OECD EPIC Survey:

Analysis of energy-related data

Helene Ahlborg and Kavya Michael, Chalmers University of Technology
Katherine Hassett, OECD Environment Directorate

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BETTER POLICIES FOR BETTER LIVES

Contributors

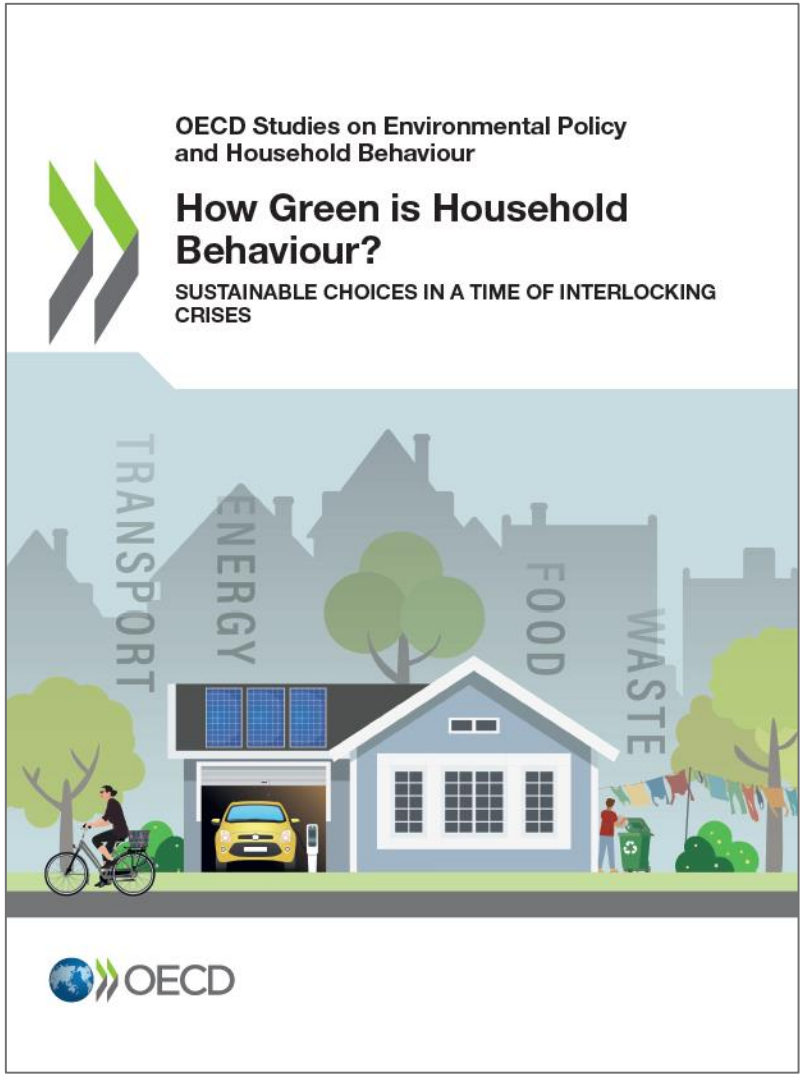
OECD

- Katherine Hassett
- Rose Mba Mébiame
- Ioannis Tikoudis
- Nicolina Lamhauge

External contributors

- Aline Mortha (Waseda University)
- Miwa Nakai (Fukui Prefectural University)
- Helene Ahlborg (Chalmers University of Technology)
- Kavya Michael (Chalmers University of Technology)
- Olufolahan Osunmuyiwa (Chalmers University of Technology)
- Toshi Arimura (Waseda University)
- Nick Johnstone (IEA)
- Ugur Ozdemir (University of Edinburg)

Third round of the OECD Survey on Environmental Policies and Individual Behaviour Change (EPIC)



9 COUNTRIES

- Belgium
- Canada
- France
- Israel
- Netherlands
- Sweden
- Switzerland
- United Kingdom
- United States

4 AREAS

- Energy use
- Transport
- Waste practices
- Food consumption

+17 000

Total sample size

Survey implementation

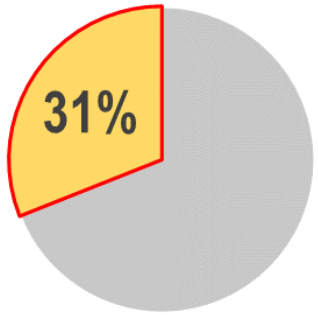
- **Target sample:** General public over 18 with full or partial responsibility for household expenses (e.g. utility bills, appliance purchases)
- **Online questionnaire**, participants were provided **compensation**
- Recruitment: **Ipsos' panel** with quotas for gender, age, region and income
- **Quality control:** Observations were screened for speeders (less the 1/3 of section-specific and country-specific median completion time), straight liners, item non-response; drop out rate: 26%
- **Post-stratification weights** based on gender, age, region and income

A few takeaways from the descriptive analysis

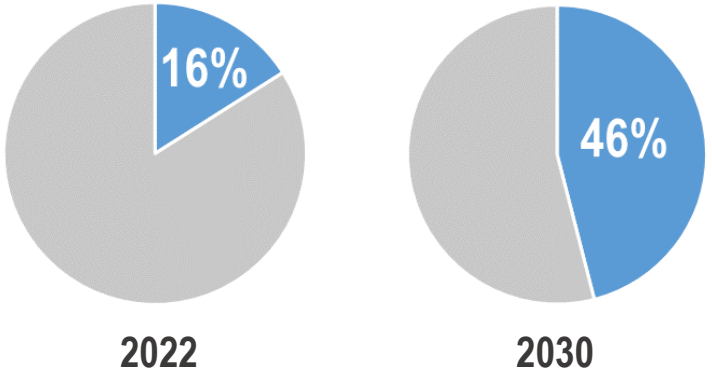
- Responses point to some **cognitive dissonance**
  - Households are willing to change, but don't want to pay for it
  - Environmental considerations appear disconnected from certain behaviours (e.g. food consumption, transport habits)
- Households tend to engage most in **low-effort, low-cost and convenient** activities
- A central cross-cutting finding is that **affordability, availability and convenience** are key to changing household behaviours
- This reinforces policy priorities such as **making sustainable options available** (e.g. investing in public transport and EV charging infrastructure), **providing financial support** for technology adoption (e.g. targeted subsidies), and **improving the convenience** of sustainable options (e.g. kerbside collection of recyclables)

Analysing energy choices: context and motivation

Building sector as a share of global CO_2 emissions in 2019 (IPCC, 2022)

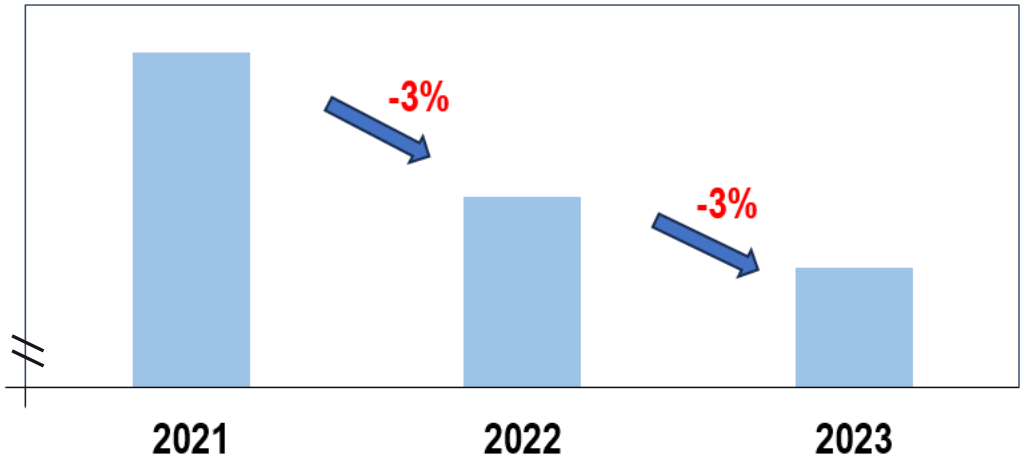


Share of renewable energy in the total energy consumption of buildings (IEA, NZE scenario)



Global energy demand in 2050 (IEA, 2021)

Electricity consumption in Europe (IEA, 2023)



Research question and key findings

- How can public policies support households in reducing energy use, investing in low-emissions energy technologies and switching to renewable electricity?

  → We assess: 1) **determinants** of household behaviour with respect to the above and
  2) **willingness to pay** for renewable electricity

- **Findings:**
  - Tenure status and residence type have a strong impact on energy efficiency investments
  - Financial considerations and environmental attitudes are both important in determining conservation and installation decisions
  - Households are willing to pay more for renewable energy
  - Substantial cross-country variation exists in reported behaviours and willingness to pay

Household profiles by reported behaviours

Energy conservation:

- How often do you do the following in your daily life?
  - ❑ Turn off the lights when leaving a room
  - ❑ Only run full loads of laundry/dishes
  - ❑ Air dry laundry
  - ❑ Minimise the use of heating and cooling
  - ❑ Minimise hot water use

Investment in low-emission energy technologies:

- Have you installed any of the following items over the past ten years in your current primary residence?
  - ❑ Highly energy-efficient appliances
  - ❑ Energy efficient windows
  - ❑ Thermal insulation
  - ❑ Heat pump
  - ❑ Solar panels

- Latent class analysis is used to define household profiles based on patterns in responses (Eliason and Hagenaars, 1990; Goodman, 1974; Lazarsfeld, 1950)

Household profiles: energy conservation

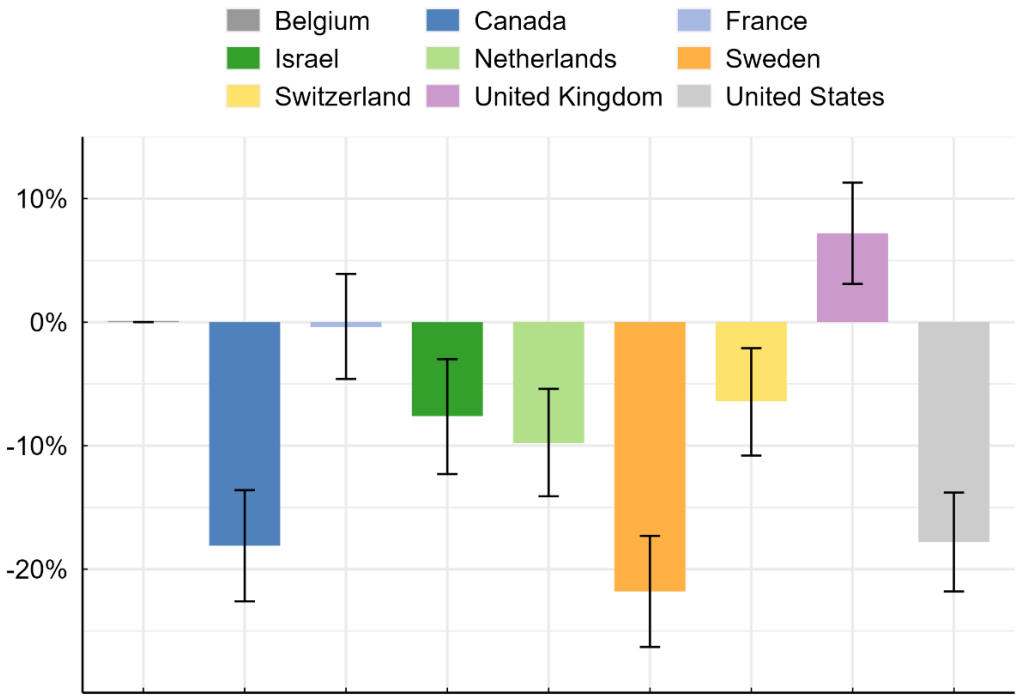
Household profiles according to energy conservation

Class	Behaviour	Proportion of the sample
Non-conservers	Never/rarely conserve	35%
Conservers	Often/always conserve	65%

Select determinants of the likelihood of being a conserver household:

- Age (55+): +9%
- Income (5th quintile): -5%
- Energy poverty: +9 to +13%
- Environmentally concerned: +10%
- Sense of personal responsibility: +19%

Country fixed effects for household propensity of falling into the *conserver* class



Note: This figure displays country fixed effects coefficients. The base country is Belgium (1st column), which has a coefficient set to 0. Black lines represent the 95% confidence interval of the parameter estimates.

Investment in low-emissions energy technologies: household types

Latent class analysis results: investment in low-emissions energy technologies

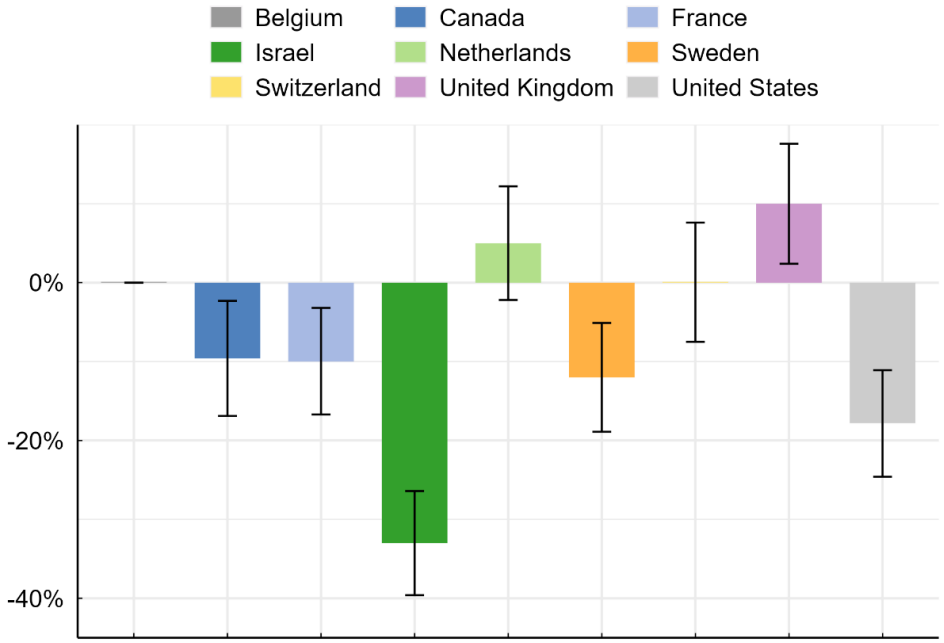
Category	Investment behaviour	Proportion of the sample
“Super investors”	Invest in all types of low-emissions energy technologies	14%
“Invest when possible”	Invest in some technologies, but report that investing in others is not possible	16%
“Low cost investors”	Invest only in low cost technologies and choose not to invest in higher cost technologies even though it is possible	27%
“Don’t invest”	Do not invest in all types of equipment	22%
“Cannot invest”	Report that it is not possible to invest in all types of equipment	13%
“Don’t know”	Report a lack of knowledge about equipment and/or the feasibility of installation	8%

Household profiles: Investment in low-emissions energy technologies

Select determinants of likelihood of being in the “invest when possible” group vs. the “do not invest” group:

- Age (55+): +21%
- Income (5th quintile): +10%
- Environmentally concerned: +8%
- Sense of personal responsibility: +13%

Country fixed effects for household propensity of falling into the “Invest when possible” vs. the “Do not invest class”



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Determinants of energy conservation behaviours

Sociodemographic and attitudinal determinants of household energy conservation behaviours

	Minimising heating and cooling	Minimising hot water use	Air drying laundry	Running only full loads of laundry/dishes	Turning off the lights
Female	+		+	++	++
Age	+	+++	++	++	++
Income	-	-	-		
Education	+	+			
Environmental concern	++	++	+	+	++
Sense of personal responsibility	++++	+++		+++	
Subjective energy poverty	+++	+++	++	-	
Objective energy poverty	++	++			
Subjective vulnerability	+			++	++
Change unnecessary	-	-		-	-
Knowledge	++	+	+	++	++
Conflicting goals	-	- -	-	- -	- -

Note: +, ++, +++, and ++++ indicate positive average marginal effects of less than 5 percentage points, 5-10 percentage points, 10-15 percentage points, and 15-30 percentage points significant at the 5% level. The inverse is true for the negative effects; the absence of a sign indicates that the effect is not significant.

Barriers to technology adoption

Percentage of respondents reporting that installing a given technology is not possible

Technology	Tenure status		Residence type	
	Owner	*Renter*	*House*	*Apartment*
Highly energy-efficient appliances	2%	24%	3%	19%
Energy-efficient windows	5%	37%	7%	29%
Thermal insulation	10%	49%	9%	43%
Solar PV	18%	59%	16%	56%
Solar water heating	17%	57%	17%	51%
Battery storage	12%	53%	14%	45%
Heat pump	17%	56%	17%	50%

Renters and those who live in apartment buildings are more likely to report that installing low-emissions energy technologies is not possible

Determinants of technology adoption

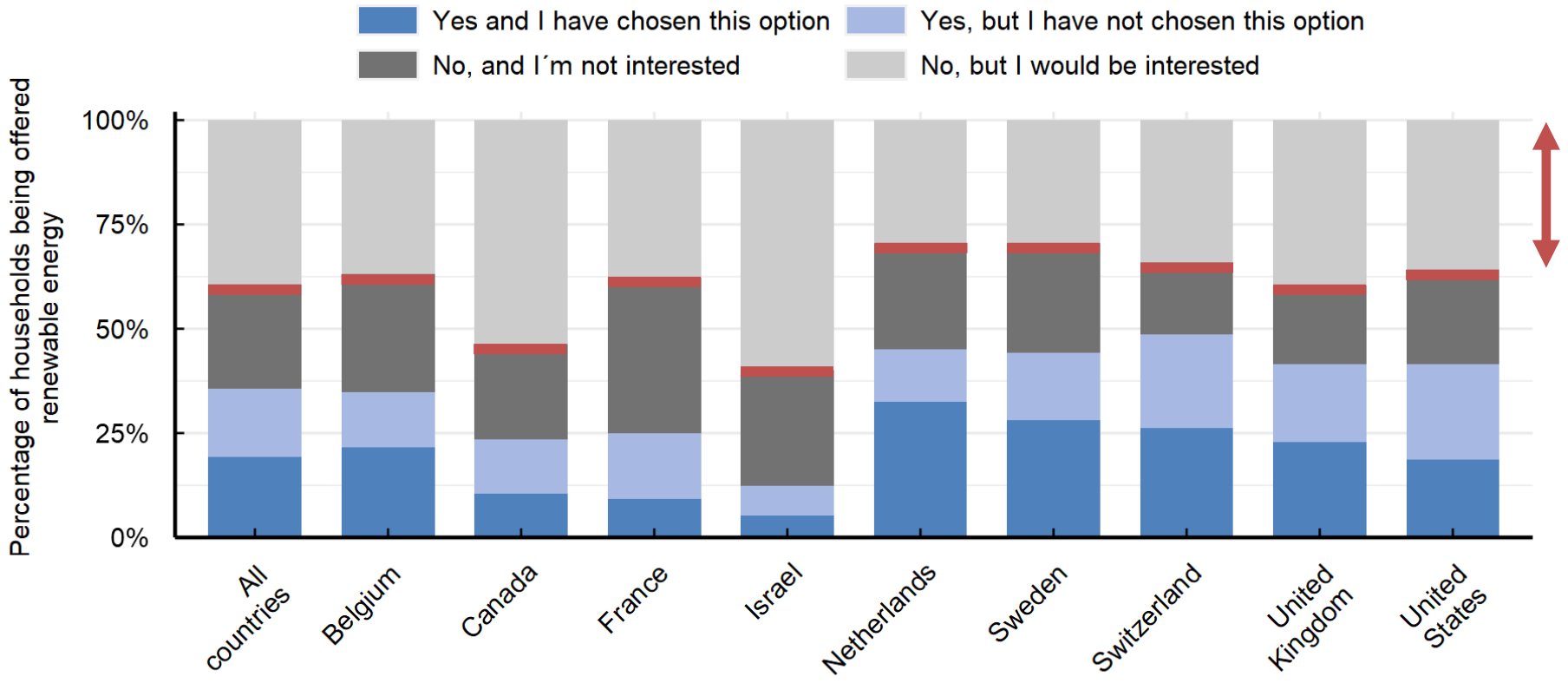
Sociodemographic and attitudinal determinants of household investment in low-emissions energy technologies

	Heat pumps	Thermal insulation	Energy-efficient windows	Highly energy-efficient appliances	Solar PV
Female	- -	-			- -
Age	- - -	++	+++	++	- - -
Income		++	+	+	+
Education	+	++	+	+	
Number of children	+	+	+	+	+
Residence size	++	+++		n/a	
Homeowner		++		+	
Access to outdoor space	++	n/a	n/a	n/a	+++
Living in a house				n/a	-
Environmental concern			++	++	
Sense of personal responsibility	+++	+++		+++	+++
Subjective vulnerability to climate change	- -			++	- -

Note: +, ++, +++, and ++++ indicate positive average marginal effects of less than 5 percentage points, 5-10 percentage points, 10-15 percentage points, and 15-30 percentage points significant at the 5% level. The inverse is true for the negative effects and the absence of a sign indicates that the effect is not significant.

Discrete choice experiment analysis

"Has electricity generated by renewable energy sources (e.g. wind, solar, tidal, geothermal, or hydropower) been proposed to you by your electricity provider?"



There appears to be high unmet demand for renewably-generated electricity

Discrete choice experiment: example choice set

Please imagine that you have the opportunity to select a new electricity provider for your household if you wish. Below you will be presented with three scenarios in which you can choose to switch to a new provider or to stay with your current provider. Please assume that, apart from the differences shown, the providers do not differ in any other way (e.g. regarding the reliability of the electricity supply).

Given the different options available in each of the following scenarios, please indicate which provider you would choose:

	Provider 1	Provider 2	Current provider
Change in price per kWh	USD 0.14/kWh (5% increase)	USD 0.15/kWh (10% increase)	USD 0.13/kWh (No change)
Change in amount of greenhouse gas emissions per kWh	347/g CO2e/kWh (10% decrease)	270/g CO2e/kWh (30% decrease)	386g CO2e/kWh (No change)
Your chosen provider:	○	○	○

Willingness to pay for GHG emissions reductions

Household willingness to pay to reduce GHG emissions intensity of electricity consumption

Country	Percent change in price for a 10% reduction in GHG emissions
Belgium	0.9%
Canada	3.9%
Israel	5.9%
France	2.1%
Netherlands	1.7%
Sweden	0.9%
Switzerland	9.0%
United Kingdom	2.1%
United States	4.8%

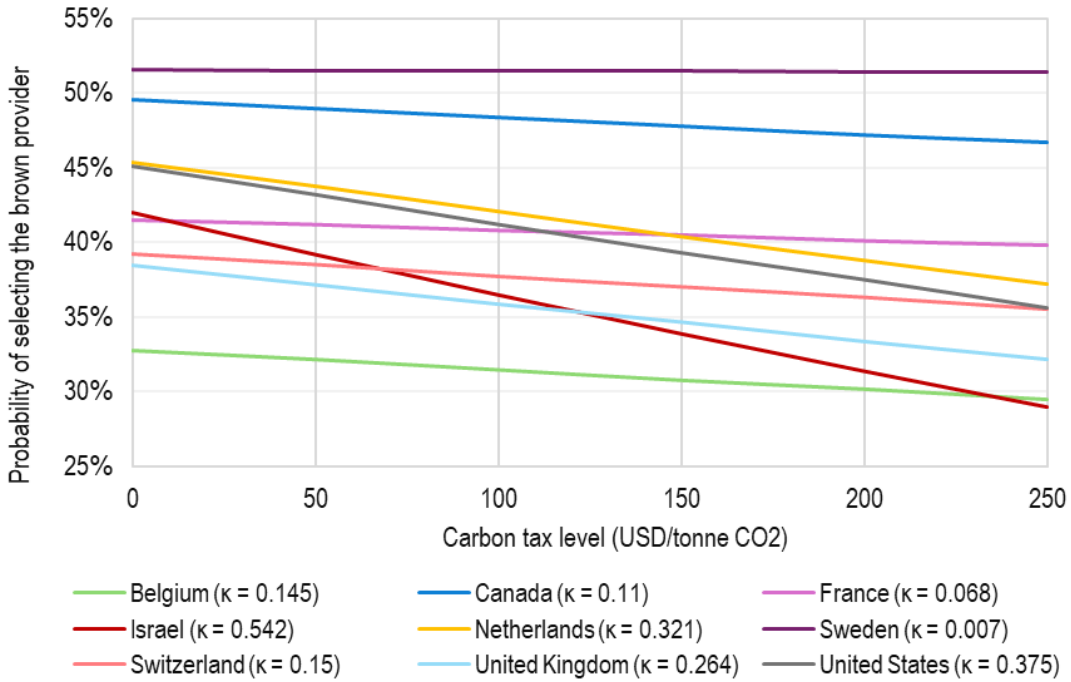
Note: Willingness to pay in Sweden is not significantly different from the base country, Belgium. Country-specific values are calculated based on the parameter estimates of Expanded Model 2.

Key findings

- Results indicate a positive willingness to pay for GHG reductions, but price premiums vary
- Variation in WTP could be driven by differences across countries wrt:
  - Assumptions about type of renewable energy
  - Average emissions intensity
  - Price fluctuations in 2022
  - Government support for renewables, public acceptance and information
- Evidence also points to a status quo effect among some groups

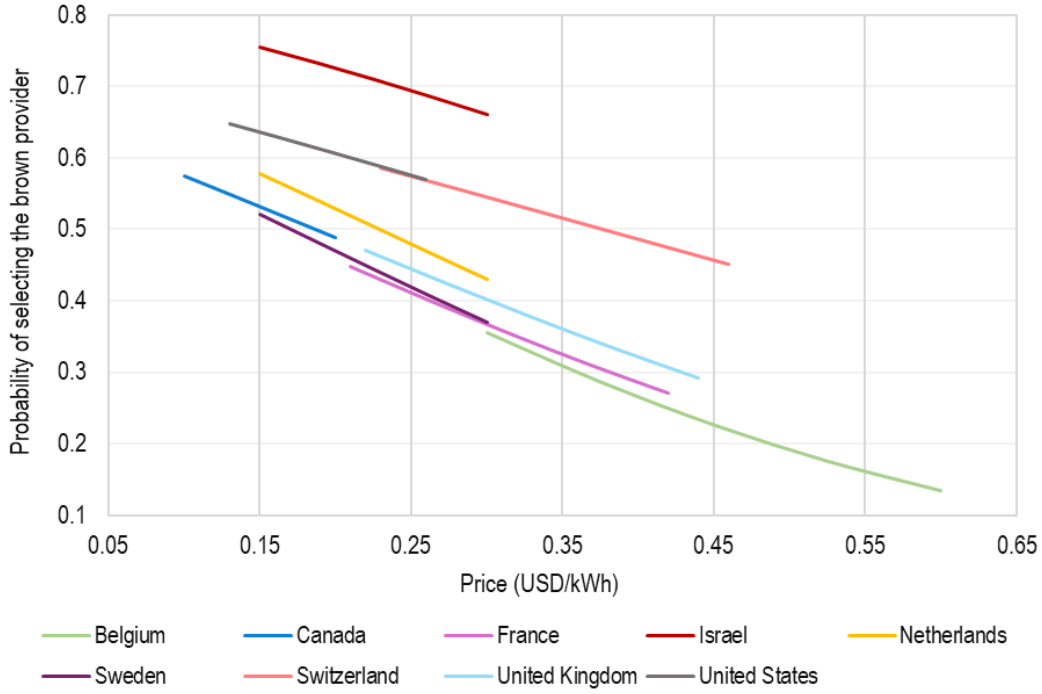
Impact of a carbon tax on household choices

Likelihood of choosing the brown electricity provider for varying carbon tax levels



Note: Kappa (κ) reflects the carbon intensity of electricity generation in a given country in $\frac{kg\ CO_2}{kWh}$.

Predicted probability of choosing the brown electricity provider at varying price levels



Note: Predicted probabilities displayed for only the price range covering $[p_c, 2p_c]$ where p_c is the average price of electricity in USD per kWh in country c.

Key observations and policy considerations

Those that rent and live in apartment buildings are less likely to install low-emissions energy technologies

→ Alleviate installation barriers for renters and apartment dwellers (e.g. green leases, on-bill financing)

Income impacts energy conservation and technology adoption, signalling the importance of financial considerations in these decisions

→ Improve the financial savings associated with energy conservation (e.g. inclined block rate pricing) and provide financial support for installing low-emissions energy technologies (e.g. targeted subsidies)

Environmental concern and a sense of personal responsibility determine energy conservation as well as investment in low-emissions energy technologies

→ Awareness campaigns could be expected to foster energy conservation and investments in technologies

Willingness to pay and reported behaviours vary considerably across countries

→ Local policy context is important to consider to more effectively encourage sustainable energy choices

Future work

- Other directions for future work could assess:
  - **Country differences** in more detail
  - How household behaviours may be related to **policy preferences**, **trust in institutions** and **trust in specific information sources**
  - The extent to which **attitudes** may have different impacts on behaviour among different socioeconomic groups

Future work

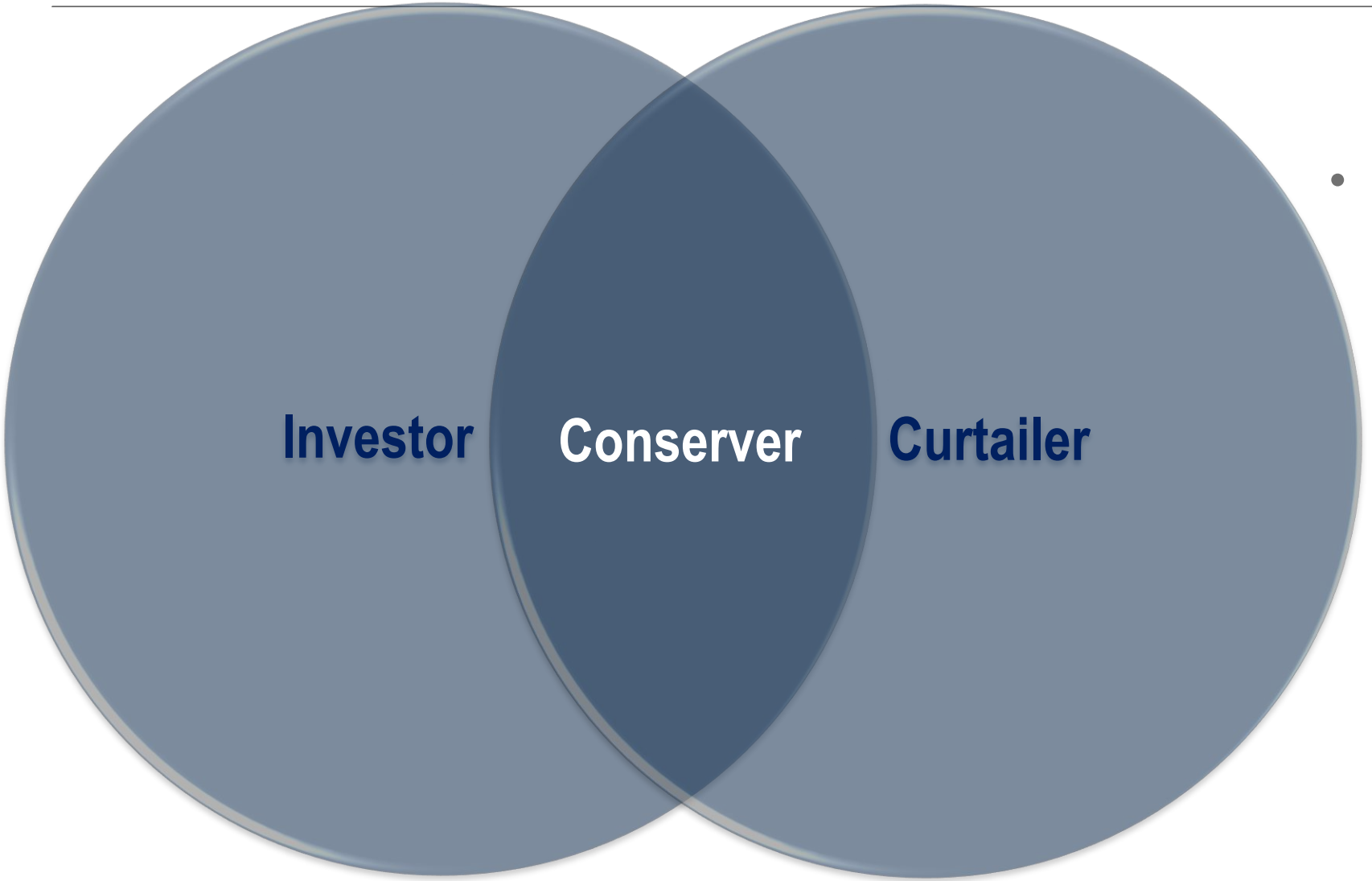
Helene Ahlborg, Kavya Michael, Anjali Ramakrishnan and Olufolahan Osunmuyiwa

Who is moving? Who is left behind? How do you ensure that policy does not leave groups behind?

- **Classify User Groups:** Analyse data to identify and categorize different user groups based on observed data
- Identify and target **high impact user groups** who have the potential to do more
- Identify the **energy poor and vulne**rable households who need support
- **Policy Recommendations:** provide a basis for country-specific policy mixes for identified user groups and connecting it to effectiveness and acceptability

Future work

Helene Ahlborg, Kavya Michael, Anjali Ramakrishnan and Olufolahan Osunmuyiwa



- What characterises each of these users?
  - Attitudes
  - Reasons for behaviour
  - Energy use
  - Country contexts
  - Socio-demographics

Future work

Helene Ahlborg, Kavya Michael, Anjali Ramakrishnan and Olufolahan Osunmuyiwa

Creating these users with data

- **Investor: Someone who invests in installing appliances but never or occasionally curtails**
  1. Strong Investor: Invests in all 10 appliances
  2. Medium Investor: Invests in ≥ 5 appliances (incl. LED Bulbs)
  3. Low Investor: Invests in < 5 appliances (incl. LED Bulbs)
  4. No Investor: Does not invest in any of 10 appliances

- **Curtailer: Someone who curtails but does not invest in any appliances (except LED bulbs)**
  1. Strong curtailer: selects 'ALWAYS' for all actions
  2. Moderate curtailer: selects 'occasionally', 'often', or 'always' for >1 appliance but not a non-curtailer (that is does not select 'never' curtails when asked)
  3. Low curtailer: Mixed action intensity
  4. All actions are never done

Future work

Helene Ahlborg, Kavya Michael, Anjali Ramakrishnan and Olufolahan Osunmuyiwa

*Conserver Profile: Someone who **invests and curtails** to the extent they can*

Strong Conserver | Medium Conserver | Neutral Conserver | Low Conserver

The profile will be based on three key information points:

- Reasons for energy use
- Frequency of curtailment or energy saving
- Investment in appliances

Thank you!

Contact:

Katherine.Hassett@oecd.org

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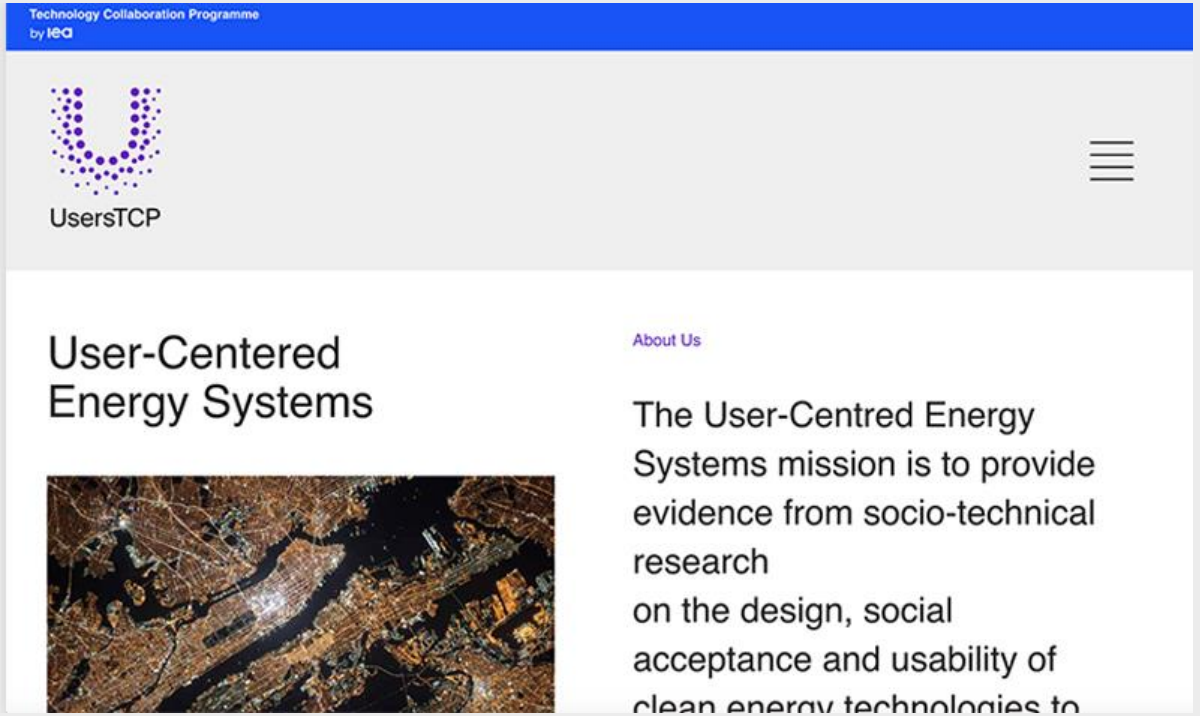
Contact:
admin@userstcp.org



User-Centred Energy Systems Academy

UsersTCP | Social License to Automate

UsersTCP | Public Engagement for Energy Infrastructure

UsersTCP | Peer-to-Peer Energy Trading

UsersTCP | CampaignXchange

UsersTCP | Hard-to-Reach Energy Users

UsersTCP | Behavioural Insights Platform

UsersTCP | Gender and Energy