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

H2020 ICT-731767

Final integration and validation activities of SOCIALENERGY system

Deliverable D5.3

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Contributors

Prodromos Makris, Dimitrios Vergados, Nikolaos Efthymiopoulos (ICCS)
John Papagiannis, Vassilis Nikolopoulos (INTELEN)
Jevgenijs Danilins, Andrew Pomazanskyi (NRG)
Atanas Georgiev, Krassen Stefanov (SU-NIS)

Internal Reviewers

Vassilis Nikolopoulos (INTELEN), Manos Varvarigos (ICCS)

Acknowledgements

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Document History

This deliverable includes a summary of the final S/W integration and validation results of the SOCIALENERGY platform. D5.3 is a prototype (DEM) deliverable. This report aims at guiding and supporting the platform's end users towards setting up a new user account, navigate through the various SOCIALENERGY subsystems and functionalities and enjoy the SOCIALENERGY services. Thus, it can also serve as an end user manual for dissemination/communication purposes towards SOCIALENERGY products and services' commercialization. It can also serve as a guidebook for end users' participation in SOCIALENERGY's real-life pilot tests. D5.3 is the final version of S/W integration and validation representing the work progress done by SOCIALENERGY consortium during M19-M27 period.

Table 1: Document History Summary

Revision Month	File version	Summary of Changes
08/02/2019	v0.1	Draft ToC circulated to the entire consortium by ICCS.
15/02/2019	v0.2	Final ToC version agreed among all partners.
22/02/2019	v0.4	First round of contributions from all partners regarding the S/W integration and validation tests. A draft version has been presented during 6th plenary meeting in Athens.
15/03/2019	v0.8	Second round of contributions from all partners regarding the S/W integration and validation results after fixing S/W bugs and addressing all comments from real end users.
22/03/2019	v0.9	Final version has been prepared from ICCS for internal review.
29/03/2019	v1.0	INTELEN reviewed the deliverable and made the final amendments before the submission in ECAS portal by ICCS coordinator.

Executive Summary

The SOCIALENERGY architecture is *"modular by design"* in order for all subsystems (i.e. GSRN deployed by INTELEN, GAME deployed by NRG, RAT deployed by ICCS and LCMS deployed by SU-NIS) to be potentially exploitable as stand-alone commercial products in the future. The technical APIs for the interaction between the various subsystems have been appropriately designed in a way that any possible combinations of SOCIALENERGY subsystems to be commercially exploitable in the future (e.g. GSRN with RAT as one single product, GAME with RAT as another one, GSRN-GAME as another one, GSRN-RAT-LCMS as another one, etc.). This strategic decision at the design phase provides the flexibility to the consortium to decide how to prioritize its dissemination, communication and further exploitation activities towards commercialization. Of course, **the default choice and ultimate objective of the consortium is to fully integrate all 4 subsystems into one single SOCIALENERGY S/W platform in the context of WP5 work**. In this way, the SOCIALENERGY product and associated services are expected to be competitive enough in order to enter the liberalized ICT/energy market and be sustainable as a product from a business perspective.

D5.3 is a 'DEMO' deliverable aiming at reporting the final version of S/W integration and validation activities until M27. However, this document is an accompanying report describing a summary of the results of all the related S/W development work, which has been undertaken during M19-M27 period in the context of Task 5.2. An integrated DEMO of SOCIALENERGY's 'alpha' version was demonstrated during the 2nd review meeting (Athens, 18/9/2018) in front of the potential customer of SOCIALENERGY product and services. **In March 2019 and after testing the 'alpha' version of SOCIALENERGY for several months with a total of 30 real end users, the 'beta' version of SOCIALENERGY is currently available to be released for real-life pilot tests, which will take place until the end of project's lifetime (i.e. June 2019).**

The remainder of this report is structured as follows: Section 1 provides an explanatory and comprehensive end user manual for the initial registration and navigation of the end user throughout the main SOCIALENERGY subsystems. In particular, any interested end user will be able to follow-up the step-by-step guidelines towards navigating through all SOCIALENERGY subsystems and thus better understand and become familiar with the platform's functionalities.

Section 2 provides a summary of the S/W integration results. Hence, indicative screenshots showcase how the changes in one subsystem produce real-time changes in the central GSRN platform. For example, when an end user plays the GAME, the GSRN is automatically and online updated with all game scores, credits, experience points, badges and activities.

In section 3, a summary of the final version of all S/W validation activities is provided. The validation plan that has been extensively described in D5.1 has been followed. A total of 83 main S/W validation checks have been successfully performed using real-life energy and behavioural datasets from real end users. Now that the 'beta' version of SOCIALENERGY S/W platform is ready to be released, the next step is to perform real-life pilot testing

experimentations in order to assess the impact of SOCIALENERGY project's results at the end of project's lifetime in M30.

1. End User Manual

This section provides an end user manual, guiding thus the end user from the initial registration in SOCIALENERGY system until the use of the most important SOCIALENERGY functionalities. In case that an end user wants to download the whole SOCIALENERGY application, the open access D5.2 (delivered in June 2018) provides extensive guidelines serving thus as a developer user manual, too.

1.1. End user's registration in SOCIALENERGY S/W platform

The first step for the end user is to register in SOCIALENERGY S/W platform. We assume that the end user is a client of the electric utility company (e.g. PROTERGIA S.A.), so s/he should express the interest of engaging in SOCIALENERGY to the company. Then, the administrative user (or else utility user) creates an account of the end user as follows:

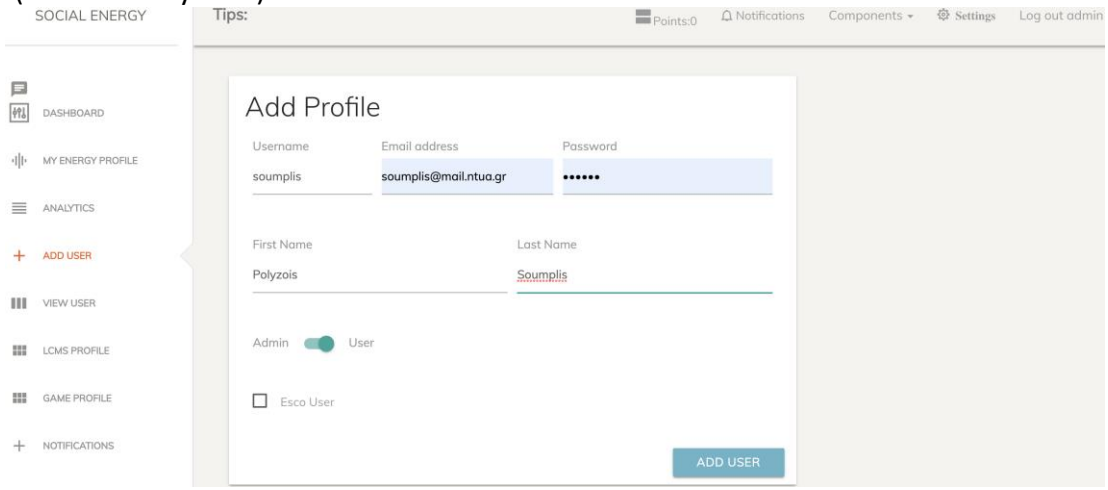

Figure 1: The admin user creates an account of the end user

Let's assume that the end user's username is "soumplis" and the e-mail address is soumplis@mail.ntua.gr as shown in Figure 1. The utility company sends a confirmation message to end user acknowledging the registration.

1.2. Initial login and fill in the GSRN questionnaire

Now, the "soumplis" user is ready to login in for the first time in SOCIALENERGY.

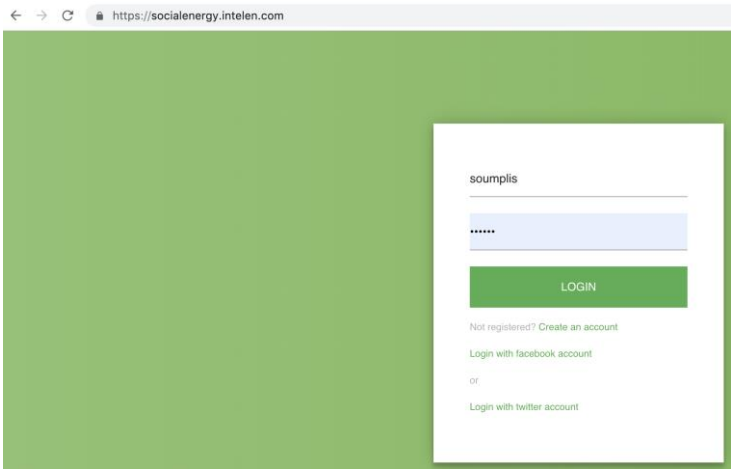

Figure 2: End user logins in the SOCIALENERGY system for the first time

S/he can use whichever internet browser (i.e. internet explorer, mozilla firefox, google chrome, etc.) and type https://socialenergy.intelen.com/. Then, s/he types the username and password in the respective fields and presses the "Login" button as shown in Figure 2.

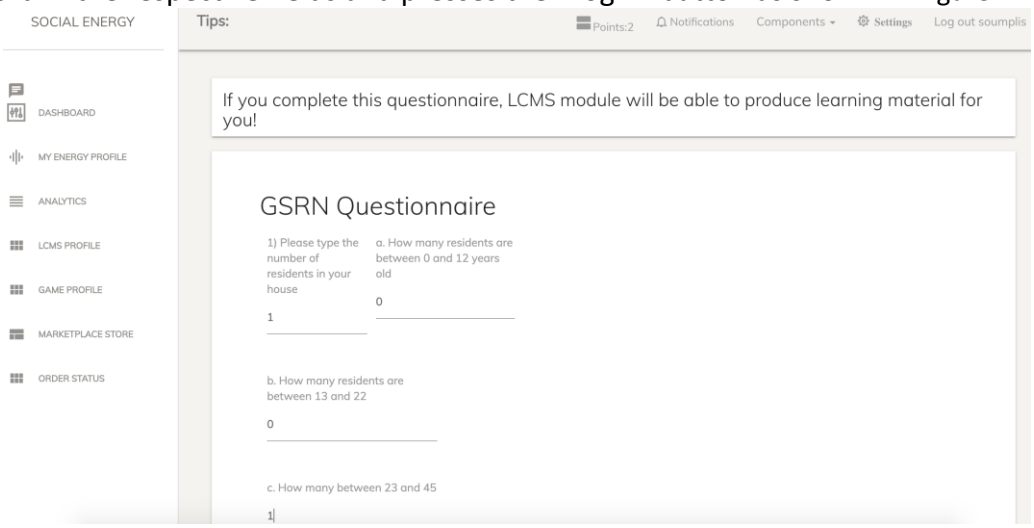

Figure 3: The user fills in the GSRN questionnaire

The GSRN questionnaire is shown in the end user's interface. It is a prerequisite to fill in this questionnaire in order for an initial user profile to be created. Thus, the SOCIALENERGY system will be able to produce personalized recommendations that best fit the end user's profile, so it is important that the end user to carefully and truthfully answer to all questions. When all questions are answered, the user presses the "Save" button at the bottom of the page.

1.3. End user's navigation in GSRN platform's functionalities

The end user is now ready to navigate in SOCIALENERGY system. As shown in the top right corner of Figure 4, the end user can visualize the total SOCIALENERGY points acquired, the notification messages, all other S/W components (i.e. GAME, LCMS, RAT), the user settings and the option for end user's logout. On the left hand side, there is the: i) "Dashboard", via which the end user can see the messages from other end users, ii) "My energy profile", in which the end user can monitor his/her historical and real-time energy consumption curve, iii) "Analytics", via which the end user can follow-up DR event instructions, receive offers to switch to a more beneficial energy program, follow-up challenges and receive tips about best energy efficiency practices and corresponding new material/features offered by SOCIALENERGY, iv) "LCMS Profile", via which the end user can visualize his/her LCMS-related activities and achievements, v) "Game Profile", via which the end user can visualize his/her GAME-related activities and achievements, vi) "Marketplace Store", where the user can purchase a new energy efficient electric appliance, and vii) "Order Status", where the user can track the state of his/her online purchases. In the center of the dashboard, the user may have a quick snapshot/summary of his/her activities and achievements in the platform.

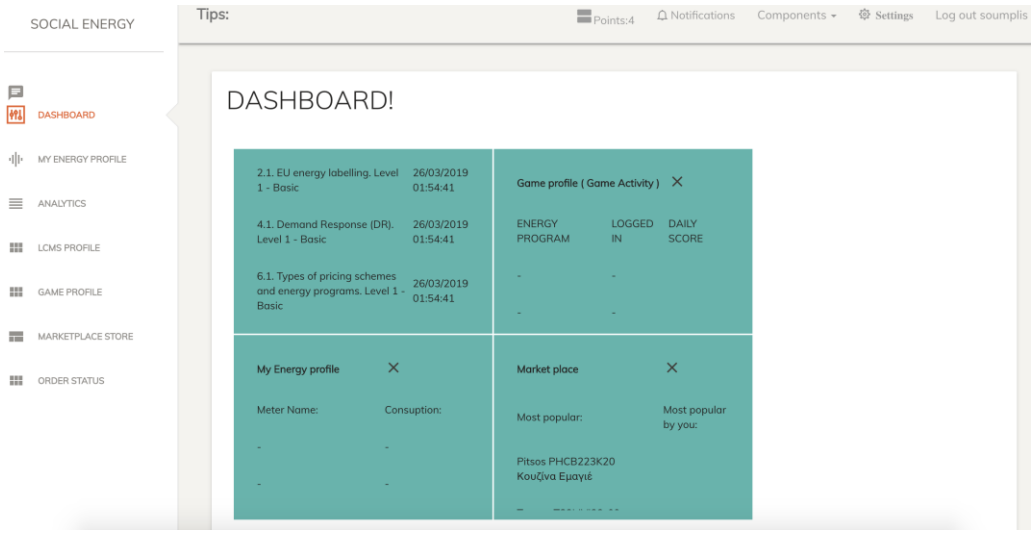

Figure 4: The main GSRN dashboard of SOCIALENERGY platform

1.3.1. How to monitor and manage my energy consumption

The end user can use “My Energy Profile” tab to view his/her historical energy consumption data generated by the respective energy meter, which is installed in the home premises. One user may have more than one energy meter associated with his/her SOCIALENERGY account, so s/he can select the energy meter as shown in Figure 5. The user can also select the exact timeframe (i.e. start and end time) in the past in order to view and analyse the data in a greater time granularity.

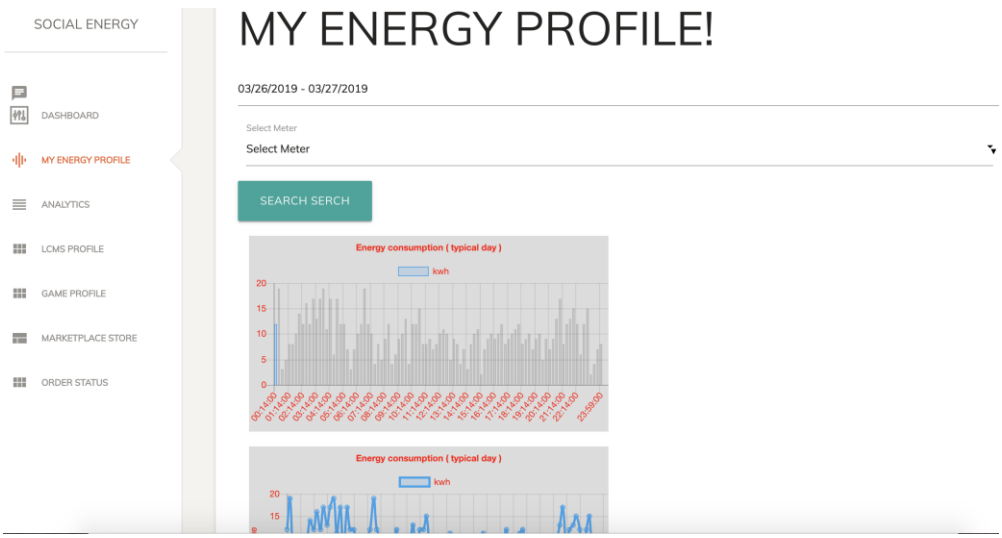

Figure 5: Monitor energy consumption through ‘My energy profile” tab

The “Analytics” tab includes information that is exchanged between the admin user and the end user. Thus, the end user is informed about: i) a new DR event and indicative steps to be followed, ii) offers by the company to purchase a new more beneficial energy program, iii) challenges issued by SOCIALENERGY platform motivating the end user to achieve pre-specified targets in terms of points collected, energy consumed, etc., and iv) tips regarding some new features unlocked in the platform, some new educational material in LCMS, guidelines to achieve better GAME scores, etc.

1.3.2. How to monitor my activities and achievements in the GAME and LCMS

From the "LCMS Profile" tab, the end user can visualize all statistics about his/her activities and achievements in LCMS. There are 3 main sub-tabs, namely: i) Score, ii) Rewards, iii) Activity. In Figure 6, there is a snapshot of LCMS-related scores. More details (i.e. "Rewards" and "Activity" sub-tabs) are provided in D3.2 (M24).

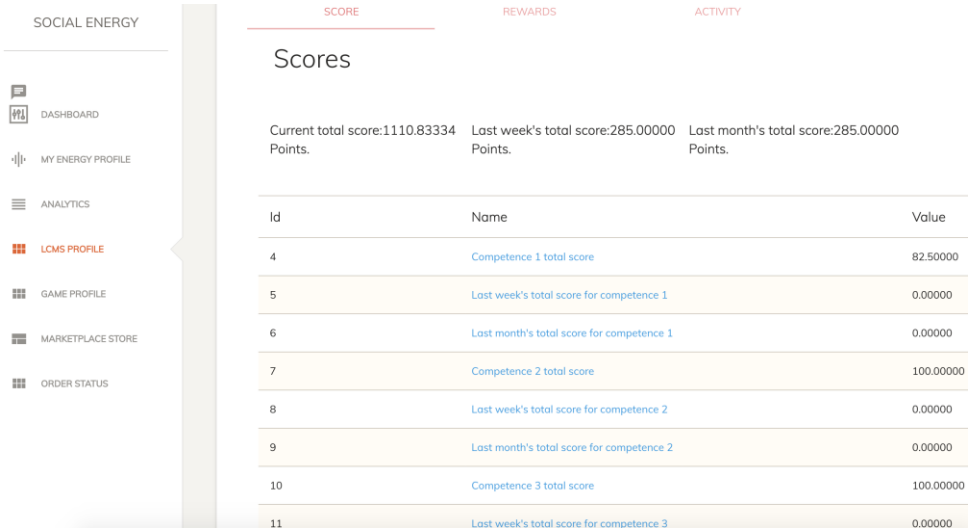

Figure 6: Monitor my activities and achievements in LCMS (Score sub-tab)

Via the "GAME Profile", the end user can see statistics about the GAME-related activities and achievements. For example, as shown in Figure 7, the current total GAME score is 245 points. Last week's and last month's total score is the same, because the end user has just registered in the platform. More details about GAME statistics in GSRN (i.e. "Rewards" and "Activity" sub-tabs) are provided in D3.2 (M24).

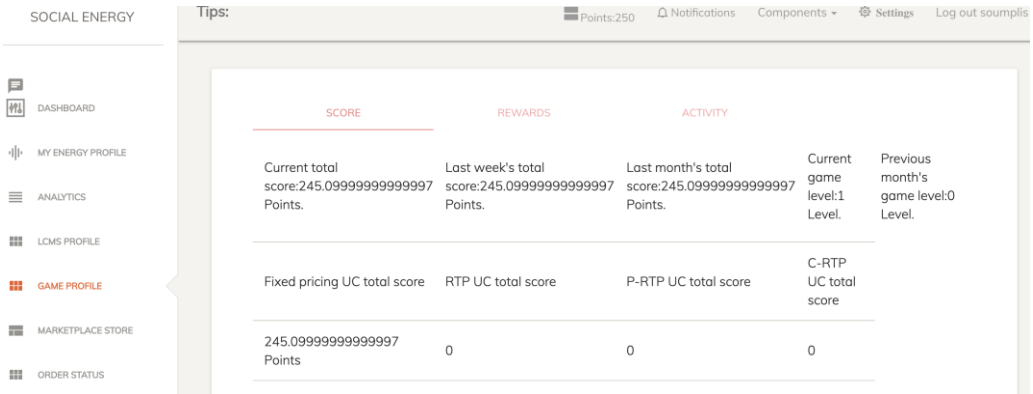

Figure 7: Monitor my activities and achievements in the GAME (Score sub-tab)

1.3.3. How to purchase energy efficiency products from the SOCIALENERGY marketplace

In the "Marketplace Store" tab, the end user can view all energy efficiency products, check their characteristics, features, price, etc (see Figure 8). Then, s/he can add a product in the basket and proceed to the online payment.

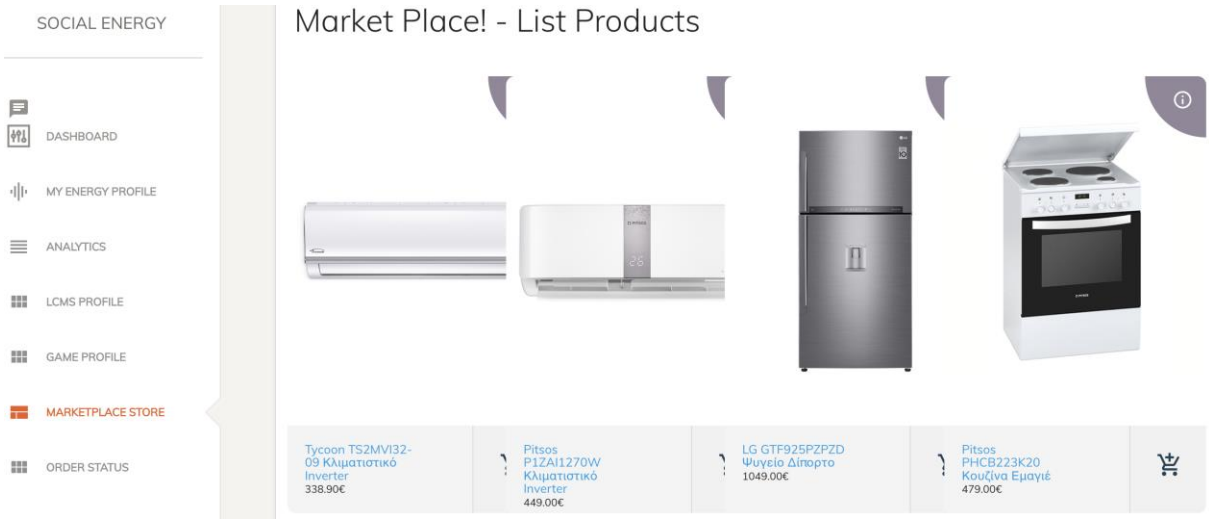

Figure 8: Purchase energy efficiency products from SOCIALENERGY's marketplace

In the "Order Status" tab, the end user can check the status of his/her online orders. For example, as shown in Figure 9, there are two orders that took place from "soumplis" user. One of them has already been approved by the SOCIALENERGY system administrator and the other one is pending for approval. The user can press the "Preview" button to see more details.

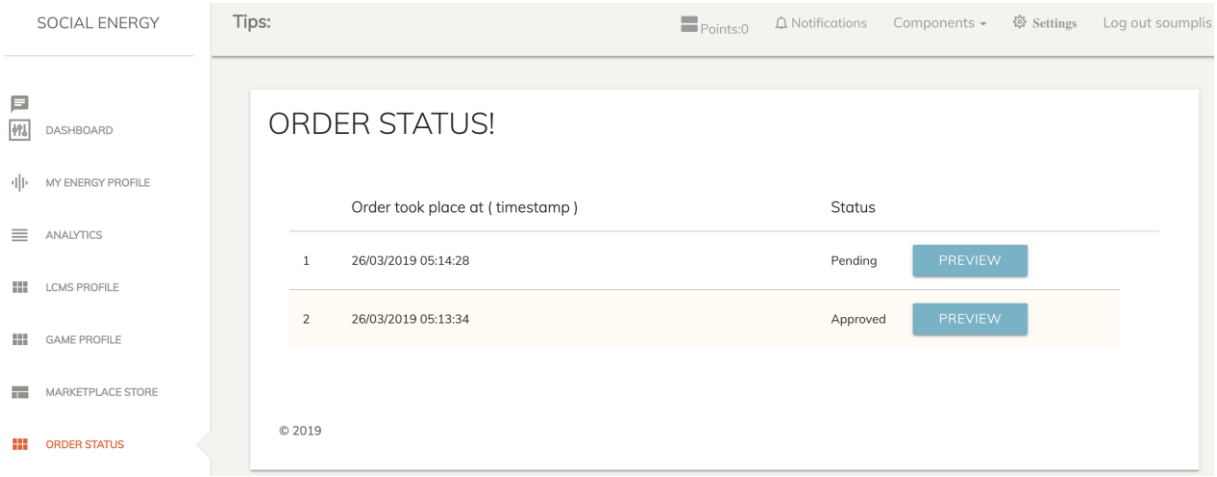

Figure 9: Check the order status for various purchases from the marketplace

1.3.4. How to create, manage and participate in Energy Communities

An end user can create an Energy Community (EC) in a bottom-up way. In this way, s/he can become an EC leader user. An EC leader user is able to create an online group/community just like it is done in other well-known applications such as skype, messenger, google hangouts, etc. Then, the EC leader can invite other users of the GSRN S/W platform to become members of the new Virtual Energy Community (VEC). Figure 10 presents the "pmakris1" end user account, who also acts as an EC leader user in the SOCIALENERGY system. As shown in Figure 11, by clicking on the "Click to Chat" in the Dashboard tab on the left hand side menu, the EC leader/end user can exchange messages online with all the VEC group's members. For example, in Figure 11, "pmakris1" EC leader user chats with "djvergad" end user.

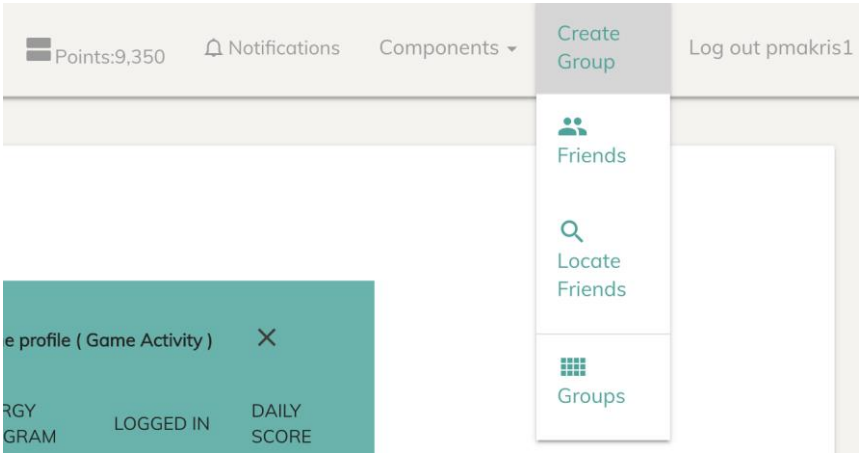

Figure 10: "Settings" tab to create, manage and participate in Virtual Energy Communities (VECs)

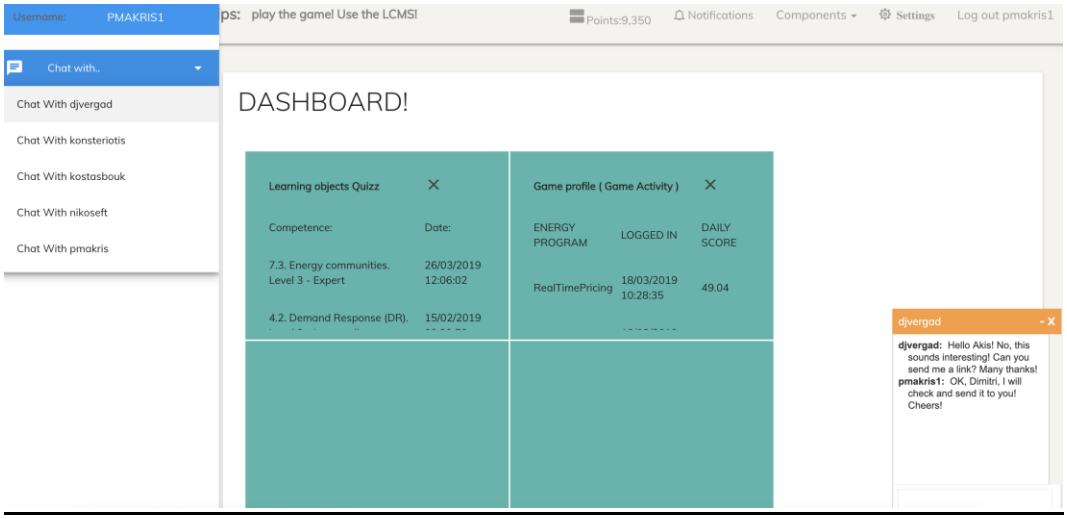

Figure 11: Chat with my friends in the Virtual Energy Community (VEC)

The EC leader can navigate through "Settings" → "Friends" → "Groups" → "View Members" to view the activities and achievements of all the group members. As shown in Figure 12, by clicking on the "View Profile!!!", the EC leader can see the profile of each individual group member. All group members can also view the profiles of all their peers.

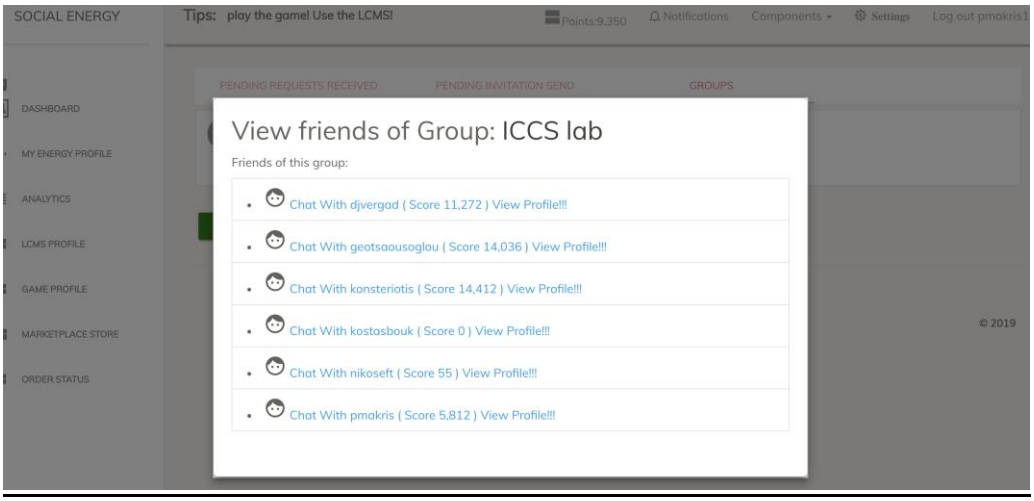

Figure 12: EC leader user views his/her group members' activities and achievements

How to create a new group/VEC (steps)

1) Login to platform with your credentials.
2) Click On “Settings” option.
3) Create Group.
4) Type group name and press YES PROCEED.
6) Wait approval by the administrator. In the backend, the admin user click on Settings option, then Groups option, then Locate groups with Status value: “Pending” and ultimately authorize thems, by selecting PENDING. Finally, the group is “on air”.
7) The end/EC leader user clicks On Settings option.
8) Locate Friends.
9) On Drop down menu 2) Select Group Name.
10) Your Group name should now be printed on the menu.

How to invite friends on a group/VEC (steps)

1) Click On “Settings” option.
2) Click On “Locate Friends” option.
3) Type username of your friend you want to invite.
4) Select group you want to add friend.
5) Press “Search”.
6) If user is alive, message will be printed on screen, then press “ADD FRIEND”.
7) In the friend’s account, a message will be printed on screen, and after a while the message disappears.
8) Click on “Settings” option, then on “Friends” option and then “Accept invitation”.
9) Refresh page – click on “Groups” tab – row of new group will be printed.
10) Switching back to the group creator’s account, click on “Settings” option, then “Friends” option.
11) Click on “Groups” sub-tab option.
12) Select “View members” of the group you are interested in.
13) Members of group are printed, click on group member’s “View Profile” to view the individual end user’s profile.

How a member can remove himself/herself from a Group (steps):

1) Click on “Settings” option.
2) Click on “Friends” option.
3) Click on “Groups” tab.
4) Select “Remove yourself from group” you want to exclude yourself.
5) Select “YES PROCEED”.
6) A message “YOU HAVE SUCCESSFULLY REMOVED YOURSELF FROM GROUP” is printed in your screen.

Note: when a group has no members, even on the owner’s group page, the group will be not be printed on Friends – group tab (since it has no members). The owner of the group can validate group record on Locate friends - select group name.

How to delete a group (steps):

Groups can be removed only by the EC leader.
1) Click On “Settings” option.
2) Click on “Friends” option.
3) Click on “Groups” sub-tab.

4) Select “remove the group” of the group of your choice.
5) Select “Yes Proceed!” and the group has now been removed successfully.

1.4. End user’s navigation in GAME’s functionalities

To play the SOCIALENERGY GAME, the end user clicks on “Components” tab and then on the “GAME” option. Then, s/he enters again her SOCIALENERGY credentials in order to login the GAME application (see Figure 14).

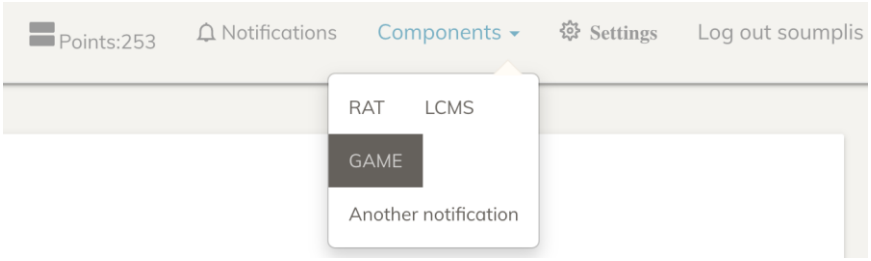

Figure 13: End user is redirected to the SOCIALENERGY GAME application

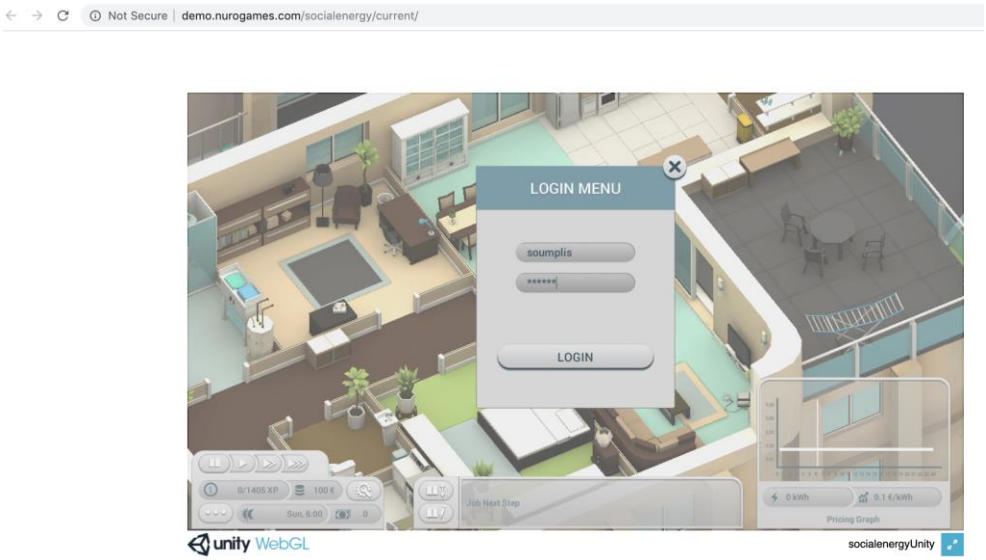

Figure 14: End user enters his/her credentials to be globally authenticated in the GAME application

The GAME itself provides exhaustive guidelines for the end user in order to easily understand the GAME’s goals, objectives, options, features, etc. These guidelines are provided in the form of pop-up windows for the player to understand all available options before starting the gameplay. Guidelines and required information are also provided during the gameplay, so the player can stop/pause the GAME and read instructions in order to achieve a better score. Targeted LCMS material links are also provided, so the player can be redirected to related LCMS links to deeply comprehend the best practices on energy consumption. In this way, s/he can also achieve higher game scores.

More details about end user’s navigation in GAME functionalities are provided in sections 2-5 of D4.3 (M24). In section 2, the 4 use case scenarios are explained and how the gameplay is adapted according to each scenario. In section 3, there are many explanations about the GUIs (e.g. intuitions about how the game scores are calculated). In section 4, there are animation-

related explanations and in section 5, it is explained how the central GSRN platform is updated according to the game activities and achievements.

1.5. End user's navigation in LCMS functionalities

To navigate in LCMS subsystem and view all available educational content and courses, the end user clicks on "Components" tab and then on the "LCMS" option. Then, s/he clicks "Log in" button in the upper right corner of the new window. Then, the end user should click on "GSRN" button and in the new window enters again her SOCIALENERGY credentials in order to login the LCMS application (see Figure 15).

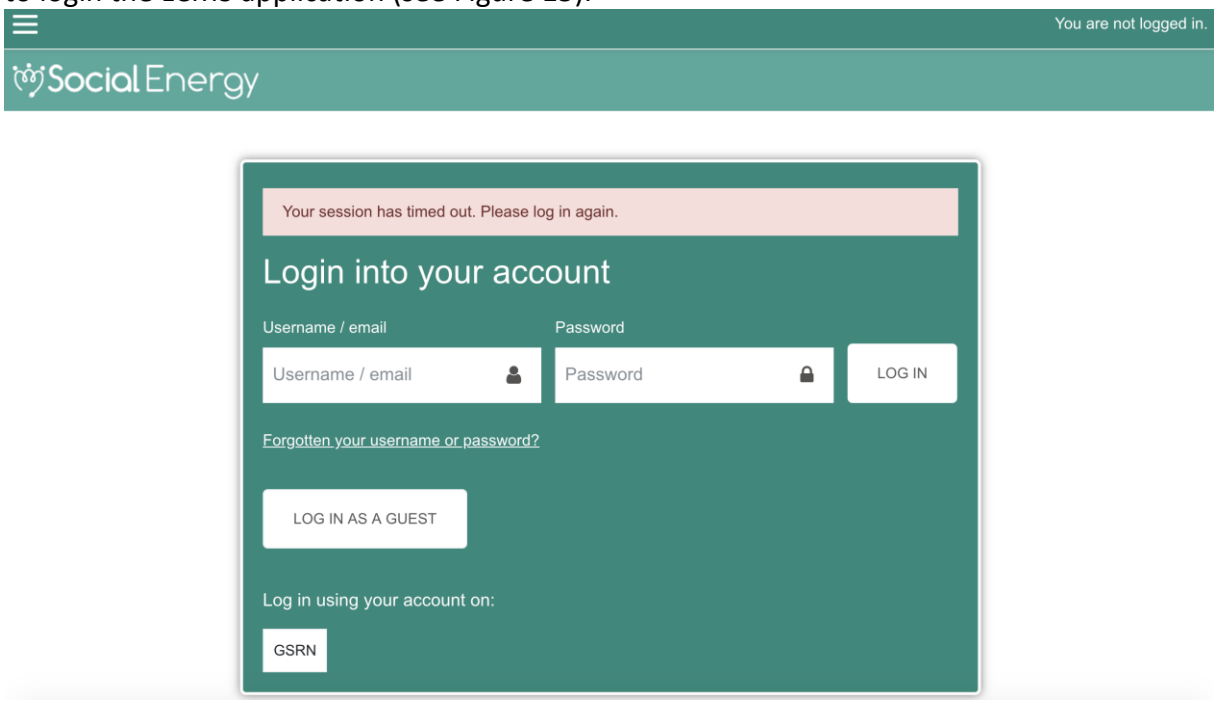

Figure 15: End user enters his/her credentials to be globally authenticated in the LCMS application

When the end user logs in the LCMS, s/he can view her Individual Learning Plan, which includes the 3 more relevant courses according to end user's profile. As shown in Figure 16, the end user can select the "Site home" tab at the right hand side. Then, all available educational courses will be presented being categorized in seven (7) competences and three (3) levels of expertise (i.e. basic knowledge, intermediate and expert profile).

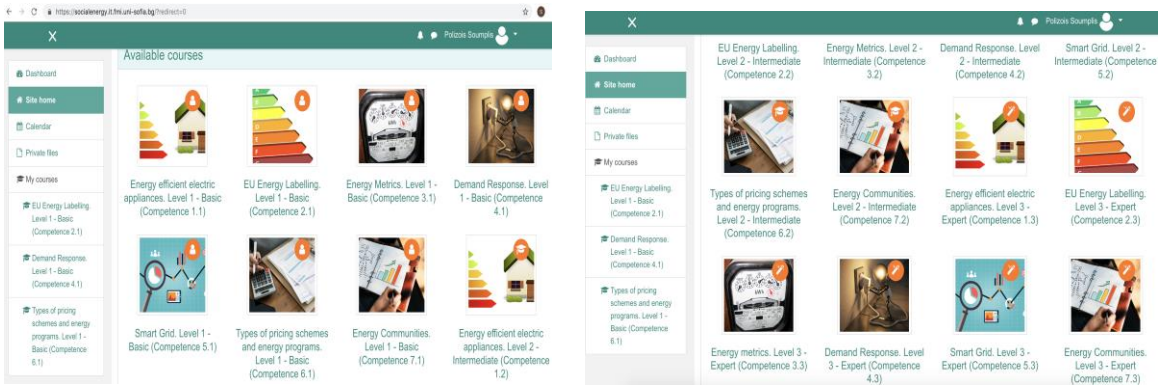

Figure 16: End user can choose from a total of 21 formal and well-structured educational courses in LCMS

For example, the end user may choose to enrol himself/herself in the course 4.1 as shown in Figure 17. There are plenty of options for the end user for each course that s/he decides to enrol. More details are provided in section 6 of D4.3 (M24).

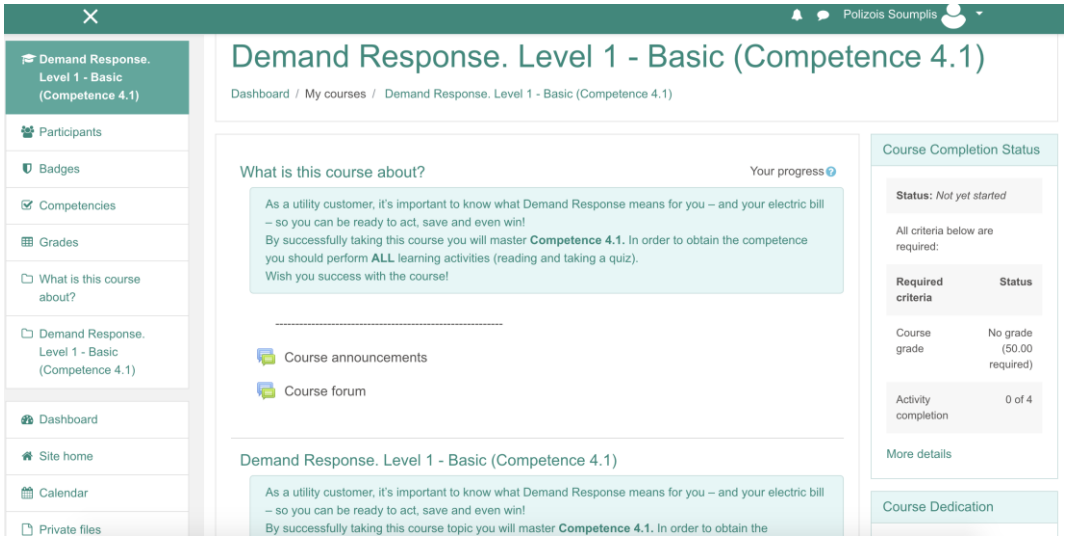

Figure 17: Example of enrolling in a new LCMS course

In addition to the formal training courses covering the knowledge, skills, autonomy and responsibility, required to achieve competences in the energy efficiency domain, LCMS offers community-based courses, which are less formal and more discussion focused. The main rationale is to let the end users and EC leaders to create experiences for themselves and also actively participate by investigating, analyzing, collaborating, sharing, and reflecting on challenges from energy efficiency domain. This way, peer/social pressure and distributed social network effects are expected to be realized towards leading to desirable behavioural changes regarding energy efficiency.

All information about VECs' creation and dynamic adaptation, which take place in the core GSRN platform, is transferred to LCMS. Hence, the EC leader user can create ad-hoc material and share it with her group members. S/he clicks on "SOCIALENERGY Communities" option in the "Site Home" tab and the window shown in Figure 18 appears.

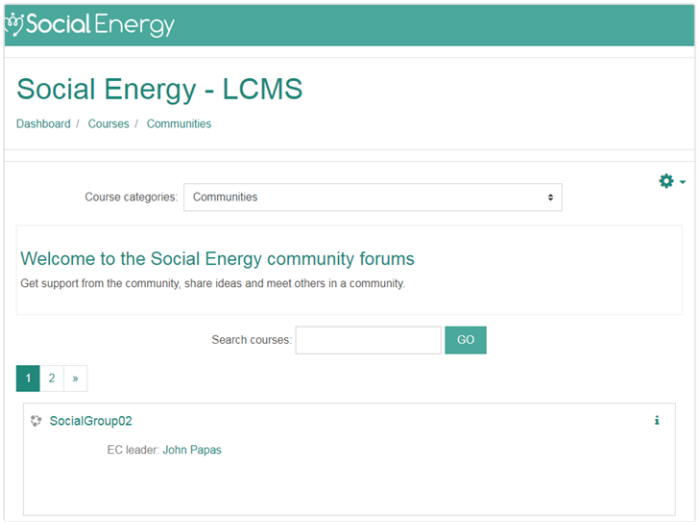

Figure 18: The EC leader creates a forum discussion and community course in LCMS

Community courses' primary focus is to have discussions and two-way engagement. Effective learning takes place, when learners are actively engaged in constructing knowledge i.e. creating or doing rather than passively reading, memorizing or viewing. LCMS supports this by providing ability to the EC leader users to add discussion topics and upload educational material for their group members. For example, as presented in Figure 19, the EC leader "John Papas" has started a new discussion and the end user "Atanas Georgiev" has responded requesting to learn more details and read/watch more educational material.

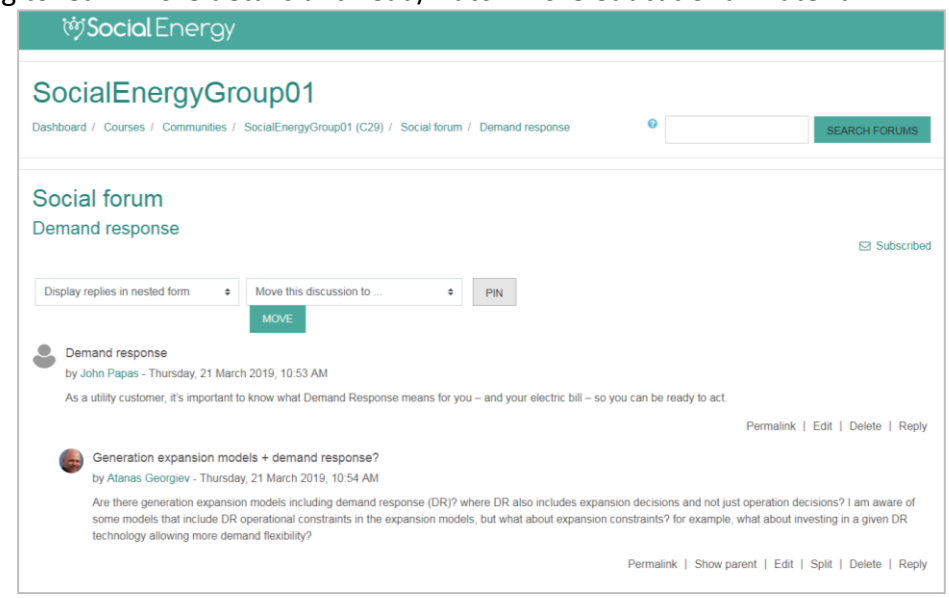

Figure 19: EC leader discusses with one of his group members in an informal LCMS community-based course

1.6. EC leader's navigation in RAT's functionalities

As already stated in previous deliverables, the RAT is a business analytics and intelligence tool, which is mainly used by the SOCIALENERGY's administrative user in order to manage the electric utility company's business portfolio. Hence, the end user cannot have access in the RAT, but rather visualize the RAT's results in the "Analytics" tab of GSRN. However, the EC leader user can have access to RAT being thus the administrator of his/her VEC. Thus, the EC leader can have access to the profiles of his/her group members. The EC leader user clicks on "Components" tab and then on the "RAT" option. Then, s/he clicks "Sign in with GSRN" button. Then, the EC leader user should enter again her SOCIALENERGY credentials in order to login the RAT subsystem.

As shown in Figure 20, the EC leader can view the energy consumption profiles of all his/her EC group members. Moreover, as shown in Figure 21, the EC leader can view all data about the activities and achievements of all his/her EC group members. Furthermore, the EC leader can analyse all his/her EC members' behavioural datasets and provide context-aware recommendations to the end users. For example, as shown in Figure 22, some end users have high score only in LCMS, others only in the GAME and some others have good scores in both. The EC leader user can create aggregated recommendation messages and send them automatically through RAT. The end users can visualize these messages in the "Analytics" tab of GSRN.

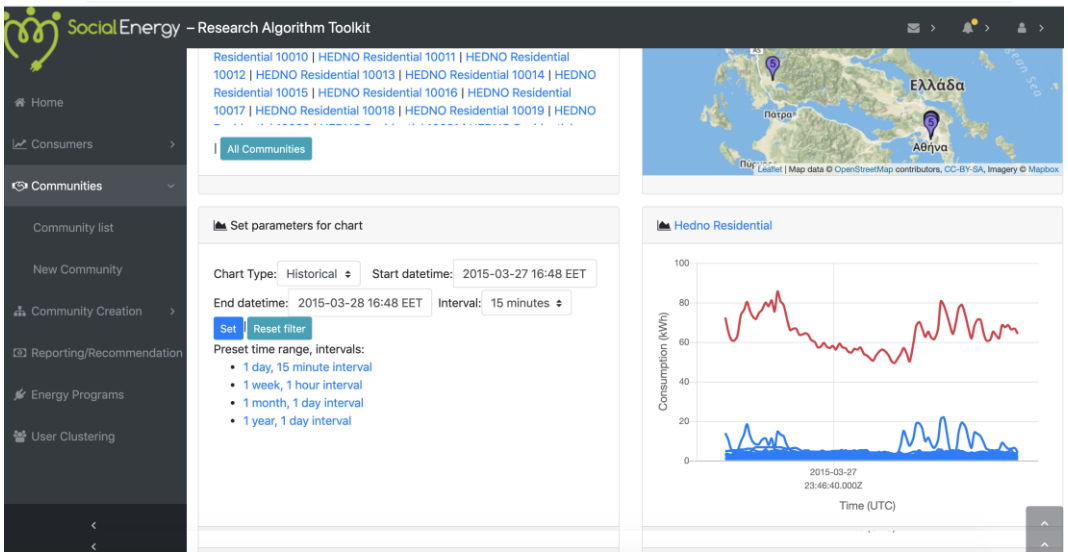

Figure 20: The EC leader user can view the energy consumption profiles of all his/her EC group members

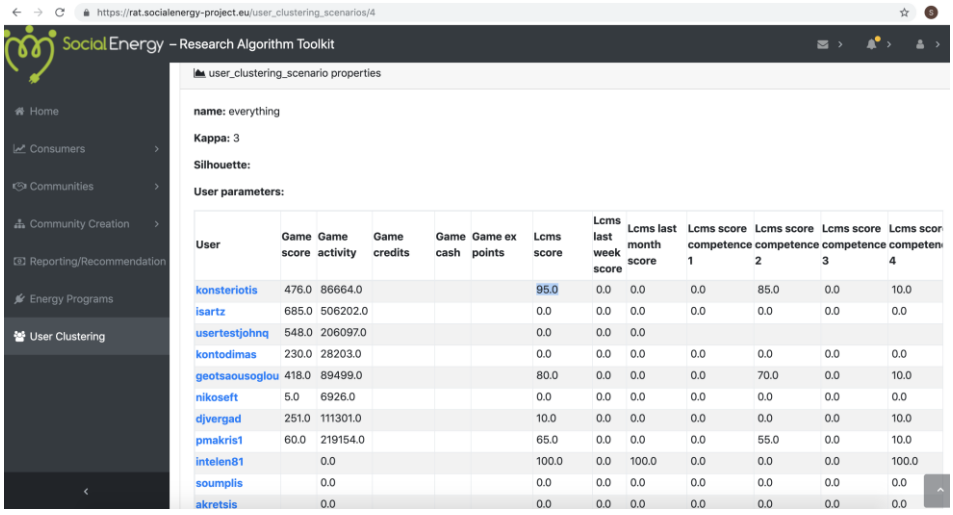

Figure 21: The EC leader user can view all the behavioural datasets of all his/her EC group members

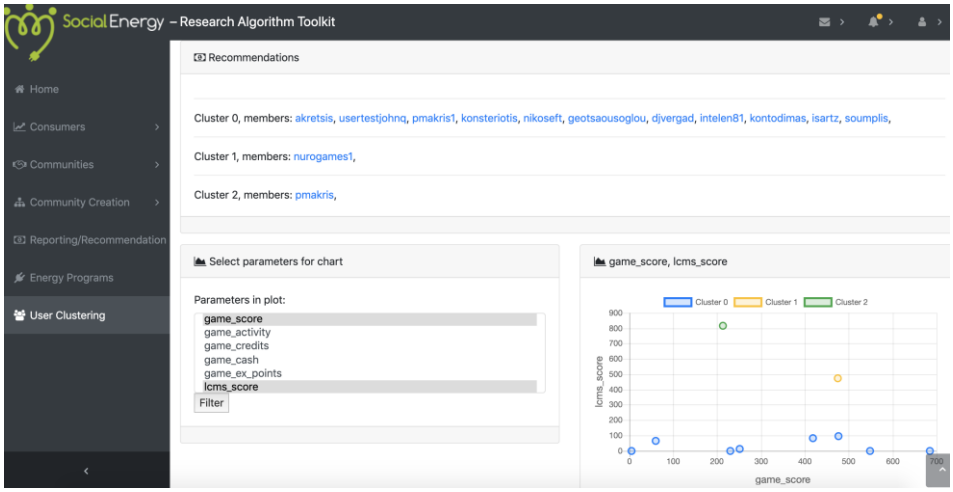

Figure 22: The EC leader user can analyse all his/her EC members' behavioural datasets and provide context-aware recommendations to the end users

2 S/W integration and interaction between GSRN and other subsystems

In this section, we present some examples regarding the interaction between the SOCIALENERGY subsystems. When the end user produces any kind of activity and/or achievement in the GAME or LCMS, the GSRN is instantly updated with all the related statistics data. In the next subsections, we describe some examples from the real-life use of the platform to serve as a continuation of end user's manual presented in section 1.
Note: More technical details have already been provided in section 2 of D5.2 (M18) from a S/W developer's point of view.

2.1. Automated and online GAME updates shown in GSRN

Let us assume "soumplis" username as the real end user, who has recently registered and logged in for the first time in the SOCIALENERGY system as already described in section 1.

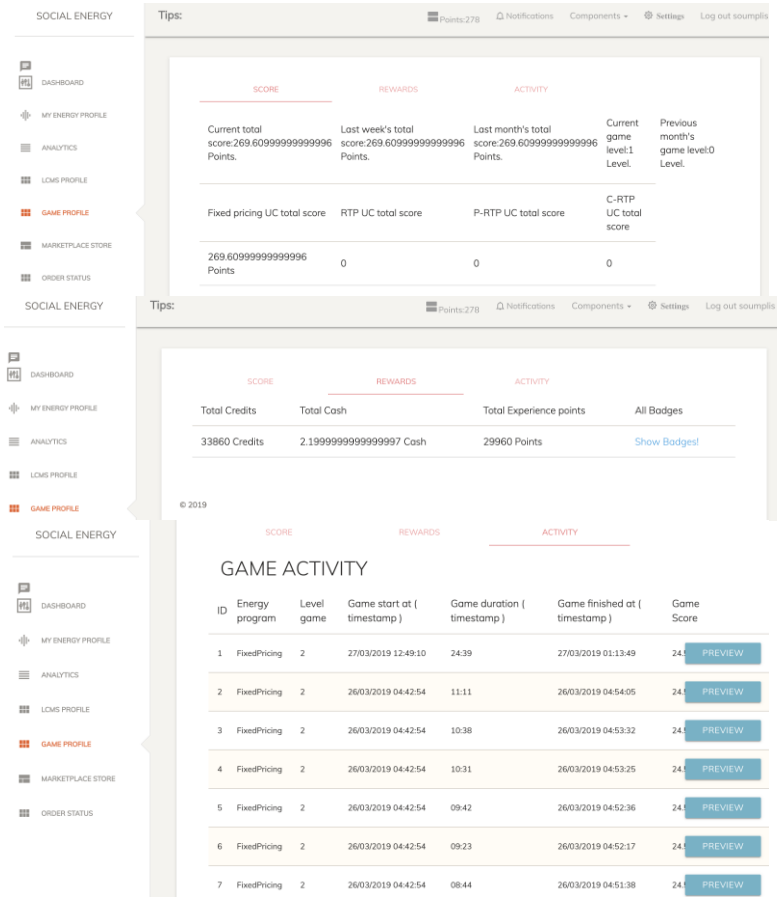

Figure 23: The current end user's GAME profile before playing the GAME

As shown in Figure 23, the end user "soumplis" has a total of 278 SOCIALENERGY points. Looking at the "GAME Profile" tab, the current total GAME score is 269.6 points, which is identical with the last week's and last month's total GAME score, because "soumplis" has first logged in the platform during the past few days. We can also see that the current game level is 1, while all game points acquired so far refer to the Fixed Pricing use case (UC) scenario, which is actually the only unlocked and thus available UC to play. Now, that "soumplis"

reached game level 1, the RTP UC scenario has also been unlocked and it is thus available for gameplay. In the "Rewards" sub-tab, "soumplis" can see his total game credits and experience points, total cash to be redeemed in the SOCIALENERGY's real world (e.g. marketplace) and all game badges acquired. Finally, in the "Activity" sub-tab, "soumplis" can track all his game activity. Each row represents one game job finished. For example, the most recent gameplay lasted 24:39 minutes, the end user played "FixedPricing" UC, etc. By clicking on the "Preview" button, the end user can view more details about the performance of each game job (e.g. energy consumption per device, mode per device, points per device, etc.).

Now, let's assume that "soumplis" wants to play a new game, so he follows the process already described in section 1.4 above. This time, he selects the RealTimePricing (RTP) use case scenario. After playing the game, "soumplis" can see the updated GAME statistics in GSRN as shown in Figure 24.

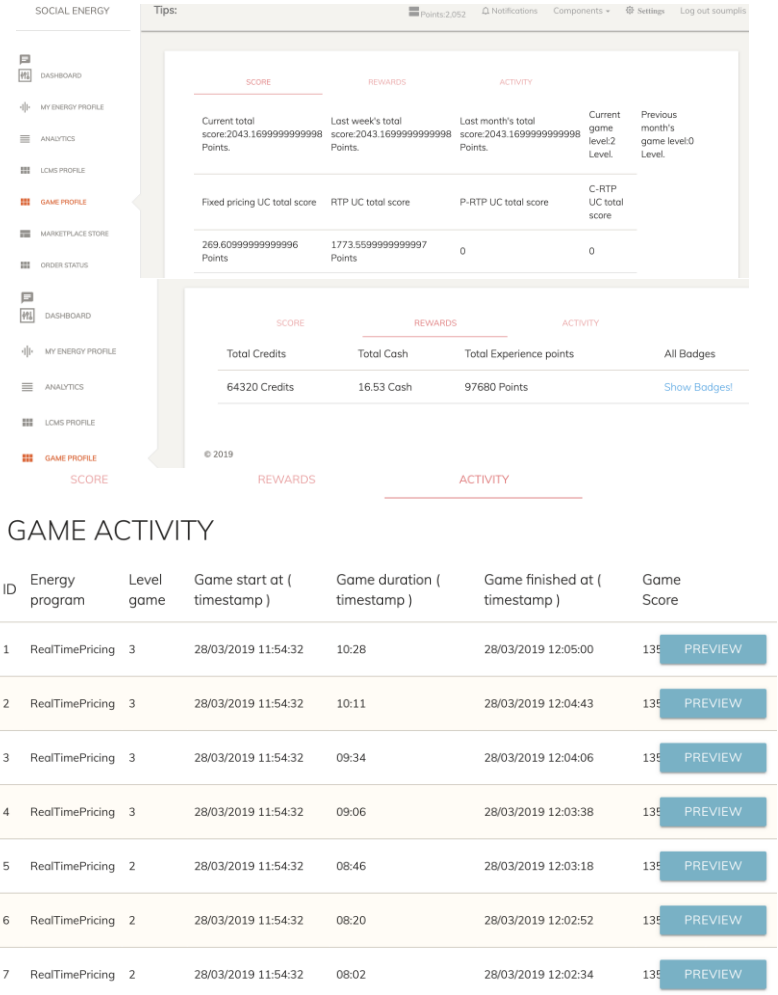

Figure 24: The end user's GAME profile after playing a new GAME

2.2. Automated and online LCMS updates shown in GSRN

Now, let's assume that "soumplis" wants to enter LCMS in order to take an educational course as described in section 1.5 above. In Figure 25, the current LCMS profile of the end user is presented. The total SOCIALENERGY points are 2052 and is the same number as shown in Figure 24 above. In the "Score" sub-tab, the current total LCMS score, last week's and last

month's LCMS score are presented. The LCMS scores per competence and per educational course are also presented. In the "Rewards" sub-tab, we can see that no badge has been assigned to "soumplis" so far. This is rational because no LCMS activity has taken place so far as it is also depicted in the "Activity" sub-tab below.

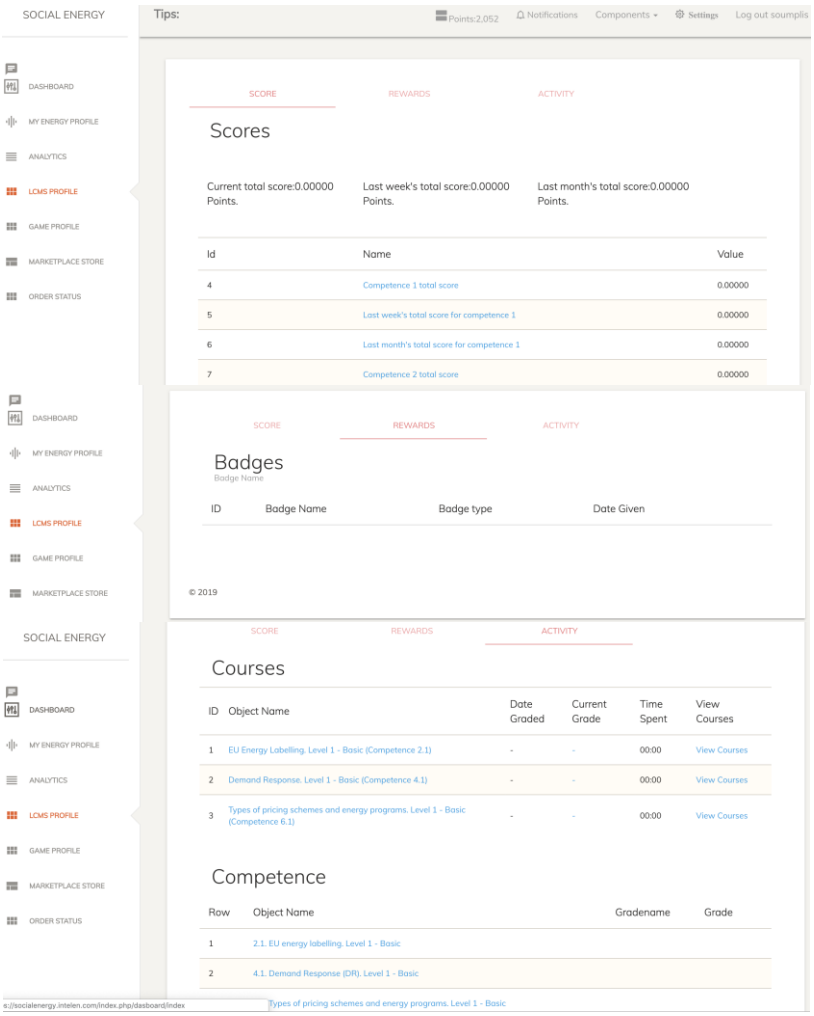

Figure 25: The current end user's LCMS profile before taking an educational course in LCMS

Now, let's assume that the end user "soumplis" logs in the LCMS and wants to take two educational courses, namely courses 4.1 and 6.1, which are proposed by LCMS Individual Learning Planner. After taking these two courses, the LCMS profile has been updated as shown in Figure 26. Thus, a total of 183.33 LCMS points have been achieved, i.e. 100 out of 100 points in course 4.1 and 83.33 out of 100 points in course 6.1. In the "Rewards" sub-tab, the two badges acquired are presented, i.e. one badge for excellent achievements in competence 4 at level 1 and one more badge for good achievements in competence 6 at level 1. Finally, in the "Activity" sub-tab, additional statistics information is provided.

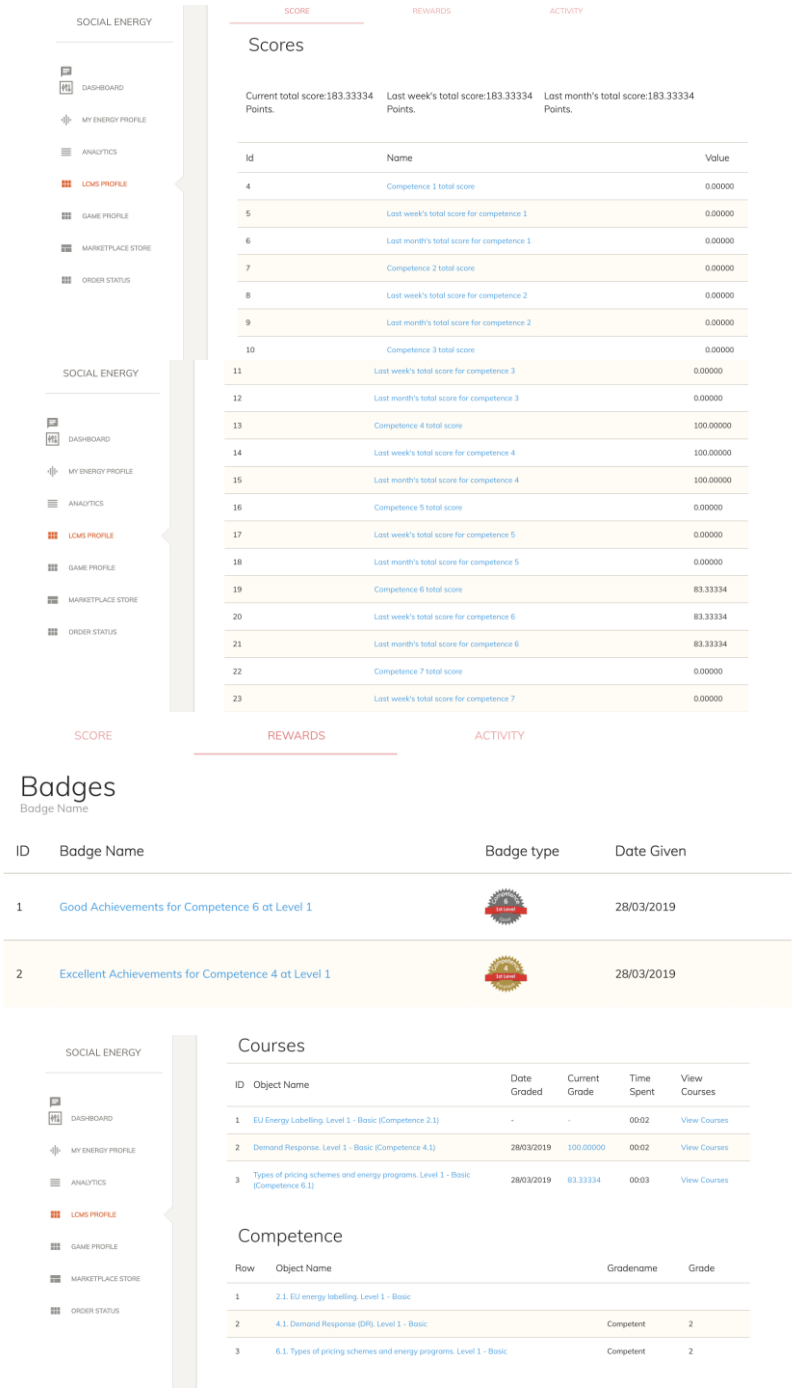

Figure 26: The end user's LCMS profile after taking two new educational courses in LCMS

2.3. Run RAT-based scenarios and receive RAT recommendations in GSRN

RAT subsystem analyzes periodically all SOCIALENERGY datasets (i.e. energy and behavioral related ones). As a result, RAT clusters users according to their energy consumption and ongoing activities/achievements in the GAME and LCMS. For example, based on the latest activities of end user "soumplis" in the GAME and LCMS, the RAT data analytics algorithms have captured all this activity and thus personalized recommendation messages are now shown in the GSRN "Analytics" tab as presented in Figure 27. The end user can also view these messages in the "Notifications" tab.

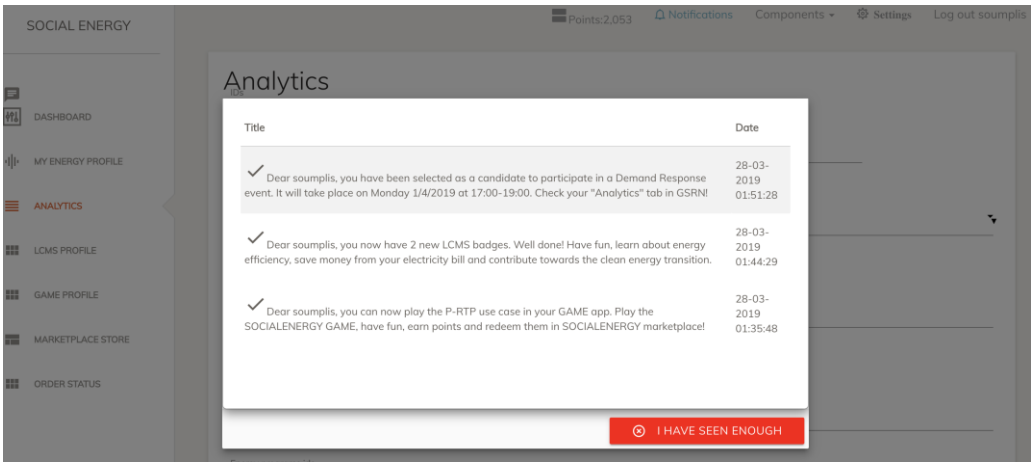

Figure 27: Personalized recommendation messages sent by RAT and viewed in GSRN "Analytics" tab

2.4. Integration of LCMS educational material and RAT mathematical formulas inside the GAME

There is targeted LCMS educational content within the GAME (e.g. advice in the form of "pop-ups", "mouse-over", "on-click", etc.) to guide the user to related educational content within LCMS. There is not a technical API for the dynamic data exchange between these two subsystems, because this would considerably reduce the quality of the gameplay. According to end user's gameplay results, the guidance to the appropriate educational content is supported (see more details in the previous deliverable D4.3).

The GAME score calculation is based on sophisticated pricing models, algorithms and mathematical formulas, which have been extensively researched in WP3 and the corresponding results are presented in D3.2.

3 Final version of S/W validation activities

In section 3 of D5.2 (M18), all steps and procedures for the evaluation of real-life pilot tests have been described in detail. In this deliverable, we follow-up all S/W validation tests/checks that have been reported in section 3 of D5.1 and we provide a summary of all S/W validation activities that have taken place during the M19-M27 period. For a period of approximately 2 months (i.e. from 16/1/2019 until 8/3/2019), the consortium received feedback from real end users about S/W errors, problems encountered, requests for enhancements, etc. Thus, in the SOCIALENERGY's beta version, all these problems are now fixed and the system is ready for the real-life pilot phase.

3.1. Summary of GSRN S/W validation activities

GSRN is the core S/W platform of SOCIALENERGY system interconnecting all other subsystems. The main S/W validation that took place during the last 3 months are the following:

- Finalize the synchronization with GAME, LCMS and RAT. Verify that score calculations are and data exchanges are done correctly.
- The EC leader user account has been created. The EC leader user can now have access to all his/her EC member profiles and thus provide several types of personalized recommendations either manually or through the use of RAT data analytics algorithms.
- All types of users including external and ESCO users are now supported.
- The "Analytics" tab has been enhanced to include information and guidance details about the DR event process, which will take place during the last 3 months of the project.
- Energy consumption data from real energy meters from Protergia S.A (Greece) and EDP (Portugal) clients are now integrated in GSRN.
- The SOCIALENERGY credit distribution policies (i.e. points' calculation) are now fine-grained and extensively tested. A new policy can easily be adapted (if needed) in order to reflect the real business process of an electric utility company.

3.2. Summary of RAT S/W validation activities

The main recent S/W validation activities for the RAT subsystem are the following:

- The EC leader user account has been created and information about all ECs and their members (i.e. EC structure can dynamically change through time) is now acquired by RAT. The EC leader user can now view all energy-related and behavioural datasets of all his/her group members.
- A new tab has been created called "User Clustering" to handle the data analytics for all behavioural datasets coming from the GSRN.
- All EC creation and dynamic adaptation algorithms have been inter-related with the RAT's reporting and recommendation functionality. Thus, now context-aware messages can automatically be sent to end users, who can view them as notification messages in GSRN.
- A new clustering algorithm has been developed in order to serve the needs of the DR event initialization process (i.e. which sets of end users are the most appropriate to participate in a given DR event). More details about this algorithm will be provided in D5.4.

- Advanced search, profiling and filtering functionalities have been to developed to manage a vast amount of EP scenarios, clustering algorithms, recommendations, etc.

3.3. Summary of GAME S/W validation activities

In the GAME's beta version, the following S/W validation activities have taken place:

- Enhancements have been made in the P-RTP game score calculations to better reflect and match the research results produced by exhaustive simulations in the RAT.
- The C-RTP use case scenario has been finalized to include more realistic interactions with several NPCs and better reflect the operation of a real C-RTP program.
- The game score calculations have been adjusted and fine-grained in order to enhance the gameplay procedure and thus engage more effectively the end user. All changes have been made according to related feedback received from real end users, who played the 'alpha' version of the GAME.
- S/W integration activities with GSRN and LCMS have been finalized in order to ensure that local game score calculations and statistics are correctly received and visualized in GSRN, too.

3.4. Summary of LCMS S/W validation activities

The following new S/W validation activities have taken place for LCMS:

- The EC leader user functionality has been tested and validated. Now, the EC leader user can create informal educational courses inside LCMS targeted only to his/her EC members.
- All educational courses for all competences have been finalized, uploaded in LCMS and tested by real end users.
- Minor changes have been made in the LCMS score calculations (i.e. grades, badges, etc.) in order to better reflect the expectations of real end users and thus engage them more effectively in the SOCIALENERGY's concepts.
- S/W integration activities with GSRN and GAME have been finalized in order to ensure that local LCMS score calculations and statistics are correctly received and visualized in GSRN, too.

3.5. Next steps

The current project's state is that the consortium has successfully accomplished Milestone 7 meaning that the final version of S/W integration and validation activities has taken place. The next step is to release the 'beta' version of the integrated S/W platform in order to start experimenting and receiving real-life datasets from real users. An integrated DEMO is also available in SOCIALENERGY's youtube channel and is used as communication material (together with other material) with targeted customer segment and audiences. Then, the goal is to gather inputs and results from real end users, who belong to a real electric utility company's portfolio. Subsequently, pilot testing results will be delivered in M30 via D5.4. Finally, in D6.3, the final version of business modeling work and results will be delivered bringing thus SOCIALENERGY products and services as close to the market as possible (i.e. TRL 8).

Appendix

Table 2: Summary of GSRN testing and validation activities

ID	Validation check	Validation outcome and comments
GSRN01	User registration, login, create account to LCMS	Works as expected. It will be the customer's (i.e. electric utility company) policy whether the end user or the admin user will initiate the registration process.
GSRN02	User logins with GSRN credentials, to RAT – LCMS using oauth2	Global authentication service works as expected. Minor changes can be made in the GUI in order for the end user to avoid filling in his/her credentials twice.
GSRN03	User account management	A registered user is be able to update his credentials, edit his own account, etc.
GSRN04	A registered user should be able to complete the questionnaire.	The first time a user logins, questionnaire must pop-up. After successful completion, questionnaire will be hidden.
GSRN05	Results from questionnaire must be posted to LCMS.	The Individual Learning Planner (ILP) functionality works as expected. The 3 most relevant courses are proposed to the end user.
GSRN06	Real-time data visualization of analytics.	Real-time data are displayed in the 'My Energy Profile'. The data updates depend on the type of the smart energy meter (i.e. every minute, 15-min, 1-hour, etc.).
GSRN07	Real-time data visualization of LCMS PROFILE.	LCMS activity data are sent instantly to GSRN. Sometimes, there is a small time elapse (e.g. maximum some tens of seconds) before the GSRN is updated.
GSRN08	Real-time data visualization of GAME PROFILE.	Same as GSRN07.
GSRN09	Real-time data visualization of notification.	Context-aware recommendations sent by RAT are sent instantly to GSRN and are visualized in the GSRN "Analytics" tab.
GSRN10	Create a new product – support CRUD functionalities.	An admin is able to create a new product in the marketplace, view, update or delete if s/he wants.
GSRN11	User must be able to add products to his basket or to checkout.	An end user is able to see all the products, to sort them, add them to his basket or even to checkout.
GSRN12	An Admin investigates all transactions of marketplace.	An admin is able to edit/update/delete all transactions of marketplace.
GSRN13	User must be able to create communities.	An end user can create group and then search and invite members to his/her group.
GSRN14	An admin must have CRUD functionalities over communities.	An admin user is able to edit/update/delete all transactions of communities.
GSRN15	User adds widget to his dashboard.	A user can add/delete/rearrange widgets to his/her dashboard page to have an overall summary of his activities in the platform.

ID	Validation check	Validation outcome and comments
GSRN16	Widget of dashboard showing updates.	Same as GSRN15.
GSRN17	MDM-GSRN service.	MDM broadcasts data (consumptions – consumers – geolocation - groups) to GSRN.
GSRN18	GSRN-RAT service.	GSRN broadcast data to RAT - user behavioral data from MDM.
GSRN19	GSRN-GAME service.	GSRN authenticates user, saves all game actions of end user and visualizes statistics via “GAME profile” tab.
GSRN20	GSRN-LCMS service.	GSRN pulls LCMS user actions, saves them to MDMS and then visualizes them via “LCMS Profile” tab.
GSRN21	GSRN-Marketplace service.	GSRN broadcast marketplace data. (behavior data – product related data)

Table 3: Summary of RAT testing and validation activities

ID	Validation check	Validation outcome and comments
RAT01	User registration and login	An admin and EC leader user can register and log in the RAT.
RAT02	User login with GSRN credentials	EC leader user gets globally authenticated together with the information about all his/her group members. EC leader can only manage his group members, while the admin can manage the whole portfolio.
RAT03	User account management	Works as expected.
RAT04	Register a new energy consumer and synchronize energy data exchange with MDMS	An administrative user is able to register a new consumer in the RAT database and synchronize with central MDMS database.
RAT05	View list of consumers/ consumer details, edit/delete consumer details	An admin user is able to view the list consumers together with their details and manage them according to his/her user rights. EC leader can only view only his/her EC members.
RAT06	Historical data visualization	Historical data are displayed in the ‘Consumer’, ‘Community’ and ‘Clustering’ views in various time granularities and for any given timeframe in the past.
RAT07	Real-time data visualization	Real-time data are displayed in the ‘Consumer’, ‘Community’ and ‘Clustering’ views. The graphs are updated dynamically as new data arrives.
RAT08	Community creation	An admin user is able to create “communities” (i.e. groups of consumers). A consumer may belong to several communities, as long as they are in different ‘clusterings’.
RAT09	View list of communities and details	An admin/EC leader user is able to view details about each community such as community members, aggregated consumption, the ‘clustering’ it belongs to etc.

ID	Validation check	Validation outcome and comments
RAT10	Manage a community	An admin/EC leader user is able to edit/update/delete a community, for example to change its name, description, member consumers, etc.
RAT11	Create a new 'clustering'	An admin user is able to create a new clustering (i.e. group of communities), based on several input parameters.
RAT12	View list of 'clusterings' and details	An admin user is able to see a list with all the 'clusterings' in the system and details about each 'clustering'.
RAT13	Manage a 'clustering'	An admin user is able to edit/update/delete clustering details, such as its name, description, and participating communities.
RAT14	Algorithmic clustering creation – Consumer type	An admin user can create a clustering automatically based on the consumer type, location, energy program, etc.
RAT15	Algorithmic clustering creation – Consumption patterns	An admin user can create a clustering automatically based on the consumers' consumption patterns .
RAT16	Algorithmic clustering creation – Flexibility patterns	An admin user can create a clustering automatically based on the consumers' flexibility patters (i.e. similar levels of flexibility over time).
RAT17	Algorithmic clustering creation – Behavioral data from GSRN activities	An end user can create a clustering automatically based on the consumers' GSRN participation (e.g. similar levels of activity in GSRN).
RAT18	Algorithmic clustering creation – LCMS participation	Same as RAT17 by using the "User clustering" tab.
RAT19	Algorithmic clustering creation – GAME participation	Same as RAT 17 by using the "User clustering" tab.
RAT20	Reporting/ Recommendation service creation	An admin user is able to create a new recommendation/ reporting service by using the output of the clustering algorithms. Then, the recommendation messages are sent automatically to GSRN.
RAT21	View list of recommendations	An admin/EC leader user is able to see/preview the list of all recommendations that have been created and their status.
RAT22	Manage recommendations	An admin user is able to edit/delete/update a recommenda-tion (before it is sent) and then successfully send it to the end users.
RAT23	Create energy program evaluation scenario	An admin/EC leader user should be able to create an energy program evaluation scenario, and assign various parameters to the scenario.
RAT24	Create energy program evaluation scenario through API	A GSRN admin user can create an energy program scenario through the GSRN platform using a REST API.
RAT25	View list of energy program evaluation scenarios	An admin user should be able to view the list of the energy program evaluation scenarios that have been created and

ID	Validation check	Validation outcome and comments
		compare the results. The EC leader can only create ad-hoc scenarios and send recommendations to end users.
RAT26	Manage energy program evaluation scenario	An admin user is able to edit/update/delete an evaluation scenario that s/he has created.
RAT27	View and compare various energy programs	An admin user is able to visualize the results of the evaluation scenario (various KPIs), compare various energy programs in order to select the most beneficial one.

Table 4: Summary of GAME testing and validation activities

ID	Validation check	Validation outcome
GAME01	User login with GSRN credentials	Works as expected.
GAME02	GSRN Competence Level	GSRN Competence is received and used to recommend Energy program (i.e. UC). Generally, an end user starts from the Fixed Pricing UC to learn the basics and then the other UCs unlock based on the game levels achieved.
GAME03	Avatar Customization	An end user is able to customize and play the customized avatar. At the same time, s/he can learn gradually about the gameplay goals and objectives.
GAME04	Send Avatar Data	Data of the avatar is sent to GSRN to have a consistent avatar on all platforms. Graphical representation of the avatar is still missing in GSRN.
GAME05	Energy programs	An end user can choose one of the 4 UC scenarios (i.e. energy program) according to his/her current game level.
GAME06	Info from LCMS	The end user can get more information about the energy program from a link to LCMS. There are also more links to targeted LCMS material throughout the GAME.
GAME07	Task planner	The end user plans his/her day by dragging and dropping his/her daily tasks into the plan at the hour s/he needs. These options directly affect the game score calculation (i.e. convenience).
GAME08	Avatar control	The avatar can be moved by the end user and interaction with all objects is done successfully throughout the whole gameplay.
GAME09	Tutorial	The game provides the player with information needed to understand the game concept. The player can also hide this information in order to play the game more easily and without distractions.
GAME10	Jobs	Jobs can be made at the scheduled time or independent from schedule. The player can choose the optimal timeslot to do each job in order to maximize his/her score.
GAME11	Activity	An activity is a step of a job trigger by interaction with an object. Activities have certain duration and unlock the next step of the job. All jobs work as expected after several bug fixes based on real end users' input.

ID	Validation check	Validation outcome
GAME12	Device options	Multiple device options are available and differ in energy consumption and convenience. The end user can choose the optimal device mode to maximize his/her score. Links to targeted LCMS material are also provided.
GAME13	Job Result	After a job is finished, a result window is displayed with end user's consumption, cost, convenience and reward. The end user can easily understand how close to the optimal score s/he has achieved so far.
GAME14	Rewarding	After a job is finished, the user is getting a reward. S/he can see the instant updates in the credits, experience and cash points.
GAME15	Sending Job Info	Job information is sent to GSRN. In the "Game Profile" → "Activity" tab, the end user can see a summary of all his/her actions within the game and learn about the energy consumption per device and mode of operation.
GAME16	Fixed price program	In the fixed pricing energy program the prices are not changing. The cost score is calculated based on the total KWh consumed.
GAME17	Result of the Day	The results of the day are presented to the end user: Amount of Jobs finished, Consumption of the day, costs of the day compared with minimum costs, convenience of the day compared with maximum convenience, daily convenience score, daily cost score.
GAME18	Time of Use pricing program	In the time of use pricing program, the prices depend on the timestamp that the user performs an activity. There is a different price per KWh consumed per hour.
GAME19	Personalized real time pricing	The prices depend on the decisions made by the end user. The prices change according to the personalized user's behavior. Score calculation is based on mathematical formulas provided by RAT research and works as expected.
GAME20	Real Time Energy Community pricing	The price depends on the decisions of the end user and the in-game NPCs. Score calculation is based on mathematical formulas provided by RAT research and works as expected.
GAME21	Device upgrades	The end user can purchase upgrades for his/her electronic devices. The upgraded devices replace the former ones. The upgraded devices change the device options. Respective credit points are subtracted.
GAME22	Decoration objects	The end user is able to buy decoration items. Respective credit points are instantly subtracted from user's profile. When the end user has no adequate credit points, s/he cannot buy new decoration objects.

Table 5: Summary of LCMS testing and validation activities

ID	Validation check	Validation outcome
LCMS01	User registration and login	An end user is able to create a user account in LCMS and login.

ID	Validation check	Validation outcome
LCMS02	User login with GSRN credentials	An end user with an active GSRN account is able to login to the LCMS using GSRN credentials. Minor changes can be made in the GUI in order for the end user to avoid filling in his/her credentials twice.
LCMS03	User profile management	Registered users are able to change their own credentials (available only for locally registered users) and update account's settings.
LCMS04	Create competency framework	An administrative user is able to set up competency frameworks and add competencies to them. Then, educational courses can be added for each level and competence. A total of 21 formal courses are now available in LCMS (i.e. 3 courses for each one of the 7 competences).
LCMS05	Create learning plan on behalf of GSRN	An end user authenticated with GSRN credentials is automatically assigned with an individual learning plan, which includes all missing competences determined by the results from GSRN questionnaire.
LCMS06	Create learning plan	An administrative user is able to create learning plan templates, add competencies to them and assign learning plans to a group of users or to individual selected users.
LCMS07	Create course	An admin user is able to create a course and add learning activities like text reading, take quizzes, forums etc. After the course creation, the end user can enroll himself/herself in the course.
LCMS08	Assign competencies to courses and course activities	An admin user is able to add competencies to courses and course activities, and configure the rules for acquiring proficiency level.
LCMS09	Dashboard	Registered users are able to view dashboard with their own learning plans, courses (in progress and passed) and the courses' progress.
LCMS10	Follow Learning Plan	According to the learning plan, the LCMS provides appropriate educational materials to the user. Users are able to view the degree to which learning plan is fulfilled.
LCMS11	Follow course	The end user can view, download learning materials and perform different tasks such as uploading files, fill in quizzes, reply with a text in forums etc.
LCMS12	Obtain badge	When a registered user acquires a new competence, s/he is automatically awarded a badge.
LCMS13	RESTful Competency API	The RESTful Competency API allows LCMS to communicate with GSRN. All LCMS statistics are visualize in the GSRN “LCMS Profile” tab. The functionality works as expected.