



# DIAGNOSING SUMMER ENERGY POVERTY AT MULTIPLE SPATIAL SCALES IN THE EU AND PORTUGAL

EPAH Practitioners' Event  
"Cool Solutions for Hot Regions"  
01/07/2025

Pedro Palma  
[p.palma@fct.unl.pt](mailto:p.palma@fct.unl.pt)



**FireflyLab**



**CENSE**

center for environmental  
and sustainability research

**CHANGE**

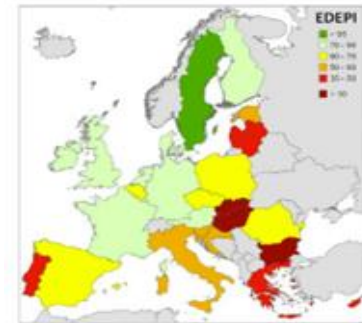
Global Change and Sustainability Institute

**Nova**

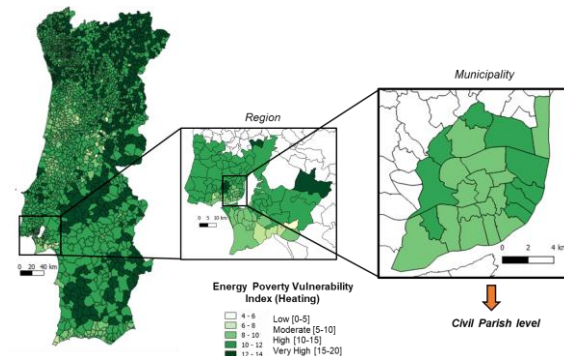
NOVA SCHOOL OF  
SCIENCE & TECHNOLOGY

# Importance of Scale in Energy Poverty Diagnosis

- Increasing focus on **Summer energy poverty** as temperatures rise
- **Clear divide between** North/Central countries and Southern/Western countries
- **Diagnosis** is needed at different scales
- National scale for **problem** setting and **wider targets and policy frameworks**
- Detection of **vulnerable groups** and monitoring measure impact can be more **effective at regional and local scales**
- Need **data and indicators** on summer energy poverty



EDEPI (Openexp, 2019)



Energy Poverty Vulnerability Index for Portugal  
(Adapted from Gouveia et al., 2019)

# Summer Energy Poverty Indicators at National Level

## What EU indicators can be used for assessing summer energy poverty?



### Socio economic

- Population living in dwellings comfortably cool in summertime (EU-SILC, 2012)
  - Disposable annual household income (Eurostat, 2023)
  - Domestic electricity prices (Eurostat, 2024)
  - Energy expenditure (electricity) (Eurostat, 2024)
  - Arrears on utility bills (EU-SILC, 2023)
  - Persons with respiratory and circulatory problems
- } Energy Expenditure-Income ratio:  
Abnormally high (2M) and Abnormally low (M/2) (2015, 2021)



### Buildings

- Population living in a dwelling with presence of leak, damp and rot (EU SILC, 2023)
- Population living in a dwelling equipped with air conditioning (EU SILC, 2007)



### Climate

- Cooling degree days (Eurostat, 2024)



### Energy

- Final energy consumption in households for space cooling (Eurostat, 2023)
- Dwellings with energy label A (BSO, 2015)

## EPAH Dashboard

EU  
Energy Poverty  
Advisory Hub





# Summer Energy Poverty Indicators at Subnational Level

## What subnational indicators are being used for assessing summer energy poverty?



Covenant of Mayors  
for Climate & Energy

- households / persons within the municipality **experiencing cooling discomfort**
- Frequency of **heat waves**
- Households with **centralised cooling system** and **cooling systems older than 10 years**
- households with **social support** (electricity tariff)
- Specific **energy poverty measures**
- **Awareness-raising campaigns** targeting vulnerable households

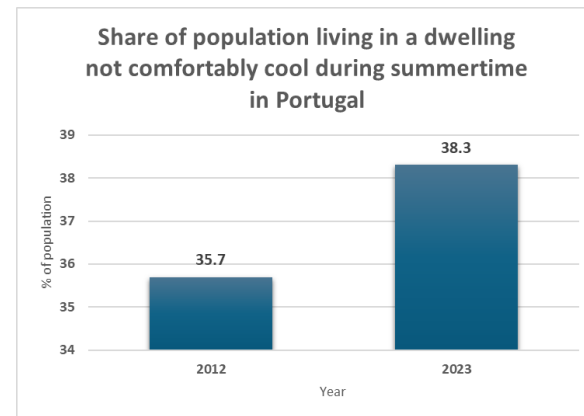
## Other indicators – scientific and grey literature review

- Measurement of **indoor temperatures/ thermal comfort assessments** (e.g. Terés-Zubiaga *et al.*, 2013)
- Energy behaviours at home – **ownership and restricting use of fans** (Horta *et al.*, 2019)
- Increase demand for **retrofits for cooling** (Morel *et al.*, 2022)
- People **spending more time in warm public areas**, such as shopping centres or libraries
- **Reluctance to have visitors** (EmpowerMed project)
- **Outdoor spaces** (e.g. Boemi and Papadopoulos, 2019)
- **Energy literacy** (e.g. Caballero *et al.*, 2021)

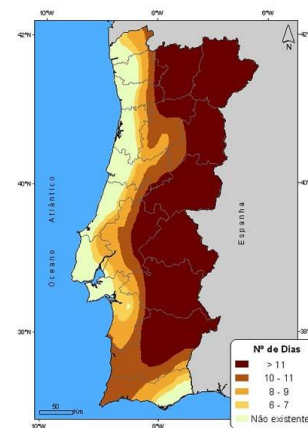
# Summer Energy Poverty Determinants in Portugal

- **High national levels** of Summer Energy poverty
- **Economic deprivation and inequality**
- **Low energy efficiency** of buildings and **low ownership** of air conditioning
- **Warm summer climate**
- Lisbon: **56.5%** in thermal discomfort in the summer (Lisboa-ENova, 2025)
- Porto: **23%** not happy with indoor temperatures in the summer (AdePorto, 2025)
- National **EP definition acknowledges space cooling** as essential energy service
- Includes **inability to cool indicator** in the monitoring framework and reduction target

INE (2025)



Longest heatwave in Portugal's history (2003)



IPMA (2025)

# Summer Energy Poverty Determinants in Portugal

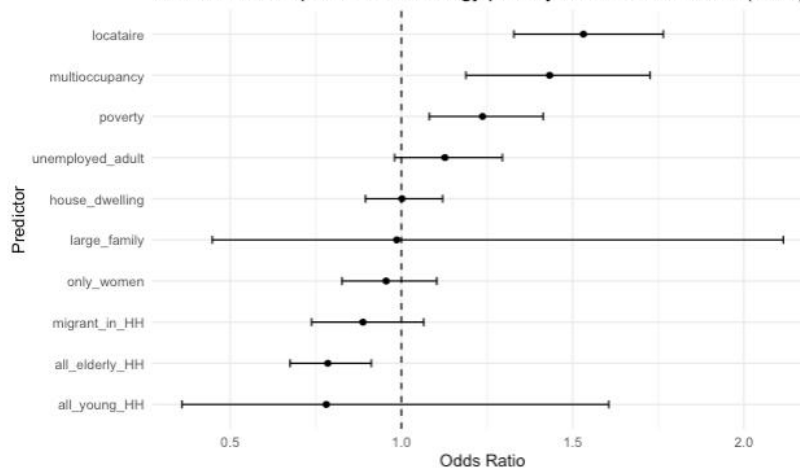
## Identifying predictors of Summer Energy poverty

Coefficients:

	Estimate	Std. Error	z value	Pr(> z )	
(Intercept)	-0.777951	0.048640	-15.994	< 2e-16	***
unemployed_adult	0.119458	0.071034	1.682	0.092626	.
migrant_in_HH	-0.119180	0.093606	-1.273	0.202943	
only_women	-0.045702	0.073661	-0.620	0.534969	
all_elderly_HH	-0.241947	0.076846	-3.148	0.001641	**
all_young_HH	-0.247640	0.377847	-0.655	0.512212	
large_family	-0.013727	0.391906	-0.035	0.972059	
house_dwelling	0.001486	0.057326	0.026	0.979320	
multioccupancy	0.359690	0.095168	3.780	0.000157	***
locataire	0.426254	0.072461	5.882	4.04e-09	***
poverty	0.212646	0.068421	3.108	0.001884	**
---					

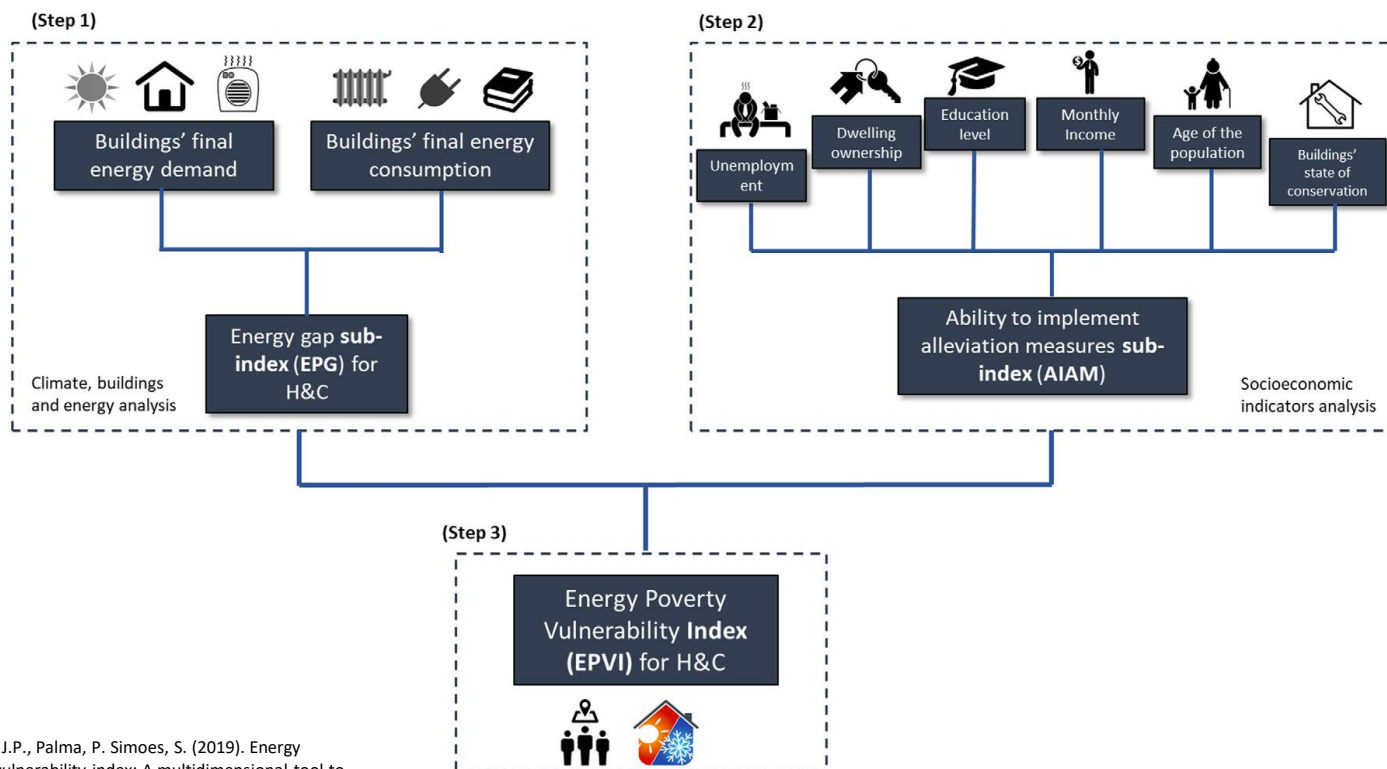
Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Odds Ratios for predictors of energy poverty - consensual based (2012)



- Using **national SILC microdata**
- **Logistic** regression model
- Significant correlations with **income poverty, overcrowded dwellings, tenants, and elderly occupants**

# Summer EP vulnerability at regional level

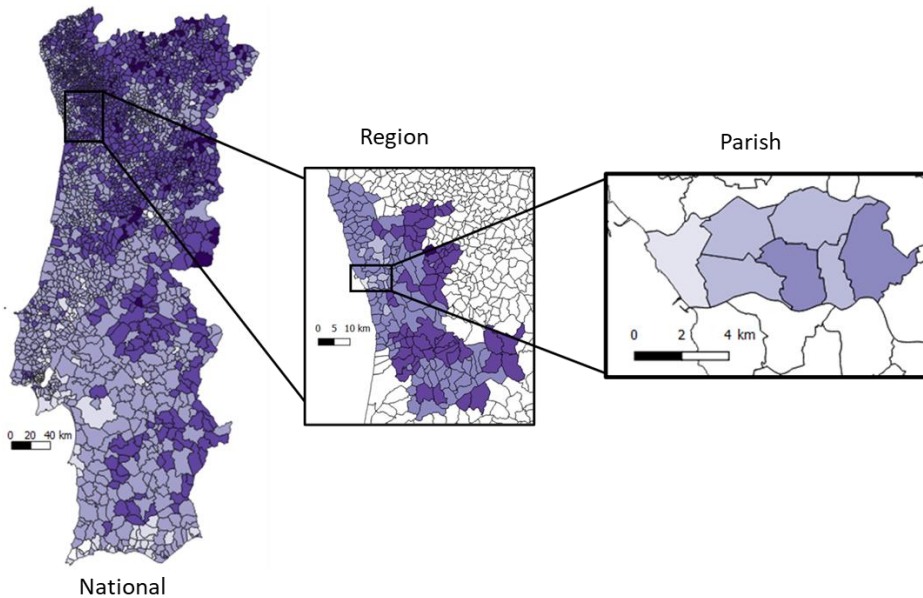


High spatial resolution (all the 3092 civil parishes in Portugal).

Hotspots for local action and relative comparison between regions.

# Summer EP vulnerability assessment

## Energy Poverty Vulnerability at different scales

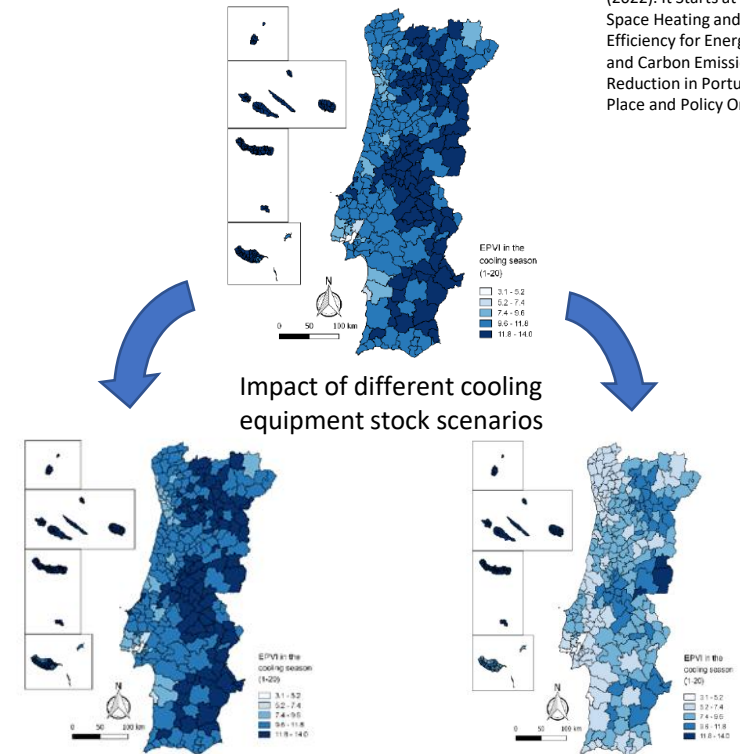


Gouveia, J.P., Palma, P. Simoes, S. (2019). Energy poverty vulnerability index: A multidimensional tool to identify hotspots for local action. *Energy Reports 5*, November 2019, Pages 187-201

## Energy Poverty Vulnerability changes in future scenarios

**P** People, Place and Policy

Palma, P., Pedro Gouveia, J., Mahoney, K., & Bessa, S. (2022). It Starts at Home: Space Heating and Cooling Efficiency for Energy Poverty and Carbon Emissions Reduction in Portugal. *People, Place and Policy Online*, 1–20.

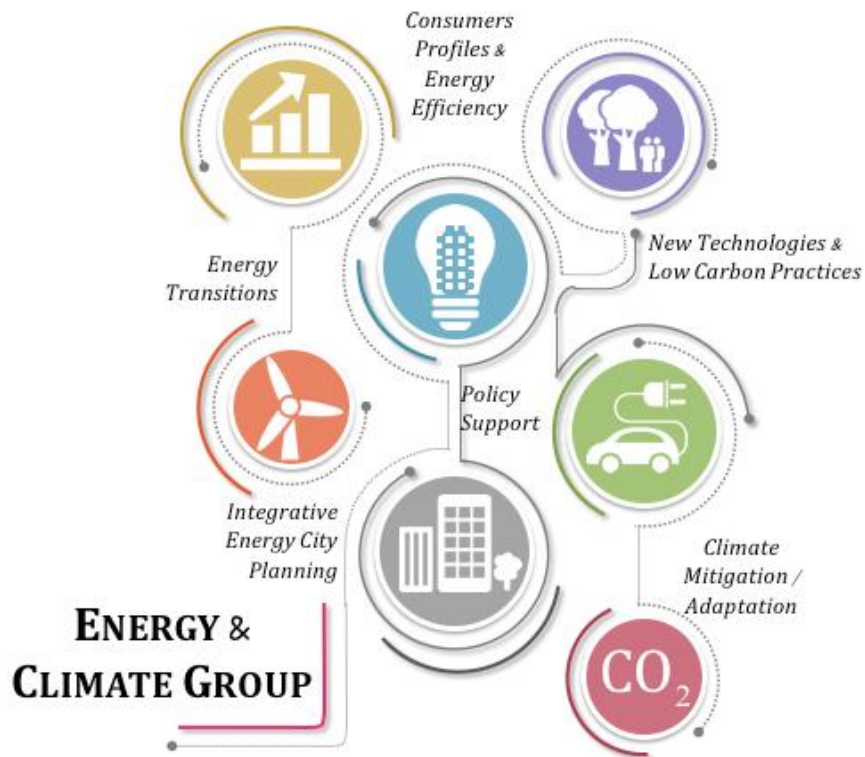




## Next Steps

- Push for higher awareness and knowledge on **summer energy poverty**
- Assess summer EP **determinants change** from 2012 to 2023
- Develop **case studies with local data**
- Update **EPVI** and test **transferability for neighbourhood scale**
- Continue to contribute to **multilevel policymaking**





Thank You

@

p.palma@fct.unl.pt

W

www.cense.fct.unl.pt



FireflyLab



CENSE

center for environmental  
and sustainability research

CHANGE

Global Change and Sustainability Institute

NOVA

NOVA SCHOOL OF  
SCIENCE & TECHNOLOGY