Case analyses, success factors and best practices of end user engagement in Smart Energy projects

Synthesis of S3C Deliverable 3.4

This document presents a short and comprehensive synthesis of the S3C Deliverable 3.4. For the full report see http://www.s3c-project.eu/News/53/S3CDeliverable34.html or click **here**. The **S3C project** belongs to a new, consumer-centric generation of smart grid projects giving centre stage to the energy end users in households and small commercial/industrial entities. The project aims to provide a better understanding of the relationship between the design, implementation and use of particular technology and user interaction schemes and the promotion of 'smart' energy end-user behaviour.

To this end, the S3C Deliverable 3.4 aims at understanding whether and how the design, implementation and use of certain user interaction schemes (as part of a smart grid pilot/test) contribute to the formation of new 'smart' end user activities and behaviours in their different roles as consumers, customers and citizens. For this purpose, 32 European smart grid pilot projects – engaged as passive pilots in the so-called S3C 'Family of Projects' (FoP) – have been investigated through in-depth case study analysis. These pilots are among the most promising smart grid projects in Europe, since they display a potential for learning with respect to end user interaction.

This deliverable reports the outcomes of the analysis of the FoP, including the assessment of cause-impact relations, the identification of **cross-cutting success factors** and **pitfalls,** as well as **opportunities** from data gathered in in-depth case studies.

1. Case Analysis

Project Selection and Research Questions

The investigated projects include a wide variety of smart energy projects in 15 different European countries, stretching from Portugal to Finland and from the UK to Slovenia, with many differences with respect to project goals, project design, target groups, tested interaction schemes, etc. The participant group ranges from one single household to as many as 30,000 and these households include vulnerable groups (low income, low education), but also significantly more highly-educated groups with higher income than average. Several projects also involved commercial parties. Some projects were designed from a top-down perspective (what services can the increased flexibility of energy end users offer to energy market participants, e.g. lowering peak demand?), whereas other projects took the perspective of the end user as the starting point (what new products and services can deliver added value to the end user?).

Overall, the project selection results in a representative set for the case study research, in which an evaluative study based on qualitative data was carried out. Since the identification of success factors and cause-impact relations in the FoP is predominately a **qualitative research process**, a set of nine clear and focused **research questions** was developed based on the project's key performance indicators, the key principles (the *do's and don'ts*) and the key challenges (the *don't know's*) for end user engagement as defined in the literature review in WP1 (D1.1).

Following these research questions (Table 1), the cross-case analysis aims to reveal insights of *what works under which conditions* to foster smart energy behaviour of end users.

Table 1 Research Questions

	S3C challenge	Research question
1	Understanding the target group(s)	Which instruments or approaches contribute to achieving better understanding of the needs and desires of target groups?
2	Products and services	What innovative products and services contribute to fostering smart energy behaviour?
3	Incentives and pricing schemes	Which (monetary or non-monetary) incentives and pricing schemes contribute to fostering smart energy behaviour?
4	End user feedback	What feedback information and which feedback channels contribute to fostering smart energy behaviour?
5	Project communication	Which communication channels, information and marketing techniques contribute to recruitment and engagement of end users in smart energy projects?
6	Cooperation between stakeholders	Does involvement of non-energy stakeholders contribute to end user engagement and smart energy behaviour?
7	Smart energy communities	Which instruments or approaches contribute to the development and support of smart energy communities?
8	New market structures	Which features of the interaction between end users and energy market structures or business models contribute to end user engagement and smart energy behaviour?
9	Scalability and replicability	Which issues hamper and/or facilitate up scaling or replication of smart energy projects?

Data Analysis

Following these research questions, the cross-case analysis aims to reveal insights of *what works under which conditions* to foster smart energy behaviour of end users. Due to the diversity of cases that were investigated – in terms of project design, scope, scale, timeframes, objectives and target groups – it was decided to develop a **staged research methodology**:

1. **Exploratory data analysis**

   An exploratory analysis of the full case study data was performed to identify recurring topics**,** to check overall coherence of the gathered data.

2. **Exploratory quantitative database analysis**

   An exploration of quantitative data in the project database was carried out to identify potential cause-impact relations and success factors. However, as the database contents turned out to be somewhat scarce and inconsistent, it was not possible to calculate correlations or perform statistical analysis.

3. In-depth thematic analysis of cause-impact relations

A thematic analysis of cause-impact relations was conducted to formulate tentative answers on the individual research questions. This step was based on isolated data packages for each research question, assembled from the respective sections in the case study reports. To clarify the reasoning based on which success factors, pitfalls and best practices have been attributed, this qualitative data analysis process made use of the Toulmin Model of Argumentation.

4. Cross-case analysis

Based on the outcomes of step 2 and 3, a qualitative cross-case analysis was performed to assess overarching and cross-cutting cause-impact relations. Again, the Toulmin Model of Argumentation was used to identify interdependences, contradictions and congruencies between the outcomes of the in-depth analysis of individual research questions. As a smart grid project often applies multiple incentives combined with several other interventions (such as communication and end user feedback systems), it is difficult to make a clear cut judgement about the performance of individual interventions. The cross-case analysis resulted in the identification of cross-cutting success factors and pitfalls of active end user engagement.

2. Lessons-learned

Through case study research, S3C developed a holistic approach of interconnected success factors and pitfalls. Thereby, the cross-cutting success factors were identified as drivers and the pitfalls as barriers to active end user engagement. The best-practice examples enabled the identification of opportunities for future smart energy projects to enhance active user engagement.

Cross-cutting success factors

- ***Addressing end users as human beings instead of as points of electricity demand.***
  To engage end users in smart grid infrastructures, it is of key importance to tailor the project as a whole to the everyday life and the social practices of end users. Instead of providing end users with (experimental) smart grid infrastructure and accompanying products and services without investigating the potential added value for end users themselves, their needs, demands and expectations should be taken into account.
- ***Obtaining a thorough understanding of target groups.***
  Generally, learning about attitudes and expectations takes place through often-applied methods, such as surveys and other forms of self-reports, but these have their limitations. A more detailed, close-up picture could be obtained to discover how end users actually interact with new technologies, what their attitudes and perceptions are towards the project and the products and services introduced to them. The case studies reveal several innovative and effective methods to get an in-depth understanding of target groups, such as qualitative contextual inquiries, the use of culture probes, home visits, and co-creation and gamification-based workshops.
- ***Creating personal relations and build trust over time.***
  Giving personal attention – i.e. listening to participants and helping them on an individual basis, according to their needs and expectations – is an effective way to reinforce active end user engagement. Trust is also of key importance in smart energy trials. Without a trust relation between the end users and the project management, on which open and honest discussions can be based, it can be challenging to keep end users committed and engaged

in the course of the project. This can be done in several ways, for instance by creating a good support system, organizing live meetings and home visits.

- ***Emphasizing sense of place: underscoring the local character of a smart energy project.***
  Whenever applicable, smart energy projects should address a regional scale: regional topics and stories have to be picked up and regional multipliers should be pursued – for example by involving mayors, business associations and stakeholders with a solid reputation into the project and by making use of local festivities and cultural events.

- ***Drawing upon community dynamics.***
  A sense of community can be a powerful driver to engage end users. This is most likely the case in local or regionally-oriented projects. Once in place, community dynamics can greatly facilitate end user engagement in smart grid projects in all stages of project development: from the recruitment of participants over the design, adaptation and instalment of technologies and end user interfaces, to the actual demonstration phase. The investigated case studies offer inspiring best practice examples how community dynamics can be harnessed and enhanced.

- ***Motivate end users with fun and good news.***
  In general, people are driven by positive incentives. Due to the primarily technological approach of the majority of investigated smart grid projects, the use of fun and gaming elements was fairly scarce, but projects that did include playful challenges and competitions managed to harvest success. On a micro-level, easily understandable historical usage feedback information and social comparison feedback can be considered a success factor.

- ***Test before the roll-out.***
  The use of friendly-user trials or so-called pre-trials with a positive, energy knowledgeable test group can be helpful in order to detect technological issues or flaws in the overall project design before the actual technology rollout starts. Furthermore, exploratory qualitative interactions with end users have shown to be beneficial for the development of end user friendly smart grid products and services. Therefore both activities should be considered mandatory prior to roll-out.

Pitfalls of active end user engagement

- ***Non-viable business cases for end users.***
  A number of evaluated projects refer to the creation of business models as one of their project objectives, but there are virtually no indications that these business models turned out to be economically attractive. Thus, for the vast majority of projects, the business case for pricing schemes seems not to be very viable. Generally, the price spread between high and low peaks is too small to be a valid (financial) incentive for participants, and for DSOs they don't reflect economic reality. Without the development of solid business models for residential and commercial consumers, full-scale rollout is not likely to be feasible.

- ***On-going technical problems and unreliable technology.***
  Approximately 40% of the investigated case studies reported technical problems that caused delays in the installation phase and/or the execution phase to such an extent that it had negative impacts on the engagement of end users. In several projects, this resulted in a loss of engagement or even a drop out of participants. In these cases, it became evident that it is a tough challenge to repair a damaged reputation. Hence, the importance of adequate

expectation management combined with allowing time for a phased roll-out, with thorough testing and troubleshooting among friendly users, should not be underestimated.

- ***Inadequate expectation management.***
  Expectation management is of key importance to keep end users committed and engaged, both regarding the outcome dimension (technology, products and services) and the process dimension. For instance, if the design of the equipment does not meet end user's expectations, e.g. because it is very big or aesthetically unattractive, the end user might refuse it. On the process dimension, a long waiting period until the actual instalment of the equipment, as well as malfunctioning equipment has shown to be a disappointing factor for end user participants.

- ***Engaging end users without sharing decision power.***
  A potential barrier for engagement of end users in active demand projects lies in the actual opportunities for end users to influence the design of specific aspects in the project (e.g. project communication, service concepts, procedures). Generally there should be some leeway for end users to bring up ideas and take initiatives within the project, without putting the project goals, the research design and the time planning at risk. In this respect, a trade-off needs to be made by project managers between active participation and empowerment of end users and staying in control of the project.

Opportunities

- ***Reinforce the end user perspective in the project design.***
  Large scale smart energy innovations are only likely to succeed if they manage to adapt to the everyday social practices of end users. A vital challenge for future smart grid developments is to design projects in such a way that the end user perspective cannot be overlooked. This implies to underscore the sense of place, to achieve a sense of ownership and to provide added value for the end user: what's in it for them?

- ***Develop viable business models.***
  The absence of obvious, viable business cases is one clear barrier for active end user engagement in smart grids. Therefore the challenge to develop economically solid smart grid business models should be high on the agenda of energy companies, because an engaged end user is the key to long-term success of the smart grid.

- ***Co-creation.***
  A promising way in which products or services can be adjusted to fit the wishes of the participants and thus improve its chance of successful use, is by applying co-creation with end users. Although it might be difficult for them to voice what they want, it is possible to gain very valuable feedback from the end users about the proposed product or service when co-creation methods are applied adequately. Products and services rooted in co-creation are more likely to succeed in future roll-out of smart grid infrastructures, as their added value for the end user is more evident.

- ***Gamification.***
  A rather novel and non-intrusive way to engage with end users and simultaneously collect data is to incorporate gamification in products and services or in research and development activities. The experiences with gaming interfaces and competitive elements in the case studies are promising and inspiring, both in terms of engaging end users in the project and in

terms of outcomes. However, a challenge regarding gamification is to capture the interest and attention of end users in the long run.

- ***Roll out smart grids towards the general public.***
  In many case studies, the end user base consisted of friendly users and energy insiders. However, the opinions and insights into consumer behaviour detected in these projects can rarely be considered representative and be used as reference when interacting with the general public. Since many business cases will only become viable if there is a large enough customer base, gaining better understanding of the needs, expectations and concerns of the general public is a precondition for future expansion of smart grid infrastructures.

- ***Develop novel stakeholder coalitions.***
  The case studies show that the current generation of smart grid projects is predominantly run by the 'usual suspects' from the energy business. In order to introduce smart grids to the general public, novel stakeholder coalitions with stronger societal involvement are indispensable. A few projects successfully managed to involve civil society stakeholders. To better connect with everyday social practices of end users, it is recommended to establish such coalitions with civil society and other non-energy stakeholders.

- ***Connect smart grids to smart cities, smart liv***ing and sustainable lifestyles.
  The smart grid is a very abstract concept that focuses on the 'low interest topic' electricity. Coupling the topic with other thematic areas that are known to raise more interest and appear less abstract is a promising strategy to overcome obstacles such as false perceptions or no perceptions at all. Therefore, it is vital to explain the interconnectedness between topics such as smart grids, smart cities, smart mobility and sustainable lifestyles to unaware end users.

- ***Develop an overarching storyline to achieve a sense of urgency about smart grids.***
  For the future expansion of smart grid infrastructures, it can be beneficial to create a consciousness about the unsustainability of the contemporary energy system. When the advantages of renewable energies and of smart grids are in the foreground, end users may be more likely to adopt a sense of urgency that increases their motivation to participate actively. An easily understandable, overarching storyline can be helpful to educate end users and to improve their energy awareness, which can lead to a stronger motivation to act accordingly.

3. Implications for S3C research

The main conclusion from the assessment of the case study data is that there is not one typical end user and therefore there is no single (set of) end user engagement strategies that can or should be applied to foster smart energy behaviour. However, the end user is not a black box: the case studies provide insights to the effects of the interventions identified under the nine respective research questions on the engagement of end users in smart energy projects. Hence, context-sensitivity is the key to successful end user engagement. It is crucial for smart energy project managers to investigate the end users' needs, expectations, worries and desires and the social, cultural, geographical contexts in which they find themselves.

Context- sensitivity is the key to successful end user management!

The findings of the cross-case analysis were presented in the form of **drivers** and **barriers** and **opportunities** to enhance the **active engagement of end users** in smart energy projects. The outcomes of the analysis serve as input for **actionable guidelines** and a **toolkit** for practitioners that is publicly available at: http://www.smartgrid-engagement-toolkit.eu/.

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Download the full Deliverable 3.4 at: http://www.s3c-project.eu/Deliverables.html

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