CHEETAH

# D4.5 Scientific working paper on factors driving household acceptance of energy-efficiency policies

FINAL REVIEW DRAFT

**Lorraine Whitmarsh, Colin Whittle (Cardiff University)**

**Corinne Faure, Marie-Charlotte Guetlein, Joachim Schleich, Gengyang Tu (GEM)**

**Review: Elisabeth Dütschke, Fraunhofer ISI**



Publication date: 28th February, 2019

Document number: Version 1

Project deliverable: 4.5

**This project has received funding from the European Union's Horizon 2020 research and innovation Programme under grant agreement No 723716. This document only reflects the author's views and EASME is not responsible for any use that may be made of the information it contains.**

CHEETAH

## Project partners

The project *Changing Energy Efficiency Technology Adoption in Households* (CHEETAH) is a three-year Horizon 2020 research project running from 2016 to 2019. It has the following project partners:

GRENOBLE ECOLE DE MANAGEMENT
TECHNOLOGY & INNOVATION

CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD

Fraunhofer ISI

TU WIEN

TU Delft Delft University of Technology

BORGOC

european council for an energy efficient economy

*www.briskee-cheetah.eu/cheetah*

This project has received funding from the European Union's Horizon 2020 research and innovation Programme under grant agreement No 723716. This document only reflects the author's views and EASME is not responsible for any use that may be made of the information it contains.

# Table of Contents



# Tables



# Figures

# 1 Introduction

This scientific working paper is submitted as Deliverable 4.5 in the CHEETAH project. The CHEETAH project has the objectives of providing evidence-based input to energy efficiency policy-making by investigating the role of policy in household energy efficiency decision-making on three levels:

1) On the micro level, the project provides empirical evidence of household energy-efficiency technology choices and responses to policy employing large-sample household surveys in eight EU member states and micro-econometric analyses based on stated preferences discrete choice experiments.
2) On the meso level, the project explores the impact of policies affecting household energy efficiency decision-making in the residential sector in Europe up to 2030. The project uses inputs from the micro-level analysis in order to improve the representation of investment decisions in energy demand modelling tools.
3) On the macro level, CHEETAH explores the long-term macroeconomic impacts of changes in micro-economic decision-making and of energy efficiency policy on employment, GDP and exports in the EU up to 2030.

This Deliverable builds on our review of the literature on policy responses and policy acceptance (D3.3) and, including measures employed in the household survey (D4.3), reports on findings from a choice experiment conducted within four EU member states on factors shaping citizen support for energy efficiency policies.

This report consists of four sections:

- Chapter 2 provides the background to the experiment and reviews relevant literature on policy response and policy acceptance.
- In Chapter 3, the choice experiment methodology and measures are described.
- Chapter 4 then presents results of the choice experiment.
- Chapter 5 outlines conclusions and implications from the research.

# 2 Background and literature review

## *2.1 Citizen support for energy efficiency policies*

Improving energy efficiency is essential to help meet societal goals of addressing climate change, reducing fuel poverty and providing energy security. In recognition of this, the updated Energy Efficiency directive (Directive 2012/27/EU), set a target for 32.5% energy efficiency by 2030 for all EU countries (Statement/18/3997). This is intended to cover all stages of the energy chain – from production to final consumption – and is targeting the improvement of energy efficiency in buildings and the energy performance of products. Reaching this target is expected to: improve the energy security of EU countries through a 12% reduction in fossil fuel imports; lift between 515,000 to 3.2 million EU households out of fuel poverty through increasing the efficiency of the housing stock; and significantly contribute to the reduction of global greenhouse gas emissions by reducing primary energy consumption. It is also intended to align the EU's energy efficiency objectives with its Energy Union governance regulation and the targeted 40% reduction compared to the 1990 level of greenhouse gas emissions by 2030 (COM, 2014).

Energy efficiency policies are needed to encourage, promote and facilitate the uptake of energy efficient technologies and measures by householders. As residential energy consumption currently accounts for 25.4% of the total final energy consumption in the European Union (Eurostat, 2018), such uptake of energy efficiency by householders is required to meet the target of 32.5% energy efficiency by 2030.

Policies for energy efficiency in the EU include those which seek to provide information to consumers, those which are intended to incentivise or aid consumers, and those which regulate industry. In terms of providing information to consumers, the introduction of the mandatory EU Energy Label for household appliances and lighting (Council Directive

92/75/EC) and the Energy Performance Certificates (EPC) for buildings (Directive 2010/31/EU) have meant that consumers are now provided with energy consumption and performance information for each product or building. The EU Energy Label has been found to successfully increase purchases of more efficient appliances (Stadelmann & Schubert, 2018) as well as increase WTP for televisions (Heinzle & Wüstenhagen, 2012). Likewise, energy performance was positively related to higher purchase prices in a sample of 325,000 property transactions (Fuerst, McAllister, Nanda, & Wyatt, 2015). However, in a survey of homebuyers in the EU, only 50% (n= 3,155) saw the EPC before they made an offer. Of those, only 33% considered the EPC to be an important factor in their decision (Tigchelaar, Backhaus, & Best-Waldhober, 2011). Whilst the information provides guidance to the consumer, the consumer has to be active in their use and response to the information.

In terms of incentivising or aiding consumers, rebates may be used by utilities or governments to reduce the monetary impacts of policies or to set incentives for desired consumer behaviour. For instance, to reduce the impact of its environmental and social policy costs, the UK implemented a Government Electricity Rebate between 2014 and 2015 to mandate that all energy suppliers provided a £12 rebate to their customers. Between 2007 and 2010, the Italian government offered a tax rebate for consumers who bought refrigerators or freezers with the higher efficiency grades (A+ - A+++). Other schemes, such as feebates (or bonus-malus systems) aim to incentivise the uptake of energy efficient technologies through providing rebates or reductions on the more efficient product, whilst penalising (such as through fees or taxes) inefficient products. Generally, and in line with prospect theory (Kahneman & Tversky, 1979), consumers typically prefer subsidies to taxation (Drews & van den Bergh, 2015; Eriksson, Garvill, & Nordlund, 2008). However, subsidies may lead to free riding, i.e. consumers would have acquired an energy-efficient technology even without the subsidy (e.g. Olsthoorn et al. 2017). Galarraga et al. (2013) find that a subsidy promotes adoption of energy efficient appliances, but a tax more effectively reduces sales of low efficiency appliances. Across the EU, different methods of incentives and aid have been tried (such as the UK's Green Deal, Spain's "Renove" plan, Germany's Stromspar-Check-PLUS for low-income households) and are generally intended to reduce the barriers (mainly financial) that consumers may face when seeking more efficient appliances or buildings. However, they still require the consumer to be motivated to seek energy efficiency and be willing and able to make the investment.

Policies which seek to regulate energy performance include EU's Ecodesign Directive (Directive 2009/125/EC), which uses minimum energy performance standards (MEPs) to remove the least energy efficient product or component from the market. Similarly the Energy Performance of Buildings Directive mandated member states to set minimum energy performance standards for new buildings, major renovations and the replacement or retrofit of building elements (Directive 2010/31/EU). The source of energy consumed is also the focus of EU policy, with the Renewable Energy Directive II (Directive 2009/28/EC) mandating that a minimum of 14% of the energy consumed in road and rail is from renewable sources by 2030. Such policies mean that the range of products and buildings that consumers may choose from become increasingly energy efficient, meaning that gains in energy efficiency are made with limited consumer engagement. From an economics perspective, standards are often considered to be less efficient than economic policy instruments such as taxes, but they may be considered by consumers as being less coercive.

Understanding citizens' perspectives on energy efficiency policies and the policy context is important for policy effectiveness and success (Dietz & Stern, 2008). Normatively, citizen perspectives are important to consider if policy-making is to be democratic and accountable; substantively, citizens possess valuable knowledge and experience, which can add unique perspectives to policies and ultimately improve their quality; and instrumentally, policies which take account of citizens' perspectives are more likely to be accepted (Fiorino, 1990; Stirling, 2006; Wesselink, Paavola, Fritsch, & Renn, 2011). This paper therefore contributes to understanding how citizens respond to different energy efficiency policy options in order that future policies can take account of these perspectives.

## 2.2 Factors influencing policy response

Studies have found broadly two sets of inter-related factors which predict policy support, acceptance or acceptability[1]: policy-specific beliefs (e.g., policy effectiveness) and personal or social characteristics (e.g., environmental identity, income). Policy-specific beliefs relate to how individuals perceive the policy on a number of dimensions, such as whether they think it will be effective or whether it will be costly to them (Eriksson et al., 2008; Schmocker, Pettersson, & Fujii, 2012). Personal/social characteristics relate to the values and beliefs that individuals' hold, as well as their socio-demographic characteristics or nationality, which may then influence their perceptions of the policy. In relation to energy efficiency policies, for example, individuals' environmental beliefs, values, knowledge and income are likely to influence how the individual responds to a policy on environmental issues (e.g. Eliasson & Jonsson, 2011).

The design characteristics of a policy will influence how individuals perceive the policy, which will in turn, determine how they respond to the policy. Understanding how policies are perceived and how these perceptions influence individuals' responses is important for acceptance. For instance, how coercive the policy is, including whether it is push (constraining choice) or pull (maintaining or increasing freedom of choice; Schuitema et al., 2011) based; the target of the policy, such whether it is a difficult to change behaviour or an easy to change behaviour; and what topic or problem the policy relates to will all influence how effective, fair and acceptable the policy is perceived as being (e.g. de Groot & Schuitema, 2012).

### *2.2.1 Policy-Specific Beliefs*

*Perceived Effectiveness*. Findings from both choice experiments and surveys consistently show that the perceived effectiveness of a specific policy positively influences or is related to greater acceptance, acceptability, and support for the policy (Cools et al., 2011; Dreyer & Walker, 2013; Eliasson & Jonsson, 2011; Eriksson et al., 2008; Furst & Dieplinger, 2014; Garling & Schuitema, 2007; Kim, Schmocker, Fujii, & Noland, 2013; Schmocker et al., 2012). Individuals have also shown a preference for policies that they perceive as being more effective at solving the targeted problem (Bostrom et al., 2012) and individuals are more accepting of a policy when they perceive the policy as having positive outcomes and direct benefits for themselves (e.g. reduced traffic congestion; Furst & Dieplinger, 2014; Schuitema, Steg, & Rothengatter, 2010). Choice experiments show household policy acceptance is higher if it generates more environmental benefits, such as reductions in greenhouse gas (GHG) emissions (Gracia, Barreiro-Hurlé, & y Pérez, 2012; Hackbarth & Madlener, 2016; Murakami, Ida, Tanaka, & Friedman, 2015; Susaeta, Lal, Alavalapati, & Mercer, 2011; Tanaka, Uno, Shiomi, & Ahn, 2014), reductions in air pollution (S. Dietz & Atkinson, 2010), or protection of the natural habitat (Susaeta et al., 2011). Indeed, Alberini, Bigano, Ščasný, and Zvěřinová (2018) found that participants in Italy and the Czech Republic were, respectively, willing to pay €133 and €94 per ton of $CO_2$ emissions avoided due to an efficiency policy.

Whilst it is frequently found that perceived effectiveness leads to a more positive response, there has been some suggestion that causality could also go the other way, with more positive attitudes leading people to believe the policy will be more effective (Eliasson & Jonsson, 2011). Furthermore, Rosentrater et al. (2013) found that their participants were willing to support policies without necessarily believing that they were an effective way of tackling the problem, which suggests that other factors than perceptions of the effectiveness of the policy are involved (e.g. they preferred the low-cost policies that would impact on them less). Similarly, Rhodes, Axsen, and Jaccard (2014) found that giving individuals information about a range of climate and energy efficiency policies had little effect on their acceptability, which was more a product of their political ideology. This resistance of policy support to information is consistent with 'motivated reasoning' whereby information processing and use is biased to support one's goals and beliefs (Kunda, 1990). These results

[1] In this paper, we generally do not distinguish between support for policies, policy acceptance and policy acceptability but rather treat these concepts interchangeably. 'Support' typically implies a more active assessment, while 'acceptability' and 'acceptance' are considered to be a rather passive assessment. Usually, 'acceptability' refers to an attitude elicited prior to the implementation of a policy while 'acceptance' refers to an ex-post assessment (see, for example, Batel et al., 2013).

highlight the importance of examining not only policy-specific beliefs, but also more general ones, such as environmental or political values.

*Personal Cost*. Whilst individuals' attitudes are positively influenced by their anticipation of personal benefits, there is evidence that individuals' policy responses are negatively influenced by their perceptions of the personal cost of a policy (Bechtel & Scheve, 2013; Shwom, Bidwell, Dan, & Dietz, 2010). Cost can be considered as the actual costs associated with following a policy or as the perceived costs. Furthermore, not all the costs considered are monetary. For instance, a policy can be considered high-cost if it targets behaviours which are perceived as being particularly difficult to change (e.g. car use; Schuitema et al., 2010). A policy may, for example, also be perceived as high-cost if it is perceived as infringing on personal freedoms, such as choice (Attari et al., 2009; Kim, Schmöcker, Fujii, & Noland, 2013; Schmocker et al., 2012) and/or the policy could have a large, direct effect on the individual (e.g. $CO_2$ taxes and high-frequency car users; Hammar & Jagers, 2007). Other interpretations of cost may be perceived reductions in well-being and threats to financial welfare (Drews & van den Bergh, 2015).

By and large, studies have found that a greater actual and/or perceived cost of a policy is related to a reduction in support for the policy (see also: Zverinová, Ščasný, & Kyselá, 2014). For instance, cost of policies to reduce GHG emissions was negatively associated with policy choice in the UK, Czech Republic and Poland (Ščasný, Zvěřinová, Czajkowski, Kyselá, & Zagórska, 2017), whilst cost of a climate change mitigation project was negatively associated with selection in Scotland (Glenk & Colombo, 2013). Lundhede, Jacobsen, Hanley, Strange, and Thorsen (2015) specifically investigated acceptance of payment of policy through taxes and found greater tax payments were negatively associated with choice of conservation policy. However, de Groot and Schuitema (2012) found perceived cost of the policy interacted with the coerciveness of the policy. They found that policies targeting high-cost (more difficult) behaviours were less acceptable than policies targeting low-cost (easier) behaviours and that push measures were less acceptable than pull measures. However, if a push measure targeted a low-cost behaviour, it was almost as acceptable as a pull measure (and push measures targeting high-cost behaviours were deemed very unacceptable).

*Perceived Fairness*. Within the policy response literature, fairness is divided into three types. General fairness is an assessment of the fairness of the policy itself; distributional fairness relates to equality and whether the policy equally advantages/disadvantages everyone; and procedural fairness relates to how the policy is developed and introduced. All three have been found to positively relate to policy acceptance (Dreyer & Walker, 2013; Kim, Schmocker, et al., 2013; Schmocker et al., 2012). Kim, Schmöcker, et al. (2013), also found that scenario fairness (how fair the policy is perceived to be for oneself) was actually the strongest predictor of acceptance.

Studies that have explored preferences for policies have found that progressive cost distributions are preferred to regressive cost distributions, and that the private cost is negatively related to the choice of policy (Brannlund & Persson, 2012). Furthermore, when considering the design for an emissions reduction policy, an accountability principle (those who are most responsible pay the most) was preferred when deciding who should bear the burden of emission reductions (see also: Bechtel & Scheve, 2013; Cai, Cameron, & Gerdes, 2010; Schleich et al., 2016). In London, participants preferred policies in which the polluters (motorists) and main beneficiaries (residents in the city centre) paid more for pollution tax than those not in these groups (Dietz & Atkinson, 2010). Likewise, to achieve EU's GHG emission reduction targets, households from the Czech Republic and the UK significantly prefer the distribution of policy costs based on the emissions of the EU countries to income-based or per-capita based rules (Ščasný et al., 2017).

*Social Norms*. An aspect that is likely to be related to perceptions of fairness is social norms i.e. perceptions that others are also going to accept the policy and respond appropriately (Cialdini, Kallgren, & Reno, 1991). Overall, policy response studies have indicated that the higher the perceived social norm is to accept the policy, the higher the acceptance of the policy is (e.g. Adaman et al., 2011; Cools et al., 2011; de Groot & Schuitema, 2012; Furst & Dieplinger, 2014). Perceptions of social norms may also interact with the level of coerciveness. For instance, when a majority of the public is perceived as supporting a push

measure, then the policy was evaluated as being almost as acceptable as a pull measure (de Groot & Schuitema, 2012).

### *2.2.2 Values, beliefs and personal characteristics*

*Trust*. The influence of trust on policy response is frequently explored. In particular, trust relating to politicians and government has been explored, but also trust in other citizens and related agencies has been explored. Trust in politicians has been found to relate to greater support and a more positive attitude towards policies in a number of studies (Hammar & Jagers, 2006b; Harring & Jagers, 2013; Jagers & Hammar, 2009). Indeed, trust in governments has been associated with greater support for a carbon tax policy (Rhodes, Axsen, & Jaccard, 2017). Findings are mixed for generalised trust in other people (who they do not necessarily know), however. Hammar and Jagers (2006b) found that it did not predict policy support, but Harring and Jagers (2013) found that interpersonal trust (an alternative term for generalised trust) was predictive of people's attitudes towards a policy.

At a broader level, Adaman et al. (2011) showed that trust in the institution responsible for the implementation of the project had a strong, positive effect on WTP. Similarly Dietz et al. (2007) found that the levels of trust in the institutions involved in the policy-making were important. They found that the more the participant trusted environmentalists and the less they trusted industry predicted greater support for climate change mitigation policies. However, trust in government agencies (such as the Department for Energy) did not have a significant effect on support.

*Environmental beliefs and identity*. While the influence of environmental beliefs and values on everyday environmentally-impactful activities (e.g., energy consumption) is typically weak (due to competing motivations and contextual barriers), these values exert a stronger influence on environmental policy support (Steg & Vlek, 2009; Stern, 2000). For example, pro-environmental beliefs were found to have an indirect effect (via an awareness of climate change consequences) on support for policies to reduce fossil fuel burning (Dietz, Dan, & Shwom, 2007); and pro-environmental beliefs were found to have an indirect effect (via perceived effectiveness and trust) on acceptability of transport policies (Eriksson et al., 2008). While environmental beliefs and values are often measured by the New Environmental Paradigm (Dunlap et al., 2000), a more parsimonious measure of pro-environmental identity has been shown also to predict support for a range of pro-environmental measures and policies (e.g. Schleich and Faure, 2017; Schleich, Gassmann, Meissner & Faure, 2019; Whitmarsh, Capstick, & Nash, 2017; Whitmarsh & O'Neill, 2010) and will be applied in this study.

*Socio-economic factors*. Socio-economic variables appear to have less influence on policy acceptance in comparison to general and specific attitudes and beliefs (Zverinová et al., 2014). For instance, Eliasson and Jonsson (2011) concluded that, on aggregate, income, gender, education and area of living may be important for acceptance as they found differences in support between groups. However, they also found that the influence of these socio-economic factors on policy support was negligible once car dependency, environmental concerns and perceived effects of the policy were controlled for. There are still studies that have found effects of some socio-economic factors, however. By and large, political orientation has been found to influence policy response, depending on the policy. For instance, having a green party political orientation (Hammar & Jagers, 2006a) or a liberal political orientation has been found to relate to greater support for environmental policies (Dietz et al., 2007). Typically, age has a negative relationship with environmental policy acceptance (Drews & van den Bergh, 2015; Zverinová et al., 2014), although positive relationships have also been found ( Dietz et al., 2007; Hammar & Jagers, 2006a). Higher formal education is usually positively associated with support and willingness to pay for climate and environmental policies (Drews & van den Bergh, 2015; Zverinová et al., 2014).

*Cross-national variation*. There are a limited number of studies that have measured and compared policy response in more than one country and – with the notable exception of Alberini et al. (2018), Ščasný et al. (2017) and Zverinová et al. (2014) - their samples are often limited by either being unrepresentative (e.g. Bostrom et al., 2012) and/or small in size (e.g. Fujii, Garling, Jakobsson, & Jou, 2004). As such, further research is needed to identify and understand any similarities and/or differences in how different countries

respond to a policy. However, there is evidence that European countries respond similarly to energy and environmental policies, except on issues of nuclear power, carbon taxes, limiting population growth, and fertilizing oceans (Bostrom et al., 2012; Steentjes et al., 2017). It appears that many of the factors reviewed above, such as perceived fairness and personal cost, are influential in predicting public responses to policies across nations (e.g. Fujii et al., 2004). On the other hand, Schleich and Faure (2017) found that a higher level of perceived trust in international climate policy was positively related to perceived policy relevance in the U.S and in China, but not in Germany. Our research therefore addresses the need for further cross-national comparative research.

While previous studies have explored predictors of policy support, they have tended to focus on climate change or energy policies in general (e.g., Rhodes et al., 2017; Alberini et al., 2018), or are single country studies which do not allow for cross-national comparison and greater generalisability of findings. Our study aimed to address the need for more systematic, cross-national analysis of citizens' energy efficiency policy preferences. Furthermore, we apply robust methods (multi-country choice experiment, combined with survey) that allow us to experimentally manipulate policy attributes and to quantify trade-offs between types of energy efficiency policy (e.g., informational, economic, regulatory) in terms of willingness to pay. Indeed, previous research has shown that individuals distinguish between various attributes of policies (Alberini et al., 2018).

## 2.5 Aim, operationalisation, and hypotheses

Policy-specific perceptions, including perceptions of the policy's effectiveness and fairness as well as personal costs/benefits to the self, seem to be important determinants of attitudinal policy response. The distal predictors of these specific perceptions are only just beginning to be identified, however. In particular, trust in government seems to have a largely consistent effect on perceptions of fairness and effectiveness (Kim, Schmocker, et al., 2013; Schmocker et al., 2012). General beliefs that are of relevance to the policy, such as pro-environmental values/identity, are also important to consider (Eriksson et al., 2008).

We operationalise these key factors as follows (see Table 1) within the choice experiment: (a) *Policy effectiveness* is operationalised at two levels: how much energy consumption has been reduced by 2030 (in line with EU policy) and reduction of energy imports (consistent with national energy security policies); (b) *Fairness* is operationalised as the share that households have to pay, compared to other stakeholders (industry, public sector, etc.); (c) *Personal cost* is operationalised at two levels: additional annual cost for the household, and the type of policy including both more coercive or restrictive push measures (taxes, per capita limit on consumption) and less restrictive pull measures (education, standards). Three further constructs are included within the survey as non-experimental independent variables: (d) *Trust*, (e) *Green identity*, and (f) *Personal experience of energy-efficiency policies*, as a proxy for perceived policy benefits (see 3.3 for details).

In particular, we focus on the key theoretical variables of policy effectiveness, fairness and personal cost/benefits, as well as trust, and green identity. Based on the policy acceptance literature overviewed in sections 2.2.-2.4, for these variables, the following hypotheses are proposed:

- ***H1****: Policy effectiveness:* (a) It is hypothesised that the percentage of reduction in energy consumption by 2030 will be positively related to willingness to pay (WTP; i.e. the acceptance of additional expenses for their household, compared to the current policy). (b) Likewise, higher targets for reduction in energy imports will be positively associated with WTP.
- ***H2****: Fairness*: It is hypothesised that the share of total costs paid by households will be negatively related to WTP. This will be due to participants perceiving households contributing a greater percentage than industry, agriculture, private and public services as being unfair.
- ***H3****: Personal costs*: (a) Since taxation (i.e. push measures) are typically found to be negatively related to WTP, an additional tax on energy (e.g., for electricity, gas, oil, coal) as a method of achieving energy efficiency will be negatively related to WTP. (b) As policies which are perceived as infringing on personal freedoms are found to be negatively associated with policy acceptance, it is hypothesised that a limit on energy

consumption per person will be negatively related to WTP. (c) In contrast, policy approaches that require less cost to the individual (i.e. pull measures) are typically found to be preferred. As such, education and information programs on energy-saving measures will be positively related to WTP. (d) The greater the monetary cost a policy has for the individual, the less accepted it typically is (Bicket & Vanner, 2016); as such it is hypothesised that the additional annual costs will lead to lower acceptance; although, this relationship is likely to be stronger for lower-income respondents (Kallbekken & Sæælen, 2011; Rienstra, Rietveld, & Verhoef, 1999)

- ***H4****: Trust. (a) Trust and effectiveness:* There is evidence that trust in one's government has a mediated relationship with policy acceptance via the perceived effectiveness of the proposed policies (Kim, Schmocker, et al., 2013). It is argued that those with higher trust in the government may have a stronger belief that the policy will be successfully enacted by the government and so they are more accepting of it (Zverinová et al., 2014). As such, we predict that trust in government will be positively associated with willingness to pay more for the higher (more effective) energy reduction targets. *(b) Trust and personal cost:* Perceived infringement on freedom has a negative relationship with policy acceptance. However, greater trust in one's government is associated with a decrease in the perceived infringement on freedom of proposed, coercive policies (Kim et al., 2013). As such, we seek to test if having greater trust in government increases the acceptance of policies which may infringe on individuals' freedoms. We predict that trust in government will be positively associated with willingness to pay more for the more coercive policies (per capita limit on consumption, taxes) relative to less coercive policies (industry standards policy, education).
- ***H5****: Green identity. (a) Green identity and effectiveness:* Pro-environmental beliefs have been found to have a positive association with perceived policy effectiveness (via problem awareness), which in turn, had a positive relationship with acceptance (Eriksson et al., 2008). As such, we predict that green identity will be positively associated with willingness to pay more for the higher (more effective) energy reduction targets. *(b) Green identity and policy attributes:* Environmental concern has been found to be positively associated with attitudes towards coercive policies, such as congestion charging (Eliasson & Jonsson, 2011) and increased taxes on fossil fuels (Eriksson et al., 2008). This suggests that individuals with stronger environmental concerns will have more positive attitudes towards coercive policies than those with weaker environmental concerns. As such, we predict that green identity will be positively associated with willingness to pay for the more coercive policies (taxes, per capita limit on consumption and education) relative to less coercive policies (industry standards policy, education).
- ***H6****: Experience of rebates*: Pre-implementation attitudes towards a policy may change once the policy has been implemented. For instance, in the case of road charges (tolls and congestions charges), opposition has been seen to decrease in the years following their implementation, potentially because of recognised benefits (Eliasson & Jonsson, 2011). As such, policy experience may be an important factor in policy acceptance. To explore this, we used participants' past experience of energy efficiency policies (e.g., rebates). We predict that experience of receiving financial support for efficiency measures will have a positive association with WTP for higher (more effective) energy reduction targets.

Finally, although we expect WTP for different types of energy efficiency policy to vary across different countries (e.g., Sweden has previously shown more support for taxes than other EU countries to achieve energy efficiency; Eurobarometer, 2006), we do not posit country-specific hypotheses about the predictors of this WTP as there is too little prior research to furnish these.

# 3 Methods

## 3.1 Data collection

A choice experiment was designed and integrated into an online household survey in the UK, Poland, Sweden and Italy. These countries reflect differing levels of trust in government (ESS, 2016), energy efficiency policies, and levels of income. In each country, participants were selected via quota sampling in order to obtain representative samples in terms of gender, age, income, and regional population dispersion. Information on individual and household characteristics, including trust in government, was gathered both at the beginning (to ensure that quota requirements were met), and at the end of the questionnaire. The household panel was provided by NORSTAT, participants received a remuneration fee through NORSTAT for completing the survey. The survey was fielded in July and August 2018.

## 3.2 Discrete choice experiment

A discrete choice experiment (DCE) aims to simulate a market environment in which a consumer considers multiple products that have shared attributes on which they then vary and compete. DCEs are used to manipulate the attributes of products or policies and present the participant with a hypothetical choice between two or more options. As such, DCEs are particularly useful for exploring new or hypothetical products or policies because they enable exploratory attributes to be systematically varied, with the possibility of additional message framing interventions or combinations of attributes (e.g. Hanley, Mourato, & Wright, 2001). The influence of each attribute on participants' choices, in relation to the other attributes, can then be statistically inferred. Indeed, a key aspect of the DCE is that it places product attributes into competition with each other and the participant must trade-off the competing attributes to make a selection, thus revealing which attribute is, relatively, the most important to them (Louviere, Flynn, & Carson, 2010). Therefore, DCEs allow for the exploration of different, hypothetical policy attributes and their influence on participant preference. Strictly speaking, because DCEs involve hypothetical decisions, the findings on policy attitudes should be interpreted as policy acceptability (rather than policy support or policy acceptance). To date, relatively few DCEs explore preferences for energy efficiency policies, so our study addresses a need for more studies in this area.

Our DCE operationalised key theoretical variables of energy efficiency policy effectiveness, fairness and personal cost via five attributes, each with several attribute levels (see Table 1). Each participant was shown six choice cards and asked to choose between three options: one of two new policies (A or B) or the current policy (Table 1). The attribute levels for Policy A and Policy B varied from one scenario to another. The attribute levels for the current policy were the same across all scenarios and chosen to be similar to energy efficiency policies currently in place in the European Union. The current policy was de facto the opt-out option in the choice experiment (see Table 2 for levels the attributes took for the current policy).

In a pretest with 50 UK respondents from Prolific Academic[2], the concept of social norms was operationalized via a sixth attribute with the following levels: "You may assume that policies are supported by 20%, 50% or 80% or the population." The attribute was, however, not found to have a significant effect on policy choice. In addition, 54% of respondents indicated that they had considered the attribute little or not at all, while only 4% indicated that they had considered the attribute a lot. Consequently, we did not include the attribute in the final study.

In a separate pretest also conducted with 51 UK respondents from Prolific Academic, we also tested for the origin of policy support with the following levels ("You may assume that policies are publicly supported by the scientific community, energy providers, or environmental groups"). This pretest also showed that this attribute had no significant

[2] Prolific Academic is a crowdsourcing platform for the recruitment of participants for academic research studies; the use of this platform for academic research has been tested and validated (Peer et al. 2017).

effect on policy choice. Moreover, 35% of respondents indicated that they had considered the attribute little or not at all, while only 12% indicated that they had considered the attribute a lot. We therefore decided not to include this attribute in the final study.

**Table 1. Attributes and attribute levels for the energy efficiency policies**

| Theoretical constructs | Attributes | Attribute levels | Number of levels |
|---|---|---|---|
| Policy effectiveness | Reduction in energy consumption by 2030 | Policies reduce energy consumption in COUNTRY by 20, 25, 30 or 40 percent, compared to having no energy efficiency policy in place | 4 |
| Policy effectiveness | Import | Policies seek to reduce COUNTRY's energy imports by 5, 10, 30 or 50 percent, compared to having no energy efficiency policy in place | 4 |
| Fairness | Share of total costs paid by households | Total costs to reach the energy consumption target by 2030 are shared between households and other sectors (industry, agriculture, private and public services). The share paid by households is 30, 40, 50, or 60 percent. Currently, households consume about 40 percent of total energy. | 4 |
| Personal cost/impact | Main policy measure | The reduction in energy consumption by households is mainly achieved through one of the following policy measures:<br>○ Education and information programmes on energy-saving measures.<br>○ An additional tax on energy (e.g., for electricity, gas, oil, coal).<br>○ A limit on energy consumption per person.<br>○ Stricter minimum energy efficiency standards for buildings and appliances. | 4 |
| Personal cost/impact | Additional annual cost | Over the next 10 years, Policies A and B will cause additional expenses for your household compared to the current policy (for example because of higher energy taxes). Additional expenses will be 25€, 50€, 100€, 150€, 200€, or 300€ per year | 6 |

**Table 2. Example of choice card**

| | Policy A | Policy B | Current policy |
|---|---|---|---|
| **Energy consumption by 2030** | 25% less | 40% less | 20% less |
| **Share of total costs paid by households** | 50% | 40% | 40% |
| **Import** | 50% | 10% | 5% |
| **Main policy measure** | Education and information programmes | Stricter energy efficiency standards for buildings and appliances | Stricter minimum energy efficiency standards for buildings and appliances |
| **Additional annual cost** | 50€ | 200€ | 0 € |

To reduce the large numbers of possible treatment combinations and increase the efficiency of the DCE design, we applied a Bayesian efficient design (Sándor & Wedel, 2001) using the NGENE software (ChoiceMetrics, 2014). Instead of using fixed prior probabilities (priors) for each attribute, Bayesian efficient designs use random priors that follow a specified distribution. (The prior distribution represents the information about an uncertain parameter prior to observing data.) They thus rely less on accurate parameter estimates and are more stable than non-Bayesian efficient designs. In our case, the mean values for priors for all attributes were obtained from a pilot study with 50 UK respondents from Prolific Academic and we assumed all priors to follow a normal distribution.

Since the survey was conducted in countries with different currencies, the monetary amounts used in the DCEs were adjusted to keep the relative value similar between countries in terms of purchasing power. To this end, the following rates were applied: Poland: 1€ = 3 PLN; Sweden: 1€ = 10 SEK; UK: 1€ = 1£.

## 3.3 Survey measures

Psychological, contextual and demographic variables were included in the household survey, along with the choice experiment. Measures used were:

### *3.2.1 Trust in government*

A three-item scale was developed comprising the following items: The government *takes into account many perspectives* when making a decision about policies to lower energy consumption; The government *provides all of the available information to the public* when making a decision about policies to lower energy consumption; and In general, *I trust* the government. Response options were: strongly disagree (1) to strongly agree (5).

The scale was reliable in the UK $\alpha(3)= .841$; Poland $\alpha(3)= .809$; Sweden $\alpha(3)= .672$; and Italy: $\alpha(3)=.823$. Based on the scale, a dummy variable (*hightrust*) was created that took on the value 1 if respondents were above the median in their country and 0 otherwise.

### *3.2.2 Pro-environmental identity*

Pro-environmental (green) identity was measured using a four-item scale (Whitmarsh & O'Neill, 2010): To save energy is an important part of who I am; I think of myself as an energy conscious person; I think of myself as someone who is very concerned with environmental issues; and Being environmentally friendly is an important part of who I am. Again, response options were: strongly disagree (1) to strongly agree (5).

The scale was reliable in the UK $\alpha(4)= .924$; Poland $\alpha(4)= .877$; Sweden $\alpha(4)= .879$; and Italy: $\alpha(4)= .902$. Based on the scale, a dummy variable (*greenID*) was created that took on the value 1 if respondents were above the median in their country and 0 otherwise.

### 3.2.3 *Experience of energy-efficiency policies*

Relevant policy experience, and thus perceived benefit, was measured with the item: 'For which of the following measures have you ever benefited from financial support (e.g., rebates, grants, low- interest loans). (Check all that apply): Thermal insulation of building components, Installation of windows, Installation of heating system, Purchase of energy efficient appliances, Purchase of heating control devices, None of the above'. A dummy variable (*exp_rebate*) was created that took on the value 1 if the respondent had benefitted from financial support for at least one of the above-mentioned items and 0 otherwise.

### *3.2.4 Demographics*

As for the remaining variables, gender was represented by a dummy variable (*female*) that took on the value 1 if the respondent was female and 0 if the respondent was male. *Age* was a continuous variable. Respondents in our survey were between 18 and 65 years old. Household income was captured by two dummy variables (*lowinc* and *highinc*) that took on the value 1 if reported household income was in the lowest and highest income category, respectively, based on the screening questions. A high level of education was indicated by the dummy variable *higheduc* that took on the value 1 if the respondent's level of education was equal to or higher than the country median and 0 otherwise. We considered the

following four levels: no degree or certificate, trade or vocational certificate, high school or equivalent, higher education. Information on whether respondents were living in an urban area was captured using a dummy variable (*urban*) that took on the value 1 if the respondent's primary residence was located in a major city.

Descriptive statistics for the abovementioned variables are provided in the Annex (Figures 1-7 and Table 8).

## 3.4 Analysis

To analyse the choice experiment, we employed a mixed logit model. Further, to study the impact of trust in government and pro-environmental identity on the acceptance of targets for the reduction of energy consumption and the acceptance of various different policies, we run regressions on the individual WTP for these attributes as explained by trust, pro-environmental identity, and socio-demographic factors.

In contrast to conditional logit models, mixed logit models do not rely on the so-called Independence of Irrelevant Alternatives (IIA) assumption and allow for unobserved heterogeneity of individual preferences (Revelt & Train, 1998). Thus, coefficients may vary across individuals. In a given sample, a total of *N* respondents is assumed to face *T* choice situations with a choice set of J alternatives. The utility for respondent n choosing alternative j in the choice set in choice situation t may be expressed as:

$$U_{njt} = \beta_n X_{njt} + \varepsilon_{njt}, \qquad n = 1, \dots, N, \quad j = 1,2,3 \quad t = 1, \dots, T \tag{1}$$

where $X_{njt}$ is the observed attributes vector of refrigerators in our choice experiment and $\beta_n$ is a vector of individual-specific parameters associated with each attribute. The unobserved error term $\varepsilon_{njt}$ is assumed to be Gumbel-distributed. In our DCE, participants faced 6 choice situations, i.e., T=6. Each situation involved three alternatives, i.e., J=3. As is standard in mixed logit models, coefficients for all attributes except price were allowed to vary across individuals. Conditional on knowing $\beta_n$, the probability of an individual n to choose alternative j in situation t can be expressed as:

$$\mathrm{P}_{njt}(\beta_n) = \frac{\exp(\beta_n X_{nit})}{\sum_{j=1}^{J} \exp(\beta_n X_{njt})} \tag{2}$$

The parameter $\beta_n$ varies among respondents according to a distribution with a density$f(\beta|\theta)$, where $\theta$ is a vector of parameters of the distribution (Train, 2003). In this paper, each individual-specific parameter is assumed to be normally distributed. Knowing $\beta_n$, the conditional probability of the observed sequence of choices is given by:

$$\Gamma_n(\beta_n) = \prod_{t=1}^{T} P_{njt}(\beta_n) \tag{3}$$

Since $\beta_n$ is unknown, the unconditional probability of the observed sequence of choices is the conditional probability integrated over the distribution of $\beta$:

$$\Lambda_n(\theta) = \int \Gamma_n(\beta_n) f(\beta|\theta) d\beta \tag{4}$$

The log likelihood function is given by:

$$LL(\theta) = \sum_{n=1}^{N} \ln \Lambda_n(\theta) \tag{5}$$

Since this function cannot be solved, it is approximated through simulation (Train, 2003). The simulated log likelihood is given by:

$$SLL(\theta) = \sum_{n=1}^{N} \ln \left\{ \frac{1}{R} \sum_{1}^{R} \Gamma_n(\beta^r) \right\}, \tag{6}$$

where $R$ is the number of replications and $\beta^r$ is the $r$th draw from $f(\beta|\theta)$. We used 100 Halton draws.

Lastly, marginal willingness-to-pay (WTP) for an attribute x is calculated as the negative of the ratio of the respective parameter $\beta_x$ to the price parameter $\beta_p$.

$$WTP_x = -\frac{\beta_x}{\beta_p} \quad (7)$$

After calculating individual WTP for each of the attribute levels, we ran regressions on these WTPs using trust, pro-environmental identity, and socio-demographic variables as covariates. More specifically, we ran heteroskedasticity-robust OLS regressions on the willingness-to-pay for targets and for the policy measures if they turned out to be statistically significant at p<0.1 in the mixed logit model. For the WTP-regressions of the policy instruments we employed a Zellner (or seemingly-unrelated-regression - SUR) approach to allow dependence across equations.

# 4 Results

Table 3 shows estimates for the parameters in equation (1). Standard errors appear in parentheses below the parameter estimates. The upper part of the table depicts the mean values of the coefficients, the lower part the standard deviations. The variable *cost* denotes additional annual expenses for households compared to the current policy, *statusquo* is a dummy variable for current policy. The variables *target, share* and *import* denote attributes 1-3 in Table 1. Dummy variables are used to represent the attribute levels for policy mechanisms: *p_tax* for an additional tax on energy, *p_edu* for education and information programmes on energy-saving measures, and *p_limit* for setting a limit on energy consumption per person. The standard deviations of all parameter estimates are statistically significant, suggesting (unexplained) heterogeneity of these parameters across respondents, and therefore corroborating the appropriateness of using a mixed logit model.

The coefficient associated with *cost* is negative and statistically significant in all countries. Thus, as expected (Hypothesis 3d), additional costs lower respondents' latent utility in equation (1). In the UK, Poland and Italy, respondents generally prefer the status quo (i.e. no change in policy), to alternative policies, independent of other attributes. The coefficients associated with *target* and *import* are positive and statistically significant in all countries, implying that respondents generally prefer more ambitious policies with regard to reduction of both energy consumption and energy imports. We further observe that respondents in Italy, Poland and Sweden are indifferent as to how costs are shared between households and other sectors. In the UK, contrary to expectations, respondents prefer on average higher shares of total costs paid by households. (We thus fail to reject the null hypothesis associated with Hypothesis 2.) In Sweden and Poland, the coefficients for *p_tax* and *p_limit* are negative and significant, implying that the average respondent prefers the status quo policy “stricter minimum standards” over taxes or a per capita limit for energy consumption. Lastly, in Italy, Poland and the UK, implementing education and information programmes rather than stricter minimum standards increases the average respondent’s latent utility as predicted in Hypothesis 3c.

Table 4 reports the marginal willingness-to-pay (WTP) estimates in those cases where the coefficients reported in Table 3 were statistically significant at the 10 percent level or lower. P-values appear in parentheses below the parameter estimates. Respondents in Italy, Poland and the UK are on average willing to pay 159€, 132€ and 580€ per year, respectively, for the current policy. In line with Hypothesis 1a, WTP to further reduce energy consumption by 1 percentage point ranges from an average of 5.74€ per year in Sweden to an average of 18.41€ per year in the UK. Similarly, and in line with Hypothesis 1b, respondents are on average willing to pay 1.37€ per year in Sweden to 3.93€ per year in the UK to reduce energy imports by an additional percentage point. We further estimate that respondents in Poland and Sweden are on average willing to pay up to 122€ per year to keep the status quo policy « stricter standards » rather than replacing it with an additional tax on energy or a limit on per capita energy consumption. These results are in line with Hypotheses 3a and 3b. UK respondents are willing to pay 7.53€ for a higher shares of total costs paid by households, in contrast to expectations (H2). Finally, the average respondent in Italy, Poland and the UK is willing to pay more than 112€ per year to replace stricter minimum standards for buildings and appliances with education and information programmes. This result is in line with Hypothesis 3c.

**Table 3. Results for mixed logit model**

| choice | IT<br>Coef.<br>(se) | PL<br>Coef.<br>(se) | SE<br>Coef.<br>(se) | UK<br>Coef.<br>(se) |
|---|---|---|---|---|
| **Mean of the parameters** | | | | |
| cost | -0.0079*** | -0.0073*** | -0.0076*** | -0.0058*** |
| | (0.001) | (0.001) | (0.001) | (0.002) |
| statusquo | 1.2533** | 0.9605* | 0.2439 | 3.3650*** |
| | (0.521) | (0.556) | (0.542) | (1.066) |
| target | 0.0763*** | 0.0657*** | 0.0436*** | 0.1068*** |
| | (0.015) | (0.017) | (0.016) | (0.032) |
| share | 0.0106 | 0.0075 | -0.0101 | 0.0437** |
| | (0.009) | (0.010) | (0.010) | (0.019) |
| import | 0.0171*** | 0.0120*** | 0.0104*** | 0.0228*** |
| | (0.003) | (0.004) | (0.003) | (0.007) |
| p_tax | -0.0913 | -0.4278** | -0.9243*** | -0.5499 |
| | (0.170) | (0.183) | (0.191) | (0.408) |
| p_edu | 1.0755*** | 0.8170*** | 0.2566 | 1.6210*** |
| | (0.206) | (0.219) | (0.215) | (0.420) |
| p_limit | 0.3078 | -0.8117*** | -0.7291*** | 0.4165 |
| | (0.225) | (0.248) | (0.234) | (0.464) |
| **Standard deviation** | | | | |
| statusquo | 6.058*** | 5.786*** | 5.147*** | 7.044*** |
| | (0.390) | (0.369) | (0.366) | (0.846) |
| target | 0.126*** | 0.143*** | 0.118*** | 0.164*** |
| | (0.012) | (0.013) | (0.012) | (0.027) |
| share | 0.074*** | 0.083 | 0.070*** | 0.093*** |
| | (0.007) | (0.006) | (0.006) | (0.014) |
| import | 0.025*** | 0.031*** | 0.013*** | 0.036*** |
| | (0.003) | (0.003) | (0.003) | (0.007) |
| p_tax | 1.205*** | 1.753*** | 1.484*** | 1.986*** |
| | (0.171) | (0.168) | (0.170) | (0.350) |
| p_edu | 2.157*** | 2.182*** | 2.279*** | 2.552*** |
| | (0.212) | (0.205) | (0.191) | (0.427) |
| p_limit | 2.483*** | 2.593*** | 2.303*** | 2.798*** |
| | (0.227) | (0.253) | (0.194) | (0.558) |
| LL0 | -4293.560 | -4490.150 | -4193.731 | -1377.979 |
| LL | -5387.284 | -5592.334 | -5323.031 | -1793.372 |
| Number of respondents | 889 | 929 | 882 | 308 |

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

**Table 4. Willingness-to-pay results for mixed logit model**

| | IT | PL | SE | UK |
|---|---|---|---|---|
| statusquo | 158.65 | 131.58 | - | 580.17 |
| target | 9.66 | 9.00 | 5.74 | 18.41 |
| share | - | - | - | 7.53 |
| import | 2.16 | 1.64 | 1.37 | 3.93 |
| p_tax | - | -58.60 | -121.62 | - |
| p_edu | 136.14 | 111.92 | - | 279.48 |
| p_limit | - | -111.19 | -95.93 | - |

Table 5 reports the share of respondents who preferred the status quo over the alternative policies in all six scenarios as well as the share of scenarios in which the status quo was chosen. In the UK, the status quo option was chosen in more than half of the scenarios and 31% of respondents always chose the status quo. (This partly explains the high WTP for *statusquo* in Table 4.) In the other three countries, fewer respondents always preferred the status quo option over the alternative policies though the share of scenarios in which the status quo was chosen remains high.

**Table 5. Preference for status quo over alternative policies**

| | IT | PL | SE | UK |
|---|---|---|---|---|
| Share of respondents always choosing the status quo option | 19% | 22% | 23% | 31% |
| Share of scenarios in which the status quo was chosen | 44% | 47% | 47% | 54% |

Table 6 shows the results from regressing individual willingness-to-pay estimates for the attribute *target* on individual and household characteristics. P-values are reported below the parameter estimates. Individual characteristics notably include dummy variables for high levels of trust in government (*hightrust*) and green identity (*greenID*). In accordance with hypothesis H4a, we find that WTP for more ambitious targets for reduction of energy consumption is higher for respondents with a high level of trust in government in all countries. In Sweden and the UK, green identity is also associated with higher WTP for *target* as predicted in hypothesis H5a Moreover, we find that WTP for *target* is lower for older respondents in Italy and the UK, for women in Italy, Sweden and the UK, and for respondents with low household income and high level of education in Poland. Finally, in accordance with hypothesis H6, WTP for *target* is higher for respondents who have benefited from financial support for energy efficiency investments in their home in Italy and the UK.

**Table 6. Results for the OLS regression of WTP for the attribute *target* on individual and household characteristics**

| | IT<br>b/p | PL<br>b/p | SE<br>b/p | UK<br>b/p |
|---|---|---|---|---|
| **wtp_target** | | | | |
| hightrust | 1.5046** | 1.6680** | 1.5660*** | 3.1203* |
| | (0.040) | (0.043) | (0.008) | (0.095) |
| greenID | 0.7243 | -1.2450 | 1.3157** | 3.2574* |
| | (0.329) | (0.139) | (0.032) | (0.076) |
| lowincome | -0.2252 | -2.0695** | 0.1550 | -1.3328 |
| | (0.784) | (0.023) | (0.828) | (0.574) |
| highincome | 0.5539 | 1.8130 | 0.6073 | 4.2788 |
| | (0.636) | (0.472) | (0.522) | (0.144) |
| female | -1.7174** | -0.4033 | -1.0603* | -4.0207** |
| | (0.020) | (0.628) | (0.094) | (0.040) |
| age | -0.0629** | -0.0131 | -0.0284 | -0.1857** |
| | (0.047) | (0.685) | (0.232) | (0.017) |
| highedu | 0.3773 | -1.9823** | -0.0565 | 1.5661 |
| | (0.635) | (0.020) | (0.926) | (0.420) |
| exp_rebate | 2.7034*** | 0.8790 | 0.1765 | 8.9944*** |
| | (0.001) | (0.352) | (0.829) | (0.000) |
| urban | 1.3128* | -0.0008 | 0.1614 | 4.8257** |
| | (0.087) | (0.999) | (0.824) | (0.046) |
| constant | -8.6290*** | -6.1117*** | -5.5422*** | -16.1345*** |
| | (0.000) | (0.001) | (0.000) | (0.002) |
| Model | OLS | OLS | OLS | OLS |
| R-sqr | 0.041 | 0.022 | 0.019 | 0.155 |
| LL | -3370.422 | -3638.479 | -3151.919 | -1290.980 |
| Number of respondents | 889 | 929 | 882 | 308 |

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

**Table 7. Results for the Zellner regression of WTP for the attributes *p_tax, p_edu, and p_limit* (vs. standards) on individual & household characteristics**

| | IT | PL | SE | UK |
|---|---|---|---|---|
| | b/p | b/p | b/p | b/p |
| **wtp_tax** | | | | |
| hightrust | - | -20.7013** | -16.1472** | - |
| | - | (0.032) | (0.049) | - |
| greenID | - | -20.6676** | -7.8263 | - |
| | - | (0.035) | (0.351) | - |
| lowincome | - | -9.6384 | 6.6039 | - |
| | - | (0.351) | (0.518) | - |
| highincome | - | 31.7542 | -25.7416** | - |
| | - | (0.254) | (0.033) | - |
| female | - | -4.3809 | 6.0692 | - |
| | - | (0.651) | (0.491) | - |
| age | - | 0.6402* | 0.6800** | - |
| | - | (0.084) | (0.044) | - |
| highedu | - | -19.7461** | 6.0034 | - |
| | - | (0.046) | (0.482) | - |
| urban | - | 5.2297 | -10.0648 | - |
| | - | (0.594) | (0.289) | - |
| constant | - | 68.6888*** | 103.1436*** | - |
| | - | (0.001) | (0.000) | - |
| **wtp_edu** | | | | |
| hightrust | 25.6372** | 29.3878** | - | 49.6786 |
| | (0.038) | (0.016) | - | (0.116) |
| greenID | 16.9890 | -12.6923 | - | 67.8151** |
| | (0.170) | (0.310) | - | (0.034) |
| lowincome | -15.7027 | -30.9797** | - | -37.7221 |
| | (0.253) | (0.018) | - | (0.323) |
| highincome | 23.0518 | 4.9242 | - | 87.0515* |
| | (0.229) | (0.889) | - | (0.059) |
| female | -35.6744*** | -8.8677 | - | -51.4134 |
| | (0.004) | (0.471) | - | (0.118) |
| age | -1.1511** | -0.2508 | - | -4.0411*** |
| | (0.028) | (0.595) | - | (0.001) |
| highedu | 16.1420 | -27.6703** | - | 24.1308 |
| | (0.220) | (0.028) | - | (0.463) |
| urban | 23.0973* | -4.2963 | - | 91.8353** |
| | (0.070) | (0.730) | - | (0.017) |
| constant | -99.3651*** | -65.0421** | - | -179.7043** |
| | (0.000) | (0.015) | - | (0.019) |
| **wtp_limit** | | | | - |
| hightrust | - | -2.4452 | 20.4959* | - |
| | - | (0.867) | (0.086) | - |
| greenID | - | -37.4494** | 1.9651 | - |
| | - | (0.012) | (0.872) | - |
| lowincome | - | -29.6041* | 16.6089 | - |
| | - | (0.060) | (0.263) | - |
| highincome | - | 44.9786 | -7.9465 | - |
| | - | (0.288) | (0.650) | - |
| female | - | -4.6186 | -14.1164 | - |
| | - | (0.754) | (0.270) | - |
| age | - | 0.5856 | -0.1951 | - |
| | - | (0.299) | (0.691) | - |
| highedu | - | -35.1000** | 22.2761* | - |
| | - | (0.020) | (0.073) | - |
| urban | - | 12.5620 | 4.1569 | - |
| | - | (0.400) | (0.763) | - |
| constant | - | 142.5791*** | 84.4401*** | - |
| | - | (0.000) | (0.003) | - |
| Model | OLS | SUR | SUR | OLS |
| R-sqr | 0.035 | 0.021 | 0.018 | 0.126 |
| LL | -5887.891 | -17437.148 | -10975.241 | -2163.280 |
| No. of respondents | 889 | 929 | 882 | 308 |

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7 shows results from Zellner regressions (or seemingly unrelated regressions -- SURs) of the attributes *p_tax*, *p_edu*, and *p_limit* on individual and household characteristics. We only report results for attributes with estimated parameter means significantly different from zero (see Table 3). (In Italy and the UK only the parameter for *p_edu* was significantly different from zero. The SURs of *p_edu* correspond to OLS regressions.) P-values are again reported below the parameter estimates. By using seemingly unrelated regression models, we allow for residuals to be correlated. Based on the results of Breusch-Pagan tests of independence, we can reject the null hypothesis that the correlation between residuals is zero in both Poland and Sweden. This corroborates the appropriateness of using SUR.

In Poland and Sweden, we observe that WTP for additional taxes is lower for respondents with high trust in government compared to respondents with low trust. At the same time, Swedish respondents with high trust in government are less opposed to per capita limits on energy consumption. We further find that in Italy and Poland respondents with high trust in government are willing to pay more for education and information programmes compared to respondents with low trust. Green identity is found to be negatively related to WTP for additional taxes on energy and WTP for limits on energy consumption in Poland. In the UK, respondents with green identity have a higher WTP for education and information programmes compared to other respondents. These results are discussed in more detail in the conclusion section.

# 5 Discussion & Conclusions

Understanding citizens' perspectives on energy efficiency policies and the policy context is vital for policy effectiveness and success. While much is known about public preferences for climate policies, less is known about citizen perspectives on energy-efficiency policies, and how these perspectives vary across and within countries. Here, we presented findings from a novel choice experiment conducted in four diverse European Member States – the UK, Sweden, Poland and Italy – that manipulated policy attributes in order to quantify trade-offs between attributes and also types of energy efficiency policy (e.g., informational, economic, regulatory) in terms of willingness to pay.

Consistent with H1 on the importance of policy effectiveness for public support, we found respondents generally prefer more ambitious policies with regard to reduction of both energy consumption and energy imports. WTP to reduce energy consumption by 1 percentage point ranges from 5.74€ per year in Sweden to 18.41€ per year in the UK, while WTP to reduce energy imports by 1 percentage point ranged from 1.37€ per year in Sweden to 3.93€ in the UK. These findings are in line with previous research, which consistently finds that the perceived effectiveness of a specific policy is associated with acceptance and support for the policy (e.g., Eriksson et al., 2008).

Contrary to expectations, respondents appear largely indifferent as to how costs are shared between households and other sectors (though in the UK there is actually a preference for households to pay more than other sector, in line with their greater WTP for effective energy policies). We therefore do not find support for H2. In the literature, perceived distributional fairness and procedural fairness have been positively associated with environmental policy support (e.g., Kim et al., 2013). Here, we explored distributional fairness, which seemed not to predict support for energy efficiency policies, perhaps because respondents did not have a clear sense of who is 'to blame' for problems arising from energy consumption in the same way that emissions from transport are more readily identified with motorists (Dietz & Atkinson, 2010). Future research should explore this anomalous finding further, examining for example whether understanding of the distribution of emissions across sectors may mediate the relationship between perceived policy effectiveness and support. A further area to explore would be perceptions of procedural fairness, such as involvement of citizens in policy design.

As expected and in line with H3, personal cost (i.e., more coercive policies and those incurring additional financial costs for householders) were less preferred to the status quo (standards) (cf. Ščasný et al., 2017). Specifically, we predicted that education and information programs on energy-saving measures would be positively related to support and WTP (H3c), while taxes and limits on consumption would be negatively related to

support and WTP (H3a,b). This was largely supported, although effects were statistically significantly negative only for taxes and for a consumption limit in Poland and Sweden, and positive for education in all countries except Sweden. Consistent with the higher WTP for effective policies in the UK, there seemed to be less resistance to coercive measures and most support for education (compared to standards for appliances and buildings) in the UK. These national differences may reflect different cultural contexts or historical policies. In partial support for H3d, we found that in all countries, additional costs to households reduced support for energy efficiency policies compared to the status quo (cf. Bicket & Vanner, 2016), though WTP was lower for lower-income respondents only in Poland. This may be because citizens in other countries enjoy higher incomes, so lower incomes in Poland are especially low in the overall context.

Relatedly, we predicted that experience of receiving financial benefits for energy efficiency measures would predict support for energy reduction targets (H6). This hypothesis was partially supported: in Italy and the UK (but not Poland or Sweden) experience of financial support was a positive predictor of policy support.

Previous research shows trust is another important predictor of policy support, including for environmental policies (e.g., Rhodes et al., 2017). We predicted, therefore, that higher trust in government would predict WTP for effectice energy reduction (H4a). Consistent with this prediction, we found that trust in government increases WTP for higher energy reduction targets. Although effects were smaller than for policy attributes, those with high trust in government were willing to pay between 1.50€ (in Italy) and 3.12€ (in the UK) more for a 1 percentage point decrease in energy consumption, compared to respondents with low trust. We further hypothesised that higher trust in government would be positively associated with WTP for more coercive policies (H4b; cf. Kim et al., 2003). Largely contrary to this prediction, we found that higher trust in government increased support for 'pull' measures (education) in Poland and Italy, and decreased support for taxes in Poland and Sweden. However, Swedish respondents with high trust in government were less opposed to per capita limits on energy consumption – again, reinforcing the importance of cultural context to understanding citizen support for different policies. Future research could expand this examination of trust - also with respect to the partially unexpected findings - and consider trust in other groups, such as other citizens or industry, as well as government (cf. Dietz et al., 2007).

Finally, we posited two hypotheses related to pro-environmental or 'green' identity: that it would positively predict WTP for the more effective energy reduction targets (H5a) and that it would predict WTP for more coercive policies, such as taxes or limits (H5b; cf. Eriksson et al., 2008). Partly consistent with H5a and previous research (e.g., Steg & Vlek, 2009), we found green identity predicted support for more effective policies in Sweden and the UK; but contrary to H5b, we found green identity increased support for education policies in the UK and decreased support for taxes and consumption limits in Poland. While this effect is unanticipated, it may be that our results belie an interaction effect between variables as indicated in previous research, which has found, for example, that pro-environmental beliefs have an indirect effect (via perceived effectiveness and trust) on acceptability of transport policies (Eriksson et al., 2008). Alternatively, it may be a result of the measure (green identity) used, which has more typically been applied to predict energy and environmental behaviours, rather than policy support. Further research should explore possible interaction effects, and include measures of environmental values and worldview (e.g., NEP; Dunlap et al., 2000) found to more consistently predict environmental policy support.

That we found differences across countries reinforces the importance of cross-national studies. Future work should expand the number and range of nations examined in order to identify reasons for these cross-national differences, such as cultural type, energy mix, or GDP (Demski et al., 2018). There is also scope for further work to explore the reasons why we did not find evidence for social norms as a predictor of energy efficiency policy support, contrary to previous research (e.g., Cools et al, 2011).

Within nations, we found not only that trust, policy experience, green identity and (low) income predicted policy preferences, but also age, gender, education and location (albeit not always in the same way across countries). Older respondents in Italy and the UK were less supportive of more ambitious energy efficiency policies, perhaps because they perceive

fewer personal benefits from the policy which delivers energy consumption targets by 2030, but also because older respondents are typically more sceptical of climate change (e.g., Whitmarsh, 2011). This finding is also consistent with the literature which finds that age is a negative predictor of environmental policy support (e.g, Zverinová et al., 2014). In terms of gender, we found women less supportive of ambitious energy efficiency policies in Italy, Poland and the UK. Those living in rural areas were also less supportive of energy efficiency in Italy and the UK; while those with higher education and lower income were less supportive in Poland.

We have already indicated where future research might focus. One additional direction relates to an inherent limitation of our method. We examined willingness to pay in an experimental context but this may not correspond fully with citizens' actual WTP once a policy is introduced. In particular, evidence shows policy acceptance often increases once a policy is introduced and the benefits experienced (e.g., Jagers et al., 2017), which highlights the importance of examining policy acceptance and support in longitudinal research designs.

*Policy implications*

Overall, we found there is citizen support for and resistance to different types of policies, and also variation in preferences amongst different countries and groups of citizens. In particular, our research highlights that energy efficiency policies are more acceptable when they are particularly effective (i.e., ambitious in reducing energy consumption and imports) while also incurring minimal costs on, or coercion of, citizens. Unfortunately, these criteria may be difficult to reconcile as the most effective policies are likely to include at least some degree of 'push' or coercion that limit consumer choices in respect of the most energy-intensive choices. This may suggest a need to involve the public in more deliberative debate about the inevitable trade-offs involved with achieving a sustainable energy transition, for example spelling out that addressing climate change and energy security might incur costs in terms of higher bills and/or reduced consumer choices but potentially reduce costs for adapting to climate change or dealing with energy disruption/shortages (e.g., Pidgeon et al., 2014). Such deliberative citizen engagement might also help foster a sense of procedural justice in, and thus greater support for, policies developed through this participatory process.

At the same time, we also found that those who trust government more, who have benefited directly from energy efficiency policies in the past, and have higher green identity, are generally more supportive of energy efficiency policies (albeit with some cross-national variation). These findings point to where policy-makers might focus in building support for future energy efficiency measures, for example, by introducing financial support measures in advance of more coercive or costly measures or by designing informational measures that remind people of any benefits they have already experienced from energy efficiency policies. In addition, building trust in government would appear to be an important pre-condition for public support for policies, and therefore should be a focus of efforts (e.g., through more transparent and participatory policy-making; Blind, 2006). Environmental education might also serve to increase green identity and values amongst the public, which may also lead to more support for energy efficiency policies. Finally, since public support in some countries, like the UK, appears to be higher than elsewhere, and in light of cross-national variation in predictors of policy support, this indicates that policies need to be established with cultural or national differences in mind.

# 6 References

Adaman, F., Karah, N., Kumbaroglu, G., Or, I., Ozkaynak, B., & Zenginobuz, U. (2011). What determines urban households' willingness to pay for CO2 emission reductions in Turkey: A contingent valuation survey. *Energy Policy, 39*(2), 689-698.

Alberini, A., Bigano, A., Ščasný, M., & Zvěřinová, I. (2018). Preferences for Energy Efficiency vs. Renewables: What Is the Willingness to Pay to Reduce CO2 Emissions? *Ecological Economics, 144*, 171-185.

Attari, S. Z., Schoen, M., Davidson, C. I., DeKay, M. L., Bruine de Bruin, W., Dawes, R., & Small, M. J. (2009). Preferences for change: Do individuals prefer voluntary

actions, soft regulations, or hard regulations to decrease fossil fuel consumption? *Ecological Economics, 68*(6), 1701-1710.

Batel, S., Devine-Wright, P., & Tangeland, T. (2013). Social acceptance of low carbon energy and associated infrastructures: A critical discussion. *Energy Policy*, 58, 1–5.

Bechtel, M. M., & Scheve, K. F. (2013). Mass support for global climate agreements depends on institutional design. *Proceedings of the National Academy of Sciences of the United States of America, 110*(34), 13763-13768.

Bicket, M., & Vanner, R. (2016). Designing policy mixes for resource efficiency: The role of public acceptability. *Sustainability, 8*(4), 366.

Blind, P. (2006). Building Trust in Government in the Twenty-First Century. http://unpan1.un.org/intradoc/groups/public/documents/UN/UNPAN025062.pdf

Bostrom, A., O'Connor, R. E., Bohm, G., Hanss, D., Bodi, O., Ekstrom, F., . . . Saelensminde, I. (2012). Causal thinking and support for climate change policies: International survey findings. *Global Environmental Change-Human and Policy Dimensions, 22*(1), 210-222. doi:10.1016/j.gloenvcha.2011.09.012

Brannlund, R., & Persson, L. (2012). To tax, or not to tax: Preferences for climate policy attributes. *Climate Policy, 12*, 704-721.

Cai, B., Cameron, T. A., & Gerdes, G. R. (2010). Distributional preferences and the incidence of costs and benefits in climate change policy. *Environmental and Resource Economics, 46*(4), 429-458.

ChoiceMetrics (2014). Ngene 1.1.2 *User Manual & Reference Guide*, Australia.

Cialdini, R. B., Kallgren, C. A., & Reno, R. R. (1991). A focus theory of normative conduct: A theoretical refinement and reevaluation of the role of norms in human behavior. *Advances in Experimental Social Psychology, 24*, 201-234.

COM. (2014). Communication from the commission to the European parliament, the council, the European economic and social committee and the committee of the regions. A policy framework for climate and energy in the period from 2020 to 2030.

Cools, M., Brijs, K., Tormans, H., Moons, E., Janssens, D., & Wets, G. (2011). The socio-cognitive links between road pricing acceptability and changes in travel-behavior. *Transportation Research Part a-Policy and Practice, 45*(8), 779-788.

Council Directive 92/75/EC of 22 September 1992 on the Energy Labelling of Household Appliances.

de Groot, J. I. M., & Schuitema, G. (2012). How to make the unpopular popular? Policy characteristics, social norms and the acceptability of environmental policies. *Environmental Science and Policy, 19-20*, 100-107.

Demski, C., Poortinga, W., Whitmarsh, L., Böhm, G., Fisher, S., Steg, L., Umit, R., Jokinen, P. & Pohjolainen, P. (2018). National determinants of energy security concerns across Europe. *Nature Energy, 3*, 882–888.

Dietz, S., & Atkinson, G. (2010). The Equity-Efficiency Trade-off in Environmental Policy: Evidence from Stated Preferences. *Land Economics, 86*(3), 423-443.

Dietz, S., & Stern, N. (2008). Why economic analysis supports strong action on climate change: a response to the Stern Review's critics. *Review of Environmental Economics and Policy, 2*(1), 94-113.

Dietz, T., Dan, A., & Shwom, R. (2007). Support for climate change policy: Social Psychological and social structural influences. *Rural Sociology, 72*(2), 185-214.

Directive 2009/28/EC. Directive 2009/28/EC of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

Directive 2009/125/EC. Directive 2009/125/EC of 21 October 2009 on stablishing a framework for the setting of ecodesign requirements for energy-related products.

Directive 2010/31/EU. Directive 2010/31/EU of the European Parliament and of the council of 19 May 2010 on the Energy Performance of Buildings.

Directive 2012/27/EU. Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency.

Drews, S., & van den Bergh, J. C. J. M. (2015). What explains public support for climate policies? A review of empirical and experimental studies. *Clim. Policy*.

Dreyer, S. J., & Walker, I. (2013). Acceptance and Support of the Australian Carbon Policy. *Social Justice Research, 26*(3), 343-362.

Eliasson, J., & Jonsson, L. (2011). The unexpected "yes": Explanatory factors behind the positive attitudes to congestion charges in Stockholm. *Transport Policy, 18*(4), 636-647.

Eriksson, L., Garvill, J., & Nordlund, A. M. (2008). Acceptability of single and combined transport policy measures: The importance of environmental and policy specific beliefs. *Transportation Research Part a-Policy and Practice, 42*(8), 1117-1128.

ESS. (2016). ESS Round 8: European Social Survey Round 8 Data (2016). Data file edition 2.1. NSD - Norwegian Centre for Research Data, Norway – Data Archive and distributor of ESS data for ESS ERIC.

Eurobarometer (2006). Attitudes to Energy. http://ec.europa.eu/commfrontoffice/publicopinion/archives/ebs/ebs_247_en.pdf

Eurostat. (2018). Energy consumption in households.

Fiorino, D. J. (1990). Citizen participation and environmental risk: A survey of institutional mechanisms. *Science, Technology, & Human Values, 15*(2), 226-243.

Fuerst, F., McAllister, P., Nanda, A., & Wyatt, P. (2015). Does energy efficiency matter to home-buyers? An investigation of EPC ratings and transaction prices in England. *Energy Economics, 48*, 145-156.

Fujii, S., Garling, T., Jakobsson, C., & Jou, R. C. (2004). A cross-country study of fairness and infringement on freedom as determinants of car owners' acceptance of road pricing. *Transportation, 31*(3), 285-295.

Furst, E. W. M., & Dieplinger, M. (2014). The acceptability of road pricing in Vienna: the preference patterns of car drivers. *Transportation, 41*(4), 765-784.

Galarraga, I., Abadie, L. M., and Ansuategi, A. (2013). Efficiency, effectiveness and implementation feasibility of energy effciency rebates: The “Renove” plan in Spain. *Energy Economics*, 40, S98–S107

Garling, T., & Schuitema, G. (2007). Travel demand management targeting reduced private car use: Effectiveness, public acceptability and political feasibility. *Journal of Social Issues, 63*(1), 139-153.

Glenk, K., & Colombo, S. (2013). Modelling outcome-related risk in choice experiments. *Australian Journal of Agricultural and Resource Economics, 57*(4), 559-578.

Gracia, A., Barreiro-Hurlé, J., & y Pérez, L. P. (2012). Can renewable energy be financed with higher electricity prices? Evidence from a Spanish region. *Energy Policy, 50*, 784-794.

Hackbarth, A., & Madlener, R. (2016). Willingness-to-pay for alternative fuel vehicle characteristics: A stated choice study for Germany. *Transportation Research Part A: Policy and Practice, 85*, 89-111.

Hammar, H., & Jagers, S. C. (2006a). Can trust in politicians explain individuals' support for climate policy? The case of CO2 tax. *Climate Policy, 5*(6), 613-625.

Hammar, H., & Jagers, S. C. (2006b). Can trust in politicians explain individuals' support for climate policy? The case of CO<inf>2</inf> tax. *Climate Policy, 5*(6), 613-625.

Hammar, H., & Jagers, S. C. (2007). What is a fair CO2 tax increase? On fair emission reductions in the transport sector. *Ecological Economics, 61*(2-3), 377-387.

Hanley, N., Mourato, S., & Wright, R. E. (2001). Choice modelling approaches: a superior alternative for environmental valuatioin? *Journal of economic surveys, 15*(3), 435-462.

Harring, N., & Jagers, S. C. (2013). Should we trust in values? Explaining public support for pro-environmental taxes. *Sustainability (Switzerland), 5*(1), 210-227.

Heinzle, S. L., & Wüstenhagen, R. (2012). Dynamic adjustment of eco-labeling schemes and consumer choice–the revision of the EU energy label as a missed opportunity? *Business Strategy and the Environment, 21*(1), 60-70.

Jagers, S. C., & Hammar, H. (2009). Environmental taxation for good and for bad: The effciency and legitimacy of Sweden's carbon tax. *Environmental Politics, 18*(2), 218-237.

Jagers, S.C., Matti, S. & Nilsson, A. (2017) How exposure to policy tools transforms the mechanisms behind public acceptability and acceptance—The case of the Gothenburg congestion tax, *International Journal of Sustainable Transportation, 11* (2), 109-119.

Kahneman, D. & Tversky, A. (1979). Prospect Theory: An Analysis of Decision under Risk. *Econometrica*. *47* (2): 263–291

Kallbekken, S., & Sælen, H. (2011). Public acceptance for environmental taxes: Self-interest, environmental and distributional concerns. *Energy Policy, 39*(5), 2966-2973.

Kim, J., Schmocker, J. D., Fujii, S., & Noland, R. B. (2013). Attitudes towards road pricing and environmental taxation among US and UK students. *Transportation Research Part a-Policy and Practice, 48*, 50-62.

Kim, J., Schmöcker, J. D., Fujii, S., & Noland, R. B. (2013). Attitudes towards road pricing and environmental taxation among US and UK students. *Transportation Research Part A: Policy and Practice, 48*, 50-62.

Louviere, J. J., Flynn, T. N., & Carson, R. T. (2010). Discrete choice experiments are not conjoint analysis. *Journal of Choice Modelling, 3*(3), 57-72.

Lundhede, T., Jacobsen, J. B., Hanley, N., Strange, N., & Thorsen, B. J. (2015). Incorporating outcome uncertainty and prior outcome beliefs in stated preferences. *Land Economics, 91*(2), 296-316.

Murakami, K., Ida, T., Tanaka, M., & Friedman, L. (2015). Consumers' willingness to pay for renewable and nuclear energy: A comparative analysis between the US and Japan. *Energy Economics, 50*, 178-189.

Olsthoorn, M., Schleich, J., Gassmann, X., Faure, C. (2017). Free riding and rebates for residential energy efficiency upgrades: A multi-country contingent valuation experiment. *Energy Economics* 68 (S1), 33-44.

Pidgeon, N., Demski, C., Butler, C., Parkhill, K., & Spence, A. (2014). Creating a national citizen engagement process for energy policy. *Proceedings of the National Academy of Sciences*, *111*(Supplement 4), 13606 LP-13613.

Revelt, D., Train, K. (1998). Mixed logit with repeated choices: Households' choices of appliance efficiency level. *Review of Economics and Statistics, 80*(4), 647–657.

Rhodes, E., Axsen, J., & Jaccard, M. (2014). Does effective climate policy require well-informed citizen support? *Global Environmental Change, 29*, 92-104.

Rhodes, E., Axsen, J., & Jaccard, M. (2017). Exploring citizen support for different types of climate policy. *Ecological Economics, 137*, 56-69.

Rienstra, S. A., Rietveld, P., & Verhoef, E. T. (1999). The social support for policy measures in passenger transport.: A statistical analysis for the Netherlands. *Transportation Research Part D: Transport and Environment, 4*(3), 181-200.

Rosentrater, L. D., Sælensminde, I., Ekström, F., Böhm, G., Bostrom, A., Hanss, D., & O'Connor, R. E. (2013). Efficacy Trade-Offs in Individuals' Support for Climate Change Policies. *Environment and Behavior, 45*(8), 935-970.

Sándor, Z., Wedel, M. (2001). Designing conjoint choice experiments using managers' prior beliefs. *Journal of Marketing Research, 38,* 430–444.

Ščasný, M., Zvěřinová, I., Czajkowski, M., Kyselá, E., & Zagórska, K. (2017). Public acceptability of climate change mitigation policies: a discrete choice experiment. *Climate Policy, 17*(sup1), S111-S130.

Schleich, J., Dütschke, E., Schwirplies, C., Ziegler, A. (2016). Citizens' perceptions of justice in international climate policy – an empirical analysis. *Climate Policy,* 16 (1) 50-67.

Schleich, J., & Faure, C. (2017). Explaining citizens' perceptions of international climate-policy relevance. *Energy Policy, 103*, 62-71.

Schleich, J., Gassmann, X., Meissner, T., Faure, C. (2019). A large-scale test of the effects of time discounting, risk aversion, loss aversion, and present bias on household adoption of energy-efficient technologies. *Energy Economics,* 80, 377–393.

Schmocker, J. D., Pettersson, P., & Fujii, S. (2012). Comparative Analysis of Proximal and Distal Determinants for the Acceptance of Coercive Charging Policies in the UK and Japan. *International Journal of Sustainable Transportation, 6*(3), 156-173.

Schuitema, G., Steg, L., & Rothengatter, J. A. (2010). The acceptability, personal outcome expectations, and expected effects of transport pricing policies. *Journal of Environmental Psychology, 30*(4), 587-593.

Schuitema, G., Steg, L., & van Kruining, M. (2011). When Are Transport Pricing Policies Fair and Acceptable? *Social Justice Research, 24*(1), 66-84.

Schwirplies, C., Ziegler, A. (2016). Offset carbon emissions or pay a price premium for avoiding them? A cross-country analysis of motives for climate protection activities. *Applied Economics*, 48 (9), 746-758.

Shwom, R., Bidwell, D., Dan, A., & Dietz, T. (2010). Understanding U.S. public support for domestic climate change policies. *Global Environmental Change, 20*(3), 472-482.

Stadelmann, M., & Schubert, R. (2018). How Do Different Designs of Energy Labels Influence Purchases of Household Appliances? A Field Study in Switzerland. *Ecological Economics, 144*, 112-123.

Statement/18/3997. STATEMENT/18/3997 of 19 June 2018 on Energy efficiency first: Commission welcomes agreement on energy efficiency.

Steentjes, K., Pidgeon, N., Poortinga, W., Corner, A., Arnold, A., Böhm, G., . . . Tvinnereim, E. (2017). *European Perceptions of Climate Change: Topline findings of a survey conducted in four European countries in 2016*. Retrieved from Cardiff:

Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology, 29*(3), 309-317.

Stern, P. C. (2000). Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues, 56*(3), 407-424.

Stirling, A. (2006). Analysis, participation and power: justification and closure in participatory multi-criteria analysis. *Land Use Policy, 23*(1), 95-107.

Susaeta, A., Lal, P., Alavalapati, J., & Mercer, E. (2011). Random preferences towards bioenergy environmental externalities: A case study of woody biomass based electricity in the Southern United States. *Energy Economics, 33*(6), 1111-1118.

Tanaka, M., Uno, N., Shiomi, Y., & Ahn, Y. (2014). Experimental study of effects of travel time distribution information on dynamic route choice behavior. *Journal of Intelligent Transportation Systems, 18*(2), 215-226.

Tigchelaar, Backhaus, & Best-Waldhober, d. (2011). *Consumer response to energy labels in buildings: Recommendations to improve the Energy Performance Certificate and the Energy Performance of Buildings Directive based on research findings in 10 EU countries*.

Train, K. E., (2003). *Discrete Choice Methods with Simulation*. Cambridge University Press.

Wesselink, A., Paavola, J., Fritsch, O., & Renn, O. (2011). Rationales for public participation in environmental policy and governance: practitioners' perspectives. *Environment and Planning A, 43*(11), 2688-2704.

Whitmarsh, L. (2011). Scepticism and uncertainty about climate change: dimensions, determinants and change over time. *Global Environmental Change, 21*, 690–700.

Whitmarsh, L., Capstick, S., & Nash, N. (2017). Who is reducing their material consumption and why? A cross-cultural analysis of dematerialization behaviours. *Phil. Trans. R. Soc. A, 375*(2095), 20160376.

Whitmarsh, L., & O'Neill, S. (2010). Green identity, green living? The role of pro-environmental self-identity in determining consistency across diverse pro-environmental behaviours. *Journal of Environmental Psychology, 30*(3), 305-314.

Zverinová, I., Ščasný, M., & Kyselá, E. (2014). What Influences Public Acceptance of the Current Policies to Reduce GHG Emissions? *Choosing Efficient Combinations of Policy Instruments for Low-Carbon Development and Innovation to Achieve Europe's 2050 Climate Targets (CECILIA2050)*.

# Annex

*Figure Annex 1: "The government takes into account many perspectives when making a decision about policies to lower energy consumption."*

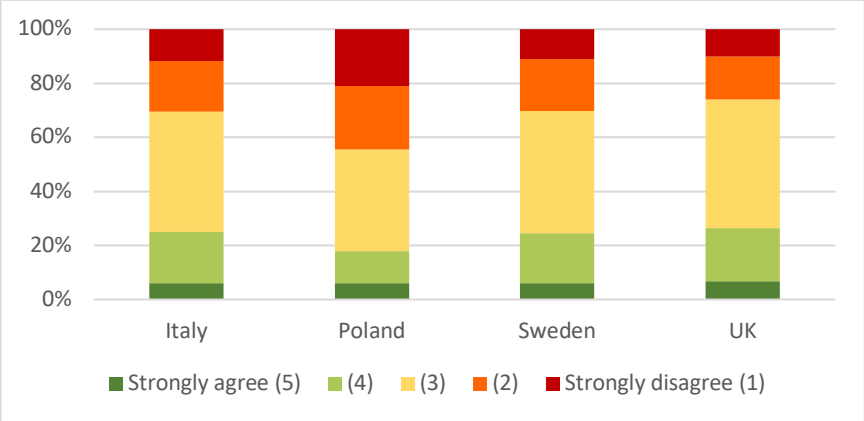


*Figure Annex 2: "The government provides all of the available information to the public when making a decision about policies to lower energy consumption."*

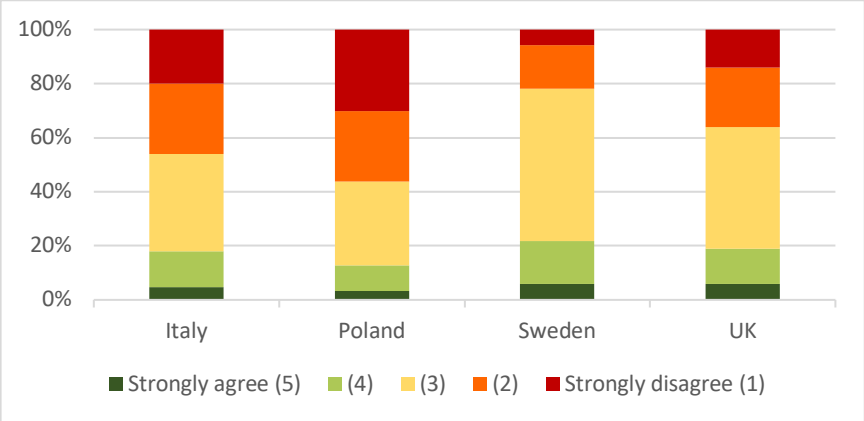


*Figure Annex 3: "In general, I trust the government."*

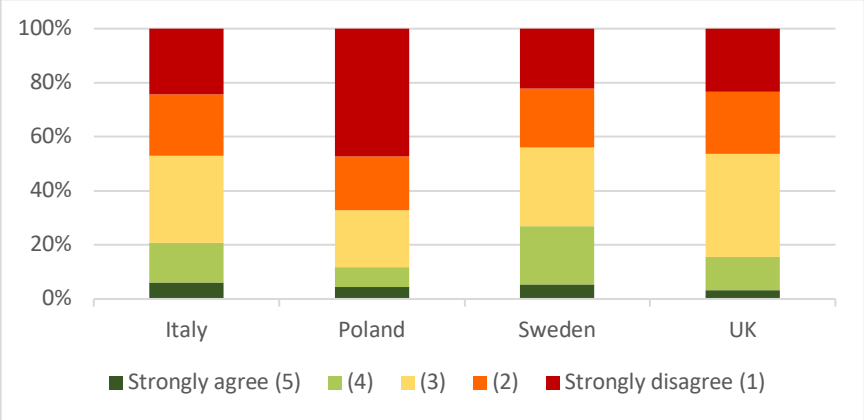

*Figure Annex 4: "To save energy is an important part of who I am."*

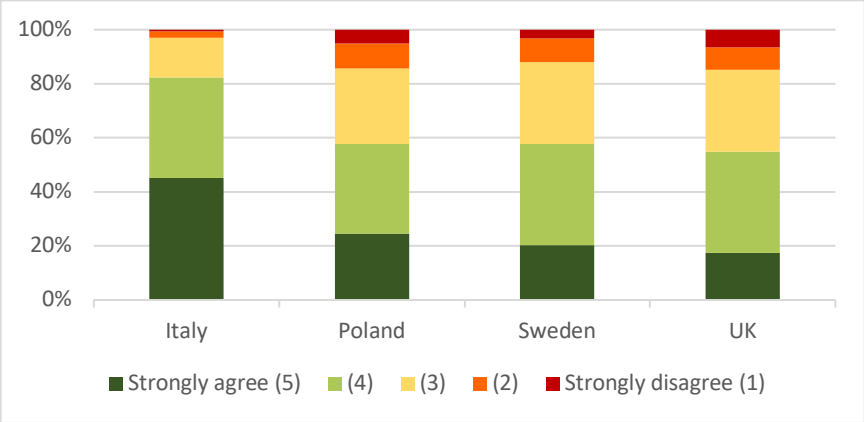


*Figure Annex 5: "I think of myself as an energy conscious person."*

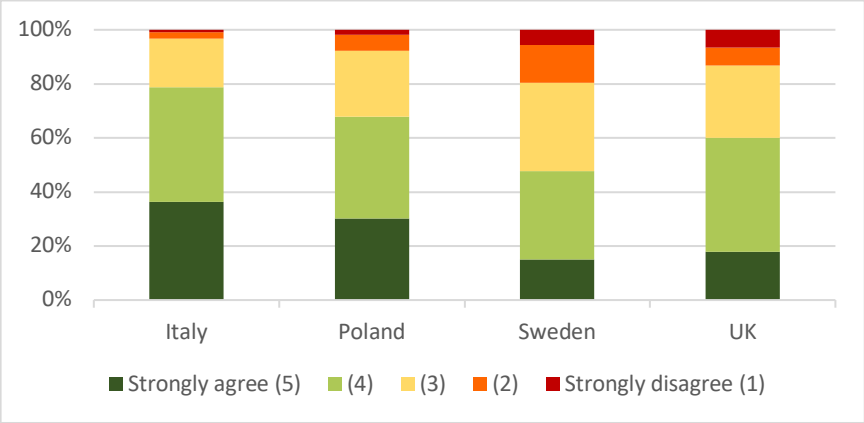


*Figure Annex 6: "I think of myself as someone who is very concerned with environmental issues."*

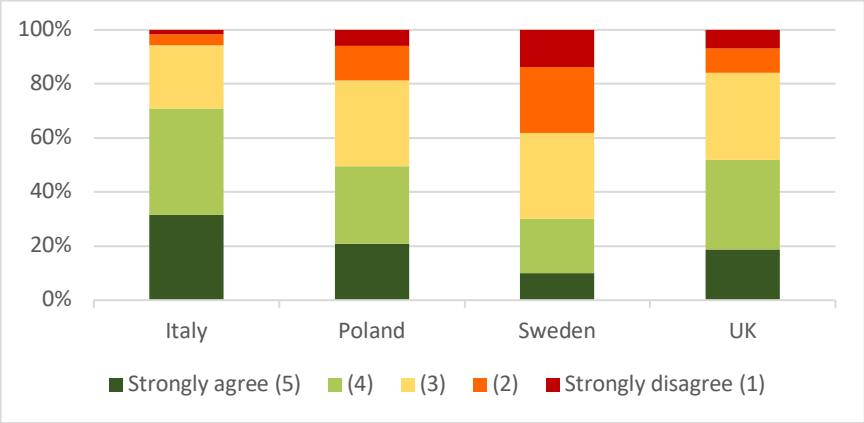


*Figure Annex 7: "Being environmentally friendly is an important part of who I am."*

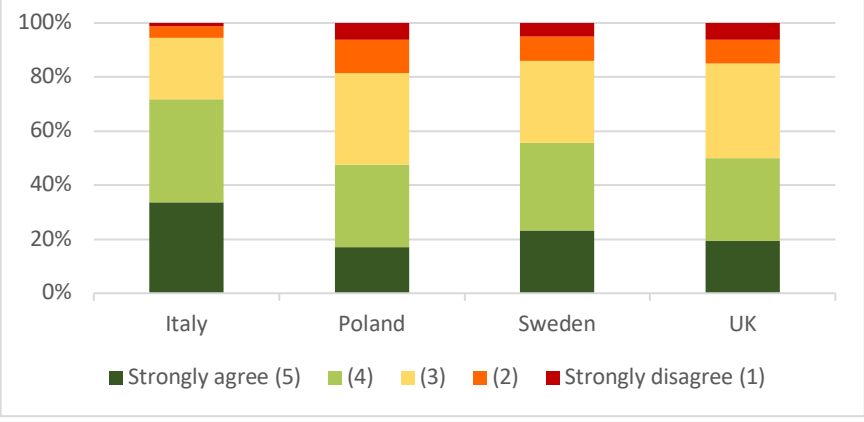

*Table Annex 1: Descriptive statistics for variables described in section 3.3.*

| | Italy | Poland | Sweden | UK |
|---|---|---|---|---|
| low income | 49% | 66% | 24% | 52% |
| high income | 15% | 3% | 15% | 21% |
| female | 50% | 51% | 45% | 49% |
| average age | 42.7 years | 42.2 years | 43.1 years | 42.1 years |
| high education | 41% | 62% | 46% | 58% |
| experience of energy-efficiency policies | 35% | 23% | 16% | 22% |
| urban | 38% | 35% | 27% | 22% |
| Number of respondents | 889 | 929 | 882 | 308 |