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D2.2 CoSSMic user concepts

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ABSTRACT

This deliverable provides the methods that were used as part of the user-centric design processes. User workshops have been carried out based on these methods and the results are documented. The findings and artifacts include personas, scenarios, product and user interaction concepts, paper prototypes and low-fidelity prototypes/mock-ups developed through co-design processes with users. The findings have been evaluated by the users and this is also documented.

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1 About this Document

1.1 Role of the deliverable

This deliverable provides the methods that were used as part of the user-centric design processes. User workshops have been carried out based on these methods and the results are documented. The findings and artifacts include personas, scenarios, product and user interaction concepts, paper prototypes and low-fidelity prototypes/mock-ups developed through co-design processes with users. The users have evaluated the findings and this is also documented in section 4.

1.2 Relationship to other CoSSMic deliverables

D2.1 provides the user groups that will be involved in the user centered design cycles that are documented in this deliverable.

D2.2 [this document] serves as input to requirements in WP3 and also forms a fundament for deliverable D2.4.

1.3 Relationship to other versions of this deliverable

This is the only version of this report.

1.4 Structure of this document

Section 2 describes the background of smart use of solar energy and presents relevant related projects.
Section 3 describes the method used for bringing about the results
Section 4 describes the results of applying the different iterations of the method
Section 5 presents a discussion regarding the application concepts as well as a methodology reflection.
Finally we conclude and discuss further work to be done.
The details of the users group are documented in the appendix.

2 Background – Smart use of solar energy

In this section we provide the background information regarding smart use of solar energy and how this is done in other projects. Lessons to learn from these projects sum up this section.

Despite the growth of the PV Industry and the markedly reduced prices for photovoltaic installations, product lines still fail to respond to the variety of customer requirements within the building stock. Smart meters are day after day finding a larger diffusion. Denmark for instance aims at providing within 2020 all houses within the country with smart meters, while several developers are extending the design and implementation of such utilities to any kind of commercially available appliance and component. Still, according to a scientific report released in 2010 by the ACEEE - American Council for an Energy-Efficient Economy - utilities connected to smart meters "need to go beyond and use a range of energy-feedback tools to achieve significant reductions in customers' power consumption and their electricity bills". According to this study significant reduction of electricity consumption will be possible only "if customers have context for the data that advanced metering can provide". "Smart meters are – simply - by themselves just not 'smart' enough to get the job done for consumers and our economy" (Ehrhardt-Martinez et al 2010). "Utilities need to use smart meters to provide consumers with information on their consumption in ways that grab consumers' attention and encourage them to take action". That means involving users through feedback of different nature about their user behaviour in relation to the energy performance of the whole house technical system. "Users need to be shown how they can slash their power use and costs in order to sufficiently motivate them to change ". This can be achieved through the use of displays and well-designed programs that successfully inform, engage, empower and motivate people through different forms of feedback, such as: Direct feedback of actual energy consumption, statistical analyses of consumption patterns, direct and indirect information about generation, energy management and storage. According to Karen Ehrhardt Martinez - today senior research associate at the University of Colorado's Renewable and Sustainable Energy Institute in Boulder - "People may be unhappy to get an electricity bill for $200, but it's even worse to find out that your neighbors' energy bills are half what you're paying even though their homes are the same size". "Through enhanced billing consumers can better evaluate their energy consumption practices, determine how energy is being wasted, and take action." (Ehrhardt-Martinez et al 2010).
As a consequence of this scenario today more and more attention is given into translating the huge amount of data collected by smart meters into feedback and solutions for increasing the engagement of consumers and correct their attitude and behaviour towards energy efficiency. Preet Singh et al 2013 designed and implemented a cloud-based architecture able to control the huge amount of data generated and collected by smart meters about consumer energy consumption. The software developed by them is aiming at translating data into feedback for the users providing consumers with fast access and ne-grained control over their usage data, as well as the ability to analyze this data with algorithms of their choosing. Another company called SolarDesign developed "a user oriented software tool for numerical modeling and simulation tool for enabling the user to calculate solar radiation received" even on complex shapes. The software tool was developed following a living lab methodology which involves end-users through different levels of involvement:1. be; 2. test; 3. watch; 4. hear; 5. imagine.

Finally in the "North House" designed by the Canadian Team North for the US competition solar decathlon, the whole interior of the house was conceived as an extended interface between users and integrated technology systems. A smart phone app was also developed in order to enable the inhabitants to remotely control appliances and devices integrated in the building. A similar approach was adopted for the design of the Living LAB project at NTNU, a prototype of an energy positive solar powered house where technologies and concepts developed at the ZEB research Centre will be investigated in relation to users' interaction.

2.1 Technologies and the User development

Sustainable development in the European Union (EuropeanUnion, 2013) highlighted that solar solutions are growing fast in terms of renewable electricity as solar installations start to be economically viable without subsidies where weather conditions are favourable. There are a growing number of solar related studies to reflect this pace. There are other projects in which solar is considered alongside other renewable energy sources. The H2SusBuild project combines photovoltaic solar panels and wind power generators with water electrolysis for the production of hydrogen. In the Cost Effective project, a set of five new multifunctional façade components and systems has been successfully developed with the aim of reducing production and installation costs. They are· transparent solar thermal collector; air-heating vacuum tube collector angle-selective transmittance BIPV-component façade integrated natural ventilation system with heat recovery solar assisted decentralised heat pump system (EeB\PPP, 2012). Thus highlighting the relevance of a project like CoSSMic but there are success stories for which CoSSMic can develop on such as in Barcelona and Vienna.

Barcelona is the first European city to have a Solar Thermal Ordinance making it compulsory to use solar energy to supply 60% of running hot water in all new buildings, renovated buildings, or buildings changing their use. It applies to both private and public buildings (http://www.c40.org/cities/barcelona/case_studies). Barcelona's solar hot water ordinance system have had proven effects related to their initial objectives. The Barcelona solar power system, initiated in 2005 with 31,050 m² of installed solar panelling, has led to annual energy savings of 24,840 MWh (Manville, Cochrane, Cave, Millard, Pederson, Thaarup, Liebe, Wissner, Massink and Kotterink, 2014). The Vienna Solar Power Project offers citizens the chance to buy whole or half panels at a price of EUR 950 or EUR 475 respectively which is a business model that CoSSMic could consider. Wien Energie rents the panels back from the individual purchasers in exchange for an annual profit of 3.1% on their investment, paid directly into their accounts annually. Once the service life of the plant ends after approximately 25 years, Wien Energie repurchases the panels and the original investment is returned to the citizen (Manville et al., 2014).

Smart City projects that include the projects from Barcelona and Vienna have involved the participation of citizens through ICT enabled platforms of open data strategies and platforms, crowd sourcing and co-creation platforms, and other forms of citizen participation and ideation. The open data projects include citizen or user competitions to develop apps and other digital services (often re-using public data) to improve the quality and level of participation of public services. Because citizen and business participants set the agenda there are opportunities for the vocalization of preferences and capabilities of participants (Manville et al., 2014). Perhaps such a platform could be considered for CoSSMic if feasible as the benefits have been in enabling citizen and business participants to set the agenda there are opportunities for the vocalization of preferences and capabilities of participants.

2.2 Past research on user engagement with «smart» energy technologies.

Once the technologies have been designed, users often test them. In CoSSMic we are both designing and testing technologies, so past research on how related technologies have been received by its audience might provide cues for learning. The idea of using some sort of feedback mechanism combined with new technologies to stimulate change in electricity consumption patterns is far from new. In fact, experimentation with feedback technologies have been going on at least since the 1970s. The main difference between CoSSMic and past studies of "smart" energy technologies is the inclusion of battery storage capacity, online communities, as well as the particular focus on solar energy. However, success in CoSSMic requires user engagement.

What are the past experiences?

Sarah Darby (2000, and updated in 2006) analysed 38 studies of feedback technology over a 25-year period. She found that the feedback stimulated 5-20% energy savings, and that the best results were achieved through direct feedback, for example through an energy monitor in the home. Fischer (2008) carried out a similar synthesis of the results from 26 feedback studies from 11 different countries. Fischer points out that very few of these studies were done in real-life settings. This might give CoSSMic an edge, but the limited results from these extensive studies also suggest that CoSSMic might have a challenge. Fischer found energy savings in the range of 1.1%-20%; usually they were between 5-12%. Fischer makes a number of design recommendations that might be of relevance for CoSSMic:

- Multiple feedback options (different time periods, extra information i.e. energy saving tips, info on environmental impact)
- Interactive elements
- Comparison with earlier periods
- Breakdown of how different household appliances influence the energy consumption total.

Fahruqui, Sergici & Sharif (Faruqui, Sergici, and Sharif 2010) carried out a similar review, studying the results from 12 feedback studies across the globe between 1998-2011. They found a range of 3-13% savings, with an average of 7%.

These three review studies comprise 76 trials from numerous countries. The results suggests that in controlled trial settings with what we can assume to comprise mostly of volunteering technology enthusiasts, we can expect somewhere between 5-10 percent savings. Keep in mind that the goals in CoSSMic go beyond mere energy savings; we want to achieve auto consumption, establish regular software-interaction, and set up some sort of active user community – all based around the consumption and production of electricity in CoSSMic neighborhoods.

Several studies exists that shed light on how users in such trials interact with the technology in question. These studies might provide valuable learning for CoSSMic. Hargeaves, Nye and Burgess (2010, 2013) show that users who are involved in testing feedback and energy control systems have a range of different reasons for participating in trials. Some participate for economic reasons; others for environmental reasons, a third group are interested in information while a fourth group participate because they have an interest in technology. This suggests that different user groups have different expectations to the technology, and this is of course a design challenge. Further, what information do you provide to these groups? In the reported trial, you could choose between information about CO2 emissions, KWh used and money. CO2 and KWh was considered too abstract, even by the information hungry and environmentally interested, so close to all participants used the monetary measure, even if it did not interest them. Similar issues have been reported by many others: abstract information could be a problem (see e.g. Wallenborn, Orsini, and Vanhaverbeke 2011). How was the technology used? During the first 2-3 months of this project interest in the technology was high, but behavioral changes very limited. The feedback technology was used to identify what was characterized as "wasteful" consumption. This was reduced, but alarmingly this resulted in the establishment of a new "normal" condition even more solid than before. After a while, the participants lost interest in the technology, it failed to provide new, relevant information. Some stopped using it altogether; others looked at it from time to time.

Participants reported that if they should make drastic changes they would require substantial monetary gains. This might be a possibility that CoSSMic should be able to benefit from, given the participants also reported increased interest in microgeneration and other measures. This might be good news for CoSSMic, since we plan to combine visualization with microgeneration and storage.

A recurring theme in studies of smart energy technology trials is that they fail to account for the meaning electricity played in day-to-day social life. Wallenborn et al. (2011) show that shifting habits are associated with morals and norms. For example, reducing the temperature in washing machines from 90 degrees to 60 degrees might make sense economically, but if this is associated with bad parenting, lack of cleanliness and fear of diseases it is still thoroughly rational. In their study, Wallenborn and colleagues found people to be much more interested in buying efficient appliances than in changing practices. Sophie Nyborg and Inge Røpke (2011) sum up:

> *"Several trials with consumers show that any behavioural changes accomplished through e.g. feedback and visualization on displays are not permanent and that people return to their old consumption patterns after a period of about three months – regardless of the continued feedback."*

In other words, the message from past research on user interaction with new energy technologies is a challenge to CoSSMic. From the types of studies cited above it is also possible to distil some design tips:

- Avoid too abstract measures
- Add comparative standards: how does energy use in this building compare to other energy intensive activities, e.g. air flights and transportation.
- Make interface intuitive and usable without too much explanation.
- Energy is relational: visualize how appliances relate to one another, compare to each other etc.

Apps, websites and other user interfaces should continue to provide new and relevant information also after users have learned how to work the equipment.

We have prepared a list of related projects, which can be found in Appendix D.

3 Method

Central to the work of identifying CoSSMic application concepts is our iterative approach relying on the Lean Startup product design method described in section 3.1, and the identification of the CoSSMic scenarios. Our approach enables stakeholders and end-user involvement throughout the whole project, which is essential for the CoSSMic project to be successful.

CoSSMic will produce results that stakeholders need in the CoSSMic ecosystem. Pointing to the lean startup; this means the full cycle from the process of developing technology (Make), sharing of services and applications using a marketplace (Share) and using the service and applications (Use). The technology vendors "Make" the technology, the service providers "Share" the service, while the service recipients "Use" the service. We will relate to this ecosystem of stakeholders as the make-share-use cycle.

To be successful it is not enough to follow an iterative process involving all relevant stakeholders (including end users), there is also a need to develop a shared understanding of the CoSSMic success-criteria among all project participants. We will now first describe the overall approach of the method, including lean startup and user-centred design.

CoSSMic has defined success criteria to ensure that what we create in CoSSMic is indeed what real end-users want.

Copied from the description of work:

- To develop all CoSSMic scenarios and solution concepts.
  Success factor: 90% of all scenarios and concepts developed in stakeholder and user workshops.
  - In D2.4 (and also WP3) we will report on the usage of the scenarios and concepts.
- To develop all user interface software for the trials.
  Success factor: At least 70% of all recruited users use the software at least once a day after its release.
  - To be measured after start of trials. To be reported in WP6 as part of evaluation (Task 2.5 ends in M36, the final WP2 deliverable is in M22)
- To develop new business models based on the CoSSMic concepts
  - Documented in D2.3
- To evaluate all user interface software for the trials.
  Success factor: 50% of all software specification developed in co-design workshops together with users.
  - In D2.4 report on the use of GUI aspects

  80% of all trial participants answer evaluation questionnaires.
  - A questionnaire will be developed in T2.5. It will be send out after trial start and feedback will be measured and reported in WP6 as part of the evaluation (Task 2.5 ends in M36, the final WP2 deliverable is in M22).
- To create a community of users and third party service providers for CoSSMic software.
  Success factor: At least 50% of involved users participate at least once a month in the online community.
  - To be developed and maintained in T2.5. Measure in WP2 and report in WP6
- At least 5 third party service providers create services for CoSSMic online community platform.
  - We plan to host a development challenge as part of I4CS conference. This will be reported in WP6.

In this section we focus on the workshops and the results. For a comparison with mature home energy systems and concepts, please refer to D3.1 page 93 and onwards.

3.1 Overall approach: Lean startup product design

WP2 employs an iterative design methodology based on the Lean Startup product design approach (Ries 2011). This approach focuses on quick cycles through three distinct activities, shown as circles in Figure 1 below. Each activity aims at creating a result (shown as rounded rectangles) where the fidelity of the results improves gradually towards an artifact as we iterate through the whole process.

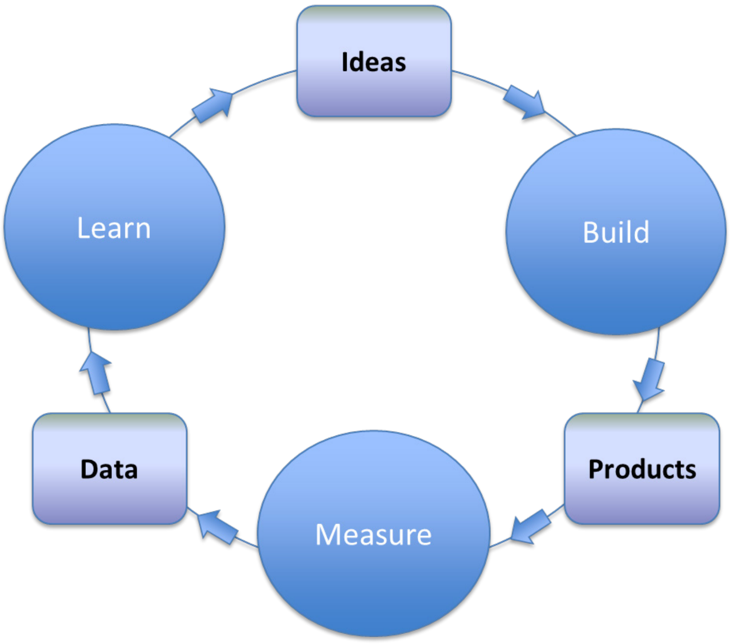


Figure 1: The Lean Startup product design approach adopted from (Ries 2011)

The activities in Figure 1 and their corresponding results are:

- Starting from initial ideas, the **build activity** creates a set of products that are designed to validate some hypothesis about the initial ideas. The products can vary from scenario descriptions and paper-based prototypes to low and high fidelity implementations of software prototypes.
- The developed products are evaluated during the **measure activity**, where real world empirical data are collected about the validity of the initial hypothesis.
- During the **learn activity**, empirical data are analyzed, resulting in new insights and new ideas that again initiate the build activity.

To enable continuous end user feedback, it is essential to minimize time-to-completion for each of these iterations. As a consequence, the product developed in each iteration needs to be limited and should mainly focus on validating designed mainly to validate one hypothesis or idea at a time.

In CoSSMic we combine the Lean Startup approach (Figure 1) with strong user and stakeholder involvement in each of the activities according to (ISO 2009). WP2 has continuously involved two types of stakeholders in the process:

- **Internal stakeholders:** The technical work packages, based on the Description of Work (DoW) for CoSSMic, constitute a major input to the process. Since the DoW only contains initial ideas, WP2 will develop a group of **liaisons** from the technical WPs (WP3-5) to function as an internal stakeholder panel. These liaisons represent their own WPs, but also act as representatives for real stakeholders from outside CoSSMic.

- **External stakeholders**: WP2 has started to develop relations to a number of stakeholder groups external to CoSSMic who can benefit from CoSSMic results. These stakeholders will be selected according to criteria in D2.1 and will also contribute to the lean startup cycles.

We have held a series of workshops, each resulting in a further iteration. The iterations are described below.

3.1.1 First iteration

Each iteration has an associated workshop. At the first workshop (the build phase), in order to provide tangible results for the users to work with in the second workshop, we have to identify the key features of the project. We do so by playing a number of games which each will provide an artefact to be used in the next step of the process (shown in Figure 2). The games are described in more detail in the sections below.

The first game, product vision, is to create a cover story with what we want to be the headlines of a newspaper after the end of the project. With this in mind, we define a number of personas to identify the individual characters of the different user types we will face during the project. With these two combined, we are ready to create a product box, a physical artefact that represent our product. The outside of the box should be appealing to our personas so they want to use the product. As the final exercise, we create a business model canvas to map and visualize our value proposition.

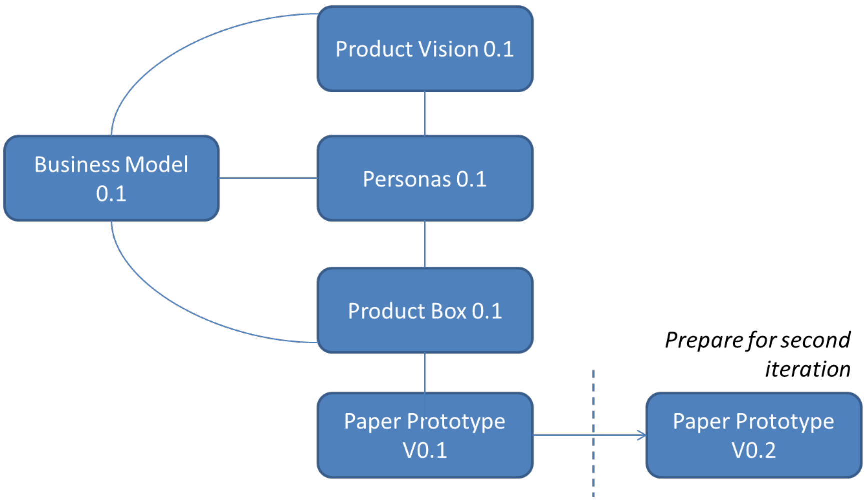


Figure 2: First iteration artifacts

The main goal of this iteration is to create the first paper prototypes and associated scenarios. This will serve as the input for the second iteration. The CoSSMic WP2 participants produce all artifacts in this iteration.

3.1.2 Second iteration

During the second iteration, users selected based on the criteria from D2.1 will participate in their respective local workshop, one in Caserta and one in Konstanz.

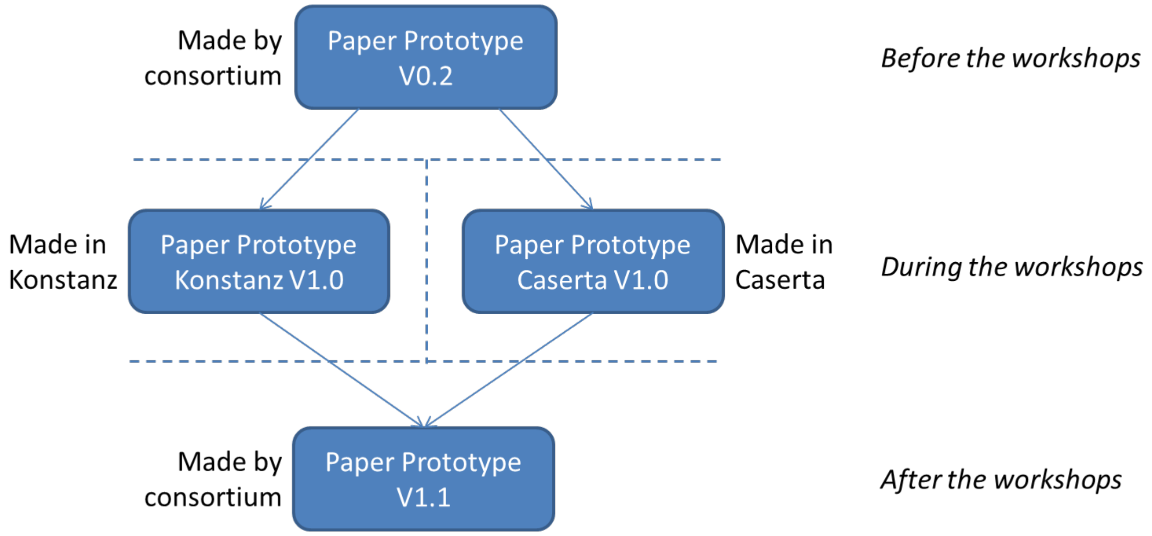


Figure 3: Second iteration artifacts

The participants will first receive information about the project, and will be shown the "base artifacts" created in the first workshop (product vision, personas, etc). Then, the paper prototypes are shown along with the scenario/story line associated to it. The users give their input and suggest improvements. When both local workshops are finished, the WP2 team uses the feedback as input for creating version V1.1 of the paper prototype including associated scenarios. This is the basis for the third iteration.

3.1.3 Third iteration

The same users groups (with some variations due to timing issues) as in iteration 2 will participate in their respective local workshop, one in Caserta and one in Konstanz. Version 1.1 is used as input for getting feedback once more.

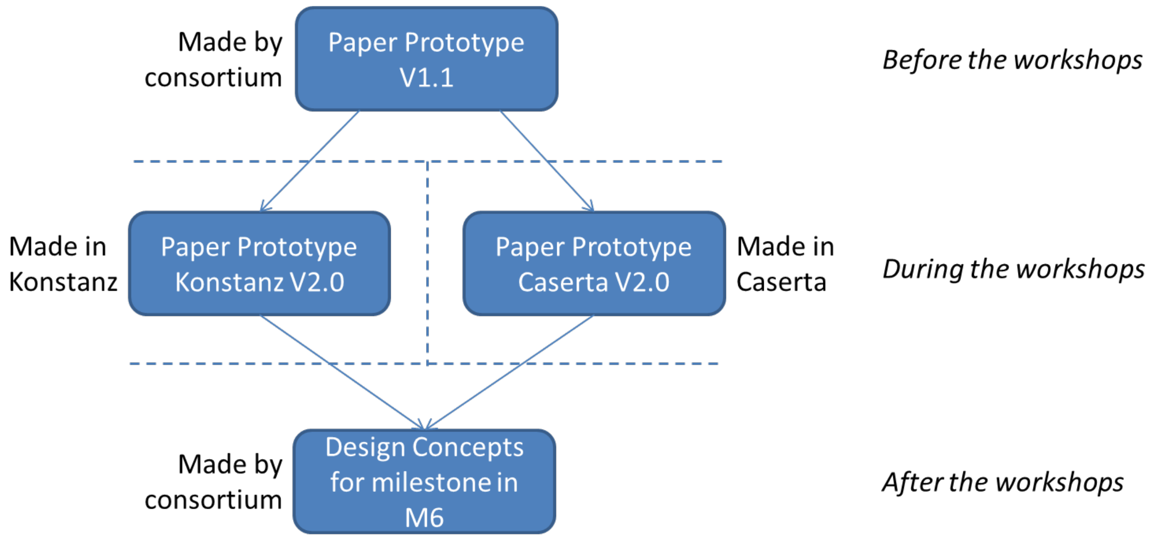


Figure 4: Third iteration artifacts

The users give their input and suggest improvements. When both local workshops are finished, the feedback is used by the WP2 team as input for creating the design concepts due in month 6.

3.2 User centred design

User centred design can be characterized as a multi-stage problem solving process that not only requires designers to analyse and foresee how users are likely to use a product, but also to test the validity of their assumptions with regard to user behaviour in real world tests with actual users. In this section we explain the methods that we have used to extract feedback from potential end-users of CoSSMic.

3.2.1 Design workshops

Design workshops were conducted with users and use of co-design games to develop CoSSMic concepts. Methods used include rough prototyping, experience prototype and product box. Workshops incorporated a number of communication tools to encourage ideas and discussion to flow.

- Communication tools
    - *Tomorrow headlines* is a communication tool that stakeholders can use to think about the impact of the project will have on the. It is based on fictional articles or advertising images published on magazines or journals that could be composed by projecting themselves in the future and trying to understand what kind of impact the service will have on the society(Diana, Pacenti et al. 2009) .
    - *Storyboard* techniques is a communication tool used to facilitate the sharing of thoughts and encouraging participation in workshops. Storyboards can also explain pieces of complex processes in a quick and effective way (Diana, Pacenti et al. 2009).
    - *Service image* is a unique picture that is able to give in one shot an immediate idea of the main features of a service concept. The service images are aimed at supporting the dialogue with the stakeholders, bringing them a vision of the service, but also at supporting the discussion around concepts, facilitating the elicitation of the prominent aspects of every ideas and the comparison between them (Diana, Pacenti et al. 2009)

The workshops were used with the aim that the user will be involved in the development of the software/technology in their homes. The results are directly given to the software/technology developers to assist in the development of parameters and concepts. Therefore creating an iterative process of involving what the user wants and checking how these aspirations fit with what the software can be developed to provide.

There were a total of five workshops although workshops are referred to as the first workshop held in Konstanz in December 2013; the second workshop which is two workshops that occurred in February 2013 in Konstanz and Caserta; the third workshop which is again two workshops that occurred in March 2014 in Konstanz and Caserta. The first workshop involved researchers of Workpackage 2. Researchers put themselves in the place of the CoSSMic end user and imagined what different types of end users would want from CoSSMic. Tomorrow headlines, Storyboard techniques and Service images assisted in the building up of ideas to result in a tangible paper prototype.

Paper prototypes developed from the first workshop are given a ‘reality check’ with what is possibly for WP4 can deliver. This exercise has been initially conducted in the second plenary meeting that happened in Trondheim in February 2014. The outcome of this is an assessment of the aspirational design from the workshops with the real capabilities of what the software can deliver. The outputs of the first workshop and the ‘reality check’ from the initial meeting are integrated into the other workshops, which involve intended users in the CoSSMic projects in Konstanz and Caserta.

The user centric workshops held in Konstanz and Caserta involved actual users for which the CoSSMic software will be tested in. The workshops are held twice in each city. These workshops will build on the paper prototypes developed from the initial workshop further develop parameters and concepts for the software which in turn will be given to Work Package 4.

3.2.2 Interviews

Interviews are conducted to identify specific needs and values that end users want in the system. The guide is developed from work already done in 2.1 and 2.2. Interviews are semi-open discussion as they must fall within the boundaries of the project. Questions asked therefore primarily start with how, what and why and aim in developing a focused discussion. The interview guide outlines clear instructions on how to conduct the interview as well as criteria on how to prevent bias influencing the interview. The interviews were conducted after the second workshops held in Konstanz and Caserta. The interview guide can be found in Appendix C – Interview Guide.

3.3 Developing scenarios in CoSSMic

CoSSMiC intends to demonstrate the potential of installing hardware and software to facilitate the storage of electricity and small scale electricity trading. In what follows we will illustrate the potential difference between future developments in the two sites through elaborating the difference between a set of as-is-scenarios and a set of to-be scenarios. In other words, what development do we expect to see in the two test sites without CoSSMic intervention, and how will that differ from various scenarios where CoSSMic hardware and software is installed?

In this section we provide details on the games that are used in order to create the future scenarios. Each game is described and an example of the outcome is given. The complete outcomes from all groups can be found in the appendix.

3.3.1 Product Vision – Cover Story

The goal of this game is to create a product vision and to write tomorrow's newspaper´s headlines. This game is inspired by Game-storming (Gray et al 2010) thus all of the examples and templates are taken from the book.
Imagine the best-case scenario for the results from CoSSMic - and then take that scenario even a step further.
The workshop started by filling out the provided templates individually:

- Cover – states the spectacular success accomplished by CoSSMic
- Headers – reveal what the story is about
- Sidebars – include parts of the report
- Quotes – testimonials about the accomplishment from anyone imaginable
- Images – pictures that support the cover story
- Brainstorms – used for writing down ideas before starting the activity

This first activity was followed by a group assignment to collaborate on generating the "cover story of the year" in a single template.
Note any common vision themes and areas of agreement. Share observations, insights and concerns about the future state. The end product is the cover story for the project that will be used as a further guidance for creating the scenarios.
Output: one cover story per group.

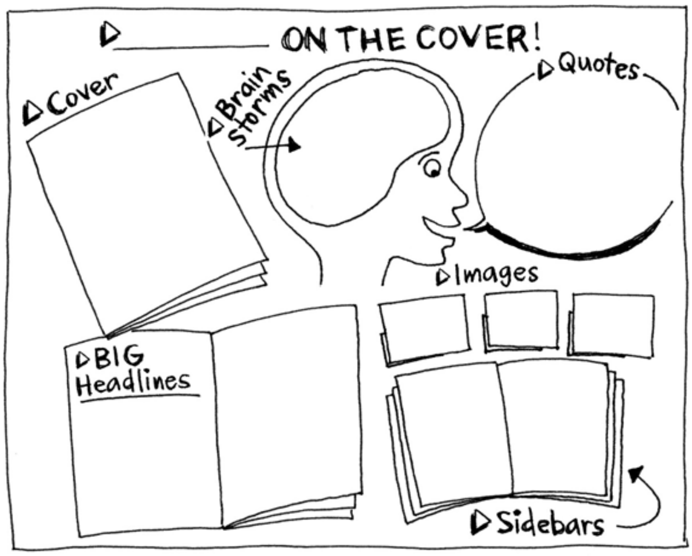


Figure 5: Cover story template

3.3.2 Persona

In marketing and user-centred design, the term ‘personas’ are used to describe fictional characters created to represent different user types within a targeted demographic, with similar attitudes and/or behaviour sets that are imagined to use a website, a brand or any other product in a similar way. The term ‘persona’ heavily resembles Max Weber’s classical sociological notion of ‘ideal types’: a representation highlighting patterns of characteristics in a segment of the population without it being meant to represent any specific individual. In this way, it is –as many other concepts from marketing – a quite popularized version of ideas from classical social theory.

A ‘user persona’ is a term used to describe a representation of the goals and behaviours of a hypothesized group of users. In most cases, personas are constructed based on data collected from interviews with prospective users. The user personas are typically presented through 1–2 page descriptions that include details about behaviour patterns, goals, skills, attitudes, and environment, with a few fictional personal details to make the persona a realistic character. For each product, more than one persona is usually created, but one persona should always be the primary focus for the design.

3.3.2.1 Benefits of using personas

The literature suggests that there are a number of advantages to using the persona concept (see e.g. Cooper, 1999):

- Personas might help members of design teams share a specific, consistent understanding of various audience groups. Data about the groups could be contextualized properly. This could facilitate new types of understanding through the creation of coherent stories.
- Personas might guide the creation of proposed solutions. Features of the product can be prioritized based on how well they address the needs of one or more personas.
- Personas might help designers through the provision of a human "face" so as to focus empathy towards the persons represented by the demographics.

3.3.2.2 Personas: a few words of caution

Historically, the engagement with energy and electricity users has been enacted more or less as passive acts of consumption or non-consumption. In other words users or consumers have had very little to say in scientific processes or in more commercially oriented processes of design. During the last 20 years or so, there has been a clear change, at least in the rhetoric around user involvement, both in science and commerce. The idea is that involving users will benefit both users and designers, bring about more engagement and democratize the processes in science and technology development.

The notion of personas can be seen in this light: as one of many potential ways to bring the public into scientific and technological processes. It is a way of imagining potential users, imagining what their needs are and actively engaging with these needs. However, several studies indicates that when experts and designers imagines the users of their technology, they tend either to underestimate the users/publics capacity in terms of possibility to contribute in constructive processes, or they tend to imagine users and publics as obstacles that need to be overcome for a particular technology to prevail (see e.g. Barnett et al. 2012, Walker et al. 2010). In the CoSSMic setting it is a challenge not to impose our own preconceptions about who potential users are, what their preferences might be and how they eventually end up using the CoSSMic technology.

The image below provides an example persona as envisioned by members of the CoSSMic research team. The goal of the game is to create personas according to this template.

Figure 6: Example persona

Our example persona includes a number of fields that can be relevant when designing the first paper prototypes. It helps to understand whom we are designing for.

3.3.3 Product Box

The goal of a product box is to identify the Most Exciting Product Features

This game involves imagining a customer who is being sold the 'CoSSMic' product at a tradeshow, retail outlet, or public market. A cardboard box is used as a product box that outlines aspects of what would be included in a 'CoSSMic' product (See figure 3). The box should have the key marketing slogans on it that described the product for the imagined customer. When finished, pretend to have a sceptical prospective customer to use the box and sell the product.

The product box game is inspired by [4].

Product boxes are to be found everywhere and typically have exciting, colorful words and phrases to convince people to buy this product.
The purpose of the game is to let the participants create such a box for their product. What would a potential customer look for in your product? The outcome of the game is an actual physical box with key phrases to convince prospective customers.

Ask yourself the following questions (taken from "The empathy map" in [6]):

- What does she see?
  - Describe what the user sees in her environment
    - What does it look like?
    - What problems does she encounter?
    - What types of other offers is she exposed to?
- What does she hear?
  - Describe how the environment influences the customer
    - Who really influences her, and how?
- What does she really think and feel?
  - Try to sketch out what goes on in your customers mind
    - What is really important to her (which she might not say publically)?
- What does the customer gain?
  - What does she truly need or want to achieve?

The output: a physical box that gives a potential customer/user "I want this and I want it now" feeling.

Output: a physical box that gives a potential customer/user a "I want this and I want it now" feeling

3.3.4 Business model canvas

The goal of a business model canvas is to visualise the value proposition.
In figure 7 (Osterwalder and Peigner 2010) describe The Business Model Canvas, as a strategic management and entrepreneurial tool. It allows you to describe, design, challenge, invent, and pivot your business model. As shown in figure 1, the canvas includes 9 building blocks such as key partners, revenue streams, key resources, etc. Each associated with a set of questions that should be addressed. By filling out each block, one creates an overview of the value of the business model.

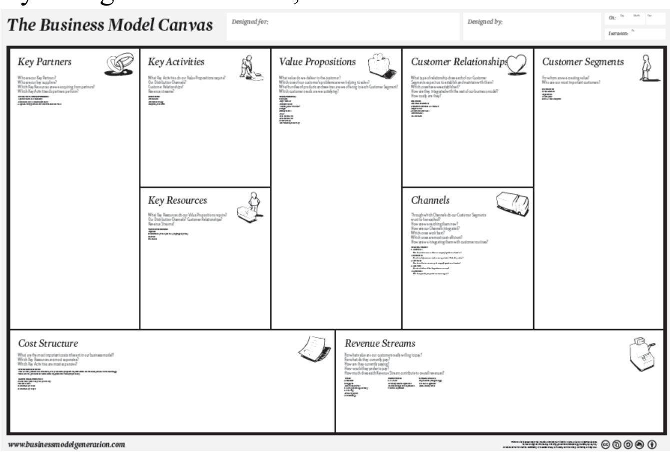


Figure 7: Business model canvas

3.3.5 Guidelines for creating a paper prototype and scenario

Paper prototypes are very low-fidelity artefacts that are drawn on paper. In our project we use this to get feedback from users regarding the functionality. The main benefit of such a low-fidelity approach is that users are more prone to focus on the functional aspects than on the aesthetic ones.

The process from an idea via a paper prototype to a mock-up scenario relies on input from real potential users. The iterations have been described by the workflow images (Figure 1, Figure 2, Figure 3 and Figure 4) above.

4 Workshop Results

This section describes a summarised version of the results from the workshops. The detailed information can be found in Appendix A – Workshop results.

As mentioned before, the first workshop was held with CoSSMic project team members, whereas the second and third workshops were held with real potential users. It must however be noted that some of the CoSSMic project team members also pose as trial users.

Both in Konstanz and Caserta, almost all people attending the workshops were present at both sessions.

4.1 Results from the first workshop

The first workshop contained a set of games as described above which were conducted by three groups of four participants. The participants were from the CoSSMic project team. Figure 8 through Figure 12 below show examples of some of the outputs created.

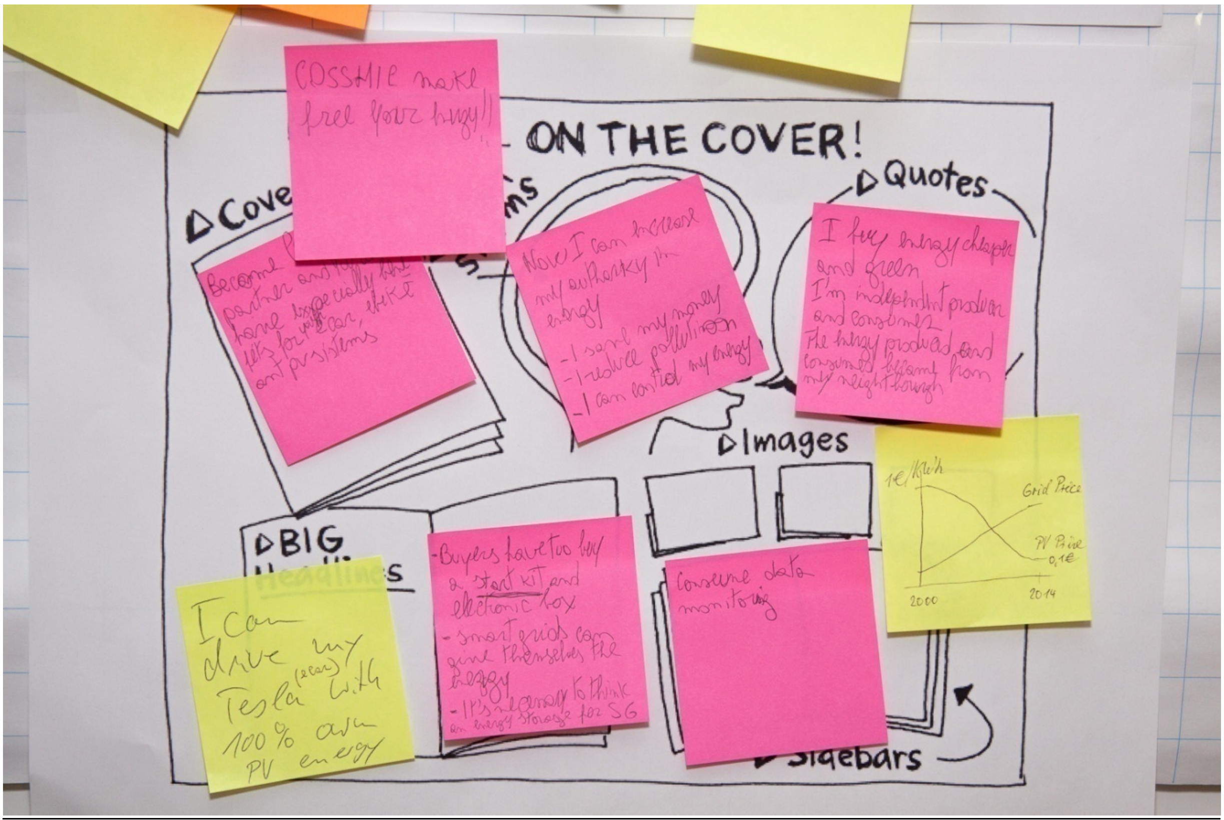


Figure 8: Dashboard of an example Cover Story

Figure 9: One example of a product box

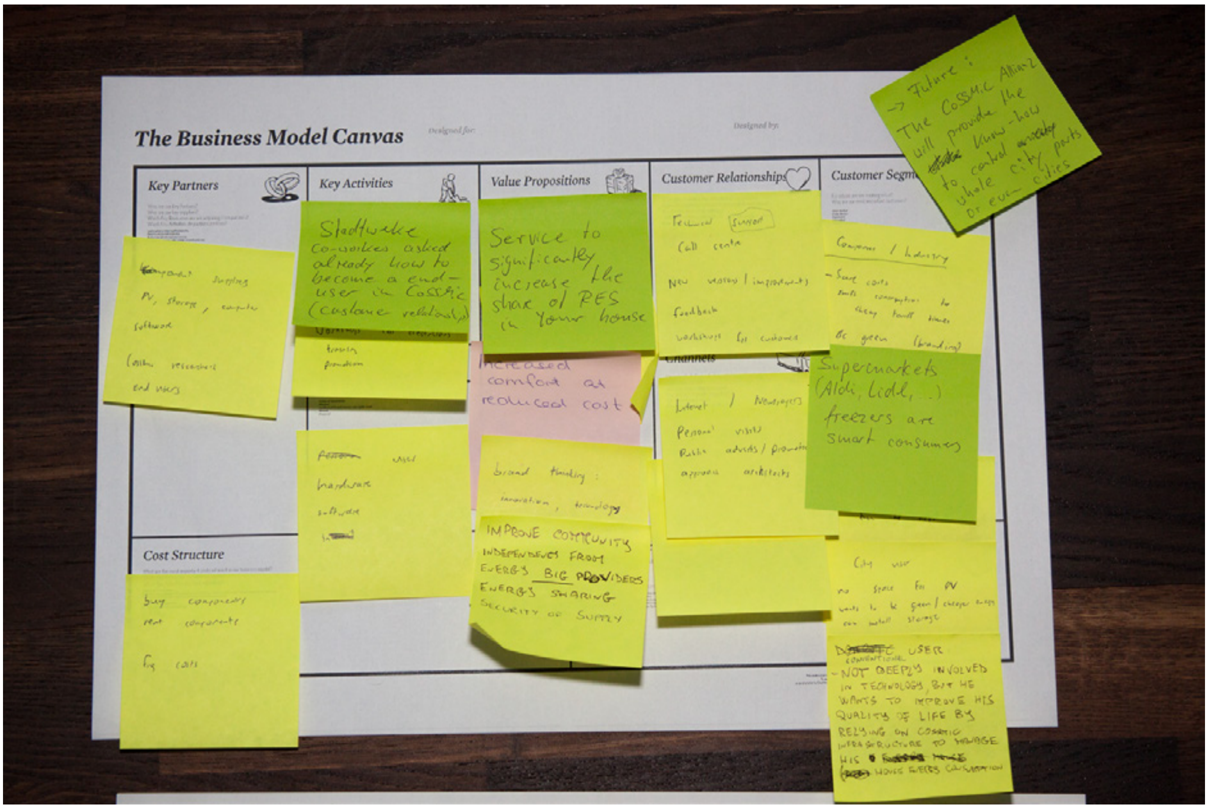


Figure 10: Business Model Canvas

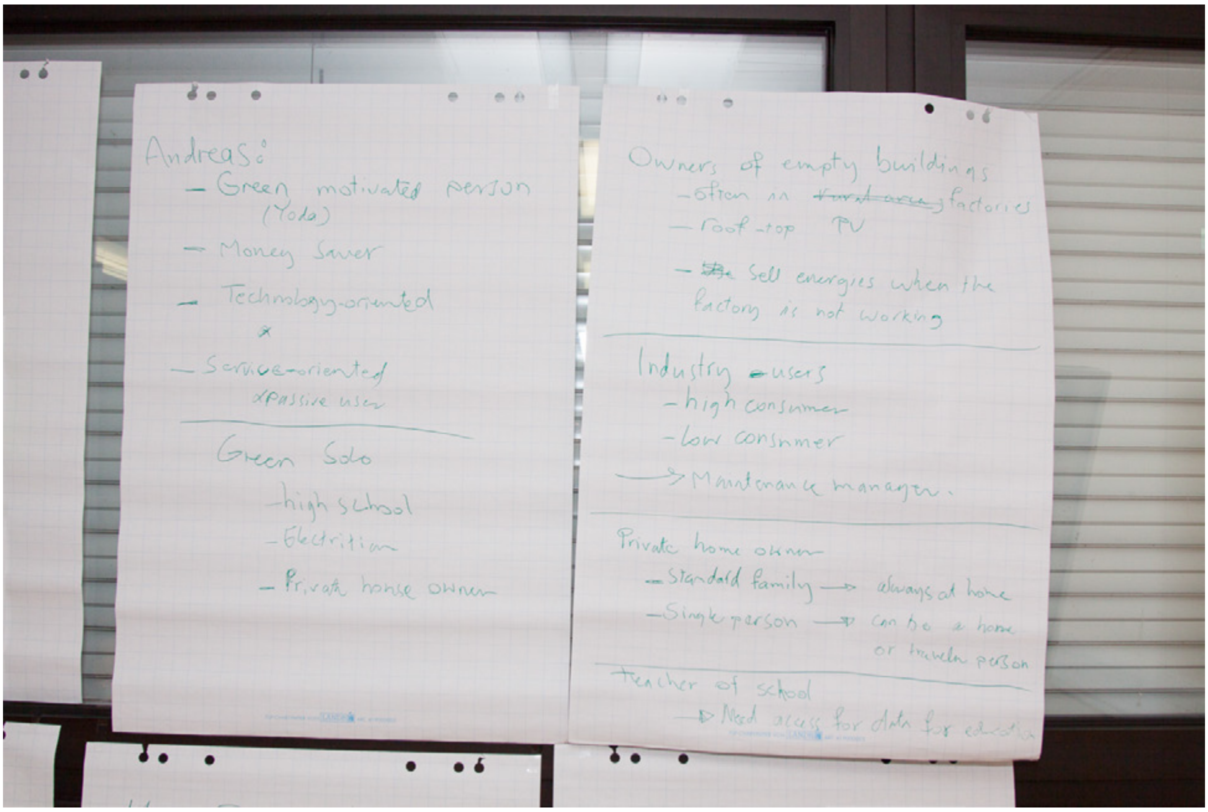


Figure 11: Personas

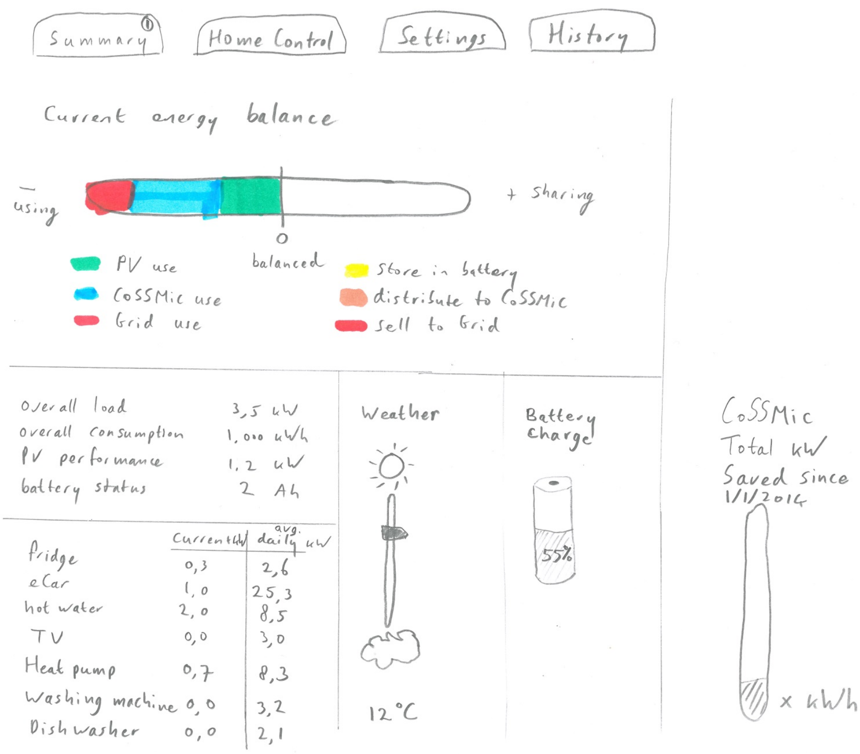


Figure 12: Paper prototype

After the workshop, the results were compiled into a first iteration of a paper prototype, as shown in the figure above.

4.2 Results from the second workshop

In the second iteration, real users (as in, non-project members) were introduced to the results of the first workshop and were asked to give feedback on the paper prototypes. The types of users at both locations are described in Appendix B - User profiles.
The feedback was collected from both places and a first version of a mock-up (using the MyBalsamiq online prototyping tool) was created. The CoSSMic team had an online meeting and went through the mock-up to identify if the input from both locations was adequately addressed. The refined version is shown below in Figure 13 through Figure 17 and served as input to for the third workshop in both Konstanz and Caserta.

4.2.1 Konstanz

In order to get a first interactive knowledge and information exchange we started to contact possible trial participation candidates already at a very early stage by the occasion of personnel contacts via Stadtwerke Konstanz (SWK), ISC and CoSSMic associated people, respectively.
So far we could identify four (4) industrial users, six (6) private household users and two (2) public domain users, i. e. in our case schools. Representatives of all of them were invited to participate in a first introductory round on the 29.ht of January.2014, and on the first User Centred Workshop, which was held at ISC KN on the 19th of February 2014.

4.2.2 Caserta

In the first user centred Workshop in Caserta, which was held on the 5 March 2014, 9 users attended: 6 teachers of the participating schools and 3 private users.
The municipal swimming pool contact person could not attend due to organizational problems.
Other people invited to the workshop could not attend due to personal problems.

Some of the users feedback: About the paper prototype the users suggest to offer different view for different kind of users. They consider the presented paper prototype more useful for householders than for other kind of building such as schools.
As instance, the schools representative would like to have the control of entire rooms, like teaching labs, instead of deciding on the control of individual devices. For these kinds of users it would be useful to include/exclude from the CoSSMic control or to set rules for a whole area.
When they add a device, they would like to add the device to a particular room or area. So add the functionality to configure rooms and related areas and then to add device to these areas. It would be also useful to have the possibility to monitor the power consumption for these areas.

User presents some concerns regarding the project and the installation of components:
The tools for the measurements shall be given on loan for use. Who preserves these devices?
It is possible that the system will be damaged? Who pays if something breaks?

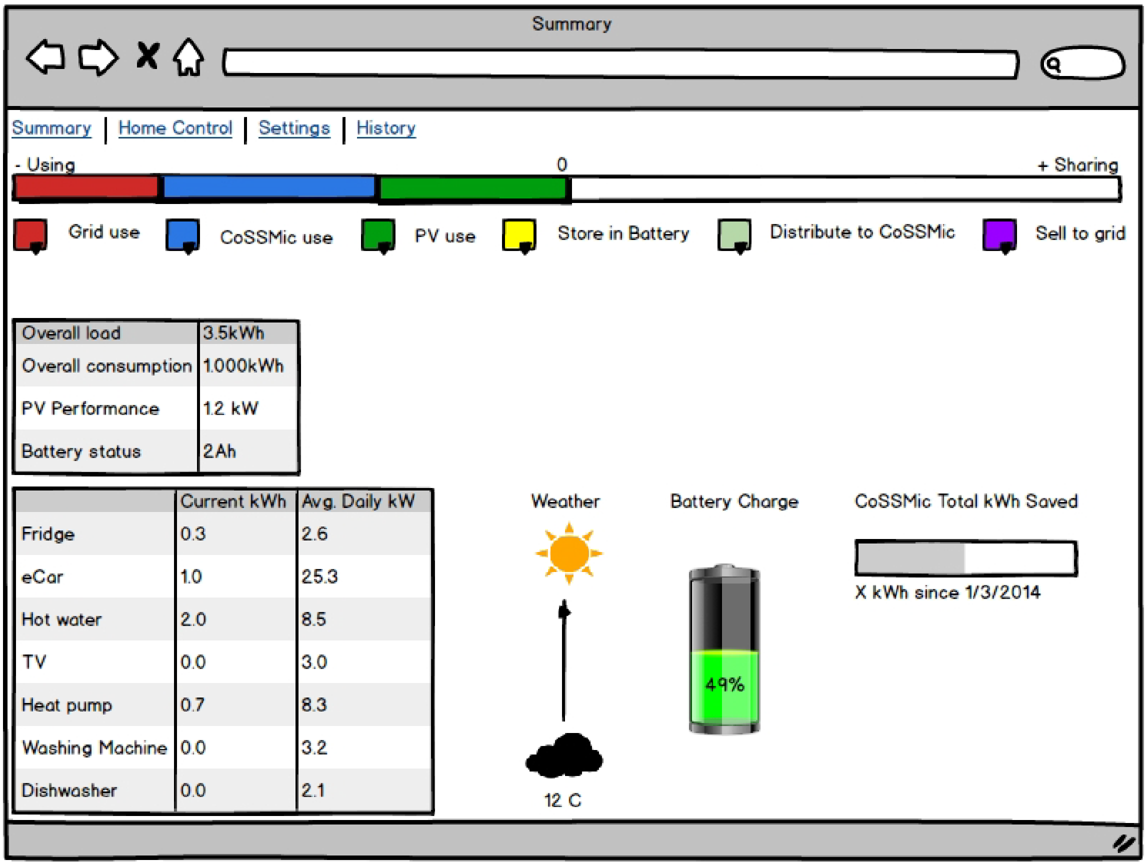


Figure 13: Mock-up v0.2 main screen

Figure 14: Mock-up v0.2 Home control

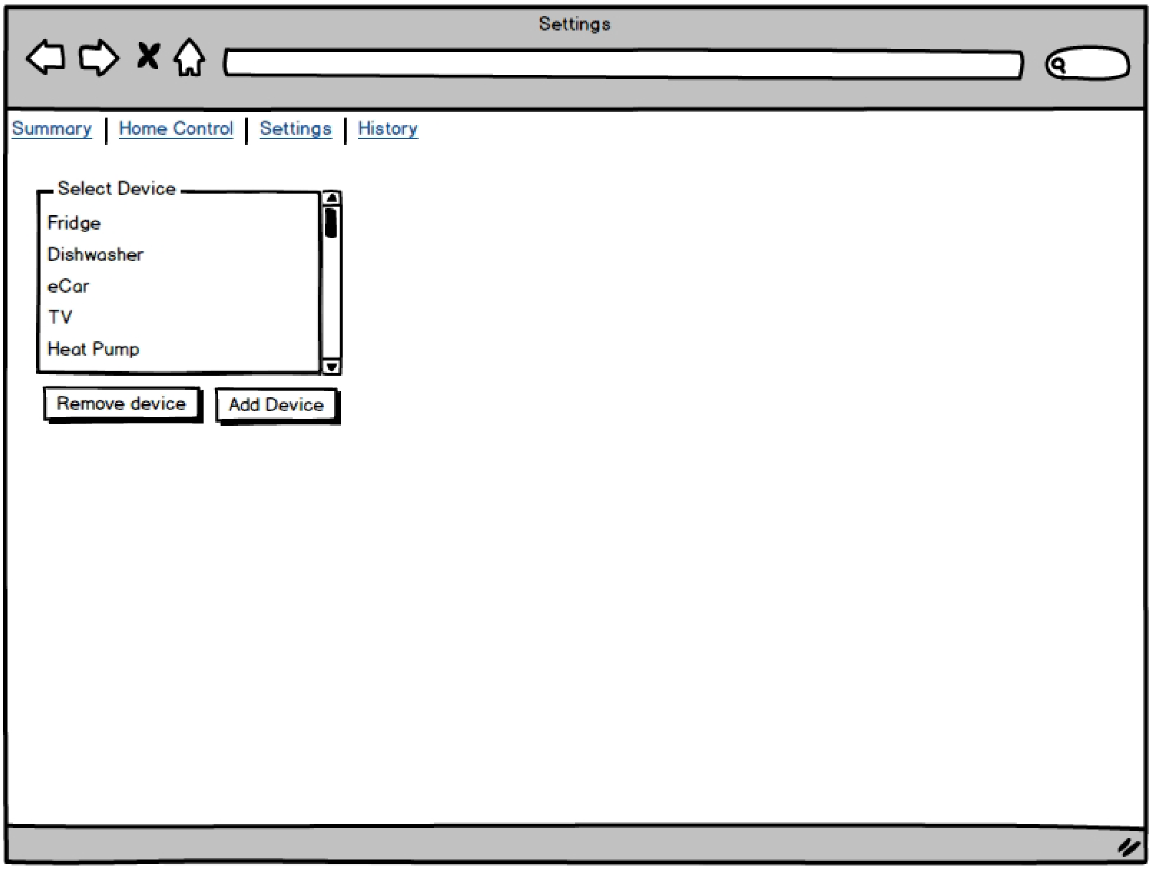


Figure 15: Mock-up v0.2 Settings

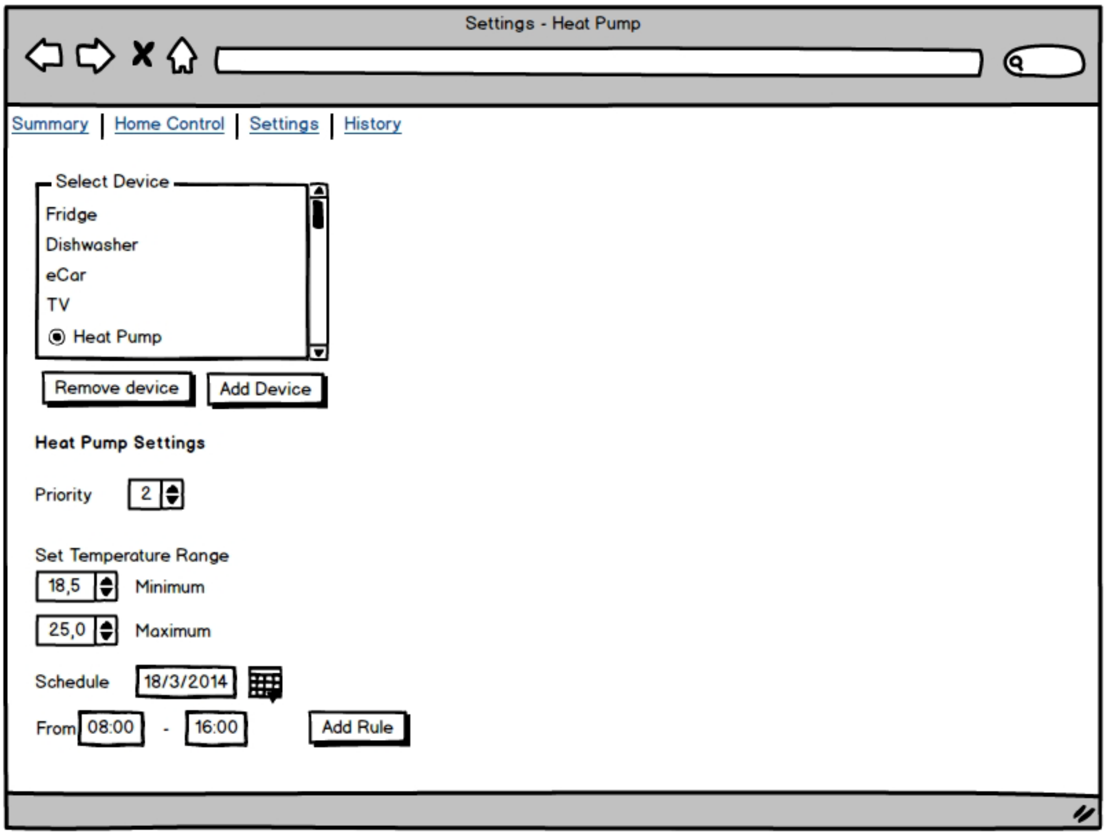


Figure 16: Mock-up v0.2 Settings - Heat pump settings

Figure 17: Mock-up v0.2 History

4.3 Results of the third workshop

Taking the output of the second workshop as a starting point, once again users were consulted to give feedback. The users were shown the mock-up and were, in an interview style, asked to provide their input. In a plenary session, the users could give their comments, which in Konstanz were directly marked on the mock-up with a digital post-it note. See Figure 18 through Figure 30 for details. In Caserta the feedback was noted, see section 4.3.1.2 for details.

4.3.1.1 Konstanz

The workshop took place as the summarizing event of the on-going survey of potential trial test participants. To get deeper insight of each participant´s expectations and concerns, the presentation of the results of the previous workshop, the answer of further questions and to integrate the detailed output of answers and feedback of the hand out questionnaire.

The overlap of present participants of Workshop I and Workshop II was about 90%
All workshop and survey participants will go on to participate in the trial test and are looking forward to hearing soon about next steps from the CoSSMic project partners ISC, Sunny Solartechnik, Stadt Konstanz and Stadtwerke Konstanz, which are directly involved to and with the Konstanz´s “Personas”.

The interview guide served as a roadmap and helpline for the conducted interviews. The questionnaire was translated into German and handed over to the workshop participants in advance to get back the answers latest at the workshop.

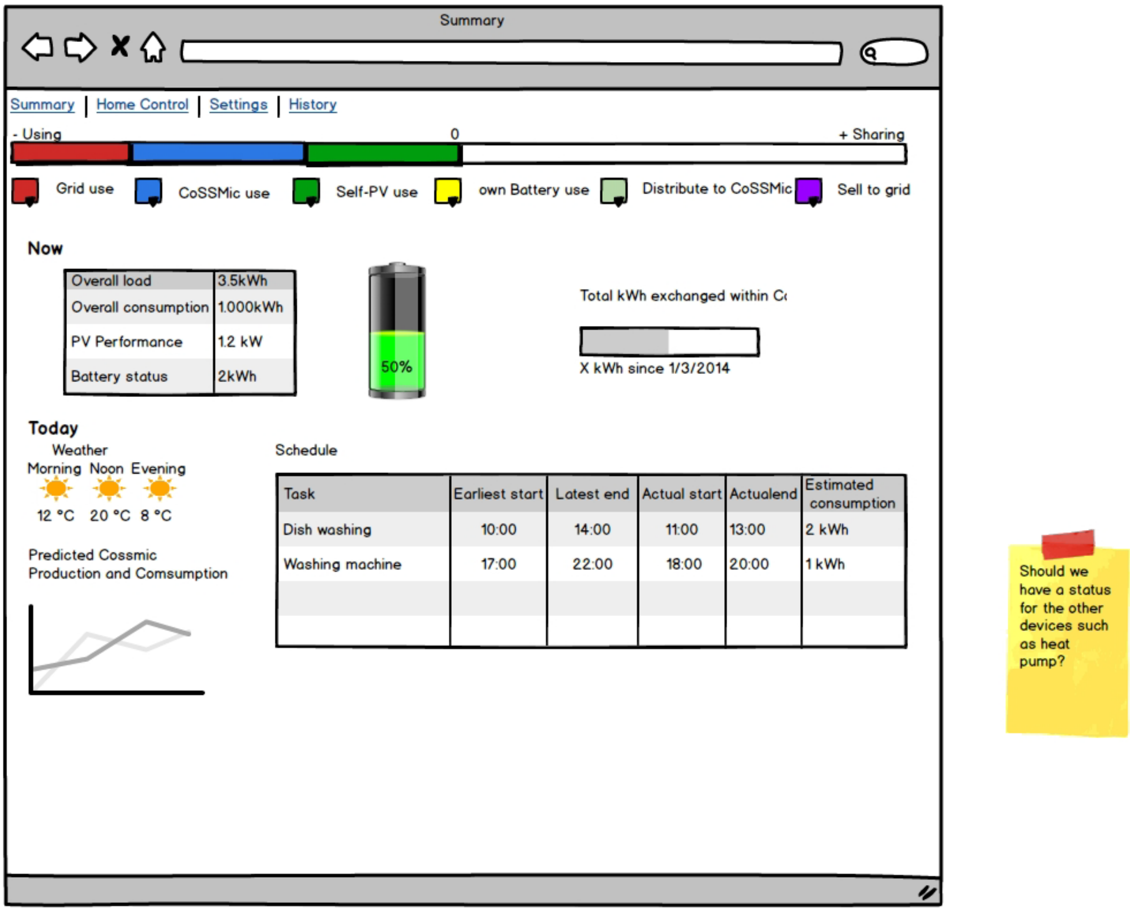


Figure 18: Mock-up v1.1 - Main summary screen

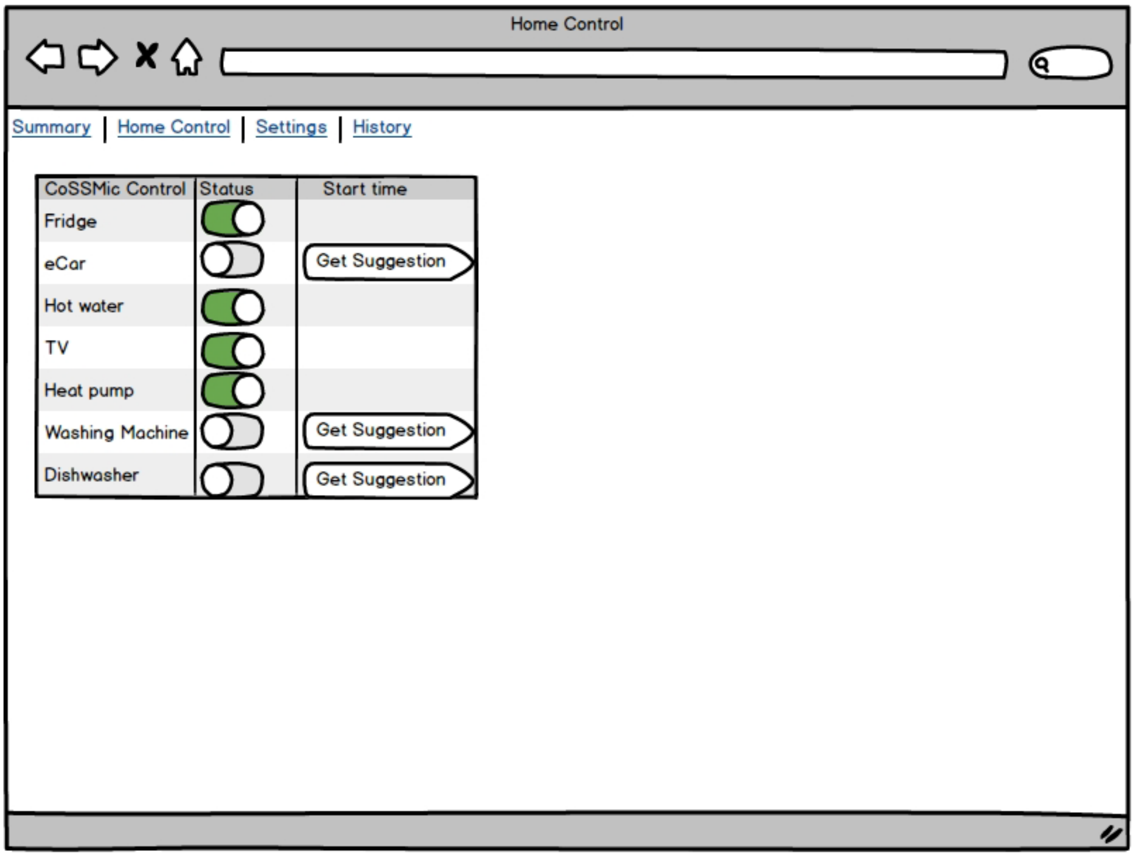


Figure 19: Mock-up v1.1 - Home control screen

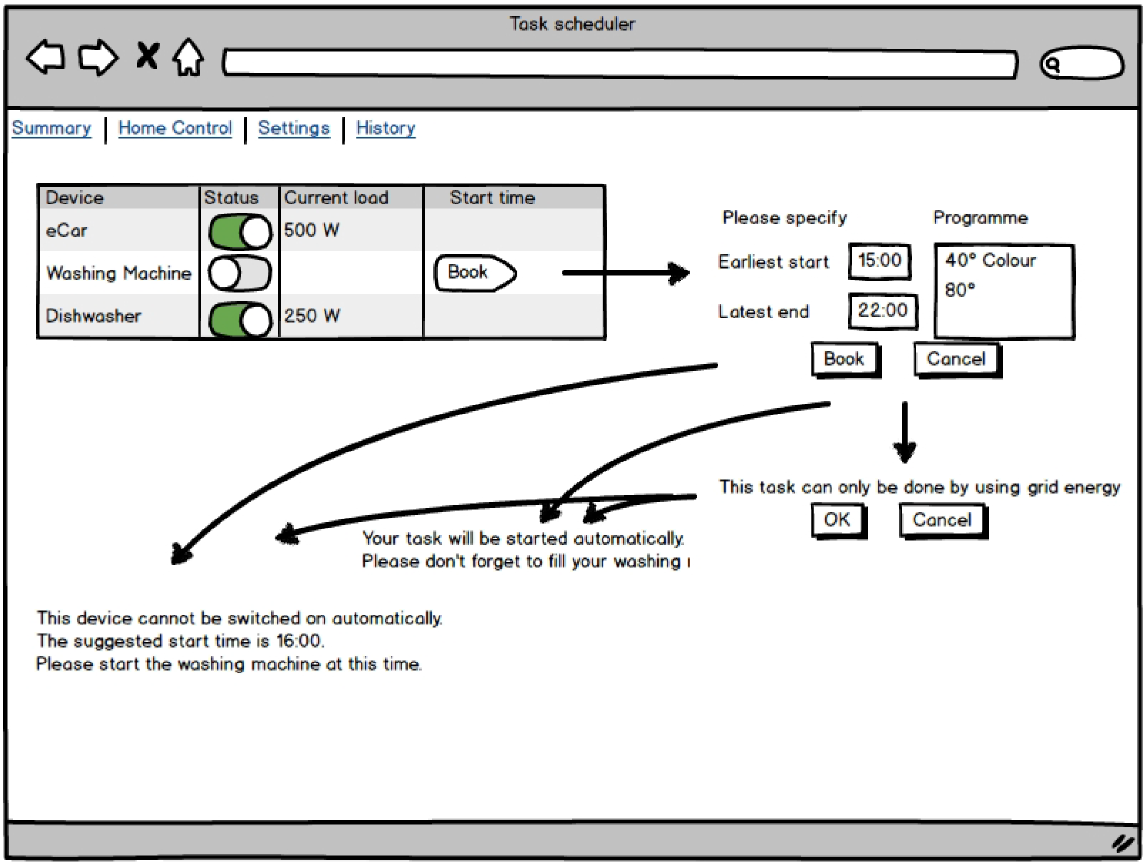


Figure 20: Mock-up v1.1 - Home control suggestion screen

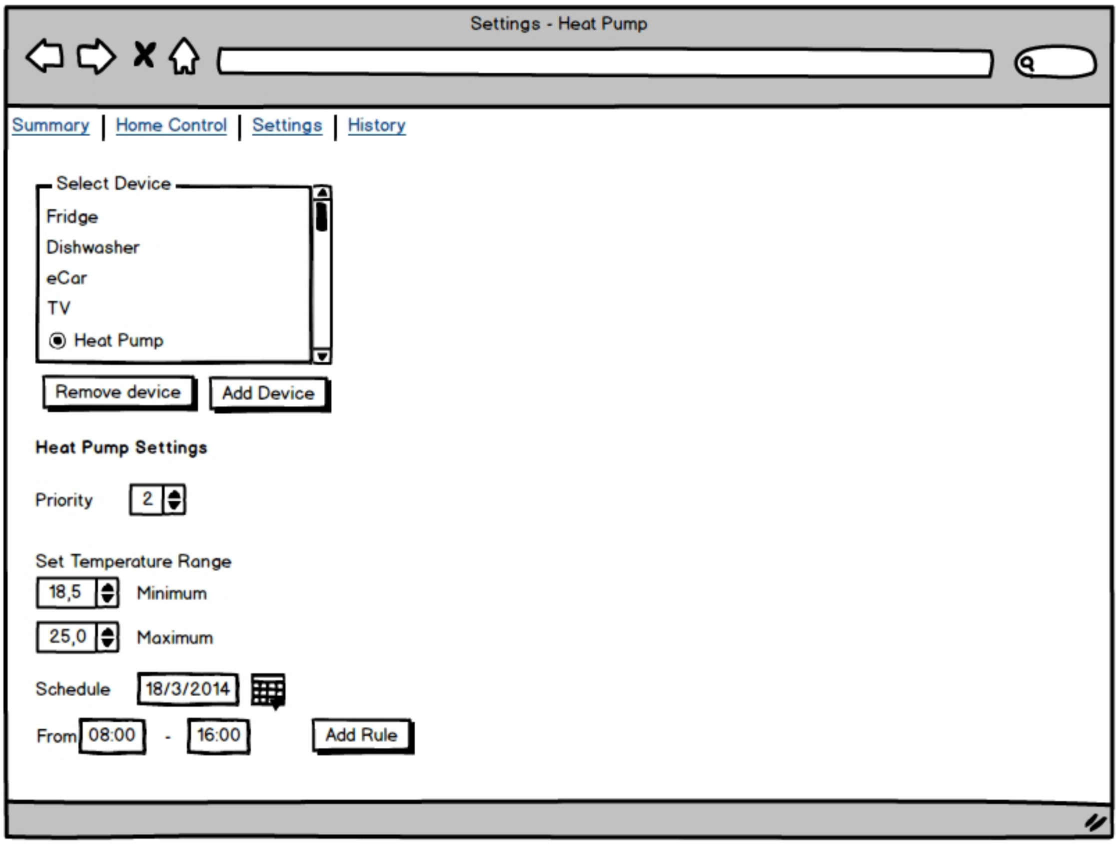


Figure 21: Mock-up v1.1 - Settings screen

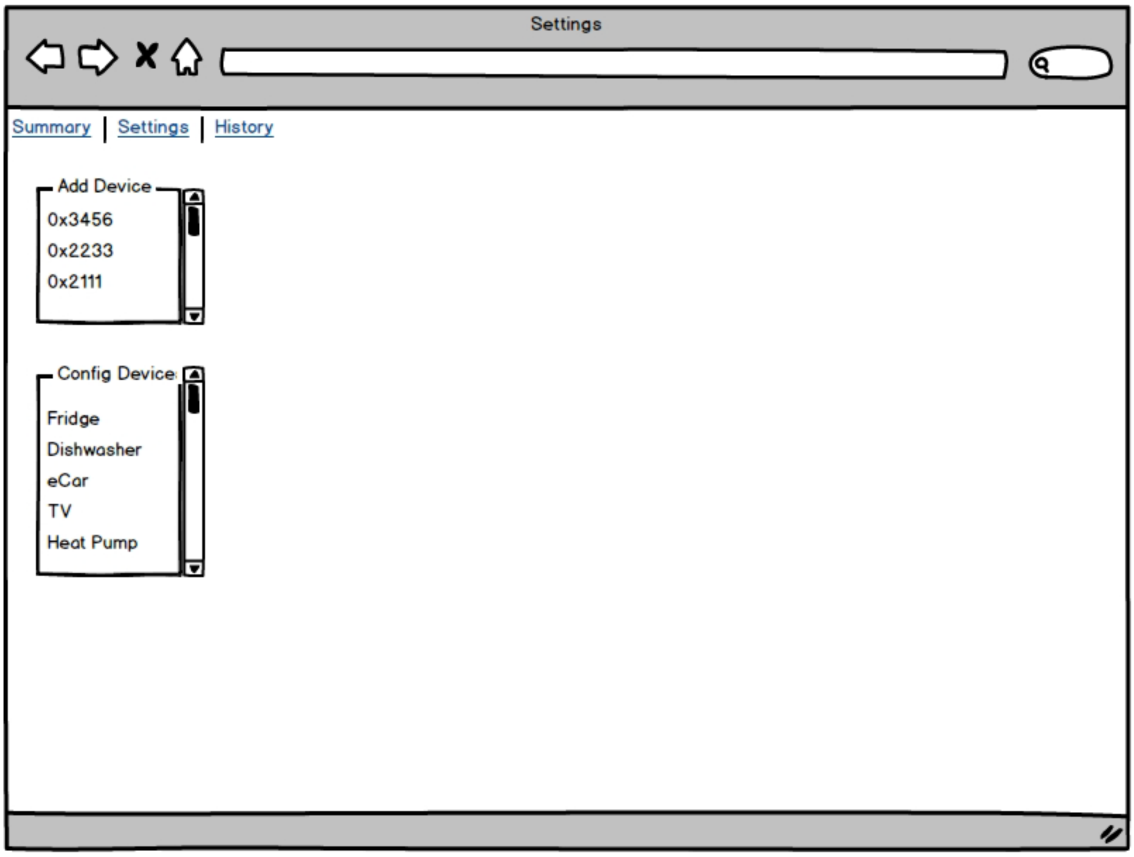


Figure 22: Mock-up v1.1 - Settings screen - Add device

Figure 23: Mock-up v1.1 - History screen

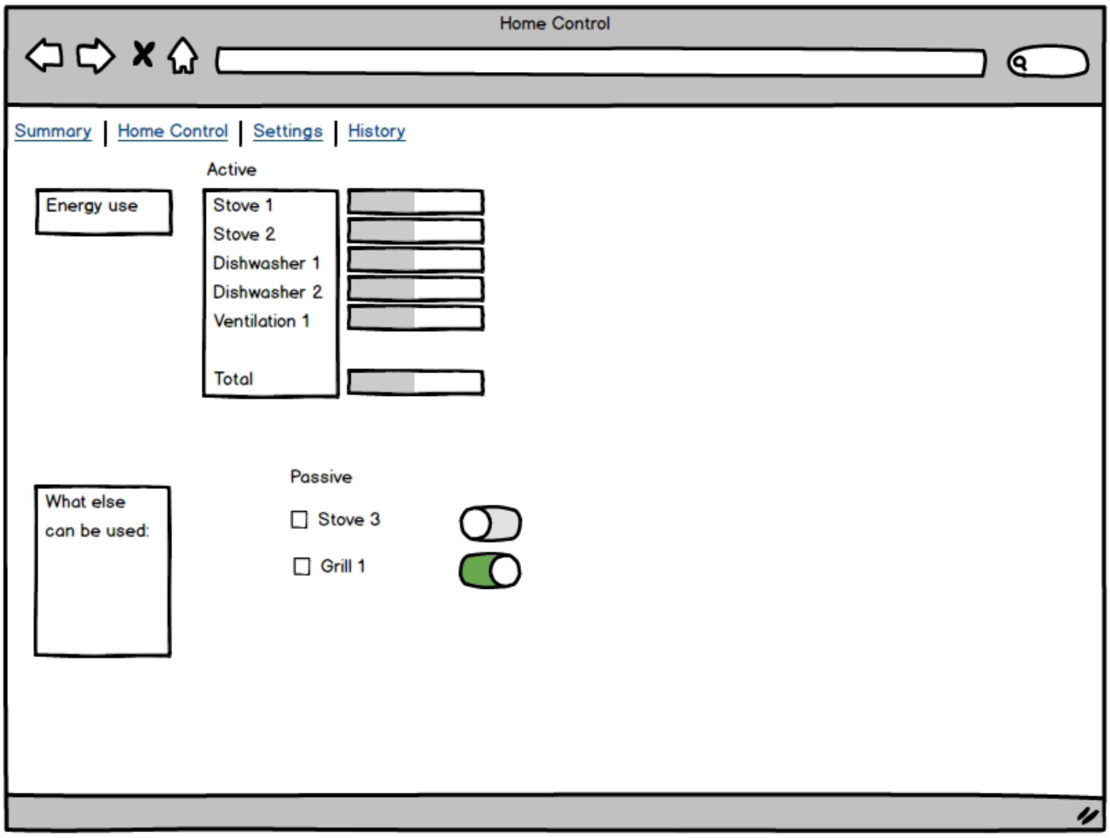


Figure 24: Mock-up v1.1 - Home control

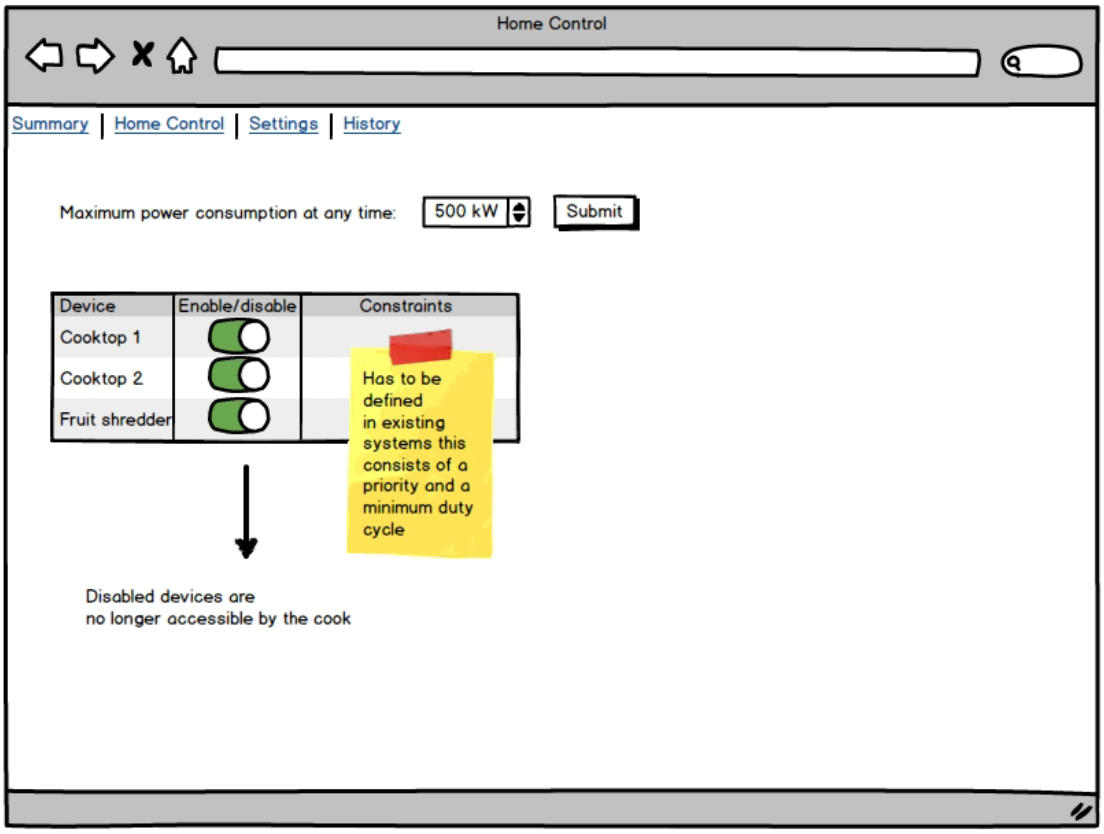


Figure 25: Mock-up v1.1 - Home control

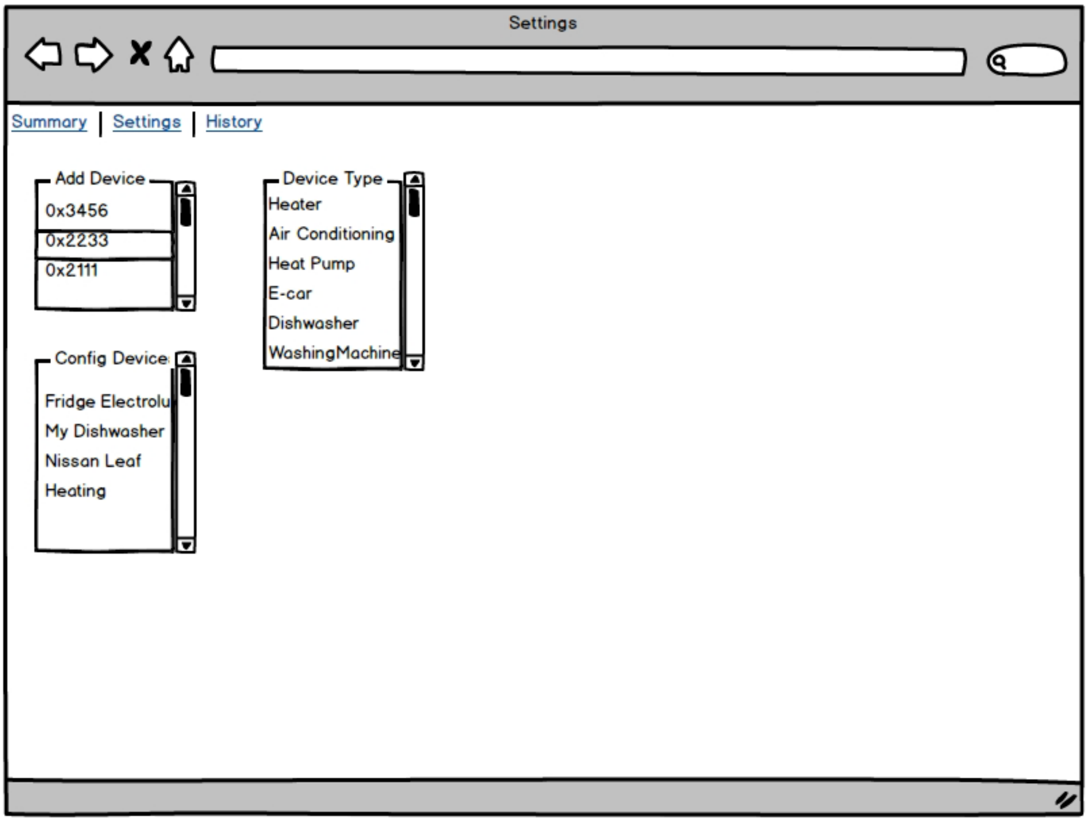


Figure 26: Mock-up v1.1 - Settings

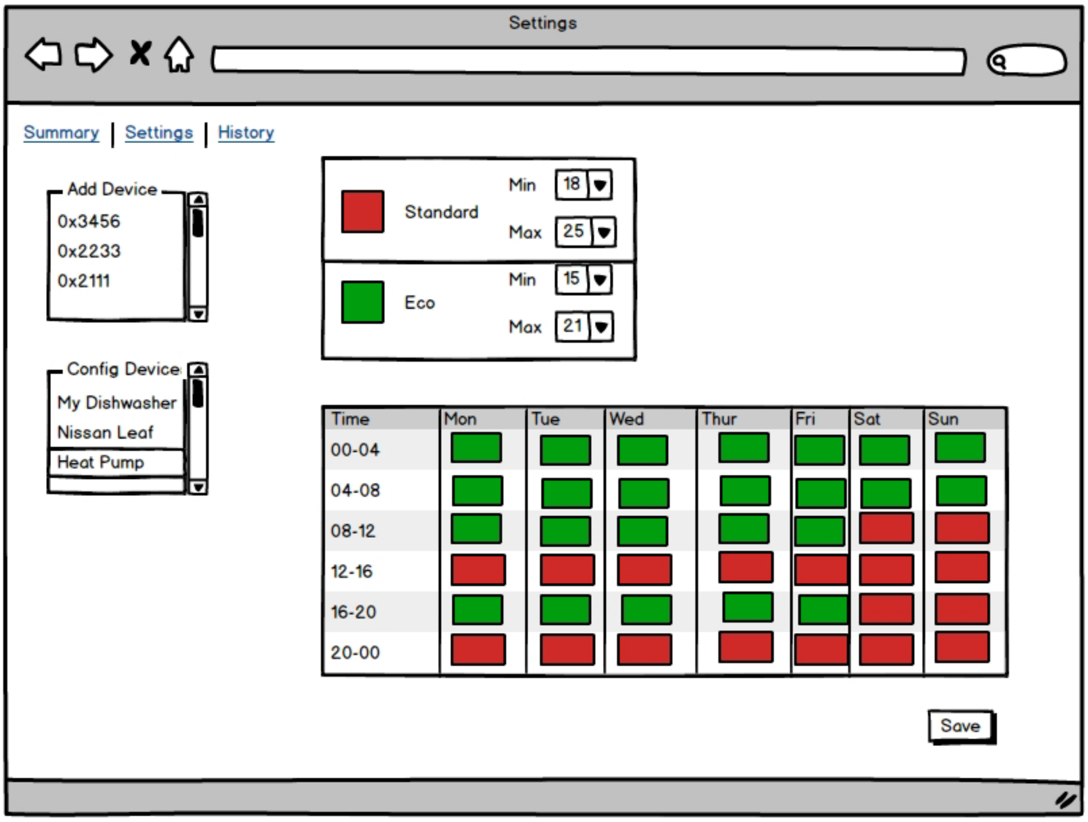


Figure 27: Mock-up v1.1 - Settings

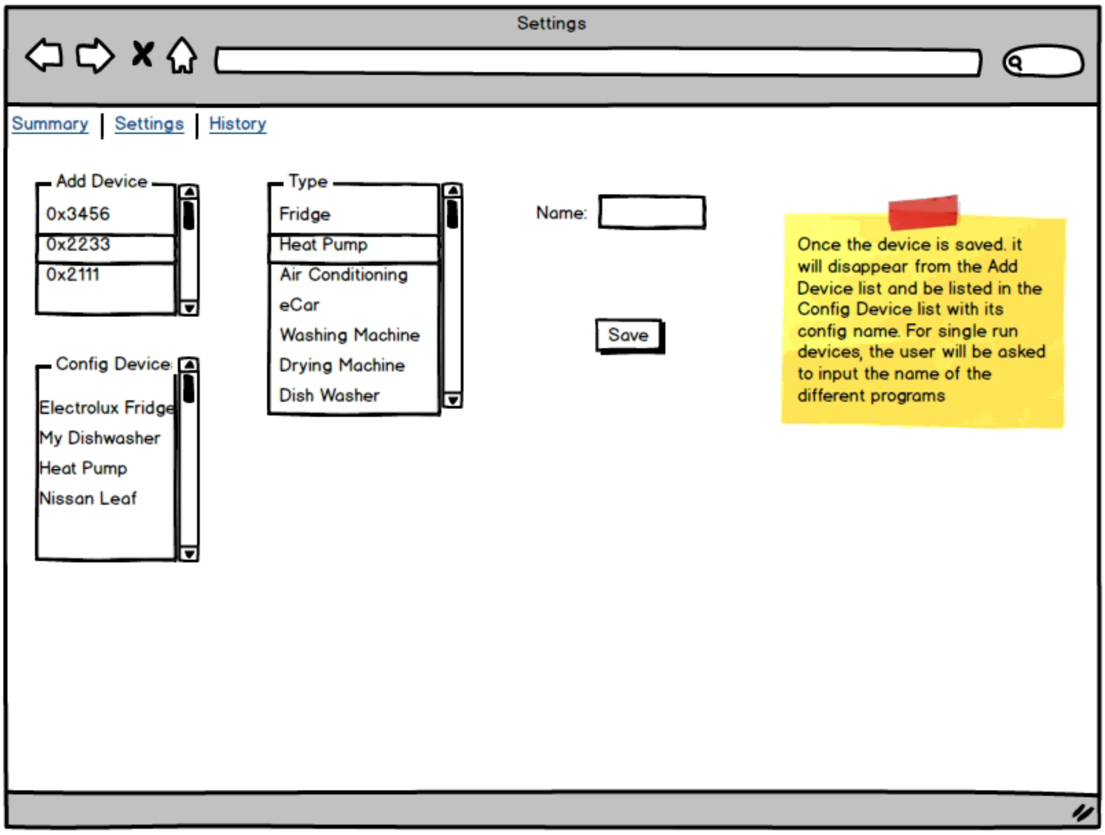


Figure 28: Mock-up v1.1 - Settings

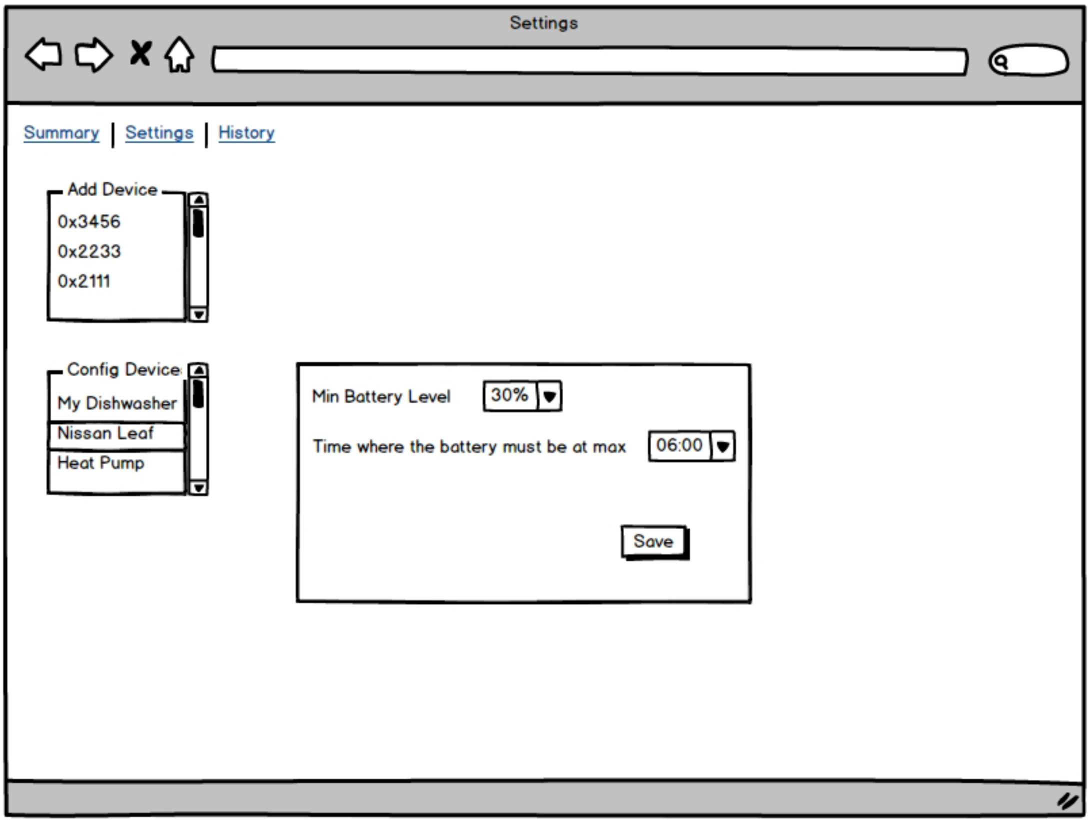


Figure 29: Mock-up v1.1 - Settings

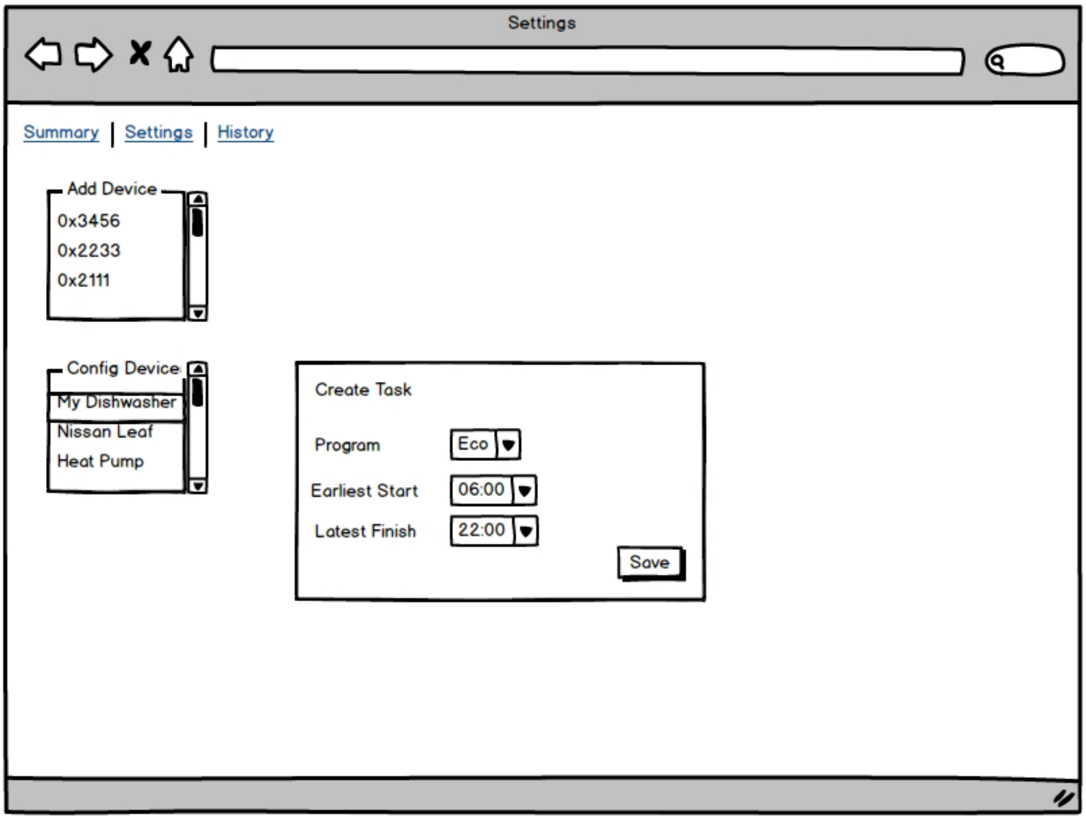


Figure 30: Mock-up v1.1 - Settings

4.3.1.2 Caserta

In the second user centered Workshop in Caserta, which was held on the 21 March 2014, 12 users attended: 8 contact persons of schools (5 from the first workshop, 3 new schools), 1 contact person from the swimming pool, and 3 private users (1 from the first workshop, 2 new)

We missed only one private user from the first workshop, and gained 2 other private users.

The first part of the workshop has focused on the interview. The collected data are shown in Table 1 and Table 2 below.

Table 1: Trial sites: Swimming pool and private homes

Trial Site	Sp	Pr1	Pr2	Pr3
Installed PV [kW]	200	7,5 kW	6	0
Inverter Brand	AROS SIRIO K100, AROS SIRIO K64, AROS SIRIO K18	KAKO POWADOR 8000xi		0
PV production [kWh/y]	288000	10000	9000	0
Consumption [kWh/y]	50000	500	300	330
Equipment		conditioning system, washing machine	Household appliances, building's lighting, conditioning system	car engine: 15 kW
Devices	building's lighting, dressing rooms, offices, devices within the central of thermal energy production		washing machine, fridge, conditioners, dishwasher	
Time slots of maximum/minimum consumption	Maximum: from 7 PM to 8 AM; Minimum: from 8 AM to 7 PM	Maximum: from 8 AM to 7 PM; Minimum: from 7 PM to 8 AM	Maximum: in the evening	Maximum: from 7 PM to 8 AM (the car recharges batteries during the night)
Household/Building size/Number of persons in the building	1000	4	4	2
Smart meters installed	no	no	no	yes

Interactive control of devices		no	Want to use appliances when the power production is high	
CoSSMic control on devices level	Medium control of devices	Want low level of control	High control on devices on the basis of produced/consumed power (swiching on/off devices, etc.)	
Want detailed overview of devices status		no	Want details about energy production and consumption	
Kind of interface to access to software	Graphical User Interface via PC	Graphical User Interface via PC, smartphone	Graphical User Interface via PC	
Concerns on components installation	no	no	no	

Table 2: Trial sites: Schools

Trial Site	Sc1	Sc2	Sc3	Sc4	Sc5	Sc6	Sc7	Sc8
Installed PV [kW]	3	3	3	3	3	3 kW	3 kW	0
Inverter Brand	AROS SIRIO EVO 3 Kw	AROS SIRIO EVO 3 Kw	AROS SIRIO EVO 3 Kw	AROS SIRIO EVO 3 Kw	AROS SIRIO EVO 3 Kw	AROS SIRIO EVO 3 Kw	AROS SIRIO EVO 3 Kw	no
PV production [kWh/y]	4360	4360	4360	4360	4850	4350	4800	0
Consumption [kWh/y]	4500	5500	5300	8000	5600	5600	9500	5300
Equipment	building's lighting, laboratories, gym, offices, conditioning system		building's lighting, laboratories, gym, offices, conditioning system	building's lighting, laboratories, gym, offices, conditioning system	laboratories, classrooms, offices	building's lighting, laboratories, gym, offices, conditioning system	building's lighting, laboratories, gym, offices, conditioning system, tensile structure	laboratories, conditioning system, mechanical equipment
Devices	40 IWBs, 125 PCs, 15 conditioners	IWBs, PCs, laboratories, conditioning system	IWBs, PCs, laboratories, conditioning system	IWBs, PCs, laboratories, conditioning system		IWBs, PCs, laboratories, vending machines, conditioning system	15 conditioners, 60 IWBs, 1 gym with convectors, tensostructure with 10 conditioners	

Time slots of maximum/minimum consumption	Maximum: from 8 AM to 7 PM; Minimum: from 7 PM to 8 AM	Maximum: from 9 AM to 1 PM; Minimum: from 7 PM to 8 AM	Maximum: from 8 AM to 7 PM; Minimum: from 7 PM to 8 AM	Maximum: from 8 AM to 7 PM; Minimum: from 7 PM to 8 AM	Maximum: from 8 AM to 2 PM; Minimum: from 7 PM to 8 AM	Maximum: from 8 AM to 12 PM; Minimum: from 7 PM to 8 AM	Maximum: from 8 AM to 2 PM; Minimum: from 7 PM to 8 AM	Maximum: from 8 AM to 2 PM; Minimum: from 7 PM to 8 AM
Household/Building size/Number of persons in the building	1200	300	1500	1000	800	800	1950	1200
Smart meters installed	no	no	no	no	no	no	no	no
Interactive control of devices	Want to express priority in (High, Medium and Low). Want to express the rules for the device with a exact time or time slots or add complex rules on the data from sensors (start the dryer only if is wet)	Want to control laboratories (lighting system) and conditioning system.	Want to control laboratories, lighting system and conditioning system.	Want to control laboratories, lighting system and conditioning system.		Sensors for switching on/off ligthing system. Internal/External temperature sensors for switching on/off conditioning system	Wan to to have control of devices on the basis of time slots and of the occurrence of other events (sensors)	Want high control level on the devices

CoSSMic control on devices level	High control on PCs, building's lighting, gym; Medium control on IWBs	High control on conditioning system and lighting system	High control on laboratories, lighting system and conditioning system	High control on laboratories, lighting system and conditioning system	Medium control of devices	Want to automate the lighting system's management	High control on computer devices and on lighting system. Medium control on conditioning system	Want CoSSMic to control all the devices
Want detailed overview of devices status	Number of on/off switches of the devices; hourly consumption of the devices	Energy consumption for each laboratory	Want an overview about the programmed usage of the devices. Want details about energy consumption of the devices in different time slots	Want an overview about the programmed usage of the devices. Want details about energy consumption of the devices in different time slots	Want an overview about the programmed usage of the devices. Want details about energy consumption of the devices in different time slots	Want details about energy production and consumption	Want an overview on energy consumption, highlighting time and usage of devices	Want an overview on user accesses and on time slots of maximum energy consumption
Kind of interface to access to software	Graphic User Interface	Graphic User Interface via tablet	Graphical User Interface via PC	Graphical User Interface via PC	Graphical User Interface via PC	Graphic User Interface via PC	Graphic User Interface via PC	Graphical User Interface via PC, tablet, smartphone
Concerns on components installation	no	Only if components emit electromagnetic fields			no			no

After the illustration of the version 0.2 of the paper prototype we collect from the users the suggestions reported below.

- Provide an accounting feature with different level of permission (normal users for example can set the air conditioning in their rooms but not in other rooms and similar)
- Provide an automatic discovery and setting of all the devices with minimum setting effort.

Summary Screen

- A larger top bar about various consumption/Sharing
- The chart on the left bottom about the prediction very useful but need to be enriched with a clear description and measurement units.
- Weekly forecasting instead of daily one (for someone)
- Weather forecasting useful for the most of user, for the minority useless
- The schedule table should contains the past history of consumption of devices until the present and if possible also a part on the future assignment and schedule.

Home Control

- On/Off buttons include the stop of the monitoring of the consumption data of the device or only the control of CoSSMic on it? Want both buttons
- The suggestion feature very appreciated. The possibility to book would be completed with some functionality: they want to book but on conditions. Book in any case, book only if CoSSMic energy is available. The suggestion on when is more convenient to start a process very appreciated.
- They don't want to set limitation on the power but they want to limit and control the daily energy consumption.
- In the screen on which we have the active and passive components they want to switch on and off the devices already active to give the place to other devices that are passive.

Settings

- They want to decide the priority of the devices according to the defined constraints: they want to express priority in (High, Medium and Low). High priority means that the constraint is mandatory and the would CoSSMic address the schedule in any case, also if it means a big payment.

History

- Add a char that indicates the credit and due of the users.

The results comments from both locations were again collected and serve as input to both task 2.4 and WP3.

4.4 User perspectives – a selection

A lot of different user stories and user opinions have been gathered from the users, both as a part of the interviews and the workshops. In this section we give some examples of the user perspectives.

One Konstanz private user wants to load his own stationary battery system only by PV generated energy to use it only for the own consumption, but the user is also open to share the PV generated energy with other CoSSMic trial users.

One other private Konstanz user wants to have installed a so-called “smart e-car battery charger” which shall adapt the charging of the battery with the sunshine intensity.

Some of the industrial users of Konstanz are willing to adjust their daily consumption of electrical energy with additional available PV generated power, when this share does have only a neglectable influence on their daily running business processes.

In Caserta, during the user workshops, we had the chance to hear a lot of interesting practical experience of the users.
For instance, a private user in Caserta was complaining that even though he installed a PV system with the main purpose of obtaining cost saving, at the end of month the final amount of his bill was not so much changed. By investigating the habits of his family it came out that the family members are led to use more electricity when the plant is not in production (during sunshine hours all of them were at school or at work) and these results in a very limited cost reduction.
This user would like to be able to delegate certain task scheduling to an automatic system so that some tasks can be done during the day when the family is not at home (as instance start the washing machine or the dishwasher). The only thing they care about is that the machines finished their task when he came home from work.

Another user in Caserta has the need of keeping a monthly budget for the energy usage. He would like to receive some alerts when his consumption behavior is exceeding the desired one in order to tune his activities. One of the most important parameters to take under control should be the energy price that it is consuming in a certain moment: “*I would like to continuously monitor what the consuming energy cost is to tune my energy behavior and to understand if it is more advantageous to remain at home using the devices or it is better to go out and do the chores at home later. I'd like to fix a monthly budget for consuming the energy and to get alerts when the consumption is going out from the trend that allows me to remain within the fixed budget*.”

5 Discussion

5.1 Methodological reflection

The methods were primarily social science and market research in nature. Social scientists from Norway were involved in this work package primarily as an advisory role and had limited involvement in deciding on methods and conducting the methods in practice. Resource limitation in Konstanz and Caserta meant that project participants, who are not necessarily familiar by such research methods had to take on responsibilities for conducting methods in each of the workshops.

5.2.1 First workshop in Konstanz

The user centric workshop aimed to develop a CoSSMic project that delivers what people want and understand what they can get when they are participating in CoSSMic. The first workshop took place in Konstanz in December 2013 and involved project participants of WP2 representing end users from Konstanz and Caserta. This workshop set out to develop paper proto-types, product boxes and personas in order to imagine what the end-user would want from CoSSMic and to develop adequate business models. The workshop was divided into three groups to develop diverse perspectives from developed personas. Paper protocols and product boxes reflected the needs and prospective of each group's persona.
Some of the lessons learnt from this initial workshop were that it can be difficult to involve all partners where some participants were not involved in the discussion while others talked a lot. The role of the moderators was to observe and not contribute to the discussions of each group but to encourage participation. The personas were useful in understanding the perspective of how the product boxes and personas were developed. Product boxes and paper prototypes were useful in producing tangible results and developing ideas for hardware and software development in CoSSMic. The second plenary workshop in Trondheim that occurred two months after the workshop was used as an opportunity to feedback to the other work packages what had been achieved in Konstanz. This was a valuable reality check in balancing 'user centric design' with the technical and software capabilities of CoSSMic.

5.2.2 Second workshop in Konstanz / Caserta

Konstanz

In the Konstanz workshop in February there were 6 private users, 2 public users in the form of schools and 4 industry users who participated in the workshop and were anonymized for the purpose of meeting data protection requirements. These groups represented key end users of CoSSMic with some owning PV systems and others not. The groups represented different motivations for attending the workshop enabling a diverse perspective. One of the main things that came out of this workshop was that users wanted to change the paper prototypes that original came from the initial workshop. This indicated that the paper prototypes were a good focus for discussion but as were their purpose in facilitating changes as workshops progress.

Caserta

The Caserta workshop took place in early March that involved 6 teachers and 3 private users, other people could not come due to personal or organizational problems. Therefore there was a bias involving an over-representation of schools that were also the most vocal. The feedback from the teachers was that they considered the paper prototypes as relevant but they believed that the paper prototypes should be more different to represent different types of users. Private users were not highly represented on the paper prototypes and left before the end of the workshop. There needs to be some consideration as to why it was difficult to engage the private users. Some recommended steps are to go back to the private users to understand why they left early. Another step is to understand if there is something that worked well for public users in Konstanz that can be applied to Caserta.

Feedback from the two workshops were done on an online WP2 meeting in March where the ideas were discussed in terms on what to build on and what falls out of the remit of CoSSMic. Further tangible results from these workshops were the paper prototypes that were uploaded to an online resource called “myBalsamiq” where relevant project participants could contribute to their development by modifying the uploaded items in a direct way.

5.2.3 Third workshop in Konstanz / Caserta

Konstanz

There was a 90% overlap of CoSSMic users in both user workshops in Konstanz. The interview guide was given to participants as a questionnaire to be completed in their own time rather than a semi-structured interview open conversation for which it was designed. However, the interview guide served as a roadmap and helpline for the conducted interviews. The second workshop was primarily a summarizing event to get deeper insight of each participant´s expectations and concerns, the presentation of the results of the previous workshop, the answer of further questions and to integrate the detailed output of answers and feedback of the hand out questionnaire.

Caserta

The second workshop in Caserta focused on interviews in the first part and the second part facilitated discussion on the paper prototypes. It was attended by 8 contact persons of schools (5 from the first workshop, 3 new schools), 1 contact person from the public swimming pool, and 3 private users (1 from the first workshop, 2 new).The data from the interviews were synthesized into a table. Feedback on paper prototypes led to discussion by participants about devices that can be used in CoSSMic, rules on what CoSSMic users do and what administrators do as well as the type of information that they would like to receive as users.

The methods used in both workshops focus on feedback from broad discussion groups and the semi-structured interviews have been used as questionnaires rather than open conversations for which they were intended. However, the approach of combined questionnaire answers and direct conversation provided has sound insight of user’s prospections and concerns. The results presented from each of the workshops do indicate iterations to the concepts and ideas developed from the first workshop and can be used for the tasks of WP4 and also WP3 and WP5.

5.2.3 Summary

Overall, it appears that the methodological approaches initiated a forum where potential CoSSMic users could present their feedback on what is being developed by the CoSSMic team and have been quite successful in building up relations between potential users and the project teams based in Konstanz and Caserta. However, whether this is ‘user-centric’ is questionable as the initial workshop which involved projects participants of CoSSMic appears to have set the agenda for the ongoing workshops which was the basis of feedback. At the same time, nevertheless the online adaption of the paper prototypes with and by the users input can be said to be user centric. Also there are further limitations in terms of what WP4, WP3 and WP5 have the resources to provide and what is requested by users in terms of CoSSMic objectives. Despite these limitations to WP2.2, there have made clear steps forward in developing relations with end users, developing end-user ownership of the project and in giving other workpackages early feedback on how end users view the project and what an end user would like from the technology and software from CoSSMic.

6 Conclusion and further work

Overall, it appears that the iterative design approach initiated a forum where potential CoSSMic users could present their feedback on what is being developed by the CoSSMic team. It has been quite successful in building up relations between potential users and the project teams based in Konstanz and Caserta. However, whether the approach can be considered a 100% 'user-centred' is questionable. The initial workshop that involved projects participants of CoSSMic set the agenda for the ongoing workshops, which was the basis of feedback in the user-centred workshops. It must be mentioned however that at the Konstanz site, some of the project participants also are part of the CoSSMic users (representing both a private household and a company). At the same time, nevertheless the online adaption of the paper prototypes with and by the users input can be said to be user centered. Also there are further limitations in terms of whether the developing partners have the resources to provide and what users in terms of meeting CoSSMic objectives request. Despite these limitations, there have made clear steps forward in developing relations with end users, developing end-user ownership of the project and in giving the project early feedback on how the preliminary end users community views the project and what an end user would like from the technology and software from CoSSMic.

The feedback from the workshops is the basis for further work in developing a platform for smart solar-powered micro-grid communities during the next phases of the project. An early prototype will be made available to support users involvement in an early stage.

7 References

Barnett, Julie, Kate Burningham, Gordon Walker, and Noel Cass. 2012. "Imagined publics and engagement around renewable energy technologies in the UK." Public Understanding of Science no. 21 (1):36-50. doi: 10.1177/0963662510365663.

Darby, Sarah. 2006. "The effectiveness of feedback on energy consumption." A Review for DEFRA of the Literature on Metering, Billing and direct Displays no. 486:2006.

EeB\PPP (2012) "Energy efficiency Buildings Public Private Partnership Project Review" in: Ralph, G. (ed.).

EuropeanUnion (2013) "Sustainable development in the European Union" in: EuropeanCommission (ed.). Luxembourg, Eurostat.

Faruqui, Ahmad, Sanem Sergici, and Ahmed Sharif. 2010. "The impact of informational feedback on energy consumption—A survey of the experimental evidence." Energy no. 35 (4):1598-1608.

Fischer, Corinna. 2008. "Feedback on household electricity consumption: a tool for saving energy?" Energy efficiency no. 1 (1):79-104.

Gray,Dave, Brown, Sunii, Macanufo, James, Gamestorming - A Playbook for Innovators, Rulebreakers, and Changemakers, Published by O'Reilly Media, July 2010

Hargreaves, Tom, Michael Nye, and Jacquelin Burgess. 2010. "Making energy visible: A qualitative field study of how householders interact with feedback from smart energy monitors." Energy Policy no. 38 (10):6111-6119.

Hargreaves, Tom, Michael Nye, and Jacquelin Burgess. 2013. "Keeping energy visible? Exploring how householders interact with feedback from smart energy monitors in the longer term." Energy Policy no. 52:126-134.

Karen Ehrhardt-Martinez, Kat A. Donnelly, and John A. “Skip” Laitner, Advanced metering initiatives and residential feedback programs: A meta-review for household electricity-saving opportunities. Research report E105 ACEEE – Americal Council for Energy efficiency economy report. 2010.

Manville, C., Cochrane, G., Cave, J., Millard, J., Pederson, J. K., Thaarup, R. K., . . . Kotterink, B. (2014) "Mapping Smart Cities in the EU". European Union.

Nyborg, Sophie, and Inge Røpke. 2011. "Energy impacts of the smart home-conflicting visions."

Wallenborn, Grégoire, Marco Orsini, and Jeremie Vanhaverbeke. 2011. "Household appropriation of electricity monitors." International Journal of Consumer Studies no. 35 (2):146-152.

Osterwalder, Alexander and Peigner, Ives Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers / Edition 1, July 2010

Rayman Preet Singh, S. Keshav, and Tim Brecht, “A Cloud-Based Consumer-Centric Architecture for Energy Data Analytics” e-Energy '13 Proceedings of the fourth international conference on Future energy systems. Pages 63-74 ISBN: 978-1-4503-2052-8 ACM New York, NY, USA ©2013.

Walker, Gordon, Noel Cass, Kate Burningham, and Julie Barnett. 2010. "Renewable energy and sociotechnical change: imagined subjectivities of'the public'and their implications." Environment and planning A no. 42 (4):931-947.

Appendix A – Workshop results

Product Vision

The respective groups have made the following cover stories:

Group A

Cover: COSSMIC MAKES FREE YOUR ENERGY!
Become COSSMIC partner and You can have special benefits for your e-car, e-bike and PV systems

Brain storms: Now I can increase my autarky in energy.
I save my money.
I reduce pollution.
I can control my energy.

Headlines: I can drive my e-car with 100% of PV energy.
Buyers have to buy a start-kit and an electronic box.
Smart grids can give themselves the energy.
It's necessary to think to energy storage for smart grid.

Quotes: I buy energy cheaper and green.
I'm independent producer and consumer.
The energy produced and consumed comes from my neighborhood.

Sidebars: consume data monitoring.

Group B

Brain storms: Visibility of energy production, consumption and application
Cover: CoSSMic takes care about my green investment
Headlines: Save money
CoSSMic brings me and my behavior in the right energetic way
Users will exactly know about their consumption of energy
Quotes: Even when I forgot to be "green" CoSSMic does it for me
I developed consciousness about my energy footprint
Sidebars: Easy use of CoSSMic scenario
Control, awareness of behaviour
Identify bottlenecks
Images: One house with PV offers another without PV extra energy

Group C

Cover: Energy revolution – citizens become their own power provider
Headlines: CoSSMic makes life easier
Prime minister visits Konstanz to learn about CoSSMic
CoSSMic "frees" your energy
CoSSMic leads to long queues to get the newest CoSSMic contract
Quotes: "I don't have to save energy on my own – CoSSMic does it for me"

"It reduced my electricity bill"
Interview: "Yesterday I paid too much for my power consumption. But CoSSMic saves my power efficiency and my money"
"4 times by 5 star holidays, now I can see the world"

Sidebars: Save infrastructure cost by using your neighbour's equipment
Zero-footprint neighbourhood

Images: Nuclear power plant, conventional grid – Houses with PV roofs

7.1.1.1 Personas

Group A

Private

- That uses only
- That produces and uses
- That only produces
- That owns e-car, e-bike, PVs, heating pumps

Public

- That wants to save money and increase green energy use

Group B

Industry users contact maintenance managers of:
 High consumers related to own energy production (e. g. ISC itself)
 Low consumers related to own energy production (e. g. SST)
Private home owners
 Standard family (parents with two kids, one adult at home the other works outside)
 Single person
  Stays almost always at home (e. g. physically handicapped,
  Frequent traveler "work junky"
Teacher of a school who needs access to data for education and studies with students and pupils

Group C

Green Solo
 Green, motivated person
 Technology-orientated
 High school
 Electrician
  Private house owner

Product Box

Group A

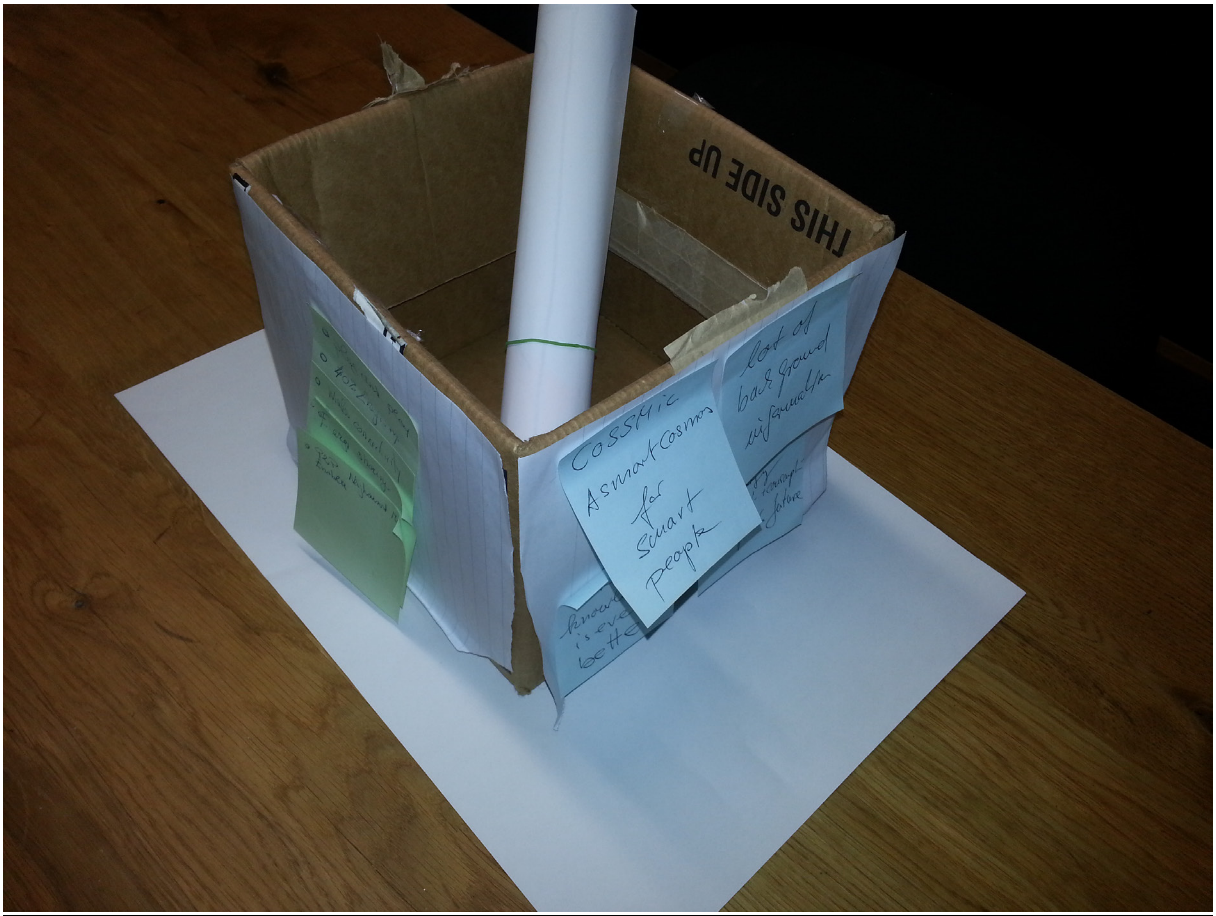
The Energy Box

- Drive your car for free
- Control your energy
- Save your time

Energy Safe Box

Technical Data and Attractive Images

<u>Group B</u>



CoSSMic – a smart cosmos for smart people
A lot of background information
Power is good but knowledge is even better
We work together on energy production and consumption for your future

Invest your energy
Green behaviour at home and away
Share excess energy
Interconnected home owners

Smart friends in a smart community
Smart software
Smart meter

Plug and play
40% energy save
Wireless connectivity
Energy shaving
P2P neighbourhood

<u>Group C</u>

Top: FREE ENERGY INSIDE

- For your house only
- Save 1000 € a year
- Optimize energy usage
- Reduce CO2 footprint

Sides:

Get rid of your electricity bill now
Turn key – plug & play – easy to use
Be CoSSMic – be green!
Contains: Sensor, Panel, Smart Software, Instructions

Bottom:

To be used by househoulds only who

- Have a solar panel
- Have an energy storage
- Want to save money
- Want to be smart
- Want to save the planet

Business Model

<u>Group A</u>

Key Partners:

ICT engineering house
Company that own national grid (Enel, …)
ICT producers
Partnership with PV system producers to make assistance (e.g. Bosch)

Key Activities:

Promote at local and national level law or interventions to support the diffusion of these tools

Key Resources:

Electric car sellers
Sellers of renewable energy products (inverters, modules, etc.)
Building stock of products
Logistic and transport partners

Value Propositions:

Energy saving and energy storage market
System for monitoring energy consumes
Electronic tools with software to put on PV grid in houses, schools, etc.
Saving money
Free used e-car, e-bike,
Product cheaper for optimize use of PV systems
Easy use for all people
Automatic use
To increase renewable use in their life

Customer Relationships:

Guarantee 5 years
Assistance (green/free number and on-line)
Forum/community on web
Service pack
App for i-phone and mobile

Channels:

Web site
Web community
Advises on social network
Communication for technical people
Selling together PV and energy storage systems

Cost Structure:

Personal
Buy HW and SW
Marketing
Administration
Logistic
Distribution
Services

Revenue Streams:

Cost : not more than €100,00 for piece

Group B

Key Partners: (1)

Stadtwerke + ENEL + Company with special power contract
Community of energy friends
Users and personas
Entire community of researcher within CoSSMic

Key Activities: (2)

CoSSMic provides households with smart boxes, software, information model apps and all necessary information
Continuously exchange of information, gained insight and knowledge between users and CoSSMic trial runners
About energy production and consumption: awareness-member compare-action-feedback

Key Resources: (3)

Users as individual personas
CoSSMic consortium
Soft- and hardware

Value Propositions: (4)

PV comes in by: store an extra amount to offer to the system to stay below threshold
To be flexible → PV and storage
CoSSMic takes care about my green investment
Controls my behavior in a desired way
Forecasting based on past and present data and behavior
We save money
CoSSMic brings me and my behavior in the right energetic way
Users will exactly know about their consumption of energy
We work together on energy production and consumption for your future

Customer Relationships: (5)

End user´s agreement for information and confirmation
Smart friends in a smart community
CoSSMic – a smart cosmos for smart people
A lot of background information
Power is good but knowledge is even better

Channels: (6)

Apps, face-book site, information website
Wireless Interconnected home owners

Customer Segment: (7)

Industry users contact maintenance managers of:
- High consumers related to own energy production (e. g. ISC itself)
- Low consumers related to own energy production (e. g. SST)

Private home owners
- Standard family (parents with two kids , one adult at home the other works outside)
- Single person
  - Stays almost always at home (e. g. physically handicapped,
  - Frequent traveler "work junky"

Teachers and lecturers
- Teacher of a school who needs access to data for education and studies with students and pupils

Stadtwerke + ENEL

Cost Structure: (8)

Equipment which already exists at the personas place
Rent/lease of some costly equipment as for example storage systems

Buy equipment to connect, switch, monitor and evaluate data up to a certain maximum value of, for example, 100-200 €

Revenue Streams: (9)

Additionally saved energy and maintaining costs

One house with PV generator offers to another one without PV extra energy

Reduced by numbers and volume of storage units because of commonly used capacities

Future sale of the layout of interconnected hardware of CoSSMic

Group C

Key Partners: (1)

Component Suppliers (PV, Storage, Computer)

Software

CoSSMic researchers

End users

Key Activities: (2)

Stadtwerke co-workers asked already how to become an end-user in CoSSMic (customer relationship)

Demonstrations

Workshops for electronicians (training, promotion)

Key Resources: (3)

User

Soft- and hardware

Value Propositions: (4)

Service to significantly increase the share of RES in your house

Low infrastructure installation efforts

Increased comfort at reduced costs

Brand thinking: Innovation, technology

Improve community independence from energy big providers.

Energy sharing

Security of supply

Customer Relationships: (5)

Technical support

Call centre

New versions/improvements

Feedback

Workshops for customers

Channels: (6)

Internet/Newspapers

Personal visits

Public adverties/Promotion

Approach architects

Customer network

Neighbours

Customer Segment: (7)

- Future: The CoSSMic Allianz will provide the know-how to control whole city parts or even cities
- Companies/Industry
  - Save costs. Shift consumption to cheap tariff times
  - Be green (branding)
- Supermarkets (Aldi, Lidl, ...)
  - Freezers are smart consumers
- Green user
  - Produces more energy than he need
- City user
  - No space for PV. Wants to be green/cheaper energy and install storage
- Conventional user
  - Not deeply involved in technology, but he wants to improve his quality of life by relying on CoSSMic infrastructure to manage his house energy consumption

Cost Structure: (8)

- Buy components
- Rent components
- Fix costs

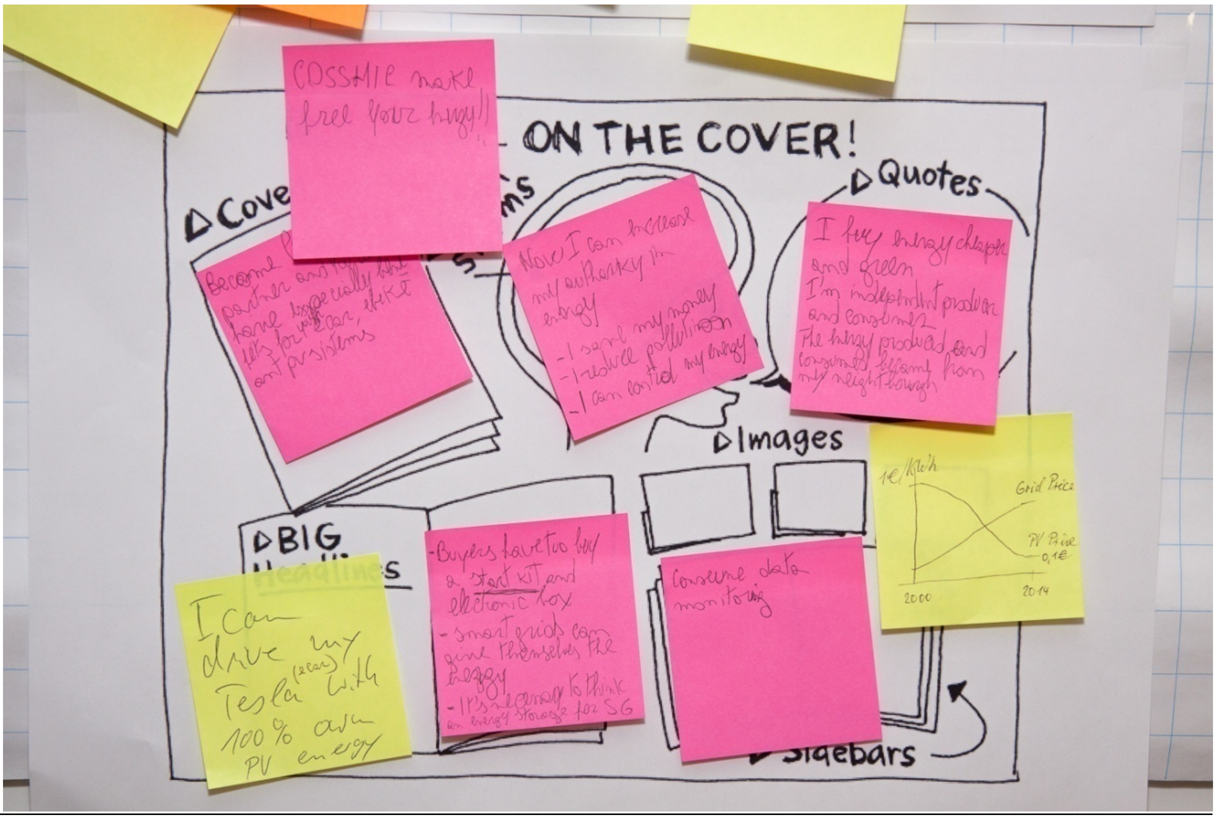
Revenue Streams: (9)

Common scenarios

From the WP2 Workshop carried out in Konstanz on the 12th and 13th Dec. 2013 the following results of the first session of the task: “Product visions building – tomorrow´s headlines” came out as noticed. The collected and below listed topics can be used to fill in the open space of the cover story sketch as shown in Figure 5.

<u>Group A with the members: </u>Rosita (Leader), Kristian, Giulio, Michael, Giuseppina

<u>COSSMIC MAKES FREE YOUR ENERGY!</u>



Cover: Become COSSMIC partner and YOU can have special benefits for your e-car, e-bike and PV systems
CoSSMic allows you to make optimal use of energy, fully exploiting our green equipment such as PV and optimizing the use of the green devices such as e-cars and e-bikes.

Brain storms: Now I can increase my autarky in energy. I save my money. I reduce pollution. I can control my energy
The two main advantages of CoSSMic are the positive economic impact on the individual finances and the environmental impact of reduced pollution. In terms of individual advantages, the full control of the energy consumption and thus the possibility to plan to avoid expensive energy consumption are attractive features.

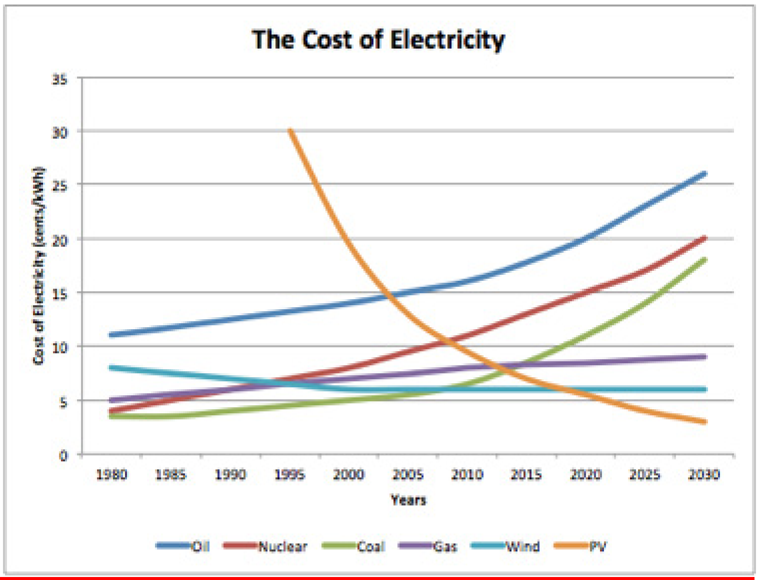
Quotes: I buy energy cheaper and green. I'm independent producer and consumer. The energy produced and consumed comes from my neighborhood.
The energy coming from CoSSMic community is not only green, but is cheaper because the sharing of energy among neighbors avoids energy payment at a higher cost level from the external energy supplier. Moreover the economic advantages are related also to the optimization of self-consumption due to the CoSSMic smart control of the households.
Big headlines: I can drive my e-car with 100% of PV energy. Buyers have to buy a start-kit and an electronic box. Smart grids can give themselves the energy. It's necessary to think on energy storage for smart grids.

CoSSMic provides benefits to the entire society, not just to individuals, allowing the growth and development of communities more and more self-sufficient in terms of energy consumption. It allows the use of vehicles that move only with green energy and in general to run everything with only green power. The only requirement is to buy a small kit non-invasive and easy to install.

Sidebars: *Monitoring of consumption data*

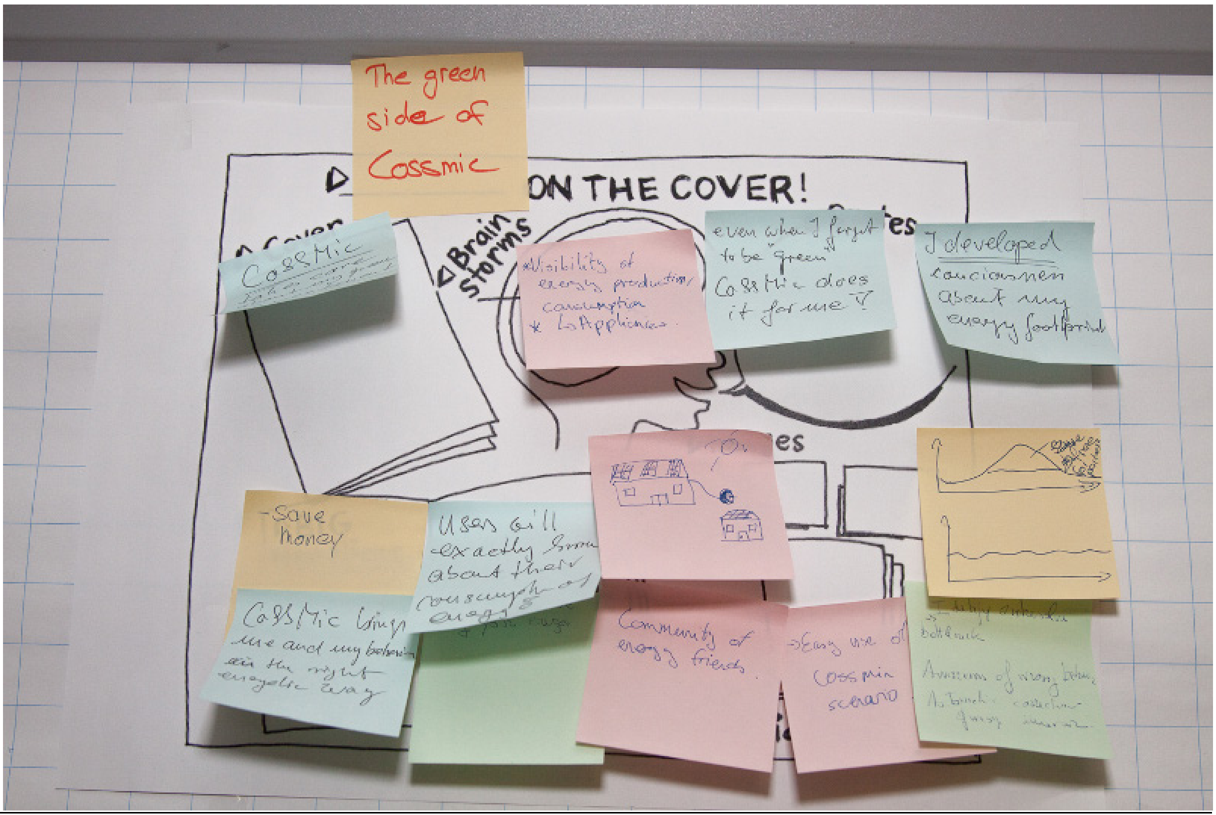
CoSSMic provides the way to monitor and control the energy consumption and thus enables to plan and adjust the energy consumption and distribution during the day to optimize the green energy utilization.

Images: Trends in the Cost of Energy



<u>Group B with the members</u>: Joachim, Nadja, Carmel, Salvatore

<u>THE GREEN SIDE OF COSSMIC</u>



Brain storms: Visibility of energy production, consumption and application

The Group attention focused on the improvement of user's awareness about his/her energy usage. CoSSMic is providing a clear vision about energy production, (self-)consumption and energy-relevance of user's applications. The improved consciousness of the users about effects on his behavior of energy utilization will allow inside the micro-grid to develop the desired control mechanisms according to their own green feeling. This will be possible thanks to the CoSSMic monitoring and the controlling that can be delegated to it.

Cover: CoSSMic takes care about my green investment

CoSSMic provides a hardware and software platform, which monitors and controls the green investment of each user by monitoring their solar-panel energy production and optimizing its utilization. In fact the revenue of such an investment is optimized by the improvement of the self-consumption and the exchange of green-energy with the CoSSMic neighbors to minimize the consumption of "dirty" energy.

Headlines: *Save money*

Money is saved by the maximization of self-consumption by an optimal scheduling of consumption of the household. Moreover sharing of green-energy with the neighbors, in turn of credits, avoids to pay too much for the energy to providers who demand probably higher rates. Also the cost overhead due to the fees, particularly to use an external power grid, also applied to the energy bill can be reduced. Finally greater awareness of energy expenses allows users to optimize their behaviors.

CoSSMic brings me and my behavior in the right energetic way

The monitoring dashboards provided by CoSSMic and the complete freedom to share, un-share and configure devices gives the users the right awareness and the possibility to choose how much they want to leave the control of their green-energy to CoSSMic according to their green feeling or to their requirements.

Users will exactly know about their consumption of power and energy

CoSSMic collects in real time information of energy consumption and production. A network of smart sensors can be installed using so many energy meters and smart plugs to get a detailed energy fingerprint of the household. Also an electric car can be monitored using "cloud services" within the CoSSMic platform. For example, historical series of monitoring and statistical resumes can be observed.

Quotes: *Even when I forgot to be "green" CoSSMic does it for me.*

The CoSSMIc platform is composed for pro-active software agents, which manage the user's energy according to high level technical policies. They take into account user's requirements or constraints and use available control functions to schedule the devices utilization and to exchange with other agents the green-energy to prioritize its exploitation.

I developed consciousness about my energy footprint

Real time monitoring, historical series and statistic figures about energy, cost and credits gives the users a continuous feedback of their energy footprint.

Sidebars: *Easy use of CoSSMic scenario*

The usage of CoSSMic scenario is straightforward: observe, share and collect feedback. A friendly Graphical User Interface (GUI) provides readable information and simple controls.

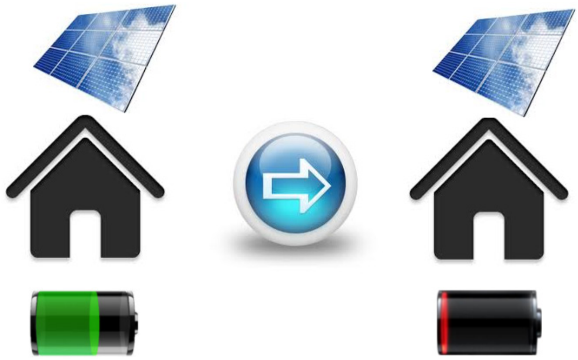
Control, awareness of behavior

Two kinds of dashboards will be provided to the users. The first one will support the awareness about the behavior providing current and historical information. The second one will support control of the behavior by defining policy about energy sharing, device schedule and configuration (earliest start and latest end, temperature range, work profile, etc. …).

Identify bottlenecks

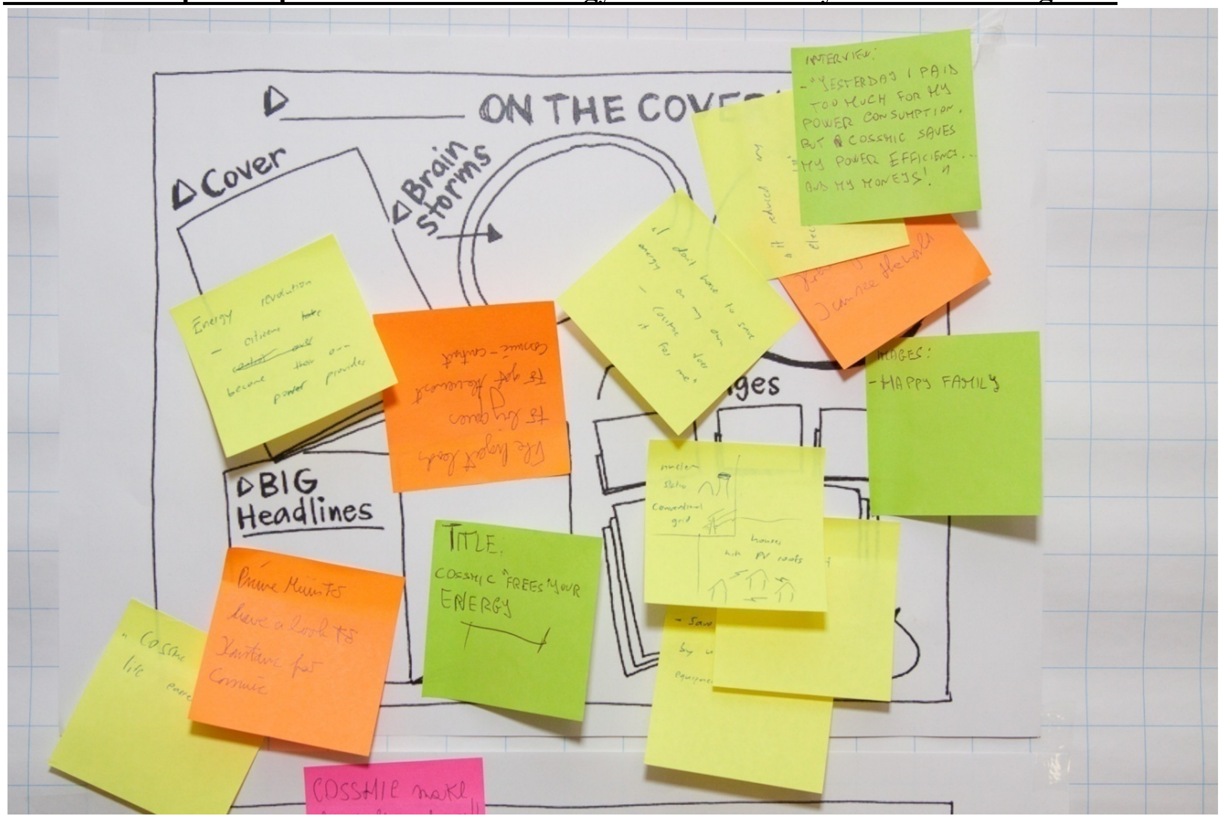
Bottlenecks like unused energy sources, missed sharing options, over-consumption, expected cost peaks, schedule improvements and credits availability will be automatically detected by CoSSMic, and will claim the user's attention by alerts and provides suggestions.

Images: One house with PV offers another without PV extra energy



<u>Group C with the members</u>: Hanne, Andreas, Matthias, Luca

<u>Self sufficient private production reduces energy costs to zero. Pay less and still be green!</u>



Cover: Energy revolution – citizens become their own power provider

Through the CoSSMic platform, citizens are able to share their energy, thus becoming providers of the neighborhood and minimizing their energy costs thanks to the minimal exchange with external power providers.

Headlines: CoSSMic makes life easier

Prime minister visits Konstanz to learn about CoSSMic

CoSSMic "frees" your energy

CoSSMic leads to long queues to get the newest CoSSMic contract

CoSSMic provides a hardware/software platform which takes care about the monitoring and the control of the houses in order to fit the user's needing in terms of minimizing the energy costs by, for example, maximizing the exchange with other CoSSMic users and increasing the use of renewable energies, such as photovoltaic. The user is relaxed from the burden of constantly monitor the own energy consumptions.

Quotes: "I don't have to save energy on my own – CoSSMic does it for me"
"It reduced my electricity bill" Interview: "Yesterday I paid too much for my power consumption. But CoSSMic saves my power efficiency and my money"
"4 times by 5 star holidays, now I can see the world"

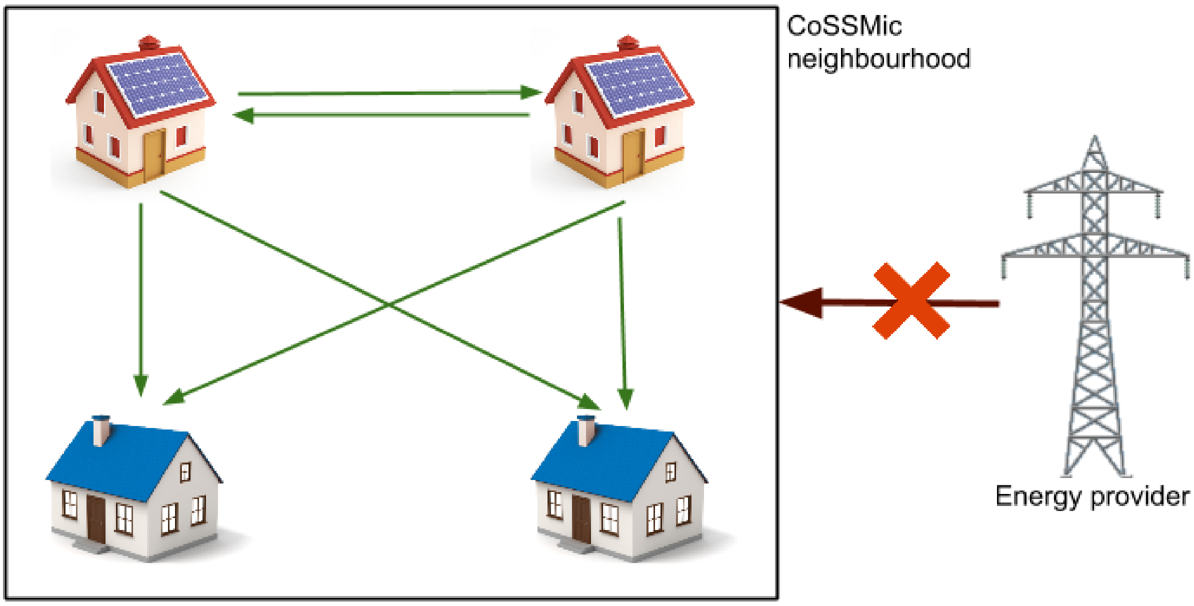
The CoSSMic platform autonomously monitors and controls the user's devices in order to save energy by purchasing it from the neighbourhood.

CoSSMic minimizes the energy exchange with the external suppliers, who sells the power at higher cost, with respect to the neighbourhood; the users have not to pay extra fees for the energy instead they pay only for the energy they get.

Sidebars: Save infrastructure cost by using your neighbour's equipment
Zero-footprint neighbourhood

Users can take advantages of using CoSSMic by sharing neighbourhood equipment in order to buy or produce their energy. They can satisfy their energy needs without buying it from external suppliers, even if they have not an energy production infrastructure: they can purchase energy from another building in the neighbourhood that has an infrastructure (for example PV panels) to generate regenerative electrical power.

Images: Nuclear power plant, conventional grid – Houses with PV roofs



Appendix B - User profiles

B.1 Konstanz

A: The industrial users 1-4:
Fruchthof Konstanz GmbH (KN-01):
A lot of electrical cooling is necessary despite geothermal cooling support
Mainau GmbH / Comturey (KN-02):
Generates e-power via PV, wood decomposition and gas fired power generator and combined heat and power station (CHP), with < 2 % PV contribution, far away from e-independency
Sunny Solartechnik GmbH (KN-03):
Abundance (twice as consumed) of PV-generated power is available which is offered to four external consumers which are gathered in one building together with Sunny Solartechnik
ISC Konstanz e. V. (KN-04):
High consumer of electricity of about 750 MWh/a with a PV contribution which counts for 2.5 % of entire consumption; M-Bus system to control the industrial consumers already available

B: The private users 1-6 (KN-07 to KN-12):
KN-07:
This house with a 10 kWp installed PV system is accounted for electrically self sufficient.
KN-08:
This household runs without PV**, counts three persons** and consumes averagely.
KN-09:
Typical for an almost self-sufficient consumption with a 5 kWp PV system on own roof top.
KN-10:
This household offers all desired devices, a PV system, a heat pump, an e-car and a lot of consuming appliances with a self-sufficient e-billing.
KN-11:
His household runs without PV and counts six persons, with only few but often running appliances
KN-12:
An example to rent an additional house rooftop from the neighbour to run own PV-modules.

C: The public users, two schools 1-2:
Thomas Stegmann from Stadt Konstanz selects two schools, both with PV installations
KN-05: Grundschule im Wallgut is a small elementary school with about 300 pupils and 20 teachers
KN-06: Geschwister-Scholl-Schule Konstanz is a large daylong running integrated/comprehensive school with about 1500 involved people (pupils, students and teachers)

A: The industrial users 1-4:

Fruchthof Konstanz GmbH (KN-01):

Production:
PV of 12 kWp installed which produces about 10 MWh/a

Consumers:
Overall consumption in 2012/13 is about 230 MWh/a, with 15 minute values between 3.35 kW (min) and 80.45 kW (max)
Continuous devices: Cooling rooms, e-vehicles (e-smart with about 18 kWh and 6 pallet jacks) with about 4 kWh each
Single-run devices: Processing line for fruit/vegetables with washing machines, shredder …

Installed measurement equipment:
overall consumption with 15´resolution

Special remarks about user agent software:
Set constraints on cooling by using a fixed range (e.g. 10 – 12°C), more or less is not allowed
Simplified user agent software for staff/personnel with scheduling of single run devices

Technical remarks:
Integration of cooling might be difficult / not possible due to existing infrastructure
Pallet jacks are connected via Schuko (which means Schutzkontakt/protected contact plugs) (easy)

GUI and data control:
For mobile access use smart phone, at site by tablet
Online interactive control from everywhere by responsible persons only

Mainau GmbH / Comturey (KN-02):

Production:
PV about 45 000 kWh/a in 2012, gas from processed wood via HVA delivers about 40 000 kWh/a

Consumers:
Entire Mainau GmbH consumes about 2200 MWh/a mainly kitchen devices; about 250 $kW_{average}$ with up to 750 kW_{peak}!

Installed measurement equipment:
Smart meters for production, on/off status of devices

Special remarks about user agent software:
User constraints: priority (1 – 20), duty cycle (0 – 100 % per minute). Devices are switched on/off frequently (once per minute) during heavy load times via relays. Problem: No scheduling! It is not clear, at which time a device will be used. Suggestion: Use average consumption behaviour (e.g. oven 10:00 – 22:00, dish washer 11:00 – 23:00, …) →has to be discussed with WP4
The kitchen personnel decide on its own when to use a device! Additional user agent software with visualization of their energy behaviour and suggestions might help.

Technical remarks:
8 smart meters are already installed for the 8 main areas of Mainau. Data for analysis by using Excel is already collected in 15 minute intervals by a server. The in-time integration of this data is still unsure. Consumption can be calculated by assuming a constant current.
Calculation from kWh/kW, electronic converters send radio signal by I > 2 A, with underlying consumption profile the consumption can be calculated.

Direct access to relays unsure, maybe we can't influence the existing system!

GUI and data control:
From remote by island WLAN internet access or via smart phone, at site via WLAN by tablet
Online interactive control can also be done via internet access to home server. This service is not necessary from outside the island of Mainau.

Sunny Solartechnik GmbH (SST) (KN-03):

Production:

PV power of about 58.6 kWp with dedicated 17 kWp for self-consumption, additionally solar-thermal installed

Consumers:

Self and feed in, two apartments, one small ICT company with 3-4 kW maximum load, one additional small consuming company EcoCamping e. V., 2+2 e-cars about 50 kWh storage capacity, a 3.7 kWh battery storage system is in house installed

Consumptions of a half year period from 28.06.13 - 01.06.14, Data are still preliminary due to ongoing reconstruction work.

SST: within the last years between 5000-12500 kWh
apartment-1: 541 kWh
apartment-2: 977 kWh
Netzwerkstatt: 1079 kWh
Ecocamping e. V.: 1269 kWh

Installed measurement equipment:

One smart meter Elster AS1440 (measures in 2-directions), which is at present not remotely controlled, for each consumer unit exists one local meter and one meter for the overall PV-generation. Some inverters from SMA and sunways are installed.

Special remarks about user agent software:

All clients, i. e. the connected five consumers of the PV power are equivalent coordinated

Technical remarks:

A lot of additional heat is available, could be shared with i. g. Apart Hotel in the vicinity
PV generated power is feed in via a 80 A /380Vfuse (extended 65 A fuse because of bottleneck)
→ different users of PV power could be integrated into trials!

GUI and data control:

From remote by internet access ok, smart phone not necessary, at site via LAN by tablet
Online interactive control can also be done via internet access to home server

International Solar Energy Research Center Konstanz e. V. (ISC) (KN-04):

Production:

The two installed PV systems generated in 2012 in total 20 085 kWh. The one on roof top with 12.4 kWp, delivered 13706 kWh/a and the one in south-east vertical mount orientation with 6.9 kWp, 6379 kWh/a.

Consumers:

High load consumer of 729053 kWh/a in 2012 which results of 2.75% of energy from own PV system

Installed measurement equipment:

Two sunways converters for the PV system; Energy consumption is already measured by M-Bus system in the categories:
PECVD – Diffusion – Fire Oven – Tecnofimes Diffusion – Rena Inline – Cooling System – Pressed Air – Cooling Water – Ventilation – Printing_1 – Printing_2 – Chemistry Lab – Clean Room – Office Building

Special remarks about user agent software:

Equivalent user agent software as for Fruchthof for personnel, available via PC

Technical remarks:

No possibility to control the devices, only suggestions for users to use/not use a device

GUI and data control:

In local network via smart phone / tablet / PC

B: The private users 1-6:

KN-07:
Production:
About 10 kWp PV installed and about 10 MWh/a production and consumption, about 3m² solar thermal; geothermal and heat pump included
Consumers:
Two persons, about 10 MWh/a
Installed measurement equipment:
Three smart meters Elster 1440 PV, heat pump and rest consumers
Special remarks about user agent software:
Wants to have production, consumption and feed in
Technical remarks: no

GUI and data control:
For mobile user access via Fritz!Box, i-phone, apple tablet available at home via tablet. Online interactive control from everywhere

KN-08:
Production:
No PV production
Consumers:
Up to date two persons, about 4000 kWh, soon one more because growing family, now: 3!
Installed measurement equipment:
no smart meter yet
Special remarks about user agent software:
Nothing special
Technical remarks:
They want to buy smart grid compatible appliances

GUI and data control:
For mobile use smart but no i-phone, at home tablet
Online interactive control from everywhere

KN-09:
Production:
The 5 kWp PV produces about 4500 kWh/a with 5° orientation to the north
Consumers:
Feeding in due to EEG-contract, five persons, have about 5000 kWh/a consumption
Installed measurement equipment:
Three smart meters type Elster for PV production self consumption and feed in
Special remarks about user agent software:
Wants to have production, consumption and feed in
Technical remarks:
Wants to analyse in more detail the heating system with pump
GUI and data control:
For mobile use probably by smart phone and at home via tablet.
Online interactive control from everywhere

KN-10:
Production:
about 10 kWp PV for 11-12 MWh/a in 2012 and a heat pump included
Consumers:
Four persons consume about 4.5 MWh/a, local grid delivers about 3MWh/a, which results in 85% of feed in and a self consumption rate of 15%.

Heat pump delivers 2100 kWh/a at Pmax = 2.2 kW
2 freezers, 1 refrigerator, 1 dishwasher with warm water connection, 1 washing machine, 1 E-kitchen stove, 1 ventilation unit with 50 Wmax
1 E-car (has charging device for charging power from 1.4 -3 kW and a battery capacity of 16 kWh
An immersion coil of 2 kW/Phase for 1000 l water reservoirs as a back-up system for the heat pump.
Installed measurement equipment:
No smart meter, but three meters installed for PV-system, heat pump and rest consumers
Special remarks about user agent software:
Wants to have production, consumption and feed in also for the e-car battery
Technical remarks:
Wants in house T-measurement to control and drive the heat pump.
When the kitchen oven is on the heat pump should be switched off.
GUI and data control:
For mobile use Samsung cell phone, at home tablet
Online interactive control from everywhere

KN-11:
Production:
No PV production
Consumers:
Up to date six persons, about 2350 kWh/a only few consuming devices like a fridge/freezer combination, a dishwasher, a washing machine
Installed measurement equipment:
no smart meter yet
Special remarks about user agent software:
Wants to include remotely driven lights and window blinds
Technical remarks:
He wants to buy smart grid compatible appliances and will install heat pump and PV system
GUI and data control:
For mobile use Samsung cell phone, at home tablet
Online interactive control from everywhere

KN-12:
Production:
9 kWp PV, 15 kWp solar thermal, + PV from the neighbours roof which is rented
Consumers:
Self consumption between 5000-6000 kWh/a and feed in, four persons, one e-car
Installed measurement equipment:
Two digital meters from SWK from Landis + Gyr type ZMD120ASER53SF03, one for the consumption and the other one for PV generated feed-in.
Special remarks about user agent software:
Responsible to charge the e-car, ...
Technical remarks:
How is the situation with the PV from the rented roof?
GUI and data control:
From remote by internet access ok, smart phone not necessary, at home tablet
Online interactive control can also be done via internet access to home server

Private user matrix: A compilation of the main input data of the six private user participants of Workshop I + II

<table>
<tr><td rowspan="2">User</td><td rowspan="2">Installed PV [kWp]</td><td rowspan="2">PV production [kWh/a]</td><td rowspan="2">Consumption [kWh/a]</td><td rowspan="2">Equipment</td><td rowspan="2">Household size</td><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td colspan="4">See legend</td></tr>
</table>

						below			
KN-12	9	10.000	5.000-6.000	e-car, fridge, freezer, dishwasher, washing machine, e-stove, tropical aquarium	4	Y	Y	Y	Y
KN-07	10	10.000	10.000	fridge, freezer, dishwasher, washing machine, heat pump + geothermal reservoir , e-stove	2	Y	Y	Y	Y
KN-08	0	n/a	4.000	fridge, freezer, dishwasher, washing machine, e-stove	3	N	Y	Y	Y
KN-11	0	n/a	2.350	fridge/freezer-combination, dishwasher, washing machine	6	N	Y	Y	Y
KN-10	10	11.000 – 12.000	4.500	e-car, 2 freezers, 1 fridge, dishwasher, washing machine, e-stove, home-ventilation, heat pump + immersion coil	4	N*	Y	Y	Y
KN-09	5	4.500	5.000	heat pump, e-stove, fridge, freezer, dishwasher, washing machine	5	Y	Y	Y	Y

1 Smart meters installed; (* in the meanwhile yes three ones for PV, HP and remaining)
2 Want detailed overview for consumption/production/feed-in
3 Interactive control from everywhere via PC/smart phone
4 Interactive control at home via smart phone/tablet

C: The public users 1-2:

Thomas Stegmann from Stadt Konstanz is the contact person for the two schools

Grundschule im Wallgut (KN-05):

Production:
A public grid owner (SWK) running PV system shared with a neighbour school of 29.8 kWp, feed-in by EEG-contract
Consumers:
About 300 involved people. Lighting, ventilation system for the gym which has a high lighting demand!; small kitchen facility, 2x dishwashers (one professional one standard, 2x 4-plate e-stoves with baking tube, 1x hot water boiler for about 50 l; grid-feed batteries for emergency lighting and alarming; without gym about 24-26 MWh/a
Installed measurement equipment:
In main building old meter, in gym modern digital (smart) meter from Landis & Gyr
Special remarks about user agent software:
Wants to have production, consumption and feed in

Technical remarks:
probably power plug of classrooms in line with light e-supply
GUI and data control:
up to now no WLAN only LAN rooter available in teacher´s room

Geschwister-Scholl-Schule Konstanz (KN-06):
Production:
Several PV systems with together 60 kWp feed in by EEG into public grid (SWK), school and school related private owners; CHP (BHKW) with about 100 kWel and a back-up gasoline generator with 48 kW and a starter battery with 2.16 kWh.
Consumers:
About 1500 involved people.
Lighting (about 85 kW), cooling (20 kW) and ventilation system, server room, for learning kitchens, one Mensa with a lot of equipment, workshop items which consume between 2 – 10 kW for 1h once per day or month, total consumption is about 300 MWh/a (whole day running school from 7am – 6pm with 25/a late events till 10pm,
Installed measurement equipment:
Landis + Gyr smart meters for PV, main meters are locked and run by SWK
Special remarks about user agent software:
Wants to have monitor PV and CHP production, overall consumption and feed in
Technical remarks:
Data acquisition of PV production already homemade displayed by school project and Excel program
GUI and data control:
LAN in every class room, no WLAN

In Konstanz we identified four companies and two schools to become users in CoSSMic. For the private users six households have committed to participate in CoSSMic.

Short description of the companies:

The ***Fruchthof Konstanz GmbH,*** is a specialized wholesaler for vegetables and fruits, supplies on a daily basis customers from the gastronomy, large-scale catering establishment and retail trade industry in the greater Konstanz area. The cooling aggregates of the company consume more energy in the summer period compared to winter time. This correlates with the energy production from PV devices, however, the company owns only a small PV system and is therefore interested to participate in CoSSMic.

The ***Insel Mainau GmbH*** is a famous tourist attraction because of its unique flower landscape.The energy roadmap for this beautiful island involves a plan to become self sustainable in the future. They own several PV Systems and a “gas from timber” powered block heat and power plant (CHP) as well.

Sunny Solartechnik GmbH is a project partner in CoSSMic and also trial user. They sell and install PV and solar thermal systems including storage technology. The company is interesting for CoSSMic because of its large PV system, battery storage capacity, electric vehicles etc. The electricity generation by PV is far above (i. e. more than twice) the own consumption in the balance over the year.

ISC Konstanz e. V. is a CoSSMic project partner and industrial user as well. The institute has two PV systems that cover only about 3% of the electricity consumption over the year. The main consumers and an electric car charging station will be include in CoSSMic.

Two public bodies (schools), the primary school ***Wallgutschule*** and the higher education school ***Geschwister-Scholl-Schule*** will be included in CoSSMic as users. The main consumers as lighting, ventilation and cooling and the PV systems will be considered in CoSSMic. The main project results will be communicated to the pupils and students to inform and motivate them, to be part of a smart energy project.

Six private users have been identified so far: One private user owns a standard PV system, which delivers the annual energy for the building (zero energy building). Two other private users produce much more energy by PV panels than the regarded buildings consume (e.g. double energy plus building). One house is equipped with solar panels, although the relevant roof is slightly tilted to the north. Two users have no PV system at all. Four more private users will be approached and included in CoSSMic.

B.2 Caserta

List and description of involved users:

Public Users:

- Federico de Chiara and Gilda Oliva: Both teacher in the same technical high school in Aversa (CE) (Istituto Tecnico Statale "C. Andreozzi"). Their school is very careful to the environment issue and has as target to become “green”. Gilda have a course in the school linked with “materials for sustainability”
- Mele Giovanni: teacher at High School of Hotel Management and Catering in Centurano (CE) (I.S.I.S. "Galileo Ferraris"). This school is very interesting because its laboratory have a lot of expensive equipment such as ovens.
- Guido Guerriero: teacher in a high school in Caserta (Liceo Statale Manzoni). He is member of WWF (World Wide Fund For Nature). He want to bring to the attention of the CoSSMic project an energy self-sufficient house built in Caserta that could be used as a trial site. He comes with more details on this in the next workshop.
- Luigi Abbate: teacher in a Technical High School in Caserta (I.T.E. Terra di Lavoro). This teacher would like to introduce their students to the project because they can actively participate due to their ICT background.
- Pignataro Giancarlo: teacher in High School in Marcianise (Liceo Scientifico "Federico Quercia"). Member of “Italia Nostra ONLUS”, an Italian association for the protection of cultural heritage, art and nature.

All the schools have a 2 kW PV system but some of them are not working at the moment. The province of Caserta will take care of resolving this issue as soon as possible

Private users:

- Francesco Leone: he hasn’t a PV system at the moment but he is planning to install a PV to save money soon.
- Filomena Di Felice: she has a PV system on the roof of her house but she did not notice big savings on her electricity bill since the PV is installed. She has understood why through the project presentation and wants to participate as a trial site.
- A user left before his presentation and did not deliver the registration form. However, we know that he is member of the association “Legambiente”, an Italian environmental association.

Appendix C – Interview Guide

Interviews will be conducted in order to identify specific needs and values that end users want in the system. The guide is developed from work already done in 2.1 and 2.2. Interviews here are semi-open discussion, as they must fall within the boundaries of the project. Questions asked therefore primarily start with how, what and why and aim in developing a focused discussion. This interview guide will outline clear instructions on how to conduct the interviews as well as criteria on how to prevent bias influencing the interview. We must also be aware that participants may get research fatigue so we must ensure that there are breaks between different methods at workshops.

Instructions to Interviewer

Target group: Workshop participants involved in User Centric Design.

Participants per interview: As the interviews are to be conducted during the workshop – it is best to have group interviews of 2-4 individuals. Ideally there should be representation of individuals from each group that are involved in the workshop.

Role of the interviewer: Questions are developed to stimulate discussion and not sway individual's opinions. Remember the aim of the workshop is User Centric Design and therefore what the user thinks is important. However, the interviewer also must act as moderator of the discussion in keeping the discussion focused on the objectives and not let the discussion develop into areas that are not helpful for the project. Also as moderator, it is important that the interviewer ensures that everyone has a chance to state their opinion and not let one individual dominate the discussion.

How long: Approximately one hour for each interviewee.

Tools: Interview guide and recording device. Recording the interview is important to ensure that all information from interviews can be captured. Note taking should be limited as it can be distracting for the interviewer and participant, sometimes resulting in taking attention away from what is being said.

Consent form: A consent form should be signed before the workshop by participants and therefore it should not be necessary to sign a second one. However, the interviewer should check that the consent form is signed at the point of interview.

Questions: The questions are built from D2.1 and some of the outputs developed from D2.2 workshops. Some of the concepts may not be familiar to the participants of the workshops and therefore follow a description of what is meant. Some questions may need further explanation and therefore 'prompt' questions are included.

Risks and resolutions: Participants in workshops may feel tired and it might be difficult to get them interested in being part of an interview. Therefore it is important to give them a break before an interview starts and also ensure that they are comfortable during the interview such as providing drinks and snacks. Ensure that the interview is part of the agenda of the workshop so that it is not surprising when it happens.

In order to avoid participants of workshops waiting for their turn to be interviewed, it is recommended that a number of interviews occur in parallel.

A. Background of Users

1. What is your background?
2. Why have you decided to be part of the project?
3. What type of building do you refer to for the CoSSMic trial?
4. What is the address of this building?
5. How many people use the building?
6. Can you please indicate what age group(s) uses the building that you refer to?

10-20 21-30 31-40 41-50 51-60 61-70

7. Who is your electricity provider?
8. Do you know your monthly consumption?
9. You know what are your main causes of power consumption?
10. You know what are the time slots in which you have maximum (or minimum) energy consumption?
11. Do you periodically check your energy consumption?
12. Do you have PV installed?
13. Do you know the detail of your PV system power production?
14. Do you already use some application to monitor your power production?
15. Do you know the brand of you inverter? Could you please provide us this information?
16. Do you use other kind of energy sources? For what purpose?

B. User needs

1. What do you want from this project trial?

   (Prompts: Energy awareness? Neighbourhood Consumption/Production exchanges? Control over energy use?)

2. What level of control do you want to have over devices targeted in the project?

   (Prompt: Setting when the dishwasher should start/stop)

   i. How would you express a task assignment (e.g., when to start dishwasher), and preferences (e.g., wash clothes on daytime...).

3. How useful to you is linking appliances to output data? Can you give an example in what context you would use these linkages?

   i. What kind of information do you want displayed from targeted devices? (E.g. number of times a device is turned on and off? Measure value? Etc.)

4. What level of control do you want CoSSMic researchers to have over your devices?

   (E.g. Setting when they want to dish washer should start/stop)

C. Hardware Component Installation

CoSSMic will install several hardware components (e.g. Computer System and Smart Plugs) in the studied houses. The hardware will run software and automatically collect data on a number of aspects regarding the energy consumption. The software interface will be controllable via e.g. a smartphone, a tablet or a website. The system will be connected to already installed PV as well as secondary battery storage.

1. Are there any concerns with hardware installation?
2. What software interfaces do you think you will use in the project?
3. The trial site is equipped with an ADSL flat access to internet? Do you have a wireless router?
4. Would you put your connection available for the transmission of small amount of data for the project purpose?
5. Would you be willing to use smart plug to allow to detect the main causes of energy consumption?
6. Your meter is installed in an accessible place?
7. Is there a power socket close to your meter?
8. Are you available to install a device on your meter?
9. Would you allow a qualified professional to install a measuring device on your meter?
10. Would you allow a qualified professional to install a socket closer to your meter?

D. Data

Data that is already to be proposed for collection is location of household, status/consumption of individual electronic devices/appliances, user's monthly bill, neighbourhood energy market, energy agreement, weather forecasting and some user identity.

1. Are there any of the proposed data that you would not be happy for the project to have?

Is there other data that you expected to be included in this list that is currently not there?

7.2 Appendix D - Relevant related research projects

A mapping of relevant EU projects is presented in Table 3. We depict the name, fact and abstract/objective of the project and explain how the project is relevant for CoSSMic (i.e. what we can learn). The information is collected from: http://cordis.europa.eu/home_en.html.

Table 3: Mapping of relevant EU projects

Project name	**Facts**	**Abstract/Objective (copied from Cordis)**	**CoSSMic relevance**
EcoGrid EU - Large scale Smart Grids demonstration of real time market-based integration of DER and DR	EU: FP7-ENERGY Project reference: 268199 Contract type:Collaborative project (generic) Budget: EUR 20 680 178 Coordinator: SINTEF ENERGI AS Project period: From 2011-01-01 to 2015-02-28	The key objective of the EcoGrid EU project is to demonstrate efficient operation of a distribution power system with high penetration of many and variable renewable energy resources. The demonstration will take place on the Danish island Bornholm with more than 50 % of electricity consumption from renewable energy production. A real-time market concept will be developed to give small end-users of electricity and distributed renewable energy sources new options (and potential economic benefits) for offering TSOs additional balancing and ancillary services. Strong industrial participation and innovative experiences from related European and US Smart Grids RD&D project will contribute to the development and implementation of robust ICT platforms and information architectures. This is the key to allow all distributed energy resources to participate actively in the real-time power market. Of a total of 28 000 customers on Bornholm, at least 2600 residential consumers will participate with flexible demand response to real-time price signals. The participants will be equipped with residential demand response devices/appliances using gateways and smart controllers. Installation of the smart solutions will allow real-time prices to be presented to consumers and allow users to pre-program their automatic demand-response	The results and experiences from the EcoGrid EU can contribute to CoSSMic in the following ways: • Show uptake and user response to the model similar to CoSSMic; • Demonstrate the efficiency of the internal electricity market in absorbing small scale RES locally; • Demonstrate a working ICT solution for user

Project name	Facts	Abstract/Objective (copied from Cordis)	CoSSMic relevance
		preferences, e.g. through different types of electricity price contracts. Automation and customer choice is one of the key elements in the EcoGrid EU concept. To make the EcoGrid EU solutions more widely applicable, the market concept will be designed for existing power exchange(s) and power regulation market(s). Because of the test site location on Bornholm, the real-time market concept will first be operational in the Nordic power market system. EcoGrid EU replication activities will ensure that the concept (or part of the solutions) can be adjusted and prepared for implementation in other power systems and regulatory conditions across Europe. http://cordis.europa.eu/projects/rcn/103636_en.html • Participation in an internal market; • Demonstrate the possibility to participate in the balancing and ancillary services markets with distributed resources – a possible second step in CoSSMic; • Identify the regulatory options for the implementation of an internal electricity market, such as foreseen in CoSSMic, in the Nordic system and its replicability Europe wide.	
e-GOTHAM - Sustainable-Smart Grid Open System for the Aggregated Control, Monitoring and	EU: FP7-JTI Subprogramme area: SP1-JTI-ARTEMIS-2011-7 Project reference: 295378 Contract type: Joint	The main objective of project e-GOTHAM is to implement a new aggregated energy demand model (based on the microgrid concept) in order to effectively integrate renewable energies sources, increase management efficiency by dynamically matching demand and supply, reduce carbon emissions by giving priority to green energy sources, raise energy consumption awareness by monitoring products and services and stimulate the development of a leading-edge market for energy-efficient	The results and experiences from the e-GOTHAM can contribute to CoSSMic in the following ways: • Provide insight on residential, service and industry users' response to a microgrid system; • Demonstrate system replicability in a

Project name	Facts	Abstract/Objective (copied from Cordis)	CoSSMic relevance
Management of Energy	Technology Initiatives - Collaborative Project (ARTEMIS) Budget: EUR 6 840 821 Coordinator: INSTALACIONES INABENSA SA Project period: From 2012-04-01 to 2015-03-31	technologies with new business models. e-GOTHAM will define a complete solution for microgrids in the residential, tertiary and industrial sectors that include different configurations of loads, distributed generators and energy storage components. To carry out the e-GOTHAM concept, the project will design an open architecture and develop a middleware that enables the needed communications for management and results optimisation. The challenge of the middleware produced in e-GOTHAM is to assemble a system which can ensure enough scalability, security, reliability, real time measurements and interoperability so as to lead to the development of a large-scale embedded systems network, a smart data management model, a set of models and algorithms that dynamically correlate energy-related, pollution-related, cost-related and behaviour-related patterns and a just-in-time adaptive communication model that interoperates different protocols to support seamless connectivity across the microgrid. e-GOTHAM is a market-oriented project that seeks to meet the needs of the involved market partners, especially power producers and microgrid owners, and to have an influence on consumers and on the authorities who define regulations. Finally, e-GOTHAM aims at creating an ecosystem meant to attract those relevant stakeholders who are willing to elaborate on project results so as to generate new products and services and to support the looked-for new aggregated energy demand model even beyond the project lifetime. This TA was approved by the ARTEMIS Joint Undertaking PO on March 7th 2012... http://cordis.europa.eu/projects/rcn/107033_en.html	Southern European country; • Show possible impact on regulation; Demonstrate working middleware architecture.

Project name	Facts	Abstract/Objective (copied from Cordis)	CoSSMic relevance
I3RES - ICT-based Intelligent management of Integrated RES for the smart grid optimal operation	EU: FP7-ICT Project reference: 318184 Contract type: Collaborative project (generic) Budget: EUR 5 254 613 Coordinator: INSTALACIONES INABENSA SA Project period: From 2012-11-01 to 2015-10-31	Recognising the need, within the energy industry, to optimize the integration of renewable energy sources and new consumer energy needs in connection with socio-economic challenges, I3RES aims to integrate renewable energy sources in the distribution grid by incorporating intelligence at three different levels: in the integration of Renewable Energy Sources (RES) and the development of control and management mechanisms that reduce the impact of its intermittency; in the facilitation of the participation of all actors in the electricity market; and in the overall operation of the network. I3RES main goal is to develop a management tool for the distribution grid underpinned by: 1) a monitoring system that integrates information from already installed systems (e.g. SCADA, EMS and smart meters); 2) energy production forecasting and network management algorithms that assist the distribution company in the management of massively distributed RES production and large scale RES production within the distribution network; 3) data mining and artificial intelligence to analyse consumers' energy demand and production in the distribution grid. To monitor and track the project activities, I3RES has defined several key performance indicators to be validated in a real-life scenario in the town of Steinkjer (Norway) and in a simulator quantifying that the benefits of the project results outweigh the costs if they were not implemented in the energy market. For this, I3RES comprises a well-balanced consortium of industrial and research organizations, strengthened with a DSO that will play a leading role to quantify and validate the	The results of the I3RES project will provide a benchmark of performance for the ICT system developed in CoSSMic.

Project name	Facts	Abstract/Objective (copied from Cordis)	CoSSMic relevance
		achievement of concrete market and technical needs involved in the introduction of an innovative smart grid management tool for DSOs and aggregators. Ultimately, this tool will enable consumers to play a new role and answer to different geographic market needs and expectations in connection with the transition to smart grids and integration of RES. http://cordis.europa.eu/projects/rcn/106338_en.html	
ADDRESS - Active Distribution networks with full integration of Demand and distributed energy RESourceS	EU: FP7-ENERGY Project reference: 207643 Contract type: Large-scale integrating project Budget: EUR 16 541 647 Coordinator: ENEL DISTRIBUZIONE S.P.A. Project period: From 2008-06-01 to 2013-05-31	ADDRESS will research, develop and deploy technologies and processes to increase usage of Distributed Generation and Renewable Energy Resources thereby engaging in a new relationship between customers, generators and network operators. ADDRESS aims to develop new innovative architectures for Active Distribution Networks (ADN) able to balance in real time power generation and demand allowing network operators, consumers, retailers and stakeholders to benefit from the increased flexibility of the entire system. Innovative use of communications, automation and household technologies will be combined with new trading mechanisms and algorithms providing ADN with low cost and reliable solutions. Customers will be encouraged into active participation enabling them to change their consumption habits, adopting a smarter use of energy and saving money. A cost/benefit analysis of different solutions will be developed: the most promising will be tested in three sites with different geographic, demographic and generation characteristics. The consortium has a distinguished membership of Large, Medium and Small Enterprises with international experience. East and West European Utilities, Global Manufacturers (both power and	The project ADDRESS will provide valuable insight regarding the utilities', power and appliance providers' interests in CoSSMic-like architectures.

Project name	Facts	Abstract/Objective (copied from Cordis)	CoSSMic relevance
		appliances), Universities, Consultants, Communications Suppliers and R&D Specialists have been selected for their specific knowledge and experience providing a well balanced mix of technology, innovation and market orientation. Competencies cover the whole spectrum of the electricity supply chain making this consortium extremely well suited to achieve the project goals and to deliver flexible, reliable, environmentally friendly and economic solutions. FP7 has provided the opportunity for this collaboration to take place completely meeting the Work Programme aims and enabling European Utilities and stakeholders to be on the cutting edge in worldwide network management. http://cordis.europa.eu/projects/rcn/100636_en.html	
FINESCE - Future INternEt Smart Utility ServiCEs	EU: FP7-ICT Project reference: 604677 Contract type: Collaborative project (generic) Budget: EUR 18 851 705 Coordinator: ERICSSON GMBH Project period: From 2013-01-01 to 2015-03-31	Change is the name of the game in energy! The shift to sustainability is visible everywhere. It is now a European priority to combine solutions which utilise energy generation from renewable energy sources and optimize energy usage efficiency into a Smart Energy System based on the introduction of Future Internet technologies. At the same time, business innovation needs to be encouraged to ensure that job creating SME's can thrive in the new energy eco-system. FINESCE will organize and run user trials in 7 European countries, building on investments of billions of Euro, addressing efficient energy usage in residential and industrial buildings, developing a new prosumer energy marketplace, building a cross-border private virtual power plant, and using electric vehicles as an element of demand response systems, enabling energy providers to move from reactive to pro-active energy network management by providing them with Future Internet ICT, enabling them to better balance	The prosumer energy marketplace, as well as, building a cross-border private virtual power plant, both parts of the project FINESCE will highlight successful approaches to designing an internal electricity market such as the on developed in CoSSMic. The consortium of 7 countries will also serve to show the international replicability of such schemes.

Project name	Facts	Abstract/Objective (copied from Cordis)	CoSSMic relevance
		volatile solar and wind energy generation with demand for energy. The FINESCE trials will prove the practical applicability of Future Internet technologies and the FI-WARE Generic Enablers to the challenges of the energy sector. FINESCE will develop an active community of innovative SME's, preparing them for the exploitation of the emerging business opportunities in energy, creating jobs, social impact and economic growth. FINESCE builds on and extends the results of the FI-PPP FINSENY project to realise sustainable real time smart energy services. The consortium includes globally leading energy and ICT operators, manufacturers and service providers and outstanding research organisations and SME's, from 12 countries, contributing directly to tightly focused trials and business innovation. It has the scale and scope to ensure that the FINESCE results drive the FI-WARE and Future Internet success and long-term exploitation internationally. http://cordis.europa.eu/projects/rcn/109257_en.html	
RESILIENT - coupling REnewable, Storage and ICTs, for Low carbon Intelligent Energy maNagemenT at district level	EU: FP7-NMP Project reference: 314671 Contract type: Large-scale integrating project Budget: EUR 8 113 704 Coordinator:	Growing investments in distributed energy resources (DER) renewable distributed energy generation combined with demand response, energy storage, plug-in electric vehicles and active management of distribution networks will require new business and technology platforms to manage the increased level of diversity and complexity of global energy management. The increasing variability of both generation and loads will also require more sophisticated and decentralized decision making. The RESILIENT project aims to design, develop, install and assess the energy and environmental benefits of a new integrated concept of interconnectivity between buildings, DER, grids and	Focusing on energy efficiency RESILIENT represents an alternative to CoSSMic. The output of the project can indicate possible improvements to the design of the CoSSMic business model.

Project name	Facts	Abstract/Objective (copied from Cordis)	CoSSMic relevance
	D'APPOLPNIA SPA Project period: From 2012-09-01 to 2016-08-31	other networks at a district level. The RESILIENT approach will combine different innovative technologies including smart ICT components, optimized energy generation and storage technologies, also for RES, integrated to provide real time accounts of energy demand and supply at a district level and assist in decision-making process. The project strategy relies on a comprehensive R&D and demonstration approach. The proposed integrated concept will be first modelled and simulated for different typologies of buildings and different climates and then installed, monitored and evaluated in three pilot projects (including residential and non-residential buildings) in the UK, Belgium and Italy. These demonstrators will be used to assess the energy and environmental benefits of the new integrated concept and also to validate models and technologies in order for the concept to be easily replicable throughout different climatic areas. The major impact from RESILIENT will be the development of a complete value chain where the annual primary energy demand of buildings collated at a district level is decreased by at least 20% compared to their expected energy performance summed on an individual building basis, this energy gain being associated with a decrease of more than 20% of the CO2 emission reference level. http://cordis.europa.eu/projects/rcn/104392_en.html	
IGREENGRID - integratinG Renewables in the EuropEaN	EU: FP7-ENERGY Project reference: 308864 Contract	iGREENGrid focuses on increasing the hosting capacity for Distributed Renewable Energy Sources (DRES) in power distribution grids without compromising the reliability or jeopardizing the quality of supply. Based on the experience of six world class DRES integration Demo Projects in low & medium	The results and experiences from the IGREENGRID can contribute to CoSSMic by providing guidelines for the implementation of DRES in distribution grids regarding:

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Electricity Grid	type:Collaborative project (generic) Budget: EUR 6 657 856 Coordinator: IBERDROLA DISTRIBUCION ELECTRICA, S.A. Project period: From 2013-01-01 to 2015-12-31	voltage grids (led by some of EEGI members; Distribution System operators DSOs-) and other EU initiatives in this field, the main final result will be a set of guidelines: Most promising solutions, Recommendations for appropriate integration of small & medium size variable DRES in distribution grids, Methodologies and tools, Criteria to establish hosting capacity and to manage curtailment procedures, and Technical requirement to DRES, equipment manufacturers & technology providers. iGREENGrid is the first analytical approach according to functional Demo Projects defined in the Roadmap and Implementation plan developed by EEGI. The assessment will include in the scope the following main functions: DRES connection; Evaluation framework defined according EEGI KPIs; Distribution system balancing: ancillary services, operation criteria, reverse power flows and active demand management, storage, curtailing, smart metering; Signalling: data exchange with DRES and consumption, signals among sensors, metering; Simulation & Evaluation environment. Strong coordination with EEGI, GRID+ project and other relevant initiatives will be established during the Project to receive appropriate feedback and to maximize the project impact. Beside, iGREENGrid encourages sharing knowledge and promoting the best practices identifying potential solutions in Demo Projects for the effective integration of DRES and validating them via simulation in other environments to assess the scalability and replicability at EU level (technical, regulatory and economic assessment). http://cordis.europa.eu/projects/rcn/106399_en.html	• Methodologies and tools; • Criteria to establish hosting capacity, manage curtailment procedures; Technical requirement for DRES, equipment manufacturers & technology providers.