TOOL: USER GROUP SEGMENTATION (LIGHT)

What is it?

The S3C user group segmentation light-tool is a simple and highly accessible tool to gain hands-on experience with segmentation, as a way to get acquainted with the approach. It is designed to obtain a quick scan of the characteristics of a user population in a smart grid project. It consists of a 10 minute survey implemented in the associated excel spreadsheet. After answering the questions, the spreadsheet calculates which segment best matches the user profile.

This light-tool is directly based on the comprehensive segmentation model of energy saving behaviour developed by Sütterlin *et al.* (2011) and previously applied by Breukers and Mourik (2013) in the context of dynamic pricing (see the guideline Using segmentation to better target user groups for more details). It contains six segments as summarized in Figure 1 and Table 1.

	Idealistic energy savers	**Selfless in-consequent energy savers**	**Thrifty energy savers**	**Materialistic energy consumers**	**Convenience-oriented indifferent energy consumers**	**Problem-aware wellbeing-oriented energy consumers**
Current energy saving efforts	High	Medium	High	Medium	Low	Low
Main motivations	Energy awareness	Energy awareness	Financial & Energy awareness	Financial & Energy awareness	Financial	Financial
Awareness of consequences of energy use	Strong	Strong	Strong	Medium	Weak	Medium
Support for energy pricing policies	High	High	Medium	Medium	Low	Low
Concern for comfort and convenience	Low	Low	Medium	Medium	High	High
Feeling of responsibility for the energy issue	High	Medium	Medium	Medium	Low	Low

Table 1: Some features of the six segments of energy consumers in qualitative terms. For the detailed characterisation of the segments see Sütterlin *et al.* (2011)

- **Idealistic energy savers**: characterized by high energy saving efforts, idealism as a key driver, a willingness to make financial and other sacrifices, and support for policies that put a price on energy.

- **Selfless inconsequent energy savers**: although clearly supporting energy saving, for example through high energy awareness and policy support, their actual energy saving behaviour is somewhat inconsistent.
- **Thrifty energy savers**: adopt energy-saving behaviour and accept energy pricing policy as long as this does not bring them any negative financial consequences, with social pressure as an additional motivation.
- **Materialistic energy consumers**: do little to save energy, but are open to energy efficiency measures for the house when it brings them financial gains.
- **Convenience-oriented indifferent energy consumers**: the least likely to energy saving behaviour, with low energy awareness, a limited feeling of responsibility for energy issues, and primarily driven by personal comfort and convenience.
- **Problem-aware wellbeing-oriented energy consumers**: although relatively energy aware, their actual energy saving actions remain limited, with a limited confidence in their ability to save energy, and a concern for loss of comfort and convenience.

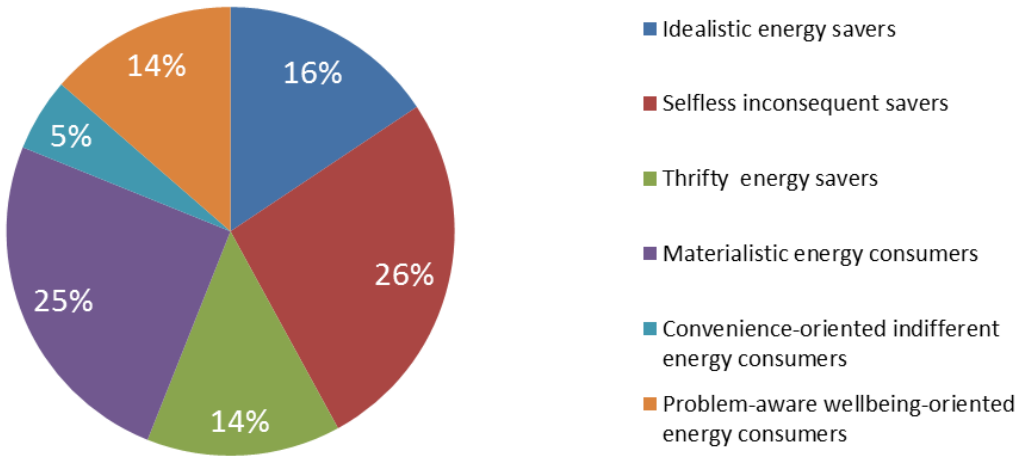

Figure 1: Six segments of energy consumers and their respective shares in the Swiss population (Sütterlin *et al.*, 2011)

When to use?

As described in the guideline Using segmentation to better target user groups, segmentation tools like these can be used in principle for recruitment, communication about new products and services ('messaging'), the tailoring of products and services, and for evaluation. For example, within the scope of the S3C project we have had the opportunity to test the segmentation light-tool for the purpose of evaluation (see the box below). However, more testing would be needed to assess its value for the various potential application areas in the context of smart grids. Therefore, we advise to use the segmentation light-tool primarily to gain hands-on experience with segmentation as a way to get acquainted with the approach. It is equally interesting to apply the tool in real life settings for further testing and development.

Testing the segmentation light-tool (Linear, BE)

Within the scope of S3C project we tested the segmentation light-tool for the purpose of evaluation (Cardinaels *et al*. 2015; S3C, 2015). First, we tested whether the representation of the segments in Linear would be similar to the one in the original Swiss population. The results of Figure 2 suggest that - compared to the Swiss profile - idealists, materialists and convenience-oriented indifferents are somewhat overrepresented, primarily to the cost of the selfless inconsequent energy consumers and thrifty energy savers.

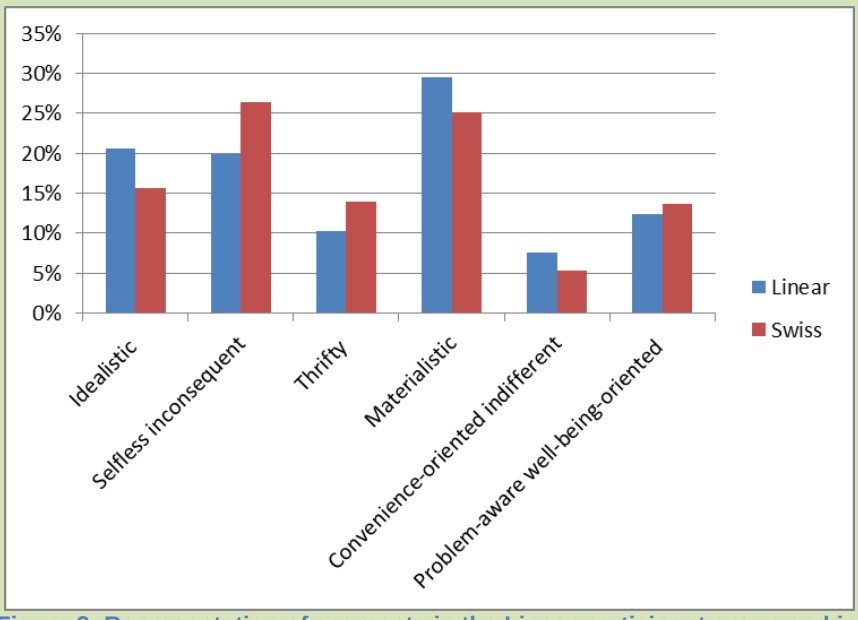

Figure 2: Representation of segments in the Linear participant group and in the original Swiss population.

We also correlated the attitudes towards smart grid products expressed by participants at the start of the Linear project to the different segments. This analysis revealed that the problem aware and convenience-oriented segments are least positive, while the idealistic and materialistic segments are most positive about smart grid products. Although the observed differences are relatively small, this suggests that comfort-oriented people who are not in favour of saving energy in the first place hold also a lower attitude for smart grid products, while people driven by idealistic motives or by financial gains hold positive attitudes for smart grid products.

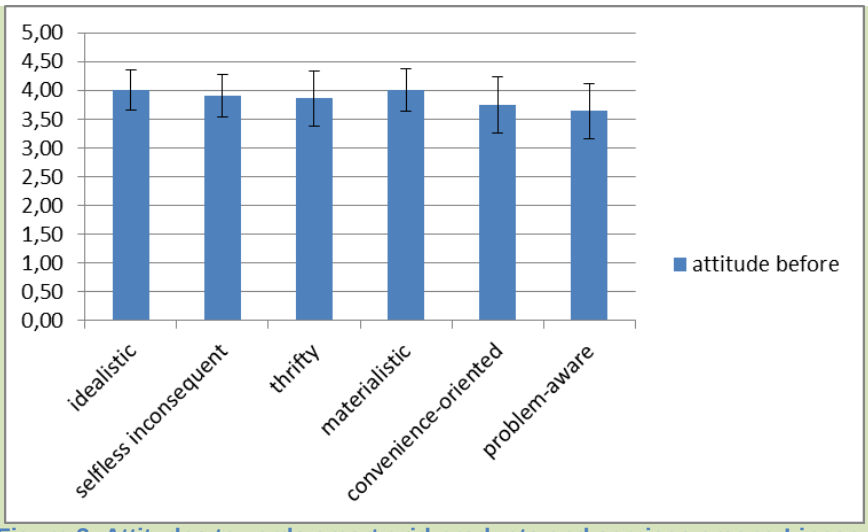

Figure 3: Attitudes towards smart grid products and services among Linear participants measured at a 5-point scale at the start of the project. Error bars represent standard deviations

Finally, we assessed for each segment the actual electricity use flexibility offered by participants, as indicated by the bonus they received from the Linear project (see Figure 4). This analysis suggests reasonable consistency between the attitudes towards smart grid products (Figure 3) and actual flexibility offered, with the idealistic segment towards the higher, and the problem-aware wellbeing-oriented segment towards the lower end. However, we also concluded that the spread of bonuses within segments is much higher than the absolute differences between them. This thus supports the view that segmentation cannot be expect to deliver accurate predictions of user behaviour.

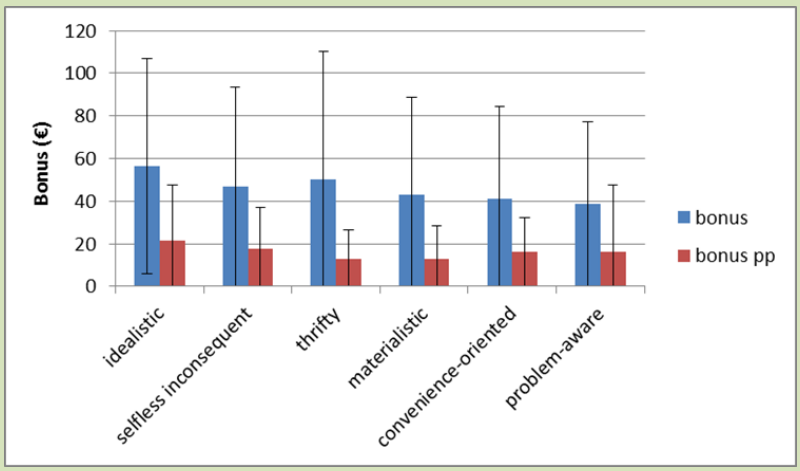

Figure 4: Average bonus obtained among the different segments of Linear participants, both in absolute terms and per person (pp) in the household. Error bars represent standard deviations

In hindsight, the most promising application area of the light-tool would be for communication purposes during the recruitment phase of a smart grid pilot - according to the project manager of Linear. Since the light-tool addresses underlying motivations of users, different types of messages could be developed for the different types of user to 'speak directly' to their interests (e.g. emphasizing environmental benefits, energy savings, financial gains, etc.). This way of use could be further tested and elaborated on.

Do's and don'ts

- **Use the segmentation light-tool to gain hands-on experience with segmentation.** In its current form, this tool is particularly suitable to get acquainted with the segmentation approach. For real-life applications, further testing and development is still required and we welcome further applications in this respect.
- **This light-tool should not replace a fully-fledged segmentation approach**. It is on purpose designed as a 'light-tool' that allows you to perform a quick scan of a user population. Please refer to a specialized agency for advanced segmentation applications.
- **Check out the associated guideline prior to using this light-tool.** The S3C guideline Using segmentation to better target user groups provides background information on segmentation and hints an tips on how and for what purposes it can be applied.

What do you need to do?

The segmentation-light tool is implemented in the associated excel spreadsheet.

To create a user profile the following steps are taken:

1. Go to the tab 'questions'.
2. For each question and for each topic, the user fills in the most appropriate value in the column 'Score' (see Figure 5)
3. When you're done, move to the tab 'results'. Here the following results can be checked:
   a. The absolute difference between the average scores of the user and the various segments for a number of topics and subtopics.
   b. Based on these values, an average distance between the user and each of the segments on a scale of 0 to 5 (see Figure 6)
   c. The rank of correspondence with the different segments, ranging from 1 (smallest distance) to 6 (largest distance) (see Figure 7). The user is allocated to the segment with rank 1, with the segment with rank 2 as a 'runner-up' match.

The spreadsheet implementation of the light-tool is convenient to assess the profiles of a small group of users. For larger groups, we advise to implement the spreadsheet as an online questionnaire.

Topic	Questions	Score
Energy saving in the house	Please indicate how frequently you show the following behaviors. The scale ranges from 1 (never) to 6 (always).	
	Fill washing machine to capacity.	3
	Defrost freezer/chest freezer/freezing compartment.	4
	Wash laundry at lower temperatures (for example hot wash at 60°C, lightly soiled laundry at 30°C).	5
	Turn off standby on appliances.	3
	Ventilate only briefly, but thoroughly during winter.	5
	Adjust room temperature according to room's usage, for example turn down temperature in unused rooms.	3
	Turning off the light when leaving a room.	6

Figure 5: Impression of the light-tool input screen for the topic Energy saving in the house

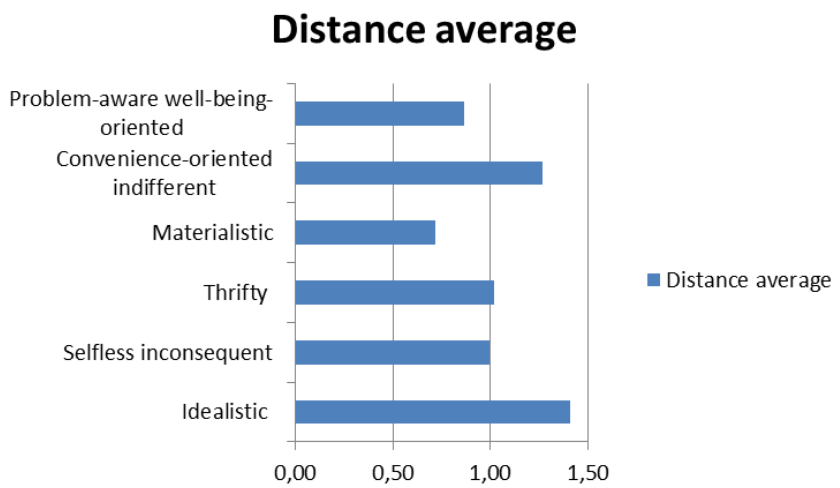

Figure 6: Average distance from the different segments on a scale of 0 to 5 for a random (materialistic) energy consumer

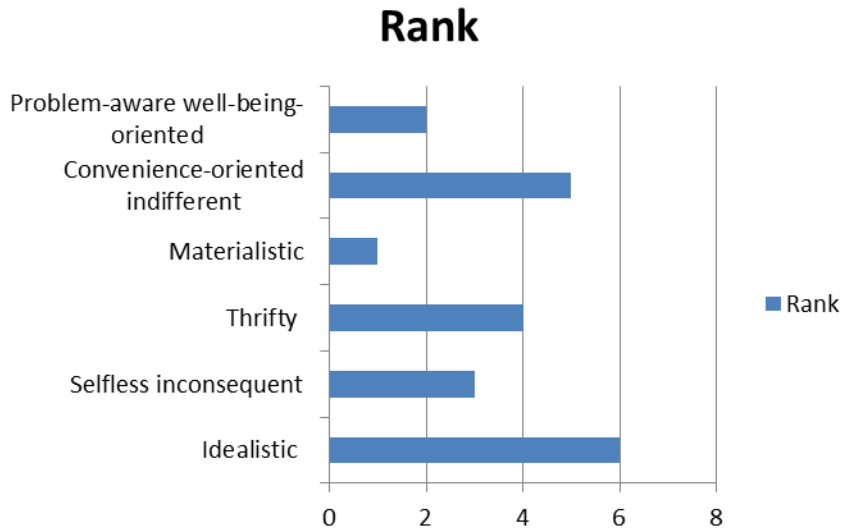

Figure 7: The corresponding rank of the different segments ranging from 1 (smallest distance) to 6 (largest distance)

Methodology and testing

The light-tool is directly based on the comprehensive segmentation model developed by Sütterlin *et al.* (2011), aiming at identifying the energy saving potential of target groups. The segments were derived through a cluster analysis of survey data among a representative population of Swiss households. The cluster analysis was performed on the basis of a number of so-called segmentation variables: a measure of a specific aspect of energy saving behaviour, such as the current level of energy-saving actions in the housing, mobility, and food domain, or the type of motives underlying energy saving[1]. The score for each segmentation variable is calculated based the average response for a number of corresponding survey questions, usually (but not exclusively) answered on a 6-point scale.

The segmentation light-tool applies this methodology 'in reverse order'. First, answers to set of closed questions are gathered. Second, it screens for each segmentation variable the difference (in absolute terms) between the users' score and the score for the different segments. Finally, by averaging the (root-mean-square) differences over all segmentation variables, the tool allocates an 'average distance' for each segment (see Figure 6), and shows the rank of correspondence with the different segments ranging from 1 (smallest distance) to 6 (largest distance) (see Figure 7). The user is then allocated to the segment with rank 1, with the segment with rank 2 as a 'runner-up' match.

To make the light-tool as user friendly as possible, the number of questions in the questionnaire was reduced from 64 in the original questionnaire to 42 in the light-tool. In this way a balance was sought between minimizing the time required to fill out the questionnaire, and acceptable levels of internal consistency for the various segmentation variables[2].

As a basic test, we verified to what extent the respondents of the original Swiss survey would be allocated by the light-tool to the same segment as they were originally in (based on the original data provided). The results indicate that the overall share of the segments in the population is well reproduced, see Figure 8. Figure 9 additionally shows for each segment the percentage of *matches* (the light-tool allocates the user to its original segment), *partial matches* (the user's original segment matches the light-tool runner-up segment), and *mismatches* (none of the before). Although the light-tool certainly doesn't always provide a perfect match, we

[1] The full scope of segmentation variables includes: energy-saving actions based on curtailment in the housing, mobility, and food domain; energy-saving actions based on energy efficiency; financial motive; energy consciousness motive; acceptance of policy measures; beliefs concerning response efficacy, self-efficacy, personal efficacy, awareness of consequences, ascription of responsibility, and personal norms; basic convictions about energy conservation; and perceived loss of comfort. In the light-tool these are somewhat reformulated and referred to as 'topics' or 'sub-topics'.

[2] In technical terms, the values of Cronbach's α remained at an acceptable value of 0.63 or higher for all segmentation variables with originally a Cronbach's α > 0.7.

do consider the matching acceptable, with matches ranging between 55 and 80 percent and with the mismatches staying below some 20 percent.

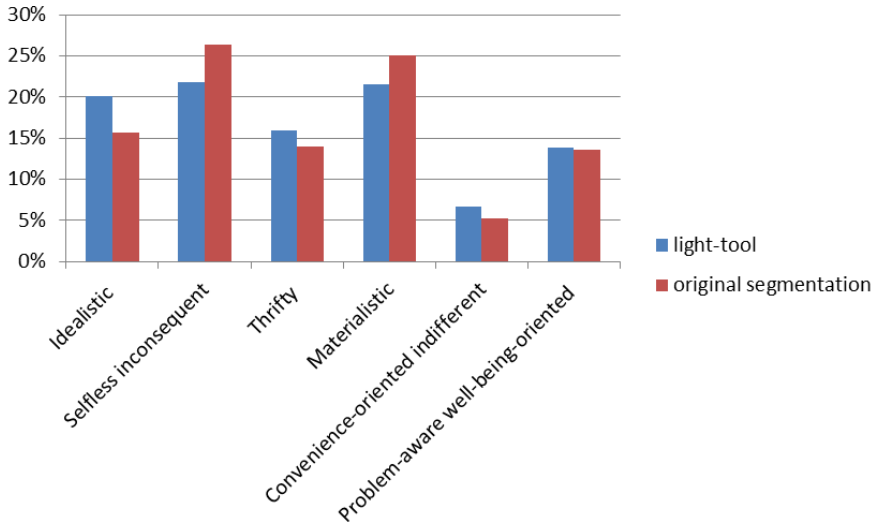

Figure 8: The share of the various segments in the Swiss population from the original segmentation excercise and reproduced with the segmentation light-tool

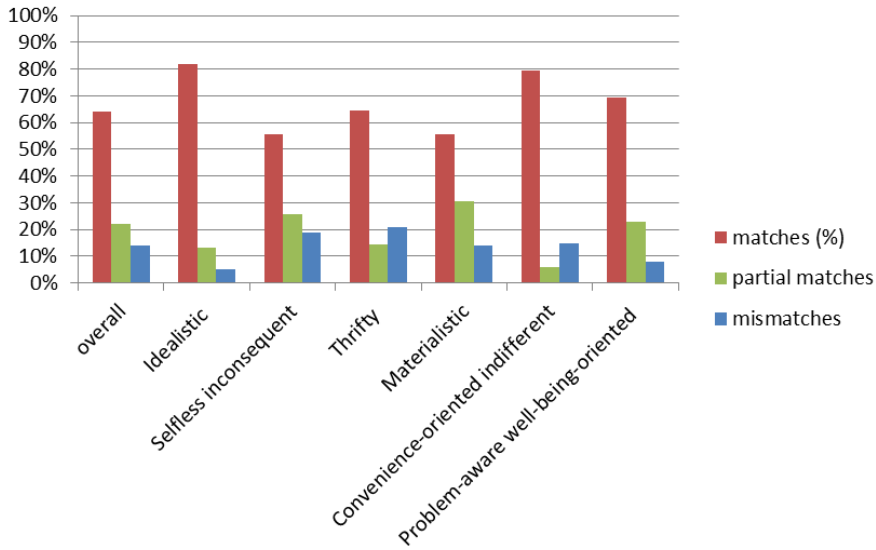

Figure 9: For each segment the percentage of matches, partial matches, and mismatches

The usability of the light-tool was further tested in the Linear project (Cardinaels *et al.* 2015; S3C, 2015). This test suggested amongst others that the light-tool was easy to use as indicated by the high response rate (67%). Also, we found a similar distribution of segments among the Linear and Swiss population, and observed that various descriptive characteristics of the Linear-based segments in relative terms matched reasonably well with the corresponding characteristics of the Swiss-based

segments[3]. In terms of usability, we found a limited value for predicting electricity use flexibility and a potential use for tailored communication in the recruitment phase (see the example on p. 2).

Further reading

- Breukers, S. and Mourik, R. (2013). *The end-users as starting point for designing dynamic pricing approaches to change household energy consumption behaviours.* Report for Netbeheer Nederland, Projectgroep Smart Grids (Pg SG). Arnhem: March 2013.
- Cardinaels et al. (2015). *Set-up and Results of the Linear Demonstration Project. Demand Response in Residential Areas*. EnergyVille, Genk, Belgium.
- S3C, 2015. *Report with detailed case analyses of 'Family of Projects' members who used the guidelines*. Deliverable 5.1 of the S3C project. Available at: http://www.s3c-project.eu/Deliverables.html
- Sütterlin, B., Brunner, T. , Siegrist, M. (2011). *Who puts the most energy into energy conservation? A segmentation of energy consumers based on energy-related behavioural characteristics.* Energy Policy 39: 8137–8152.

This tool was developed in the S3C project, and is freely available from www.smartgrid-engagement-toolkit.eu.

S3C paves the way for successful long-term end user engagement, by acknowledging that the "one" smart consumer does not exist and uniform solutions are not applicable when human nature is involved. Beyond acting as a passive consumer of energy, end users can take on different positions with respective responsibilities and opportunities. In order to promote cooperation between end users and the energy utility of the future, S3C addresses the end user on three roles. The *smart consumer* is mostly interested in lowering his/her energy bill, having stable or predictable energy bills over time and keeping comfort levels of energy services on an equal level. The *smart customer* takes up a more active role in future smart grid functioning, e.g. by becoming a producer of energy or a provider of energy services. The *smart citizen* values the development of smart grids as an opportunity to realise "we-centred" needs or motivations, e.g. affiliation, self-acceptance or community.

S3C (2012-2015) performed an extensive literature review and in-depth case study research on end user engagement in smart grids, resulting in the identification of best practices, success factors and pitfalls The analysis of collected data and experiences led to the development of a new, optimised set of tools and guidelines to be used for the successful engagement of either Smart Consumers, Smart Customers or Smart Citizens. The S3C guidelines and tools aim to provide support to utilities in the design of an engagement strategy for both household consumers and SMEs. The collection of guidelines and tools describe the various aspects that should be taken into account when engaging with consumers, customers and citizens. More information about S3C, as well as all project deliverables, can be found at www.s3c-project.eu.

[3] Concretely the age profiles and the basic attitudes towards perceived social pressure, enjoyment of life and inference of freedom of choice.