Introduction to Panel 9
Consumption and behaviour

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Introduction

This year's panel on consumption and behaviour set out to cover energy (and more widely, resource consumption) and behaviour from a systemic perspective. Behavioural sciences have highlighted the following gaps in the literature:

- The need to look both at the individual level and beyond when analysing behaviour and/or social practices. This includes taking into account social groups and the wider material, social and economic context in which people live and work, which all have an impact on energy and resource consumption behaviours and the decisions taken by households and organisations.

- The need to look beyond sectorial interventions. Policies and projects tend to focus on sectors (building, transportation, food …) whereas people do not consume energy or resources as such, but the services energy and resources provide them, regardless of the policy sector that tackles them.

- The need to articulate policy tools and act at every governance level in order to efficiently deal with the behavioural aspect of energy consumption.

It is then necessary to study not only single behaviours, but also the way they interact with each other to form varying degrees of energy intensive ways of life and to also relate them to actual impact on energy and resource consumption. Also, policy interventions should be evaluated through this lens. The papers chosen to be included into this panel were selected to cover those needs and they all contribute to filling them in one way or the other.

First, this panel presents a set of papers around new low-carbon technologies and innovations and the way they enter the social fabric. A set of papers present findings regarding prosumers in Northern Europe. Another set of papers reflect upon what happens when the adoption of the technology does not happen the way it was anticipated, using new buildings as examples.

Second, this panel presents a set of papers around the complexity and multidimensionality of human behaviour, for example to analyse the complex interplay of factors that come into play in the renovation decision. Such complexity asks for a close analysis of practices to understand their margin of manoeuvre for policies. Everyday practices or the buying process for new equipment need to be studied in details in order to tailor policies. Complexity can also be captured through segmentation techniques, as highlighted by a few papers. Evaluation is also a great way to capture that complexity and to better understand what each level of action (from a single behaviour change project to more complex integrated policies) can achieve. Regarding evaluation, a second set of papers focuses on the evaluation of renovation policies from an economics point of view.

Such multidimensionality calls for multidisciplinary approaches, which opens up new challenges that a set of paper either discusses or seek to operationalise.

New technologies and the everyday life: insights on prosumers

Some papers in this panel focus on how new technologies (PV, EC …) that enter homes are adopted by households. They study the early adopters who simultaneously produce and consume electricity. The papers aim at understanding who these pro-

sumers are, what their representations are, and how policies can have an impact on their profile.

Christensen et al. (9-162-17) present the results of a qualitative study carried out in Denmark with prosumers equipped with an electric vehicle, heat pumps or home batteries. A high proportion of these households have developed new embedded routines that enable them to consume the electricity they generate, mainly through time-shifting of laundering and dishwashing. Such new synchronisation routines do not extent to electric vehicles: households plug it in when they come home because they want to feel that they can use it whenever they need it, and therefore do not synchronise their electricity consumption and generation. Synchronisation is also challenged by home batteries, as households tend to let batteries take over the role of time shifting the consumption.

Throndsen et al. (9-127-17) goes in more detail into potential prosumers' representations and values – how do they envisage the ideal prosumer or more specifically: what do they perceive to be the expectations of what contributes to being a good prosumer? The paper reports on entries that potential prosumers in Norway added to their application form for renting a PV from the local utility. People liked to emphasise their eligibility by referring to aspects like direction or angle of the roof, but interestingly also pointed to specific needs like powering an electric car or electric space heating. There was also a strong tendency for the users in the data to highlight technological competency, evident for instance in the strong representation of electricians and knowledge workers, i.e. describing themselves as an 'expert consumer'.

Palm (9-026-17) highlights how households' motives evolve with the market and policy context and the nature of the incentives it provides them. The paper documents the main evolutions in households' decisions to invest in PV panels in Sweden over nearly a decade (2008 to 2016), and the development of economic motivations amongst adopters. This can be explained by key changes in the market and policy context of PV in Sweden: the decrease in PV panel prices, the increase in the number of companies that sell or install PVs and the introduction of economic incentives (subsidies, tax reduction …) to install PV.

Innovations and existing professional practices in the building sector

What happens when the adoption of the technology does not happen the way it was anticipated (or cannot be anticipated)? Two papers in this session mobilise social sciences insights to question existing professional practices in the building sector, and more specifically, in new buildings. Thomsen and Lappegård Hauge (9-025-17) emphasise the role of experts especially in the hand-over phase as households move into energy efficient buildings and corroborates their assumptions with qualitative case studies pointing to differing understanding of roles / expectations of households and relevant experts. Their analysis points to the different representation of roles that are held: households tend to have higher expectations on what they need to be taught as they lack expertise – sometimes to a degree that is hard to imagine from the point of view of the experts. Gram-Hanssen et al. (9-271-17) explain how existing building regulations in Denmark have led to

technological and design choices that do not fit with occupants' practices, and hence to higher than expected energy consumption. A key explanation for this lies in the limits of the theoretical calculations used to design buildings, as they fail to take uses and practices into account. Possible ways to improve the situation include improving thermal simulations and using post-occupancy evaluation schemes rather than pre-construction evaluations.

The multidimensionality of behaviour

Behaviours are multifaceted. Papers in this group present different ways to capture that multidimensionality of everyday practices, of the buying process or of renovation decisions. This is key to better understand the margins of flexibility of demand.

Regarding everyday routines, Glad et al. (9-199-17) describe a process elaborating around hot water use in households in which researchers and an artist participated, thereby enabling broader perspectives than from research alone. Grunewald et al. (9-237-17) document the work carried out to develop a new tool, based on smartphones, to capture time-use data as part of the Meter study project. Apps can provide a tailored interface, hence making it easier to fill in time-use questionnaire.

Regarding buying processes, Dütschke et al. (9-324-17) present the results of two workshops organised in Germany and Spain to gather consumers' feedback on PocketWatt, which is a digital consumer tool that gives tailored energy performance information at the point of sale (through smartphones or online). This paper introduces an innovative tool, but also points to the value of early consumer feedback on such tools as well as the challenges in development. Munkacsi and Mahapatra (9-276-17) present the result of a quantitative study carried out in Hungary in order to understand the role of social influence (from peers, both on and off-line) in the purchase of heating products by households. The role of social influence varies depending on the stage of the decision-making process, with the social environment playing a key role when customers start looking for information and cross-checking it. Professional sources of information play a more important role in the final decision stage.

Finally, two papers look at the renovation decision process. Taranu et al. (9-072-17) aim at classifying barriers and motives to do and not to do energy efficiency renovations into heuristic and deliberate and analyse this issue empirically based on two studies. They find that resistance to getting active tends to be more based on heuristics – which points to the relevance of making households actually think about renovations to get them involved. Renz and Hacke (9-184-17) highlight twelve influencing factors (such as, for example, economic considerations, ecological opinions, interest in maintenance and repair or perceived practicability) that are taken into account by households in their decision to renovate or not. The (positive or negative) outcome of the decision comes from the fact that the same factors are weighted differently by households. Given the multidimensionality of such a decision process, the article calls for integrated policy packages addressing both financial and non-financial aspects.

Better understanding the diversity of energy users: segmentation

A key insight from social sciences is that looking at the average individual is not helpful when it comes to developing interventions that are relevant to the diversity of energy users. That diversity can be captured through different methodologies. On the one hand, Bent and Kmetty (9-182-17) illustrate how quantitative segmentation techniques can be used to adapt policy to real-life settings. They present a methodology developed in the NATCONSUMER project to segment the population of four European countries based on their values and attitudes, in order to tailor the energy saving feedback. Attitudinal segmentation allows adapting the style of the feedback (how the message is given to households) according to households' attitudes and values. Bouly le Lesdain and Douzou (9-092-17), on the other hand, base their segmentation on logics of action (the 'altruists', the 'thrifty' and the 'comfort-seekers') that explain electricity-related behaviours. By studying three French islands that are characterised by a rapidly increasing electricity demand and the need to limit that demand to what can be produced onsite, this paper shows that it is necessary to study in depth the logics of electricity uses to understand the margin of manoeuvre that policies have when attempting to make households shed loads.

Such segmentation techniques can also be useful to unveil the diversity within what would otherwise look like a homogeneous group. Deumling et al. (9-432-17) investigate the demographics, behaviour and satisfaction of the lowest 10 % of electricity consumers in Sacramento, California. They find that this group is surprisingly diverse, and that they cut across typical categories (demographic, social, economic). They identify six profiles within this group, based on a mix of demographics and attitudes. This result is highly relevant for policy as it shows that lower energy use can be achieved in a wider proportion of the population than expected.

Evaluating behaviour change projects

EVERYDAY ROUTINES

Stiess et al. (9-398-17) summarise experiences from a programme for electricity saving for households which led to 5–10 % reduction. Follow-ups also showed that the effects were sustained, indicating a comparatively successful programme. Lopes et al. (9-330-17) report findings from a smart meter field trial in Portugal and factors related to different indicators for energy consumption are identified. They find that structural variables (e.g. stage of life), certain energy-consuming activities (e.g. weekly washes) as well as engagement (e.g. performing activities related to energy issues that require some expertise) significantly relate to electricity end-use. This supports the understanding of electricity use as a social practice within a contextual framework with a quantitative data base. Bull et al. (9-084-17) present the results of the evaluation of the Student Switch Off campaign, which is an inter-dormitory energy-saving competition in five European countries. In total, it achieved an average of around 9 % energy savings across countries in its second year (when it was fully operational). Students have carried forward energy-saving actions established during their time in dormitories when they move out, hence confirming the

interest to develop interventions that target key moments of change in the lifecycle.

Looking beyond single studies is also important: Chatterton et al. (9-077-17) give the gist from two studies which summarized first, the effectiveness of energy usage behaviours in homes and second, interventions targeting heating. The discussion focuses on shortcomings in published research that limit their impact on policy making. One argument amongst others is that studies hardly ever quantify the costs and efforts for implementing the intervention. And as the effects of the intervention are often relatively small, 1–11 % at best, this is a highly relevant issue.

RENOVATION POLICIES

Two papers in this panel present findings from econometric evaluations of renovation policies. Collins and Curtis (9-005-17) present an evaluation of the Better Energy Homes scheme (Irish grant aid scheme to increase renovation uptake). The scheme was quite successful in triggering renovation, as it has a rather low free-riding rate. Only 8 % of households who received the grant would have carried out works without it, and a further 7 % would still have carried out works if the subsidy was lower. The scheme did not, however, manage to achieve deeper retrofits, even when bonus payments were introduced for more comprehensive renovation. The paper therefore points to the need to complement the grant scheme with household support, to overcome the organisational burden of deep renovation. Nauleau (9-200-17) analyses panel data from France about factors related to a set of renovating measures. These factors include building and household characteristics as well as economic aspects and incentives, information, contextual factors and concerns. Results suggest that in case of investment in heating systems subsidising retrofit cannot impact the timing of the decision but only the level of performance while it can impact both the timing and the level of performance in case of insulation. She also identifies specific drivers to multiple-measures retrofitting, such as the opportunities created by recent move-in or access to ownership. These findings give valuable advice for developing policies.

Operationalising multidimensionality: combining disciplines

A set of papers presented in this panel discuss multidisciplinarity and the extent to which complex approaches can be integrated into policies.

First, Granier (9-006-17) looks at why behaviour policies in Japan were more prone to integrating insights from behavioural sciences (i.e. psychology, behavioural economics, cognitive science and brain science) rather than social sciences (i.e. sociology, anthropology and ecology). As any policy change, this was due to the convergence of a context (climate change regulations and the March 2011 disaster) and the work of policy entrepreneurs who imported policy solutions from abroad. Behavioural approaches were adopted because they fitted better within the culture of these policy entrepreneurs. The success is also due to three interlinked factors: first, the fact that economics and psychology have developed common analysis over the past decades, facilitating the integration of psychological insights into policy; second, the fact that behavioural research has greatly evolved and improved

the robustness of its investigation tools. And, finally, the fact that social sciences tend to produce more complex and comprehensive policy recommendations that ask to go beyond interventions at the individual level and that are not easy for policy makers to transform into practical policy tools.

A second set of papers seek to operationalise multidisciplinary insights. Johansson and Neij (9-336-17) present a set of questions specifically developed to be applied to papers on behavioural interventions in the building sector in order to widen the angle of evaluations also to underlying psychological aspects. Rotmann (9-191-17) reports on the International Energy Agency's Demand Side Management Programme's Task 24. She spreads out the learnings of a great review of psychological, sociological and economic theories, labelled 'the monster' – coming to the conclusion that all of them are wrong but many are very helpful. Also pointing to the challenge of hard facts of behaviour change, i.e. putting down numbers (see Chatterton), but also developing a concept for this as part of the Task.

Gaspard et al. (9-197-17) present a multidisciplinary checklist derived from social sciences (economics, psychology, social psychology, sociology and anthropology). The checklist helps policy makers analyse the various facets of renovation behaviours and the associated policy challenges and gaps. The paper then presents an ideation methodology that is classically used in Design Thinking to fill in the policy gaps.

Wilson (9-418-17) introduces the notion of disruptive low-carbon innovations.: From the initial analysis, a subset of six innovations perform well on three criteria: they are disruptive (in offering novel attributes from those valued by mainstream users); they are close to market (or already commercialised); and if adopted at scale they offer significant potential reductions in GHG emissions. This subset comprises: telecommuting, car-free living, e-bikes, active travel modes, car clubs, autonomous (driverless) vehicles. These mobility-related disruptive low carbon innovations are the potential kernel of an end user-led transformation in the transportation sector.