



Designing effective and acceptable energy policies for a low carbon heating consumption

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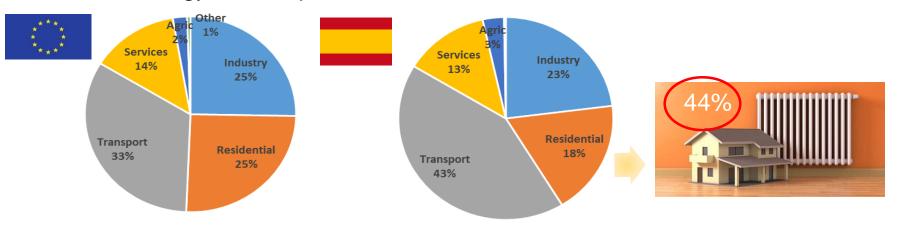


ikerbasque Basque Foundation for Science



Motivation

 Residential building sector in Spain, as in Europe, is a major driver of current and future energy consumption and associated CO2 emissions.



- Climate change and energy security require a reduction of fossil fuels used in buildings, by 90-100% by 2050.
- Challenges:
 - Nearly zero energy buildings
 - Energy efficiency improvements
 - Development of renewable energy sources

BASQUE CENTRE FOR CLIMATE CHANGE Klima Aldaketa Ikergai ...but what about from the demand side?

Factors influencing household heating behaviour

- Socio-economic and demographics characteristics (Wei et al., 2014)
 - Family income
 - Energy poverty
- Residence characteristics (Karytsas and Theodoropoulou, 2014)
 - Type of residence
 - Year of construction
 - The retrofits for improving energy efficiency (EE)
- Environmental awareness (Ramos et al., 2016)
 - Ecological reasons
 - Indoor air quality
 - Health aspects
- Other factors that explain non optimal behaviour on energy consumption (Markandya et al., 2015)
 - Capital constraint, time preference, principal-agent problem.



...And in Spain?

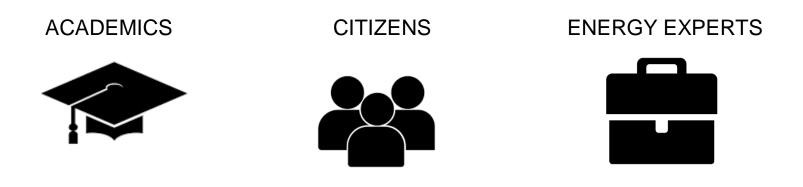
- Socio-economic and demographics characteristics
 - Energy poverty is significant although below the European Union poverty (Bouzarovski and Tirado Herrero, 2017)
- Residence characteristics
 - 50% of buildings were constructed before Energy Efficiency requirements (Ramos et al., 2016)
 - Half of Spanish household have conventional boiler.
 - Changes in the energy sources used for heating: a decrease in solid fuels and natural gas in favour of biomass (IDAE, 2018)
- Environmental awareness
 - Spanish households belonging to higher income groups and higher education levels are more likely to invest in Energy Efficiency but NOT to adopt energy savings habits (Ramos et al., 2016)



Research goal

- The objective of this work is twofold:
 - To learn more about the determinants of households energy consumption for heating.
 - To find out what policies can effectively to encourage low-carbon heating behaviour.

By considering different views from:





METHODOLOGY

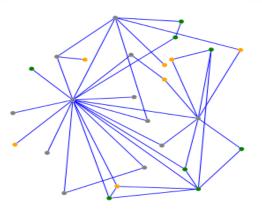
Fuzzy Cognitive Mapping (FCM) (Kok, 2009)

What is it about?

- **Soft system** modelling and mapping approach •
- Semi-quantitative mind mapping: combines aspects of qualitative with the advantages of quantitative methods
- It is based in causal networks
- Participatory methodology
- Fosters learning between participants and knowledge co-production:
 - It allows aggregation
 - It allows scenario building

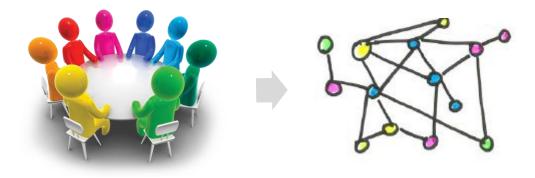
	Focus Group (FG)	Participants number	When?	Where?
Two ways to build FCM	FG with ACADEMICS	8	December 20 th , 2017	BC3
Individual interviews	FG with CITIZENS	8	January 23 rd , 2018	Bilbao
Focus groups	FG with ENERGY EXPERTS	7	January 31 st , 2018	XIII Conference of the AEEE, Zaragoza





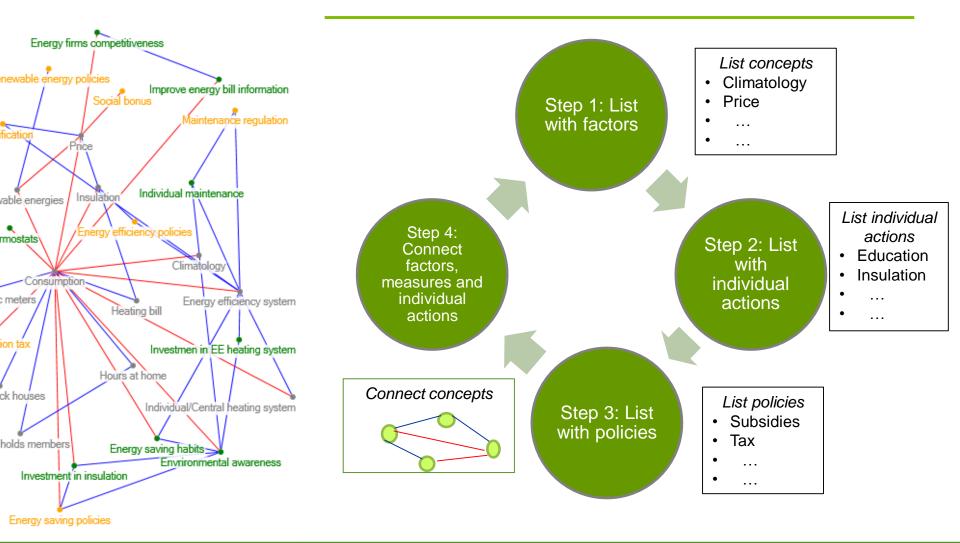
Three sequential questions were asked in each Focus Group:

- 1) What basic **elements** influence the amount of your heating bill?
- 2) What individual measures could help to reduce your heating bill?
- 3) What **policies** could politicians implement to bring down heating bills?





Process







•

Homogenization of the three cognitive maps

- academics, citizens and energy experts -

Low carbon heating policy simulations

0.9

In-degree (li)

Out-degree (Oi)

1

Very strong

connection

0.8

0.2

0.3

0.1

Density (D)

Centrality (Cti)

Scenario building

Comparison of scenarios

0

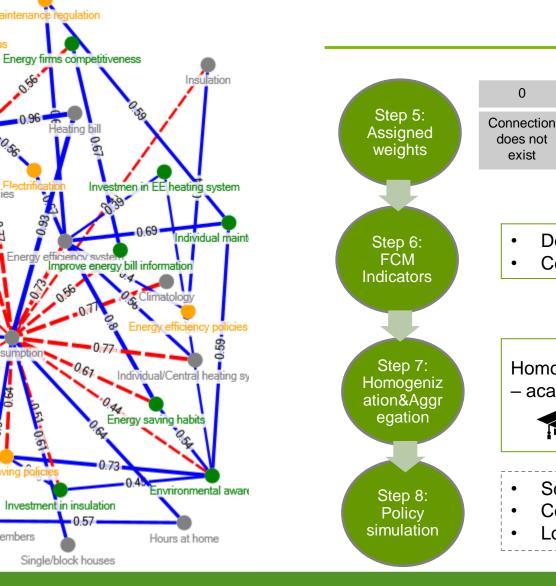
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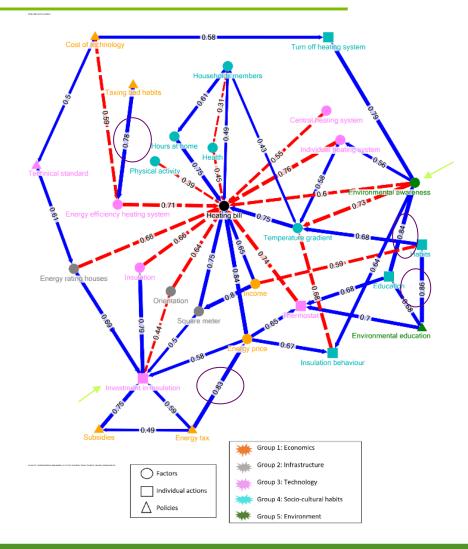
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FINDINGS

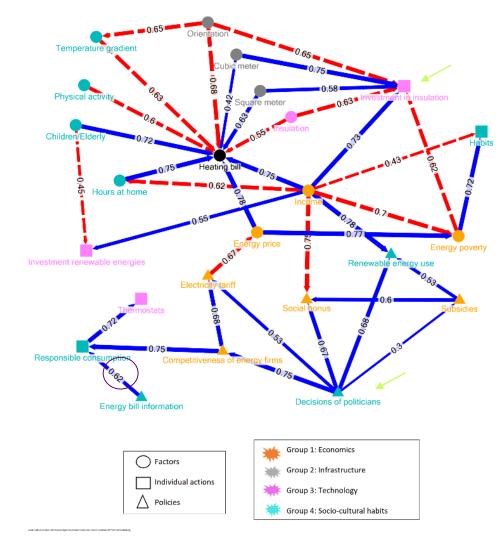






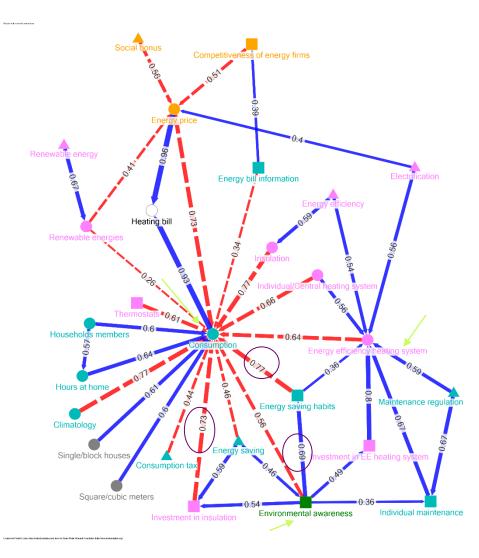
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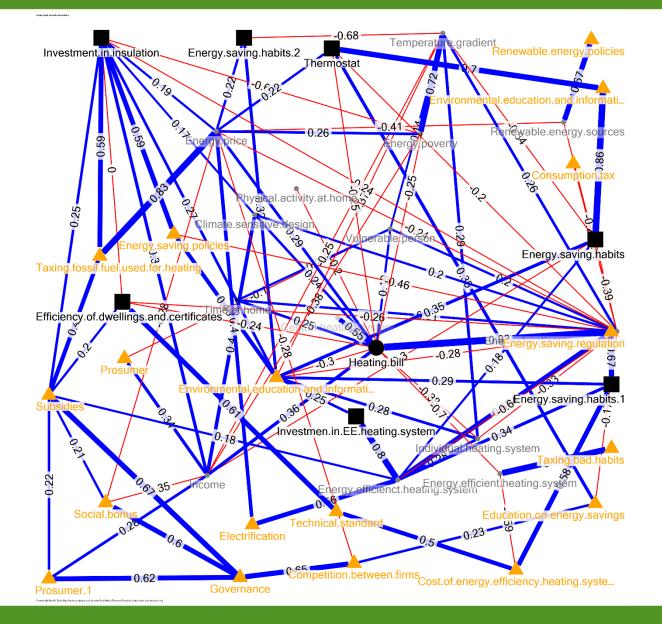




Differences between the Focus Groups

Thematic issues								
Economics	Infrastructure	Socio- cultural habits	Technology	Environment	Energy poverty	Polic Subsidies	ies Taxes	
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\checkmark	\checkmark	\checkmark	\checkmark		\checkmark	\checkmark		
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CONCLUSIONS

A few policy implications

Taxing bad habits and/or fossil fuels for heating

- To stimulate use of energy efficient heating systems →to reduce energy consumption
- To motivate investment in insulation
- To implement subsidies or rebate schemes

Subsidies

- For the use of renewable energy
- To contribute alleviating energy poverty (social bonus)

Environmental education policies

• To change the habits of consumers

Policies to help people understand energy bills

To lead to more responsible consumption habits



Ongoing work

- **Survey** with energy experts to test which of the policies from the three Focus Groups are the most important
- The development of scenarios based on the modelled network combining policy measures
 - It can be interpreted as what might happen in the future if alternative sets of policy options are used
 - For modelling purposes, this is done by setting a fixed value on an outgoing influence of a variable



THANK YOU!!

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