A Gaming and Social Networking Platform for Evolving Energy Markets' Operation and Educating Virtual Energy Communities

H2020 ICT-731767

SOCIALENERGY's Game Design Document

Deliverable D4.1

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Glossary of Acronyms

Acronym	Definition
API	Application Programming Interface
BMC	Business Model Canvas
C&I	Commercial & Industrial
CIS	Customer Information System
CRM	Customer Relationship Management
DMP	Data Management Plan
DR	Demand Response
DoA	Description of Action
DSM	Demand Side Management
DSO	Distribution System Operator
EC	Energy Community
ECC	Energy Consumption Curve
EC-RTP	Energy Community Real Time Pricing
EE	Energy Efficiency
EIDaaS	Energy Information distribution as a Service
EMS	Energy Management System
EP	Energy Program
ESCO	Energy Services Company
ESP	Energy Services Provider
GDPR	General Data Protection Regulation
GSMaaS	Gamified Social Marketing as a Service
GSRN	Green Social Response Network
InEC	Innovation & Exploitation Committee
IBR	Inclining Block Rates
ICT	Information and Communications Technology
IPR	Intellectual Property Rights
KPI	Key Performance Indicator
LCMS	Learning Content Management System
LO	Learning Object
M&V	Measurement & Verification
NGO	Non-Governmental Organization
ORDP	Open Research Data Pilot
P-RTP	Personalized Real Time Pricing
RAT	Research Algorithms Toolkit
S/W	Software
ToU	Time of Use
VEC	Virtual Energy Community
VPC	Value Proposition Canvas

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Document History

This deliverable includes the results of Task 4.1 activities during M4-M9 period. It also includes the design of the applied energy efficiency game and the technical specifications of the respective S/W modules.

Table 1: Document History Summary

Revision Month	File version	Summary of Changes
21/05/2017	v0.1	Draft ToC, internal review within NRG team
30/05/2017	v0.2	Final ToC structure is agreed, first game design document with avatar satisfaction parameters specification and score calculation sent to the consortium.
25/06/2017	v0.3	ICCS comments and feedback to the initial design document are addressed.
19/07/2017	v0.4	Integrated the description of the Time-of-Use (ToU) pricing and Real-Time Pricing (RTP) provided by ICCS team.
10/08/2017	v0.5	Further improvements by NRG on "Jobs", game score calculation, etc.
20/09/2017	v0.7	Adopting the design document after f2f discussion on the game's use case scenarios during the 3rd plenary meeting in Cologne.
22/09/2017	v0.8	Game loop definition, final formatting before the review.
25/09/2017	v0.9	ICCS and SU-NIS reviewed D4.1 and provided comments to NRG team.
29/09/2017	Final	NRG addressed the reviewers' comments by making some required enhancements and the deliverable was submitted in ECAS portal by the coordinator.

Executive Summary

This report is aimed towards the provision of public deliverable of H2020-GA-731767-SOCIALENERGY project dealing with the game design of the future game, virtual environment and interactions within it. More specifically, deliverable 4.1 (D4.1) elaborates on the specification of the design decisions given project's requirements evolving from the WP2 work (cf. D2.1 and D2.2 delivered in M4 and M6 respectively). Since the tasks envision a user-centric approach towards product development, and at the same time the consortium acknowledges the fact that the future virtual environment and the game should closely be related to commercially successful leisure games that are appealing to all the age groups and do not discriminate between different users (in other words the goal of the game is to attract the users who are active and involved in the energy efficient market as well as those who are not). The presented game design document takes into consideration a number of decisions made in other work packages, which includes the architecture design of the whole platform and communication of the SOCIALENERGY game with the rest of SOCIALENERGY's S/W components (or else subsystems).

The whole game design document is divided into several chapters addressing major points that the gaming studios and developers refer to during the creation of a new game. Thus, Chapter 1 introduces the overall aim of the SOCIALENERGY game, including global project's goal, game goals and sub-goals and some technical specification of the game.
Chapter 2 elaborates on the user profile, describing the initially defined parameters that are relevant for the game to be able to start it. Such parameters are user's personal profile (e.g. demographics, personal data, data related to the use of the platform, etc.), which are datasets retrieved from the core GSRN S/W platform. Furthermore, an initial set of ground rules and specifications on communication and data exchange between the platform and the game client are described in this part of the document.
Moreover, in Chapter 3, we present our approach on avatar design ensuring that the proposed solution could appeal to a variety of end-users of any age, gender, skin colour etc. In Chapter 4, we introduce a detailed description of the use case scenarios that drive the gameplay. In particular, we introduce the time of use pricing (ToU), personalized real time pricing (P-RTP) and real-time energy community pricing (EC-RTP).
The virtual environment that will be created as part of T4.2 activities of the DoA, is described in Chapter 5 of this document. In particular, it provides an overview of the whole scene that the end-user will be able to observe and interact with (such as electric appliances, functional objects or decoration objects). We elaborate on individual and community jobs that the user will be able or have to perform along the course of the game differentiating between two types of interactions: functional objects' interactions and avatar interactions. Moreover, the document elaborates on the definition of the convenience factors of the avatar and energy cost calculations, which are going to be combined and the trade-off between these two factors shall be found. Chapter 5 also provides a few indicative examples of the ways that the gamification principles are going to be introduced within the game, such as different unlocks and rewards within the game, badges, currencies, total scores, high score lists and position, etc.

Chapter 6 is important as it provides the basic mathematical modelling and respective equations for the most important game score calculations. Of course, much more advanced models will be used for the various use case scenarios and more details will be provided in subsequent WP4 deliverables. In chapter 7, various virtual rewards are presented together with indicative examples regarding their use inside the gameplay.

In chapters 8-10, several implementation features of the game are presented (i.e. from the presentation of non-player characters to the illustrative graphical user interfaces that the game will support). Details about the game's sound, music and other types of game's aesthetics are also described.

Finally, in chapter 11, SOCIALENERGY's interactions with the H2020 RAGE flagship project are described. The game will exploit certain features, best practices and libraries from RAGE exploiting the participation and related work of NRG and SU-NIS partners in both consortia. Concluding remarks conclude the report and summarize the major action points of the consortium for the upcoming months.

1. Introduction

1.1 Project Goal

The SOCIALENERGY Game will be developed in order to motivate and engage energy consumers and energy efficiency companies to deeply interact and to pleasantly educate both parties within the following objectives:

- Education and social inclusion towards greater energy efficiency.
- Deeply enhance the interaction between energy communities and energy efficiency oriented stakeholders.
- User engagement and profiling

Therefore, the SOCIALENERGY Game will be designed as a serious game focusing on simulation and management gameplay, but also will use some strategy and city builder game mechanics too. Depending on the required effort of each feature, more or less of the features described in this concept can be implemented given the restricted budget of the project.

1.2 Gameplay Goal

The overall goal of the SOCIALENERGY Game is: "Play in different use case scenarios to experience and learn about different aspects towards energy efficiency!". Therefore, the player has to satisfy the convenience of his/her avatar that lives in a virtual home by achieving the minimum energy consumption or the maximum energy efficiency. The convenience of the player's avatar is influenced by interactions of the player with virtual electric appliances of the virtual home. The electric devices are predefined and have parameters (i.e. size, energy consumption) that the player can influence.

The interactions are described and defined in "Jobs", which the player must do (for example cook, wash, heat, work, etc.). These Jobs are related to the electric appliance, respective timeframes and durations. At the start of each day, the player gets a list of jobs he has to solve within the day. The player has to schedule these jobs in a way that the user reaches the highest combined score of convenience and power consumption costs shown to the user in a costs/time diagram. While executing these jobs, the player has to achieve specific scenario goals assigned by the game.

To achieve the main goal, the player has to:

1. Determine the optimum convenience and costs by comparing the time/costs diagram with the detailed job convenience Info
2. Decide when and with which order s/he must execute the jobs.

3. Execute the jobs and get the best possible game score

1.3 Sub Goals

Within the game development there is no limit of possible goals. A number of games have already explored a vast range of goals that guide the player behavior. Nevertheless it is common to introduce sub goals as a mean to structure player's experience. That being said, game design of SOCIALENERGY considers not only putting together certain mechanics to reach the main objective of the game, rather shapes an experience controlling game's length while keeping the plot consistent during the play. Such goals are not explicit to the player per se and can consist of certain artificial incentives.

The introduction of the sub goals are especially useful within non-finite games where players might require more time understanding how their earlier game actions contribute to the ultimate goal achievement. The completion of sub goals reward the player giving him/her the guidance throughout the game. Some of the main sub-goals of the SOCIALENERGY gameplay are the following:

- "Do several jobs in a regular base by using electric devices and functional objects in order keep up the avatar's convenience and energy cost in order to earn virtual money and experience points!"
- "Get feedback, rewards or even receive "punishments/penalties" (e.g. in the form of game points' reduction) for your behavior during interacting with electric appliances!"
- "Repeat jobs in variations to behave better and better!"
- "Interact with virtual Non Player Characters (NPCs) to improve energy efficiency!"
- "View learning materials presented by a virtual assistant to improve your knowledge about energy consumption and good practices on energy efficiency!"
- "Level up and unlock new jobs, electric devices, upgrades and decoration objects!"
- "Interact with objects and inventory to do jobs (homework, tidying up the room, feeding the fish, etc.)!"
- "Get decoration objects to place them in the virtual world!"
- "Visit the SOCIALENERGY GSRN Platform to spend the virtual currency Cash in the respective digital marketplace!"

1.4 Target Group

On the global level, SOCIALENERGY Game does not discriminate the users by means of who it is targeted to; on the contrary it shall serve as a stimulus to be engaged in the energy efficiency market targeting at all the end users of all age groups and backgrounds. Nevertheless, it is possible to point out certain groups of people who might serve as the early adopters of the SOCIALENERGY Game. Those are the key stakeholders, including the end users who are interested in the concepts of considerate energy consumption, passive consumers, communities as well as subsets of targeted populations, including difficult-to-

reach populations, such as building occupants that do not pay for utility services and, therefore, receive no direct financial benefit from energy efficiency[1].
Thinking beyond the engagement of the end user, the game shall be appealing for a number of other stakeholders that will also contribute to successful exploitation and most importantly show an added value to key customer segments such as utilities, ESCOs, ESCO clients, C&I, SMEs, public authorities in smart cities, appliance retailers, aggregators, etc.

1.5 Technical Specifications

To ensure that the future SOCIALENERGY Game can be exploited in many different ways, the possibility of a cross-platform development was considered. For the purposes of the project, it was agreed on the following technical specifications to deliver a browser-based game:

- The target platform for the game is web browsers (Html 5 / Web GL)
- Development in Unity[2]
- Render Resolution 1280x720 pixel

Starting from 2005, when Unity was initially released and introduced to game developers it has become an integral part for many beginners and professional developers of the creative industry to explore the gaming industry. It allows to create games by utilize three-dimensional objects and elements, as well as adding various components and features to them, such as visual effects, shadows, etc.
The major decision choosing Unity was the ability of cross-platform development since it has a very good browser support and the ability to export the game to a range of devices as a native application as well as it closed-source development with support for Windows, Mac OS X, Linux and major mobile platforms (iOS, Android).
Nowadays, Unity includes a vast and strong support community and an up to date documentation with regular updates. So, the technology selection comes down to the scope of work that has to be done based on the requirements and which framework can satisfy them.

[1] SOCIALENERGY Consortium, D6.1 Data Management Plan, Dissemination and Exploitation plans
[2] https://unity3d.com. Unity is a cross-platform game engine developed by Unity Technologies, which is primarily used to develop video games and simulations for computers, consoles and mobile devices.

1.6 Gameloops and Parameters Overview

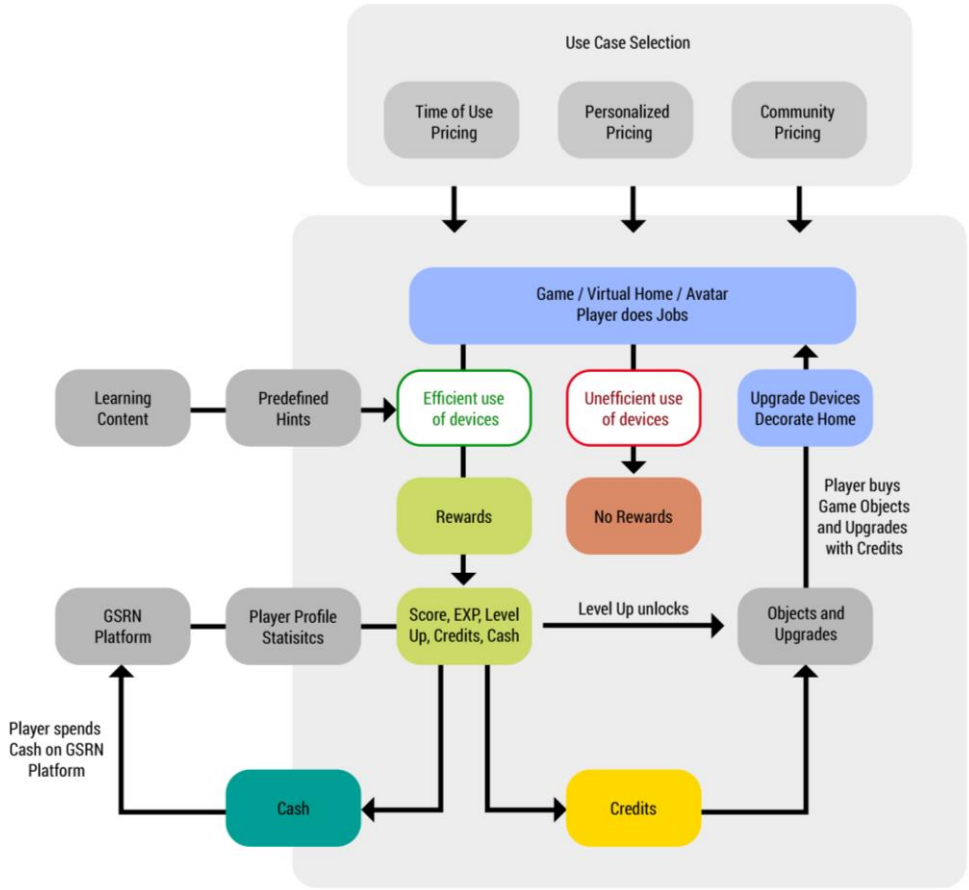


Figure 1. Gameplay loops / Parameters Overview (Chart)

"A Gameplay Loop is a game design term that is used to describe the repetitive activities that a player will take, while playing a game. It, essentially, defines what the player DOES while playing"[3]. Within the scope of the SOCIALENERGY Game, everything that the player is doing can be categorized based on different criteria. It helps to realize which actions in the virtual world have an immediate or measurable effect, how the interaction of the user affects the loop of the gameplay. On a high level, Figure 1 reflects the central Virtual Home with Avatar that can be entered after selecting the use case (or DR event) the player wants to simulate. Further actions and consequences are defined buy pointing arrows where in simple words the user can get reward for correct fulfillment of the jobs, goals and sub goals (e.g. efficient use of devices gets a reward, while inefficient use provides no rewards.). We further envision different time of reward system like scores, experience levels, credits and cashes that later can be used in the game as a virtual currency or as a currency ("Cash") within the GSRN Platform.

[3] http://engagedfamilygaming.com/parent-resources/video-game-definition-week-gameplay-loop/

2 User Profile

2.1 Register

Before the player can start the game, s/he has to register on the GSRN platform. Here, the user has to create his/her user profile, where diverse information is requested, i.e. name, age, gender, User ID, Password. A part of this demographic and behavioral data will also be used by the game.

2.2 Competence Level Pretest

During the first session in the GSRN platform, the user has to run through a pretest. This pretest will determine the user's actual energy efficiency competence. The GSRN will rate the users competence to store the result of the test on the GSRN platform. The GSRN platform will send the competence level of each user to the game, where it can be used, i.e. to recommend an optimal use case scenario and/or difficulty level of gameplay for the player. Information regarding the competence level of the user may be periodically updated in GSRN and sent to the game, too.

2.3 Game Login

After the player has registered, s/he can use his/her GSRN account to log in the game client. Therefore, the GSRN Platform and the game are connected.

2.4 Game Parameters

The game will send game-related data that can be shown in the users profile view on the GSRN Platform, i.e. Level, Badges. Moreover, the LCMS and RAT modules are able to acquire game-related data from the GSRN Platform. The following list of game parameters will be made available to all the other SOCIALENERGY subsystems:

- Experience Points
- Game Level
- Avatar Convenience Status
- Avatar Appearance (i.e. Name, Gender, Skin Color, Hair, Hair Color, Clothes, etc.)
- Cash (Currency to buy real GSRN platform objects)
- Credits (Currency to buy virtual game objects)
- Electric Appliances Status (enabled, disabled, settings)
- Play time
- Unlocked objects
- Badges (achievements)
- Tracking Data

By the term "tracking data", we mean that the game will be able to send log files regarding the specific actions of the gameplay back to GSRN. This information can be important for the SOCIALENERGY system to track the behavior of each user's gameplay and then efficiently educate him/her via the various functionalities of the SOCIALENERGY platform as a whole.

2.5 Data exchange between GSRN and Game Client

The following (non-exhaustive) list of features will be the datasets that are exchanges between the GSRN and the game client:

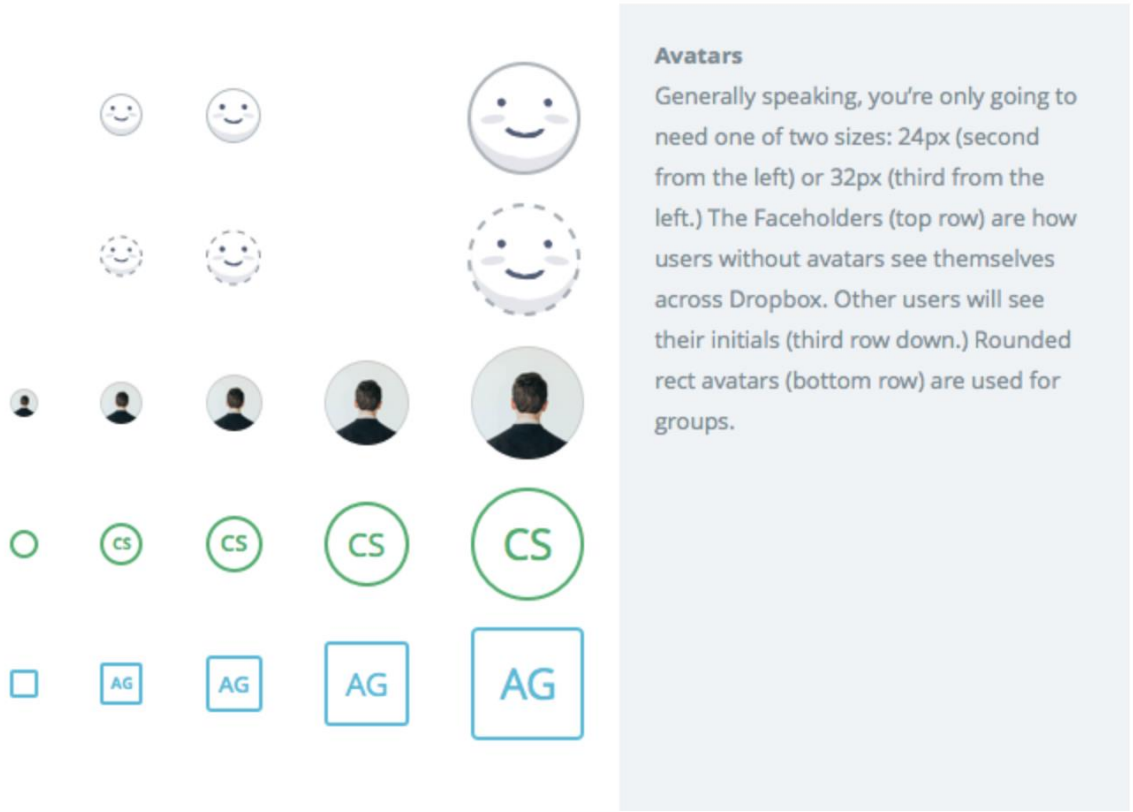
- User Profile information, i.e. name, age, gender, User ID, Password (GSNR registration)
- User Save Game Data (Load to continue the game by user or automatically after login), i.e. experience points, Level, unlocked objects, score, virtual currency, device status, play time
- GSRN platform user interaction events
- Competence Level (result of the pretest)
- Login Permission or Failure
- Multiplayer Highscore list and Position
- Cash (currency for GSRN platform purchases)
- Credits (currency for in-game purchases)
- Activity Level (GSRN Platform interactions)
- Overall Score and Badges

Note: The dynamic energy prices will be calculated by the Game Client. This will be done by integrating the respective mathematical models provided by RAT research work, which takes place in WP3. Any possible slight changes in the above list of features may take place after the end of the 1st S/W integration phase.

3 Avatar Editor

The first use of the term Avatar in the computer gaming context was first introduced back in 1979 within role playing game Avatar by PLATO4. Almost a decade later it became common to use this term to represent the user's identity within the virtual environment. Since then, the objective of humanizing the online community almost unanimously became a must have feature. Nevertheless, at early adoption the platforms have almost exclusively started off with predominantly male white-typed imagery. A number of studies[5] has pointed to the need of more inclusive approaches to avatars in various digital spaces that would be able to reflect race and gender equity.

Nowadays, many companies are trying to introduce a gender and race neutral avatars, offering less realistic and gray-scale defaults. Over the course of development of more inclusive approaches, big corporations started to experiment with different solutions, like generic human silhouette, identicon style, anonymous animals, smiley faces etc.:



[4] https://www.uvlist.net/game-174616-avatar
[5] Harrell Fox, "Identity Representation", School of Humanities, Arts, and Social Sciences and Computer Science and Artificial Intelligence Laboratory. MIT

Figure 2. Examples of Neutral avatars

As the industry has matters, many solutions have been proposed on how to address equality and social inclusion within digital space and social networks. But, the situation with computer games is a bit different if the user's avatar is at the same time the in-game character that supposes to be animated and interact with objects. Many games that are available on the market offer a limited set of customization of the main protagonist, limiting the choice mostly to the outfit selection. In the recent years, more attention has been devoted to offer the player a choice of at least two characters within the game: male and female. Good examples of the personalized avatar creation can be seen in many MMO games as well as simulation games like The Sims[6]. Offering the avatar editor, developers and publishers ensure self-relatedness of the player to the character and more personal experience when simulating a certain event within a virtual space. The latter feature and its benefits are of crucial importance for the SOCIALENERGY Game, therefore is going to be proposed at the start of the game to each user. For the sake of the project the avatar customization is going to be limited, but it will show the ability of the future product to be highly customizable and socially inclusive.
Selected user profile information is used by the game to create the avatar automatically (i.e. gender). After the first start, an avatar editor offers to the user some customization options for more individual characters that could also be used as profile picture on the GSRN platform, too.

[6] https://www.thesims.com

4 Use Case Scenario Selection Menu

The game can be played in different scenarios that refer to each respective use case. The scenarios can be selected by the user in a menu, before s/he starts to play. Alternatively, to the use of a selection menu, the scenarios could be implemented in a linear way, so the player would have to play them step by step after or related to the users competence level determined by the Pre-Test mentioned above.

4.1 Use Case Scenarios

4.1.1 Time of Use Pricing

The user participates in an energy program with Time of Use (ToU) Pricing and has to satisfy the convenience of his avatar by achieving the minimum energy consumption or the maximum energy efficiency, while executing several "jobs". Please note that the conventional Real Time Pricing (RTP) program is also supported in this scenario (i.e. 15-min or 1-hour time granularity instead of several hours time granularity supported by the Time of Use Pricing).

4.1.2 Personalized Real Time Pricing

The user participates in an advanced energy program with Personalized Real Time Pricing (P-RTP) and has to satisfy the convenience of his/her avatar by achieving the minimum energy consumption or the maximum energy efficiency, while the price is affected by his/her decisions efficiency while executing several "jobs".

4.1.3 Real Time Energy Community Pricing

The user joins a NPC community and participates in an advanced energy program with real time pricing and has to satisfy the convenience of his/her avatar by achieving the minimum energy consumption or the maximum energy efficiency, while the price is affected by his/her decisions and by the energy consumption from other virtual NPC consumers efficiency, while executing several "jobs". They have to communicate and make arrangements with each other in order to achieve the goal as a member of an energy community with the use of predefined text snippets.

5 Virtual Home

5.1 Environment

The player controls the Avatar in his/her home that is predefined in a way that all users have the same prerequisites.

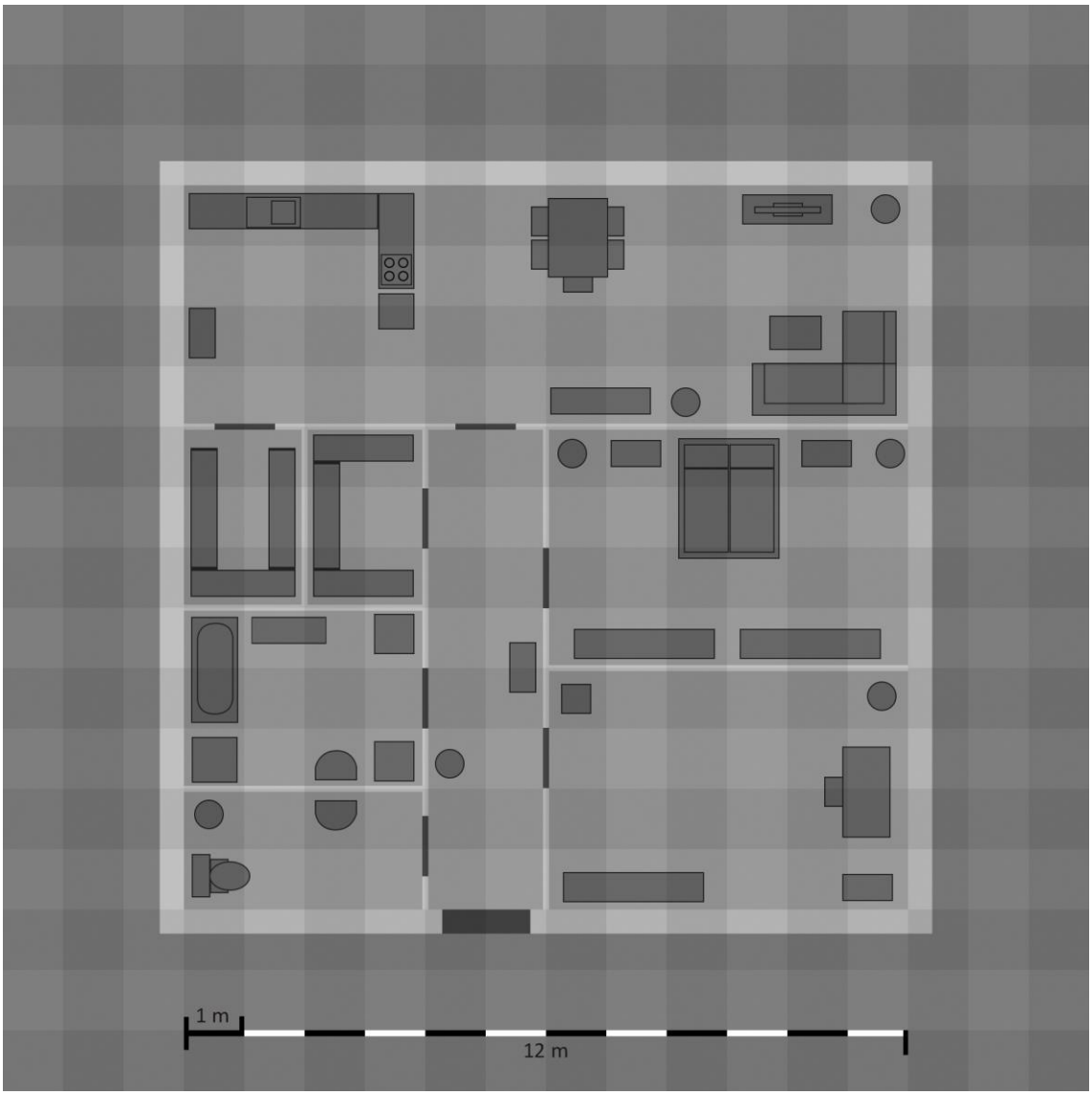


Figure 3. Environment Layout / Ground Plan (Draft)

5.2 Rooms

As in real life, the virtual home is separated in different rooms, for example home office, the living room, a kitchen, the bathroom and an entrance. In the following figure, an illustrative example is depicted:

Figure 4. Virtual Home Room Overview (Draft)

5.3 Isometric perspective camera view

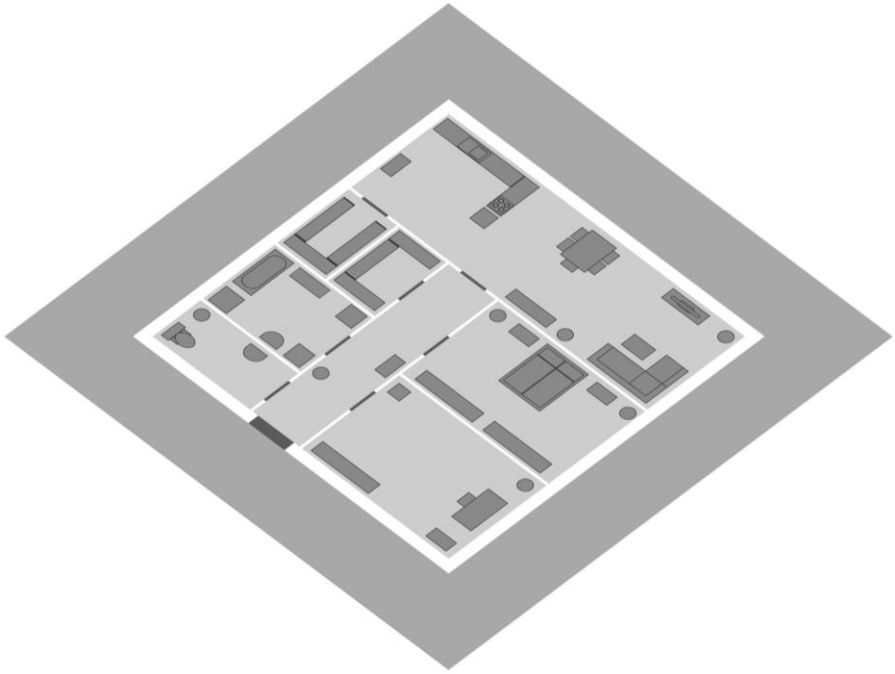


Figure 5. Isometric View (Draft)

The virtual world is shown in an isometric camera view such as the one shown above.

5.4 Objects

The rooms contain several interactive objects, with which the player can interact.

5.4.1 Electric Appliances

Once the player starts the game, the virtual home of the avatar will contain a predefined set of electric devices (i.e. microwave, fridge and laptop). These devices have several parameters. The game relevant data (i.e. electric appliance/device models) is delivered to the game client, for example:

- Name
- Type
- Energy Class
- Power Consumption / Use Time or Session
- Settings
- Upgrade
- Upgrade Effect (three levels)
- Interaction duration
- Optional: Buy Cost, Appearance, Size

These objects are part of several interaction sequences (jobs) that the player has to do during the gameplay. An indicative list is provided below:

- If the player uses these devices, there will be energy consumption and respective costs.
- The player can upgrade the electric devices up to three levels.
- The player earns upgrades as rewards for his success during the game, i.e. Level Up.
- The upgrades improve the attributes of the objects: Convenience Factor and Power consumption is influenced
- The parameters are shown in a pop up menu, when the user taps on it.

Each 'JOB' (e.g. COOK, WASH, HEAT, COOL, WORK) is mainly related to the electric appliance characteristics and duration. Every JOB within the GAME has a duration and a scheduling time horizon (e.g. should be finished until 18:00). While executing these JOBS, the GAME player has to achieve specific scenario goals assigned by the game. The electric devices have predefined parameters (i.e. capacity, mode of operation, energy class, duration) that the player can influence. The parameters that are shown in a pop-up menu within the GAME are the following:

- Capacity: measured in KWs when operating in "full"/ "max" mode. This feature also implies the size of the device.
- Mode of operation: low/medium/high mode for A/Cs, economy/normal/easy care/intensive for washers, % dimming for lights, etc.
- Energy Class: A/B/C/D or A/A+/A++/A+++ → e.g. upgrades can be done up to 3 levels
- Duration: 15-min time granularity

The MDM-GAME API structure should have the features above. GAME submits requests about 'JOBS' and MDM returns energy consumption curves (ECCs).

Table 2. Electric appliances' draft characteristics

Id	Device Name	Capacity (KW)	Mode of operation	Energy Class	Duration
1	Air Condition (A/C)	2.5/3.5/5/7	L/M/H	A/B/C/D	15-min, 1h, 2h, etc
2	Electric Heater	1/2/3	L/M/H	A/B/C/D	15-min, 1h, 2h, etc
3	Electric water heater	4.5/5.5	Single mode	A/B/C/D	15-min, 30-min, 45-min, 1h
4	Kitchen/Oven	4		A/A+/A++/A+++	15-min, 1h, 2h,
5	Dishwasher	1.0, 2, 2.5	Eco/normal/ care	A/A+/A++/A+++	15-min, 1h, 2h,
6	Washing machine	1.5, 2.0, 2.5	Eco/normal/ care	A/A+/A++/A+++	15-min, 1h, 2h,
7	Tumble Dryer	1, 2, 4	Eco/normal/ care	A/A+/A++/A+++	15-min, 1h, 2h,
8	Electric vehicle	0.5, 1, 2	One		15-min – 12 hours
9	Lights	0.01, 0.02, 0.05, 0.1, 0.2, 0.4	0% / 25% / 50% dimming	A, C, F	

5.4.2 Functional Objects

Some of the interactive objects are functional objects that are just part of the interaction sequences, but have no energy consumption. These sorts of objects are usually introduced to keep the consistency to the gameplay and to be able to reflect the reality in a better way. For example, an electric appliance like a microwave cannot stand on a flow, rather has to be placed on the table. In such a way we ensure that the user can relate the virtual world to the real world in a more credible way, which also contributes to relatedness to the scenario. Examples of functional objects could be:

- Table
- Cupboard

5.4.3 Decoration Objects

To reward the player and to visualize the player's progress within the game, in addition to the score points, the play is rewarded with decoration objects that appear in the virtual home. Decoration objects are not interactive but serve as rewards for the player's success. They can be unlocked via Level Ups to "pimp up" the virtual home. Decoration objects are not novel within game design and proved to be a nice addition to the gameplay drive. Coming back to one of the most successful examples of The Sims game, every player was striving to succeed in their daily activities doing a routing of going to work, socializing and doing house related jobs to fulfil an ultimate goal of getting rewarded with new furniture, earning money that would enable the player to buy new and more expensive and visually attractive appliances or at all new houses. Such examples within the SOCIALENERGY Game can be:

- Plant
- Sculpture
- Carpet

5.4.4 Inventory Objects

Inventory objects can be used with the electric appliances and functional objects (drag and drop interaction), i.e. laundry must be dragged out of a basket and dropped into the inventory to drag and drop it into the washing machine. Inventory objects visualize the progress during the job sequences and are displayed in the user interface.

5.5 Virtual World Time

The Game Client delivers the virtual world's time that is synchronized to the players actions, especially during the jobs and the interactions with the electric appliances.
Depending on the specific use case scenario, the energy price calculation is affected by this virtual world time, too.

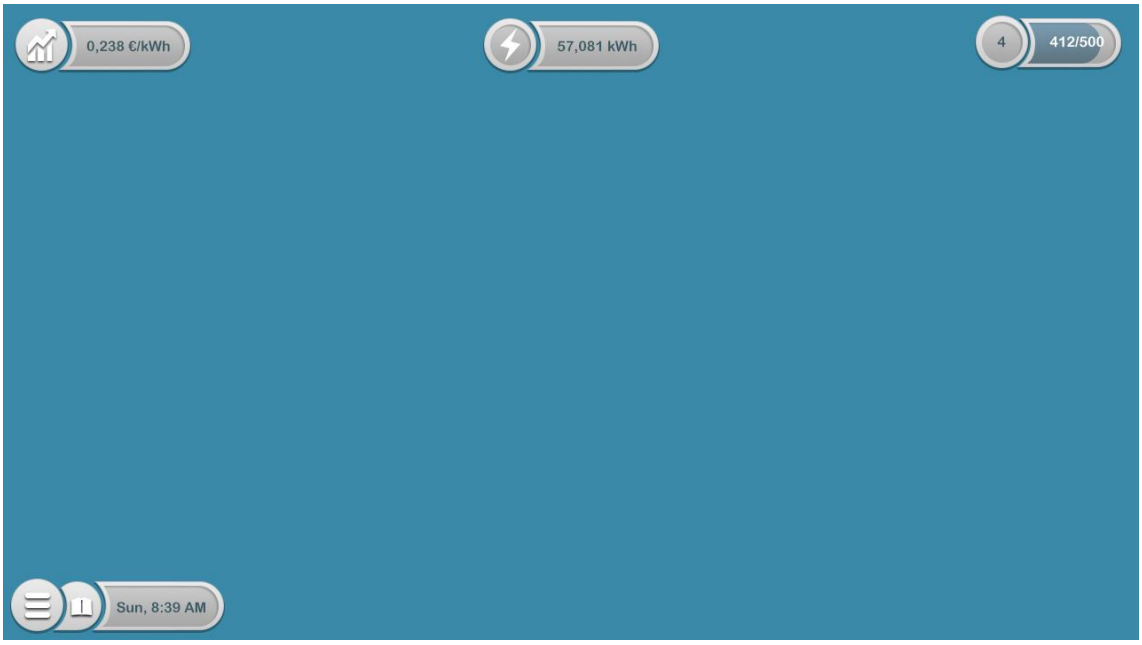


Figure 6. HUD (Draft)

5.6 Jobs

At the start of each day, the player gets a list of jobs that s/he has to solve within the day[7]. The player has to schedule these jobs so that the user reaches the highest combined score of convenience and power consumption/costs, which is shown to the user in a costs/time diagram.

[7] Another option could be to "appear" jobs during the day in the beginning of the time frame (or else just before the beginning, e.g. 10 min earlier).

Figure 7. Daily Job Overview Window (Draft)

Each job is a "production chain" that can include one or more device and avatar interactions in a specific order. So in the context of the game the user shall fulfil a chain of actions with a number of different interactions between the avatar and the object in order it to be completed. For example, for a job name "Lunch", the interaction steps would be ordered like this:

1. Take an empty plate out of the cupboard
2. Go to the fridge to fill the plate with food
3. Put the plate into the microwave
4. Configure the microwave
5. Start the microwave
6. Wait until microwave has finished
7. Take the plate to the table
8. Wait until avatar has eaten the meal
9. Bring dirty plate to dishwasher
10. Configure the dishwasher
11. Start the dishwasher

12. Wait until dishwasher has finished
13. Bring cleaned plate to cupboard

5.6.1. Device Interactions

As in real world, every device interaction takes a predefined duration depending on the device type and the selected mode. The same approach is going to be introduced within the virtual world of the game.

Example: Washing Machine

- Normal Mode: 2 h
- Eco Mode: 3 h
- Fast Mode: 1 h

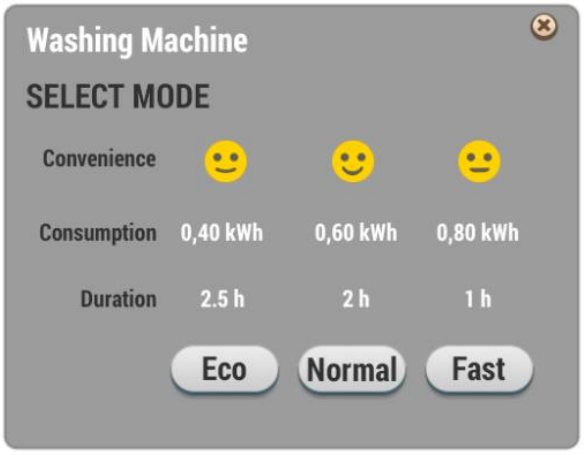


Figure 8. Interaction Menu for Device with Modes, Duration and Power Consumption (Draft)

5.6.2 Avatar Interactions

Every avatar interaction corresponds to a pre-defined time duration.

Example:

- Sort Cloths (10 min)
- Fill Washing Machine (5 min, player occupied)
- Unload Cloths (5 min)

5.7 Avatar Convenience

The avatar that lives in the virtual home has a convenience that is related to interaction sequences (Jobs). The device interactions of the user during a job are influencing the

parameter "convenience". The player's goal is to achieve a high convenience factor. If the player does not interact optimally, s/he will lose some of his/her convenience points.

5.8 Convenience Factor

The convenience is influenced by predefined Convenience Factors depending on the job category:

5.8.1 Time based Convenience

The convenience (or else user satisfaction) is influenced by the timeframe that is required when to execute the task (i.e. for meals) (i.e. prepare lunch between 11 and 14 o'clock using Microwave).[8]

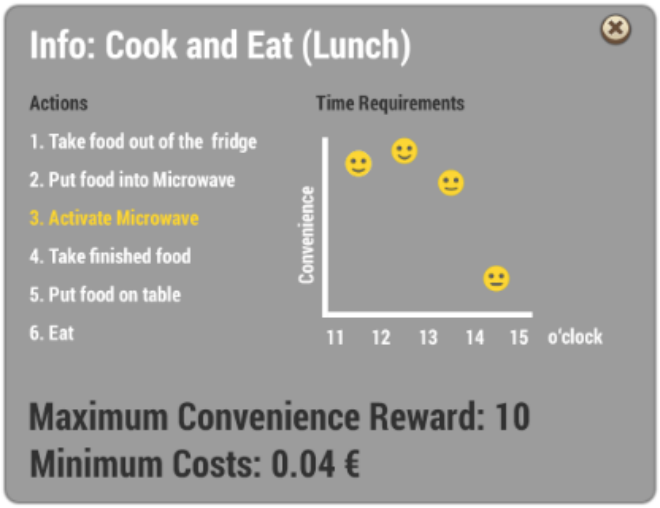


Figure 9. Job Category Time based Convenience Detailed Info (Draft)

Examples Jobs in Type 1 (i.e. convenience influenced by related to timeframes)

Table 3. Jobs in Type 1 (i.e. convenience influenced by related to timeframes)

Breakfast Time	07 - 08	08 - 09	09 - 10
Convenience Factor	0.95	1	0.97

Lunch Time	11 - 12	12 - 13	13 - 14	14 - 15
Convenience Factor	0.98	1	0.95	0.8

Dinner Time	18 - 19	19 - 20	20 - 21	21 - 22
Convenience Factor	0.9	1	0.97	0.9

[8] There will be a timeframe requirement for each job

5.8.2 Device Mode based Convenience

The convenience is influenced by the device mode in which the job is executed (i.e. wash clothes using Washing Machine in eco, normal or fast mode).

Figure 10. Job Category Device Mode based Convenience Detailed Info (Draft)

Examples Jobs in Type 2 (i.e. convenience influenced by device setting)

Table 4. Jobs in Type 2 (i.e. convenience influenced by device setting)

Device Mode Air conditioning	Low	Med	High
Convenience Factor	0.7	0.9	1

Device Mode Water heater	Eco	Full
Convenience Factor	0.8	1

Washing machine	Fast	Eco	Normal
Convenience Factor	0.7	0.9	1

Lights	Dimmer 20%	Dimmer 40%	Dimmer 60%	Dimmer 80%	Dimmer 100%
Conv. Factor	0.2	0.4	0.7	0.87	1

5.8.3 Fixed Convenience

Influenced by nothing (i.e. Watch TV)
Jobs in Type 3 (i.e. convenience influenced by nothing)

Table 5. Type 3 (i.e. convenience influenced by nothing)

TV	n.a.
Convenience Factor	1

5.8.4 Convenience Factor Info

From the user's perspective, it is difficult to understand how the parameter 'convenience' is affected by his/her actions, if this is calculated in a different way for several jobs, i.e. "Why are dimmed lights less convenient than bright lights?", "Why is the washing eco mode less convenient?", "Why does watching TV not affect the convenience?", "Why has lunch a timeframe of 4 hours, but breakfast only 3 hours?". Because of the fact that there is the need for the project to use the statistical data, it is important to clarify to the player why the convenience is influenced in this way by using textual explanations. These textual explanations, which are integrated in SOCIALENERGY game are based on the results of LCMS work done in task 4.4 (cf. user competences taxonomy framework). An example of this type of textual explanations is illustrated below:

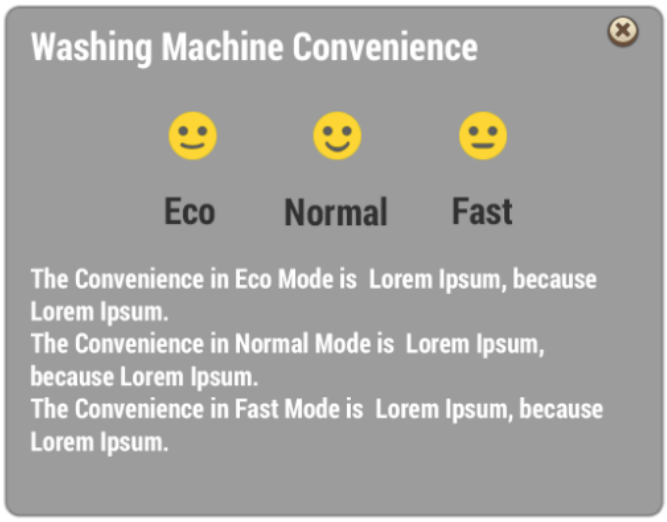


Figure 11. Device Detailed Info for Convenience (Draft)

5.9 Energy Costs Calculation

By using devices while executing jobs, the player increases the costs depending on the utilized electric devices power consumption, which is mainly influenced by:

a) the selected device modes and,

b) the duration of the interaction

Furthermore, the calculation of the costs is influenced by one of the price models, which the player has selected in the Use Case Scenario Selection Menu:

1. Time of Use (ToU) Pricing
2. Personalized Real Time Pricing (P-RTP)
3. Real Time Energy Community Pricing (C-RTP)

5.10 Time of use Pricing

Within this section we introduce the time of use pricing scenario, where the energy consumption prices are dependent on the time slot the user consumes the energy. The following table provides an overview of the prices which are based on the actual electricity market data from a real market operator (i.e. Nordic Pool). Similar approach will be followed for the rest scenarios of the SOCIALENERGY game and a more detailed overview of such calculation for each of the use cases will be described in the D4.2.

Table 6. Real Market electricity ToU pricing

Time slot (k)	€/MWh	pk/pmax	pk (€/KWh)
00 - 01	28.77	0.66016521	0.02877
01 - 02	27.35	0.62758146	0.02735
02 - 03	26.02	0.59706287	0.02602
03 - 04	25.4	0.58283616	0.0254
04 - 05	25.34	0.58145939	0.02534
05 - 06	27.96	0.64157871	0.02796
06 - 07	32.76	0.75172097	0.03276
07 - 08	38.64	0.88664525	0.03864
08 - 09	41.51	0.95250115	0.04151
09 - 10	41.99	0.96351537	0.04199
10 - 11	41.95	0.96259752	0.04195
11 - 12	42.7	0.97980725	0.0427
12 - 13	43.58	1	0.04358
13 - 14	39.92	0.91601652	0.03992
14 - 15	36.57	0.8391464	0.03657
15 - 16	33.79	0.77535567	0.03379
16 - 17	34.9	0.80082607	0.0349
17 - 18	38.4	0.88113814	0.0384
18 - 19	38.97	0.89421753	0.03897
19 - 20	39.04	0.89582377	0.03904
20 - 21	33.32	0.7645709	0.03332
21 - 22	28.71	0.65878844	0.02871
22 - 23	28.09	0.64456173	0.02809
23 - 00	24.08	0.55254704	0.02408

5.10.1 Time / Energy Costs Diagram

The actual energy costs are shown to the user in a costs/time diagram. As a result, the user is continuously aware of the energy cost during the gameplay and is thus able to make the optimal decisions towards achieving the highest game score.

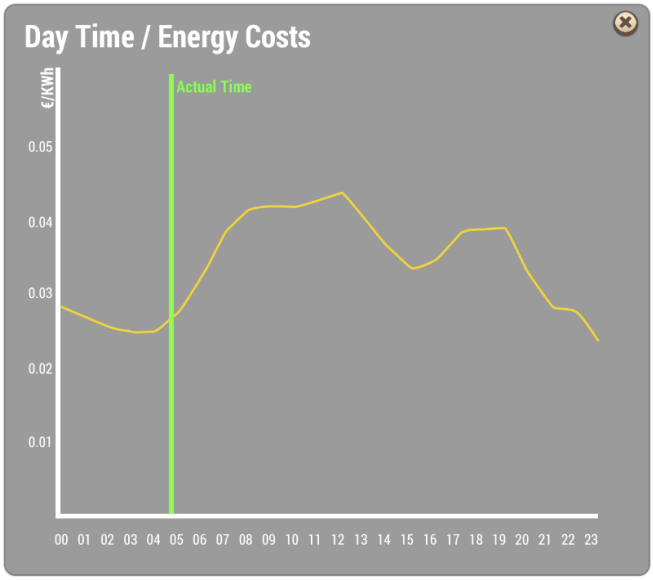


Figure 12. Time / Energy Costs Diagram (Draft)

5.10.2 Calculation Device Interaction Example

Within the following section we provide an example of calculation for device interaction. In case of the Washing Machine we assume the following modes:

- Normal Mode: 0,60 kWh
- Eco Mode: 0,4 kWh
- Fast Mode: 0,70 kWh

For the sake of use case example the player might choose the Fast Mode as preferable starting to use it at 10:30 and continuing for 1 hour. Following the example on the costs and consumption for a given device within the given time frame, the total costs would sum to 0,0296275.

Table 7.Device interaction calculation

Time slot (k)	pk (€/KWh)	Duration	Consumption	Costs
10 - 11	0.04195	30 Min	0.35 KW	0,0146825
11 - 12	0.0427	30 Min	0.35 KW	0,014945

5.11 Personalized Real Time Pricing

The Personalized Real Time Pricing calculation will be researched and translated to the gameplay during the project. The results of the research work that is taking place in WP3 by ICCS (i.e. RAT subsystem) will then be used as input for the game score calculations.

5.12 Real Time Energy Community Pricing

The Real Time Energy Community Pricing calculation will be researched and translated to the gameplay during the project. The results of the research work that is taking place in WP3 by ICCS (i.e. RAT subsystem) will then be used as input for the game score calculations.

6 Game Scores

Separate scores for energy costs and convenience will be shown to the player in order to calculate the total score and thus make it easier for the player to comprehend the relation between these two values.

At the same time, it puts the player in the situation of having to decide which parameter to optimize. He might ask "is it worth going for the full mode if the eco mode only decreases the convenience by a little bit?" and learn how to actively behave in an energy efficient way. The project's ultimate goal is seamlessly educating the users via the game in order for them to be able to apply their "lessons learned" in the core GSRN S/W platform.

6.1 Daily Costs Score

At the start of each day, the user has 0 € Costs. At the end of a day, the player will have specific amount of costs (i.e. 2,50 €), depending on his interactions (time, device mode, duration) during the execution all required jobs.
To calculate a normalized Daily Costs Score, the Minimum and Maximum Costs can be calculated and be used (Costs for all daily jobs if user behaves the best or worst way). The mathematical function is the following:

Daily Cost Score = 100 – { [(Maximum Costs - Daily User Costs) / (Maximum Costs - Minimum Costs)] * 100 }

For the sake of an example we introduce the following:
Daily Minimum Costs = 1.78 €

Daily Maximum Costs = 2.32 €

Daily User Costs (real) = 1.98 €

For these example score values, the following indicative computation takes place:

Daily Cost Score = 100 – { [(2.32 € - 1.98 €) / (2.32 € - 1.78 €)] * 100 } = **37.04**

6.2 Convenience Score

6.2.1 Job Maximum Convenience Score

Each job has a predefined JobConvenienceMaximumScore that is related to the average percentage of energy (p_c) that each house consumes for each category of devices. For each Job that the player misses until the end of the day, s/he will earn zero Convenience Score. The following table provides an overview of the device categories that are commonly present in a single household.

Table 8. Convenience Score

Category (c)	Devices (d_c)	Percentage (p_c)	Job Maximum Score
1	A/C, Heating, Cooling	25%	25
2	Electric heater	7%	7
3	Electric water heater	9%	9
4	Cooking: Kitchen, Microwave	10%	10
5	Dishwasher	2%	2
6	Washing machine & Dryer	5%	5
7	Lights	12%	12
8	Entertainment (TV, Sound System)	7%	7
9	Electric Vehicle (EV)	10%	10
10	Stand-by/Other	3%	3
11	Refrigeration	10%	10

6.2.2 Job Convenience Score Calculation

- The Job Convenience User Score is the Convenience Score that the player achieves for a specific job.
- This Score depends on the predefined Job Convenience Maximum Score and the Job Convenience Factor influenced by the player's decisions.

Job Convenience User Score = Job Convenience Maximum Score * Job Convenience Factor

Example:

Job "Wash" Maximum Convenience = 5

Job "Wash" Convenience Factor = 0.7 (User Selected "Fast")

Job "Wash" Convenience User = 5 * 0.7 = **3.5**

Table 9. Job Result Window (Draft)

6.2.3 Daily Convenience Score Calculation

At the Start of the Day, the user has 0 Convenience Points. At the end of a day, the player will have specific amount of Convenience Points (i.e. 47), depending on his/her interactions (time, device mode, duration) during all the jobs' execution. To calculate a normalized Daily Convenience Score, the Maximum Convenience can be used (Convenience for all daily jobs, if user behaves the best way).

Daily Convenience Score = (100 * Daily User Convenience) / Daily Maximum Convenience

Daily Maximum Convenience = 125

Daily User Convenience = 80

Daily Convenience Score = (100 * 80) / 125 = **64**

6.3 Daily Total Score Calculation

Daily Total Score = Daily Convenience Score - Daily Costs Score[9]

The Dialy Total Score takes into consideration the dialy costs and convenience score. Given the formula above, an example of Dialy Total Score can look as follows:

Daily Cost Score = **37**

Daily Convenience Score = **64**

Daily Total Score = **27**

Table 10. Daily Result Window (Draft)

[9] If the Daily Total Score is negative the player gets 0 Points

6.4 Game Total Score Calculation

The total score will constitute of the sum of the daily scores to state the overall progress of the user. Finally this total score will be considered when listing the players in the ranking lists (se chapter 7.6 for details).
Game Total Score = Daily Total Score Day 1 + Daily Total Score Day 2 + Daily Total Score Day [N]

7 Virtual Rewards

Virtual rewards are unexpected interstitials delivered to users during achievement worthy moments during their gameplay. They are moments such as natural pauses, often achievements, when users complete relevant actions inside mobile apps or games. Real Rewards include tangible products, like a bag of Sour Patch Kids or a sample of Propel Fitness Water. Virtual Rewards are often extra in-app currency or bonuses sponsored by the brands or just a badge that provides a sense of achievement to the player. Developers maintain full control over how much incentive to give users per reward but they need to maintain fairness in the game and not favour any particular player. Incentives and Rewards are an important piece in the engagement puzzle of an application. With proper and thoughtful design, incentive and reward programs can be very effective in providing necessary motivations for driving engagement of the users. That is, with the right selection and mix of achievements and rewards, and with an effective system for delivering these, participants not only become more engaged, but are also retained and become valuable evangelists for the application/game they are rewarded from while completing all the tasks of the game or application.

7.1 Credits

Within the SOCIALENERGY Game, the player will be often rewarded with "Credits", if s/he succeeds above a certain score threshold in the game. One of the incentives of the player is to receive as many credits a possible, since with " Credits", virtual world products can been purchased in the game (i.e. decoration objects)."Credits" will be stored and handled in the user's GSRN profile. These credits will then be used by GSRN's virtual marketplace module to provide specific offers to the user.

Figure 13. Credits Draft example

7.2 Cash

Similarly to the approach of the "Credits", the player can be additionally rewarded with "Cash", if s/he succeeds in the game. With "Cash", real world's energy-efficiency-related products can been purchased on the GSRN Platform. The "Cash" will be stored and handled in the user's GSRN profile. The value will be updated and sent10 to game, if real world products have been purchased on the GSRN platform, or if the player has earned credits in the game. The concept of a parallel currency that can also be traded outside the virtual world is under investigation at the moment and going to be elaborated further throughout the project maturity.

[10] Fraud detection / security issues have to be respected

Figure 14. Cash Draft example

7.3 Experience Points

After the player has finished a task, s/he will get rewarded with experience points. With experience points, the player can level up to unlock several things.

Figure 15. Experience points Draft example

7.4 Level

The player will earn experience points throughout the game. When a sufficient amount of experience points are obtained, the character will "level up". With each "Level Up", several new things can be unlocked. The experience points will allow the player to level up to unlock several things, such as:

- New Jobs
- New Scenarios
- Energy Devices / upgrades
- Functional Objects
- Credits / Cash
- Achievements

Figure 16. Level Up Draft Example

7.5 Badges

Virtual Badges are essentially badges which a player achieves through their gameplay experience based on different factors such as their progress in the game, carious task completions, the extra-ordinary achievements they have gained by playing the game better than other users or a pre-defined threshold. There are 3 types of badges that can be deployed

1. Badges that are automatically generated by the system. Example.: For achieving a game milestone
2. Badges that can only be created and awarded by Admins or game moderators. Example: For going above and beyond the tasks defined in the application or the game
3. Badges that users can award to one another. Example: For accomplishments that impress other users

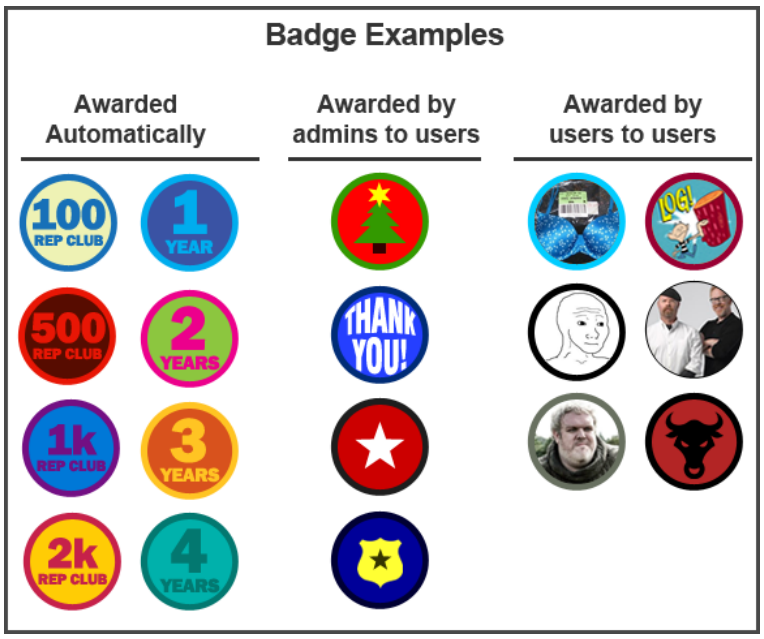


Figure 17. Badges Example

Achieved jobs, scenario goals and learning units are rewarded with score points within the game. The following parameters could be used to create an "overall score" that shows the status of the user, i.e. on his user profile and to unlock badges:

- Competence Level (cf. GSRN)
- Activity Level (cf. GSRN)
- Game Level (cf. Game)

7.6 High score List and Position

The concept of high scores was initially popularized by Atari with the game Space Invaders[11] meant to keep a track of players score which afterwards made arcade gaming more

[11] https://www.giantbomb.com/space-invaders/3030-5099/

competitive. Generally speaking, high score lists are based on the abstract quantity of points that can be associated to a player. Nowadays it is almost a ubiquitous feature among many competitive games since such scores represent a certain level of achievement for a player to aspire to. Within the SOCIALENERGY the following is going to be implemented:

- The total scores of each player are stored and shown in multi-player high score lists on the GSRN platform.
- There can be different lists, i.e. for the various use case scenarios.

8 Non-Player Characters (NPCs)

A non-player character (NPC) was introduced in the next generation lexicon back in 1996, defining it as a character in the game, that is controlled via predetermined behaviour and populate the virtual world as a "supporting actors" of the gameplay or a narrative[12].
During the Energy Community Real Time Pricing (C-RTP) use case scenario, NPCs will be generated that simulate the collaboration between the various consumers, who belong to the same virtual energy community. Nowadays many games create rules for the characters that are aimed at to sustain positive allies or followers of the main character. These can also help to fulfil the main game goal.
NPC behavior in computer games is usually scripted and automatic, triggered by certain actions or dialogue with the player characters. In certain multi-player games, a player that acts as the GM can "possess" both player and non-player characters, controlling their actions in order to further the storyline[13].

[12] "The Next Generation 1996 Lexicon A to Z: NPC (Nonplayer Character)". Next Generation. No. 15. Imagine Media. March 1996. p. 38.
[13] https://www.revolvy.com/main/index.php?s=Non-playable%20characters&item_type=topic

9 Graphical User Interface (GUI)

The graphical user interface (GUI) is defined as a user interface that enables the player to interact with the device or a game through a certain set of graphical icons and visual indicators that are triggered through a direct manipulation of the elements. Within the SOCIALENERGY the GUI of the game shows several parameters depending on the actual use case scenario. Below, there is non-exhaustive list of these parameters, while the final version of the list will be provided in D4.2 (M15).

- Exp / Level
- Score Points
- Pricing tariff (i.e. Euros/KWh)
- KWh consumed
- Credits
- Cash
- Virtual Coach shows info's and hints
- Current Jobs and Goal
- Avatar Status (Convenience in percent, or several parameters)
- Type of Demand Response Event
- NPC Messages
- Inventory
- EC members' actions

9.1 Upgrade Device Object and Decoration Menu

Further, within the game an upgrade menu for different objects will be introduces. This will include the upgrades for the electric device objects already unlocked as well as upgrades for the objects that the player will unlock, if they reach the next level.
In addition to that such menu will provide an overview of the costs for the Upgrades and upgrades duration. The unlocked Upgrade can be selected to activate them inside the virtual home. The player has to perform the following actions:

- Click on the Upgrade objects menu button
- Ensure that s/he has enough money to purchase an already unlocked Upgrade
- Select an Upgrade
- Accept Purchase
- Wait until the Upgrade is delivered

9.2 Graphic Style

Every video game can be differentiated by its unique visual or graphic style. Studies have shown that a graphic style within a game shapes players' gaming experience in terms of three salient dimensions: narrative pleasure, ludic challenge and aesthetic reward[14]. In game

[14] Yin Wu, The Style of Video Games Graphics: Analyzing the Functions of Visual Styles in Storytelling and Gameplay in Video Games, B.A., (New Media Arts, SIAT) Simon Fraser University, 2008

design some state that the better illusion that the representational graphics can produce, it is more likely to enhance the overall level of engagement and suspension. All game art will be created in a realistic, but simplistic style because of the constraints of the target platform, too. The realistic representation graphics can be subdivided into several categories:

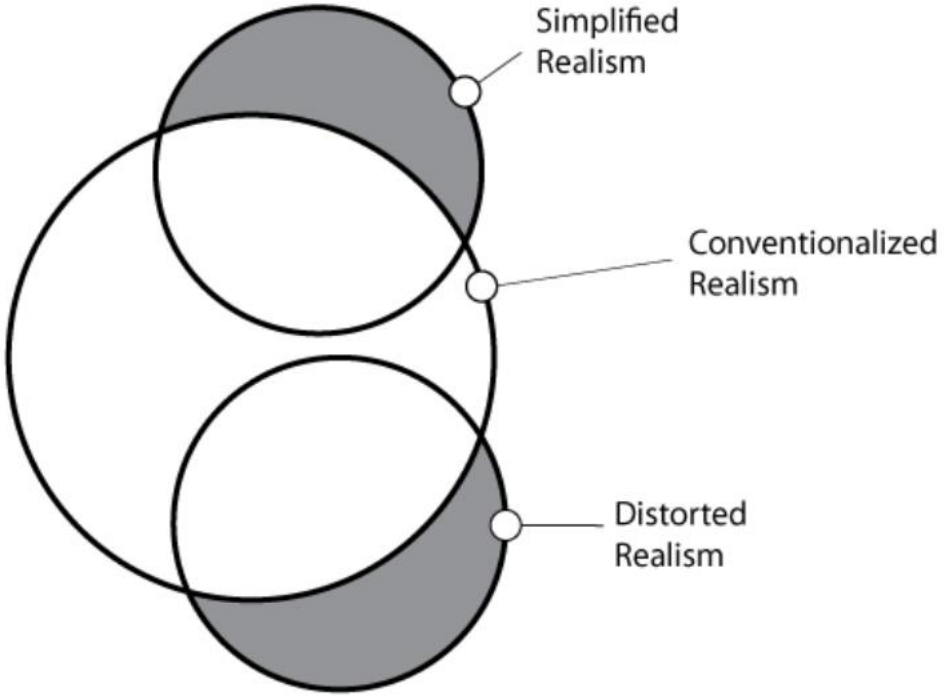


Figure 18. Sub-categories of representational graphics[14]

The choice of simplified realism for SOCIALENERGY game is taken for the sake of symbolic power of images that can amplify the expressive range. Conventionalized realism relies mostly on believability of the world which might become too boring if one tries to reproduce the environments one to one with the reality (and usually require much higher costs for the development) and distorted realism envisions more abstract realism.

9.3 Perspective (Camera View)

The game world will be presented in a tile-based isometric view also because it fits best for the gameplay. During tasks and the related interactions, a side view will be used.

9.4 GUI graphical style

The design of the GUI and the HUD (head-up display, sometimes referred to as a Status Bar) must fit to the game world style, but first of all it will allow a good usability and readability. The HUD is usually referred to a method through which the information is visually communicated to the user as part of the game interface[15]. Applying this method to the

[15] "What is a HUD". Webopedia. QuinStreet Inc. Retrieved 15 December 2014

SOCIALENERGY game would be mean a simultaneous visualisation of several items of information, e.g. energy consumption, levels, items as well as the overall score on a single screen.

9.5 Style Guide

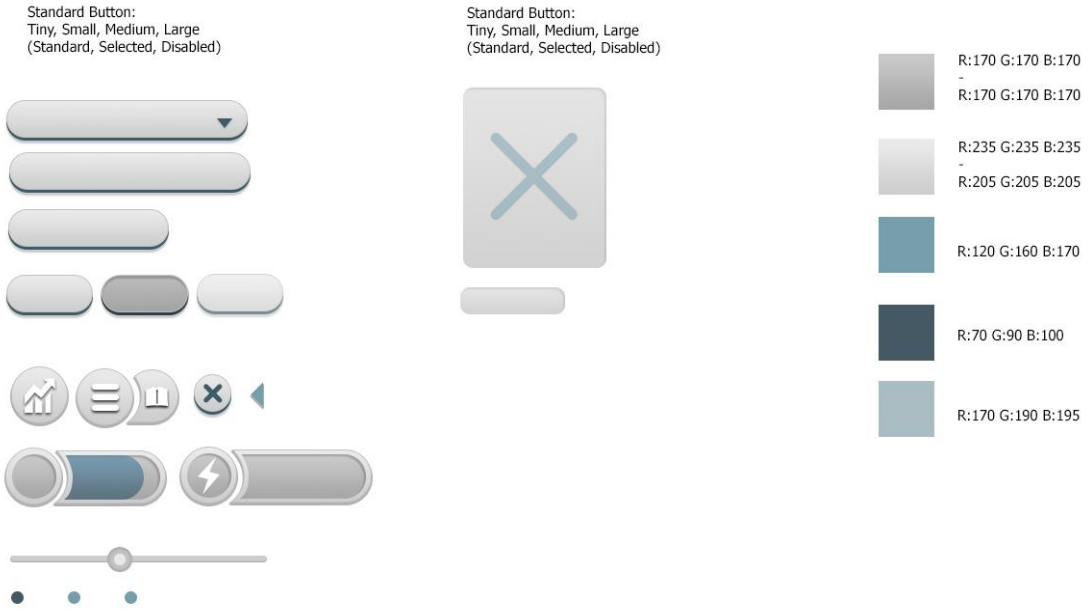


Figure 19. Style Guide (Draft)

10 Languages and Localization

To avoid the need of voice actors and to allow playing the game muted, there will be no voice recordings. Instead, text overlays and speech balloons will be used. Technically, the texts can be implemented in different languages but initially English language will be used.

10.1 Sound and Music

As users should be able to play the game with muted devices, sound and music will be produced for a limited use, also to avoid sensory overload. There will always be background music and an atmospheric sound.

10.2 Usability

10.2.1. Tutorial and User Guidance

At the start of the game and if features are available, there will be tutorial screens that explain to the player what s/he has to do and how s/he can control the interactions. Besides that, a manual could be implemented that summarizes all the things that the player has to know. This document will be part of the D4.3 at the end of WP4 (i.e. M24).

10.2.2 Interactions

There will be mainly three interactions that must be handled and will be standardized for an optimal usability:

- interactions with the game world objects
- interactions with the NPCs
- interaction with the GUI

10.2.3 Controls

Controls will be implemented and optimized for easy and intuitive mouse interaction on desktop PCs. If necessary and possible, alternative controls could be implemented for the use with keyboard or a touch screen.

10.2.4 Camera Zoom

The player has the possibility to customize the camera frame by zooming in or out.

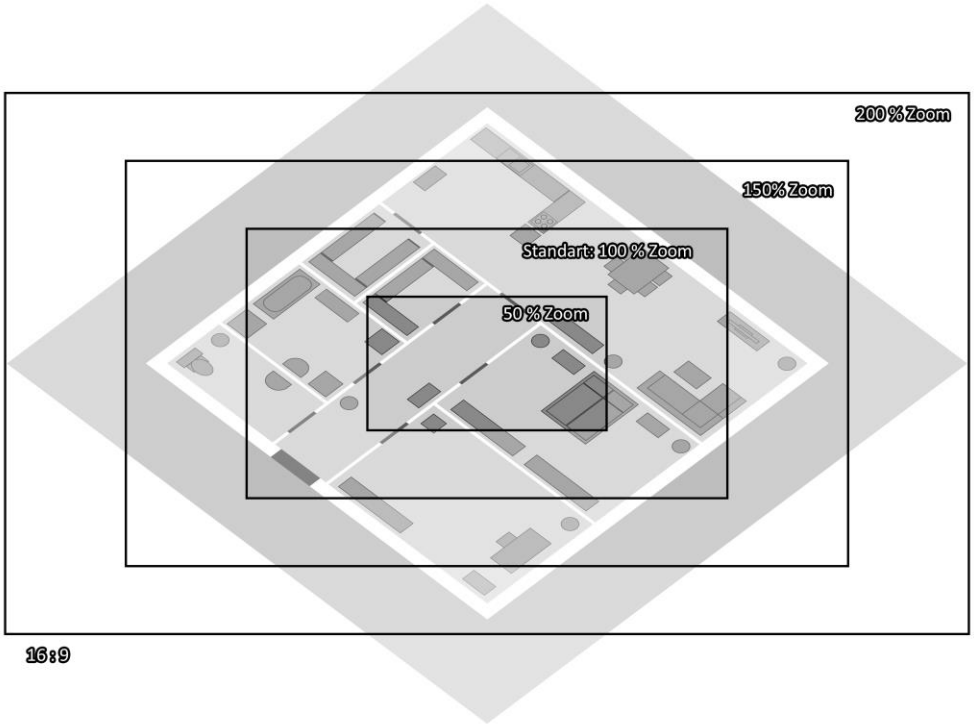


Figure 20. Camera Zoom schematic example

11 Assets from H2020 RAGE Project

Evaluating the main goals of the EU-funded RAGE project[16], the SOCIALENERGY consortium sees many possibilities to exploit the results of both projects in many different ways. From the RAGE consortium statements: "the EU based industry for non-leisure games (applied games) is an emerging business. As such, it is still fragmented and needs critical mass to compete globally. Nevertheless, its growth potential is widely recognised and even suggested to exceed the growth potential of the leisure games market. RAGE will help to seize these opportunities by making available 1) an interoperable set of advanced technology assets tuned to applied gaming 2) proven practices of using asset-based applied games in various real-world contexts, 3) centralised access to a wide range of applied gaming software modules, services and resources, 4) an online social space (the RAGE Ecosystem) that arranges and facilitates collaboration that underlie progress and innovation, 5) workshops and online training opportunities for both developers and educators, 6) assets-based business cases that support the game's industry at seizing new business opportunities, and 7) a business model and launch plan for exploiting the RAGE Ecosystem beyond the project́s duration".

SOCIALENERGY consortium will closely follow up the development of the project to seek the possibility to test and integrate certain components within the game that in the end will also rely on the requirements and compatibility with the chosen platform of development. For the time being, the following components are of interest to the game development team.

- Server-side Authentication and Authorization (T2.4A/UCM)
- Server-side Dashboard and Analysis (T2.4B/UCM)
- Performance Statistics (T2.2E/OUNL)
- Client-side interaction tracking (T2.1 A/UCM)
- Server-side interaction storage and analytics asset (T2.1 B/UCM)
- Player Model (T2.4C/OUNL)
- Communication Scenario Editor and Player (T3.3F/UU)

Mentioning collaboration, further reusability and contribution to standards it is worth to mention that NRG follows a certain set of recommendations and guidelines for accessibility for game creation, described in the table below:

Table 11. Guidelines and standards used

PARTNER	TITLE AND NUMBER	TYPE AND NAME OF SSO	TECHNICAL COMMITTEE	SCOPE	APPLICATION AREA	STATUS
NRG	Web Content Accessibility Guidelines (WCAG) 2.0, User Agent Accessibility Guidelines	The World Wide Web Consortium (W3C), Web Accessibility Initiative (WAI)	Mobile Accessibility Task Force A11Y TF	Mobile Accessibility: How WCAG 2.0 and Other W3C/WAI Guidelines Apply to Mobile" describes how the Web Content Accessibility Guidelines (WCAG) 2.0	provides informative guidance (but does not set requirements) with regard to interpreting and applying Web Content Accessibility Guidelines	Work in Progress. Public Working Draft by the Mobile Accessibility Task Force (Mobile A11Y TF) operating under the terms of its Work Statement under the joint coordination and review of the Web

[16] http://rageproject.eu

	2.0 [UAAG20]			[WCAG20] and its principles, guidelines, and success criteria can be applied to mobile web content, mobile web apps, native apps, and hybrid apps using web components inside native apps. It provides informative guidance, but does not set requirements. It also highlights the relevance of the User Agent Accessibility Guidelines 2.0 [UAAG20] in the mobile context.	(WCAG) 2.0 [WCAG20] to web and non-web mobile content and applications.	Content Accessibility Guidelines Working Group (WCAG WG) and the User Agent Accessibility Guidelines Working Group (UAWG), which is part of the Web Accessibility Initiative (WAI) of the World Wide Web Consortium (W3C). This document is intended to become a W3C Note.

12 Conclusions

Conclusively, introducing this deliverable the progress is shown towards the creation of the SOCIALENERGY game, whereas the game design serves as an internal milestone to set the ground ideas and rules for the future design and development processes. The consortium has progressed in the user requirements analysis based on the commercially available leisure games to ensure future acceptance as well as collaboration with the actors from the energy efficiency market (represented by INTELEN and ICCS) and finally adopting it to the SOCIALENERGY game specification.

All the interactions and sequences described in this report take the overall architecture of the energy consumption collection platform into consideration and serve as the first step towards application development and virtual environment creation within T4.2.

Furthermore, the Game Design document raised the first consideration towards fulfilling the gamification and social gaming definition and implementation foreseen in T4.3 and will be further investigated starting from M12.