

Summary Note

Workshop on Consumers, Economics, and Energy Systems

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The aim of this workshop was to examine the latest research on consumers and energy from the social science, economics and other disciplines. Consumers will play a crucial role in the future development and integration of sustainable energy systems. For example, the International Energy Agency estimates that \$53 billion needs to be invested cumulatively by 2035 in a transition to a sustainable energy system to achieve 2°C. Most of this investment will need to be made by private investors, both individual consumers, households, and firms. It is important to understand the drivers and probability that consumers will undertake the investment in new energy technologies and change their behaviour.

The workshop addressed a number of important topics in the energy agenda, such as the role of consumers in future sustainable energy systems; public acceptance of infrastructure; influencing consumer behaviour; policy instruments; and rebound effects. A range of international experts from different disciplines, such as psychology, marketing and economics presented their perspectives on consumer behaviour in the energy field. In a series of presentations in five sessions, they gave an overview of their field, identified the main areas where research is needed, proposed solutions, explored ideas for future research and opened the ground for future collaboration. The audience of 40-50 participants included representatives from the Irish national energy agency, SEAI; the regulator, CER, industry, international and local academics and research students. Following each set of presentations, the Chair of each day moderated an extensive discussion with the audience.

Session 1: Policy Instruments influencing Consumers' Energy Behaviour

Dr. Claudia Aravena of Heriot Watt University (Scotland)/ the Royal Swedish Academy of Sciences (Sweden), Professor Massimo Tavoni of Politecnico di Milano and FEEM (Italy), and Professor Bengt Kristrom, SLU-CERE of Umeå, Sweden, discussed how policy instruments can influence how consumers use energy and adopt related technology. The presentations explored the interactions between policy instruments and consumers' energy behaviour from economists' perspectives. Dr. Aravena introduced the topic showing the technical, economic, and behavioural factors that influence consumers' relationships with the demand and supply of energy supply. This is important in the context of energy policy as it tries to influence consumer choices. She showed some examples of research projects that showed that (a) consumers make decisions based on more than just than financial costs – they may have a preference for clean energy for example, (b) consumer preferences may not always be technically feasible and therefore consumers alone should not drive policies, and (c) policies need to be revised regularly to remain effective in encouraging behavioural change.

Professor Tavoni then presented the results of a research project that endeavoured to understand consumer attitudes to energy efficiency through the example of consumer purchases of light bulbs in

China. While more energy efficient light bulbs are longer lasting and use significantly less energy over their lifetime, there are barriers to their purchase such as a higher upfront cost, lack of information about the direct and indirect costs and benefits, and they may have a bias to the present, i.e. the immediate benefits are more attractive than future benefits. An experiment was carried out with customers where they were presented with information on the capital and future costs and environmental impacts of various light bulbs. The results of this research showed that consumers were more willing to pay for energy-efficient light bulbs when they were provided with information on the long-term costs and environmental impacts of individual light bulbs. This willingness to pay was higher with increasing income.

Professor Kristrom discussed the influence of prices and social, or softer, policy mechanisms on consumer behaviour using several examples from his research. He highlighted the need for research in a mix of economic, sociology and psychology in understanding consumer behaviour. There is consistent evidence that residential energy demand is price inelastic and therefore additional factors such as social norms, demographics, and information drive behaviour. Demand flexibility is likely to become increasingly important in balancing systems with more intermittent electricity sources and therefore the role of the consumer will grow in the future. The policy implications are that incentive-based policies do have an impact (for example, one study shows that consumers in countries with higher electricity prices are more likely to turn off the electricity when leaving the room) but that “softer” policies are more promising than previously thought by economists. Information on its own is not sufficient, it must be tailored for the audience and objectives.

The research in this session demonstrates the need to recognise the barriers to optimal consumer decision making and that policy needs to be adapted to address them. Economic assumptions of rational behaviour are often not valid as consumers make choices for a variety of reasons. The speakers agreed that more research is needed to better understand how policy instruments can impact on different consumer types and behaviour and which are likely to have most success.

Session 2: Rebound and energy demand

Dr. Lisa Ryan, University College Dublin (Ireland), and Professor Karen Turner, Strathclyde University (UK) presented the latest research on the wider benefits of energy efficiency measures to consumers. Dr. Ryan described the historical rationale for energy efficiency in terms of energy savings, greenhouse gas emissions mitigation and energy security. However, there is increasing recognition that the benefits of energy efficiency extend to wider socioeconomic benefits such as health and wellbeing improvements, macroeconomic benefits, employment, and environmental impacts. Some of these benefits come with a trade off in terms of reduced energy savings that are called rebound effects. Dr Ryan argued that rebound from energy efficiency measures is often welfare-enhancing through the multiple benefits engendered and that there should be less focus on rebound and more on increasing welfare in energy research.

Prof Turner presented the result of computable general equilibrium (CGE) modelling of an increase in energy efficiency of 5% across the household sector in the UK. The research showed that lasting economic stimulus is generated when energy efficiency improvements take place as a result of:

- Increased disposable household income

- Savings from lower energy bills that can be spent on other things
- Reallocation of spending, changing the composition of activity
- Upward pressure on prices (depending on supply conditions)
- Some winners and losers
- But likely net gains at economy-wide/macroeconomic level.

Many governments target low income groups for energy efficiency investment and therefore the research compared the impacts of 10% energy efficiency improvement across all households sector with an improvement in energy efficiency in low income groups only. They found that the economic stimulus to the wider economy was greater when the measures were implemented across all households rather than lower income groups alone. For governments, the multiple benefits of economic expansion can provide justification for making energy efficiency a strategic national infrastructure investment priority.

In conclusion, the speakers proposed that further research in this topic is needed to better understand and measure the multiple benefits of energy efficiency measures. This should provide insights to policy makers on how welfare can be maximised. In addition, the rise of prosumers, where consumers generate their own electricity, will change how consumers interact with and benefit from energy efficiency and research is needed to understand these interactions.

Session 3: Influencing Consumers' Energy Behaviour

Professor Linda Steg, University of Groningen (the Netherlands) and ***Professor Sabine Pahl from Plymouth University (UK)*** elaborated on different ways in which consumers' energy behaviour could be influenced from a psychological point of view. Prof Steg focused on the role of values and value conflicts. Consumers often face value conflicts, for example between saving money (egoistic values), environmental benefits (biospheric values) and feeling good (hedonic values). Saving *small* amounts of money has repeatedly been shown to be counterproductive in behaviour change, as small amounts are not enough to motivate people to change. Instead, focussing on environmental benefits or making people feel good about themselves because they feel they contribute to a positive goal, can be more effective. Values shape consumers' preferences and views, for example how they see themselves and their own behaviour (self-identity). Finally, the influence of contextual factors on consumers' behaviour were discussed, particularly the role of social norms. In situations where informal social rules (social norms) were violated, people tend to comply less to "normal behaviour", for example, they litter more and show more unethical behaviour.

Prof Pahl focussed on tools that can be used to enhance behaviour change and in particular on the use of visualisations. Visual imagine can be very effective to change consumer's behaviour because energy is abstract and invisible to consumers, and often not their priority. Also, from a psychological point of view, visuals can increase consumers' awareness of energy issues, provide specific cues for action (i.e., is a form of tailored feedback), present complex information in a comprehensive way, and can overcome language and knowledge barriers. All in all, visualisations can communicate messages quickly and powerfully. Studies showed that presenting people with thermal images of energy efficiency in their homes led to a significant reduce in their carbon footprint (based on their energy bills), and they performed more energy efficiency actions, especially when the behaviour was directly

linked to the thermal images. Thermal images did not only lead to behaviour change in the short term (2 weeks), but there were also longer term (1 year) effects seen, particularly when the information was tailored to consumers' own situation.

Prof Steg and Prof Pahl concluded that the build of techno-social programmes needs to be based on strengths of the human mind (e.g., visual images). There are two key issues on which future research should focus: scoping up and understanding people who are not interested in energy issues (the latter is a large part of the population). Key challenges are to make energy meaningful and engaging to people, in order to translate this into demand reduction and better balancing of demand and supply for a sustainable energy transition. To achieve this, pilot studies and large experimental trials are needed.

Session 4: Public acceptance of energy infrastructure

Professor Patrick Devine-Wright from the University of Essex (UK) and Dr Geertje Schuitema (UCD) talked about the public acceptance of energy infrastructure. First Prof Devine-Wright illustrated that acceptance of infrastructure is not the same as support as people may accept, but not support, such initiatives. A common, but controversial model, to explain public responses to energy infrastructure is the Not-In-My-Back-Yard (NIMBY) effect. However, the NIMBY effect is heavily criticised, as it is generally pejorative, inaccurate and does not explain the real cause of public opposition. NIMBYism is rather the product of social interaction and expectations. What then explains the public responses to energy infrastructure?

Prof Devine-Wright and Dr Schuitema outlined various causes of community objections. Firstly, proposed projects often have a negative impact and lack positive impact for communities. This may in some cases be influenced by compensation schemes (to stimulate communities' economy or facilities, ownership), but one must be aware of the possibility of negative side effects (e.g., they may be seen as a bribe or recognition of negative impacts). If the costs and benefits of projects are seen as unfairly distributed within a community, intra community conflicts may occur. Trust in authorities and decision makers is another factor that largely influences consumers' responses to energy infrastructure. Trust strongly influences consumers' perception of impacts, risks, and benefits of projects. It also influences their emotional reactions to projects and policies. Dr Schuitema illustrated this with a study on public responses to the Irish water charges: particularly negative emotions influenced the public acceptance of these charges, partly because people saw more negative effects. Trust is strongly linked to feelings of procedural injustice, that is community objections are often rooted in dissatisfaction with consultation and decision making procedures. Finally, Prof Devine-Wright illustrated how different ways in which people are attached to "their place", influences their responses to energy infrastructural projects. Typically, people who have always lived in a place, or returned to their place of childhood after being away for a while (i.e., traditionally attachment) accept energy infrastructure more easily than those who moved or have actively decided to move to a location where they had not lived before (i.e., actively attached).

Prof Devine Wright and Dr Schuitema concluded that the concept NIMBYism has to be avoided, and that it's better to focus on the actual underlying objections and motivations of public resistance to energy infrastructure. In engaging the public is important to be sincere, and acknowledge and address

real concern of the public. In this respect, it is important not to underestimate 'non-rational' factors, such as feeling of unfairness, distrust and emotions, as are very important factors for public responses to infrastructural projects. There is no fixed set of rules that can be applied to engage the public in projects, as every community and every project is different. Finally, it is important to realise that what is best from a technical/political point of view is not always best from a community point of view.

Session 5: The Need for Social Sciences in Energy Research

Professor Benjamin Sovacool from Sussex University (UK) and **Prof Mark O'Malley (UCD)** presented their work and thoughts on why Social Sciences should be better included in energy research. Prof Sovacool argued energy research needs to focus on increasing the fundamental understanding of energy research as well as add to the immediate usefulness for society. As a result, a better understanding of energy behaviour and consumption is needed. This includes consumers' risk perceptions of different technologies and their consequences (e.g. affordability, security), perceptions of equity, fairness and justice. When focussing on the impact of energy use, the impact on human (as opposed to the economy for example) should be understood as well. Prof Sovacool illustrated the limited role that social sciences currently have in energy research in a content analysis. Under 20% of all energy research is currently performed by social scientists. When analysing who was doing this research, females were largely underrepresented; interdisciplinary and comparative collaborations were rare; and quantitative methods were mostly used.

Prof O'Malley explained the need for social sciences from an engineering point of view. He focused on the need for a flexible grid, in which consumers play an important role. Consumers' play an important role in the demand-response of energy. Firstly, consumers can provide a source of valuable flexibility in the system. It is important to understand different business models that can facilitate consumers to accept this role. Secondly, consumers' characteristics impact the demand response, as not all consumers behave in the same way. Social sciences are fundamental for the integration of variable renewable energy into the grid and discussions on centralised or decentralised energy generation and storage.

In conclusion, both speakers stressed the important role that social sciences should play in energy research, and conclude that the social sciences have largely been neglected till very recently. Within social sciences research, a better representation of women and underdeveloped countries is important, as they have an important view on energy issues. Also, a wider variety of methods, collaborations, as well as a focus on neglected research topics (such as anthropology and culture, communication and persuasion, politics and political economy) are required. Finally, if the aim is to stimulate social sciences in energy research, a bigger slice of funding should go to this, there should be a focus on problems not on disciplines, researchers should attempt to include expertise and data from others more (e.g., from lay people, community leaders) and reach across disciplines (particularly beyond Europe and North-America).

Closing discussion: Areas for Future Research

Professor Eleanor Denny, Trinity College Dublin moderated the final session that invited the audience to discuss the main points of the previous sessions and propose areas for future research on consumers and energy research. Some popular themes were the following:

- Trust is important in determining the effectiveness of policy in changing behaviour. Without trust in the agent promoting the policy, the consumer is unlikely to believe the message or take action.
- Heterogeneity was a common theme across many of the presentations both from economics and psychology.
- The way energy measures and policy are perceived is not always based on the quality or rationality of the measures. Issues such as equity and fairness play an important role in the perception and implementation of a measure.
- While multiple benefits associated with energy measures can positively influence energy efficiency behaviour and acceptance, the weighting of different benefits will vary between individuals since they have different values and norms.
- More work is needed across different social science disciplines on developing common methods and approaches. Capacity across disciplines should be developed for a next generation of researchers who can do interdisciplinary research.
- It is important to work with and benefit from the experts in each discipline so that multidisciplinary work has a sound theoretical basis and does not risk “dumbing down” the research.
- The residential sector has been the focus of most of the social science energy research discussed at the workshop and in the literature. It will be important to expand the research to other sectors also.

Overall, the participants of the workshop were in agreement on the importance of multidisciplinary social science research in consumer energy behaviour. With increasing prominence being attached to the role of the consumer in transforming energy systems and policy, this area of research is likely to grow.