Personal Energy Administration Kiosk application:
an ICT-ecosystem for Energy Savings
through Behavioural Change, Flexible Tariffs and Fun
Contract No 695945

Deliverable D1.1.
Report on findings of the multidisciplinary meta study of success indicators

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V0.1	20/05/2016	First release	Integration of products and tools proposed by partners. Initial analysis performed.
V0.2	10/06/2016	Second release	Integration of inputs and suggestions from partners. New structure for the document.
V1.0	08/07/2016	Release ready for internal review	Integration of inputs from partners. Completion of Section 4, 5 and 6.
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Executive Summary

The European Commission has repeatedly addressed energy savings through ICT, for example in the Impact Assessment for the Energy Efficiency Plan 2011 (European Commission 2011) and the Evaluation of the Energy Behavioural Change Programmes (BEHAVE) (European Commission 2009). These references derive that three conditions are required to trigger lasting behavioural change that results in countable energy savings, which are

1. a high level of information and communication,
2. the provision of economic incentives,
3. and a supporting administrative framework, such as regulated static vs. dynamic energy prices.

With this in mind, in order to collect the required information relevant for PEAKapp, this deliverable gathers information related to the products/tools to be analysed in the PEAKapp context. Partners of the PEAKapp consortium, including the electricity retailers, have been involved in a variety of research projects dealing with the provision of information to households in terms of consumption patterns and the enhancement of households' energy efficiency, as well as customer engagement. This deliverable D1.1 will collect the experience and knowledge of tools/products which influence energy consumption behaviour as well as lifestyle choices and products outside of the "energy world" which successfully achieved sustainable changes in consumers' behaviour. The D1.1 will serve as a reference for the developments and implementation of functionalities in Task 1.2.

The document provides a detailed plan and template to be used for collecting information in Section 2. The Section 3 provides a clustering of the existing ICT-solutions for energy efficiency in households collected by the consortium (complemented by Annex 1 and 2 with more detailed information of each solution). After this, Section 4 categorises each product and tool detailed in Section 3 considering how they can be more helpful for PEAKapp, detailing which PEAKapp component and/or requirements can satisfy. Finally, Section 5 provides a rough assessment of energy savings potentials of consumer information oriented ICT solutions is carried out to demonstrate their relevance for the EU energy targets.

Table of Contents

1 General Information of the Deliverable

Table 1: D1.1 General Information

Title	Report on findings of the multidisciplinary meta study of success indicators.
Description	This deliverable summarizes the findings of existing projects related to PEAKapp's objectives and reports them. It will serve as a reference for the developments and implementation of functionalities in Task 1.2.
Deadline	M5 - July, 2016
Leader	Tecnalia
Partners Involved	EI-JKU (1), IJS (0.5), Tecnalia (1), GreenPocket (0.5), ENAMO (0.5), ELDER (1), RTDS (1), DTU (0.5), BED (0.5)
Steps covered	All

2 Introduction

Before the smart meter roll-out was decided, European households were informed about their electricity consumption once per year. Considering that feedback about the implications of an individual's behaviour is one of the major preconditions for changing his or her behaviour (Stem 2000), the almost complete disconnection of consumption behaviour and feedback (i.e. consumption information) the disconnection between consumption behaviour and feedback might impair households in their adoption of energy conservation behaviour.

As a first step to overcome this problem, Directives 2009/72/EC and 2009/73/EC, and Directive 2012/27/EC ask for almost complete availability of smart electricity meters on all household sites until 2020 (i.e. most EU countries will roll-out smart meters for more than 80% of their households). Smart meters collect the electricity consumption of households in a high frequency (i.e. quarterly values) and transmit these figures to the responsible hub. The granular consumption data may then be forwarded to the consumers, which can be exploited to motivate them to save energy by better understanding the impact of their behaviour and related financial benefits (Boucher et al. 2012).

Forwarding consumption data only may be of low effectiveness as consumers will often be asked too much when left alone with interpreting load curves and deriving conclusions for improving their energy efficiency. Additionally, people usually know the number of devices they own and often also the primary generation source of the electricity they use, but have only low understanding of the energy consumption related to these devices (Boucher et al. 2012). However, with the ascent of smart phones and mobile internet connections, software apps may provide a qualified platform for triggering energy efficiency through exploiting energy consumption data from smart meters in a motivating and incentivizing way. Penetration rates of tablets and smart phones are promising and allow using these as a platform for forwarding energy consumption related information to households. As such, (Holland and Koch 2014) estimate that 92% of the Germans use their smart phone every day and 36% are surfing the net on their device. In addition, usage of apps has dramatically increased from 2008 (500) to 2014 (850.000). While Germany may be above the EU average, considering that the smart meter roll-out is not completed before 2020, smart phones will likely qualify in all member states. Altogether, exploiting smart phones and tablets as one-stop platform for the provision of related information to households suggests itself, and respective apps may combine energy consumption information with playful elements and further motivational mechanism like the comparison with other consumers (connect user, work as a team) to trigger lasting behavioural change**Fehler! Textmarke nicht definiert.**. We henceforth refer to such apps as consumer information oriented ICT systems.

The European Commission has repeatedly addressed energy savings through ICT, for example in the Impact Assessment for the Energy Efficiency Plan 2011 (European Commission 2011) and the Evaluation of the Energy Behavioural Change Programmes (BEHAVE) (European Commission 2009). These references derive that three conditions are required to trigger lasting behavioural change that results in countable energy savings, which are

1. a high level of information and communication,
2. the provision of economic incentives,
3. and a supporting administrative framework, such as regulated static vs. dynamic energy prices.

The first of these conditions is the core mechanism addressed through consumer information oriented ICT systems. The second channel for triggering energy consumption savings in households also relies on ICT, e.g. by providing households flexible tariffs incentivizing load shifting towards times of high production from renewable sources. Dynamic energy tariffs are not primarily designed to save energy but mainly to use the energy at specific times. However, field trials have shown that the catch-up effect is significantly lower than 100%, which means load-shifting will likely create energy savings in addition and we discuss such savings in Section 5.

Therefore, policy makers have repeatedly identified such consumer information oriented ICT systems as promising option for triggering lasting behavioural change with respect to the energy conservation behaviour of households. The European Commission has highlighted the importance of making use of ICT, most notably in its recommendation of 09.10.2009 on mobilising Information and Communications Technologies to facilitate the

transition to an energy-efficient, low-carbon economy (Commission of the European Communities 2009). Auxiliary in this context is also the requirement of the Directive 2012/27/EU (European Parliament 2012) for electricity companies to strive for additional sources of revenue besides selling electricity and generate innovative solutions and business concepts. The Directive points out that the EU member states shall enable the following points:

- access to demand response for small-scale, end-use consumers (Art. 45)
- the shifting of the load from peak to off-peak times by final customers taking into account the availability of renewable energy, energy from cogeneration and distributed generation (Annex XI, (2a) Directive 2012/27/EU)
- retail energy sales companies to inform their customers in a clear and understandable manner […] and provide advice on available energy efficiency measures and benchmark profiles for their energy consumption (Annex VII, (1.3) Directive 2012/27/EU)
- dynamic pricing for demand response measures by final customers (Art.45)

Dynamic pricing can motivate the consumer to participate in the electricity market and to gain economic savings. In times with high production and excess amount of electricity there is a low price level which can be utilized by the household if there is enough information provided and the management connection is working (Boucher et al. 2012). An ICT system can provide such information for the consumers. Consequently an ICT system can support an energy efficient lifestyle of European citizens - not only to conserve energy, but also to shift loads towards times of increased production from renewable resources; thus enabling households to benefit from the price volatility on electricity spot markets. According to (Breukers and Mourik 2013) are other motivating factors for consumer's health, comfort and environmental goals, which can be achieved by shifting their energy consumption. A very important factor which should be concerned is the privacy issue of the data. The app should support the consumer in daily concerns and have a low usage barrier and risk factor for the personal data (Buck and Eymann 2013).

However, despite the promising facts about consumer information oriented ICT systems, empiric evidence on their effectiveness is sparse. Furthermore, the authors are not aware of an available tool or app addressing all of the above features. To support the development of such an ICT system it is important to define the state of knowledge with respect to existing consumer information oriented ICT systems, their functionalities, and – if available – their effectiveness and the consumer acceptance thereof. This article summarizes experiences from existing solutions, tries to separate best practice examples from less successful implementations, and derives success criteria for the next generation of respective ICT systems.

2.1 Procedure

This document contains the process and the information needed to develop the deliverable D1.1 according to Task 1.1. The planning defined for completing D1.1 is as follows:

Date	Process to develop D1.1	Partners involved
30/04/2016	Step 1 – Prepare a template and planning	Tecnalia
13/05/2016	Step 2 – Provide inputs following the template (2-3 projects/products per partner)	All T1.1 partners
20/05/2016	Step 3 – Release first draft	Tecnalia
31/05/2016	Step 4 – Prioritize the know-how based on PEAKapp needs to be used in next tasks	All T1.1 partners
15/06/2016	Step 5 – Release second draft	Tecnalia
30/06/2016	Step 6 – Send final comments to second draft	All T1.1 partners
08/07/2016	Step 7 – Release pre-final version of internal review	Tecnalia
15/07/2016	Step 8 – Receive comments from internal review	Reviewers
22/07/2016	Step 9 – Release final version	Tecnalia

In order to collect the required information relevant for PEAKapp, we have developed a template (see Table 2) to be used by the partners involved in this deliverable to gather information related to the products/tools to be analysed in the PEAKapp context. Partners of the PEAKapp consortium, including the electricity retailers, have been involved in a variety of research projects dealing with the provision of information to households in terms of consumption patterns and the enhancement of households' energy efficiency, as well as customer engagement. Deliverable D1.1 will collect the experience and knowledge of tools/products which influence energy consumption behaviour as well as lifestyle choices and products outside of the "energy world" which successfully achieved sustainable changes in consumers' behaviour.

Thus, the "Area" section of this template is defined as follows:

- **Energy consumption behaviour**: these are products/tools that give information about user consumption to both consumer and utility regarding the energy (consumption, cost, forecast, efficiency, etc.).
- **Lifestyle choices**: these are products/tools that educate consumers in the usage of energy by providing recommendations in order to save energy and reduce cost in a more efficient way.
- **Outside of the energy world**, which successfully achieved sustainable changes in consumers' behaviour: these are products/tools have been applied to contexts different to the energy domain in order to achieve sustainable changes in user´s behaviour.

Table 2: Tools and Products Information Template

ID #:	**Product Name:**
Area: ☐ Energy consumption behaviour ☐ Lifestyle choices ☐ Outside of the energy world achieving sustainable changes in consumer behaviour	
Current Status: ☐ Ongoing (when is planned to finish it?) ☐ Completed	
Description (including technical aspects):	
Related project (name, programme, call, if applicable):	
Target end-users (retailers, consumers, building managers, …):	
Platform addressed (web-based, android, IOS, …):	
TRL[1]**:**	
Licensing and IPR (Put special focus on owned products and tools):	
Benefits for PEAKapp (identify in WP task this product can be (re)-used):	
Other aspects: • Supported language: English … • Easy-to-extend with new functionalities: Yes/No • API: Yes/No • URL with more details: http:// - www.	

[1] http://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-g-trl_en.pdf

3 Description of existing ICT-solutions for energy efficiency in households

This section provides a clustering of the existing ICT-solutions for energy efficiency in households collected by the consortium. We have selected only tools that were implemented in the last 5 years and were, at least, one partner from the consortium was involved. We have also selected projects based on the availability of respective information. The clustering follows the categorization described in previous section: ***3.1 Energy consumption behaviour, 3.2 Lifestyle choices and 3.3 Outside of the energy world***. This section provides a summary of those ICT-solutions based on the template-based descriptions included in Annex 1, where a link to more detailed documents and/or websites is provided. The below mentioned ICT-solutions were selected from a bride range of examples of applications by implementation state and available respective information.

3.1 Energy consumption behaviour

3.1.1 2020 Energy (#1)

The **serious game** 2020 Energy available in the iTunes store and via website was designed within the framework of ENERGY-BITS [2]a European cross-media awareness programme for teenagers (14-17 years old) financed by Intelligent Energy Europe. The serious game introduces energy issues with a sustainable development message in a fun way through 9 interactive missions. It can be used as an introduction to the notion of sustainable development or to assess the acquired skills at the end of a school programme. This serious game addresses the following concepts:

- Introduce the concept of sustainable development and the associated vocabulary: economical, social, environmental, equitable, liveable, bearable, and sustainable.
- Raise awareness to the reduction of energy consumption, improvement of energy efficiency and promotion of renewable energies.
- Get aware of the issues at the individual, local and global levels.

With a fun approach, different issues related to mastering our energy and renewable energies are addressed through:

- The responsibility and impact of our actions on the planet and society.
- The temporal dimension of our actions and their consequences in the long run.
- The links between the individual, local and global scale of the issues.

This serious game is focused on educating teenagers about an efficient energy behaviour at general level and not at households and is still online available[3].

3.1.2 Energy-Consumption-Analyzer for Android (ECAS) (#4)

This freeware **Android application** records the entered consumption data of an arbitrary number of consumption meters in a household. After the installation the service is provided without internet connection. Thereby the entered data of the energy consumption from gas, water, heat and electricity can be noted separate or as a sum. Because the consumption meters can also run in the opposite direction the data from electricity production from PV or heat production from heat pump as well as all consumption of the aforementioned energy carriers and water can be stored. To compare the production of PV or the energy consumption with weather conditions the system can be connected to sensors for wind, radiation or temperature. The average energy consumption per hour, day, week or month are visualized over the time in graphs and curves. The app can also calculate sums of money instead of

[2] European Commission (2011); [online] https://ec.europa.eu/energy/intelligent/projects/en/projects/e-bits [28/06/2016]
[3] Energy-Bits, Intelligent Energy Europe (European Commission) (2013); [online] http://www.2020energy.eu/en [28/06/2016]

values of energy consumption. Therefore it is necessary to enter a lot of information for costs per unit, overhead per year, currency of the calculation and the unit of the consumption. All the data will be stored and there is access to a backup via the app. Data for or from Microsoft Excel can be imported or exported as CSV data. With this app it is achievable to analyse the consumption data and react in the future. So far there are more than 100.000 installations of the app from the Google store but mainly in Germany. Through this app it is possible to record different consumption data which seems very useful for consumers. Furthermore there is a very good feedback obvious at Google store and a continuous optimization process from Christoph Zens going on.[4]

3.1.3 Wiser2 (#5)

The **Wiser2 application** from Schneider Electric (Australia) is the connection to a Wiser2 Home Control System in households. Thereby it is possible to connect with the system through the mobile network or via the home wireless access point to the TV, PC or smart phone and tablet. The system can record and control lighting, security, climate, entertainment as well as energy and camera monitoring automatically. For instance this application makes it possible to have control of the lights on the home automation relays by the smart phone and offers access to timers to turn the light automatically off. The easy understandable application is high developed and so far there are more than 1.000 previous installations and it is currently available at the app store.[5]

3.1.4 Energy Expert Engine-EEE (#6)

Centerpiece of the GreenPocket software solutions, the highly flexible **Energy Expert Engine application** summarizes analyses and visualizes the smart meter data on a PC, tablet or smart phone. The multi-compatible interface enables the connection with a range of AMR and EDM systems, customer databases and billing systems. Digital energy consumption data is initially prepared in the EEE. Additional data, such as environmental indicators, are subsequently included in the calculations and are supported by the Data Collector and a Data Warehouse. Datasets are linked and interpreted in line with the requirements of energy consumers on the basis of algorithms and heuristics. The now 'intelligent' data serves as a basis for forecast, alert and control functions. For energy consumers, this creates valuable detailed information on their personal energy requirements. The Energy Expert Engine has been designed with an intelligent plugin system of cartridges. Customers for the GreenPocket products are companies which are interested in flexible and modular solutions for the visualizing and analysing of the data from smart meters in households.[6]

3.1.5 Live-ticker APP for energy efficiency (#9)

Regarding realization of the German federal government objective to reduce energy usage (in 2008) by 25% until 2050, the **StromTicker Berlin app** for energy efficiency creates awareness and transparency regarding to the current feed-in situation in Berlin. A live view of the current electricity in Berlin as well as imports from surrounding areas, current load and load peaks are core features of the app. Displaying individual electrical substations in Berlin and a display of individual districts of Berlin including separate pictures, rounds up the functionalities of the Live-ticker APP for energy efficiency. The app is currently available at the store and shows data from January 2012 until now and so far there are more than 500 previous installations. The target end users of this application are primarily citizen of Berlin.[7]

3.1.6 EDF APP for Olympic Games 2012 (#10)

The **EDF app** for Olympic Games in 2012 was elaborated for the usage of residential customers during the Olympic Games in London 2012. The app initiates playful competition to raise the environmental consciousness via comparison with neighbours, several rankings and badges. The users gain insight in Energy consumption in kWh and energy costs, previous consumption of the current day and forecast for the period up to the end of the day.

[4] ECAS Netzheim (2016); [online] http://ecas.netzheimat.at/ [28/06/2016]
[5] Wiserhomeautomation (2016); [online] http://www.wiserhomeautomation.com/ [28/06/2016]
[6] GreenPocket (2014); [online] http://www.greenpocket.de/en/products/greenpocket-solution/ [28/06/2016]
[7] Stromnetz Berlin (2016); [online] http://www.stromnetz.berlin/de/stromticker.htm [28/06/2016]

The energy consumption is converted into carbon dioxide emission. The environment comparison includes two analyses: the environmental impact compared to UK average and the environmental savings compared to eDF average. The second part of the representation points out the difference and tells the user how much he has protected the environment. The user is also able to view a comparison of his own consumption with other households and a ranking that compares him with all other app user. Additionally news is published here for the user.
Technical architecture for this solution is GP's Energy Expert Engine (EEE). For technical description on data storing, data monitoring etc. please see Annex2 GreenPocket Additional Information. This product as frontend solution only works together with GP's backend system, the Energy Expert Engine (EEE).

3.2 Lifestyle choices

3.2.1 Power House (#2)

Power House, initially developed at Stanford University by Byron Reeves and was funded by the ARPAe Program in the Department of Energy, is an **online game** that connects home smart meters to a game that is grounded in real world social networks. Player energy use is tracked via personal accounts with local energy providers. This information is then inputted into the game environment, where it influences the player's in-game abilities, and has consequences for player options, rewards, and reputation. Real world energy behaviours produce particular in-game advantages and disadvantages, transforming otherwise dull and distant information into feedback that is palatable, timely and relevant. The Dashboard functions as the main informational display for players, allowing players to view a graph of the last 24 hours of their home energy data, as well as compare the current consumption level to saved historical data. Unlike common UIs, the Power House Dashboard also contains a full summary of the player's in-game status. The game is currently online available but just for costumers of the Pacific Gas and Electric Company (San Francisco) which provides the data from the smart meters (Reeves et al. 2012).

3.2.2 Energy Chickens (#3)

The virtual pet game "Energy Chickens" developed by the StudioLab of the Penn State University is available via an Internet browser. The game shows the consumers' actual energy consumption habits through a flock of chickens where each chicken expresses an appliance in the office or shared space of the consumer. The image of the chickens shows information about the present stage of energy consumption of the appliances. As more energy is consumed, chickens begin to get smaller, turn green, and become sick and lethargic. There are 3 growing/sick stages or "levels" and the size and health of the chicken determines the number of eggs that it will lay. The energy consumption data of the appliances are collected through sensors and are disposable through an online server. The game is still online available (Penn State University 2016) (Orland et al. 2014)[8].

3.2.3 Energy management for residential customers V2.0 (PEAKapp 1.0) (#7)

The **energy management web portal** for residential customers V2.0 is a first step in order to save energy and money and enables to understand how much energy is used and what its costs are. The dashboard summarizes the most important key figures. The monthly balance helps estimating the cost ratio across all divisions and meters (production included). Thanks to reliable forecasts in the Cost-Check and in the Consumption-Check, based on individual instalment payments of the user, he always stays up to date and can increase his financial security in planning. Intuitive processes and a user-friendly interface, packed in an attractive design, create a unique user experience. Technical architecture for this solution is GP's Energy Expert Engine (EEE). For technical description on data storing, data monitoring, etc.

[8] PennState StudioLab (2016); [online] http://studiolab.psu.edu/projects/energy-behavior-change [28/06/2006]

- Optimizing energy consumption; saving costs: Other functions, like the Budget Manager or the Energy Usage Check, support optimization of individual energy consumption behaviour. The Budget Manager informs energy consumers in good time if a previously determined cost limit is likely to be exceeded at the end of the month. The Energy Usage Check shows possible saving potential in the household.
- Illustrating energy records; Protecting the environment: Environmental analogies help energy consumers to better assess their energy usage with the aid of known benchmark values. For example, the CO2 output generated by energy consumption is set in relation to the number of kilometres for a car journey. Similarly, personal water usage is compared with the daily requirement of drinking water per person.

3.2.4 APP for residential customers (#8)

High usability and a convincing design ensure energy consumption attracts the attention of energy consumers. With the aid of intuitive gesture control (multi-touch), this **app** through live load cycles and forecasts of personal energy consumption can be navigated quickly and easily through a range of different displays. A trigger function facilitates the convenient selection of vertical and horizontal tables and diagrams. In addition to mobile use on the road, the apps and display solutions also lend themselves for direct visualization of energy consumption data in individual households. Due to its handy size and easy operation, a smart phone offers an ideal home display. Data is transported either via a web server connection or via WLAN. Technical architecture for this solution is GP's Energy Expert Engine (EEE).

3.2.5 Social Metering APP (#12)

GreenPocket is the first company worldwide to develop an **application** that links smart metering to the social web through Facebook integration. With Push-messages and contests this "social metering" app motivates the users to reduce their energy consumption and increase their CO_2 efficiency in the long run using competition with friends and virtual badges and achievements. Technical architecture is GP's Energy Expert Engine (EEE).

- Joining the contest; Competing with friends: The consumers can share their energy saving experiences with other users and prove their energy efficiency in weekly contests against their friends. The whole contest is based on a straightforward points system evolving around energy saving and environmental awareness.
- Collecting virtual badges; Sharing achievements: As a further incentive, exceptional accomplishments are rewarded with virtual "badges". Users receive such a badge for taking part in specific activities, achieving their goals or for personal energy saving efforts. All gained badges can be posted in the newsfeed on the user's personal facebook page.
- Customer Engagement; New marketing channels: Combining Smart Metering and the Social Web open up completely new marketing and communications channels. Utility companies can link the virtual badges to real benefits, e.g. tickets to a sports event or concert. Such campaigns do not only increase customer retention but also lead to greater brand awareness.

3.3 Outside the energy world

3.3.1 BUSMOD (#11)

In BUSMOD 5th EU RTD FP project a business modelling **methodology and application** was developed for studying the business feasibility and analysing each electric market's stakeholder benefits calculation in a broad range of market conditions. The BusMod business modelling approach was developed and extensively tested with precisely purpose in mind. This approach:

- Explained the business model of the entire value network in just a few pictures,
- Gave a complete checklist for DG/DER business models;
- Offered easy-to-use steps and worksheets to create and assess business models,
- Allowed to identify what precisely is the market offering, and which actors are involved,
- Helped to identify the goals, and who 'own' these,

- Model how do the actors create and exchange value and how can they act to make a profit,
- Lead to make estimations on cash flow, operational and ICT expenses, and investments,
- Consider what-if analysis: e.g., what is the impact of existing or emerging regulation on business model.

3.3.2 PLAYHIST: Enhancing visitor experience in history learning by using gamification technology combined with 3D avatars (#13)

The goal of the game PLAYHIST experiment is to enhance visitor experience in history learning by using gamification technology combined with 3D avatars. This was done by developing a **3D interactive and collaborative serious game** that will take advantage of the documentation, exhibitions and 3D content already developed at the Foundation for the Hellenic World and the technological features provided by the EXPERIMEDIA facility (University of Southampton IT Innovation Centre) as the 3DCC module for avatar creation. Visitors are proposed with a mission or set of tasks that must be developed to achieve a specific goal, in an engaging and collaborative experience enhancing the learning process and therefore achieving a better historical knowledge. The PLAYHIST experiment supports the view that educational serious games fit into the constructivist concept of learning, as they allow participants to be actively engaged in the learning process, while conceptualizing knowledge from the perspective of their own experiences. To examine the game it was presented at the FHW Hellenic Cosmos venue in Tavros, Greece 2014. Ever since this experiment there are no dispatches available in the internet. [9]

4 Identification of success indicators of existing solutions

All the products and tools collected in Section 3 can be helpful for PEAKapp in two ways:

1. **Reuse and extend it** because it only fulfils a partial set of criteria for PEAKapp solution.
2. **As inspiration** for the PEAKapp solution design.

It is clear that the IPR and licensing will be a critical aspect to decide how we can use those products and tools.

- In the owned IPR by project partners, we can reuse it, reuse and extend it or use as inspiration.
- In the non-owned IPR by project partners, we have to go for inspiration (option 2).

Taking into account these criteria, we have categorized each product and tool considering how they can be more helpful for PEAKapp, detailing which PEAKapp component and/or requirements can satisfy.

4.1 Energy consumption behaviour

4.1.1 2020 Energy (#1)

Benefits for PEAKapp: This serious game is focused on educating teenagers about efficient energy behaviour at general level and not at households. This is out of scope of PEAKapp so we cannot reuse this ICT-solution.

4.1.2 Energy-Consumption-Analyzer (#4)

Benefits for PEAKapp: There are previous installations from Google store (around 100.000-500.000) but mainly in Germany. The first steps requires to enter a lot of information and continuous meter reading inputs from the user before consumption data can be displayed., implying a high effort for the consumer. However, the software that generates average energy consumption data per hour/day/month can be input for the data collection process design in WP1. Besides, consumption data monitoring through graphs and zooming in the graphs to obtain detailed information about the consumption seems very useful for consumers.

[9] Experimedia (2016); [online] http://www.experimedia.eu/2014/02/25/playhist/ [28/06/2016]

4.1.3 Wiser2 (#5)

Benefits for PEAKapp: This app requires having Schneider appliances so it is a proprietary application and it is not feasible to be used in PEAKapp.

4.1.4 Energy Expert Engine-EEE (#6)

Benefits for PEAKapp: The EEE is a backend system and will be central part of PEAKapp. The main features supported are:

- Long term storing of historical data.
- Data and gap control (data monitoring).
- Algorithms and calculation (forecast, comparison with own average and previous period, differences etc.).
- Notifications and Emailing.

The whole product, including technical and content ideas, conceptualization as well as software development, installation, customizing and redistribution of the GP solution is Intellectual Property of GP. Any contribution of this GP product for all tasks and work packages results in IPR for GP on the elaborated PEAKapp solution using this GP product as basis.

4.1.5 Live-ticker APP for energy efficiency (#9)

Benefits for PEAKapp: This product as frontend solution only works together with GP's backend system, the Energy Expert Engine (EEE). The main features supported are:

- Cloud-based-APP (data retrieval via web service).
- Current electricity generation data for city and specific regions.
- Electricity import data.
- Load and load peaks.
- Current grid load, substations and interconnection points (map presentation).

The whole product, including technical and content ideas, conceptualization as well as software development, installation, customizing and redistribution of the GP solution is Intellectual Property of GP. Any contribution of this GP product for all tasks and work packages results in IPR for GP on the elaborated PEAKapp solution using this GP product as basis.

4.1.6 EDF APP for Olympic Games 2012 (#10)

Benefits for PEAKapp: The main objective is to use playful competition to raise the environmental consciousness. This app can be reused as inspiration for the WP1. Here is an analysis of game dynamics, mechanics and elements included:

- **Dynamics** *(Reiss)* Saving, Social contact, Status.
- **Mechanics** *(Radoff)*: Collecting, Gaining recognition for achievements, Gathering knowledge.
- **Game elements** *(Manrique)*: Achievements, Leaderboards, PvP, Progress Hud.

4.2 Lifestyle choices

4.2.1 Power House (#2)

Benefits for PEAKapp: Tracking solutions of the household's energy consumption data can give broader aspects to electricity companies for the requirements to host ICT-to-Human ecosystem. This online game can be reused as inspiration for the WP1. Here is an analysis of game dynamics, mechanics and elements included:

- **Dynamics** *(Reiss)***:** Curiosity, Independence, Saving, Social contact, Status.

- **Mechanics** *(Radoff)*: Recognizing patterns, Collecting, Gaining recognition for achievements, Gathering knowledge.
- **Game elements** *(Manrique)*: Rewards, Trading system, Virtual credits, Avatar, Chat, Teams/party, Achievements, Leaderboards, PvP, Progress Hud, Quest.

4.2.2 Energy Chickens (#3)

Benefits for PEAKapp: Tracking solutions of the household's energy consumption data can give broader aspects to electricity companies for the requirements to host ICT-to-Human ecosystem. This online game can be reused as inspiration for the WP1. Here is an analysis of game dynamics, mechanics and elements included:

- **Dynamics** *(Reiss)***:** Curiosity, Independence, Saving, Status.
- **Mechanics** *(Radoff)*: Recognizing patterns, Collecting, Gaining recognition for achievements, Gathering knowledge.
- **Game elements** *(Manrique)*: Levels, Currency, Equipment, Progress Hud, World, Rankings.

Collecting points for less energy consumption seems to be the only feature can be applicable for PEAKapp system.

4.2.3 Energy management for residential customers V2.0 (PEAKapp 1.0) (#7)

Benefits for PEAKapp: This product as frontend solution only works together with GP's backend system, the Energy Expert Engine (EEE). The features provided are:

- Implementation possible as: EEE-based solution
- Cloud-based solution
- Local APP-Solution
- Analysis of consumption and costs
- Analysis of generation and revenues
- Monthly cost balance
- Cost Check: calculation of expected credit/debit
- Consumption Check
- CO2 balance
- Energy saving tips

The whole product, including technical and content ideas, conceptualization as well as software development, installation, customizing and redistribution of the GP solution is Intellectual Property of GP. Any contribution of this GP product for all tasks and work packages results in IPR for GP on the elaborated PEAKapp solution using this GP product as basis.

4.2.4 APP for residential customers (#8)

Benefits for PEAKapp: This product as frontend solution only works together with GP's backend system, the Energy Expert Engine (EEE). The features provided are:

- iOS and Android APP
- Analysis of consumption and costs
- Analysis of generation and revenues
- Consumption forecast and comparisons
- Monthly cost balance and comparison with similar households
- Energy saving tips

The whole product, including technical and content ideas, conceptualization as well as software development, installation, customizing and redistribution of the GP solution is Intellectual Property of GP. Any contribution of this GP product for all tasks and work packages results in IPR for GP on the elaborated PEAKapp solution using this GP product as basis.

4.2.5 Social Metering APP (#12)

Benefits for PEAKapp: This product as frontend solution only works together with GP's backend system, the Energy Expert Engine (EEE). The features provided are:

- Local App solution
- Comparison with similar households
- Sharing with social media
- Weekly contests among friends
- Energy saving competition and rankings
- Transparency and community actions
- Incentive through linking to partner apps
- Messages via push notification
- Sharing carbon footprint on social media

The whole product, including technical and content ideas, conceptualization as well as software development, installation, customizing and redistribution of the GP solution is Intellectual Property of GP. Any contribution of this GP product for all tasks and work packages results in IPR for GP on the elaborated PEAKapp solution using this GP product as basis.

4.3 Outside the energy world

4.3.1 BUSMOD (#11)

Benefits for PEAKapp: Business modelling methodology was developed for studying the business feasibility and analysing each electric market's stakeholder benefits calculation in a broad range of market conditions. The economic concept of the app may attract the attention of end users, who want to see the economic impacts of their decisions thus, the app be taken into consideration in that context. This app can be reused as inspiration for the WP4 and WP5, mainly in tasks 4.2., 4.4., and 5.4.

4.3.2 PLAYHIST: Enhancing visitor experience in history learning by using gamification technology combined with 3D avatars (#12)

Benefits for PEAKapp: Even though the concept and the gaming of the app are completely different from the PEAKApp concepts, the expertise gained through this app may be valuable as inspiration for the WP1. Here is an analysis of game dynamics, mechanics and elements included:

- **Dynamics** *(Reiss)***:** Order, Time-limit, Stuff-limit.
- **Mechanics** *(Radoff)*: Recognizing patterns, Creating order, Competition, Collecting, Mastering a skill.
- **Game elements** *(Manrique)*: World, Tutorial, Quest, Avatar, Customization, Economy Points, Ranking, Mini-games, Levels, Progress Hud, Punishment.

5 Potentials

In this chapter a rough assessment of energy savings potentials of consumer information oriented ICT solutions is carried out to demonstrate their relevance for the EU energy targets. In the recent past the European Commission has repeatedly addressed such savings potentials through ICT, for example in the Impact Assessment for the Energy Efficiency Plan 2011 (European Commission 2011) and the Evaluation of the Energy Behavioural Change Programmes (BEHAVE) (European Commission 2009). In addition to these European sources, the American Council for an Energy-Efficient-Economy (ACEEE) has prepared an assessment of ICT related energy savings potentials in 2009 (Laitner and Ehrhardt-Martinez 2009).

According to the above papers, consumer information oriented ICT systems can trigger energy savings through four distinct channels: **1)** purely behavioural based measures like frequent defrosting of the deep freezer, **2**) appliance-based savings such as the replacement of inefficient white goods, and 3**)** tariff-induced consumption reduction along with shifting loads from primarily GHG-intensive energy production to times of high renewable production (and therefore increasing the systemic efficiency of the EU energy system), and **4)** through boosting the attractiveness and thus the efficacy of energy consumption related functionalities of home automation systems.

The 1st category, behavioural efficiency improvements, takes into account the changes of household consumption patterns, but not those energy savings through the acquisition of new and highly efficient appliances. Examples thereof are turning off the lights when leaving a room, better exploitation of the capacities of appliances like washings machines or dish washers, and even reconsidering the inalienability of planned purchases with respect to energy consuming equipment. The potential of this category is judged by experts to be 4% on average in the entire EU (Panek 2013).

Higher savings potentials are realisable through the 2nd category, the replacement of inefficient appliances by highly efficient appliances. Conservative estimates expect that households' energy efficiency can be enhanced by 9.9% on average, while the European Commission Decision C (2015)2453 considers up to 20% achievable savings as sum of behavioural change and energy efficient appliances.

The potentials through the 3rd category are primarily addressing a reduction of CO2-based energy production by shifting of electric loads to periods with high renewable generation and lower peak demand. This enables systemic energy efficiency to be improved, and more importantly decreases the associated greenhouse gas emissions significantly. Load shifts of 10% of annual energy demand are assumed (Panek 2013) for the formulation of the subsequent savings potentials and it is assumed that every kWh consumed during these periods has 25% of the CO2-based energy compared to an average kWh of electricity.

As discussed in the introductory section in addition to load shifting, dynamic tariffs may also decrease the electricity consumption in total. The only two quantitatively assessed large-scale field tests (Stromback et al. 2011) (Hillemacher et al. 2013) of (semi-)dynamic tariffs (static time zones tariffs, no load dependent variation) showed that households saved additional 2.5% and 2.6% (in Ireland and Austria) of their baseline energy consumption. However, the tariff information for this field tests was only displayed through green and red stickers on the refrigerators indication low priced and high priced time zones. It is therefore reasonable to assume at least 2.5% additional savings through advanced ICT solution, as these allow for much more flexibility in pricing and respective consumer information.

Home automation systems (the 4th category) are usually designed with the primary target of increasing the household's comfort level. Functionalities frequently address, say, the automatic adjustment of sun blinds to the intensity of solar radiation, or the combined dimming of lights, playing of preselected music tracks and control of other ambient related equipment through one click in the respective app. However, home automation system can effectively support the energy efficiency of a building through e.g. by controlling the heating system, or by synchronizing the electricity consumption with photovoltaic production. Nevertheless, as comfort usually is the primary motivation for installing home automation, energy savings potentials may lag behind. A combination of home automation systems and a consumer information oriented ICT system, at best as a one-stop app, which adds fun, peer-interaction and monetary incentives to the home automation can boost energy savings through more frequent and comprehensive utilization. Empiric evidence of this effect is low[10], and we assume additional energy savings potentials through boosting the efficacy of home automation system to no higher than 2%. However, considering the lack of additional sources and the still low penetration rates of home automation systems, we do not include estimates of energy savings to this last category of motivational channels.

[10] Estimate is based upon the field test results reported in the projects "Smart Grids Modellregion Salzburg - Consumer to Grid" (http://tinyurl.com/pwtr7rb 15.06.2016), "Nachhaltiger Energiekonsum von Haushalten durch intelligente Zähler-, Kommunikations- und Tarifsysteme" (http://tinyurl.com/nptsa29 15.06.2016), and http://tinyurl.com/oeo2w9l 15.06.2016.

To perform a quantification of expected savings, we worked with an adapted version of the US International Performance Measurement & Verification Protocol (IPMVP) as recommended in the European Commission Energy Efficiency FAQ document (European Commission 2015) advising about the methodologies for quantifying ICT related energy efficiency gains. With respect to energy consumption per country/dwelling and statistics about the EU Building stock baselines are built from Eurostat data. Data from the year 2012 was used for all variables for reasons of comparability. A static baseline development was applied for these variables, considering the potentially impactful assumptions required for building dynamic baselines (see e.g. Reichl and Kollmann 2010). Climate variables and autonomous technological progress were assumed constant. Energy prices were set to 2014 levels, as most recent year in related EU statistics. For every country the national energy mix factor of electricity production was used for translating the energetic savings into GHG reductions.

The results of the quantification of the saving targets of an ICT system to all European households and all energy carriers are summarized in Table 3.

Table 3: Applying the relative reductions targets of an ICT system to all European households results in large energy (primary energy including saved non-electricity energy carriers), monetary, and GHG emissions savings.

Savings along three dimensions	Behavioural actions	Appliance based	Loadshifts
Primary Energy Savings [in TWH]	33.89	88.30	21.18
Monetary Savings to Households [in bn. €]	6.32	15.62	3.79
Reduction of GHG Emissions [in mio. to/CO_2]	20.89	56.22	50.00

Table 4: Consumer information oriented ICT: Energy savings potentials of European households from 1. behavioural, 2. appliance based, and 3. loadshifting induced savings.

Energy savings obj. through efficiency and load shifting		Electricity Demand Reduction & Loadshifts [in kWh per household p.a.]			Electricity Bill Reductions due to efficiency gains and loadshifts/Demand response [in € per household p.a.]				GHG emissions reduced due to efficiency gains and loadshifts per household [in kg CO2e p.a.]		
Country[11]	Primary* energy savings per hh.	Efficiency Behavioural	Efficiency. Appliances	Electricity shifted	Efficiency Behavioural	Efficiency. Appliances	Savings from DR/Loadshift	∑ Savings Loadshift & efficiency	Efficiency improvements[4]	GHG reduced by Loadshift	∑ GHG reduction
Austria	17,9%	193	549	482	€ 39	€ 111	€ 24	€ 175	230	138	368
Belgium	16,2%	157	380	391	€ 35	€ 84	€ 22	€ 141	216	148	363
Bulgaria	16,3%	112	275	281	€ 11	€ 26	€ 7	€ 44	351	248	599
Cyprus	22,0%	228	885	571	€ 38	€ 145	€ 23	€ 206	1135	568	1703
Czech Rep.	21,6%	128	482	319	€ 19	€ 72	€ 12	€ 104	489	248	738
Denmark	16,0%	149	354	373	€ 44	€ 105	€ 28	€ 177	383	274	657
Estonia	14,6%	120	243	300	€ 13	€ 27	€ 8	€ 49	579	471	1051
Finland	16,1%	320	767	799	€ 50	€ 120	€ 31	€ 201	454	314	768
France	14,8%	202	420	506	€ 29	€ 61	€ 18	€ 109	91	62	152
Germany	17,4%	140	380	349	€ 37	€ 102	€ 23	€ 162	367	238	605
Greece	17,9%	158	450	395	€ 22	€ 64	€ 14	€ 100	710	451	1161
Hungary	16,5%	99	247	247	€ 16	€ 40	€ 10	€ 66	234	161	396
Ireland	16,7%	117	298	292	€ 27	€ 68	€ 17	€ 111	360	247	607
Italy	14,5%	108	215	269	€ 25	€ 49	€ 15	€ 90	228	184	412
Latvia	15,5%	68	153	170	€ 9	€ 21	€ 6	€ 36	125	92	217
Lithuania	15,3%	81	178	202	€ 10	€ 23	€ 6	€ 39	45	30	75
Luxembourg	16,4%	180	446	450	€ 31	€ 76	€ 19	€ 126	n.a.	n.a.	n.a.
Malta	16,2%	176	426	439	n.a.	n.a	n.a.	n.a.	n.a.	n.a.	n.a.
Netherlands	16,2%	141	342	352	€ 27	€ 65	€ 17	€ 108	345	244	589
Poland	16,2%	85	206	213	€ 13	€ 32	€ 8	€ 53	346	247	593
Portugal	19,3%	88	281	219	€ 18	€ 58	€ 11	€ 87	276	159	436
Romania	15,4%	58	129	144	€ 6	€ 14	€ 4	€ 24	202	153	355
Slovakia	17,2%	107	287	268	€ 18	€ 49	€ 12	€ 79	139	88	227
Slovenia	18,3%	159	470	398	€ 25	€ 72	€ 15	€ 112	379	230	609
Spain	16,3%	120	293	299	€ 27	€ 67	€ 17	€ 111	263	184	447
Sweden	16,3%	345	845	863	€ 72	€ 176	€ 45	€ 293	94	47	141
UK	16,8%	169	436	423	€ 30	€ 78	€ 19	€ 127	398	268	666
Average	**16,3% (Weighted)**	**148 kWh**	**387 kWh**	**371 kWh**	**€ 27**	**€ 69**	**€ 96**	**€113**	**309 kg $Co2_e$**	**220 kg $Co2_e$**	**557 kg $Co2_e$**

[11] Sum of behavioural and appliances based efficiency as well as system enhancements due to loadshift. Since load shifting does not automatically result in a reduction of end-use energy, but saves CO2-based energy generation trough reducing peak-loads, the quantitative savings objective is expressed in primary energy savings.

6 Conclusions

This deliverable collects and summarises the experience and knowledge of tools/products which influence energy consumption behaviour as well as lifestyle choices and products outside of the "energy world" which successfully achieved sustainable changes in consumers' behaviour. We have selected only tools that were implemented in the last 5 years and were, at least, one partner from the consortium was involved. We have also selected projects based on the availability of respective information.

The deliverable also analyses how those tools and products can be used for the benefit of PEAKapp:

1. **Reuse and extend it** because it only fulfils a partial set of criteria for PEAKapp solution.
2. **As inspiration** for the PEAKapp solution design.

After the detailed analysis, we conclude that most of the identified tools and products can be used for inspiration in the design of the PEAKapp gamified app and the serious game (mainly reusing successful dynamics, mechanics and game elements as described in Section 4). We can also conclude that the products with reference to GreenPocket's role as software developer of the PEAKapp 2.0 fit very well with the PEAKapp objectives and those products (Energy Expert Engine-EEE, Energy management for residential customers V2.0, app for residential customers) and will be used as "core input" for the final PEAKapp solution. Using as basis existing products will allow us to invest effort on adapting and extending them in order to cover all the requirements from PEAKapp.

The outcome of this deliverable will be used as basis for the design in Task 1.2.

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ANNEX 1. Existing ICT-solutions for energy efficiency in households

ID #: 1	Product Name: 2020 Energy
Area: ☑ **Energy consumption behaviour** ☐ Lifestyle choices ☐ Outside of the energy world achieving sustainable changes in consumer behaviour If outside, please indicate the domain:	
Current Status: ☐ Ongoing. When is planned to finish it (estimation): Month/Year ☑ Completed	
Description (including technical aspects): For more than a century people have been using and depleting energy resources carefree, as if they were endless. In 2020 the world could find itself in a deadlock. The player has the power to go back in time and to rewrite history. The player's objective: to reduce the consumption of energy, increase energy efficiency and choose the best renewable energies. He finds help with 3 advisers: economical, environmental, social, but it is up to the player to take the good decisions to improve our collective future. Inspired by active learning, the serious game proposes an immersive learning mode to develop critical thinking and motivation. 2020 Energy offers a perspective for debate and adds to traditional learning, which it couldn't replace. The game offers complex questioning on the issues of efficiency and the reduction of our energy consumption, renewable energies and sustainable development. • It holds a comprehensive selection of information, but doesn't replace a course. • It illustrates the key concepts linked to sustainable development without answering to all the questions and addresses some big picture debates that society has on energy questions. • By anchoring the training in reality, the game makes theoretical data and concepts lively. • The game encourages the sharing of points of views and experiences between peers while giving a true role to the educator. • The game promotes the children's sense of responsibility and a citizen centred approach. Based on the codes and rules of video games, 2020 Energy's gameplay is at the crossroads between playing and learning. The educator and the teenagers easily find their mark. • Missions replace the wording of a subject or problem • The rules of the game lay down the framework for reflection • The sustainable development advisers give back an answer sheet with information and commentaries • Scores replace grades and leaves the possibility to turn in work With fun elements, the text content, rich, stays the central part of the serious game. One tiny change in the traditional teaching method: participants have the possibility to « play against » and the subjective point of view of the player is taken into account.	
Related project (name, programme, call, if applicable): Project: EnergyBits, Programme: Intelligent Energy Europe (European Commission)	
Target end-users (retailers, consumers, building managers, …): Consumers (teenagers 14-18 years old)	
Platform addressed (web-based, android, IOS, …): Web-based, IOS	
TRL: TRL8 - TRL9	
Licensing and IPR (Put special focus on owned products and tools): - free distribution, - respect for the integrity of the documents reproduced (no modifications or alterations of any kind)	

- explicit reference to the program (2020energy.eu) as the source and the reference (Tralalere © 2010)
Benefits for PEAKapp (identify in which WPs and/or task this product can be (re)-used or serve as a reference): Reference in WP1, WP2
Other aspects: • Supported language: English, German, French, Spanish, Greek, Slovenian, Swedish, other • Easy-to-extend with new functionalities: No • API: No • URL with more details: http://www.2020energy.eu/en/serious-game
Notes: (if applicable)

ID #: 2	**Product Name:** Power House
Area: ☑ Energy consumption behaviour ☑ **Lifestyle choices** ☐ Outside of the energy world achieving sustainable changes in consumer behaviour If outside, please indicate the doma8in:	
Current Status: ☐ Ongoing. When is planned to finish it (estimation): Month/Year (?/?) ☑ Completed	
Description (including technical aspects): Power House is an online game that connects home smart meters to a game that is grounded in real world social networks. Player energy use is tracked via personal accounts with local energy providers. This information is then inputted into the game environment, where it influences the player's in-game abilities, and has consequences for player options, rewards, and reputation. Real world energy behaviours produce particular in-game advantages and disadvantages, transforming otherwise dull and distant information into feedback that is palatable, timely and relevant.	
Related project (name, programme, call, if applicable): Serious Games and Energy Use Behaviour, Precourt Energy Efficiency Center, Stanford University	
Target end-users (retailers, consumers, building managers, …): Consumers	
Platform addressed (web-based, android, IOS, …): Web-based	
TRL: TRL8-9	
Licensing and IPR (Put special focus on owned products and tools): Unclear	
Benefits for PEAKapp (identify in which WPs and/or task this product can be (re)-used or serve as a reference): WP1, inspiration and reference for game design.	
Other aspects: • Supported language: English • Easy-to-extend with new functionalities: No • API: No • URL with more details: • http://gamification-research.org/wp-content/uploads/2011/04/23-Reeves.pdf http://peec.stanford.edu/energybehavior/projects/onlinegame.php	

ID #: 3	**Product Name:** Energy Chickens
Area:	

☐ Energy consumption behaviour ☑ **Lifestyle choices** ☐ Outside of the energy world achieving sustainable changes in consumer behaviour If outside, please indicate the domain:
Current Status: ☐ Ongoing. When is planned to finish it (estimation): Month/Year ☑Completed
Description (including technical aspects): Energy Chickens is a virtual pet game that monitors energy use data collected by Plugwise devices. Each chicken represents a different appliance for which the player is responsible, and the player's energy consumption affects the well-being of their chickens. Players log in daily to care for their chickens and to collect eggs for points. If a player reduces their energy consumption for an appliance, the chicken associated with that appliance will grow healthier and happier and will lay eggs to be collected for points. If a player increases consumption, their chickens will become sick and will not lay eggs.
Related project (name, programme, call, if applicable): Energy Efficient Buildings HUB, Studio-Lab, Penn State University
Target end-users (retailers, consumers, building managers, …): Consumers/office building managers
Platform addressed (web-based, android, IOS, …): Web-based
TRL: Unclear
Licensing and IPR (Put special focus on owned products and tools): Unclear
Benefits for PEAKapp (identify in which WPs and/or task this product can be (re)-used or serve as a reference): Inspiration for game design and reference WP1.
Other aspects: • Supported language: English • Easy-to-extend with new functionalities : No • API: No • URL with more details: http://studiolab.psu.edu/projects/energy-behavior-change http://www.energychickens.com/ http://www.sciencedirect.com/science/article/pii/S0378778814000747
Notes: (if applicable)

ID #: 4	**Product Name: Energy-Consumption-Analyzer (ECAS)**
Area: ☑ **Energy consumption behaviour** ☐ Lifestyle choices ☐ Outside of the energy world achieving sustainable changes in consumer behaviour If outside, please indicate the domain:	
Current Status: ☐ Ongoing. When is planned to finish it (estimation): Month/Year ☑ Completed	
Description (including technical aspects): Record of the consumption data of a household or random number of consumption meters. The consumption meters can also run in the different direction and will be included. So you can get data for your PV or thermal heat pump as well as your consumption streams.	

The software is generating average energy consumption per hour, day, week or month and generates a graph and curve as visualization over the time. You can zoom in the graphs and look at the detail information. The app can also calculate sums of money instead of energy consumption. Therefor it is necessary to deposit data for costs per unit, overhead per year, currency of the calculation and the unit of the consumption. If you change the consumption meter the app will automatically work with the new one. You can get the data of your energy consumption of gas, water, heat and current separate or as a sum if you like to. To compare your production of your PV or your energy consumption with the weather it is possible to connect sensors for wind, radiation or temperature with the system. All the data will be saved and there is always access to the backup via the app. Data for or from Microsoft Excel can be imported or exported as CSV data. With this app it is achievable to analyse the consumption data and react in the future.
Related project (name, programme, call, if applicable): Verbrauchszähler (app), Electricity meter (app), Meter Read (app), iPhone Energy UFO (app), MyEnergy-App for iPhone (app), EnergyCheck (app), EnergyConsumption (app) etc.
Target end-users (retailers, consumers, building managers, …): Consumers
Platform addressed (web-based, android, IOS, …): Android (Version 2.4.6 or higher)
TRL: TRL 9
Licensing and IPR (Put special focus on owned products and tools): -
Benefits for PEAKapp (identify in which WPs and/or task this product can be (re)-used or serve as a reference): High acceptance of the consumer (previous installation number)
Other aspects: • Supported language: English, German & Japanese • Easy-to-extend with new functionalities : Yes • API: No • URL with more details: https://play.google.com/store/apps/details?id=at.topfen.ecas&hl=de and http://www.onlinekosten.de/news/app-der-woche-energieverbrauchs-analysator-fuer-strom-wasser-gas-co_195371.html and http://www.androidapps.biz/app/at.topfen.ecas/de
Notes: (if applicable) Previous installations from google store: 100.000-500.000 – app for free First steps necessary to enter a lot of information Continuous enter information about the consumption required – effort Without a smart meter possible to calculate significant data App works without internet connection after the installation Very good feedback from the users and continuous optimization of the app One app for the record of different data (water, gas, current, heat) No comparison of the different users or gaming nature or tips & tricks to save energy (app Energiesparen 2.0 quiz with questions to energy saving activities)

ID #: 5	**Product Name: Wiser2**
Area: ☑ **Energy consumption behaviour** ☐ Lifestyle choices ☐ Outside of the energy world achieving sustainable changes in consumer behaviour If outside, please indicate the domain:	
Current Status: ☐ Ongoing. When is planned to finish it (estimation): Month/Year ☑ Completed	

Description (including technical aspects): The Wiser2 application provides an android connection to your Wiser2 Home Control System. Either locally, through your home's wireless access point or via your device's mobile network connection, control of your home through Wiser2 is as simple as connecting. Once connected, there is nothing to configure. You will have available at your fingertips, everything your Wiser2 Home Control has access to. This may include lighting, security, climate, entertainment as well as energy and camera monitoring. You can even have multiple connections simultaneously with a consistent, user experience across all.
Related project (name, programme, call, if applicable): Control4 MyHome(app), Pocket Keypad for Control4 (app)
Target end-users (retailers, consumers, building managers, …): Consumer
Platform addressed (web-based, android, IOS, …): Android (Version 3.0 or higher), iPhone and PC browser and local HDMI-CEC enabled TV
TRL: TRL 9
Licensing and IPR (Put special focus on owned products and tools): -
Benefits for PEAKapp (identify in which WPs and/or task this product can be (re)-used or serve as a reference): High developed app Design of the display easy to understand with the bars.
Other aspects: • Supported language: English • Easy-to-extend with new functionalities : Yes • API: No • URL with more details: http://www.wiserhomeautomation.com/ and https://play.google.com/store/apps/details?id=com.schneider_electric.wiser2&hl=de
Notes: (if applicable) Previous installation 1.000-5.000

ID #: 6	**Product Name: Energy Expert Engine (EEE)**
Area: ☑ **Energy consumption behaviour** ☐ Lifestyle choices ☐ Outside of the energy world achieving sustainable changes in consumer behaviour If outside, please indicate the domain:	
Current Status: ☐ Ongoing. When is planned to finish it (estimation): Month/Year ☑ Completed	
Description (including technical aspects): Centerpiece of the GreenPocket solution is the highly flexible Energy Expert Engine. The multi-compatible interface enables the connection with a range of AMR and EDM systems, customer databases and billing systems. Digital energy consumption data is initially prepared in the EEE. Additional data, such as environmental indicators, are subsequently included in the calculations. Datasets are linked and interpreted in line with the requirements of energy consumers on the basis of algorithms and heuristics. The now 'intelligent' data serves as a basis for forecast, alert and control functions. For energy consumers, this creates valuable detailed information on their personal energy requirements. The Energy Expert Engine adds intelligence to the dataset. Algorithms and heuristics form the basis of all analysis and control functions provided by the GreenPocket Solution. The Energy Expert Engine has been designed with an intelligent plugin system of cartridges. These enable utility companies to expand functions flexibly and in modular fashion.	

The EEE is GP's backend system and is central part of the PEAKapp 1.0 and works together with a frontend, e.g. GP's energy management portal for residential customer V.1 and V.2, etc. Description (Selection of main features): - Long term storing of historical data - Data and gap control (data monitoring) - Algorithms and calculation (forecast, comparison with own average and previous period, differences etc.) - Notifications and Emailing Technical architecture for this solution is GP's Energy Expert Engine (EEE).
Related project (name, programme, call, if applicable): Energy Expert Engine (EEE)
Target end-users (retailers, consumers, building managers, …): Retailers, consumer, utilities
Platform addressed (web-based, android, IOS, …): Web-based ; working on any devices (tablet, smart phone etc.) due to fully responsiveness with HTML 5
TRL: TRL9
Licensing and IPR (Put special focus on owned products and tools): The whole product, including technical and content ideas, conceptualization as well as software development, installation, customizing and redistribution of the GP solution is Intellectual Property of GP. Any contribution of this GP product for all tasks and work packages results in IPR for GP on the elaborated PEAKapp solution using this GP product as basis.
Benefits for PEAKapp (identify in which WPs and/or task this product can be (re)-used or serve as a reference): • WP1 and related tasks • WP2 and related tasks • WP6 and related tasks
Other aspects: • Supported language: English, German, Spanish • Easy-to-extend with new functionalities : Yes • API: Yes (Rest-APIs) • URL with more details: http://www.greenpocket.de/en/products/greenpocket-solution/energy-expert-engine/
Notes: (if applicable) Please see "Annex 2 GreenPocket Additional Information" for more information and screenshots on GreenPocket solutions.

ID #: 7	**Product Name:** Energy management for residential customers V2.0 (PEAKapp 1.0)
Area: ☑Energy consumption behaviour ☑ **Lifestyle choices** ☐ Outside of the energy world achieving sustainable changes in consumer behaviour If outside, please indicate the domain:	
Current Status: ☐ Ongoing. When is planned to finish it (estimation): Month/Year ☑ Completed	
Description (including technical aspects): The energy management portal for residential customers V2.0 is a first step in order to save energy and money and enables to understand how much energy is used and what are its costs. The dashboard summarizes the most important key figures. The monthly balance helps estimating the cost ratio across all divisions and meters (production included). Thanks to reliable forecasts in the Cost-Check and in the Consumption-Check, based on	

individual instalment payments of the user, he always stays up to date and can increase his financial security in planning. Intuitive processes and a user-friendly interface, packed in an attractive design, create a unique user experience. Technical architecture for this solution is GP's Energy Expert Engine (EEE). For technical description on data storing, data monitoring etc. This product as frontend solution only works together with GP's backend system, the Energy Expert Engine (EEE). Description (Selection of main features): • Implementation possible as: EEE-based solution • Cloud-based solution • Local APP-Solution • Analysis of consumption and costs • Analysis of generation and revenues • Monthly cost balance • Cost Check: calculation of expected credit/debit • Consumption Check • CO2 balance • Energy saving tips
Related project (name, programme, call, if applicable): Energy management for residential customers V.2.0 (PEAKapp 1.0)
Target end-users (retailers, consumers, building managers, …): Retailers, consumer, utilities
Platform addressed (web-based, android, IOS, …): Web-based ; working on any devices (tablet, smart phone etc.) due to fully responsiveness with HTML 5
TRL: TRL9
Licensing and IPR (Put special focus on owned products and tools): The whole product, including technical and content ideas, conceptualization as well as software development, installation, customizing and redistribution of the GP solution is Intellectual Property of GP. Any contribution of this GP product for all tasks and work packages results in IPR for GP on the elaborated PEAKapp solution using this GP product as basis.
Benefits for PEAKapp (identify in which WPs and/or task this product can be (re)-used or serve as a reference): • WP1 and related tasks • WP2 and related tasks • WP6 and related tasks

Other aspects:
• Supported language: English, German, Spanish
• Easy-to-extend with new functionalities : Yes
• API: Yes (Rest-APIs)
• URL with more details:
  • http://www.greenpocket.de/en/products/residential-customers/web-portal/
  • http://www.greenpocket.de/en/products/residential-customers/apps-display-losungen/
  • http://www.greenpocket.de/en/products/residential-customers/social-metering/

Notes: (if applicable) Please see "Annex 2 GreenPocket Additional Information" for more information and screenshots on GreenPocket solutions.

ID #: 8	**Product Name:** APP for residential customers
Area: ☑ Energy consumption behaviour ☑ **Lifestyle choices** ☐ Outside of the energy world achieving sustainable changes in consumer behaviour	

If outside, please indicate the domain:
Current Status: ☐ Ongoing. When is planned to finish it (estimation): Month/Year ☑ Completed
Description (including technical aspects): High usability and a convincing design ensure energy consumption attracts the attention of energy consumers. With the aid of intuitive gesture control (multi-touch), live load cycles and forecasts of personal energy consumption can be navigated quickly and easily through a range of different displays. A trigger function facilitates the convenient selection of vertical and horizontal tables and diagrams. In addition to mobile use on the road, the apps and display solutions also lend themselves for direct visualization of energy consumption data in individual households. Due to its handy size and easy operation, a smartphone offers an ideal home display. Data is transported either via a web server connection or via WLAN. Technical architecture for this solution is GP's Energy Expert Engine (EEE). For technical description on data storing, data monitoring etc. This product as frontend solution only works together with GP's backend system, the Energy Expert Engine (EEE). Description (Selection of main features): • iOS and Android APP • Analysis of consumption and costs • Analysis of generation and revenues • Consumption forecast and comparisons • Monthly cost balance • Comparison with similar households • Energy saving tips
Related project (name, programme, call, if applicable): APP for residential customers
Target end-users (retailers, consumers, building managers, …): Retailers, consumers
Platform addressed (web-based, android, IOS, …): iOS and ANDROID APP
TRL: TRL9
Licensing and IPR (Put special focus on owned products and tools): The whole product, including technical and content ideas, conceptualization as well as software development, installation, customizing and redistribution of the GP solution is IP of GP. Any contribution of this GP product for all tasks and work packages results in IPR for GP on the elaborated PEAKapp solution using this GP product as basis.
Benefits for PEAKapp (identify in which WPs and/or task this product can be (re)-used or serve as a reference): • WP1 and related tasks • WP2 and related tasks • WP6 and related tasks
Other aspects: • Supported language: English, German • Easy-to-extend with new functionalities : Yes • API: Yes (Rest-APIs) • URL with more details: http://www.greenpocket.de/en/products/residential-customers/apps-display-losungen/
Notes: (if applicable) Please see Annex 2 "GreenPocket Additional Information" for more information and screenshots on GreenPocket solutions.

ID #: 9	**Product Name:** Live-ticker APP for energy efficiency

Area: ☑ Energy consumption behaviour ☐ Lifestyle choices ☐ Outside of the energy world achieving sustainable changes in consumer behaviour If outside, please indicate the domain:
Current Status: ☐ Ongoing. When is planned to finish it (estimation): Month/Year ☑ Completed
Description (including technical aspects): Regarding realization of the German federal government objective to reduce energy usage (in 2008) by 25% until 2050, the Live-ticker APP for energy efficiency creates awareness and transparency regarding to the current feed-in situation in Berlin. A live view of the current electricity in Berlin as well as imports from surrounding areas, current load and load peaks are core features of the app. Displaying individual electrical substations in Berlin and a display of individual districts of Berlin including separate pictures, rounds up the functionalities of the Live-ticker APP for energy efficiency. Technical architecture for this solution is GP's Energy Expert Engine (EEE). For technical description on data storing, data monitoring etc. This product as frontend solution only works together with GP's backend system, the Energy Expert Engine (EEE). Description (Selection of main features): • Cloud-based-APP (data retrieval via web service) • Current electricity generation data for city and specific regions • Electricity import data • Load and load peaks • Current grid load, substations and interconnection points (map presentation)
Related project (name, programme, call, if applicable): Live-ticker APP for energy efficiency
Target end-users (retailers, consumers, building managers, …): Individual consumers of German capital Berlin
Platform addressed (web-based, android, IOS, …): Cloud-based App (data retrieval via web service)
TRL: TRL9
Licensing and IPR (Put special focus on owned products and tools): The whole product, including technical and content ideas, conceptualization as well as software development, installation, customizing and redistribution of the GP solution is IP of GP. Any contribution of this GP product for all tasks and work packages results in IPR for GP on the elaborated PEAKapp solution using this GP product as basis.
Benefits for PEAKapp (identify in which WPs and/or task this product can be (re)-used or serve as a reference): • WP1 and related tasks • WP2 and related tasks • WP6 and related tasks
Other aspects: • Supported language: German • Easy-to-extend with new functionalities : Yes • API: Yes (Rest-APIs) • URL with more details: http://www.greenpocket.de/en/products/residential-customers/
Notes: (if applicable) Please see "Annex 2 GreenPocket Additional Information" for more information and screenshots on GreenPocket solutions.

ID #: 10	**Product Name:**

	EDF APP for Olympic Games 2012
Area: ☐ Energy consumption behaviour ☑ Lifestyle choices ☐ Outside of the energy world achieving sustainable changes in consumer behaviour If outside, please indicate the domain:	
Current Status: ☐ Ongoing. When is planned to finish it (estimation): Month/Year ☑ Completed	
Description (including technical aspects): The EDF APP for Olympic Games in 2012 was elaborated for the usage of residential customers during the Olympic Games in London 2012. The app initiates playful competition to raise the environmental consciousness via comparison with neighbours, several rankings and badges. Technical architecture for this solution is GP's Energy Expert Engine (EEE). For technical description on data storing, data monitoring etc. This product as frontend solution only works together with GP's backend system, the Energy Expert Engine (EEE). Description: • Local APP-Solution (iOS) • Real time data • Comparison with neighbours • Ranking/Competition • Rewards and incentives (Badges) • Messages via push services	
Related project (name, programme, call, if applicable): EDF APP for Olympic Games 2012	
Target end-users (retailers, consumers, building managers, …): Individuals during Olympic Games 2012 in London, England	
Platform addressed (web-based, android, IOS, …): Local App solution (iOS)	
TRL: TRL8	
Licensing and IPR (Put special focus on owned products and tools): The whole product, including technical and content ideas, conceptualization as well as software development, installation, customizing and redistribution of the GP solution is IP of GP. Any contribution of this GP product for all tasks and work packages results in IPR for GP on the elaborated PEAKapp solution using this GP product as basis.	
Benefits for PEAKapp (identify in which WPs and/or task this product can be (re)-used or serve as a reference): • WP1 and related tasks • WP2 and related tasks • WP6 and related tasks	
Other aspects: • Supported language: English, German • Easy-to-extend with new functionalities : Yes • API: Yes (Rest-APIs) • URL with more details: http://www.greenpocket.de/en/products/residential-customers/	
Notes: (if applicable) Please see Annex 2 "GreenPocket Additional Information" for more information and screenshots on GreenPocket solutions.	

ID #: 11	**Product Name: BUSMOD**
Area: ☐ Energy consumption behaviour	

☐ Lifestyle choices ☑ Outside of the energy world achieving sustainable changes in consumer behaviour If outside, please indicate the domain: Electric Business oriented model development tool
Current Status: ☐ Ongoing. When is planned to finish it (estimation): Month/Year ☑Completed
Description (including technical aspects): In BUSMOD 5th EU RTD FP project a business modelling methodology was developed for studying the business feasibility and analysing each electric market's stakeholder benefits calculation in a broad range of market conditions. The BusMod business modelling approach was developed and extensively tested with precisely purpose in mind. This approach: • Explained the business model of the entire value network in just a few pictures, • Gave a complete checklist for DG/DER business models; • Offered easy-to-use steps and worksheets to create and assess business models, • Allowed to identify what precisely is the market offering, and which actors are involved, • Helped to identify What are the goals, and who 'own' these, • Model how do the actors create and exchange value and how can they act to make a profit, • Lead to make estimations on cash flow, operational and ICT expenses, and investments, • Consider what-if analysis: for example, what is the impact of existing or emerging regulation on the business model.
Related project (name, programme, call, if applicable): EESD Project NNE5/2001/256 BUSMOD
Target end-users (retailers, consumers, building managers, …): Researchers, different electric market stakeholders.
Platform addressed (web-based, android, IOS, …): - Graphic interface: http://e3value.few.vu.nl/tools/other/ The e3editor is a JAVA application, so it should run also on other platforms than Windows XP. Users report good experiences with OS/X (Apple) and Linux (Kubuntu). To use the editor, you have to download the two jar files below, which are the latest version. java -jar e3.jar and java -jar e3timeseries.jar are needed. - Excel - Visual Basic
TRL: TRL6-7
Licensing and IPR (Put special focus on owned products and tools): E3value license is free. Deliverables explaining the BUSMOD methodology are available in the links provided below.
Benefits for PEAKapp (identify in which WPs and/or task this product can be (re)-used or serve as a reference): It can be used in WP4 and WP5. Mainly in tasks 4.2., 4.4., and 5.4.
Other aspects: • Supported language: English … Yes. • Easy-to-extend with new functionalities: Medium-Large effort. • API: No • URL with more details: http://e3value.few.vu.nl/docs/misc/BUSMODbrochure.pdf http://e3value.few.vu.nl/docs/misc/VUA_DGB_WP05_01_01.pdf

ID #: 12	**Product Name:** Social Metering APP
Area: ☑ Energy consumption behaviour	

☑ **Lifestyle choices** ☐ Outside of the energy world achieving sustainable changes in consumer behaviour If outside, please indicate the domain:
Current Status: ☐ Ongoing. When is planned to finish it (estimation): Month/Year ☑ Completed
Description (including technical aspects): GreenPocket is the first company worldwide to develop an application that links smart metering to the social web through facebook integration. With Push-messages and contests this "social metering" app motivates the users to reduce their energy consumption and increase their CO_2 efficiency in the long run using competition with friends and virtual badges and achievements. Technical architecture for this solution is GP's Energy Expert Engine (EEE). For technical description on data storing, data monitoring etc. This product as frontend solution only works together with GP's backend system, the Energy Expert Engine (EEE). Description: • Local App solution • Comparison with similar households • Sharing with social media • Weekly contests among friends • Energy saving competition and rankings • Transparency and community actions • Incentive through linking to partner apps • Messages via push notification • Sharing carbon footprint on social media
Related project (name, programme, call, if applicable): Social Metering APP
Target end-users (retailers, consumers, building managers, …): Consumers, retailers, utilities
Platform addressed (web-based, android, IOS, …): Local App solution
TRL: TRL4
Licensing and IPR (Put special focus on owned products and tools): The whole product, including technical and content ideas, conceptualization as well as software development, installation, customizing and redistribution of the GP solution is IP of GP. Any contribution of this GP product for all tasks and work packages results in IPR for GP on the elaborated PEAKapp solution using this GP product as basis.
Benefits for PEAKapp (identify in which WPs and/or task this product can be (re)-used or serve as a reference): • WP1 and related tasks • WP2 and related tasks • WP6 and related tasks
Other aspects: • Supported language: English, German • Easy-to-extend with new functionalities : Yes • API: Yes (Rest-APIs) • URL with more details: http://www.greenpocket.de/en/products/residential-customers/social-metering/
Notes: (if applicable) Please see "Annex 2 GreenPocket Additional Information" for more information and screenshots on GreenPocket solutions.

ID #: 13	**Product Name:** PLAYHIST: Enhancing visitor experience in history learning by using gamification technology combined with 3D avatars.

Area:

☐ Energy consumption behaviour
☐ Lifestyle choices
☑ Outside of the energy world achieving sustainable changes in consumer behaviour

Current Status:

☐ Ongoing (when is planned to finish it?)
☑ Completed

Description (including technical aspects):

The goal of the PLAYHIST experiment is to **enhance visitor experience in history learning by using gamification technology combined with 3D avatars**. This will be done by developing a 3D interactive and collaborative serious game that will take advantage of the documentation, exhibitions and 3D content already developed at the FHW (Foundation for the Hellenic World) and the technological features provided by the EXPERIMEDIA facility as the 3DCC module for avatar creation.

Visitors will be proposed with a mission or set of tasks that must be developed to achieve a specific goal, in an engaging and collaborative experience enhancing the learning process and therefore achieving a better historical knowledge.

The PLAYHIST experiment supports the view that **educational serious games fit into the constructivist concept of learning, as they allow participants to be actively engaged in the learning process**, while conceptualizing knowledge from the perspective of their own experiences.

The game player will have a main objective in his/her way in the city of Miletus. The objective will be:

To erect a votive stele along the Sacred Way to celebrate the annual festivities in honour of Apollo called Didymeia, which included a procession starting at the Delphinion along the Sacred Way.

For this objective, the player will have to play the role of a merchant from Miletus purchasing goods from overseas, perhaps Ptolemaic Egypt or Seleucid Syria and sell them in the market (Agora). With the benefit the character get with the selling of goods (like precious metals: silver or gold), he/she will buy a votive stele for the annual festivities in honour of Apollo and do the procession along the Sacred Way.

Gameflow summary: The main steps for the game progression will be:

- The visitors get their tablets and begin to configure their character in the game. They will have to choose between a standard character and a personalized one. For the personalization a visitor can take a picture of him/her and through the application get their own character with their face → **3D Content Component (3DCC)** avatar creation module to capture the face of the players and insert this image on the character chosen to play.
- The visitors will be presented the main objective of the game, a brief historical introduction to the game and the steps or minigames to get the final objective.
- For each minigame, there will be an initial brief presentation of the specific challenge, and immediately, the visitors will begin to play the minigame. The end of each minigame will be defined both by time ending assigned to each minigame or by all the visitors finishing and reaching the objective, the first of both events. Depending on the level of achievement on each minigame, the visitor will be assigned punctuation and ranked in a general list (visible on the general screen of Tholos for all the visitors).
- Once all the visitors have passed through all the minigames, there will be only one of them who have reached the main objective of the game, and will be the winner.

Related project (name, programme, call, if applicable):

EXPERIMEDIA Opencall (http://www.experimedia.eu/experiments/): EXPERiments in live social and networked MEDIA experiences.
EUROPEAN COMMISSION, FP7 - COOP – ICT

Target end-users (retailers, consumers, building managers, …):

Visitors (final users)

Platform addressed (web-based, android, IOS, …):

N/A

TRL[12]**:** TRL8
Licensing and IPR (Put special focus on owned products and tools): TECNALIA
Benefits for PEAKapp (identify in WP task this product can be (re)-used): WP1 inspiration (T1.3)
Other aspects: **Supported language:** English **Easy-to-extend with new functionalities : Yes/No -** Yes **API:** Not aplicable **URL with more details:** http://www.experimedia.eu/2014/02/25/playhist/

[12] http://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/annexes/h2020-wp1415-annex-g-trl_en.pdf

ANNEX 2. GreenPocket Additional Information

See attached pdf

[Attachment 1: Background included]

According to the Grant Agreement (Article 24) Background is defined as "data, know-how or information (…) that is needed to implement the action or exploit the results". Because of this need, Access Rights have to be granted in principle, but parties must identify and agree amongst them on the Background for the project. This is the purpose of this attachment.

PARTY 1

As to [NAME OF THE PARTY], it is agreed between the parties that, to the best of their knowledge (*please choose)*,

The following background is hereby identified and agreed upon for the Project. Specific limitations and/or conditions, shall be as mentioned hereunder:

Describe Background	Specific limitations and/or conditions for implementation (Article 25.2 Grant Agreement)	Specific limitations and/or conditions for exploitation (Article 25.3 Grant Agreement)
Technical Database: Energy Expert Engine EEE (see Screens 1 and Feature list 1)	Description (Selection of main features): - Long term storing of historical data - Data and gap control (data monitoring) - Algorithms and calculation (forecast, comparison with own average and previous period, differences etc.) - Notifications and Emailing	
Energy management for residential customers V. 1.0 (see Screens 3)	Description (Selection of main features): • Analysis of consumption and costs • Analysis of generation and revenues • Monthly cost balance • Budget manager • Household comparison on defined criteria • Consumption Check • Energy saving tips	

Energy management for residential customers V. 2.0 (see Screens 3 and Feature list 2)	Description (Selection of main features):
	• Implementation possible as:
	  • EEE-based solution
	  • Cloud-based solution
	  • Local APP-Solution
	• Analysis of consumption and costs
	• Analysis of generation and revenues
	• Monthly cost balance
	• Cost Check: calculation of expected credit/debit
	• Consumption Check
	• CO2 balance
	• Energy saving tips	

APP for residential customers (see Screens 4 and Feature list 3)	Description (Selection of main features): • iOS and Android APP • Analysis of consumption and costs • Analysis of generation and revenues	

	• Consumption forecast and comparisons • Monthly cost balance • Comparison with similar households • Energy saving tips	
Live ticker-APP for energy efficiency (see Screens 5)	Description (Selection of main features): • Cloud-based-APP (data retrieval via web service) • Current electricity generation data for city and specific regions • Electricity import data • Load and load peaks • Current grid load, substations and interconnection points (map presentation) • R	
EDF-APP (see Screens 6)	Description: • Local APP-Solution (iOS) • Real time data • Comparison with neighbors • Ranking/Competition • Rewards and incentives (Badges) • Messages via push services	
Social Metering-APP (see Screens 7)	• Local App solution • Comparison with similar households • Sharing with social media • Weekly contests among friends • Energy saving competition and rankings • Transparency and community actions • Incentive through linking to partner apps • Messages via push notification • Sharing carbon footprint on social media	
Gamification concepts for APPs (see Screens 8)	Feed your carbon monster Social Orangery Energy Quiz and Tutorials Green Motivation CSR	

Annex 1:

1. Energy Expert Engine (EEE): Extended functionality due to integration of EEE

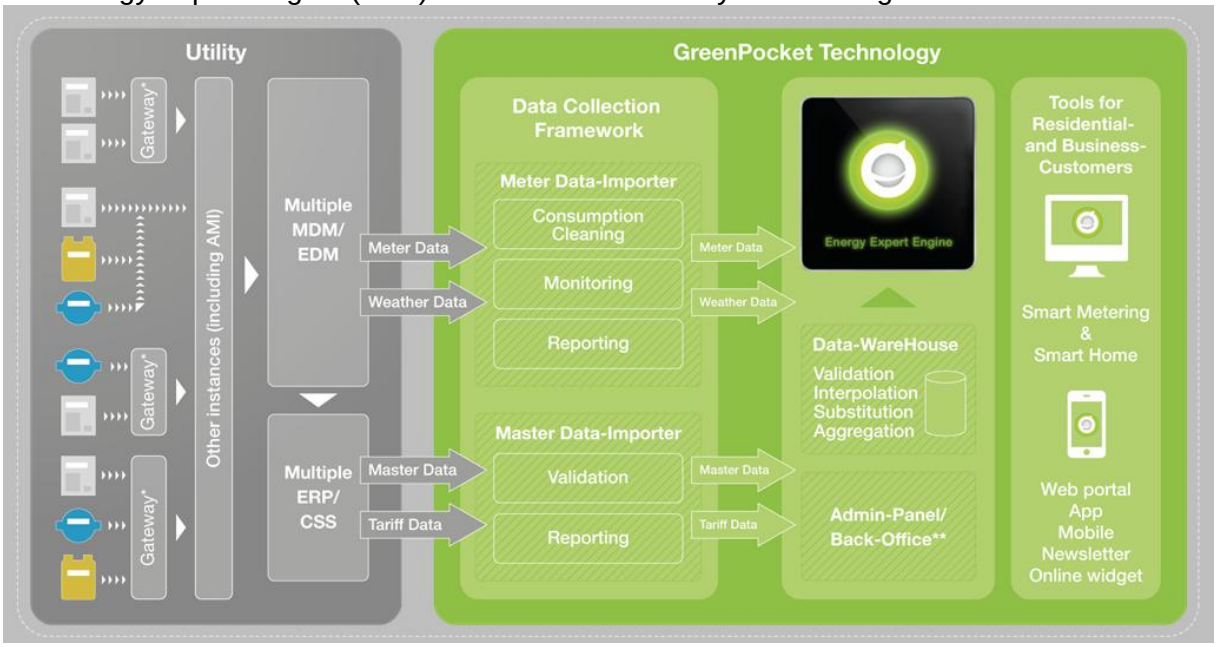

Figure 1: Energy Expert Engine (EEE)

2. Energy management for residential customers V. 1.0 (Original Release)

Figure 2: Dashboard with monthly consumption, monthly balance and budget manager

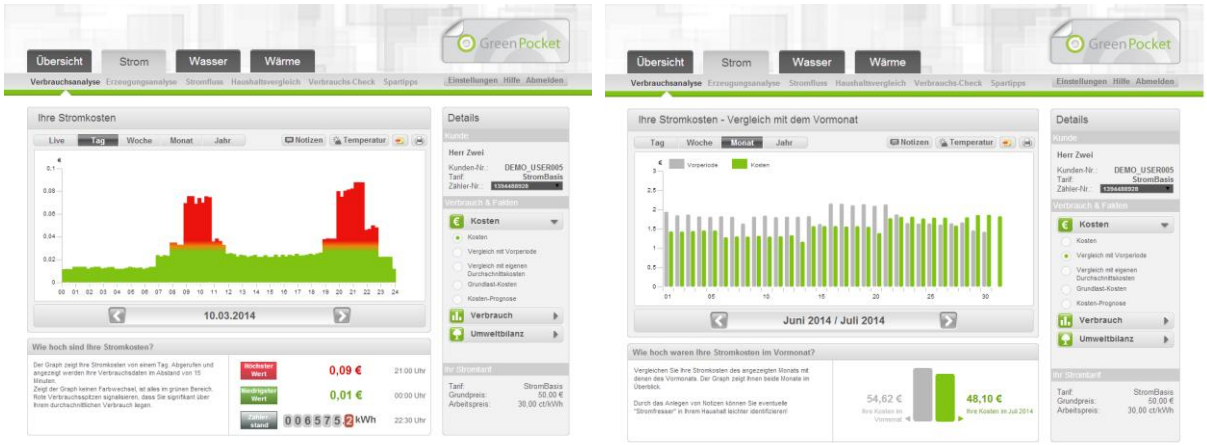

Figure 3: Analysis and comparison with previous period

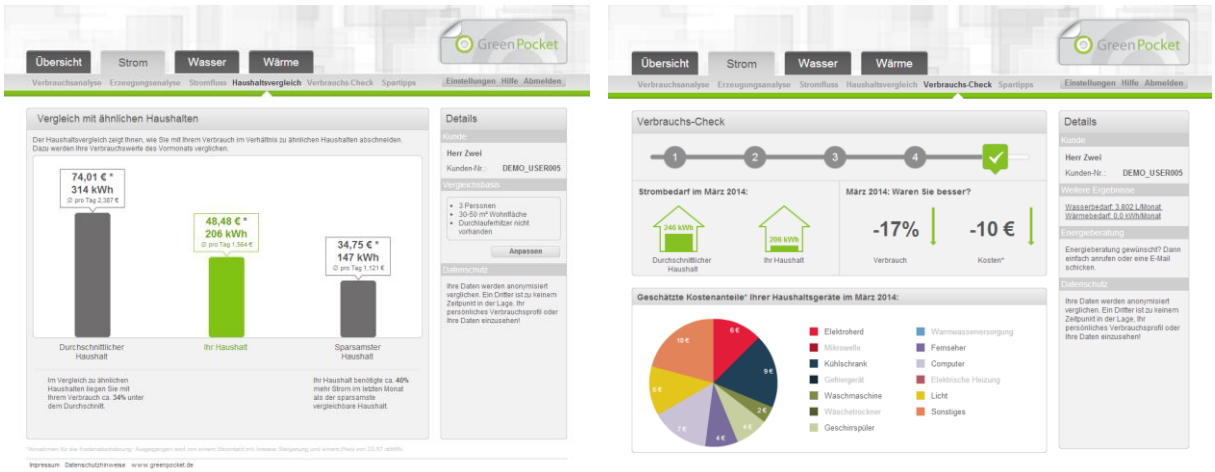

Figure 4: household comparison on defined criteria

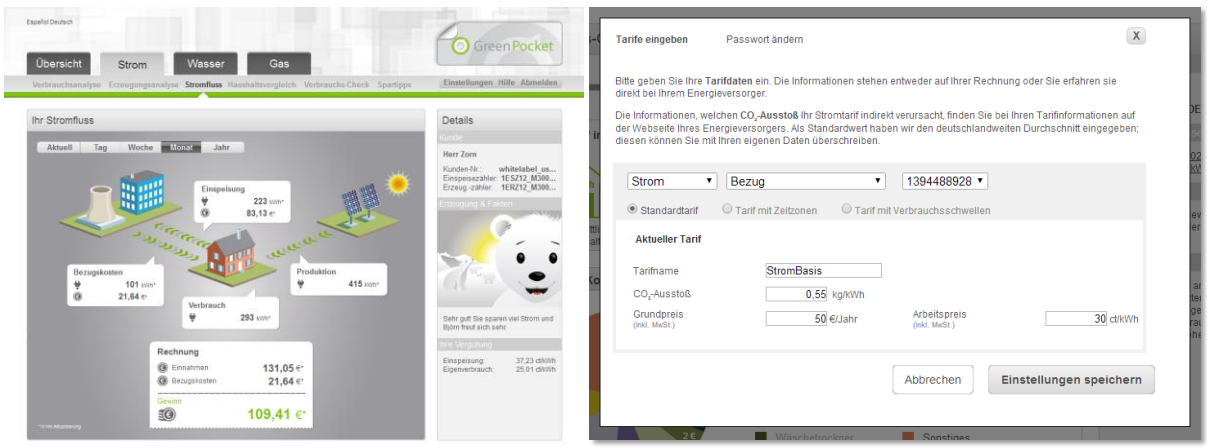

Figure 5: Generation and consumption energy flow and tariff settings

3. Energy management for residential customers V. 2.0 (New Release)

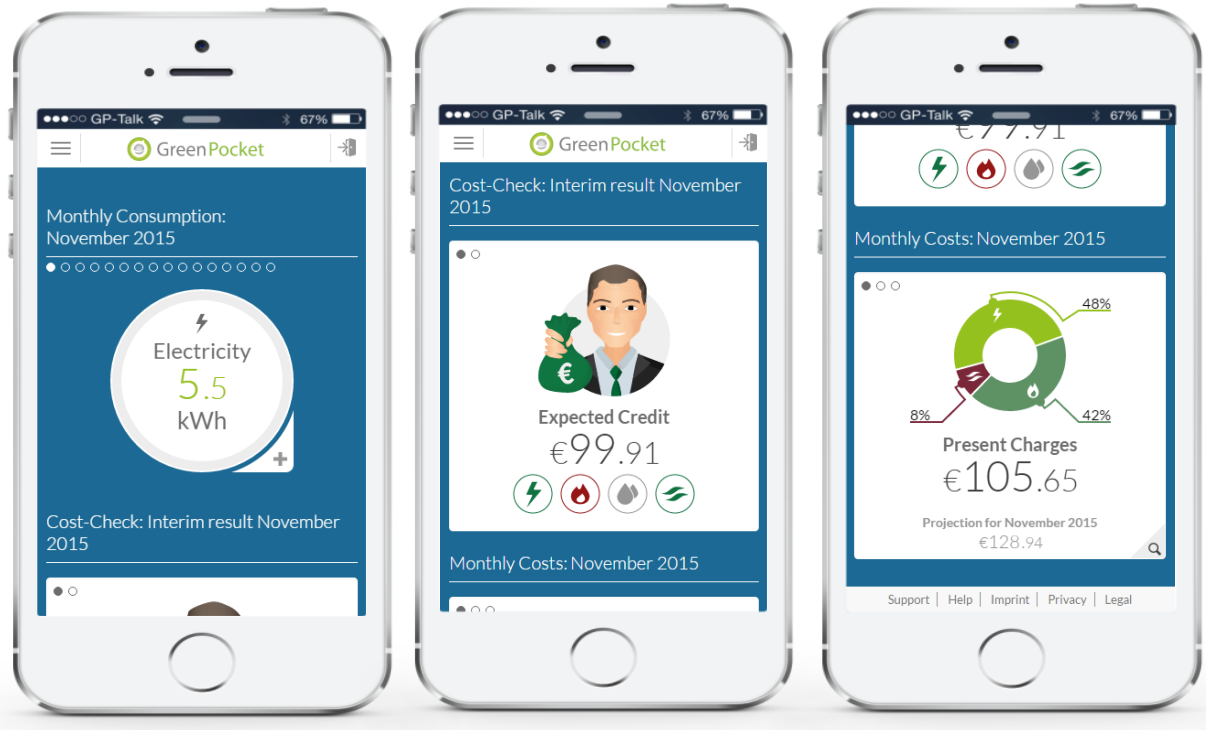

Figure 6: Energy management for residential customers - Dashboard

Figure 7: Energy management for residential customers – Detailed Analysis

4. Home portal for residential customers - APP

Figure 8: Home portal for residential customers – Overview consumption and generation

Figure 9: Home portal for residential customers – Cost Balance for generation and consumption

5. Live-Ticker App for energy efficiency

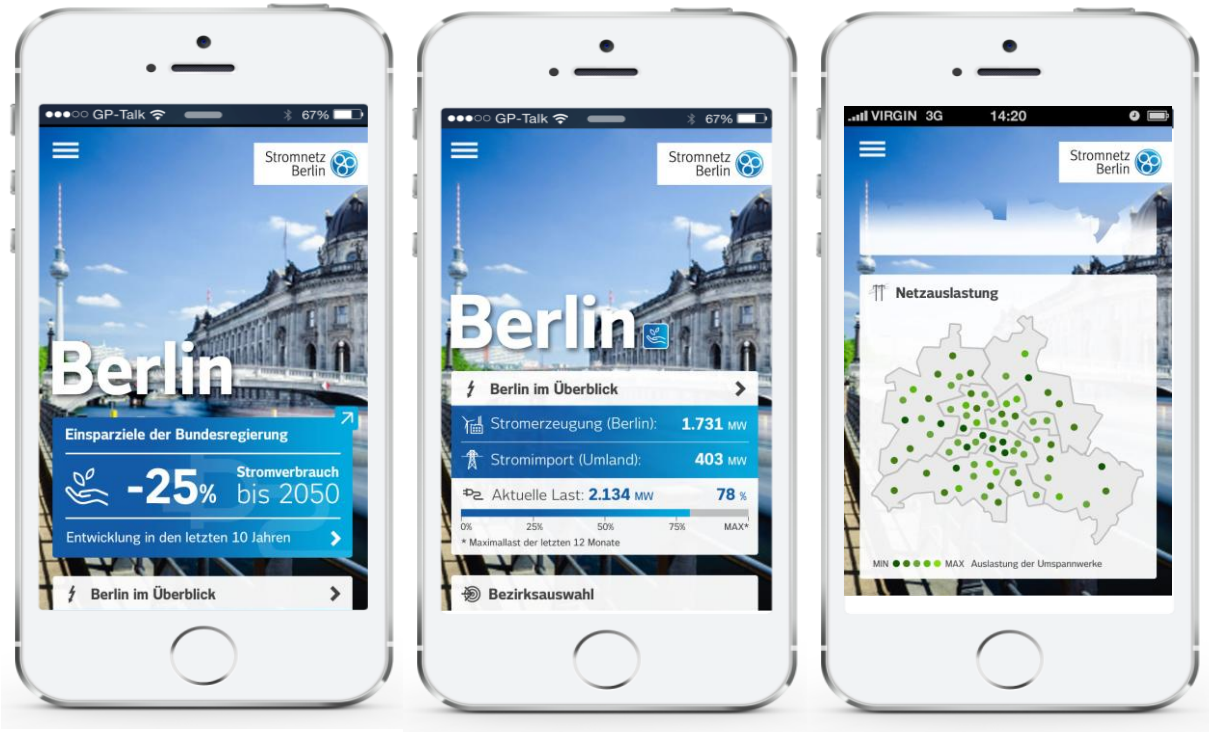

Figure 10: Live-Ticker APP – Consumption, electricity import and substations

Figure 11: Live-Ticker APP – Grid interconnection points, region selection and detailed load analysis

6. EDF-APP for Olympic Games 2012

Figure 12: EDF APP for Olympic Games 2012 – daily consumption, rankings and social comparisons

7. Social Metering-APP

Figure 13: Social Metering APP – Consumption and heat map

Figure 14: Social Metering APP – Household comparison and badgets

Figure 15: Social Metering APP – Comparisons on social media

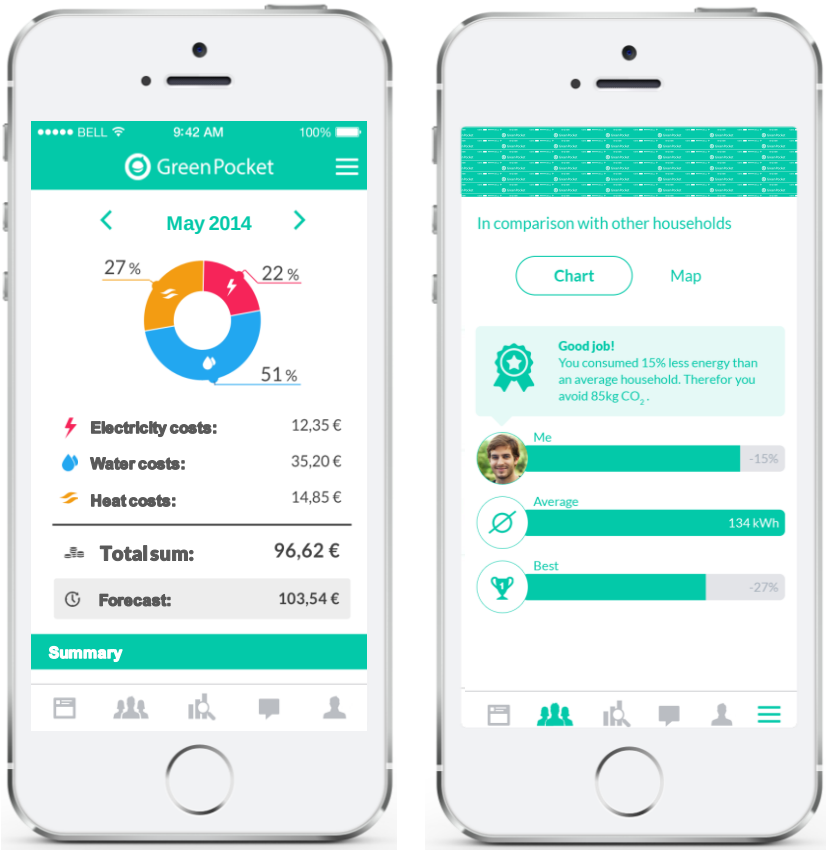

Figure 16: Social Metering APP – Consumption and comparisons on social media

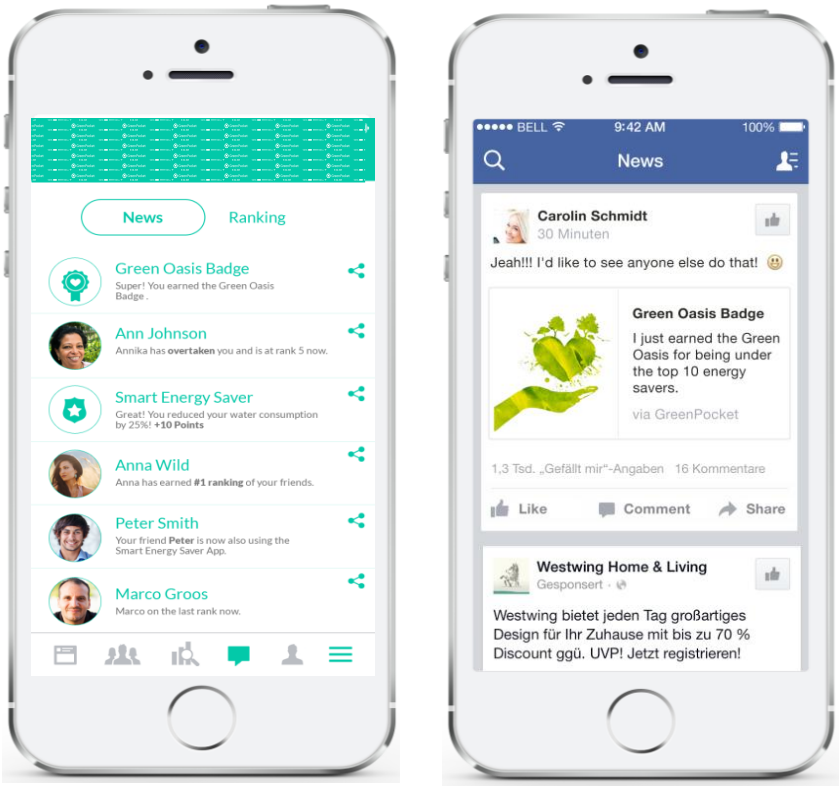

Figure 17: Social Metering APP – Comparison on social media

8. Further APP-concepts

Figure 18: Further APP concepts – Feed your carbon monster

Figure 19: Further APP concepts – Social orangerie

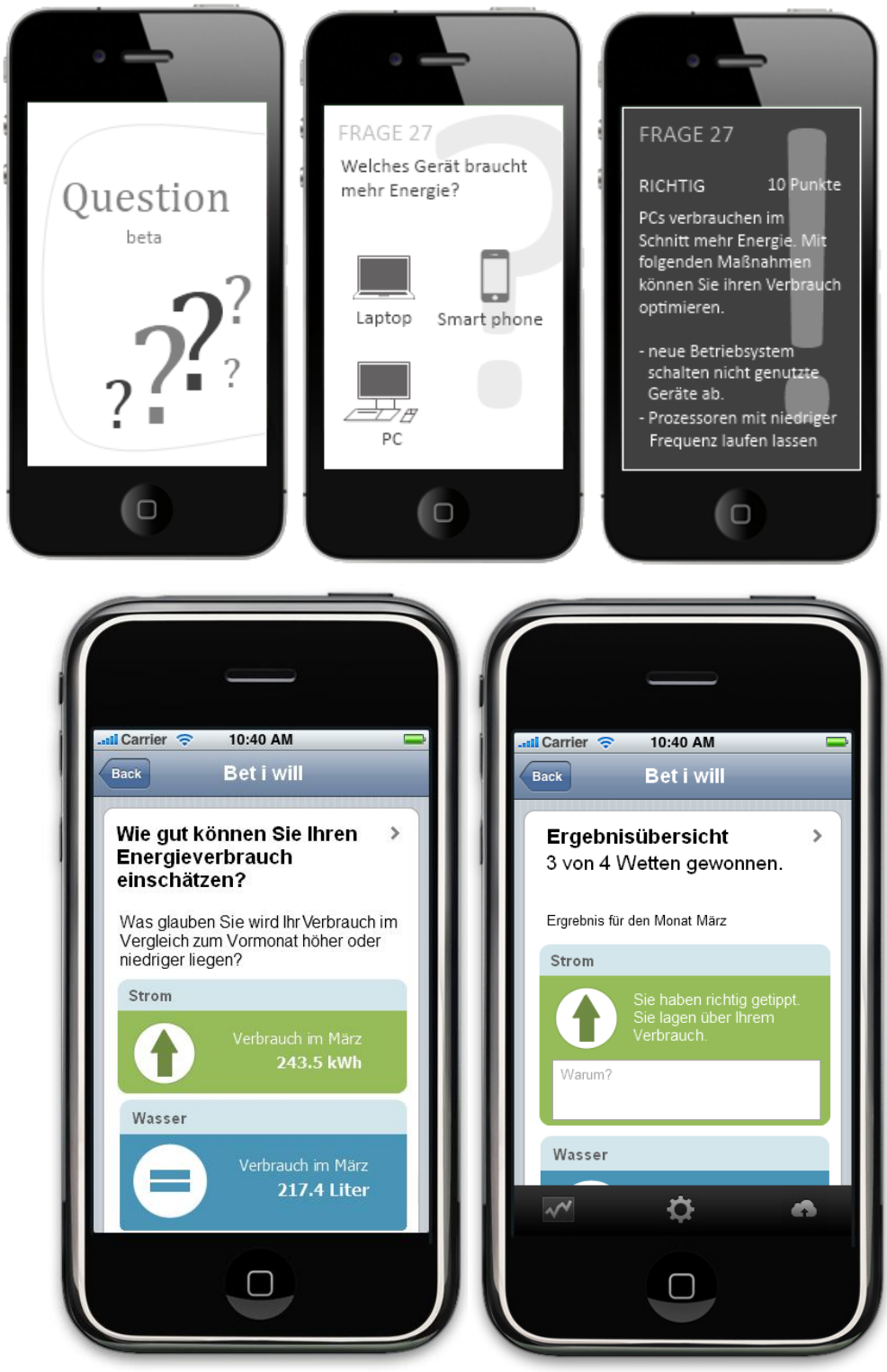

Figure 20: Further APP concepts – Energy quiz

Figure 21: Further APP concepts – Tutorials

Figure 22: Further APP concepts – Green Motivation

Figure 23: Further APP concepts – CSR CO2 emission saving clock

Annex 2: Feature lists

1. Feature list 1: Energy Expert Engine

Functions
Basis for all applications
Multi-client capability: Multi-clients comprise isolated clients with separated users and organisational units.
Multi-utility support (single and multiple energy types)
Conversion of energy consumption data into €
Calculation of average values for energy consumption
Conversion of energy consumption data into environmental factors (CO_2, car journey), taking into consideration the relevant energy mix
Analyses: Comparison of average consumption data and previous period data
Calculation of energy consumption forecasts
Generation and automatic Emailing after initial password generation and password changes
Global search function

2. Feature list 2: Energy management for residential customers

Features
Customizing
Client specific adjustment of login page (separate background image)
Client specific adjustment of portals background image, font color (headlines), segment colors (electricity, gas etc.) and box contours according to clients CI
Client specific adjustment of headers and footers (logo image and endorsement), Favicon according to clients CI
Client specific adjustment of texts (Imprint, data privacy police, support and contact data etc.) according to clients CI
Linking the logo and endorsement to the client specific target site
Overview
Multiple meter support: display of multiple meters per customer contract for each energy type
Summary view of monthly energy data for all energy types (electricity, gas, water and heat): comsumption, costs, CO_2-emissions and comparison with own average
Display of meter readings for standard and time dependent tariffs (e. g. low/high tariffs) incl. meter reading time stamp
Cost-Check for each energy type: calculation of expected credit or debit in the current statement period based on consumption/consumption forecast, tariffs and payments, calculation of monthly interims results across all energy types
Consumption Check: Adjusting and monitoring of an inidvidual consumption limit
Monthly balance: breakdown of monthly energy costs by energy type and meter incl. navigation in past month
Display of 2 to 6 customer specific saving tips
CO2-Balance: calculation of different CO2 equivalents

Generation analysis
Generation Overview (Dashboard): Key figures of current electricity generation and consumption (kWh and costs), calculation of energy balance (share of generation in relation to electricity purchase) and cost balance (revenues, savings and procurement costs)
Display of feed-in and own consumption in kWh in a diagramm, possibility of aktivation/deaktivation of generation meters for detailed analysis
Comparison of electricity purchase and generation in kWh
Display of revenues from feed-in and own consumption
Comparision of revenues from generation with purchase costs
Display of tariff history in cost analysis for each selöescted time period
Display of meter specific generation data in a tooltip via mouse-over
Comparisons of generation and revenues with own average
Comparisons of generation and revenues with previous period
Export of generation data from each meter
Selection of different time resolutions (day, week, month and year)
Navigation in past time periods
Y-Axis fixation for enhanced comparability
Clear summary of generation key figures (Sum generation/feed-in/own consumption/purchase) for each time period and resolution
Generation Overview (Dashboard): Key figures of current electricity generation and consumption (kWh and costs), calculation of energy balance (share of generation in relation to electricity purchase) and cost balance (revenues, savings and procurement costs)
Consumption analysis
Display of consumption for each energy type (in kWh, Water in m^3)
Disply of purchase costs for each energy type (calculation based on tariff infomation: support of standard tariffs and time dependent tariffs with up to 6 time zones)
Display of tariff history in cost analysis for each energy type in selected time periods
Display of CO_2-emissions according to consumption in kg CO_2 (except for water)
Display of meter specific consumption, cost and CO_2 data in a data tooltip via mouse-over
Comparisons of consumption, costs and CO_2-emissions with own average
Comparisons of consumption, costs and CO_2-emissions with previous period
Export of meter specific consumption data in all energy types (Excel)
Forecast of consumption, costs and CO_2 emissionen
Display of tariff use of time-dependent tariffs due to the tariff and consumption data (support of time based tariffs with up to 6 time zones)
Selection of different time resolutions (day, week, month and year)
Navigation in past time periods
Y-Axis fixation for enhanced comparability
Clear summary of consumption key figures (minimum and maximum values, sum) for each time period and resolution

Settings and Support
Change/forgot password function
Installing of a demo user for customers without consumption data
Email notification in case of expected credit (cost check)
Email notification in case of exceeding the consumption limit (consumption-check)
Input and editing function for tariffs
Display of tariff history, editing and delete function of historic tariffs
Input and editing function for payments in an individual statement period
Input and editing function for consumption limit for an individual time period (1 month, 2 month etc.)
Installing a kiosk user for presentations (upon display pillars or monitors) with specific user configuration, Creating of meter data and import of demo consumption/generation data for the kiosk user
Support information on login page and in the complete portal
Help page with glossary, FAQ and instructions (how to use the portal)
Smartphone optimized (responsive via HTML5 programming)
Administration
Automatic password generation and Emailing of login data
Master data: sortable list of all customers (Client, name, customer no., Login-ID, date of initial confirmation of general terms and condition, date of confirmation of new/changed general terms and conditions and privacy policy, validity and comments)
Master data: sortable list of all meters (meter point number, meter number, energy type, meter type, client, customer no.)
Customer details: detailed view with all customer information incl. meter information
Configuration of a minimal resolution to each meter for all energy types
Input of customer specific comments
Deleting of customers and meters
Log into a customer account as administrator
Export of all customer and meter data (CSV)
Consumption data monitoring: regular test routine and sortable display of consumption gap to each meter in 3 different intervals
Document vault: sortable list of all documents of a client (general terms and conditions, privacy policy and customer information) with information to document type, date of last change and source type (Link or PDF)
Detail view to each document type with download function of current PDF documents
Upload function for new/changed documents as link or PDF
Display of general terms and conditions and privacy policy with request for confirmation (after inital upload and amend documents)
Display a link to customer information
Automatic client data import
Efficient, file-based import interface for automatic import of customer-, contract- and meter data
XML data format with open specification
Check routines for identification of inconsistent data records and gaps in consumption delivery
Validation of necessary properties and dependencies between customer - contract – meter data
Automatic reporting via Email
Migration of existing data, System testing after migration and quality assuranc

Web analytics
Registration & Login (Google)
User evaluation with number of sessions, visitors (unique/returning visitors) and access over desktop/tablet/mobile devices
Evaluation of users demographic characteristics: language, country and city
Evaluation of users system properties: Browser, operation system and internet provider
Evaluation of users mobile device properties: operation system, internet provider and screen resolution
Evaluation of user behavior: number of page views, session duration, exit rates and visits per page
Creating and automatic sending of reports

3. Feature list 3: APP for residential customers

Features
Branding & customizing
Customization of font colors, (headers), header (including logo), the division of the frame elements and colors according to customer-CI
General features
Real-time comparison - based on personal consumption, signaling the average consumption (different display options, such as traffic lights)
Monthly balance sheet (including tabular analysis of the monthly consumption as a representation of 3-month comparison and dynamic pie chart)
Help page including screenshots and instructions on the operation of the application
Individual page including contact information
Display options & user interface
Representation as a graph of the consumption in kWh / Ltr.
Tabular representation of the consumption in kWh / Ltr.
Tabular representation of costs in €
Tabular representation of consumption in CO_2 emissions
Tilt function for more accurate representation of consumption
Granularity of data e.g. 15 min/ 1 hour, day, week, month, year (representation of underground fuel consumption)
Possibility to navigate back to the way in prior periods chart
Representation of predicted consumption
Touch function to obtain accurate point-in-time consumption data; Multi-touch function to obtain precise time-space-related Consumption Values
Connectivity & data import
Mobile recall of consumption, customers and tariff data via web-server connection