

**ENERGYSENSE:
A PLATFORM FOR MULTI-DISCIPLINARY ENERGY RESEARCH
ON ATTITUDES, USE AND BEHAVIOUR OF HOUSEHOLDS**

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Abstract

Energysense [1] is a flagship project of the Energy Academy Europe, carried out by the University of Groningen. Energysense was conceived as a demonstration of the power of multi-disciplinary approaches to energy research, of the benefits of bringing a critical mass of researchers from different institutions together, and of the strength of a private-public partnership to stimulate innovation. In 2015, Energysense pursued a pilot project with 300 households to develop all the necessary technical and organisation components for the platform. From these households, data on energy use, behaviour and attitudes is being collected. Requests for use of data and use of the infrastructure can be submitted to Energysense [1]. In the period 2016-17, Energysense will scale up and be rolled-out to meet its target of 10 000 participating households. Energysense is open-ended and set up for a minimum of 10 years, so that a longitudinal set up will enable research into long-term effects of interventions and societal trends.

VALUABLE ENERGY DATA

Energysense is developing in a context where there is growing tension between on the one hand a flood of energy data [2] and on the other, a dire need for independent, well-curated and high-quality energy data. Energysense aims to meet these needs, and to provide data that is representative of the population and 'real life' use, and not necessarily tied to specific high-intervention technological roll out, as is the case in many smart grids projects. The infrastructure being developed by Energysense also ensures that essential privacy, security and trust issues and processes are well addressed and documented.

FACILITATING MULTI-DISCIPLINARY RESEARCH

Energysense is attuned to the specific requirements of multi-disciplinary research, since it is created around a common object, the household. In Energysense, a household is defined as a set of occupants in a given dwelling over time, so that both the social and the physical dimensions are entwined in this key unit. A household is therefore a shared boundary-object across disciplines and social worlds [3]. Different aspects of the data collected about a household can be foregrounded or backgrounded, depending on the focus of a specific research question, while the other aspects of a household remain available, leading to richer understandings of energy attitude, use and behaviour. As a platform, Energysense can facilitate experimental research in real-life settings, for example the testing of the effects of interventions aimed to promote sustainable energy behaviours [4]. Awareness of the challenges involved in data-sharing [5] and of the way infrastructures can sustain or unintentionally hinder particular kinds of research [6][7] enriches the vision that drives Energysense.

CONTEXT AND OBJECTIVES

Energysense is also a way to support researchers who face the challenges of upscaling of research, who must meet demands of funding agencies to engage a diversity of partners (public-private partnership, SME involvement) and to increase the span of research projects (from fundamental contributions to valorisation). Energysense provides access to networks with a diversity of partners and a solid infrastructure to facilitate stakeholder engagement and social impact. Furthermore, in the current context of complex privacy regulation (General Data Protection Regulation) and changing norms and practices in research data management and ownership of data (Open science, open data, etc), platforms such as Energysense can muster the necessary expertise and support researchers.

APPROACH

Energysense is a high-quality knowledge infrastructure that will grow to include data from thousands of households. By focusing on households as a combination of residents and dwellings, Energysense offers a unique approach that makes the combined study of both social and technological change possible. Energysense provides a shared object of study for researchers from different disciplines. It therefore creates an invaluable opportunity for multi-disciplinary collaboration. Energysense is open-ended and set up for a minimum of 5 to 10 years. This longitudinal set up will furthermore enable research into long-term effects and societal trends. Such a combination of rich data collection over a long period is an exceptional resource.

RECRUITMENT OF PARTICIPANTS

Energysense is recruiting two cohorts of participants. The first is recruited via a randomised sampling approach according to a protocol designed by the Scientific Board of Energysense. This cohort aims to be representative for the Netherlands. It will only be monitored and will not take part in intervention studies. Participants are solicited via door-to-door canvassing by specially trained team of students. The areas to be canvassed were selected based on random selection of postal codes in the Netherlands. For households who express interest in participating, names and email addresses are gathered and further email and web communication from Energysense ensures registration and participation. These participants are offered a chance to win a gift certificate for a local business in a raffle for participants in their area. This cohort is exclusively monitored. Participants have access to the *Mijn Energysense* webportal but are not actively provided with insight about energy use or actively involved in Energysense activities. These measures aim to minimize potential influencing of participants.

A second cohort is recruited through announcements in media, through Energysense partners or via events. The use of partner organizations to recruit participants is motivated by the desire to build a sustainable relationship with participants via trusted third parties, the desire to vary the kinds of households approached, and a wish to achieve some geographical concentration in the Northern Netherlands. Regional identity can help bind participants to the project, thereby aiding in sustaining participation for this longitudinal project. Furthermore, geographical concentration can be a real asset in setting out intervention studies or in operational activities of Energysense as living lab since visits to households that may be required to install prototypes or perform more intensive data gathering are logistically easier to carry out.

The various recruitment campaigns and the composition of the two groups are carefully documented and participants can be exclusively selected for purposes of data collection and data analysis.

DATA COLLECTION

Starting 1 June 2016, Energysense has started its large-scale roll out and will collect data from a broad range of households. Data is collected via smart meters and websurveys. Other types of data collection can be added in future, according to requests by researchers.

SMART METER

Smart meter data (“P4”) is currently being collected for households that have a smart meter, and more fine-grained data has been collected for a subgroup of households via P1. P4 data is an hourly reading of gas and 15 minute reading of electricity meters. For households that do not yet have a smart meter, participants are asked to provide a reading of the meter via a web interface.

SURVEY

A baseline survey is filled in by all household in Energysense. It is currently being reviewed and a revised version will be implemented in 2016. The baseline survey contains questions on

- Occupancy and socio-econo-demographic information
- Physical information about living area and dwelling
- Type and number of electric and heating technologies
- Mobility
- Tenure, renovations, insulation measures taken
- Financial aspects (subsidies and contracts with energy suppliers)
- Solar panels (technical and social aspects)
- Involvement in energy and sustainability groups (formal and informal)
- Attitudes and values

Follow-up surveys will be implemented to monitor changes over time and will allow for additional data collection on specific aspects of energy use, behavior or attitude.

ACCESS TO DATA

Energysense manages the data collection, data storage and data access of all data collected within the framework of Energysense. Energysense is the prime contact party for the households participating in Energysense.

The data is made available by Energysense solely for research and innovation to contribute to the energy transition. Households have given informed consent to use their data for this purpose only. The data can be used by international researchers employed at a University, knowledge institute, governmental organisation, NGO, or private company, as long as the data is used for research and as long as these parties commit themselves to strict privacy regulations.

To access Energysense data or infrastructure, Energysense has put a procedure in place to ensure that the researcher receives data suitable for the proposed research in an efficient way and to ensure that the data is used according to the ethical and legal constraints of Energysense. Requests can be submitted to Energysense (see website). All requests for use of the data or the infrastructure will be reviewed by the Energysense Scientific Board.

ETHICAL ASPECTS

All potential participants are informed about the study before they start participation in Energysense and if requested, additional information is given. All participants give informed

consent. Informed consent is conceptualised as an ongoing relationship in Energysense, rather than a single contractual moment. This means that there is ongoing interaction with participants. For example, from the time that the smart meter data is being collected, a postcard is mailed to the household, explaining once again that this data is being collected. This provides an additional occasion to inform all inhabitants of a dwelling and furthermore serves as an additional check on the validity of the registration.

In the design and setup of the Energysense infrastructure the standards for academic integrity of the University of Groningen are followed. Ethical and legal experts have been consulted and involved to warrant the ethical and legal aspects of the data collection.

LIMITATIONS

Energysense has a broad interdisciplinary scope and aims to serve users in research, business and policy domains. To keep the work doable, there is a strict focus on households. While Energysense does contain some data on hybrid cases such as farms, where both private and commercial activities take place, there is no systematic data collection on industrial or commercial energy users nor on public buildings such as schools, hospitals or offices.

A further limitation is the heavy reliance on written materials in Dutch and on digital interfaces. Non-functionally literate persons and non-users of digital technologies are therefore underrepresented among the Energysense participants.

POLICY RELEVANCE AND IMPACT

Energysense enables researchers to directly address important questions from the European Commission's Strategic Energy Technology Plan on energy consumption behaviour and behavioural change. Energysense can also support work that is relevant to the Dutch national research agenda and to the goals of the Dutch national Agreement on Energy for Sustainable Growth (Energieakkoord).

FUTURE DEVELOPMENTS AND INTERNATIONAL NETWORK

Energy is undergoing an informational turn [8][9]. This means that novel smart energy technologies and the increasing presence of sensors and advanced artificial intelligence components in buildings and media devices yield ever increasing flows of relevant data. To tap into these and make them amenable to use by researchers, Energysense has adopted a flexible and modular approach to ICT infrastructure. The Energysense database infrastructure is able to store a diversity of types of data, and can be expanded as needed. Upon review by the Scientific Board, specific topics will be addressed for projects in Energysense, and additional information will be gathered from households. This can be done via different platforms and at a number of scales. For example, while such material has not yet been collected, Energysense could store sound files and transcripts, for researchers wishing to work

with interviews. Integration of real-time and fine-grained energy data is part of the planned work for 2016

Energysense connects to broad expertise on energy research and innovation. It also has a Scientific Board, made up of leading researchers with a strong track record in interdisciplinary research, who guide the scientific development of the project and ensure proper use of the infrastructure and data. Energysense is also keen to collaborate with ongoing international projects that have a similar focus in order to ensure relevance, international visibility and comparability of data, among others LUKES, NATconsumers and GLAMURS.

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