

# Consumer energy efficiency decision making

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## I. Overview

The primary driver of global Greenhouse Gas (GHG) emissions is the production and consumption of energy. The European Commission identifies increased energy-efficiency (EE) as the most cost-effective and rapid way to reduce CO<sub>2</sub> emissions. Global investments in energy efficiency (EE) in the buildings, transportation and industry sectors are expected to grow by \$336 billion annually over the next two decades 2010–2029.

There is currently a large knowledge gap in terms of understanding how consumers make decisions which involve an energy consumption component. It is unclear which factors are salient in consumers' decisions, the relative importance of these factors and how these factors change by consumer group and product type. Thus, in response to the EU's targets for climate and energy for 2020 and 2030 (20% improvement in EE and 20% GHG emissions reduction by 2020; 27% EE goal and 40% emission reduction by 2030), there is interest in understanding the incentives that motivate energy-efficient behaviour for consumers, for example through purchasing more energy-efficient appliances, dwellings and transport.

We report here on a new EU funded project concerning behavioural aspects of energy decision making (CONSEED). We address the issue of consumer energy efficiency decision making and the related European efforts to address the Energy Efficiency Gap. We review existing models of energy investment decisions and examine the interaction of different consumers with existing energy efficiency policies aimed at influencing consumer decisions at the point of sale. We conclude with a preliminary assessment of EU policy recommendations based on green labelling for the energy sector.

## II. Methodological approach

Based on a critical review of existing energy/economy models, we study in-depth the various types of investments that different consumer groups make - for example, household appliance decisions versus machinery decisions for industrial consumers - and the full range of factors which could potentially be considered in the decision-making process for each category. We then develop a behaviorally robust and empirically tractable framework on how consumers make investment decisions that involve an energy component. This theoretical framework accommodates a range of theoretical models for different consumers across a variety of products and sectors. For instance, the model for choosing a particular appliance by a specific consumer in a particular sector may depend on consumer needs (such as type of economic activity, size of activity etc.), characteristics of the appliance itself (e.g. price, power, capacity, design features etc.), consumer characteristics (e.g. age, gender, income etc.), sectoral aspects (e.g. sector specific fuel prices, technological advances), geographical characteristics (e.g. country, urban or rural), policy aspects (e.g. taxation environment, financial supports, national and EU energy policy considerations etc.), and behavioural aspects (e.g. discounting, status quo bias, imperfect information etc.).

### III. Results

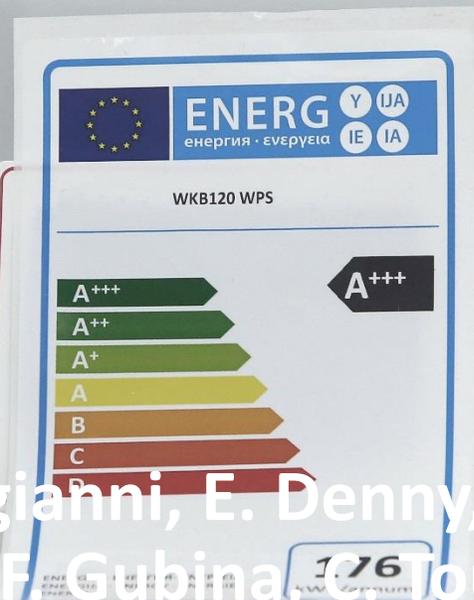
We discuss a state-of-the-art energy/economy decision models and their potential use in information provision policies for energy efficiency choices.

We present CONSEED's theoretical framework on energy choices and discuss its ability to incorporate a suite of differentiated energy consumer choice models. We link our models with EU Labelling Policy and discuss their ability to support for monetary usage labelling schemes.

### IV. Discussion and conclusions.

Future energy policy should be developed with a strong evidence-base. Our results show the need for a behaviourally consistent choice framework to assist the development of effective EU green labelling policies in the energy sector.

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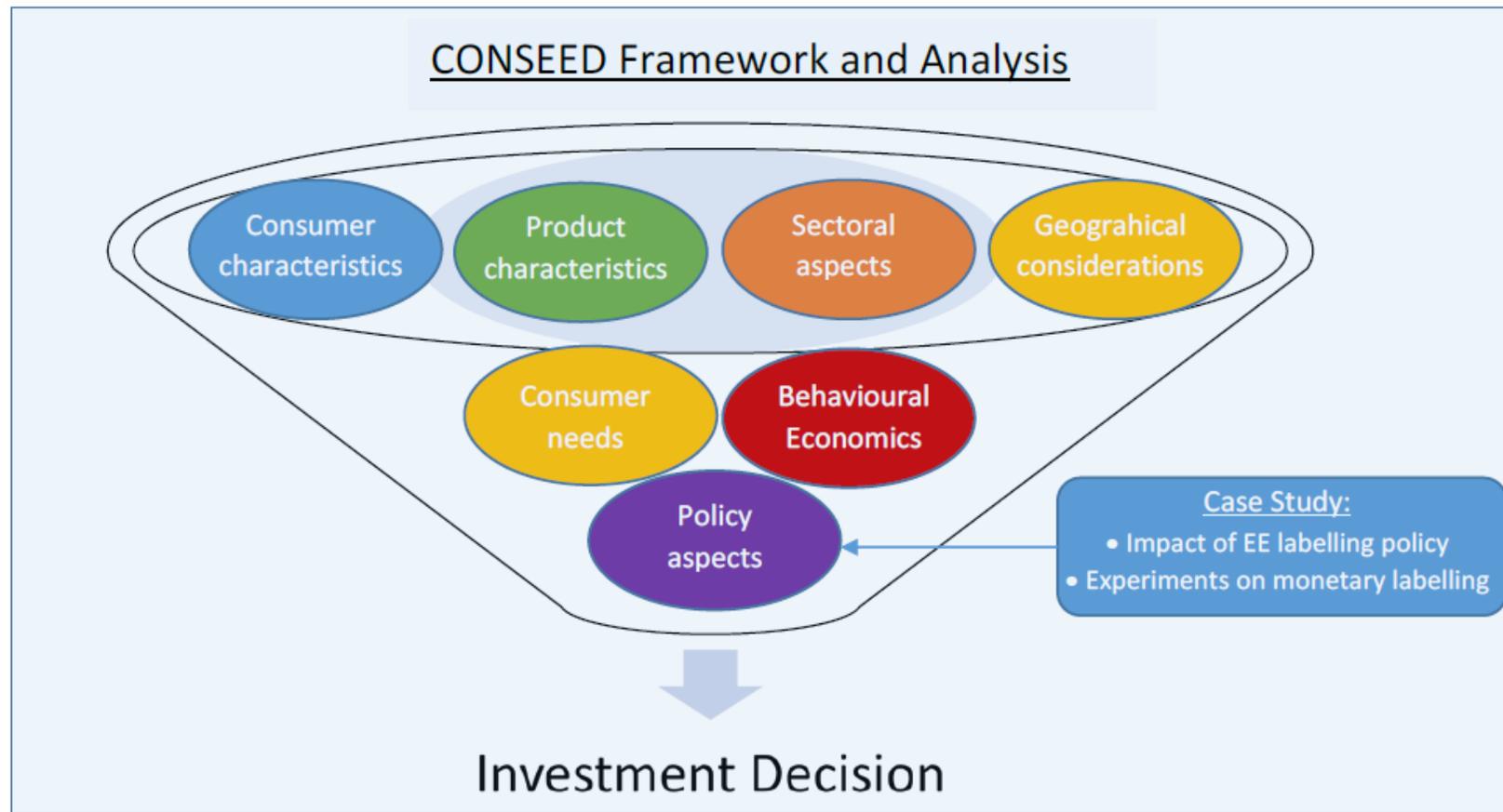
# Energy efficiency as new source of energy

- ✓ Energy efficiency is considered a priority within the framework of EU Energy Union.
- ✓ European Commission identifies increased energy-efficiency as the most cost-effective and rapid way to reduce CO<sub>2</sub> emissions
- ✓ Establishment of an ambitious target for 2030 (27% energy savings)
- ✓ The global investments in energy efficiency in the buildings, transportation and industry sectors are expected to grow by \$336 billion annually over the next two decades 2010–2029

# Energy efficiency gap

- ✓ A **large knowledge gap** in terms of understanding how consumers make decisions involving an energy consumption component.
- ✓ It is unclear which **factors are salient** in consumers' decisions, the **relative importance of these factors** and **how these factors change** by consumer group and product type.
- ✓ The consumers **fail to minimize the total costs** of their energy-consuming investments due to a range of market and non-market based failures.
- ✓ A **better understanding of consumer behaviour** is particularly important when it comes to addressing this gap and encouraging more efficient purchases.

# Aspects considered in the consumer investment decision



# About CONSEED

*We aim to better understand how consumers make energy efficiency decisions:*

- *Do they use energy efficiency labels?*
- *What information are they looking for?*

- Focus groups, surveys & experiments
- 3 sectors: cars, buildings and appliances/machinery
- 5 focus countries
- 5 research partners



# CONSEED project - Objectives

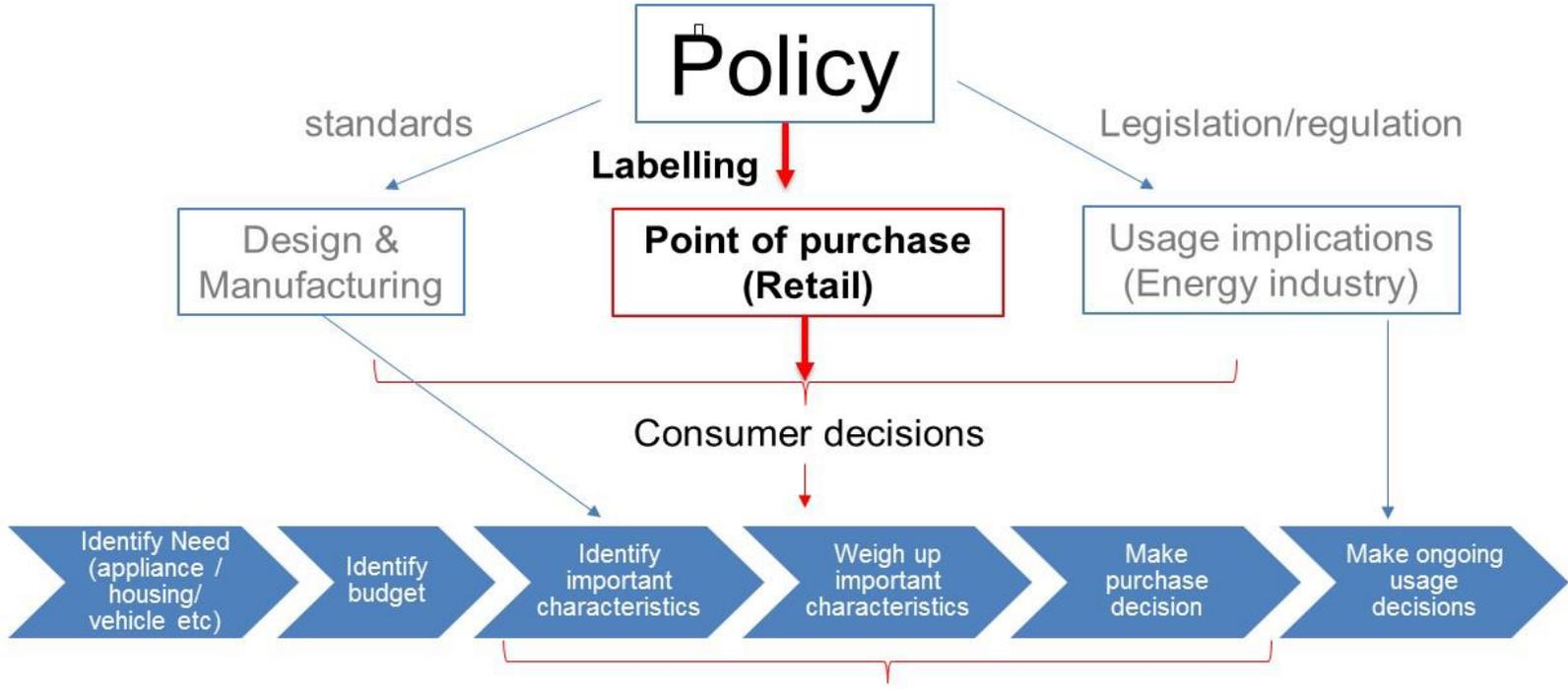


# Positioning of CONSEED into the energy landscape

CONSEED focusses on the labelling directives and the Energy Star programme

## 'The Big Picture'

A 'high level' view of the field of Energy Efficiency Policy



The CONSEED project

# Modelling consumer behaviour in energy efficiency investments

| Reference                     | Subsector  | Country     | Main conclusions  |
|-------------------------------|------------|-------------|---|
| Sammer and Wüstenhagen (2006) | Appliances | Switzerland | The price premium for a A-labelled washing machine versus C-labelled and B-labelled is 30% and 15%, respectively<br>The price premium for a premium brand washing machine compared with a non-name product is 50% |
| Galarraga et al. (2011a)      | Appliances | Spain       | The price premium for a dishwasher with the highest EE label is 16%   |
| Galarraga et al. (2011b)      | Appliances | Spain       | The price premium for a refrigerator with highest EE label is 9%  |
| Langley et al. (2012)         | Appliances | EU          | With both new design labels respondents are willing to pay more comparing with the current EE label (e.g. between €2 and €4 more in the bidding exercise)   |
| Ward et al. (2011)            | Appliances | USA         | Consumers are, on average, willing to pay an extra \$250-\$350 for a refrigerator that has been awarded the ENERGY STAR label   |

| Reference              | Subsector              | Country     | Main conclusions   |
|------------------------|------------------------|-------------|--|
| Brounen and Kok (2011) | Residential properties | Netherlands | EPC price-premiums compared to D rated homes: A = 10%; B = 5.5%; C = 2%; E = -0.5%; F = -2.5%; G = -5%   |
| Hyland et al. (2013)   | Residential properties | Ireland     | 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)   | Residential properties | UK          | EPC price-premiums compared to D rated homes: A/B = 5%; C = 1.8%; E = -0.7%; F = -0.9%   |
| Kok and Kahn (2012)    | Residential properties | USA         | ENERGY STAR labelled homes sold for 9% more than non-labelled homes  |
| Galarraga et al., 2014 | Vehicles               | Spain       | Vehicles labelled A and B are sold at prices 3 to 5.9 percent higher than those with similar characteristics but lower energy-efficiency labels  |
| Alberini et al. 2014   | Vehicles               | Switzerland | The effect of the label on price is estimated to be 6-11%  |

# Behavioural energy/economy modelling

HR approaches - DCE approaches - Socioeconomic/cultural models

## Focus groups

- Local and regional level

## Consumer Surveys

- National level

## Field trials

- Local for in-store trial (appliances and cars)
- National for online trials (property)

## Discrete Choice experiments

- National level

# Modeling framework

$$\begin{aligned} \text{Decision}_{ij} = & \alpha + \sum_1^n \beta_n (\text{consumerneeds}_{i,n}) + \sum_1^r \delta_r (\text{productcharacteristics}_{j,r}) \\ & + \sum_1^c \gamma_c (\text{consumercharacteristics}_{i,c}) + \sum_1^s \pi_s (\text{sectoral aspects}_{i,s}) \\ & + \sum_1^g \varpi_g (\text{geographical characteristics}_{i,g}) + \sum_1^p \kappa_p (\text{policy aspects}_{i,p}) \\ & + \sum_1^b \sigma_b (\text{behavioural aspects}_{i,b}) + e_i \end{aligned} \quad (2)$$

# Specific sub-models

| <i>Consumer group</i> | <i>Sub-sector</i>                    |
|-----------------------|--------------------------------------|
| Households            | Appliances, properties and transport |
| Agricultural sector   | Machinery/Appliances and transport   |
| Services sector       | Appliances, properties and transport |
| Industry sector       | Machinery/Appliances                 |

## Random Utility Models [RUMs]

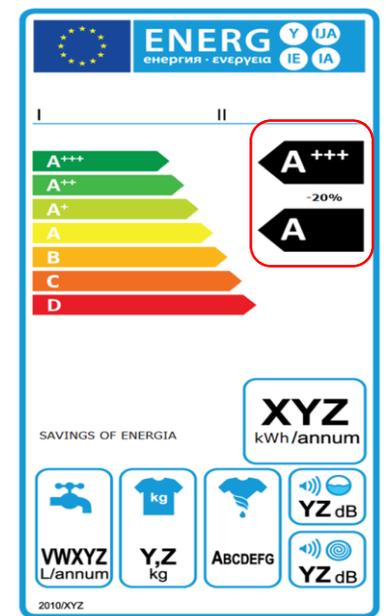
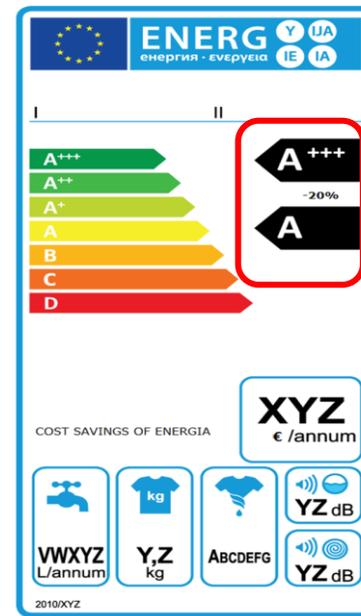
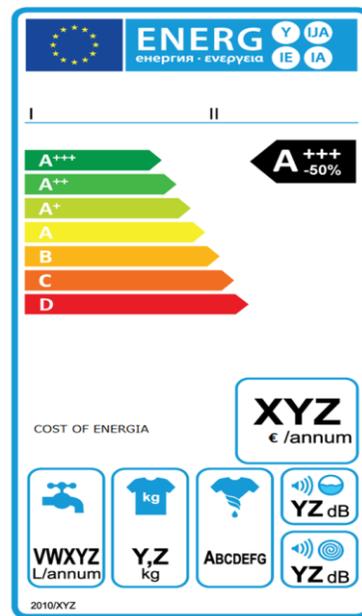
$$U_{ij} = V_j(X_i) + \varepsilon_{ij} \text{ or } P(j) = P(V_j(X_i) + \varepsilon_{ij} > V_k(X_i) + \varepsilon_{ik}) = P[\varepsilon_{ik} < \varepsilon_{ij} + V_j(X_i) - V_k(X_i)]$$

## Hedonic Regression Analysis [HRs]

$$P(z) = p(z_1; z_2; \dots; z_n) \text{ or } \ln(P_i) = a + \beta z_i + \varepsilon_i$$

# Testing information provision through labels

Use of DCE models in information provision policies for energy efficiency choices – Labels with physical versus monetary information



# Implicit Discount Rate

Individuals severely discount future benefits.....

implying a non-attentativeness for energy efficient appliances.....

therefore neglecting future monetary benefits from reduced operational costs...

opting for immediate benefits, i.e. lower upfront costs

# Closing remarks

What if varying behavior across phenomenally identical situations does not imply lack of rationality for the consumer but lack of complete information for the observer?

Need for a behaviourally consistent choice framework to assist the development of effective EU green labelling policies in the energy sector.

# Thank you for listening!

## More info at:



[www.conseedproject.eu](http://www.conseedproject.eu)



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