

## ► RESEARCH INFORMATION

### KEYWORDS

Deep energy renovation, nZEB, behavioural change, energy efficiency, behavioural economics, policy making

### INTRODUCTION / CONTEXT

- Buildings are responsible for 40% of the total energy consumption in Europe [1]. Energy efficiency is the world's 'first fuel' [2].
- In 2012 the renovation rate of residential stock in Belgium was of 1% [3]. For all buildings to meet the energy efficiency standards by 2050, a renovation rate of 2-3 % of the total residential floor area per year is needed [4].
- There is a gap between self-reported intentions and the actual energy efficiency measures completed [5].
- Many EU countries including Belgium have high rates of ownership (over 70%) [6]. In Flanders prevail terraced, semidetached and detached houses (94.9%) over apartment blocks [7]. Therefore in order to reduce residential energy consumption it is important to understand the mechanisms behind individual investment behaviour.
- Empirical findings in the field of behavioural economics attest a heuristic behaviour of individuals opposed to the rational *homo economicus*.
- New instruments such as nudges have proven their efficiency in other fields of policy making. *Nudging* - structuring the choices that people make in order to lead them towards particular outcomes [7].

### QUESTION / GOAL

The purpose of the research is to verify if new policy instruments such as nudging are efficient for the uptake of energy-efficient renovation. Nudges aim to correct **individual choice failures** due to bounded rationality or bounded willpower. The libertarian paternalistic measures will be analysed in a complex framework alongside traditional policy measures, that target the **market failures**.

### HYPOTHESIS / METHODOLOGY

- The hypothesis tested is whether the dwellers have a heuristic or a rational processing of the information regarding energy renovation.  
Method: literature review, questionnaire and choice experiment
- The influence of information framing on decision making regarding energy efficiency renovation measures will be exploited. An example is the reframing of the Flemish EPC taking into account behavioural insights.  
Method: laboratory experiments, eye tracking, focus groups.
- The efficiency or inefficiency of innovative methods based on behavioural insights, such as nudges, will be tested.  
Method: randomised controlled trials, experiments in the context of Werfgoed Living Lab.

### PRELIMINARY RESULTS

- Results based on literature review  
There are two main types of policies for encouraging energy renovation: traditional methods based on neoclassical economics (incentives, mandates) and innovative methods based on behavioural economics (nudges). These approaches might be complementary rather than concurrent or mutually exclusive.
- Results based on the survey  
Positive attitudes regarding energy efficiency measures are more rational than heuristic, while negative ones are balanced. That might explain the inefficiency of policies based on monetary incentives.

### CONCLUSION

Although literature review confirms the effectiveness of nudges in various fields of policy making, more research is required in the context of energy renovation. Libertarian paternalism addresses mostly individual choice failures. A comprehensive framework is needed in order to consider both behavioural and market failures, socio-demographic and technological context.

## ► CONTACT

victoria.taranu@uhasselt.be  
http://www.fac-ark.squarespace.com/new-page-2

## ► REFERENCES

- BPIE. (2011). *Europe's buildings under the microscope*.
- International Energy Agency. (2015). *Energy efficiency market report*.
- Algemene Directie Statistiek <http://statbel.fgov.be/>
- WWF, Ecofys, OMA. (2011). *The energy report 100% renewable energy by 2050*.
- Bartiaux, F., Vekemans, G., Gram-Hanssen, K., Maes, D., Cantaert, M., Spies, B., & Desmedt, J. (2006). *Socio-technical factors influencing Residential Energy Consumption SEREC*.
- BPIE. (2011). *Europe's buildings under the microscope*.
- Kadastrale statistiek van het gebouwenpark [http://statbel.fgov.be/nl/statistieken/cijfers/economie/bouw\\_industrie/gebouwenpark/](http://statbel.fgov.be/nl/statistieken/cijfers/economie/bouw_industrie/gebouwenpark/)
- Baldwin, R. (2014). From Regulation to Behaviour Change: Giving Nudge the Third Degree. *The Modern Law Review*.

The main reasons for placing wall insulation were...

Even if I decided to place wall insulation, these were the reasons that made me hesitate:

### Survey

The survey consists of a questionnaire and a choice experiment. In a first phase, it was sent out to 1983 staff members of Hasselt University.

The response rate was of 15,3% (303 responses)

The scope of the **questionnaire** is to verify if arguments of the house owners in favour to renovate are mostly rational and the negative arguments are mostly heuristic:

$$H_a \Sigma(R+) > \Sigma(H+) \quad \text{and/or} \quad \Sigma(H-) > \Sigma(R-)$$

Positive rational    Positive heuristic    Negative heuristic    Negative rational

### Preliminary results (one sided t-test, \*\* p < 0.05)

	Positive arguments Diff (Rational - Heuristic)		Negative arguments Diff (Rational - Heuristic)	
	mean Δ		mean Δ	
Wall insulation	1.29**	Σ(R+) > Σ(H+)	1.17**	Σ(R-) > Σ(H-)
Efficient windows	3.18**	Σ(R+) > Σ(H+)	0.27	Σ(R-) = Σ(H-)
Efficient boiler	3.08**	Σ(R+) > Σ(H+)	-0.11	Σ(R-) = Σ(H-)
PV panels	2.80**	Σ(R+) > Σ(H+)	1.07**	Σ(R-) > Σ(H-)
Solar water heater	2.77**	Σ(R+) > Σ(H+)	2.38**	Σ(R-) > Σ(H-)

- For both dwellers who placed the energy efficiency measure and who did not:
  - Positive arguments  
Rational positive arguments prevail over heuristic arguments for all measures.
  - Negative arguments  
For EE windows and boiler rational and heuristic negative arguments are balanced.  
For wall insulation, PV panels and solar water heater rational negative arguments still prevail over heuristic ones.

► Fig.1: Survey part 1: Questionnaire rational/ heuristic dwellers

Imagine you are the owner of a medium size house in Flanders and you have to choose between 4 hypothetical energy renovation measures:

Given a limited budget, which of the following measures would you choose?

	Windows Energy efficient glazing	Insulation Roof and wall insulation	Heating system Geothermal heat pumps	Renewable energy PV panels
Visual changes	minor	drastic	drastic	drastic
Level of thermal comfort	high	high	low	high
CO <sub>2</sub> reduction	25%	75%	75%	50%
Cost	12000 Euros	12000 Euros	12000 Euros	6000 Euros
Hassle during renovation	low	high	low	high
Advice from	professional	friend	professional	professional

Would you actually undertake this measure with these characteristics for your house?

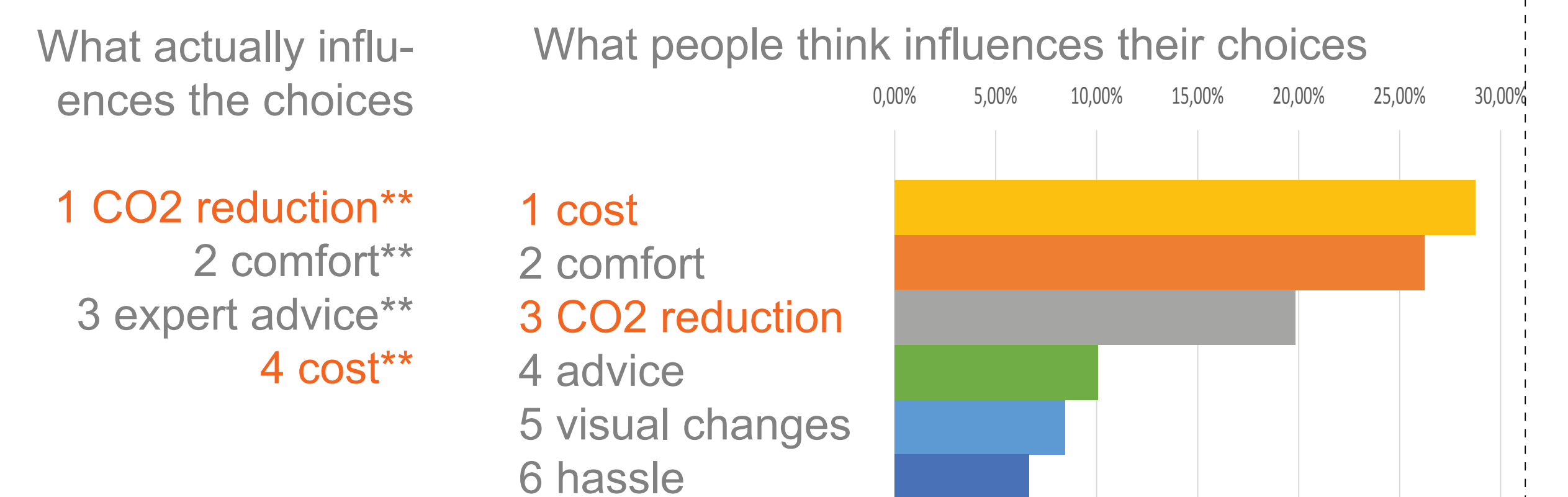
Yes  
 No

### Choice experiment

The purpose is to determine which monetary and non-monetary characteristics of the renovation measure overweight in choosing between competing energy efficiency measures.

### Preliminary results

- Cost, CO<sub>2</sub>, comfort and expert advice have an impact on all the measures.
- Visual changes and friend advice affect only the insulation and heat pumps. The impact on the aesthetics affects wall insulation, but is not the case for geothermal heat pumps. It might be explained by lack of knowledge, that is coherent with the feedback from an open ended question.
- The hassle level influences choices on windows and heat pumps while friend advice is relevant only in the case of roof and wall insulation.



Dwellers **overestimate the influence of cost** and underestimate the impact of CO<sub>2</sub> reduction over their own choices.

► Fig.2: Survey part 2: Choice experiment