crossCert

Next-generation of Energy Performance Assessment and Certification

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 101033778

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Next-generation of Energy Performance Assessment and Certification

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Towards reliable, practical, and people-centred European energy performance certification of buildings

Norberto Fueyo, Antonio Gómez, María Herrando
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What is crossCert?

- An ongoing (2021-2024) Coordination and Support Action...
- ... involving 11 European countries...
- ... to improve building Energy Performance Certificates (EPC's) in Europe

crossCert countries

EPCs are a hot topic!

- ‘Sister’ EU-funded projects working on EPC’s

Next Generation Energy Performance Certificates H2020 cluster

Qual DeEPC

U-CERT
User-Centred Energy Performance Assessment and Certification

X-tendo

D2EPC

EDYCE

ePANACEA
Smart European Energy Performance Assessment & Certification

EPC RECAST
ENERGY PERFORMANCE CERTIFICATE RECAST

crossCert
Next-generation of Energy Performance Assessment and Certification

EUB SuperHub

iBRoad2EPC

TIMEPAC
The new EPC for Europe

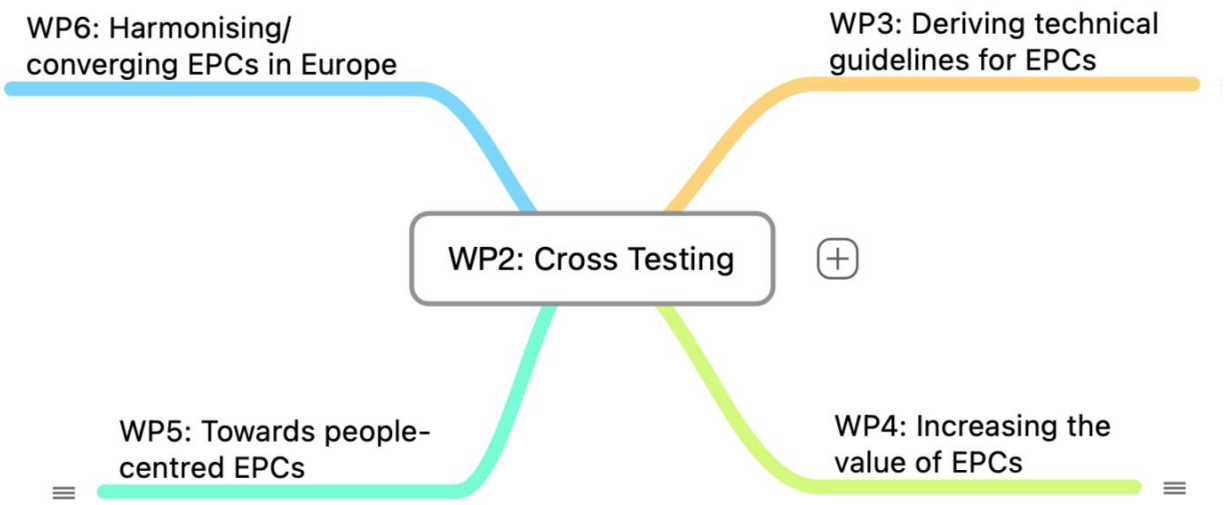
These projects have received funding from the European Union’s Horizon 2020 research and innovation programme. The European Union is not liable for any use that may be made of the information contained in the documents prepared by the projects’ consortia, which are merely representing the authors’ view.

What can be improved in EPCs in Europe?

Need improvement

- Robustness
- Added value
- User centered
- European-wide convergence

The crossCert project



What is cross testing

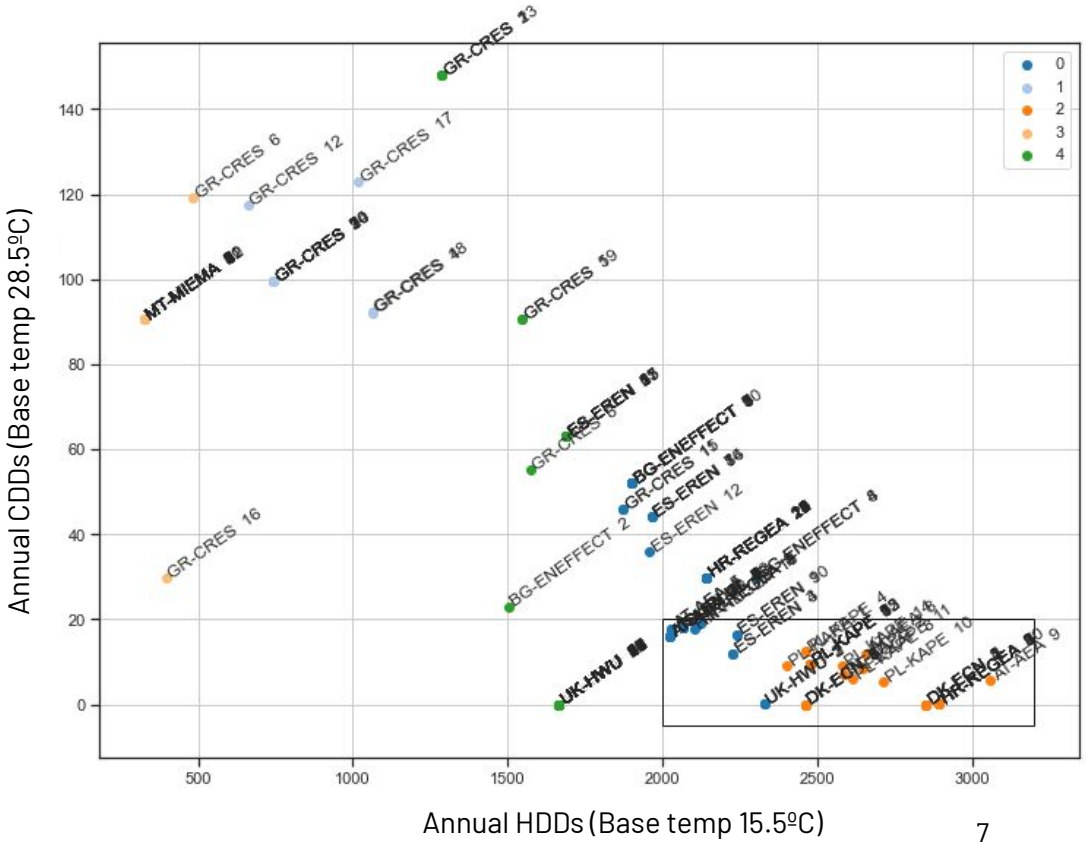
- A country tests its own buildings using other countries EPCs
  - And we learn in the process
- A total of 149 buildings, most usage categories, in many climates

Building typologies, actual count		CRES	REGEA	KAPE	ENEFFECT	MIEMA	EREN	ECN	AEA	HWU	IRI UL	Total in category
	Number of buildings in country	20	22	15	10	12	16	10	10	24	10	149
	Colour indicates climate	Greece	Croatia	Poland	Bulgaria	Malta	Spain	Denmark	Austria	UK	Slovenia	
Residential	Single family house	5		7	1	2		3	3	20		41
	Terraced house			1		2		2				5
	Multi-apartment Building	5		1	3			3	3			15
Tertiary sector	Educational	5	13	4	2	2	2		1	3	9	41
	Office	2		1	3	4	7	2	1			20
	Sports hall	1	3	1							1	6
	Healthcare buildings		3				2			1		6
	Public entertainment buildings				1							1
	Community/Public assemby buildings		3			2						5
	Social housing						2					2
	Retail buildings	2							1			3
	Buildings for religious activities											0
	Public security buildings											0
	Others						3		1			4
Industrial secto	Industrial buildings and warehouses											0

A first difficult for cross testing...

- Climate!!!
- National certificates often work only for the national climates
- Large climate spread across crossCert
  - See graph for crossCert buildings:

    Cooling Degree Days CDD
    vs
    Heating Degree Days HDD



Cross testing: Overcoming difficulties

- Climate and language (of the certificating software) are the main difficulties
- Our crossCert solution: three test building groups ('ensembles')

1. Project-wide ensemble (P-buildings) [7 buildings]
   All partners test, using results from a reference (dynamic) model for comparison

2. Climate clusters (C-buildings) [7 buildings x 10 partners]
   Tested in partner pairs of countries with a similar climate

3. Partner local building ensemble (L-buildings) [Remaining buildings]
   Local testing

Robustness

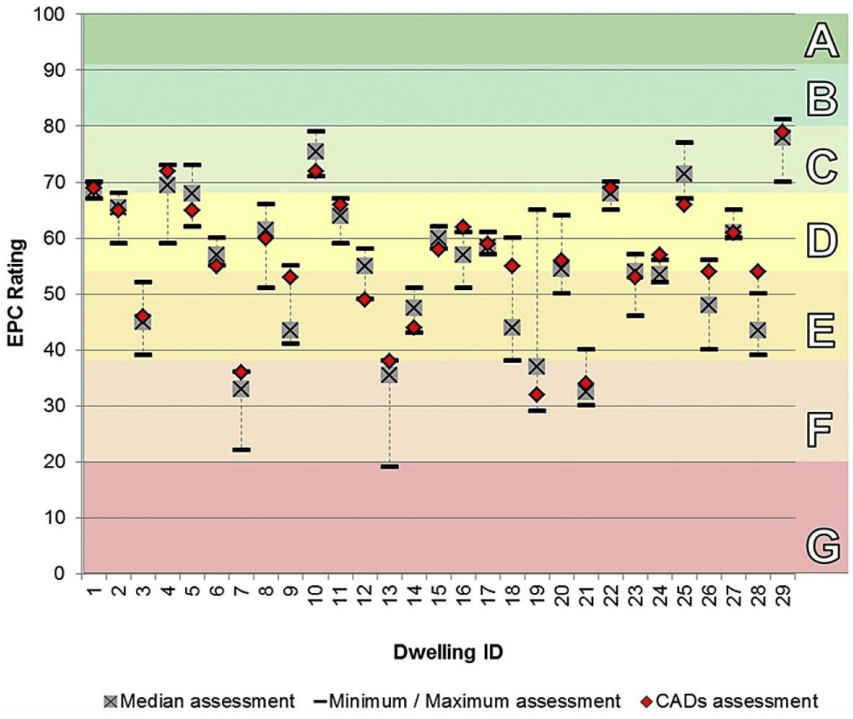
- Performance gap

  How accurate is the EPC in predicting the building annual energy consumption, assuming correct inputs

- Repeatability or consistency
  Same building but different assessor = same results?

Robustness in the UK

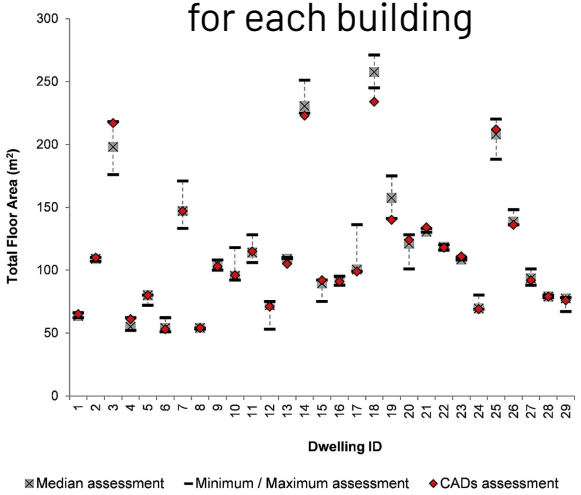
- 29 homes, 5 EPC evaluations of each home
- A reference EPC (diamond in the graph)
- Note wide dispersion of results!!!



Details:
David Jenkins, Sophie Simpson, Andrew Peacock, Investigating the consistency and quality of EPC ratings and assessments, Energy, Volume 138, 2017

Why the lack of robustness?

Floor area assessed for each building



# of assessors (out of 29) that agree on...

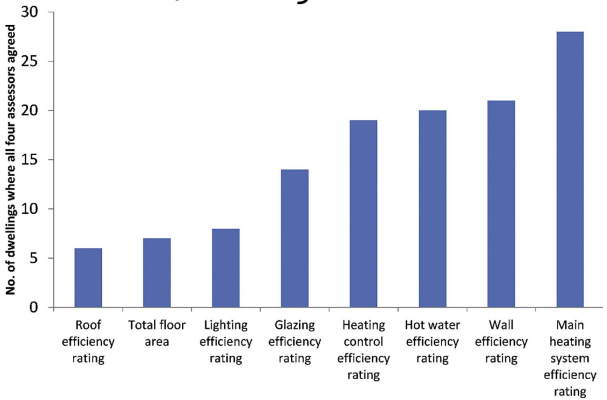


Fig. 6. Number of dwellings where all four assessors agreed on parameters used in the EPC calculation process.

# of assessors (out of 29) that agree on...

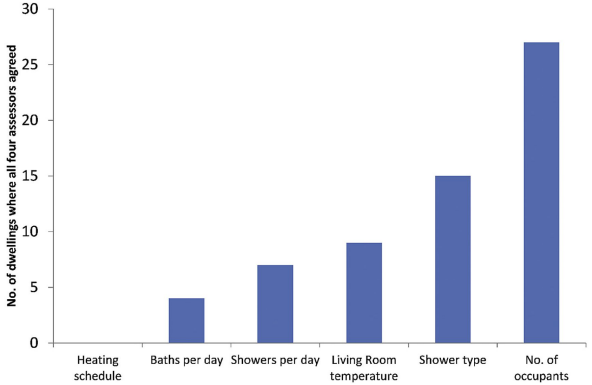


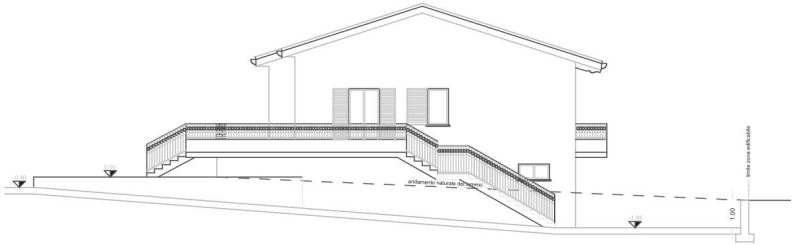
Fig. 9. Number of dwellings where all four assessors agreed on parameters used in the Green Deal OA calculation.

- Uncertainty in input data (areas, U-values, thermal bridges)
- Insufficient or inadequate training (oriented towards app usage, not towards the physics behind)
- Insufficient description of the methodology

Details:
David Jenkins, Sophie Simpson, Andrew Peacock,
Investigating the consistency and quality of EPC ratings and assessments,
Energy, Volume 138, 2017

Robustness in Italy

- 162 experts assess the same building (single dwelling)
- Large dispersion in results
- (But 70% agree on performance grade/letter)



South-East View

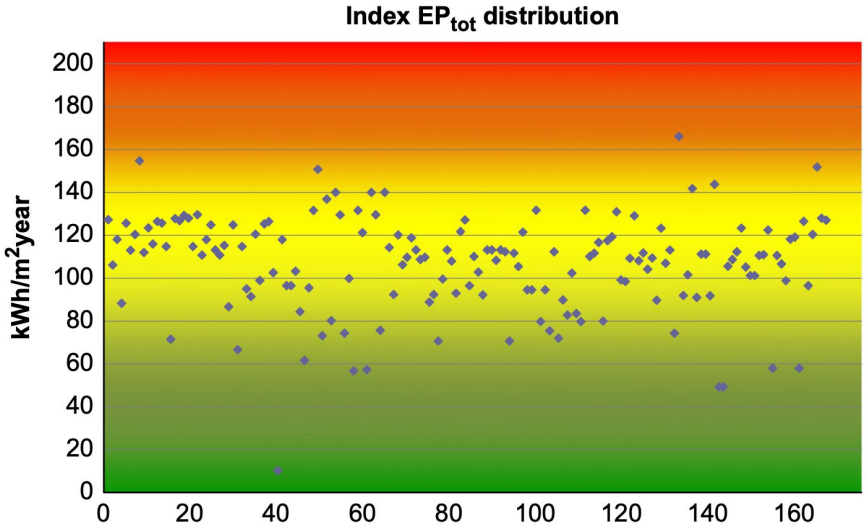
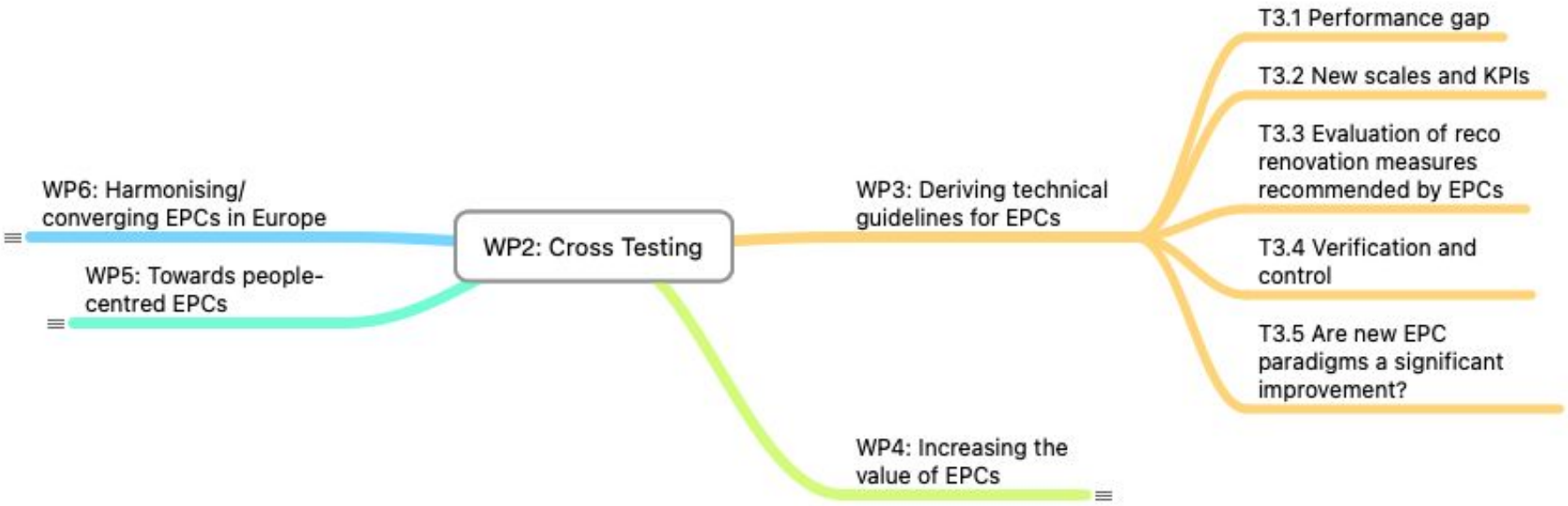


Fig. 3. EP_{tot} index—result dispersion.

Details:
Lamberto Tronchin, Kristian Fabbri: Energy Performance Certificate of building and confidence interval in assessment: An Italian case study. Energy Policy, 2012

Robustness (WP3): crossCert contribution

- Cross testing of existing and emerging methodologies



Adding value to EPCs

- How can we increase the value/usefulness of EPCs?

- Exploitation of EPC databases (great heterogeneity across Europe)
- Adaptation of EPC data to specific sectors (financing, investors)
- Relation to other (existing and emerging) building tools:
  - Energy audits
  - Building Renovation Passports
  - Logbooks
- One stop shops

Added value

- Example: energy poverty analysis in Bologna, using the ratio of energy expenditure (via EPC) to income as a proxy

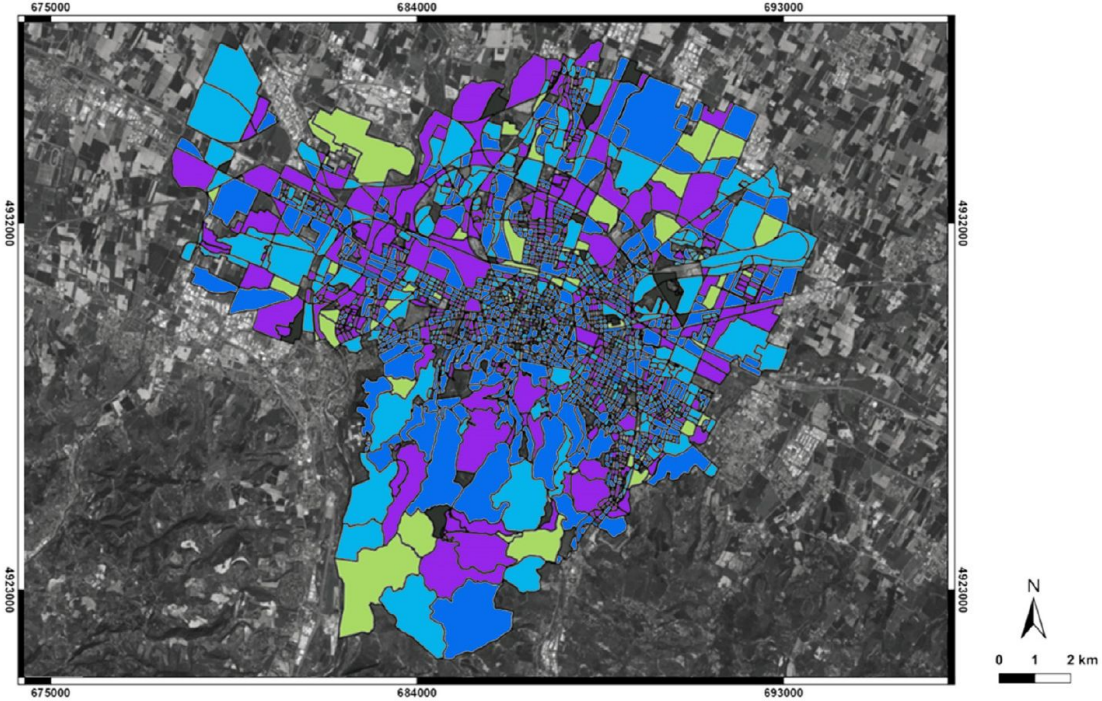
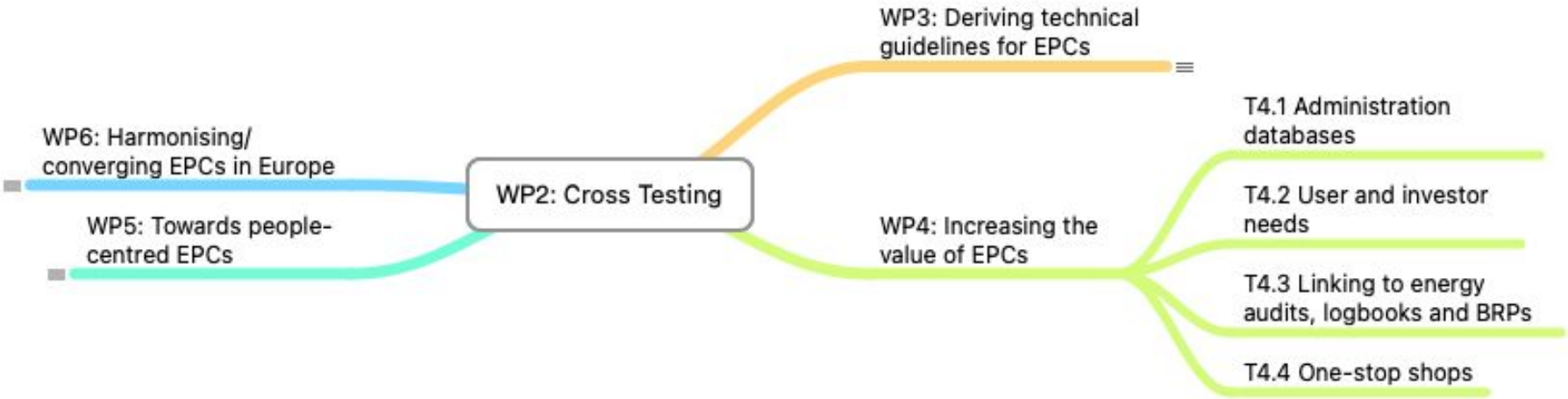


Fig. 2. Energy Poverty Map (EPM) of Bologna. The map reports the buildings potentially generating a risk of energy poverty, aggregated at cadastral parcel level. Legend: No energy poverty risk. Category A, B (table 6). Category C (table 6). Category D (table 6).

Details:
K. Fabri, J. Gaspari
Mapping the energy poverty: A case study based on the energy performance certificates in the city of Bologna, Energy & Buildings, Volume 234, 2021

Adding value (WP4): crossCert contribution

- Analysis and evaluation



User-centric aspects: low uptake by end users

- (See also review in crossCert deliverable D5.1 by IRI-UL; website at the end)
- Currently, low user uptake of EPCs
  - Germany: "The EPC is **not considered a reliable tool** to motivate building renovation and is viewed as **an administrative obligation**"
  - UK: **Only 18% of recipients are affected by the information** and more than 80% think the influence is minor or negligible"
  - The Netherlands: "**only 10%** of the sample stated that the EPC had **influence** them **in the process of property purchase**"
  - Denmark: "EPC is regarded as a reliable and easy-to-understand energy efficiency information source by the respondents, but [it does] **not have adequate information** to encourage them **to undertake home renovation** work"

Details:
Y. Li, S. Kubicki, A. Guerriero, Y. Rezgui: Review of building energy performance certification schemes towards future improvement. Renewable and Sustainable Energy Reviews, Volume 113, 2019

User-centric aspects: use of EPCs in transactions

- Availability of EPC in selling/buying/rental transactions

Figure 7 – Real use of EPCs in property sales or rent transactions.

Zebra 2020 project report:

ZEBRA 2020 - NEARLY ZERO-ENERGY BUILDING STRATEGY 2020. Strategies for a nearly Zero-Energy Building market transition in the European Union

User-centric aspects: price premiums

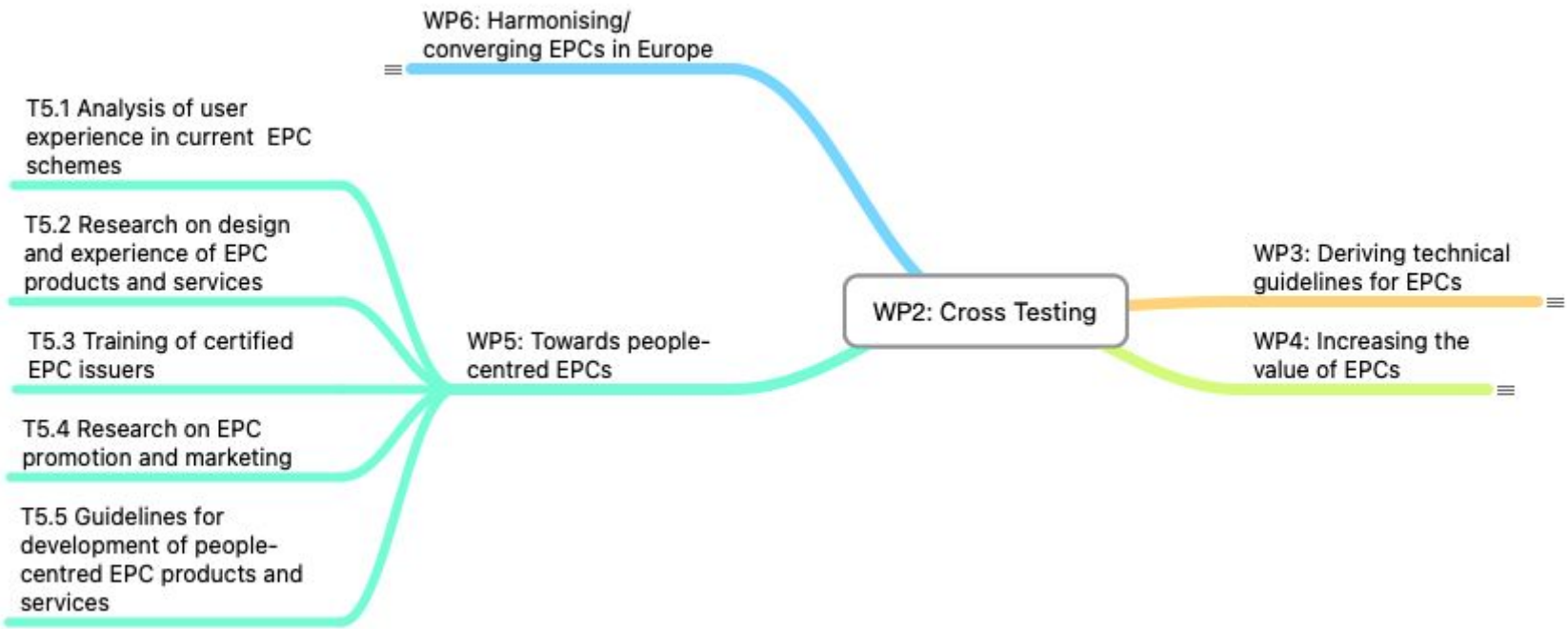
- Influence of EPC in the building selling or renting price
- In Spain: A,B, C, D 5-10%price premium with respect to E, F, G

Details:
A. Ayala, I. Galarraga, J.V. Spadaro: The price of energy efficiency in the Spanish housing market. Energy Policy, Volume 94, 2016

Table 1
Summary of literature review on EE ratings effect in the residential sector.

Reference	Country	Dependent variable	Main finding
Brounen and Kok (2011)	Netherlands	Trans. price $/m^2 (sales)	EPC price-premiums compared to D rated homes: A=10%; B=5.5%; C=2%; E=−0.5%; F=−2.5%; G=−5%
Bio Intelligence Service et al. (2013)	Some EU countries	Trans. price € (sales and rentals)	One-letter improvement in EPC carried a price-premium (except in Oxford): Austria=8% (sales), 4.4% (rentals) Belgium: Flanders=4.3% (sales), 3.2% (rentals); Wallonia=5.4% (sales), 1.5% (rentals); Brussels=2.9% (sales), 2.2% (rentals) France: Marseille=4.3% (sales); Lille=3.2% (sales) Ireland=2.8% (sales), 1.4% (rentals) Oxford (UK)=−4% (sales)
Caijas and Piazolo (2013)	Germany	Market value and €/m^2 (sales and rentals)	A 1% increase in energy saving increased market values by 0.45% and rent prices by 0.08%
Hyland et al. (2013)	Ireland	Listed price $ (sales and rentals)	EPC price-premiums compared to D rated homes: A=9.3% (sales), 1.8% (rentals); B=5.5% (sales), 3.9% (rentals); C=1.7% (sales), −0.6% (rentals); E=−0.4% (sales), −1.9% (rentals); F/G=−10.6% (sales), −3.2% (rentals)
Fuerst et al. (2015)	England	Trans. price £/m^2 (sales)	EPC price−premiums compared to D rated homes: A/B=5%; C=1.8%; E=−0.7%; F=−0.9%

User-centric aspects (WP5): crossCert contribution

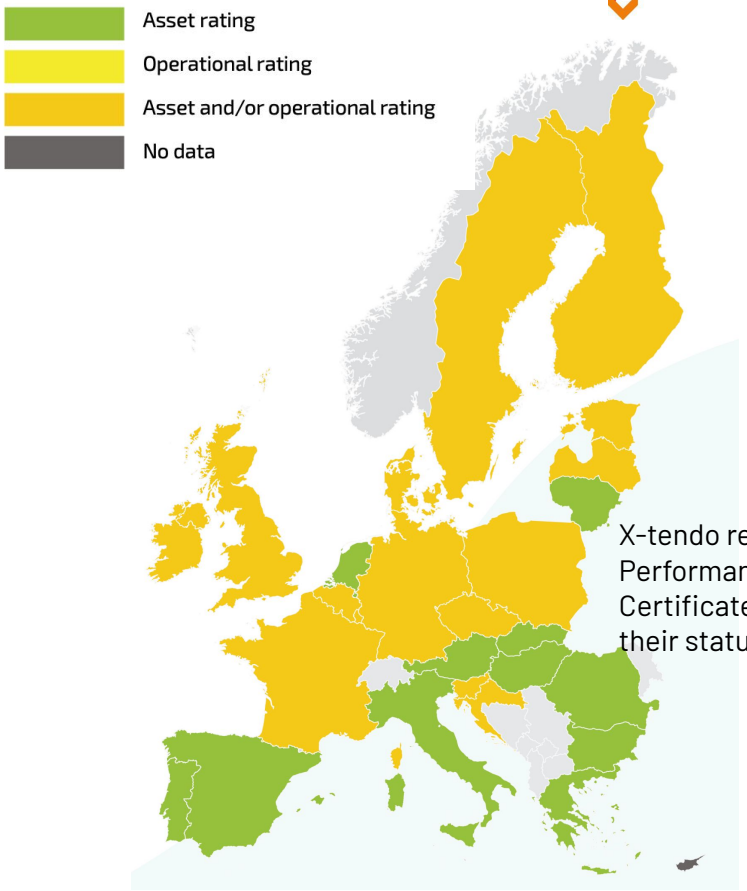


About European convergence

- EPC production methods:
  (Directive 2010/31/EU on the energy performance of buildings):
  - Modelling (“*Asset rating*”)
  - Measurements (“*Operational rating*”)
- Disparity in Europe

Table 17
Range of Default U-values for Exterior Walls.

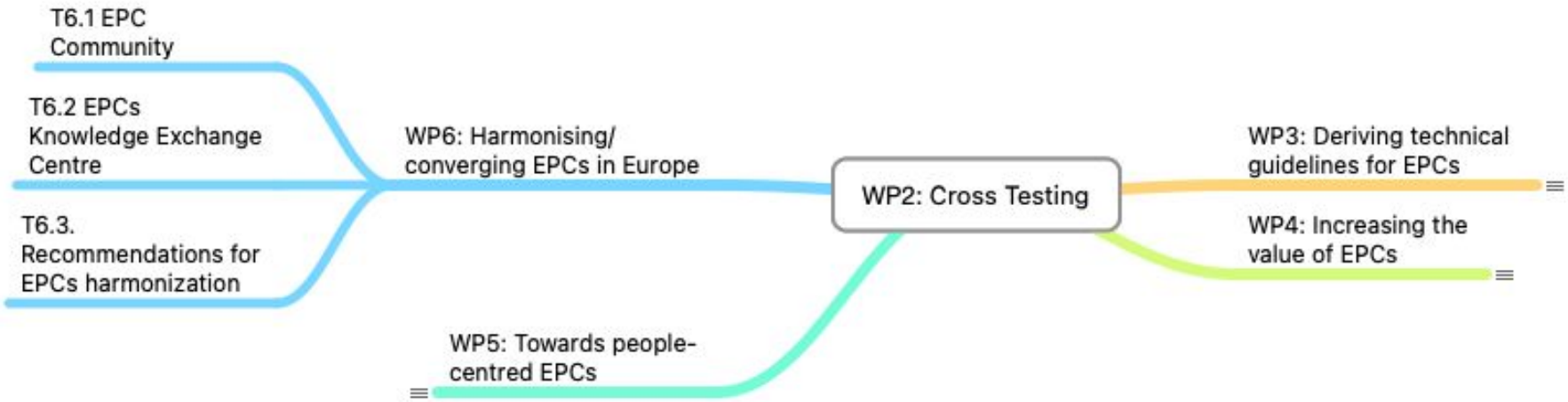
	U-values [W/m^{2}K]		number of wall types	total number of options
	min	max		
Germany	0.40	1.70	2	16
Spain	0.57	3.12	15	120
France	0.32	3.90	14	116
Italy	0.55	3.59	6	20
Poland	0.71	3.87	9	17
United Kingdom	0.19	2.50	40	570



X-tendo report. Energy Performance Certificates assessing their status and potential

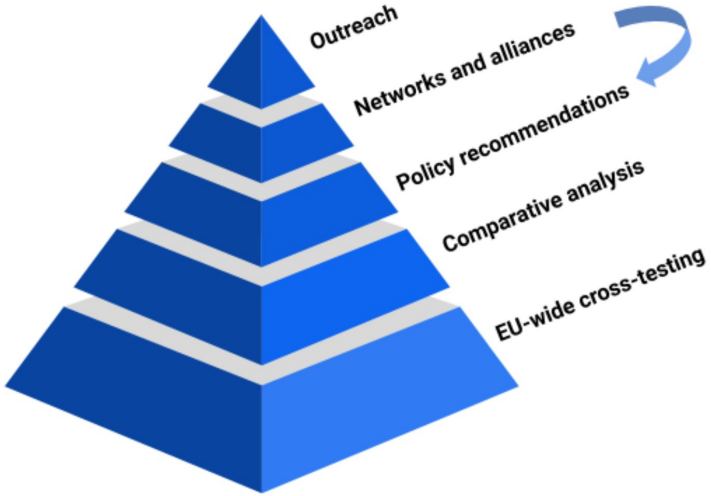
S. Semple, D. Jenkins. Variation of energy performance certificate assessments in the European Union. Energy Policy, Volume 137, 2020

Harmonisation (WP6): crossCert contribution



Summary: crossCert in figures

- 12 partners | 11 countries
- 140+ buildings
- 3 years (Sep 21 - Aug24)
- 3 M€ budget



ES	Universidad de Zaragoza (UZ)
UK	Heriot Watt University (HWU)
SI	Institute for Innovation and Development of University of Ljubljana (IRI UL)
EL	Centre for Renewable Energy Sources and Saving (CRES)
HR	North West Croatia Regional Energy Agency (REGEA)
PL	Polish National Energy Conservation Agency (KAPE)
BG	Center for Energy Efficiency - EnEffect Foundation (ENEFFECT)
MT	Malta Intelligent Energy Management Agency (MIEMA)
ES	Ente Regional de la Energía de Castilla y León (EREN)
DK	Energy Consulting Network AS (ECNET)
AT	Austrian Energy Agency (AEA)
DE	Climate Alliance (CA)

Thank you!

- More info?
  - www.crosscert.eu