Introduction to Panel 8 Dynamics of consumption – from knowledge to action

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Introduction

Consumers play a crucial role in the transition towards a sustainable energy system – not only as powerful customers, but also as conscious end-users of energy technologies, as 'political consumers', or even as producers of energy. Buying decisions and use patterns are driven by the need for energy-using services (be it light, heat, communication, entertainment or mobility), but these needs co-evolve with social values, norms, habits, attitudes, and wider externalities such as infrastructure and the development of technology.

The papers in panel 8 discuss the various relationships between policy interventions, awareness programmes, processes of social learning and technological innovation. They are looking for new insights regarding these dynamic, and often complex, relationships. Consumption is used in its broadest term, including a wide range of social actors, not only consumers, and a wide range of activities – from taking a shower to buying a new home. The papers are motivated and linked together by the vision of a future energy system that is based on highly efficient consumption patterns, sustainable practices, and radically improved energy saving behaviours and technologies. Turning research into practicable intelligence for policy makers, implementers and end users to promote a more sustainable energy system, is a major goal of this panel.

Main topics and research perspectives

The 2011 panel on dynamics of consumption includes 32 papers (22 oral presentations and 10 posters) which may be a new record for the eceee. However, this selection of papers is not only impressive by sheer quantity but also due to the high quality of the research and the wide range of approaches and fields of investigation that are presented.

The first group of papers focus on *energy-related behaviours in households*. These papers deal with good (or even best) practices and discuss opportunities to mainstream successful models. They also try to explain variation in household energy consumption, develop and use frameworks to describe and predict energy saving behaviours and uncover peoples' energy rationalisations.

The second group of papers deals with specific *social environments and related energy experiences*. These papers remind us that there still is enormous inequality between various socio-economic groups and that the terms 'consumption' and 'energy saving' have crucially important meanings to vulnerable households in energy poverty, for example.

The third group of papers revolve around *smart metering and energy feedback systems* – a topic discussed at the eceee for some time now. This year's contributions either report on the most recent developments in individual countries (Sweden, Austria, the Netherlands, California) or try to bring results from different studies together to improve our understanding of feedback-induced energy savings.

The fourth group of papers explores *the energy impact of evolving socio-technical practices* using mixed-methods research strategies. Here, examples are air-to-air heat pumps in Denmark, terrace heaters in Norway and electric vehicles (respectively, analogue technologies) in Germany.

The fifth group of papers explores and discusses *new frameworks and approaches to understand energy consumption*. The authors in this group deal with investment decisions and building designs, the evolving vision of the smart home, and energy saving potentials of specific socio-technical niches.

In the sixth group, the focus is on *energy efficiency through social learning and technology design* in professional workplace

environments. Two case studies deal with potentials for energy saving in professional kitchens. Another study reports on experiences with feedback tools in the field of ICT.

With the seventh group we gradually move towards the practical side of the dynamics of consumption. The three contributions in this group propose and report on *new approaches to promote energy efficiency*. Here we get familiar with two novel approaches to re-conceptualise energy advice and technology learning and we learn more about first experiences using social media tools to spread research findings on energy efficiency.

The eighth and final group eventually leads us to the *practical realm of energy advice*. The papers report on a number of novel toolkits and concepts using peer-to-peer communication, consumer empowerment strategies, regional networks and close cooperation between project practitioners.

Understanding energy behaviours

Sylvia Breukers, Julia Backhaus and Oksana Mont investigate options to mainstream sustainable practices in the field of energy demand at the micro-level, and how energy demand side management projects can encourage those processes. An important finding of this study is that, in order to shift everyday practices to a more sustainable direction, an understanding of possibilities to trigger changes in social norms is needed. Furthermore, connecting supply and demand (instead of merely addressing the demand side) can be crucial in mainstreaming sustainable energy practices.

Using data from the Norwegian national consumer survey, Eivind Stø, Nina Heidenstrøm, Pål Strandbakken and Harald Throne-Holst try to explain the decrease of electricity consumption in Norwegian households since the mid 1990s. They do not come up with a single explanation; rather they discuss a number of technological, economic, regulatory and personal factors.

Janine Morley and Mike Hazas explore the variability in domestic energy consumption using empirical data from comparable student apartments in a UK university. They develop hypotheses regarding the resulting variance in energy use based on a practice theory approach. Findings challenge the view that such difference in consumption of electricity is largely due to idiosyncrasies of individual behaviour.

Richard Snape, Katherine Irvin and Christophe Rynikiewicz present a prototype Agent Based Model (ABM) as a means to examine the effect of individual behaviour and social learning on energy use patterns – from the adoption of energy saving behaviours, energy saving technologies and individual- or community-based energy use practices. They draw on New Zealand's Energy Cultures framework to understand real-world observations and incorporate representative energy use behaviours into the model and discuss the model's relevance with case studies.

In order to overcome insufficient energy policy instruments in the field of energy saving, Kevin Maréchal and Laurence Holzemer suggest analysing energy consumption patterns by using the concept of habitual-practice, which focuses on practices that are meaningful for the practitioners. The aim of this research is to identify and describe 'grips'. Grips can contribute to the identification of consumption profiles and then be used as a dialogue interface between those profiles and the design of novel energy-saving tools.

Miranda Mirosa, Rob Lawson, Daniel Gnoth and Janet Stephenson have studied the paths that link energy behaviours to peoples' rationalisations for those behaviours, and to their personal values. In-depth, qualitative interviews were conducted in four contrasting locations in New Zealand. The results reveal many different rationalisations arising from the behaviours which have varied links to different values. Given the diversity of paths that exist, the authors conclude that understanding people's rationalisations for behaviour is just as relevant as understanding their values in seeking to identify appropriate policy interventions that target energy efficiency and conservation.

Social environments and energy experiences

Andreas Huber, Sébastien Girard and Yoann Thomas analyse the carbon footprint of different social milieus in France. They identify the consumption areas with the highest footprint and subsequently suggest appropriate "intervention strategies" targeting specific characteristics in each milieu.

Karl-Michael Brunner, Anja Christanell and Markus Spitzer report on the project "Sustainable energy consumption and lifestyles in poor households" which used qualitative interviews to investigate energy consumption in low-income households in the Austrian capital Vienna. The authors provide a thorough insight into the limited living conditions of low-income households, discuss critical factors of energy consumption and applied coping strategies, identify potentials for energy efficiency and energy saving, and discuss policy measures that may help combat fuel poverty and social exclusion.

Wiktoria Glad presents a qualitative case study on a large retrofit housing project in Sweden. In detail she analyses the impacts of three technical systems (electricity, heating, and hot water), all parts of a novel individual metering and debiting system installed during the retrofit.

Marina Topouzi discusses occupant feedback techniques for low-carbon refurbishments and presents the theoretical foundation of a methodological design developed to investigate, observe and analyse the 'phenomena' of individual households' energy use based on monitoring data.

Stephanie Gauthier proposes a set of tools to measure thermal comfort in private households. Preliminary results from a pilot study show that different householders are interacting with their home thermal comfort systems in very different ways, and that their responses diverge from the current predictive models.

Smart metering and energy feedback systems

Henk van Elburg discusses recent experiences concerning the projected rollout of smart meters in the Netherlands which was affected by intense opposition from consumers' organisations and privacy watchdog groups. This opposition slowed down the process of regulation and innovation and stimulated the government to switch from a top-down policy implementation to a more collaborative approach with stakeholders and consumers' organisations. The author argues that the new legal framework based on a voluntary acceptance by consumers will lead to successful uptake of smart meters.

Simon Moser, Andrea Kollmann and Johannes Reichl present a novel electricity consumption information system enabling social comparison. This is an individual consumption benchmark derived from regression analysis considering a certain household's characteristics and equipment.

Based on three case studies on energy feedback services in Sweden, Jurek Pyrko shows that energy feedback does not lead to overall lower electricity consumption. Instead, users of statistics services have shown both reduced and increased electricity use in the households.

Judy Lai, Nicholas DeForest, Sila Kiliccote, Michael Stadler, Chris Marnay and Jon Donadee briefly report on the history of the tiered pricing system of California's Pacific Gas and Electric Company, discuss the problems the utility encountered with its smart meter rollout, and evaluate the proposed dynamic pricing incentive structures.

Based on a meta-review of existing studies on energy feedback programmes, Karen Ehrhardt-Martinez provides an assessment of the behaviours that drive feedback-induced energy savings. Results show that energy savings are typically achieved as a result of three categories of action: 1) simple changes in routines and habits, 2) infrequent and low-cost energy stock-taking behaviours, and 3) consumer investments in new energy-efficient appliances, devices and materials.

Energy impact of evolving socio-technical practices

Toke Haunstrup Christensen, Kirsten Gram-Hanssen, Poul Erik Petersen, Troels Fjordbak Larsen, Erik Gudbjerg, Lisbet Stryhn Rasmussen and Preben Munter focus on the comfort practices that influence the electricity consumption related to air-to-air heat pumps, based on qualitative interviews and surveys. The study also includes results from metering data on the households' actual electricity consumption and technical inspections of heat pumps. The paper draws on a practice theoretical approach, regarding energy consumption as an important part of everyday practices that integrate different elements, including habits and technologies.

Nina Heidenstrøm, Pål Strandbakken and Harald Throne-Holst present a case study on terrace heaters in Norway. They argue that terrace heaters are a potential driver for increased energy use in both public and private spaces, due to changed social norms. The aim of the paper is to study the possible transfer of this technology and these habits from the public and into the private sphere. The main empirical finding is that this transfer is rather limited.

As insights into consumer perceptions and acceptance of electric vehicles are still limited, Elisabeth Dütschke, Uta Schneider, Anja Peters, Alexandra-Gwyn Paetz and Patrick Jochem describe consumer perceptions of LPG and CNG vehicles, as potential comparison to electric vehicles.

New frameworks to understand energy consumption

The paper of Sophie Nyborg and Inge Røpke traces the co-evolution of the visions on smart homes and smart grids in Denmark. The smart home vision is seen as a kind of 'melting pot' of different trends as automation of household chores, entertainment and energy management. The problem is that the smart grid could – contrary to the dominant narrative – become a dynamic system that constructs and normalises new energy-demanding practices and facilitates escalating expectations of comfort.

Nicole Woolsey Biggart and Loren Lutzenhiser propose a way to incorporate a sociological and institutional dimension into understanding housing choice by using the concept of 'ideal type'. Based on preliminary fieldwork study and archival research, the authors propose a two-dimensional conceptual scheme that posits how ideas and values may be expressed in particular materials, building forms and arrangements.

The paper by Noam Bergman proposes a framework aimed at classifying niches and assessing their potential to increase sustainability and reduce carbon emissions under different circumstances and policy environments. The empirical examples are heat pumps, car clubs, and a Camp for Climate Action.

Energy efficiency through technology design

Erica Löfström and Ida Nilstad Pettersen explores the potential role of using visible symbolic qualities (VSQ) of resource-saving measures in influencing kitchen-related consumption, partly building on how VSQ can be factors in design. The concept of strategically using VSQ of consumption is not unproblematic as it raises questions concerning what behaviour is to remain private and what can and should be revealed to others.

Richard Bull, Neil Brown and Farhan Faruk report on a project focussing on the design of a feedback tool for building-users in a workplace context. The authors show the difficulties in attempting workplace 'user-engagement' in ICT-based energy reduction initiatives, and reflect on the complexities of workplace energy saving.

Lars Bang-Jensen, Mads Lindevall Kristiansen and Annette Gydesen report on a project aimed at reducing energy consumption in commercial kitchens in Denmark. The paper provides a review of existing expertise and knowledge about energy consumption in commercial kitchens and discusses suitable instruments to promote energy efficiency in this field.

New approaches to promote energy efficiency

Hans Nilsson and Clas-Otto Wene provide an overview of the most commonly-mentioned barriers to energy saving measures, explain why they are insufficient as a concept, and indicate a different foundation for policy-making using behavioural economics. Moreover, the authors advocate for focused deployment programmes that make use of technology learning.

Lene Nielsen proposes to critically rethink the traditional energy efficiency planning concepts. In her paper she suggest a new set of 'dogmas' for future energy efficiency policy, of which several elements are transferred from disciplines other than energy efficiency research.

Sea Rotmann, Amardeep Sandhu and Lauren Christie present initial findings from a series of social experiments that are being carried out in New Zealand, using social media technologies to translate and disseminate research results and generate discussion and feedback to inform researchers, policy-makers and community action groups involved in motivating change.

Energy advice in action

Saskia von Gunten and Jacob Tompkins report on an ongoing advice and awareness-raising project on water and energy efficiency in the UK. An evaluation within the project has shown that, in order to educate people and change their long-term behaviour, it is crucial to use a personalised approach and focus on quality rather than quantity of the advice given to customers.

Kerstin Fink, Andreas Koch, Pia Laborgne and Sandra Wassermann present first results of the interdisciplinary project "Consuming energy sustainably – consuming sustainable energy: Heat energy in the field of tensions between social predictors, economic conditions and ecological consciousness".

Virve Rouhiainen presents first experiences from a pilot study on a co-operative concept for providing energy efficiency services for households in Finland. The main idea of the project is to establish an energy advice network based on peer-to-peer communication.

Päivi Laitila, Irmeli Mikkonen and Erkki Eskola report on experiences from 14 two-year pilot projects on energy use in buildings and renovation in Finland. The projects are carried out by a multitude of organisations such as regional energy agencies, municipalities, NGOs and non-profit associations. The experiences show, among other things, that cooperation among project practitioners is a crucial factor to improve the quality of advice.

Conclusion

The wide range of papers, sectors and methodologies presented in this panel provide an up-to-date overview of current research and interventions in the dynamic field of energy consumption. The need to turn science into practicable intelligence and outcomes leading to reduced energy use is as apparent as ever. We hope that we have taken yet another step towards improving understanding in this important field – increasing oil and electricity prices and increasing energy demand from developing countries make it imperative to implement the 'behavioural wedge' – estimated to make up around 20 % of total energy use (Dietz et al. 2009).

References

Dietz T, Gardner GT, Gilligan J, Stern PC, Vandenbergh MP (2009). Household actions can provide a behavioral wedge to rapidly reduce US carbon emissions. Proc Natl Acad Sci USA 106:18452–18456.