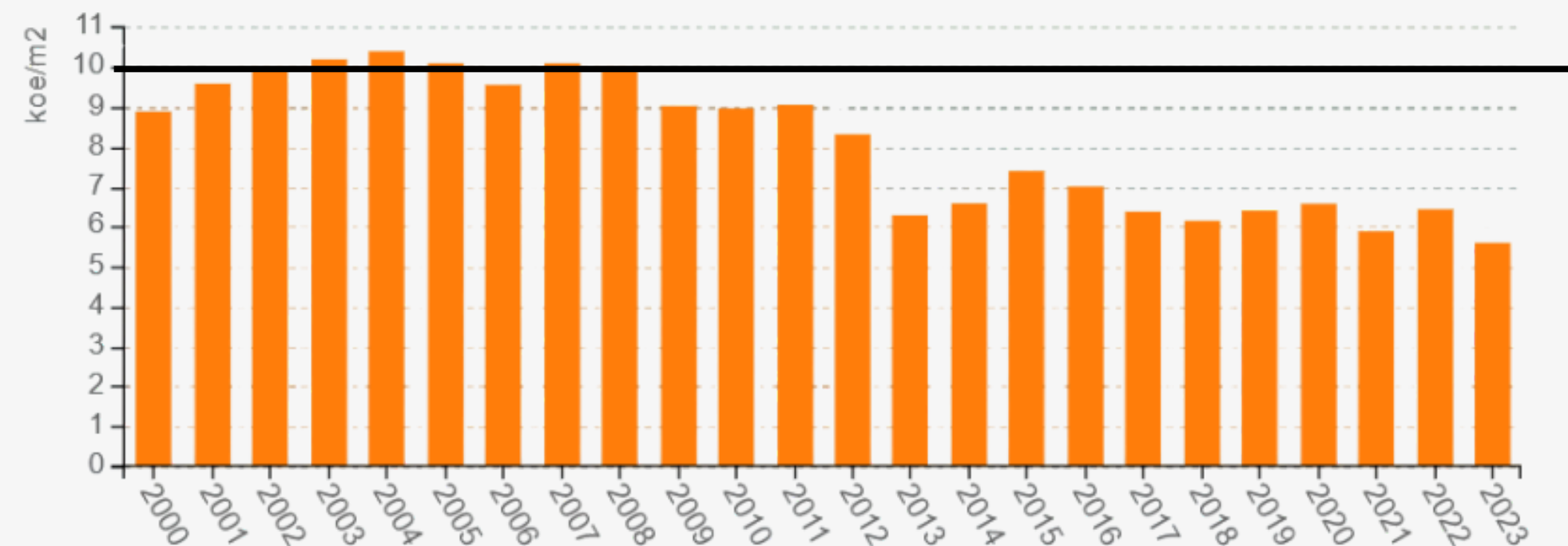
Figure 8: Energy consumption of household space heating per m² (with climatic corrections)



GREECE

HDD SE 5.31 > HDD GR

Figure 8: Energy consumption of household space heating per m² (with climatic corrections)



A2. City of Athens as a pilot

District Modeling:

2.1 Energy covered by PV

2.2 Energy Analysis

2.3 Comfort Dynamic Analysis

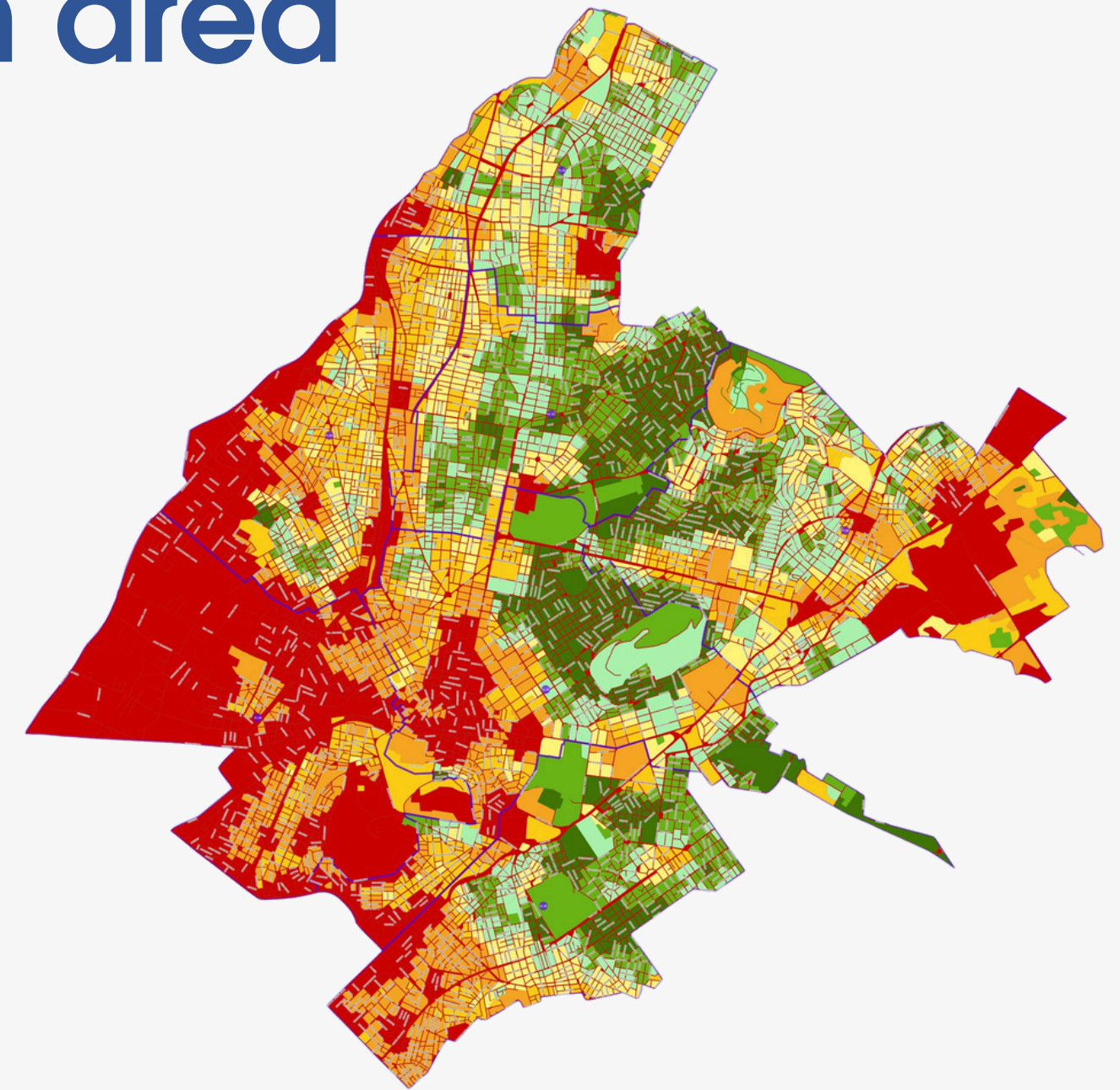


The pilot: Athens metropolitan area

- **427.825 dwellings** (~6.5 million in Greece)
- 342.107 **(80%) built before 1980** - Totally uninsulated
- Avg Energy **Demand** ~ **300kWh/m²a** (20°C-25°C baseline)
- Avg Energy **Consumption** ~ **112kWh/m²a** → **Energy Poverty**
- **~700.000 inhabitants**
- ~5.000.000 inhabitants in the whole Attiki Area



Image credit: Yiorgis Yerolymbos

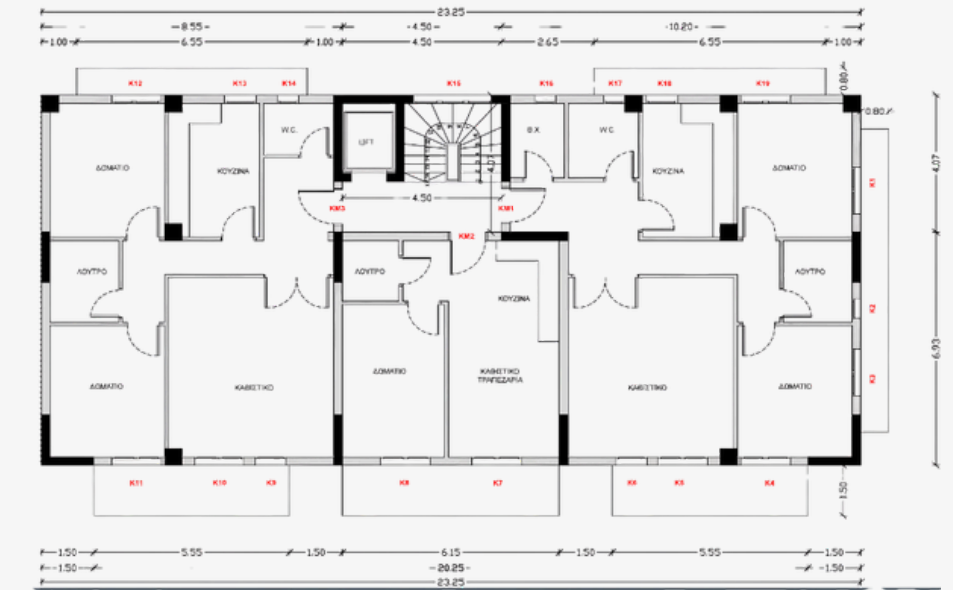


Summer Temperature in Athens -
Green **35°C**, Red **45°C**

2.1 Energy coverage by PV - Methodology

Can PV panels cover the energy heating and cooling demand of Multi-family buildings?

- **PHPP calculations** with Variants
- Net-Metering **all electric**
- **3- to 6-storey buildings** in Athens and Thessaloniki (northern Greece)
- 6 Cases for energy
 - a. 1980 (65% of Greek Buildings): Uninsulated
 - b. 1981-2011 (25%): 3cm insulation
 - c. 2011-2021 (7%): National Energy Legislation
 - d. nZEB: A class buildings
 - e. A+ buildings: 10% construction m2 bonus
 - f. Passivhaus

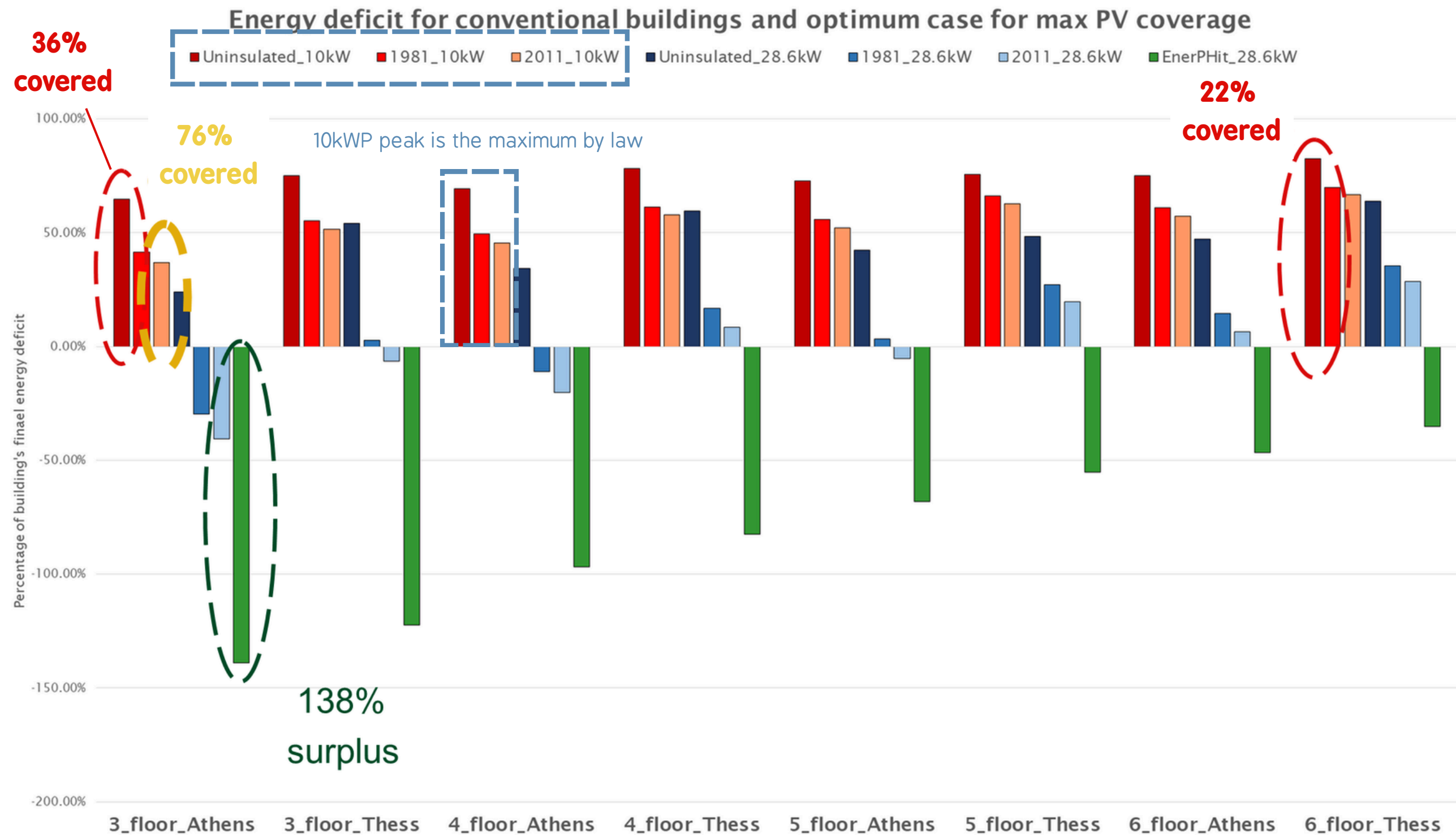


Typical floorplan for multifamily houses in Athens,
3 apartments per floor



Data from Tabula webtool

2.1 10kWp (max by law) & 28.6 kWp PV installation



- 65% of the buildings cannot cover the energy demand with 100% PV coverage
- Only PH can be 100% autonomous



PV and electrification alone
will not save us!

2.2 City of Athens - Methodology

Energy performance level

Main categories:

- Geometry → 8 variants
- Energy → 3 variants

Avg sqm per building = 692 sqm

Cross check via google maps:

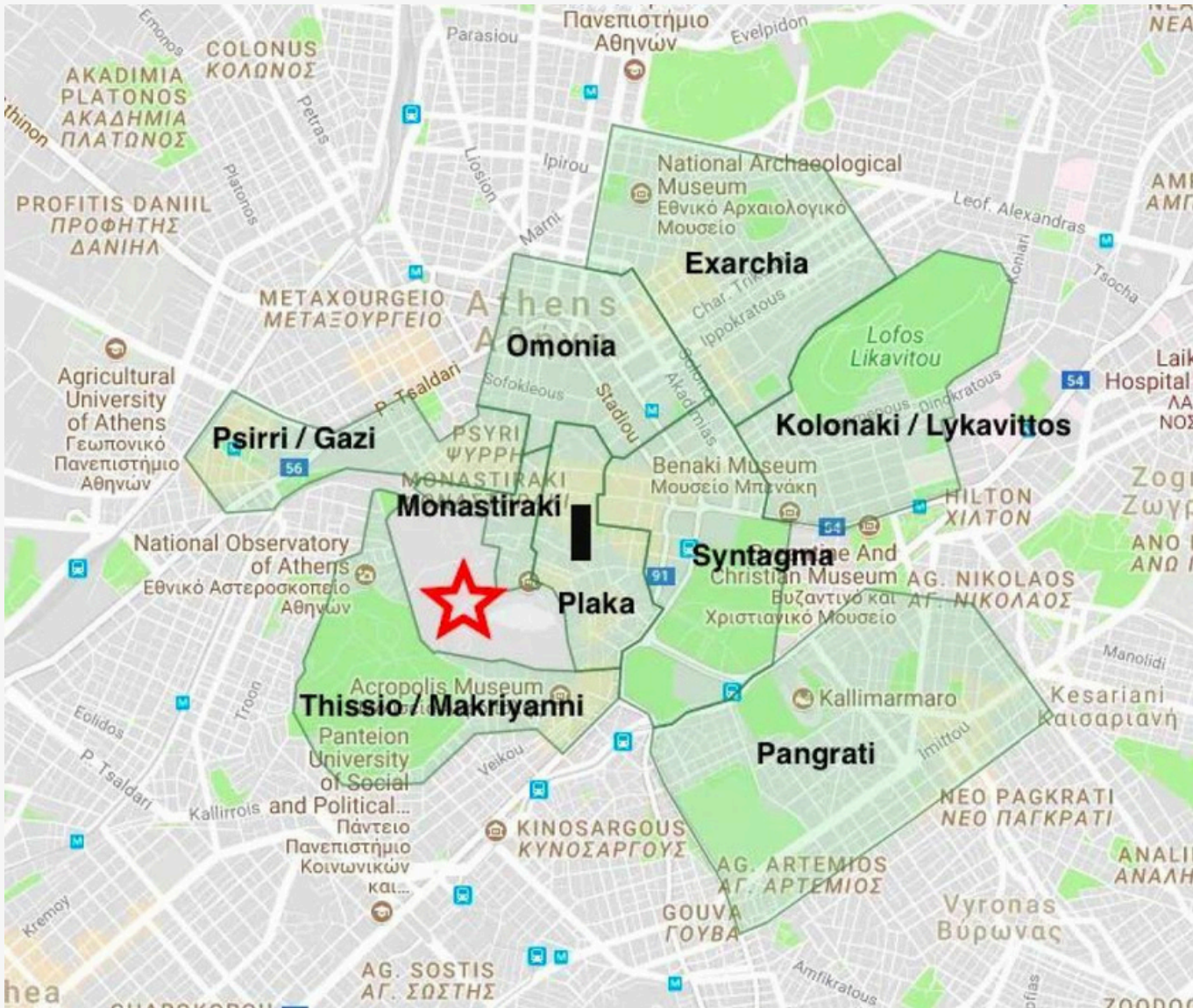
- Total Buildings of the sample = 1.226 (973 MFH, 253 SFH)
- Categorization by geometry and energy (24)
- Each Category → 62% before '80, 20% after '80, 18% after '00

Geometry	Pilotis	Without
2 sides to ambient	32.301 du	231.279 du
3 sides to ambient	19.381 du	112.840 du
All sides to ambient	3.876 du	19.381 du
Single Family	242 buildings	8.524 buildings



Energy	Insulation	Windows	Quantity
Built before 1980	No	Single glazing	259.153 du
Built after 1980	3 cm	Double glazing	87.311 du
Built after 2000 & Renovation	3-5 cm + roof	Double glazing	81.361 du

2.2 City of Athens - DistrictPH results for 30m sqm



Useful energy demand of the whole district

	Treated floor area	30340758 m ²	
	Persons	717941	
Building	Heating demand	1449342 MWh/a	48 kWh/(m ² a)
Building	DHW demand	448636 MWh/a	15 kWh/(m ² a)
Building	Cooling demand	0 MWh/a	0 kWh/(m ² a)
Building	other electricity demand	910223 MWh/a	30 kWh/(m ² a)
Building	Auxiliary electricity demand	74041 MWh/a	2 kWh/(m ² a)
	other electricity applications	143588 MWh/a	

Boundary Conditions:

- Winter: 12.6°C
- Summer: 29.5°C

Two different cases will be examined in detail:

- Kypseli Area
- Moschato-Tavros → Passivistas: The Tavros Project

ion	Usage type	Explanation	Photo	Year from	Year to	TFA m ²	No. of storeys	No
+1960-1980	SFH	Example build. 03.GEN.I		1960	1980	110.5	2	
+1981-2000	SFH	Example build. 03.GEN.I		1981	2000	110.5	2	
+2001-2023	SFH	Example EGR.ZoneD		2001	2023	110.5	2	
+1960-1980	MFH	Example EGR.ZoneA		1960	1980	947.75	4	
+1981-2000	MFH	Example EGR.ZoneA		1981	2000	947.75	4	
+2001-2023	MFH	Example EGR.ZoneA		2001	2023	947.75	4	
+1960-1980	SFH	Example EGR.ZoneD		1960	1980	180.2	2	
+1960-1980	SFH	Example EGR.ZoneD		1960	1980	180.2	2	
+1981-2000	MFH	Two-stor HU.N. MFH		1981	2000	341	2	
+2001-2023	MFH	Two-stor HU.N. MFH		2001	2023	341	2	
+1981-2000	MFH	Two-stor HU.N. MFH		1981	2000	341	2	
+2001-2023	MFH	Two-stor HU.N. MFH		2001	2023	341	2	
+1960-1980	SFH	Example EGR.ZoneC		1960	1980	179.35	3	
+1981-2000	SFH	Example EGR.ZoneC		1981	2000	179.35	3	
+2001-2023	SFH	Example EGR.ZoneC		2001	2023	179.35	3	
+1960-1980	SFH	Example EGR.ZoneC		1960	1980	179.35	3	
+1981-2000	SFH	Example EGR.ZoneC		1981	2000	179.35	3	
+2001-2023	SFH	Example EGR.ZoneC		2001	2023	179.35	3	

2.2 Kypseli neighborhood: From initial to PH

- 18 Buildings in Total
- 14 Buildings uninsulated
- 4 Buildings with 3cm XPS

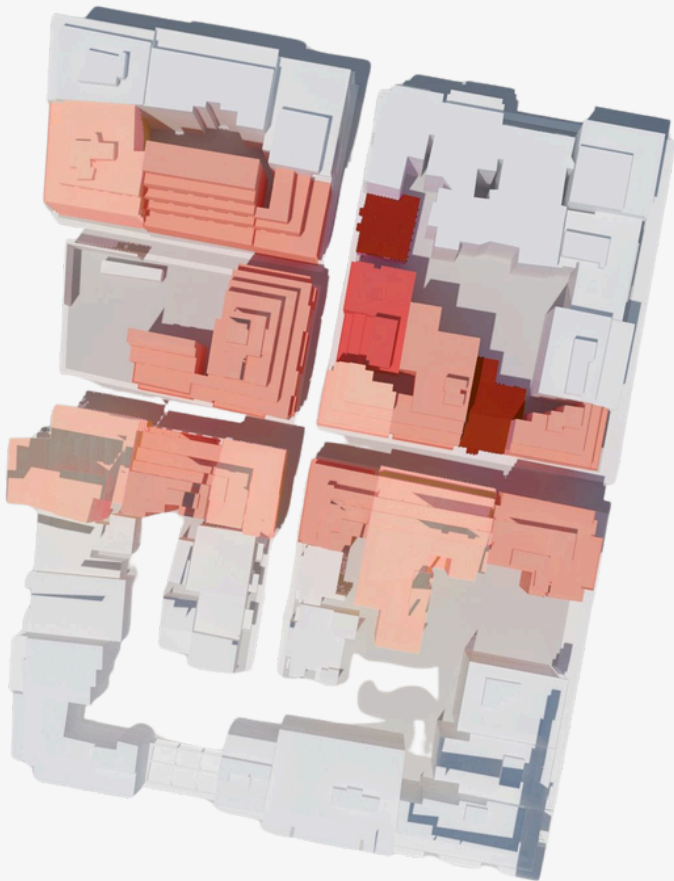
Why this area is easier to be renovated:

- Terraced Buildings → less areas towards ambient
- Very good A/V ratio

Result overview				
Useful energy demand of the whole district				
Treated floor area		17977	m²	
Persons		462		
Building	Heating demand	1207	MWh/a	67 kWh/(m²a)
Building	DHW demand	284	MWh/a	16 kWh/(m²a)
Building	Cooling demand	533	MWh/a	30 kWh/(m²a)
Building	other electricity demand	539	MWh/a	30 kWh/(m²a)
Building	Auxiliary electricity demand	79	MWh/a	4 kWh/(m²a)
other electricity applications		122	MWh/a	

Result overview				
Useful energy demand of the whole district				
Treated floor area		17977	m²	
Persons		462		
Building	Heating demand	170	MWh/a	9 kWh/(m²a)
Building	DHW demand	284	MWh/a	16 kWh/(m²a)
Building	Cooling demand	253	MWh/a	14 kWh/(m²a)
Building	other electricity demand	539	MWh/a	30 kWh/(m²a)
Building	Auxiliary electricity demand	85	MWh/a	5 kWh/(m²a)
other electricity applications		122	MWh/a	

District Condition	Category	Setpoint room temperature for the heating period [°C]	Setpoint room temperature for the cooling period [°C]
Existing condition	III	17.1	28.1
Refurbished	II	20	25



2.2 Kypseli neighborhood: Scenarios until 2040

All buildings renovated following national standards for renovation according to the subsidy program → **30% heating demand reduction**

Result overview

Useful energy demand of the whole district

		Treated floor area	17977	m²		
		Persons	462			
Building	Heating demand		841	MWh/a	per m² treated floor area	47 kWh/(m²a)
Building	DHW demand		284	MWh/a		16 kWh/(m²a)
Building	Cooling demand		441	MWh/a		25 kWh/(m²a)
Building	other electricity demand		539	MWh/a		30 kWh/(m²a)
Building	Auxiliary electricity demand		98	MWh/a		5 kWh/(m²a)
	other electricity applications		122	MWh/a		

9 /18 buildings renovated as **EnerPHit** → **30% heating demand reduction**

Result overview

Useful energy demand of the whole district

		Treated floor area	17977	m²		
		Persons	462			
Building	Heating demand		878	MWh/a	per m² treated floor area	49 kWh/(m²a)
Building	DHW demand		284	MWh/a		16 kWh/(m²a)
Building	Cooling demand		478	MWh/a		27 kWh/(m²a)
Building	other electricity demand		539	MWh/a		30 kWh/(m²a)
Building	Auxiliary electricity demand		101	MWh/a		6 kWh/(m²a)
	other electricity applications		122	MWh/a		

Conclusions

- **Energy demand reduction** is the **same** for both cases 9 /18 buildings cost less than 18 /18 (scaffold, workers, etc)
- With national standards we **compromise** thermal comfort (i.e. mould issues)

Creating good examples raise the level of **awareness** and **trust**

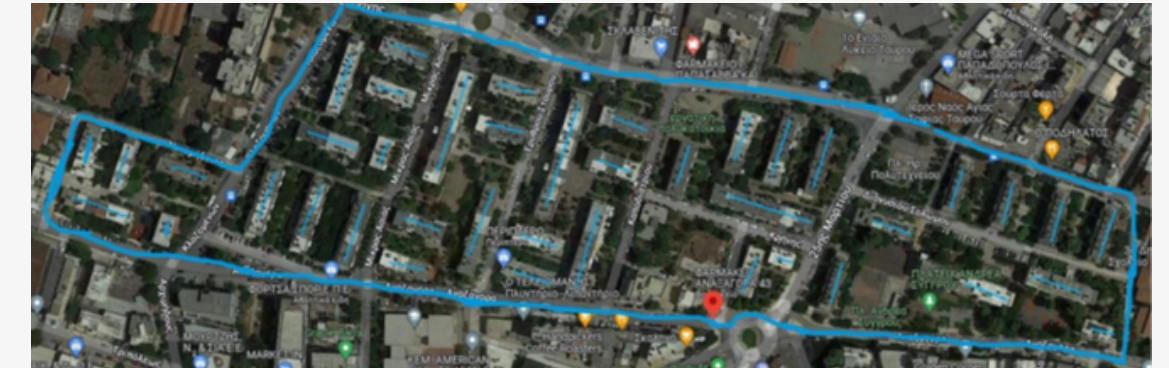
Every renovation which is **not targeting Passivhaus** is another **wasted opportunity**

2.2 Tavros Area - Passivistas Project

80 identical refugee social housing buildings - 8 flats in 4 storeys → **640m²**

- Heating demand before renovation: **178 kWh/m²a**
- Cooling demand before renovation: **59 kWh/m²a**
- After renovation: **Passivhaus Premium** covering also mobility
- Renovation cost ~ **200,000€**
- Yearly Energy Cost ~ **16,000€**
- Return of investment ~ **8 years**

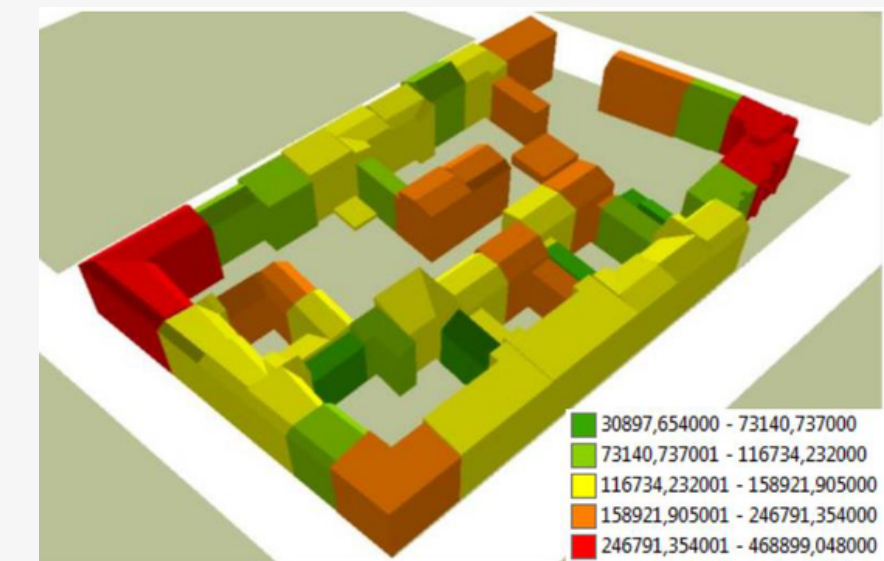
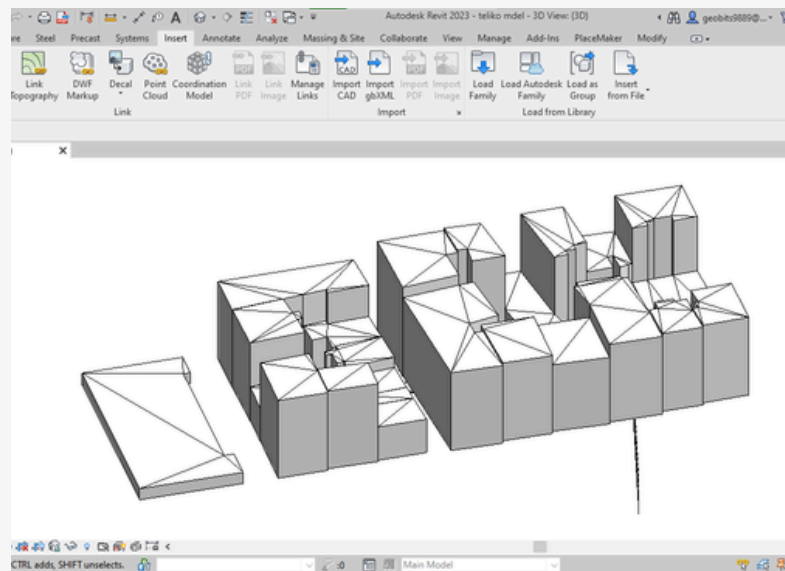
Energy Services Company Contract for x years → **Passivhaus** is the only methodology which delivers what it promises



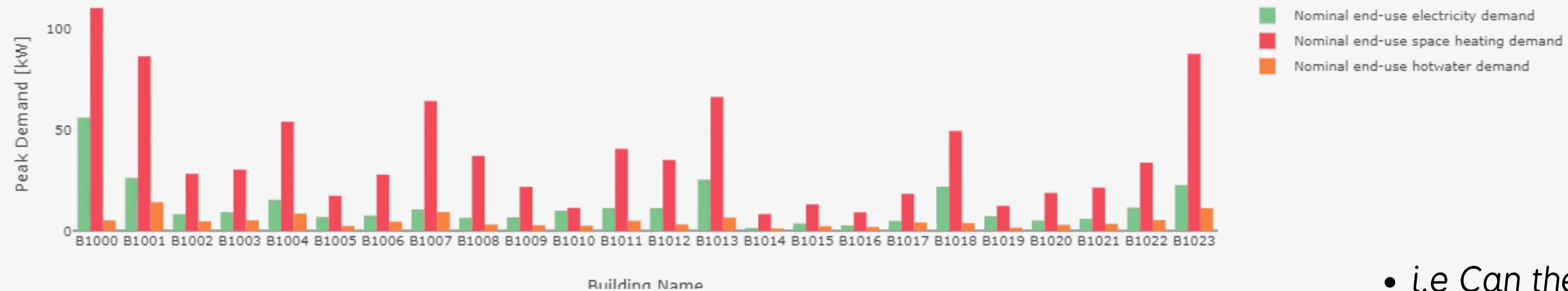
2.3 Districts Dynamic Simulation - Methodology



City Energy Analyst

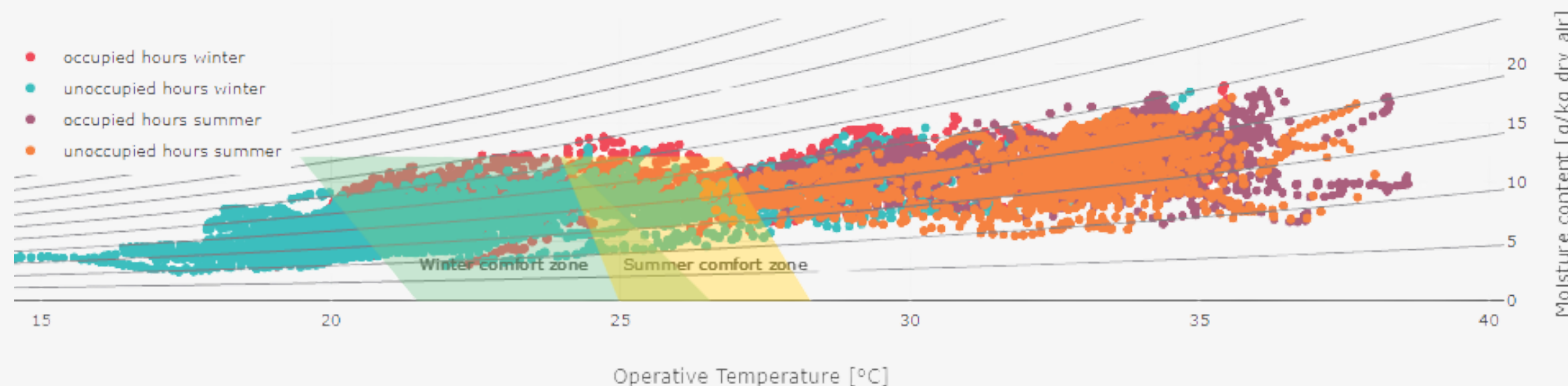


2.3 Results lead to Policy Strategies



Peak Demand for the Area

- i.e Can the peak demand be covered from grid if all buildings are fully **electrified**?
- i.e How do you **prioritize** district renovation?



Thermal Comfort of the Area → Modelling energy poverty

The only true
wisdom is in
knowing you
know nothing

Socrates



28th INTERNATIONAL PASSIVE
HOUSE CONFERENCE 2026

B. Field research

B1. Summer 2024 - “Identifying energy poverty challenges through energy audits in low income homes”

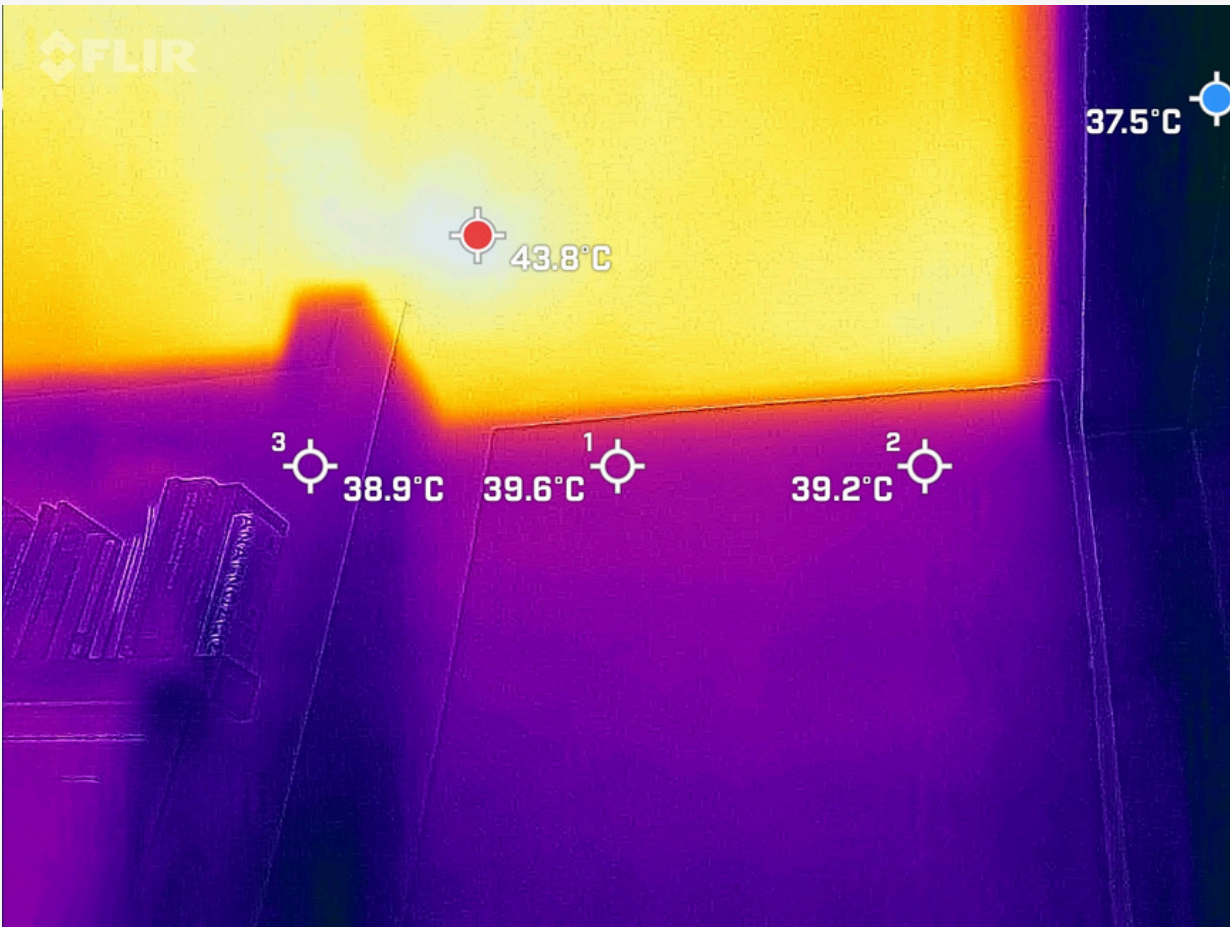
in collaboration with the City of Athens & C40 Cities



B1. Summer Energy poverty 2024

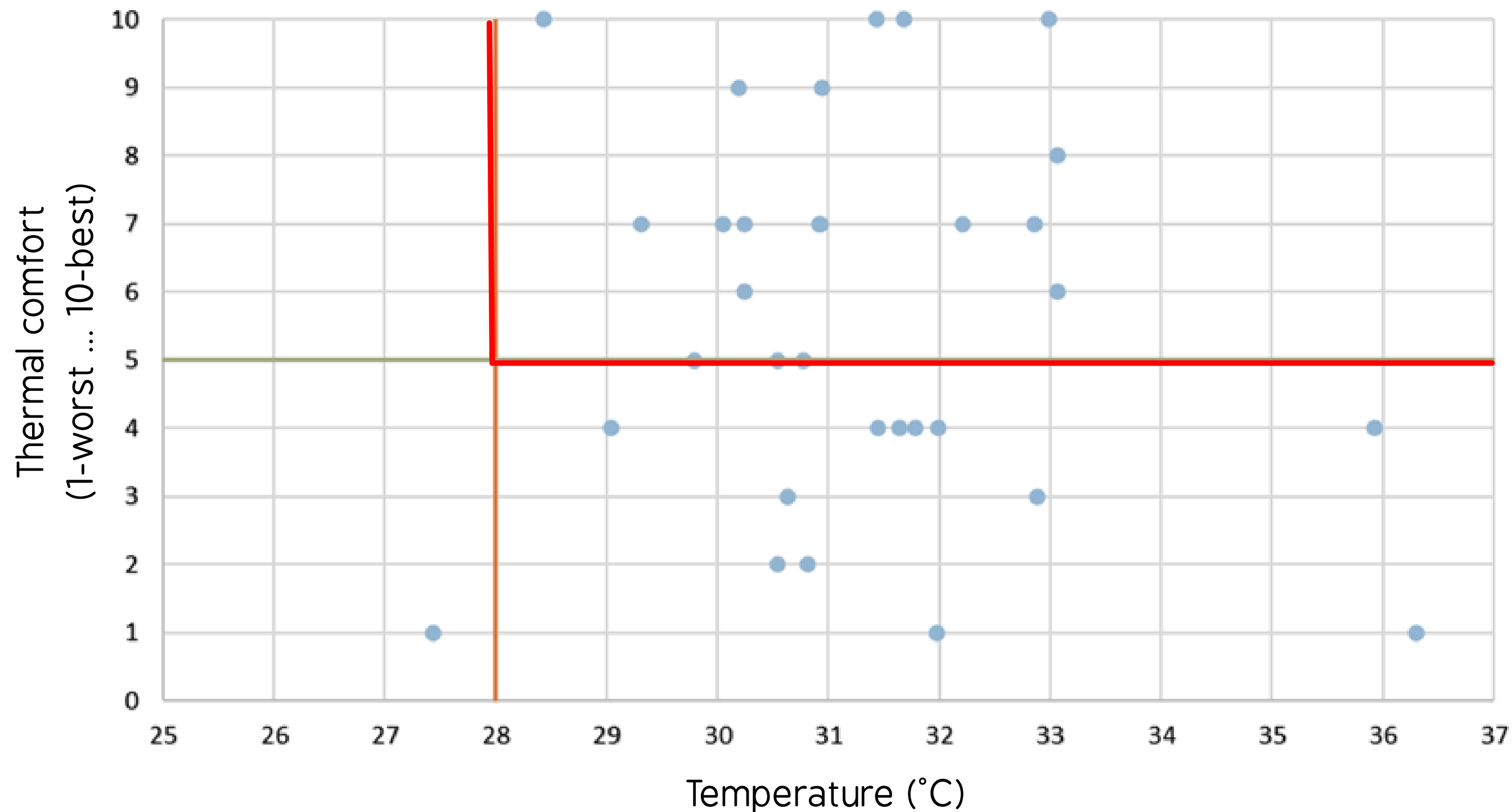
Athens (49 households)

- 49 Energy on-site audits visits
- Monitor indoor temperature, relative humidity, and CO₂ concentrations (T, rH%, CO₂)
- Surveys about occupants' perceived comfort, adaptive behaviours, and constraints
- Infrared thermography
- Data analysis (classification, energy modeling etc.)
- Combinagion of tailored suggestions for immediate interventions and EnerPHit



Insulation	Windows	HVAC systems
80% uninsulated 73% uninsulated roof	65% Double-glazed 33% Single-glazed 2% Triple-glazed	Heating: Radiators (24%) & natural gas (22%) Cooling: Air condition DHW: Solar (51%) or electrical (38%) water heater

B1.Adaptive thermal comfort



What do the users believe?

56% of participants reported a thermal comfort level above 5 (scale 1 - 10) even when indoor temperatures exceeded 28°C.

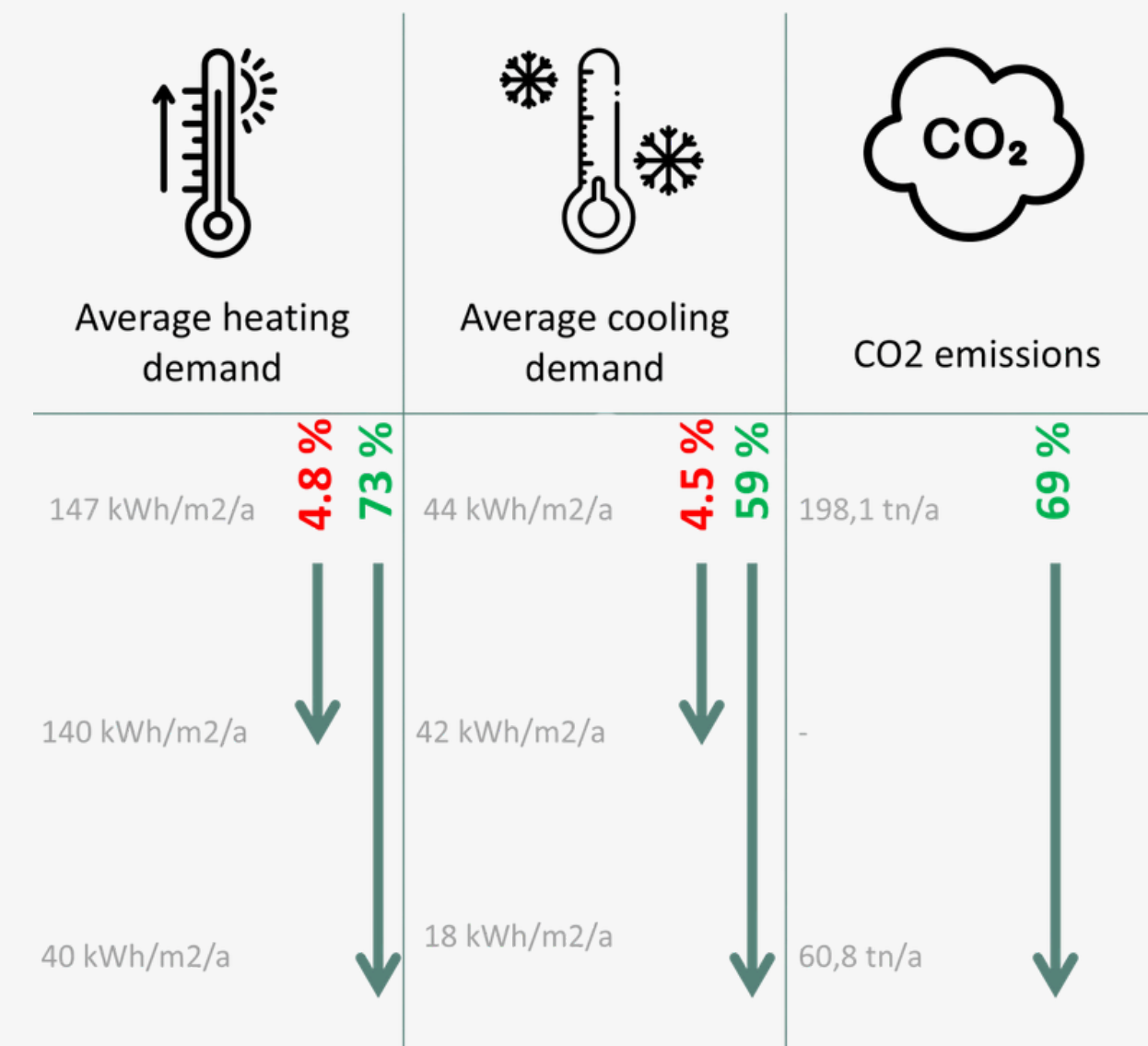
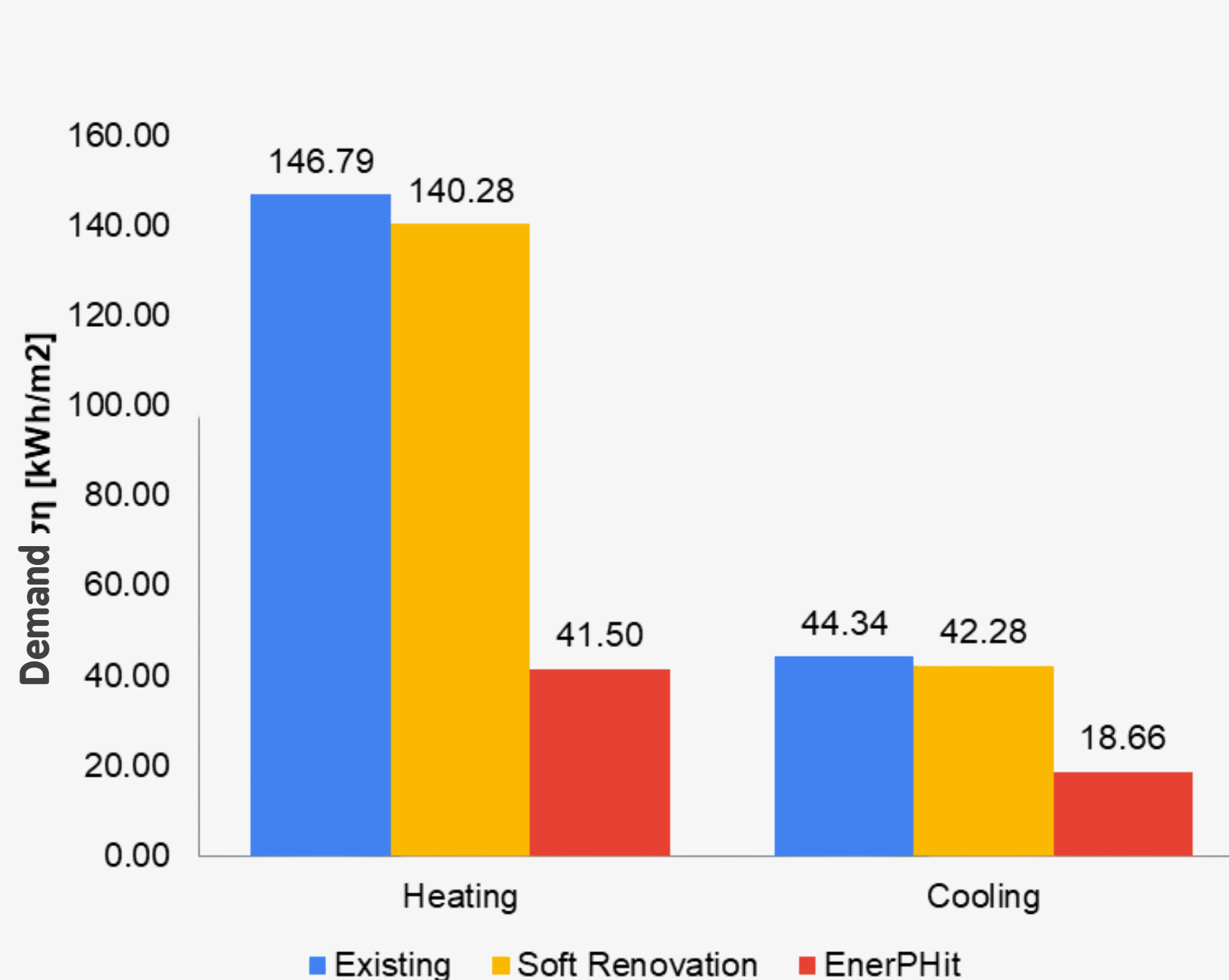
strong adaptation to elevated temperatures

B1.PHPP Energy simulation results

Quantitative results

Soft measures can only improve comfort **temporarily**

Impact of immediate measures VS EnerPHit renovation approach





B. Field research

B2. Summer 2025 - Report on Field Research into Summer Energy Poverty in Greece (July–August 2025)

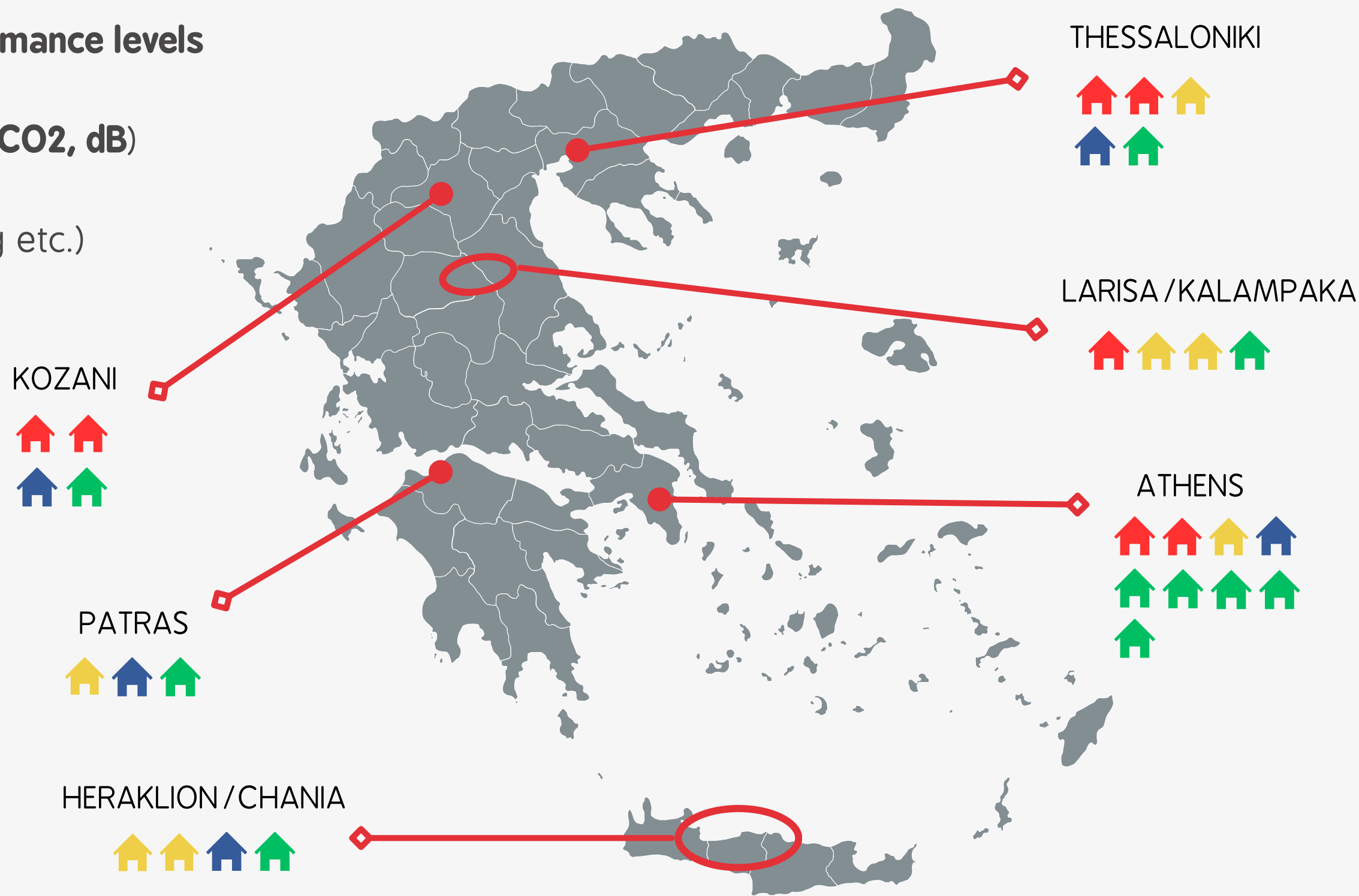
in collaboration with Greenpeace Greece



B2. How sustainable are our homes during the summer period in Greece?

- **6 Cities:** Thessaloniki, Kozani, Larisa-Kalampaka, Patra, Athens, Crete
- **29 households - with different energy performance levels**
- Measurement of interior conditions (**T, rH%, CO2, dB**)
- **Data analysis** (classification, energy modeling etc.)
- **Thermal Comfort Questionnaires**

Energy performance level		
	Uninsulated	7
	Lightly renovated	7
	Strongly renovated	5
	Passive House	10



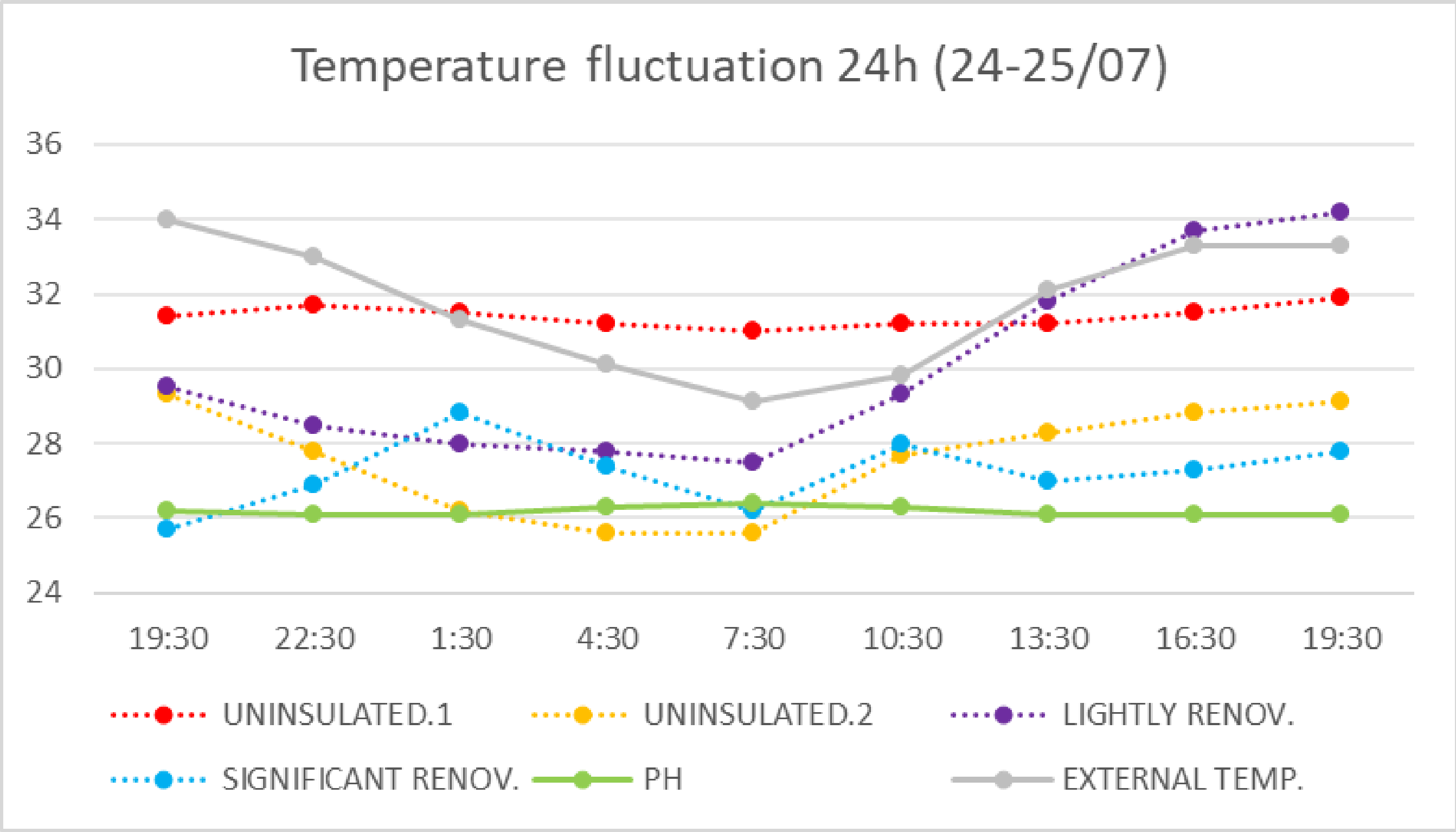
B2.Quantitative results

Partial renovations **are not enough** to fully address **indoor thermal comfort**

Comparison indoor conditions across different building types and Climatic zones

Energy stauts	Temperature (°C)	Deviation from the limit 25°C (°C)	Noise (dB) (limit < 40dB)
Uninsulated	26,3 - 33,2	+1,3 - 8,2	36- 47
Lightly renovated	27,4 - 30,7	+2,4 - 5,7	38- 49
Significant Renovated	28,4 - 29,2	+3,4 - 4,2	37- 44
Passive House	25,2 - 27,2	+0,2 - 2,2	33- 41

B2.Quantitative results



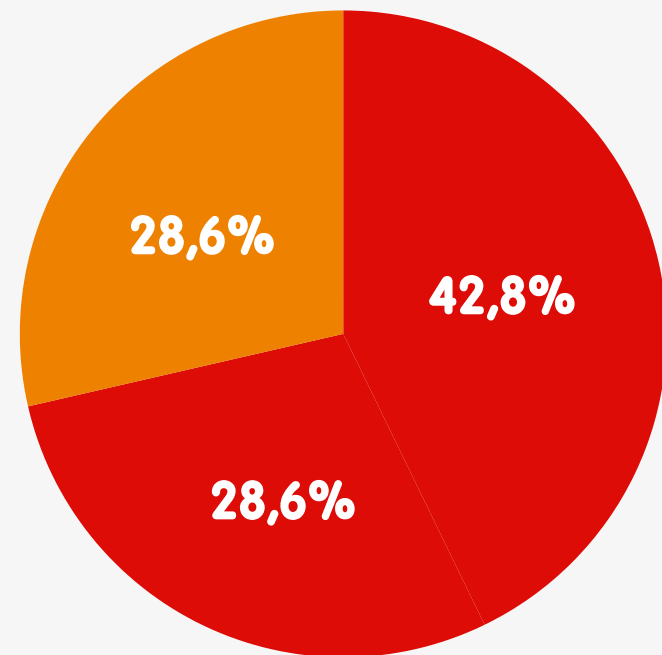
Lightly and significantly renovated
 Rapid reheating post-cooling

Passive House
 stable temperature

B2.Thermal comfort questionnaires

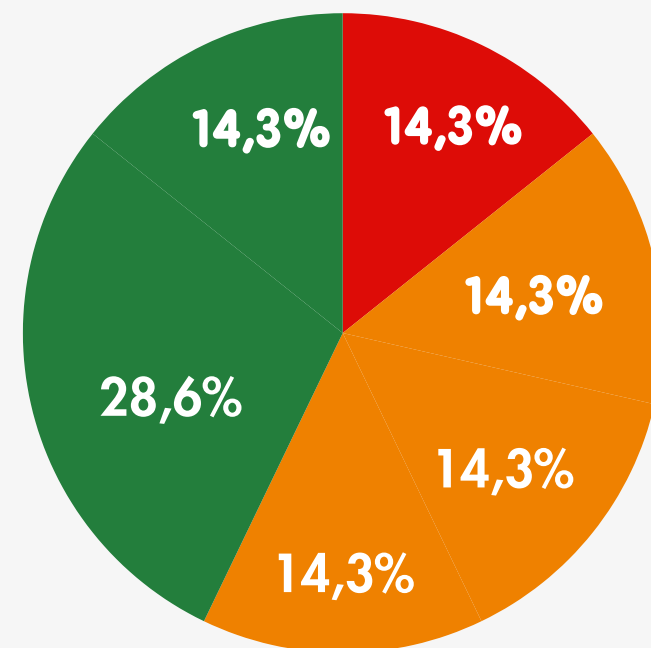
How satisfied are you with the indoor thermal comfort?

No Insulation



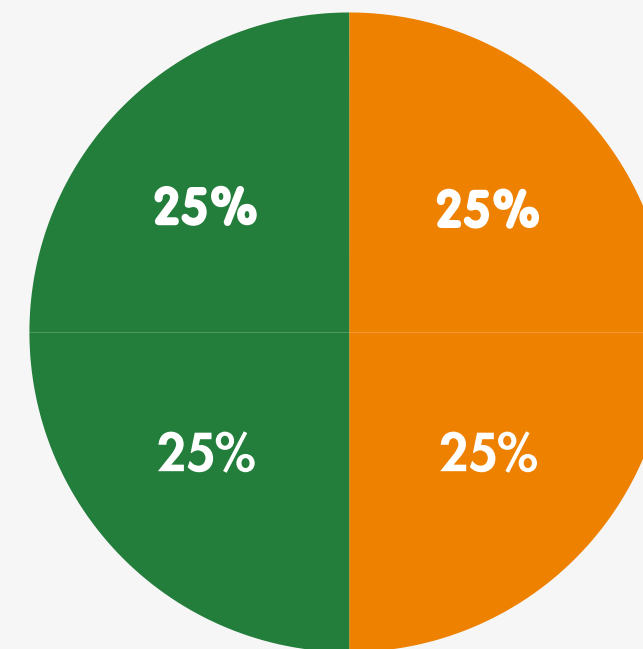
3
4
7

Minor Energy Upgrade



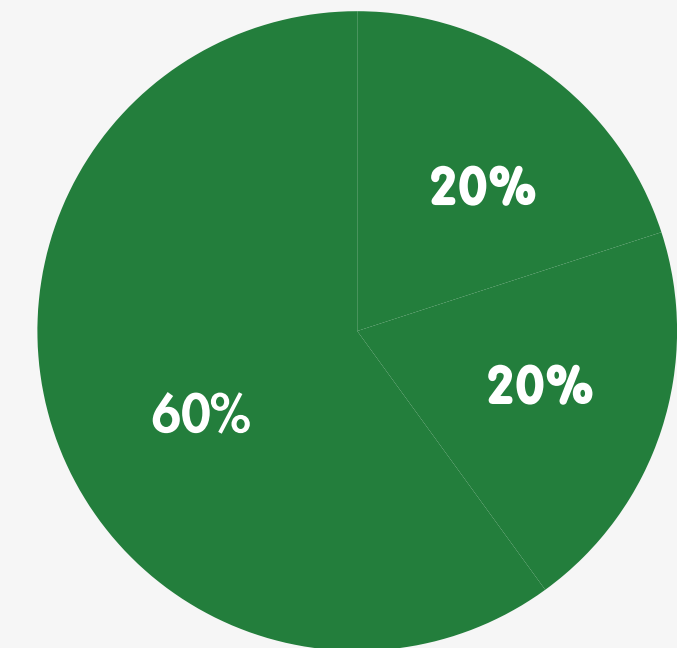
3
5
6
7
8
10

Major Energy Upgrade



5
6
9
10

Passive House

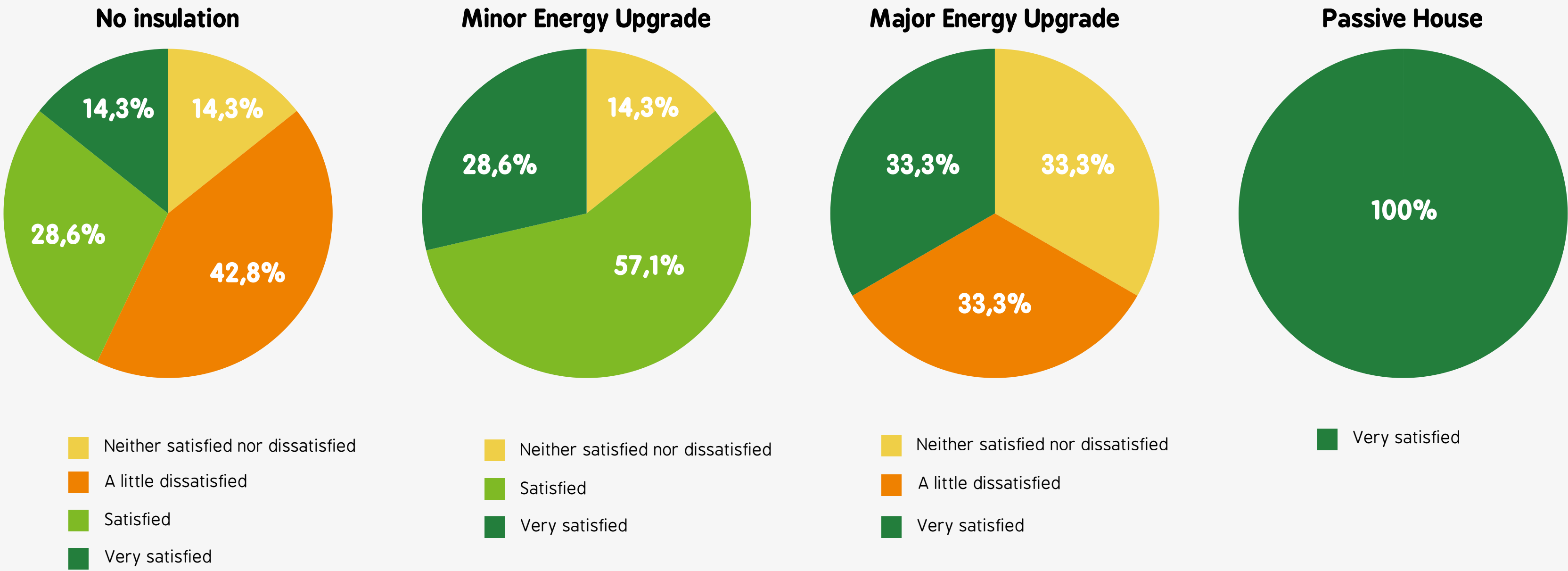


8
9
10

70% of residents in uninsulated dwellings report critically low comfort (1–4 /10)

B2.Thermal comfort questionnaires

How would you rate the indoor air quality?



Major Energy Upgrade = Super airtightness with no MVHR system

An aerial view of a city model with a blue overlay. The model consists of numerous white rectangular blocks representing buildings, arranged in a grid-like pattern. A central blue rectangular area with rounded corners is overlaid on the model. The background is a light tan color, representing the ground. Small green spheres are scattered throughout the model, possibly representing trees or parks. The blue overlay contains the text "Next Steps" in white.

Next Steps



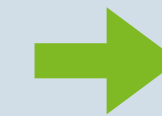
Barriers

- Lack of **knowledge**
- Scarcity of qualified on-site **technicians** and contractors
- Limited number of **engineers** specialized in deep energy retrofits



**Expertise &
Awareness Deficit**

- Financial schemes and subsidies **failing to target deep energy retrofits**
- **Lack of incentives** for high energy efficient buildings (i.e. high VAT)
- Lack of **private financing**



**Economic &
Financial Barriers**

- Regulatory, urban planning and procedural barriers



**Policy &
Planning Constraints**

From Barriers to Action

- **Expand Certified Passive House Designer (CPHD) training**

1. Integrate Passive House into university curricula
2. Include refugees in training programs

- **Continuous upskilling of engineers and contractors**

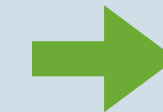


Addressing
Expertise &
Awareness Deficit

- **Smart Incentives:**

1. Leveraging White Certificates
2. Implement Social ESCOs (e.g., CLR).

- Promote Passive House as **protection against ETS2** and energy price
- Apply **Demand Response strategies** in buildings



Overcoming
Economic &
Financial Barriers

- **EPBD 2024 Compliance:** Mandatory effective monitoring (i.e. IoT & BDT)

- **Industrialization:** Using Prefabrication to speed up deep renovations.

- **Scaling Up:** District-scale EnerPHit in Athens to reach the 2% annual target.



Resolving
Policy &
Planning Constraints

Tool Development



DTERBIM



District-scale Strategy and Replicability

- District-scale PHPP /District PH replication in Athens to drive 2% annual deep renovations and eradicate energy poverty

1. MyEasyPH visualization → HPHI variant as early assesment tool

2. ARC → Renovation Cost calculator

3. ComPHy → Thermal Comfort Assessment

DTERBIM openBIM framework





Conclusions

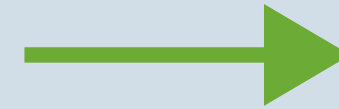
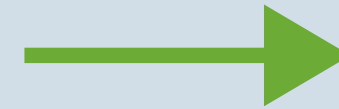
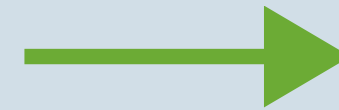


Financial Policy Strategy

Boost public funding schemes

EnerPhit retrofits

- Social housing for **vulnerable households**
- **Middle-income** households
- **High-income** households



Economic incentives

- Fully funded
- Low / Zero interest loans
- Tax incentives

Why Passive House?

- Every renovation which is not targeting Passivhaus is another **wasted opportunity**
- Passive House methodology **eliminates the 'performance gap'**
- To eliminate energy poverty in Athens, we must move to District-scale EnerPHit, **targeting a 2% annual renovation rate**



Thank you for your attention! Questions?



info@eipak.org



www.eipak.org



+30 211 408 1109



Tz. Alevizatou 64,
Papagou, 15669, Athens



@ Hellenic Passive House Institute



@ Hellenic Passive House Institute



@hellenic_passive_house_inst



@hellenicpassivehouseinst



@hellenic_passive_house_inst