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Final Summary Report

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Abstract:

This deliverable delivery a final summary of the S3C project in five distinctive parts:

1) executive summary, 2) project context and objectives, 3) description of main S&T results and foregrounds, 4) potential impact, main dissemination activities and exploitation of results, 5) project website and contacts

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1. Executive Summary

How can you support your customers and stakeholders to become part of the energy system of the future? How can you motivate them to think about and possibly adapt their energy behaviour? What incentives are necessary to encourage new routines? The S3C project ("Smart Consumer, Smart Customer, Smart Citizen") has developed a practical toolkit for everyone who is involved or intends to become involved in the active engagement of end users in smart energy projects or rollouts.

The S3C consortium represents a team of experts from various fields reaching from electrical engineering to social science to psychology. With the experience gained from building on existing expertise in scientific literature and in-depth analyses of our 32 collaborating smart energy projects, we identified opportunities for engaging customers. From there we have developed a set of customer engagement guidelines and tools for practitioners from the areas of smart grid and energy efficiency projects, products and services.

In our 50 guidelines and tools, we have integrated recommendations and feedback from experts from several smart grid research projects and utility partners. Our tools and guidelines have been tested and/or evaluated in the field, since we teamed up with three utilities and eight field test beds across Europe as well as a network of additional experts. We have improved them according to our experience and the experience of our partner projects and companies.

In sum, S3C

- **analyses and assesses critical success factors** for consumer involvement in active demand by measuring the performance of technical and non-technical interaction schemes as well as customer awareness initiatives deployed in smart grid pilot projects;
- **draws up a practical set of guidelines and tools** for those involved in setting up active demand projects or programs (DSOs, policy makers, research institutes, regulators etc.) for ensuring a better engagement of consumers in active demand; and
- **actively disseminates these guidelines and tools** on a dedicated website (www.smartgrid-engagement-toolkit.eu) in order to improve the knowledge on implementation, monitoring and evaluation of active demand programs.

2. Project context and objectives

The success of smart grid deployment strongly depends on appropriate technologies, incentives and end user acceptance. Compared to the amount of research on appropriate technologies funded by the European Commission, relatively few of the research projects focus on the behaviour of energy end users in a connected living environment. The S3C project's overall objective is to foster the 'smart' energy behaviour of energy customers in Europe by assessing and analysing technology and user-interaction solutions and best practices in test cases and pilot projects.

The main objectives are:

- To gain a profound understanding of which activities and market roles different types of end users are willing to take up in smart grids and to understand the enabling conditions needed to take up these activities and market roles envisaged for 'smart' end users in future energy markets (including non-monetary incentives as revealed by psychological, sociological and marketing research and practices);
- To establish a common set of 'key performance indicators' (KPIs) to evaluate active demand programs as to their potential for fostering new activity on the end user's site;
- To identify and explain critical success factors and reasons for failure through reviews and analyses of the experience obtained in programmes with respect to the implementation of instruments aiming at 'smart' energy end user behaviour;
- To identify innovative technology and best practices and to develop user-interaction schemes that best induce an efficient and effective behaviour of end users. The schemes will be identified, analysed, further developed, tested, validated and fine-tuned within a family of "accompanying" smart grid projects.
- To develop guidance for the developers of technology and user-interaction tools (energy management devices, tariffs, services, incentives, information, involvement etc.) as to how to improve effectiveness and efficiency of such means;
- To actively disseminate the results (guidelines and a toolkit) to relevant stakeholders, such as DSOs, aggregators and service providers, hardware and software manufacturers;
- To give guidance for future research activities and recommendations to policy makers, industry associations, regulatory bodies and standardisation organisations to improve the framework for advanced user oriented offerings in the energy industry;
- To give guidance to consumer organisations, NGOs, CSOs – as actors who are trusted by end users and will play an important role in the public debate about smart technologies;
- To give guidance to developments regarding "active energy usage" in smart cities to effectively involve citizens or local authorities and institutions.

3. Description of main S&T results and foregrounds

How can you support your customers and stakeholders to become part of the energy system of the future? How can you motivate them to think about and possibly adapt their energy behaviour? What incentives are necessary to encourage new routines?

The S3C project's overall objective is to foster the 'smart' energy behaviour of energy customers in Europe by assessing and analysing technology and user-interaction solutions and best practices in scientific literature, test cases and pilot projects. Based on these insights, the S3C consortium has developed a practical toolkit for everyone who is involved or intends to become involved in the active engagement of end users in smart energy projects or rollouts.

Figure 1 describes the overall logic of the S3C research set-up.

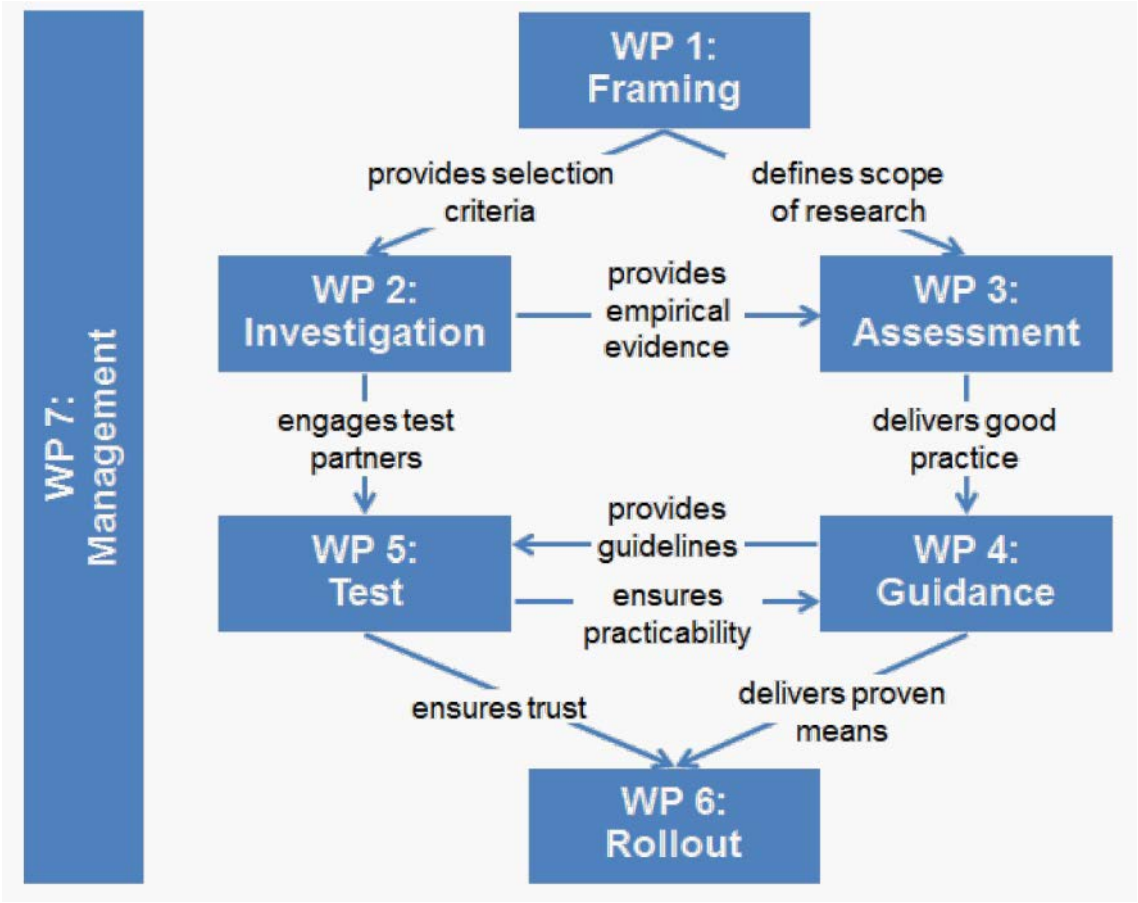


Figure 1: Overall logic of the S3C project

In a **first step**, S3C analyses which drivers (of social, technical, market and regulatory nature) are most suitable to foster 'smart' energy behaviour. In WP1, a theoretical framework based on existing research and practice experience is developed. Based on the theoretical investigations, a research protocol was developed for analysing end user engagement practices in already finalised and still ongoing smart grid pilots. The criteria for selecting these pilots were developed in WP2. Candidate pilots were assessed against a number of high-level criteria, i.e. the way end users have been involved in the design, implementation, use and evaluation of the technology and user-interaction schemes investigated in those projects. The selection process led to the definition of a number of accompanying projects, constituting the S3C 'Family of Projects' (FoP). The FoP was populated with a number of ongoing pilots, either with an "active" or "passive" option. "Active" means that a project adapted (in the framework of their own work program and within their budget and time constraints) the implementation of their project to trial

and validate some of the guidelines and tools provided by S3C (see WP5). In the "passive" option a project made available its results and data for in-depth analysis.

In a **second step** (WP 3 and WP 4), an empirical investigation of the end user engagement strategies employed by the 'passive' partners led to the identification of best practices, which most efficiently impact the behaviour of users and give guidance to the design of novel technology and end user-interaction schemes. In this stage, S3C also looked at end user involvement schemes that have been successfully rolled out in the field of telecommunications or other industries (e. g. social marketing, flat rates). This approach allowed S3C to answer the project's main research question: "*Which technology and end user interaction schemes of the emerging smart energy networks in Europe are crucial for empowering energy end users (households and small enterprises) to take up new roles contributing to active demand management and the overall efficiency of the energy system*?" Following the analysis of best practices, a toolkit containing a set of practical guidelines and tools for the main target groups of utilities, project managers, energy agencies and city developers was developed to help improve their approaches to involve customers.

In a **third step, the** guidelines and tools developed in WP 3 and WP 4 were validated and tested by the 'active partners' in the FoP as well as the experts from the S3C Advisory and Dissemination Board (ADB) and further experts. In WP 5, the S3C research team assisted the responsible actors in each active partner in applying the guidelines and tools provided by the S3C project, in order to test their efficacy and effectiveness. Results from the tests in WP 5 were used to improve the guidelines and tools in WP 4.

S3C's final output is a toolkit containing 50 tools and guidelines that facilitate the implementation of the selected user-interaction schemes in future smart-grid projects and roll-outs. Additionally, S3C delivers set of 24 recommendations to support setting favourable framework conditions. Active involvement of a large group of stakeholders (WP 6) ensured that S3C results are widely publicised and will find their way into an ever-growing Smart Grid Family in Europe. The guidelines and tools are available as an easy-to-use toolkit on a dedicated website (www.smartgrid-engagement-toolkit.eu). This website will be maintained for at least 5 years after the project.

The following paragraphs set out the main S&T results and foregrounds for each of the research steps.

3.1 Findings from literature on drivers, barriers and challenges of end-user engagement in smart grids

3.1.1 Energy practices as a key analytic tool

End user energy behaviour is influenced by a broad range of both **behavioural** and **situational** factors. Behavioural factors include monetary motivators (financial gains), non-monetary motivators (beliefs, values, habits, and routines), social influences (norms and leadership), and personal capabilities (knowledge, skills, and financial means). Situational factors include institutional prescripts (laws, and regulations), culture, infrastructure and social networks. This range of considerations implies that a nuanced view on end user behaviour is required, taking both behavioural and situational factors into account.

A growing body of literature particularly highlights energy-related practices as key to understanding and influencing smart energy behaviour. Practices are said to reside at the 'interface' of individual behaviours and social structure, as these behaviours are the product of, and also reinforce, social structure. Energy practice theory postulates that **energy is not used consciously or rationally, but rather as the 'by-product' of practices** like cooking, washing, showering, working, commuting, watching TV, socializing, and travelling. Such practices are often **driven by routines and socially shaped expectations**. Smart grid programs would thus benefit from a thorough understanding of the energy-related practices of their target groups.

Looking at energy-related behaviour through the lens of social practices enables an analysis of behaviours at **different levels of consciousness**, ranging from habitual to conscious and one-shot behaviour (Aarts, Verplanken, & Van Knippenberg, 1998). Energy-related practices as such – like washing, cooking, heating etc. – can typically be considered **habitual**. However, behaviours aiming for a change of practices – like deciding whether to engage in a smart grid project and / or to buy smart appliances – are rather more **conscious** or even **one-shot**.

Everyday energy practices (such as cooking, washing, showering, commuting, doing the laundry, etc.) should be used as the primary unit of analysis for understanding energy behaviour.

Different types of intervention should be used as end users move from the 'activation' to the 'continuation' phase in changing energy behaviour.

Key enablers and barriers of active demand are defined in the areas of comfort, control, environment, finance, knowledge & information, security, and social process.

Figure 2 presents this view in a highly stylized manner. The process of end-user engagement in smart grid programs and their consequent interaction with new technologies, feedback and pricing schemes (i.e. the 'end-user interaction scheme'), is interpreted as a process of practice change towards a higher level of 'smartness'. At the start of the process, it is assumed that end users carry out their energy-related practices in a rather habitual manner. As end users become more engaged in a smart grid program, they are stimulated towards more conscious decision-making. This phase can be considered rather 'disruptive', as existing practices need to be reconsidered and redefined. In this '**activation phase**', end-user interaction is targeted typically at achieving active end-user participation and requires an explicit consideration of old and new practices. As new practices are adopted over time, behaviour once again becomes more habitual. In the '**continuation phase**', end-user interaction is then aimed more specifically at supporting and reinforcing the new energy practices.

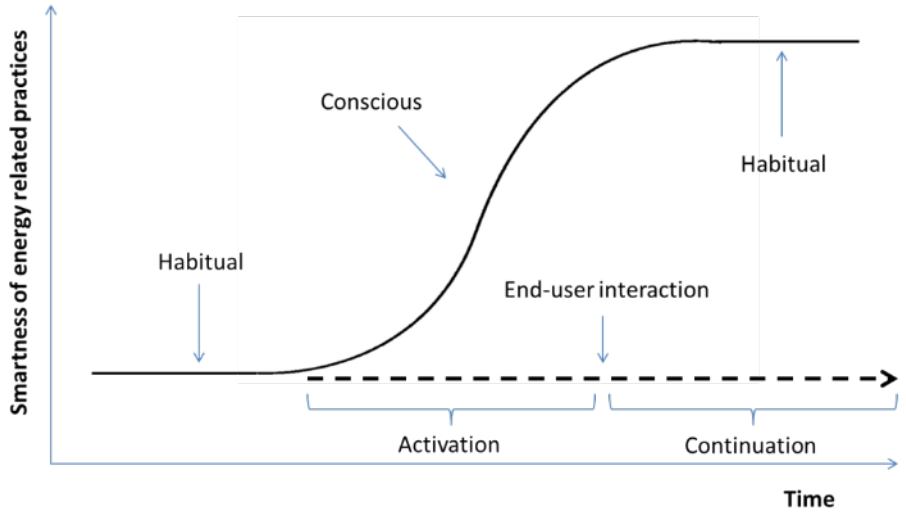


Figure 2: A stylized interpretation of the process of end-user-interaction distinguishing an 'activation' and 'continuation' phase (Source: S3C consortium).

3.1.2 Recommendations for successful end user interaction schemes

The various recommendations from literature can be organized into a set of key success factors. We have distinguished between success factors that are applicable mostly to the activation phase (Table 1) and the ones that are mostly applicable to the continuation phase (Table 2).

Recommendations for the activation phase

For the activation phase, we have arrived at the following key success factors:

Provide added value: This includes, for example, applying attractive financial incentives, ensuring comfort gains rather than losses, providing new information services, ensuring data privacy and security, and includes possibilities to overrule automatic procedures while offering new forms of end-user control. Corresponding theoretical notions include Product & Price (4P model), Exchange (Social Marketing), Encouragement (4E model) and Rational appeals (Breukers' (2009) tools for change concerning energy investments).

Understand end users: Different target groups may be susceptible to very different enablers and barriers. The challenge is thus to understand which engagement strategies are of particular relevance to particular groups. Understanding the end user is strongly supported in the empirical literature, for example, in the recommendations to apply segmentation (SGCC, 2013; JRC, 2011), to take into account a broad scope of behavioural determinants (EEA, 2013), to have a special focus for low income / vulnerable groups (SGCC, 2013; JRC, 2011), and to understand social practices and

To 'activate' end users in smart grid programs, you need to provide clear added value from the end user perspective, which means that you also need to understand what drives your end users. Furthermore, capacity building (training) and creating commitment and appeal are essential ingredients of a successful activation.

The continuation of 'smart' energy behaviour can be facilitated by linking feedback, communication and pricing strategies; using user-friendly interfaces and enabling social comparison. Because of the heterogeneity of energy end users, there are limitations of the extent to which 'tailor made solutions' can be offered. Above all, end-user engagement is a never-ending endeavour featuring constant learning and adaptation to new expectations or changing household practices.

daily routines in a social context (Verbong, 2013). Corresponding theoretical notions include, for example, the need for 'Customer orientation', 'Theory', 'Insight', and 'Segmentation' (Social Marketing).

Capacity building and awareness raising of end users: Relieving possible knowledge & information barriers will involve some form of capacity building and awareness raising as programs need to take into account consumer (non-)ability to deal with new technology (EEA, 2013). Corresponding recommendations in this context include educating end users before deployment (e.g. explaining how to shift usage to off-peak demand hours) (SGCC, 2013) and providing training to end users and installers (Erhart-Martinez 2010; Darby, 2006; Lewis et al., 2012; Dong Energy, 2012). Theory equally stresses the importance of education, for example, to enable end users to adopt new practices (4E model) and in providing transparent and understandable information & training (Breukers, 2009).

Success factor	Empirical findings
Provide added value	Attractive financial incentives
	Comfort gains rather than losses
	New information services
	Data privacy and security
	Allow automatic procedure overruling
Understand the end user	Apply segmentation
	Consider broad scope of behavioural determinants
	Special focus on low income / vulnerable end users
	Understand social practices, daily routines and social context
Capacity building and awareness raising of end user	Consider consumer (non-)ability to deal with new technology
	Educate end users before deployment
	Provide training
Create commitment & appeal	Establish trust in the whole process
	Early end users involvement
	Role models
	Customer testimonials
	Deal with free-rider effects
	Effective marketing and outreach
	Emphasizing key benefits
	Creating lifestyles around products

Table 1: Success factors for end-user engagement for the activation phase.

Create commitment & appeal: Creating commitment & appeal involves taking full advantage of social processes as important enablers. This may include ensuring trust in the whole smart grid process (JRC, 2011), involving end users at early project stages by allowing a choice of involvement level (JRC, 2011), involving role models respected by the selected group (EEA, 2013), believable customer testimonials (SGCC, 2013), and dealing with possible free-rider effects (JRC, 2011). Creating commitment & appeal also requires effective marketing and outreach (JRC, 2011) to create a 'desire' for new products, for example by emphasising key benefits and creating new lifestyles around products. Corresponding theoretical notions can be

found, for example, in the importance of the engagement factor (4E model), Cialdini's principles (Social Proof, Liking, Authority, Reciprocity, Commitment, Scarcity), and the need for consequent attention, interest, desire and action (AIDA model).

Recommendations for the continuation phase

In the continuation phase, the following factors appear particularly relevant:

Effective feedback, pricing & communication: A lot is known about which factors need to be considered when designing effective feedback and pricing schemes. For feedback, this involves, for example, considering direct and indirect feedback, interactive and disaggregated feedback and linking feedback directly to advice on action. For pricing, this involves taking into account various attributes of tariff structures – i.e. the rationale of the scheme, the number of time blocks used, the price update frequency etc. Regarding communication, it is particularly important to ensure a continuous information flow to maintain high engagement levels. Moreover, it is considered promising to link dynamic pricing, convincing feedback mechanisms and communication strategies to achieve an optimal response. Related theory includes, for example, communications theory that highlights the sender, target group, aim, message, timing and communication channels as key factors to consider in a communications strategy.

Variety of intervention methods: Although understanding of the end user is key, there are limitations on the extent to which 'tailor-made solutions' can be offered, especially for a heterogeneous target group. Several studies therefore also stress the need for the adoption of a variety of intervention methods and techniques to serve different user types. This includes, for example, adopting a variety of feedback information and channels (Lewis et al., 2012) and adopting a variety of tailored dynamic pricing schemes to address different user segments (Breukers & Mourik, 2013).

Ease of use: User-friendly, intuitive designs are considered important to minimize effort needed for operating new devices and schemes (i.e. to minimize knowledge & information barriers perceived by end users). Ease of use also includes adequate and pro-active support and service, e.g. by 'anticipating and answering questions before customers ask them' (SGCC, 2013). Support and service may actually benefit from user-friendly, intuitive designs, for example by using social media for support services (Dong Energy, 2012).

Social comparison: It may be stimulating to allow end users to compare their (new) energy behaviours to that of their peers. Besides setting individual energy-saving targets (EEA, 2013), this approach involves the comparison of targets (and their fulfilment) to others. The case for social comparison is reflected, for example, in recommendations that appeal to the competitive nature of people (Verbong, 2013) and in the perceived effectiveness of social feedback for influencing behaviour (Lewis et al., 2012). Do note that the effect of social comparison on the total energy savings of a target group is still debated, as it may equally encourage thrifty users to use more (Fischer, 2008).

Reflection & learning: Smart grid innovations can be considered 'complex', involving many connections to other domains and scale levels, with significant uncertainties on technical, social and other dimensions. Reflection and learning is therefore needed, starting in the activation phase and continuing throughout the continuation phase. This could involve, for example, eliciting end users' expectations at the start of the process, and evaluating their experiences later on, with possible fine-tuning of interaction schemes when needed. On a project level, monitoring and evaluation cycles may be incorporated to further update, upscale and replicate project designs and offerings (see e.g. NSMC (2011). Also, allowing initiatives to be part of a wider program with clear objectives can be stimulating for end users (EEA, 2013). All in all, smart grid innovation projects may function as 'niches' (see e.g. Rotmans, 2005) in which end users, suppliers, designers and other actors collaborate and co-create knowledge in the further development of the smart grid.

Success factor	Empirical findings
Effective feed-back, pricing & communication	Consider direct and indirect feedback, interactive and disaggregated feedback and linking feedback directly to advice on action. Consider attributes like the rationale of the scheme, the number of time blocks used, the price update frequency etc. Ensure a continuous information flow. Linking feedback, pricing and communication strategies
Variety of intervention methods	Variety of feedback information and channels Variety of tailored dynamic pricing schemes
Ease of use	User-friendly, intuitive designs Pro-active support and service (e.g. using social media)
Social comparison	Individual energy saving targets Appeal to the competitive nature of people Social feedback
Reflection & learning	Elicit and follow-up end users' expectations Monitoring and evaluation cycles Position initiatives within a wider program with clear objectives Co-creation of knowledge

Table 2: Success factors for end-user engagement for the continuation phase.

We thus arrive at a rather extensive list of suggestions for end-user-interaction. We stress that this list is not to be interpreted as a blue print, but rather as an overview of factors that need to be considered when designing or evaluating an end-user-interaction scheme. For more details on findings from literature, please refer to Deliverable 1.1.

3.1.3 Recommendations for further research on end-user engagement in smart grids

Given what is currently known, what are the key 'unknowns'? In this section, these unknowns are formulated as key challenges that can be identified for (research on) end-user engagement in smart grid projects.

A 1st challenge relates to **identifying and targeting specific end user groups**. Although the overall scope of potential enablers, barriers and success factors for end user engagement is relatively clear (see Table 1 and Table 2), it is as of yet largely unclear how these should be applied to the different types of end users that may be targeted. End user segmentation is one of the approaches that may require to be further developed in this respect. The challenge is thus to find instruments or approaches that contribute to achieving better understanding of the enablers and barriers of target groups and the type of end user interaction schemes best suited to them.

A 2nd challenge relates to the **added value of smart grid related products from the perspective of the end user**. The current energy system in Western Europe operates with few flaws. End users are used to being able to use electricity whenever they see fit. The risk for DSM programs is being perceived as 'demanding' a lot from customers (in return for a reduction of price), rather than a project that makes an interesting offer (for which end users may even be willing to pay). In that sense, smart grid technology is a challenging technology to 'sell'. The challenge is thus to find innovative products and services that provide clear added value to end users, while contributing to fostering smart energy behaviour.

The 3rd and 4th challenges relate to available knowledge as to the effects of end user interaction schemes. Although some research has been done on, for example, the effect of feedback and dynamic pricing on energy use peak clipping, empirical evidence on the effectiveness of the various engagement schemes remains weak. Notably, further research is needed to assess the effect of combinations of approaches and to identify critical success factors. The challenge is thus to understand **which (monetary or non-monetary) incentives and pricing schemes**, and which **feedback information and feedback channels,** contribute to fostering smart energy behaviour.

A 5th key challenge relates to the **use of communication channels, information and marketing techniques**. Although a number of general recommendations on communication and information provision can be given, empirical evidence on the impact of communication and information on smart energy behaviour remains weak. Moreover, although the field of marketing has shown the added value of applying marketing techniques, actual use of such techniques in smart grid projects has been limited to date. The challenge is thus to better understand which communication channels, information and marketing techniques best contribute to recruitment and engagement of end users in smart energy projects.

A 6th key challenge relates to **cooperation between stakeholders**. Current smart grid projects may include various participants other than the traditional energy players. It is yet unclear how the involvement of non-energy players may influence end user engagement. The challenge is thus to understand the extent to which the involvement of non-energy stakeholders contributes to end-user engagement and smart energy behaviour.

A 7th key challenge relates to the **end users as initiators of projects**. Whereas a variety of results on end-user involvement is described in literature, relatively little is reported on bottom-up projects in which end users are initiators and 'owners' of the projects. Most projects place end users in a consumer or customer role and were initiated by stakeholders other than citizens usually incentivized by a European/national/regional funding opportunity. Yet, very few projects have been reported in which the end users are placed in a citizen role. Here, combining smart grid research with research on smart cities seems promising, as the latter initiative does tend to place the end user in a more central role by default. The challenge is thus to find instruments or approaches that contribute to facilitating end user empowerment (from consumer to customer and/or citizen).

An 8th key challenge relates to **new market structures** and the role of end users in those structures. Although a number of projects have addressed this issue, further testing is needed. A specific matter for investigation is to identify mechanisms that ensure legislation and regulation that support, rather than hamper, smart grid development. A further issue is the development of new interpretations of the role of customers, as well as the market entry of completely new participants and roles, which in turn lead to new interactions and innovative value chains in the energy system. In particular, a tailored approach to different end user segments will require that the end users provide a substantial amount of information of a potentially 'sensitive' nature (e.g. regarding lifestyles, values, preferences, etc.). The issue of trust is thus of particular importance when designing new market structures. All in all, the challenge is thus to understand which features of the interaction between end users and energy market structures contribute to end user engagement and smart energy behaviour.

A 9th key challenge relates to **up-scaling and replicating pilot projects** that involve a diverse end user group. Although significant experience exists with pilot projects, little experience has been gained in larger scale roll-outs. Findings from pilot projects - often targeting specific end-user groups (e.g. 'early adopters') - cannot readily be transferred and applied to larger scale roll-outs that deal with a substantially larger and much more diverse audience. In particular, when engaging with the typical 'indifferent', 'vulnerable' or 'stalled starters', specific strategies will be applied, such as making the technology highly accessible, and utilizing very easy to understand messages. The challenge is thus to understand which strategies hamper and/or facilitate up-scaling or replication of smart energy projects.

1. **Understanding the target group(s)**: Which instruments or approaches contribute to achieving a better understanding of the enablers and barriers of target groups and the type of end-user interaction scheme best suited to them?
2. **Products & services**: How / in what way can innovative products and services provide clear added value to end users, while contributing to the fostering of smart energy behaviour?
3. **Incentives & pricing schemes**: Which (monetary or non-monetary) incentives and pricing schemes contribute to the fostering of smart energy behaviour?
4. **End-user feedback** (system communication): What feedback information and which feedback channels contribute to the fostering of smart energy behaviour?
5. **Project communication**: Which communication channels, information and marketing techniques contribute to the 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 the fostering of smart energy behaviour?
7. **Bottom-up support**: Which instruments or approaches contribute to facilitating end user empowerment from consumer to customer and/or citizen?
8. **New market structures**: Which features of the interaction between end users and energy market structures contribute to end user engagement and to the fostering of smart energy behaviour?
9. **Scalability/replicability**: Which issues hamper and/or facilitate the upscaling or replication of smart energy projects?

Table 3: Summary of key challenges

3.1.4 Selection of 'active' and 'passive' partners

Based on the theoretical investigations, a research protocol was developed for analysing end-user engagement practices in already finalised and still ongoing smart grid pilots. In particular, we were interested to what extent the experiences gained from these pilots could give us new insights on the challenges identified in our literature search (cf. Table 3).

The criteria for selecting these pilots were developed in WP2. We started from existing smart grid pilot databases (Grid+, EEGI, JRC) and we screened these databases using targeted selection criteria designed to find interesting projects from the end user engagement point of view. In the end, we found 32 smart grid pilots who were willing to share their experiences on end user engagement. These form the so-called 'passive partners' in the S3C 'Family of Projects' (FoP), and they were analysed thoroughly using a research protocol designed on the basis of our theoretical investigations (cf. *supra*). The projects forming the FoP either contribute to the empirical investigation (the so-called "passive partners") and/or become validation test-beds for the best practices and developed guidelines and tools (the so-called "active partners"). "Active" means that a project will adapt (in the framework of their own work program and within their budget and time constraints) the implementation of their project and validate some of the best practices (guidelines &tools) provided by S3C (cf. WP5). In the "passive" option a project will make available its results and data for in-depth analysis.

The identification and selection of projects to form the FoP has been based on two different pillars:

1. Selection of projects in two already existing databases:

- one of them is the JRC-Petten database on smart grid projects in Europe, which is currently under the analysis of the Grid+ project (coordinated by RSE, which is the leader of WP2), while

- the other one is the list of demonstration projects that has been built within the "Member States Initiative: A pathway towards EEGI functional projects" within the European Electricity Grid Initiative (EEGI);

2. Selection of projects proposed by each partner, mostly on a national level.

In the end, 32 'passive' pilots were found willing to share their experiences with the S3C project. The projects composing the FoP have been described in Deliverable 2.1. Furthermore, a total of eleven 'active partners' including three utilities were engaged to validate the best practices and developed tools and guidelines.

3.2 Cross-case analysis of end user engagement in 'passive' pilots

The cross-case analysis of the 32 'passive' pilots reveals that knowledge and expertise on how to successfully engage end users in smart energy projects is still partly uncharted territory. Nevertheless, the case studies provide numerous insights that contribute to answering the overarching research question.

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 insight in 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.

The findings of the cross-cutting analysis are presented in the form of pitfalls and opportunities to enhance the active engagement of end users in smart energy projects.

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.
- ***Ongoing 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 living 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.

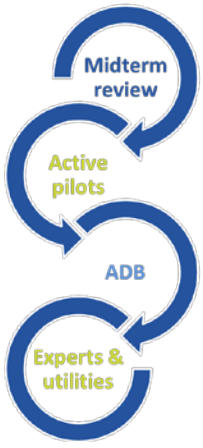
For more details on findings from the cross-case analysis, please refer to Deliverable 3.4.

3.3 Developing, testing and validating guidelines and tools

3.3.1 Toolkit website

In WP4 and WP5, the theoretical findings (WP1) and the results of the cross-case analysis on pitfalls and opportunities of end-user engagement (WP3) were translated into practical guidance. One of the key results of S3C was developed: the interactive toolkit website (www.smartgrid-engagement-toolkit.eu). Via this website, practically tested and improved guidelines and tools are made available for the main target groups of project managers, utilities, energy agencies and city developers interested in or already deploying smart grid technologies. The website contains 50 tools and guidelines for customer engagement and will remain available for 5 years after the S3C project's life cycle. Figure 9 and Figure 10 show some screenshots of the toolkit website.

The tools and guidelines were validated and have been tested and reviewed by several instances during the project runtime. After a literature review and a case study analysis (2013-2014) the draft version of the toolkit website was published. From 2014 to 2015 all tools and guidelines as well as the content of the website have been tested and validated. A total of 14 initiatives to test and verify the S3C tools and guidelines have been launched by the 11 S3C active partner projects (incl. three utilities), supplemented by practical advice received from further utilities, members of our Advisory and Dissemination Board and other expert stakeholders. Their experiences and feedback regarding the content and presentation of tools & guidelines as well as the organisation and presentation of the toolkit website was rigorously followed up in the final toolkit website design.



Number of guidelines and tools	Number of R&D projects implemen-ting T&G	Number of utilities imple-menting T&G	Number of overall initiatives launched based on the T&G	Number of utilities reviewing the T&G	Number of ADB experts reviewing the T&G
50	**8**	**3**	**14**	**3**	**16**

Table 4: Overview of testing/evaluation of S3C tools and guidelines

The main feedback messages of the review process have been:

- Better clarify connection between S3C research and toolkit contents.
- Underscore the evidence base of guidelines and tools.
- Provide better guidance to users: what is it and how can I apply it?
- Improve consistency and interlinkage between guidelines and tools.
- Make it graphically more appealing (pictures, flowcharts, diagrams).
- Adapt to language of toolkit users (utilities).

For detailed information on the testing and validation process, please refer to Deliverable 5.1.

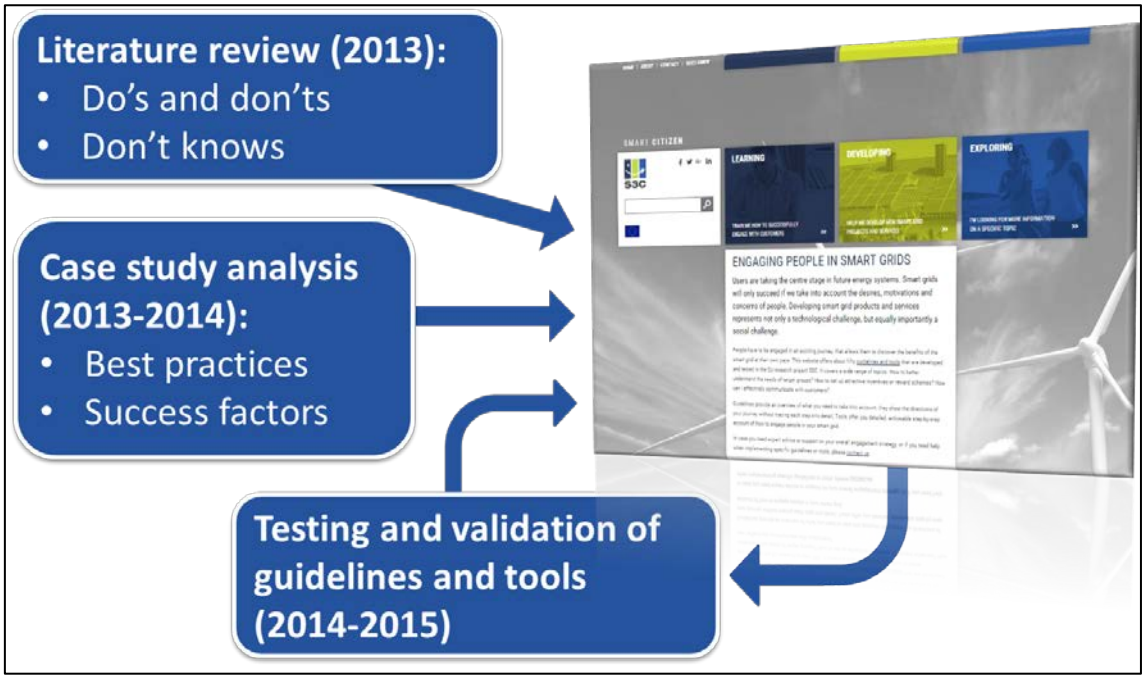


Figure 3: Approach and screenshot of the landing page

S3C guidelines provide an overview of what you need to take into account: they show the directions for practitioners without tracing each step into detail. They offer guidance on a variety of topics that have been identified within the S3C project as the most promising opportunities for customer engagement. Those topics include for example, 'co-creation', 'gamification approaches', 'choosing the right incentives', and 'getting to know your target group 'or' training installers' Additionally, the S3C guidelines provide practitioners with practical advice on what to take into account when engaging the customers as well as practice examples of smart energy projects, products and services with outstanding customer engagement strategies. As such, the guidelines are designed to stimulate learning within organizations on how to better engage people in a smart grid project or rollout.

To ease the reading of the guidelines and to streamline their content, all guidelines share a common structure which is described in Table 5.

WHAT IS IT? **Get an overview of what you can expect from this guideline. What are the topic and scope? Who is the intended target group?**
WHEN TO USE? **Find out for what purposes, in what situation or circumstances you can use the advice in this guideline and for which project phase it is especially relevant.**
Best practice example **What can it look like? Read about best practice examples for implementation of the guideline topic from smart grid projects all over the world as well as out-of-the-box examples from outside the area of energy.**
WHAT DO YOU NEED TO DO? **Receive actionable step-by-step information for implementing the guideline.**
DO'S AND DON'TS **Draw from practical recommendations related to the guideline topic to help you utilise identified success factors and avoid pitfalls.**
FURTHER READING **Get a list of relevant background information and further references and suggestions for further reading on the topic.**

Table 5: Common structure of S3C guidelines

S3C tools on the other hand offer practitioners detailed, actionable step-by-step account of how to engage people in smart grids. They are ready-to-use instruments that aim to facilitate the interaction with the customers, for example by 'setting up a sound hotline and customer support', 'organising a multi-stakeholder workshop' or 'facilitating customer-specific communication by implementing a segmentation approach'. Tools can be checklists, excel-tools or step-by-step process instructions, based on hands-on experience. They offer a direct means of engaging with people.

The S3C guidelines & tools cover a wide range of topics (for an overview of all tools and guidelines please refer to the toolkit website) and are often interconnected with each other. There are several links, which lead the reader from one guideline to another to get more details on specific topics.

At the S3C toolkit website[1], we offer three different gateways to access the tools and guidelines (cf. Figure 3). Depending on what kind of support our users are looking for, one can choose between:

- **LEARNING** – Browse through our insights on engaging people in smart grid projects or products. Learn from practitioners why and how you can use our guidelines, or select your own topics to read more about.
- **DEVELOPING** – The engagement of end users with smart energy products or services is important in the successive phases of project and product development. In each phase, different topics require attention.

[1] http://www.s3c-toolkit.eu, http://www.smartgrid-engagement-toolkit.eu and www.smartgrid-engagement-toolkit.com.

- **EXPLORING** – In this section, you can find all the information about user engagement for smart energy projects sorted by topic.

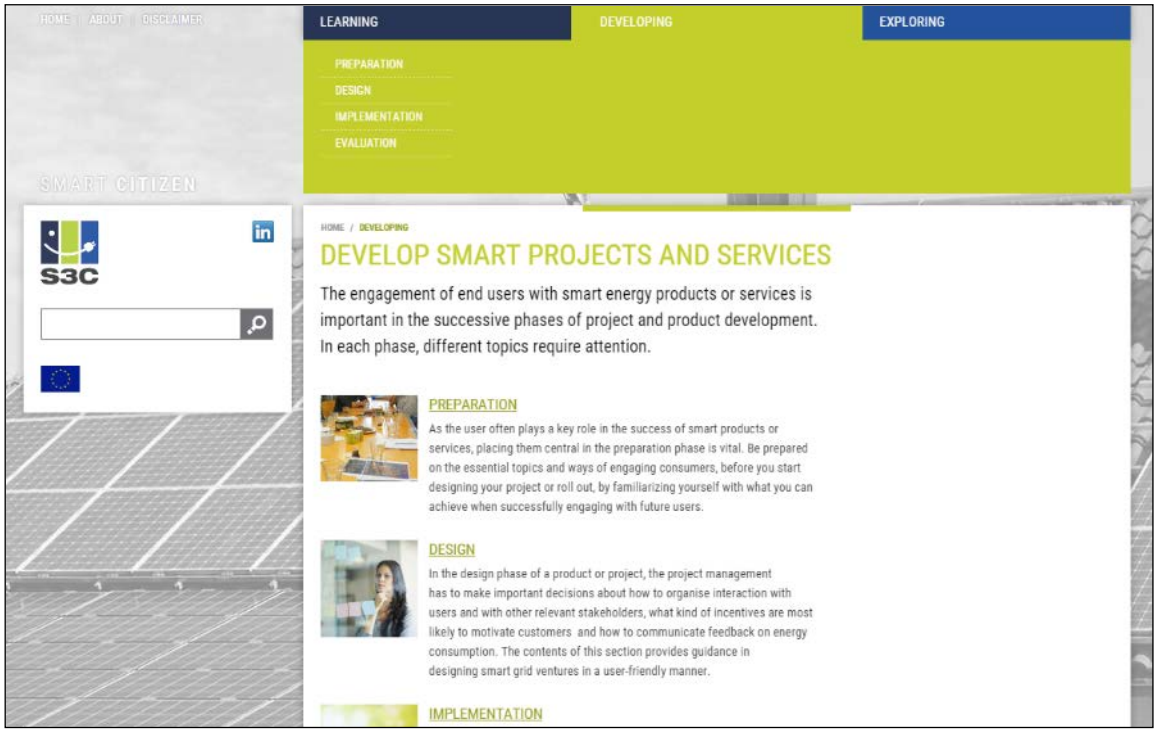


Figure 4: One of the subpages, showing the menu structure and breadcrumbs

The main innovation of the S3C tools and guidelines lies in their interdisciplinary approach merging social sciences, psychological insights, engineering and ICT-knowhow to strengthen the end user perspective in existing Smart Grid technologies (such as visualisations for feedback systems for households) and enable a smooth activation and engagement of consumers while taking into account their different drivers and perspectives by delivering actionable step-by-step introductions and concepts.

In fact, the S3C tools and guidelines will significantly increase the consumer benefit and experience within Smart Grid projects as well as mass deployments, as the tools and guidelines take the end user into account at every step of the way. The scope of the tools (ready-to-use applications) and guidelines (step-by-step introductions and manuals, decision-making assistance, guided information maps etc.) spans different project phases from planning and recruitment to the evaluation phase. As the tools and guidelines are tailored to the case- and country-specific implementation experiences from actual smart grid pilots, the potential for several replications by other projects or rollouts of smart-grid enabled products and services is high.

3.3.2 Recommendations

With its toolkit of 50 guidelines and tools, S3C has provided a sound collection of practical knowledge. However, there is still a long way to go until a majority of end users will be actively involved. Many stakeholders will have to join forces to ever better understand the needs, develop reasonable and affordable solutions to meet them and to allow them to enter the market places. So, in addition to its practical toolkit, the S3C consortium has formulated recommendations for the following 12 stakeholder groups to set the right framework conditions for enabling smart energy behaviour:

- EC legislation
- EC level research programmes

- national policy makers
- national funding authorities
- national regulatory bodies
- local authorities
- associations of energy industry
- associations of ICT industry
- associations of and for consumers
- standardisation bodies
- curriculum developers
- suppliers to energy industry.

All in all, 24 recommendations have been formulated, grouped in 5 domains of activity (for more details, we refer the reader to Deliverable 5.2):

Visions and expectations: creating a common sense as to the goals and effectively communicating it.

1. Develop an overarching storyline to achieve a common understanding and 'sense of urgency' for smart grids
2. Manage overall and specific customer expectations
3. Translate information on smart grid technologies and applications so a broad variety of citizens can understand it
4. Create trust in the energy system, its operators and the possibilities offered by new smart grid products and services
5. Stress the non-monetary incentives to engage in the smart energy field

Regulation: ensuring that the overall vision is achieved in an equitable way for the different stakeholders involved

6. Create and enforce smart grid standards
7. Establish an overall data infrastructure that allows for a wide set of consumer engagement means and at the same time does not create the anxiety of abusing personal data
8. Ensure market designs facilitating a balanced distribution of costs and benefits by conducting regulatory impact studies
9. Establish a regulatory framework to support the introduction of cost-reflective dynamic tariffs

Market formation: shaping the European energy market including the definition of market roles following new approaches in the interplay of regulated and free markets.

10. Open up the energy market to new players and their innovative products
11. Clarify settlement rules between suppliers and aggregators
12. Provide financial support and incentives for the participation of end users in smart grid programs

Knowledge formation: building up the necessary research frameworks and formulating adequate requirements to address the remaining knowledge gaps

13. Broaden the scope of smart grid research to integrated smart solutions (smart cities, smart homes, smart living)
14. Foster participation of social sciences in energy projects
15. Foster research and development on end-user engagement in smart grids through clear priorities and increased collaboration
16. Combine quantitative and qualitative research in new smart grid pilots or rollouts
17. Foster research on less motivated or involved end users, beyond a focus on 'early adaptors' or 'technology enthusiasts'
18. Develop and implement common and standardized quality criteria to ensure representativeness and comparability of end-user engagement research in smart grid projects or rollouts

Resource mobilization: mobilizing material infrastructure, investments by firms and human resources for the establishment of new business platforms offering tailored energy related services to end users.

19. Allow for end-user engagement means to be accounted for as grid investments in the calculation of distribution grid fees
20. Acknowledge potential risks of increasing costs in the transition phase to a smart energy world
21. Shift the regulatory focus in distribution grid investment from cost of investment to net benefit of investment
22. Develop common standards of automation and data communication
23. Provide a wide spread set of horizontal hardware and software platforms to foster development of innovative services (mainly by SMEs)
24. Implement means to convey learnings and tools of S3C (and other similar projects) to practitioners in utilities

The recommendations have been synthesized from the inputs of all S3C consortium members and resemble views of researchers, consultants and practitioners. In addition, views of the S3C Advisory and Dissemination Board have been included, which not only added to the insights, but validated the given recommendations.

4. Potential impact, main dissemination activities and exploitation of results

4.1 Potential impact

S3C will provide a better understanding of the relationship between the design, implementation and use of particular end user interaction schemes and the promotion of 'smart' energy end user behaviour as a consumer, customer or citizen. The project combines a theoretical and experimental learning approach. The theoretical approach investigates theoretical literature on end-user behaviour as well as published reviews of empirical evidence on end user reactions to smart grid technologies and interventions. The theoretical approach also served to identify enablers and barriers for engaging end users in smart energy projects as well as challenges to be addressed in S3C's experimental learning approach and beyond. The project consortium also conducted pilot tests and experiments within a family of existing smart grid projects or product rollouts to maximise learning and minimise risks of failure in practice. This way, S3C goes beyond the 'state of the art' of knowledge on user involvement in active demand programs by having used this existing "Family of Projects" (FoP) to improve their programs and introduce new means and methods for the user participation in active demand side management and in energy efficiency of the overall electricity system. In sum, S3C

- analysed and assessed critical success factors for end user involvement in active demand by measuring the performance of technical and non-technical interaction schemes as well as customer awareness initiatives deployed in smart grid pilot projects;
- draws up a practical set of guidelines and tools for those involved in setting up active demand projects or product rollouts (DSOs, policy makers, research institutes, regulators, energy agencies, city developers, etc.) for ensuring a better engagement of end users in active demand, including an improved communication to the end user of the added value of smart grid technologies and services. The delivered set of tools and guidelines directly relates to the opportunities and pitfalls for end user engagement in smart grid projects that were identified in the S3C research.
- delivers a set of 24 recommendations for policy makers, regulatory and standardisation bodies and associations to support the setting of more favourable framework conditions; and
- actively disseminates these guidelines and tools on a dedicated website in order to improve the knowledge on implementation, monitoring and evaluation of active demand projects or product rollouts

4.2 Main dissemination activities and exploitation plans

Apart from the S3C Toolkit website, S3C maintains a public project website www.s3c-project.eu. The public website holds all public deliverables of the S3C project, information on the S3C FoP as well as further information on relevant publications, best practices and events from the area of end user engagement in smart energy projects. The website has been updated continuously during the projects' lifetime. Both the S3C toolkit website and the S3C project website will be maintained for another five years after the project's conclusion.

During the work of the project, S3C established and disseminated its results within the S3C Family of Projects, containing 32 'passive partners' that collaborated with S3C in the identification and assessment of cross-cutting success factors, pitfalls and opportunities for end user engagement in smart grid projects and eleven 'active partners', including three utility partners that actively tested the S3C tools and guidelines. S3C also engaged additional utility experts to further validate the tools and guidelines and promote their use.

The work of S3C was supported by the S3C Advisory and Dissemination Board (ADB). Apart from ongoing support, three physical meetings to update the board members of current activities

and receive feedback on the project's direction, progress and results were organised during the project's duration. The S3C ADB consists of experts from various backgrounds and professions, including energy industry, policy, social science and psychology. Through the members of the ADB and the FoP as well as the networks of the individual consortium partners, S3C reached out to various key organisations and networks, such as the International Smart Grid Action Network (ISGAN), the International Energy Agency (IEA), the European Electricity Grids Initiative (EEGI), the Global Smart Grid Federation (GSGF), the European voice of smart energy solution providers (ESMIG), the Covenant of Mayors (CoM), European Distribution System Operators'Association for Smart Grids (EDSO), etc.

The S3C consortium hosted a project midterm and final conference. The midterm conference was held in Évora, the test site of the S3C partner project InovCity on the 27th of May 2014. The conference was promoted among the regional stakeholders as well as on a European level and reached more than 70 participants. The midterm conference focused on smart energy research and consisted of three panels: an S3C project panel, a panel introducing other relevant smart energy projects with a human-centric approach and a panel focusing on behavioural/ social science issues related to engaging end users in smart energy projects. A highlight for the participants was the field trip to the InovCity test site. The project's final conference titled "Empowering people for the smart energy system of the future" was held in Berlin on the 24th of September 2015 with more than 60 participants attending. The conference focused on presenting the finalised S3C Toolkit and overall results. Additionally, the implications of the S3C research were addressed in three panels: smart energy community approaches, smart energy research beyond S3C and smart energy products and services. At both the midterm and the final conference, a networking dinner for all participants was organised. Relevant and high-level speakers for both conferences were, to a large part, recruited from the S3C FoP and ADB.

An S3C workshop was jointly organised by the Italian consortium partner RSE and the Fondazione Consumo Sostenibile on the 20th of November 2014 in Milan. More than 150 participants from the energy industry, different consumer unions, regional authorities and academia attended the workshop.

Apart from the project website, further online and print marketing material was created for specific target audiences or occasions, e.g. a flyer to recruit FoP members, a flyer and folder advertising the toolkit and opportunity to participate in S3C for the European Utility Week 2014 and promotion flyers for both the midterm and the final conference, etc.

The marketing material was uploaded on the project website as well as disseminated at conferences, workshops, trade fairs and other relevant events on a national, European and international level. Additionally, the S3C consortium presented the projects at several of these events, including e.g.

- Workshop of the International Smart Grid Action Network (13-14 March 2013) in Moscow, Russia
- Grid+ conference (25 April 2013) in Vienna, Austria
- Behavior, Energy and Climate Change Conference (18-20 November 2013)in Sacramento, US
- Workshop on the ADVANCED project (26 January 2014) in Brussels, Belgium
- Behave Energy Conference (3-4 September 2014) in Oxford, UK
- Renewable Energy Research Conference (17 June 2014) in Oslo, Norway
- EU Sustainable Energy Week (17 June 2014), Brussels, Belgium
- European Utility Week (4-6 November 2014) in Amsterdam, Netherlands
- Qatar Foundation Annual Research Conference (18-19 November 2014), Qatar
- Final Conference of the ADVANCED project, (27 November 2014) in Rome, Italy

- IEA Committee on Energy Research and Technology (3-4 June 2015), Oslo, Norway
- ISGAN Committee meeting (14-15 September 2015), Lecco, Italy
- Inovacija energetike (7 October 2015), Kranj, Slovenia

Toward the end of the project, a brochure promoting the S3C Toolkit was developed. The brochure is also available online.

Apart from two peer-reviewed publications on the topics "Key success factors and barriers to end user engagement in smart grid projects" and "How to engage end users in smart energy behaviour?", the S3C consortium prepared a policy brief for the ISGAN Annex 7 on the topic of enabling active household engagement in Smart Grid programs.

A LinkedIn Group was created and maintained during the project's lifetime that was aimed at being a discussion forum for the S3C consortium, FoP and ADB. Now, close to the project's conclusion and at the recommendation of the ADB, the group has been changed to an open and public group that will be maintained and promoted in other relevant LinkedIn Groups.

An S3C webinar on the findings of S3C and the S3C toolkit was hosted by the Covenant of Mayors in March 2015. The webinar is available via the CoM website, the S3C project website and the toolkit website. Due to the very positive experience with the webinar format, S3C has reached out in their network to organise additional webinar tutorials on the now finalised S3C toolkit. An S3C webinar titled "Involving people in Smart Energy: a toolkit for utilities, energy agencies, project managers and smart city developers" will be hosted by the DSM University on the 18th of February 2016. A joint webinar with ISGAN is planned for the 10th of February 2016.

To foster further dissemination and exploitation of the toolkit beyond the project lifetime, a session to set up a strategy for further dissemination was organised at the third ADB meeting at the end of the project. During the session, actions in five actions fields were discussed:

- Presenting at further conferences
- Linking websites
- Continue to reach out to European and national associations
- Reaching out to emerging and new projects
- Give training

The S3C consortium has started implementing actions in the respective actions fields. Apart from setting up two additional webinars, a report on the S3C final conference and the S3C toolkit has been prepared and sent out to relevant initiatives and associations and published in several online media.

The consortium partners expect that the knowledge gained from their work in S3C and the expansion of their networks will lead to forming new projects with a focus on the engagement of end users in smart grids. In fact, the S3C consortium partners are already disseminating the S3C findings in several new projects and initiatives (see exploitation plans of individual consortium partners).

Also, due to the knowledge and experience gained from being part of the S3C project as well as the cooperation within the consortium, each of the S3C consortium partners also expect an impact on their respective area of business and expertise.

4.3 Exploitation plans of the individual consortium partners

4.3.1 B.A.U.M.

The main goal of B.A.U.M. in S3C was to contribute our expertise and assess the results of our national and international smart grid research projects regarding consumer activation and

acceptance. Due to our research in S3C, we were able to share our insights with our project partners and introduce the findings to other smart grid projects.

B.A.U.M. is involved in two projects that deal with consumer engagement in smart grids. B.A.U.M. intends to apply, extend and share the knowledge and experience gained in the S3C project. As part of the ERA-Net Smart Grids Plus support team, B.A.U.M. is managing the ERA-Net Smart Grids Plus Knowledge Community, including the working group on consumer and citizen involvement. The working groups will take place on a regular basis and will be open to ERA-Net Smart Grids Plus funded projects and external stakeholders and practitioners alike. Additionally, a web platform will be launched to share knowledge and carry on discussions on relevant topics. Furthermore, B.A.U.M. is a consortium partner in the project Energy Local Storage Advanced System (ELSA). ELSA addresses the topic "Local/small scale storage" (LCE 8 – 2014) of the call for competitive low-carbon energy (LCE) (H2020-LCE-2014-3) within the "Horizon 2020 Work Programme 2014-2015", Societal Challenge "Secure, clean and efficient energy". A sharing of knowledge via working groups has been implemented between the LCE6 to LCE 10 projects within H2020. B.A.U.M. will represent the ELSA project in the working group "Customer engagement".

Furthermore, B.A.U.M. intends to create a serious game based knowledge gained on gamification approaches in customer engagement. The concept of the game: The user will be able to play the transition from a fossil-fuelled energy system to a smart energy system based on distributed renewable energies for his own city/town/region. The game will be based on real data of the city/town/region and developed with FIWARE Generic Enablers developed within the Future Internet Public Private Partnership. The game can be used as a training and education tool by utilities, universities and schools for their energy consumers/prosumers or students to better understand the energy system and the challenges of the transition. BAUM has applied for funding in a call from the FIWARE Accelerator programme.

B.A.U.M. also intends to integrate the findings of S3C, especially regarding smart grid related marketing and communication, into new client projects with utilities and overall consulting services and products for clients in the energy sector – building on identified success factors and opportunities while avoiding the known pitfalls.

4.3.2 ECN

By contributing to S3C, ECN has further developed the expertise that was gained in previous FP-programmes and other projects in the (relatively) niche field of socio-technical and psychological research in the broader topic of energy. The main aim for ECN in S3C was to expand this expertise in consumer behaviour and to specialise it to the topic of smart grids and the role of end users, and to gather field experience in working with utilities. Furthermore, the developed toolkit can be added to ECN's portfolio of toolkits which help practitioners to develop effective user involvement strategies.

ECN intends to further develop and apply its expertise in national and European research projects that touch upon the role of users and consumers in the energy transition. In addition to smart grids, ECN aims to apply their knowledge to related topics such as smart cities and energy efficiency in the built environment. ECN is involved in the EU funded research project "Smart Cities & Communities Information System (SCIS)" (ENER C2/2013-463/S12.691121). SCIS gathers, processes and provides information from EU-co-financed projects in the fields of smart cities, sustainable energy districts and energy-efficient buildings. Specifically, ECN contributes to the process of making information (data, best practices) accessible to practitioners. Another EU funded project that builds upon knowledge gained from S3C is TRANSrisk (Horizon 2020 SC5-3a-2014). TRANSrisk creates a novel assessment framework for analysing costs and benefits of transition pathways, and a decision support tool that helps policy makers to better understand uncertainties and risks. Insights from S3C and its accompanying toolkit will contribute to this decision support tool, for instance by helping policy makers to identify risks and solutions regarding public perception and stakeholder involvement.

In two national research projects (both funded by the national TKI-STEM subsidy), ECN will also build upon S3C knowledge about consumer behaviour. PEEC (Promoting Energy Efficient Consumption) investigates the effectiveness of several innovative interventions to fight energy poverty by fostering behavioural change. The project will deliver a toolkit that offers actionable knowledge for practitioners and policy makers. The 3SFO project draws focus on behavioural drivers and barriers – the '3rd Success Factor' in addition to financial resources and technical solutions – that influence the upscaling of innovations in the built environment. Both projects are led by ECN.

Moreover, ECN intends to actively apply the results of S3C in future work, especially regarding qualitative case study research, the development of actionable guidelines and tools and online toolkits, in new research projects and contract services specifically around the topic of energy consumer behaviour and smart grids.

4.3.3 EDP

EDP Distribuição (EDPD) already has a large expertise regarding the smart grids and due to its role of market facilitator, has, over the last years, been promoting the benefits of a "smart energy behavior" along with its relevant stakeholders including national and European authorities, regulators, other utilities, R&D Institutes, new local stakeholders (closer to customers) and with consumers, customers and citizens. Due to its work in the S3C project, EDPD has the objective to promote a global dissemination with its stakeholders of the achieved results, explaining their contribution for a new paradigm towards end-user engagement.

EDPD, as a Portuguese DSO, is responsible for the deployment of smart meters in Portugal, which is quite often the first contact of a consumer with this new smart grids' approach. Therefore, dissemination activities have already started within internal teams and service providers through meetings, workshops and training sessions in order to implement some of S3C findings in its business processes. With the expected growth of the activity of EDPD concerning smart grids, dissemination actions will continue and a governance model will be implemented to exploit the achievements from S3C within all organization. On the other hand, EDP Distribuição is considering the extension of the application of the gamification platform, developed in the S3C project, to other municipalities, considering that its integration into regular communication and marketing activities may represent a step ahead towards a new model for customer relationship.

Furthermore, regular news in edp intranet, edp magazine and video reports/news have been published, extending the dissemination of S3C findings to all EDP's group employees (more than 12.000 in 14 countries).

EDP Distribuição also has a significant experience with European Research Programmes (FP7 and H2020), participating in many international projects, such as Sustainable, evolvDSO, Ecogrid, UpGrid, InSmart, in which customer engagement is addressed as a main subject. Recently, EDPD has become a partner of the project "Sharing Cities", which addresses the call "Smart Cities and Communities – Lighthouse Project" where EDPD will be able to integrate many of the S3C outcomes.

Besides, EDPD will continue to make dissemination efforts to present S3C key findings and lessons learned from the qualitative studies derived from the four tested initiative at the InovGrid demo sites, through different activities addressing a wide range of stakeholders:

- International conferences (e.g. paper proposal for CIRED Helsinki 2016, presentations);
- Publication of a press release and the e-brochure about S3C and its lessons learnt that will be distributed among relevant stakeholders, namely through EDSO for Smart Grids (representing more than 30 leading European DSOs in Europe) and ENTSO-E;
- Online publication of the final results and the e-brochure at the InovGrid website (http://www.inovgrid.pt/) and the creation of a web-link to the S3C website and toolkit;

- Presentation of S3C results in the rewarded InovCity demo site in Évora, which is regularly visited from stakeholders from all over the world.

The S3C member's team of EDPD will be responsible for the continuation and coordination of appropriate exploitation activities to ensure that S3C main findings will have a lasting impact on existing and future activities of EDPD.

4.3.4 INEA

INEA is an engineering company delivering smart grid technologies to a range of stakeholders in the energy market as energy producers, energy consumers, aggregators or utilities. In the scope of S3C, we shared our expertise and experiences to deliver high quality tools & guidelines. On the other hand, we delivered S3C findings regarding successful engagement of end users to our on-going active projects (KIBERnet, SPEU).

As INEA is currently involved in a few projects dealing with smart community issues and involvement of prosumers as well, S3C results encourage us to focus not only on technical issues, but on those dealing with end user involvement as well. Examples of those are the H2020 SME Instrument funded project Intelligent Trading Interface for development of business plan for exploitation of DSM ready interface for prosumers willing to participate in DSM programs and the feasibility study for a Slovene –Japanese (NEDO) Smart Community project where integration of end users plays a crucial role.

INEA, together with the HEMS provider partner, motivated by knowledge on end user feedback gained in S3C, intends to develop a cloud based real time service web application for managing home appliances energy consumption and production.

Apart from Smart Grid projects, INEA will implement S3C results and the S3C knowledge base when providing the energy efficiency and energy optimization solutions to end customers.

INEA as an active participant in national smart grid projects development in Slovenia and as a member of national Smart Grid platform and Competence Center Advanced Systems of Efficient Use of Electrical Energy will take advantage of the S3C findings to improve the quality of projects while empowering end users for participation and sharing this the knowledge with other involved stakeholders (utilities, regulators, city development agencies).

4.3.5 R.S.E.

Within the studies and researches on the electric system evolution that R.S.E has been carrying out for a long time, residential end users always played a priority role. This role, however, was, seen as essentially passive. End users are considered to be the main impacted stakeholders, against regulatory provisions and economic issues, e.g. tied to tariff policies implementation, and the transformation of the energy system towards the smart grid approach implies the active role of the residential end users, as consumers, customers and citizens, as the S3C slogan recites. In this context, human and social aspects assume clearly an essential role, as they co-determine the behaviour of the end users, along with other equally fundamental factors.

The main objective of R.S.E. in S3C was thus to increase its experience in dealing with end users and increase their awareness regarding energy related topics. In particular, R.S.E. was able to share the experience gained at the Italian and international level on smart grid projects, especially regarding the use of different tariff structures and domotics technologies to increase end users involvement. S3C gave R.S.E. the opportunity to develop a specific sensitivity on these issues, which firmly entered the approaches and methods of the company. S3C offered the possibility to know in depth and practically measure the relevance of human and social aspects at international and national levels, not only through the achievements produced by the project, but also by allowing a constant validation of the relevant conclusions within the debates with the stakeholders in the dedicated workshops. Exemplary, in this respect, was for instance the

experience of the conference organized in Milan by R.S.E. at which more than 125 representatives of the consumers associations were present.

R.S.E. has also been providing support to Italian institutional stakeholders (such as the Italian Authority for Energy, Gas and Water, the Italian Ministry for Economic development, etc) since its foundation. In particular, R.S.E. is involved in two projects with the Italian Authority for Energy, Gas and Water: the first one is related to the reformation of the electric tariff structure for residential end users in order to increase energy efficiency, while the second one is related to the reformation of the energy support scheme for low-income residential end users. R.S.E. intends to use the results obtained in S3C and share the related knowledge in the two projects mentioned above.

Moreover, R.S.E. is participating in the development of a pilot project with "Comune di Milano" and "Regione Lombardia" involving low-income residential households: the goal of the project is to find the most effective ways to increase their awareness about energy related topics and thus improve the energy efficiency of their households. R.S.E. will give support to the two above cited institutions using the experience gained during the S3C project, in particular to identify success factors and opportunities while avoiding the known pitfalls: to this aim, the developed toolkit and guidelines will be fundamental.

Finally, the deeper knowledge of human and social aspects was the leverage for applications by RSE in further international projects, such as the International Smart Grid Action Network (I.S.G.A.N.) and the European Energy Research Alliance (E.E.R.A.).

4.3.6 SP

SP is a polytechnical research institute with research activities within many different areas. Some of these are related to the field of active users, human-technology interaction and smart grids.

The opportunity to participate in S3C has been very valuable to SP, as the project has not only contributed with knowledge but has also formed close contacts with pilot projects, energy companies, research environments and other project developers. This will potentially result in joint efforts and further collaborations. Being a research institute SP is positioned between academia and industry with the mission to link the two. The prospect of further building on results from S3C in future projects – both in terms of new research projects and hands-on activities with industry partners – is therefore highly interesting. S3C has further provided inspiration and good examples from other European smart grid initiatives that SP will be able to spread further in the Swedish context. The insights from S3C have contributed to the knowledge increase concerning end-user engagement at stakeholders in Sweden. This is the case for the Swedish active partners, but also on a wider scale due to presentations of project results at seminars and workshops. In more detail, SP sees the following opportunities for exploiting the results from S3C:

S3C Toolkit

The toolkit holds thorough and validated experience, advise and learnings that SP will be proud to promote and disseminate among our customers and research partners.

The toolkit can also provide valuable input to future research projects and collaborations with energy companies and other smart grid project developers. For instance, a possible project idea would be to introduce a new engagement strategy in an energy company through the use of S3C guidelines.

Guidelines and tools could be used for development purposes within SP's in-house pilot projects. For instance, there is a project on visualisation of energy use in offices (a follow-up of the project "OfficeWise" that was a passive partner in S3C), where the feedback guideline could be used to improve the project setup.

Results from the analysis in D3.4

The result from the analysis in deliverable 3.4 includes many new insights into end user engagement. These insights provide inspiration and act as building blocks for future research projects within the field.

A further use of the identified success factors and barriers is to apply and refine the analyses in the Swedish context. The insights provided by S3C constitute a well-founded starting point for such analyses.

Policy recommendations in D5.2

The policy recommendations from deliverable 5.2 are important material for contacts with regulators and authorities. SP can thereby provide input to their work on smart grids and active users. An example of this is the current government commission to the Energy Market Inspectorate to investigate the possibilities for flexible demand in Sweden

The recommendations could also provide inspiration to further research within SP.

4.3.7 VITO

VITO/EnergyVille used its extended knowledge and experience in the field of smart grid research activities and (demonstration) projects in order to contribute to S3C by providing information on the main outcome of this research and the specific topics related to consumer acceptance and engagement.

Next to that, the findings of S3C will be used the other way around as important feedback towards other smart energy projects that VITO/EnergyVille is involved in on national and international level. The participation in S3C helped VITO/EnergyVille to obtain insight in consumer behaviour and the real drivers for optimal consumer involvement in smart grids or smart energy projects more broadly. The best practices, guidelines & tools and recommendations coming out of the S3C project will be actively used by VITO/EnergyVille in new research projects or in contract services.

Regarding the latter, one example is the exclusive partnership agreement for the development and commercialisation of the “Energy2Consumer” (E2C) platform between VITO/EnergyVille and the ICT company Ordina. This technological innovation is aimed at players in the energy market and a simplified dialogue with the private customer. The E2C platform analyses the energy consumption of private individuals and provides tailor-made sustainable, cost-saving solutions. The E2C platform enables analyses and simulations to be carried out based on simple queries and underlying research data. The application provides concrete insights into energy consumption and promotes energy-saving measures and heat recovery initiatives. The solution is innovative, tailor-made and offers a superior user experience. It builds on VITO/EnergyVille’s expertise on cost-effective energy saving options for households as well as the experience gained in the S3C project. Other examples are recent offers submitted to the Flemish energy agency VEA for a study on defining the optimal roll-out of smart meters in the Flemish region, and an offer submitted to EASME on business opportunities for SMEs in the ongoing development of the smart grid. Both offer include an ‘end-user engagement’ component that explicitly builds on the S3C experience.

On the research side, VITO/EnergyVille plans to submit a research proposal to the H2020 EE07 call on “Behavioural change towards energy efficiency through ICT”. Furthermore, VITO/EnergyVille will sponsor a PhD thesis in the field of behavioural economics. The PhD will investigate the impact of end user (consumer/prosumer) behaviour on the realization (harvesting) of economic value of different Demand Response (DR) mechanisms. This will be done from the overall societal point of view (through socio-economic analysis), but secondly also from the particular end user perspective in relation to the main actors interested in or impacted by the implementation of DR measures.

5. Public website address and S3C consortium contacts

The public website of the S3C project is available: www.s3c-project.eu

The S3C toolkit is publicly available at: http://www.smartgrid-engagement-toolkit.eu/

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Annex I: Selection of S3C promotion material

Figure 5: Main Versions of the S3C Logo

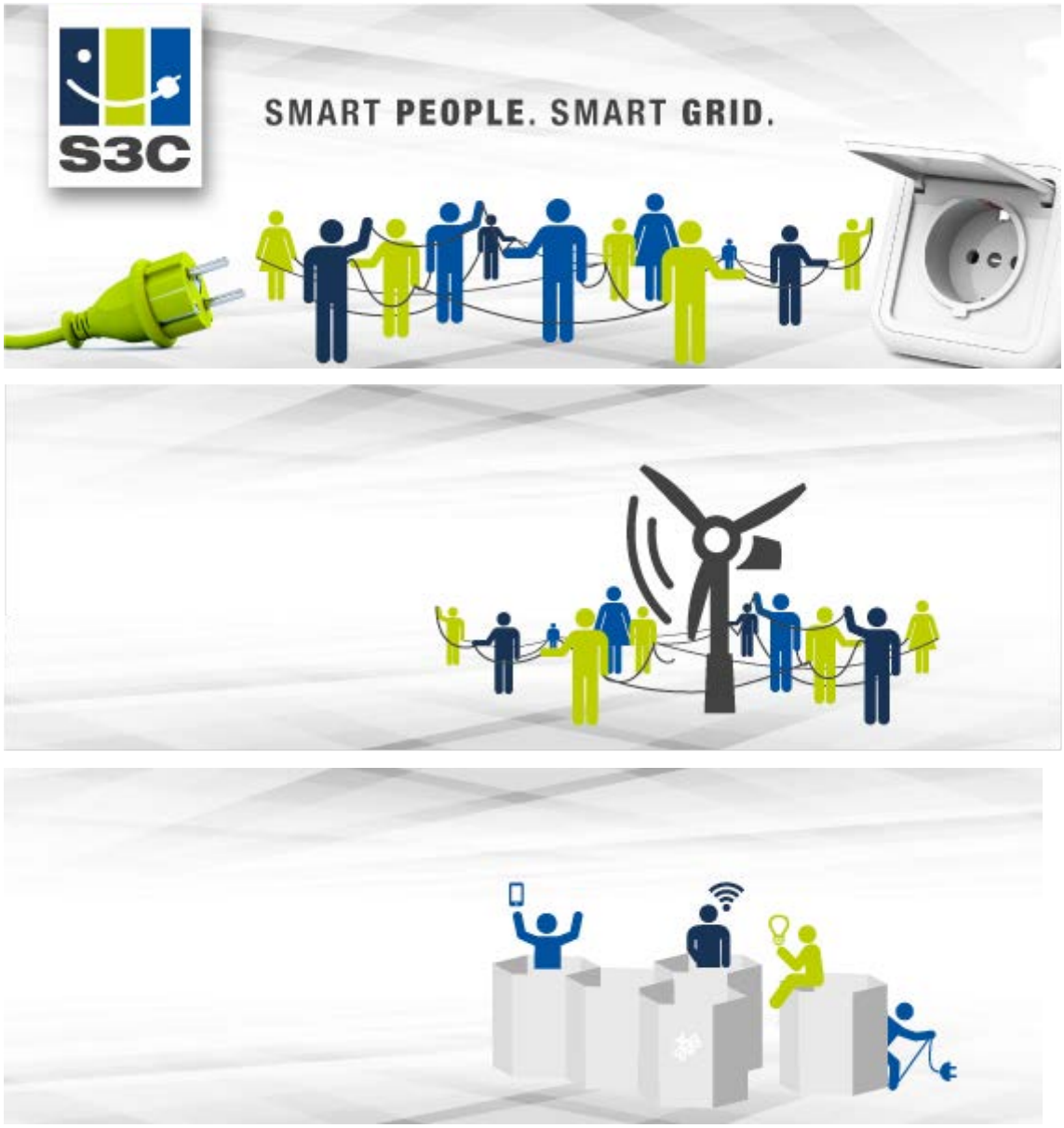

Figure 6: Key visuals for the S3C project

Figure 7: Visuals for the key success factors for end user engagement

Figure 8: S3C Roll-ups

Figure 9: Screenshot S3C project website: www.s3c-project.eu; status October 2015 (Picture credits: Maksim Shmeljov/Shutterstock)

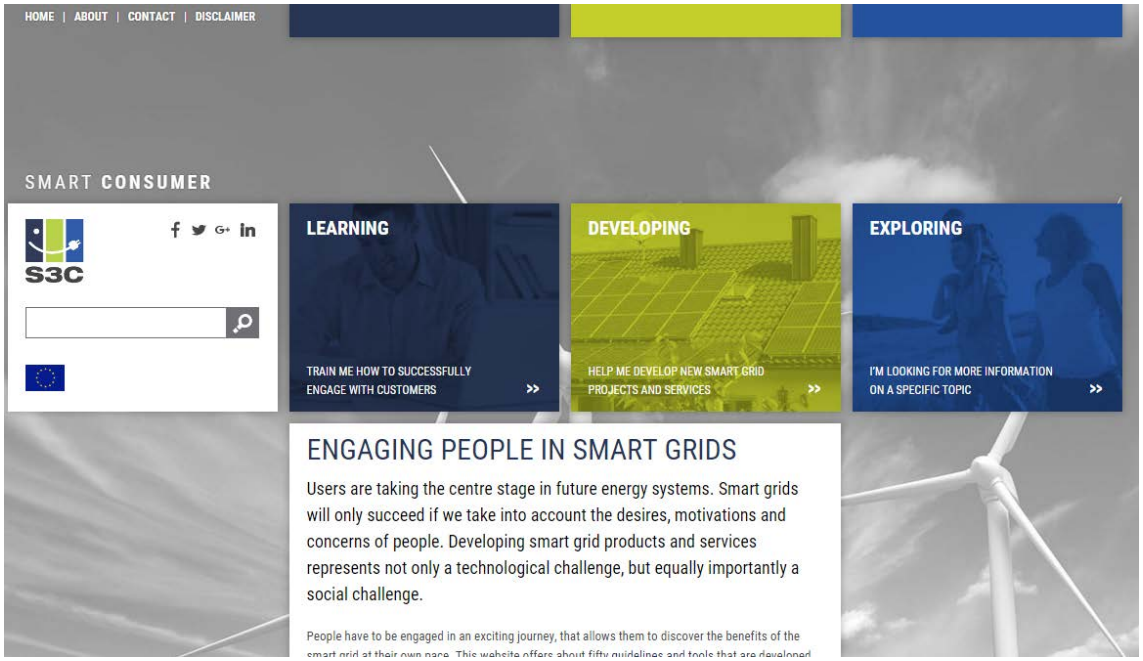

Figure 10: Screenshot of the S3C toolkit website: http://www.smartgrid-engagement-toolkit.eu/; status October 2015 (picture credits: f9photos/Shutterstock

Figure 11: S3C Project Panel at the midterm conference (from left to right): Marco Bakker (ECN, Matthijs Uyterlinde (ECN), Pieter Valkering (VITO). Erik Laes (VITO), Marina Lombardi (ENEL), Ludwig Karg (B.A.U.M. Consult)

Figure 12: Impressions from the field trip to the InovCity test site

Figure 13: Dr. Erik Laes (VITO), S3C project coordinator, presenting the S3C project at the European Utility Week 2014 in Amsterdam

Figure 14: Impression from the S3C final conference, 24.09.2015, Berlin: (from left to right) Michael Hübner, BMVIT, Coordinator of the ERA-Net Smart Grids Plus Initiative, Michele de Nigris, RSE, Chairman of ISGAN, Dr. Erik Laes, VITO, S3C project coordinator, Maher Chebbo, SAP, President of ESMIG, Kerstin Niemeier, B.A.U.M. Consult, Ludwig Karg, CEO B.A.U.M. Consult, S3C senior project manager, Richard Hampton, European Commission, S3C project officer and Drs. Rob Kool, chair of the International Energy Agency's DSM Programme, © S3C project/André Wagenzik

Figure 15: Impression from the S3C final conference, 24.09.2015, Berlin¸© S3C project/André Wagenzik

Figure 16: Impression from the S3C final conference, 24.09.2015, Berlin: Dr. Erik Laes, VITO. S3C project coordinator, presenting key results of the S3C project © S3C project/ André Wagenzik