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

H2020 ICT-731767

Pilot testing results and project assessment

Deliverable D5.4

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Table of Contents

List of Figures and Tables

List of Figures

List of Tables

Document History

This deliverable is the output of the Task 5.3 activities. It includes the results of the real-life small-scale experiments and an assessment of the project's conclusions. Deliverable 5.3 has been used as a guidebook for end users' participation in SOCIALENERGY's real-life pilot tests. As a result, this report elaborates on the outcomes and progress been made until M27 and demonstrates the pilot testing results with the participation of real end users and respective datasets. It should be noted that pilot testing work will be continued even after the end of the project's lifetime given that Protergia S.A.[1] has already expressed its commercial interest for SOCIALENERGY's products and services.

Table 1: Document History Summary

Revision Month	File version	Summary of Changes
22/02/2019	v0.1	Draft ToC circulated to the entire consortium by ICCS and INTELEN. All partners discussed about D5.4 structure during the 6th plenary meeting in Athens.
01/03/2019	v0.2	Final ToC version agreed among all partners.
27/03/2019	v0.4	The final D5.3 version (i.e. end user manual) has been released and circulated to all end users in order to start experimenting with SOCIALENERGY system.
09/05/2019	v0.5	Real data acquisition in SOCIALENERGY platform, data analysis and end user segmentation.
27/06/2019	V0.7	1st round of pilot testing results
02/08/2019	v0.8	2nd round of pilot testing results
23/09/2019	v0.9	Draft version has been prepared by INTELEN for final review meeting.
24/09/2019	Final v1.0	Final version has been prepared by INTELEN including all statistical datasets and conclusions from pilot testing results.
17/10/2019	Final v2.0	INTELEN and SOCIALENERGY consortium has addressed the EC comments about GDPR-related strategy and provided an updated section 5.

[1] Protergia is the Energy Unit of MYTILINEOS, the largest independent electricity producer in Greece. https://www.protergia.gr/en

Introduction

The purpose of this Document is the presentation of the various Pilots that were executed in the Pilot period of the project.

For the pilots, 20 residential users were selected, after the installation of all relevant AMR infrastructure (smart meters).

The Phases of the Pilot rollout can be seen below:

i) Phase 1: Pilot setup and SOCIALENERGY data acquisition – (automatic) integration of real end users' data with SOCIALENERGY system
ii) Phase 2: Initial user engagement, data analysis and AB testing – Preparation phase → check that all end users have understood well the platform's functionalities and make sure that they provide realistic/truthful data (i.e. they are not just playing around)
iii) Phase 3: Behavioural DR and recommendation messages (without gamification features). We check if end user engagement is improved when we send targeted reporting/recommendation messages.
iv) Phase 4: Real-life pilot phase 2 (more gamification, incentives, challenges, and social network effects)
v) Analysis of results, drawn from the data acquisition system (RAT)

After the analysis of the results, we can observe that:

- Participants were clustered based on their consistency to perform energy savings when requested. The results revealed four different levels of engagement reported as "Highly Engaged Participants", "Engaged Participants", "Low Engaged Participants" and "Not at all engaged Participants". The percentage of participants assigned to each group correspond to 6.8%, 50.8%, 23.7% and 18.7% of the entire sample population, respectively. The four clusters are illustrated in Figure 255 in this report. This follows exactly the literature about the initial engagement statistical groups that any DR service follows.
- The savings' level of these groups also differed, with highly engaged participants indicating at around 6% savings on average across the 10 DR events, while engaged users indicated savings close to 1%. Even though there were observed savings for the low engagement participants group too, the fluctuations in participants performance did not allow overall savings to emerge. Participants that were assigned to the "not engaged at all" group, had performed zero savings during the DR events.
- Analysis also run to evaluate the effectiveness of DR events with differences in duration. The findings showed that shortest (in duration) DR events (up to 2 hours) were much more effective than the long-lasting DR events (more than 2 hours).
- The loss aversion theory along with the theories about "resistance to change" could explain why participants might not be willing to reduce their consumption. Sacrificing the comfort level in exchange to energy savings, low monetary savings and the environmental benefits, might not value the same for participants. Sacrificing their comfort level might value more for participants. Hence, it might be necessary to

provide more behavioral and tangible incentives to participants in order to trigger attitudinal change.

- Finally, it is reasonable for any baseline model to affect the outcome of DR effectiveness. For simplicity reason, the current analysis was based on a simple and straightforward baseline model that did not account for external factors such as the temperature changes and how such changes could influence the energy consumption level. The baseline model utilized accounted only for the general trend in participant's behavior. More advanced models might perform better since they predict with high accuracy the participants' consumption level and allow the quantification of savings to be the difference between the predicted and actual energy consumption. Future research should consider such models for evaluating DR effectiveness.

1. Pilot setup, data acquisition and automatic integration with SOCIALENERGY system

The pilot execution required support for the smart meter installations to solve any issues regarding the proper functionality of the metering equipment and the communication with the central system. The support is organized in three levels. The first level support is responsible for the daily monitoring of the smart meter status to identify smart meter failures and telecom support activities to solve minor issues with the help of end users. The second level support performs remote support actions through smart meter's remote support functionalities such as rebooting the equipment and updating the network settings among others.

Third level support includes commissioning services at installation site from trained installers to restore communication and proper meter functionality in cases where there's no communication between the MDM and the smart meter and remote support is not possible.

The information displayed to the installer is as follows:

- Timestamp of the last network settings update sent to the MDM system
- Timestamp of the last instant power reading sent to the MDM system
- Timestamp of the last remote support communication signal sent to the MDM system
- Timestamp of the last energy reading sent to the MDM system

Data Preparation

In order to be able to proceed with analysis, we had first to pre-process the collected data to increase its quality and improve their suitability. The pre-processing included the selection, normalization, transformation and cleaning of the data.

Data selection

To be able to gain insights about the participants' intrinsic interest in DR, the data utilized as input for the analysis were:

- Date of the DR event
- Start time of the DR event
- End time of the DR event
- The scope of the DR event
- User ID
- Consumption per 15min during the DR event
- Consumption per 15min of the past 3 weeks during the same hour(s) as DR event
- Participants' questionnaire data

Data Normalization

We utilized data normalization to organize data into tables and columns. Normalization improved data quality since eliminated duplicate data, minimized data modification issues, and simplified queries.

Data Transformation

The initial 15-minute format of the energy data was not suitable for the analysis. Hence, the collected energy data was summed up to hourly consumption data (KWh). The same process was repeated for all DR events and for the energy data that concerned past consumption, i.e. the participants' typical consumption.

Data cleaning

Since the installed meters are quite sensitive and multiple reasons cause them to stop sending data, data cleaning was crucial. In particular, there was a significant number of missing values to be managed. We could have used "missing values" algorithms. Though, due to the nature of data (consumption data) it was considered risky to use predictions and corrupt it. Because consumers' behaviour is unpredicted and there are many external factors that could affect real consumption. Thus, we excluded all records that either had missing values during DR event, or had all consumption data from past weeks missing. In cases where data for at least one of the past weeks data existed and consumption data during the DR event were available, we properly analysed it.

Modeling

For analysing DR data and gain insights, we had to build a baseline model to compare consumption data during DR with participants' typical consumption. Moreover, a clustering model that allowed us to group participants as low / middle / or high consumers, was utilized.

Baseline

To measure effectiveness of Demand Response (DR) based on the participants' intrinsic motives, it was essential to construct a baseline model that would work as the base of measurement for participants' typical consumption. Then, this baseline consumption should be compared to the actual consumption during the DR event. In the literature, multiple approaches have been proposed for building a consumption baseline model.

Energy efficiency community uses mostly regression-based baseline models recommended by the Measurement and Verification (M&V) standards. Some of such models are of high accuracy, but they are more complex than the baselines models electric utilities usually deploy to track the effectiveness of their programs and actions. So, electric utilities generally use simple baseline models, many of which involve averaging the daily electricity consumption over several days, especially over days with high observed consumption. Or utilities just averaging the energy consumption over specific hours during a day, depending on the scope of their analysis.

For the current analysis, a simplified baseline model was utilized. In particular, 15-minute energy consumption data was transformed to hourly consumption data and then was summed up if the DR event was exceeded the one hour in duration. The same process was followed also on the consumption data of the 3 past weeks closest to the DR event, for all DR events. Then, the average of the consumption of those three weeks was estimated to account as the baseline model.

The decision for exploiting the energy consumption data of the 3 latest weeks was taken for two main reasons. The first reason was that there was a significant number of missing values among data and thus using a higher range of past weeks would lead to poorest accuracy on the results. The second reason was the seasonality effects. In order to restrict as much as possible the seasonality effects and minimize the chances to include energy data that have been incurred due to the temperature differences, the most recent weeks to the DR event were selected. As a result, the examined periods had the least cost with respect to weather conditions changes.

Moreover, it was assumed that if there were any other external factors affecting the energy consumption pattern would be more possible to be also presented in recent weeks rather than in oldest periods.

Of course, all users that had no consumption data across the three examined weeks were excluded from analysis. If, at least one of the examined periods was completed, the baseline model was adjusted accordingly.

Having considering regency and similarity, the baseline model formed as follows:

$$y = 0.33x_1 + 0.33x_2 + 0.33x_3$$

,where x_1, x_2, x_3 is the consumption of the relevant past 3 weeks, respectively.

Clustering

In order to be able to study whether low, medium or high consumers were more engaged with the DR objective, participants were clustered based on their average past consumption for each DR event separately. The *k-means* algorithm with k set to 3, was utilized. Three groups of consumers emerged per DR, with different consumption needs.

Each of the participants was assigned to one of the groups for each event, though the same participants could be assigned to a different group between DR events. This is quite reasonable if we think that DR events took place on different hours and days of a week, and so consumers might behave differently across these different periods. To understand this better imagine that a particular consumer might be a medium consumer if the DR event concerns Mondays from 20:00 to 22:00, but being a low consumer if DR runs on Thursday from 19:00 to 21:00. However, there were some fixed cases that concerned mostly the SMEs and C&I participants and were steadily assigned to the high consumption group.

The purpose for clustering participants was that regardless of whether a DR was successful or not, insights for the performance of each cluster can be drawn.

Evaluation

Having described how baseline model was built and how clusters were produced, this subsection describes the core analysis deployed for each of the DR events realized.

More specifically, the effectiveness of each DR event was examined with respect to whether it was successful overall (taking into account all participants), or not. Moreover, some descriptive statistics such as the average consumption, the total consumption, the maximum reduction (or increase, depending on the DR's scope) and the percentage of participants achieved the goal (i.e. adopted their consumption as requested), were estimated. Moreover, the effectiveness of DR across each cluster was measured both in terms of DR acceptance rate as well as the percentage of savings (or increase) achieved.

H/W equipment and Smart Meter used

Figure 1: An indicative smart meter connected to the central fuse box

Figure 2: Set of indicative smart plugs used to control the energy consumption loads during DR events

Figure 3: Indicative communication gateway used to connect and send real time data to the SOCIALENERGY S/W platform

SOCIALENERGY snapshots with Real time data

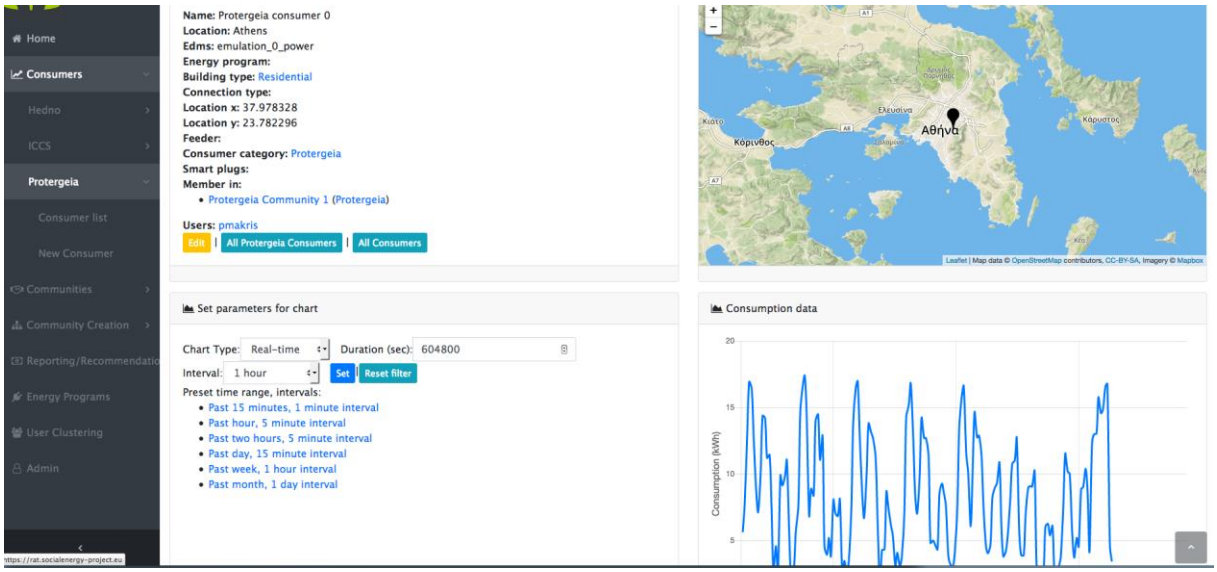

Figure 4: Real-time energy data (hourly) coming to the SOCIALENERGY platform from an indicative end user

In the figure above, we can see some real time data from the AMR and MDM system, coming into the SOCIALENERGY platform, for further analysis by the RAT subsystem.

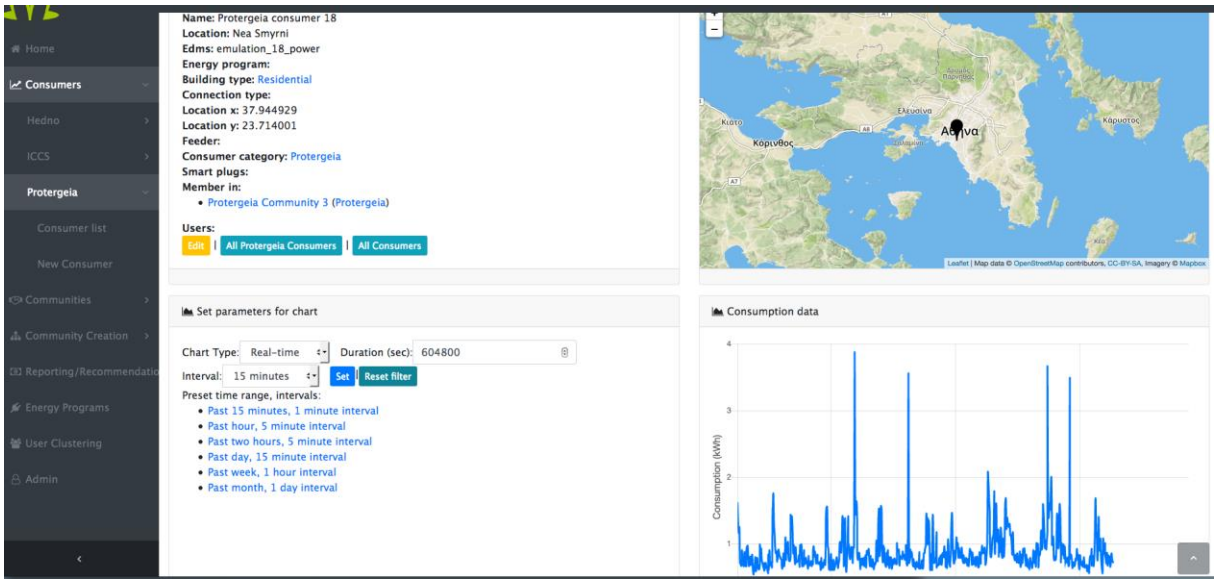

Figure 5: Real-time energy data (15-minute) coming to the SOCIALENERGY platform from another indicative end user

Moreover, energy data can be also presented with higher granularity, in 15 minutes time interval, for further analysis from the RAT subsystem. The end/EC leader/admin users are able to view energy consumption data per individual end user in several time intervals, modes and granularities. Historical energy consumption datasets can also be viewed in RAT in a similar way.

Smart Meter Infrastructure installed in end users' premises

At the Table below, the full AMR infrastructure can be seen, that is installed to all residential users, who participated in SOCIALENERGY pilots (in total 26 users).

Table 2: Summary of all H/W infrastructure installed in end users' premises

Typology/ Building ID	Zones	Equipment	Installed Equipment	Measurements
GR_TG0R01	Living Room Kitchen	Gateway x 1 Clamp Meter x 1 Multisensor x 2 Smart Plug x 2 Smart Thermostat x 2 Lighting System x 2	All	Occupancy, Temperature, Humidity, Luminance, Lighting Control, Thermostat Control, Total Consumption, Refrigerator Consumption
GR_TG0R02	Living Room	Gateway x 1 Clamp Meter x 1 Multisensor x 1 Smart Plug x 2 Smart Thermostat x 1 Lighting System x 1	All	Occupancy, Temperature, Humidity, Luminance, Lighting Control, Thermostat Control, Total Consumption, HVAC Consumption
GR_TG0R03	Living Room Bedroom	Gateway x 1 Clamp Meter x 1 Multisensor x 2 Smart Plug x 2 Smart Thermostat x 2 Lighting System x 2	None	None
GR_TG0R04	Living Room Bedroom	Gateway x 1 Clamp Meter x 1 Multisensor x 2 Smart Plug x 2 Smart	None	None

		Thermostat x 2 Lighting System x 2		
GR_TG0R05	Living Room Bedroom	Gateway x 1 Clamp Meter x 1 Multisensor x 2 Smart Plug x 2 Smart Thermostat x 2 Lighting System x 2	Gateway x 1 Clamp Meter x 1 Multisensor x 2 Smart Plug x 2	Occupancy, Temperature, Humidity, Luminance, Total Consumption, TV Consumption
GR_TG0R06	Living Room Bedroom	Gateway x 1 Clamp Meter x 1 Multisensor x 2 Smart Plug x 2 Smart Thermostat x 2 Lighting System x 2	Gateway x 1 Clamp Meter x 1 Multisensor x 2 Smart Plug x 2 Smart Thermostat x 1	Occupancy, Temperature, Humidity, Luminance, Thermostat Control, Total Consumption, TV Consumption
GR_TG0R07	Living Room Bedroom	Gateway x 1 Clamp Meter x 1 Multisensor x 2 Smart Plug x 2 Smart Thermostat x 2 Lighting System x 2	Gateway x 1 Clamp Meter x 1 Multisensor x 2 Smart Plug x 2 Smart Thermostat x 1	Occupancy, Temperature, Humidity, Luminance, Thermostat Control, Total Consumption, TV Consumption, HVAC Consumption
GR_TG0R08	Living Room Bedroom Kitchen	Gateway x 1 Clamp Meter x 1 Multisensor x 3 Smart Plug x 2 Smart Thermostat x 2 Lighting System x 4	None	None

GR_TG0R09	Bedroom 1 Bedroom 2	Gateway x 1 Clamp Meter x 1 Multisensor x 2 Smart Plug x 2 Smart Thermostat x 2 Lighting System x 2	None	None
GR_TG0R10	Bedroom	Gateway x 1 Clamp Meter x 1 Multisensor x 1 Smart Plug x 2 Smart Thermostat x 1 Lighting System x 1	None	None
GR_TG0R11	Bedroom 1 Bedroom 2	Gateway x 1 Clamp Meter x 1 Multisensor x 2 Smart Plug x 2 Smart Thermostat x 2	All	Occupancy, Temperature, Humidity, Luminance, Thermostat Control, Total Consumption, HVAC Consumption
GR_TG0R12	Living Room	Gateway x 1 Clamp Meter x 1 Multisensor x 1 Smart Plug x 2 Smart Thermostat x 1 Lighting System x 1	All	Occupancy, Temperature, Humidity, Luminance, Thermostat Control, Total Consumption, HVAC Consumption, Lights Consumption
GR_TG0R13	Living Room	Gateway x 1 Clamp Meter x 1 Multisensor x 1 Smart Plug x 2 Smart Thermostat x 1	Gateway x 1 Clamp Meter x 1 Multisensor x 2 Smart Plug x 2 Lighting System x 1	Occupancy, Temperature, Humidity, Luminance, Total Consumption, Lights Consumption

		Lighting System x 1		
GR_TG0R14	Living Room	Gateway x 1 Clamp Meter x 1 Multisensor x 1 Smart Plug x 2 Smart Thermostat x 1	All	Occupancy, Temperature, Humidity, Luminance, Thermostat Control, Total Consumption, HVAC Consumption
GR_TG0R15	Living Room Bedroom	Gateway x 1 Clamp Meter x 1 Multisensor x 1 Smart Plug x 2 Smart Thermostat x 2	All	Occupancy, Temperature, Humidity, Luminance, Thermostat Control, Total Consumption, HVAC Consumption
GR_TG0R16	Bedroom	Gateway x 1 Clamp Meter x 1 Multisensor x 1 Smart Plug x 2 Smart Thermostat x 1	None	None
GR_TG0R17	Living Room Bedroom	Gateway x 1 Clamp Meter x 1 Multisensor x 1 Smart Plug x 2 Smart Thermostat x 2	Gateway x 1 Clamp Meter x 1 Multisensor x 1 Smart Plug x 2 Smart Thermostat x 1	Occupancy, Temperature, Humidity, Luminance, Thermostat Control, Total Consumption

GR_TG0R18	Bedroom 1 Bedroom 2	Gateway x 1 Clamp Meter x 1 Multisensor x 2 Smart Plug x 2 Smart Thermostat x 2 Lighting System x 2	All	Occupancy, Temperature, Humidity, Luminance, Thermostat Control, Total Consumption, HVAC Consumption, Lights Consumption
GR_TG0R19	Bedroom	Gateway x 1 Clamp Meter x 1 Multisensor x 1 Smart Plug x 2 Smart Thermostat x 1	None	None
GR_TG0R20	Living Room Bedroom	Gateway x 1 Clamp Meter x 1 Multisensor x 2 Smart Plug x 2 Smart Thermostat x 2	Gateway x 1 Multisensor x 2 Smart Plug x 2	Occupancy, Temperature, Humidity, Luminance, TV Consumption
GR_TG0R21	Living Room Bedroom	Gateway x 1 Clamp Meter x 1 Multisensor x 2 Smart Plug x 2 Smart Thermostat x 2	None	None
GR_TG0R22	Living Room Bedroom	Gateway x 1 Clamp Meter x 1 Multisensor x 3 Smart Plug x 2 Smart Thermostat x 2 Lighting System x 2	None	None

GR_TG0R23	Living Room Bedroom 1 Bedroom 2	Gateway x 1 Clamp Meter x 1 Multisensor x 3 Smart Plug x 2 Smart Thermostat x 3	All	Occupancy, Temperature, Humidity, Luminance, Thermostat Control, Total Consumption, HVAC Consumption, Lights Consumption
GR_TG0R24	Living Room Bedroom 1 Bedroom 2	Gateway x 1 Clamp Meter x 1 Multisensor x 3 Smart Plug x 2 Smart Thermostat x 3 Lighting System x 1	All	Occupancy, Temperature, Humidity, Luminance, Thermostat Control, Total Consumption, HVAC Consumption, Lights Consumption
GR_TG0R25	Living Room Bedroom 1 Bedroom 2	Gateway x 1 Clamp Meter x 1 Multisensor x 3 Smart Plug x 2 Smart Thermostat x 2 Lighting System x 1	All	Occupancy, Temperature, Humidity, Luminance, Thermostat Control, Total Consumption, HVAC Consumption, Lights Consumption
GR_TG0R26	Living Room Bedroom	Gateway x 1 Clamp Meter x 1 Multisensor x 2 Smart Plug x 2 Smart Thermostat x 2 Lighting System x 1	Smart Plug x 2 Lighting System x 1	Lighting Control, Lighting Consumption

2 Initial end user engagement and SOCIALENERGY data analysis

Customer cluster profiles are automatically being generated for the initial customer engagement (RAT subsystem) and for the end users to be engaged with the platform. The engagement of the end users has been continuously rising during the 9 weeks of the pilots. The average number of clicks during that period was 5.3 clicks per week and this is rising since the initial DR event recommendations were sent to specific consumers that had indicated high initial engagement potential, based on the initial questionnaires and surveys.

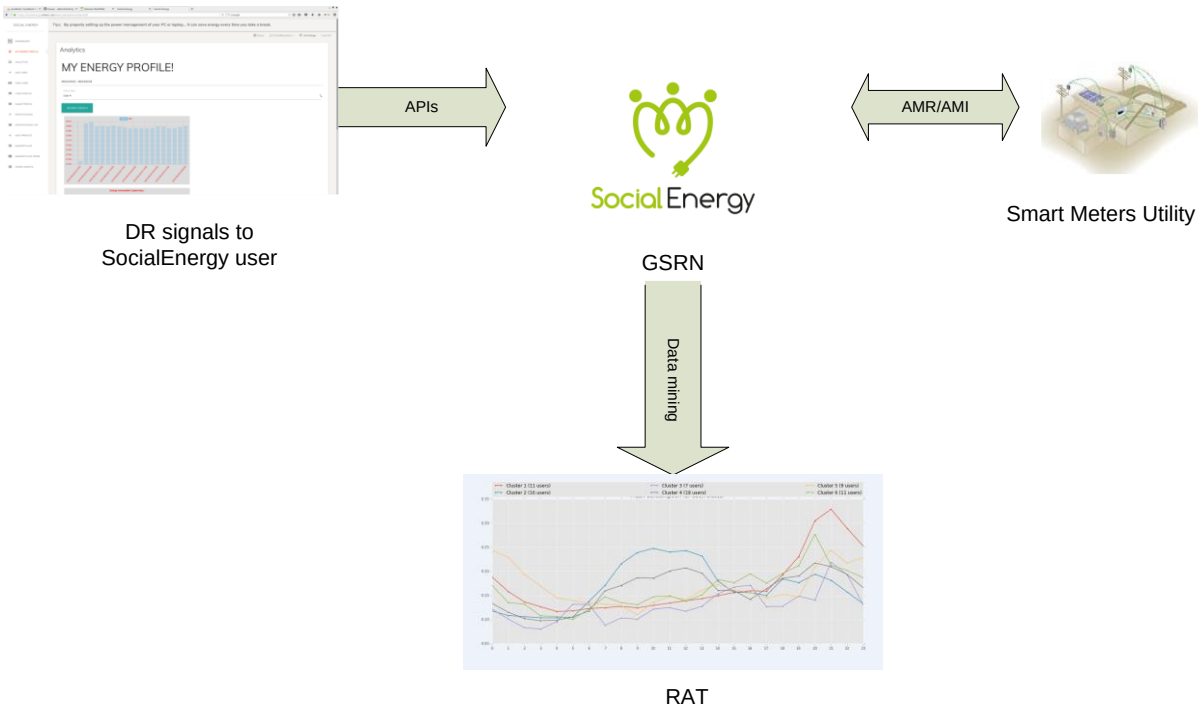

Figure 6: The high-level process of behavioural Demand Response (DR) in SOCIALENERGY

RABIT gathers all types of data from GSRN (i.e. demographical, behavioural and energy) and automatically clusters the users according to a wide variety of data features (e.g. GAME data, LCMS data, GSRN questionnaire/EC data, etc.).

End users' clustering and inter-relation with context-aware recommendations (including notifications for DR event process)

Metric	Period 1/6/2019 – 31/7/2019)
Average Clicks Per week	5.3
Average of unique visitors per week	1.85
Average Logins per week	3.62
Highly engaged users	9
Number of users logged in at least once	26

Our data analysis approach, before and during the SOCIALENERGY DR events is as follows:

- After a few weeks, we analyse the behavioural data to identify the most/least engaged users (RAT clustering). We also analyse energy data to derive respective user clusters according to Energy Consumption Curve (ECC) patterns.
- Describe the various RAT clustering (statically) and summarize the most important ones in order to send the respective recommendation messages to GSRN. For example, send demand reduction events in peak-demand hours or send demand increase events in off-peak demand hours.
- Select the most interesting RAT clustering and inter-relate them with context-aware recommendations and then send them as notifications to end users (i.e. static messages like promotional ones and not directly related with their actions inside the SOCIALENERGY platform).
- Taking into account that limited amount of data are available, which are not sufficient for savings estimation using base-load techniques, the main steps of the measurement and verification (M&V) process for the pilot is as follows:
- Employ a clustering algorithm to define representative daily load curves for each user.
- Employ a clustering algorithm to form groups of users with similar typical ECC patterns.
- Employ a clustering algorithm to form groups of users with similar behavioural data patterns
- Perform AB testing in each group to validate DR/behaviour change results by sending messages to a number of users in each group.

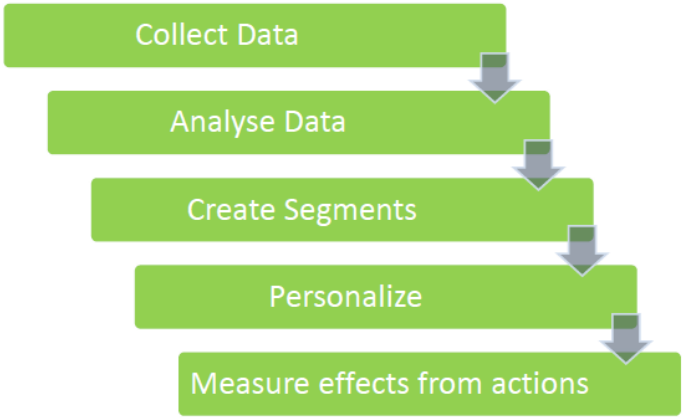

Figure 7: Behavioral M&V method/steps to follow in order to calculate actual savings/ actions from behavioral change

The result of section 2 process is that VEC groups (clusters) have been formed and respective recommendation messages are ready to be sent to end users in order to start the real-life pilot phase (both for DR events and other types of challenges for behavioural change).

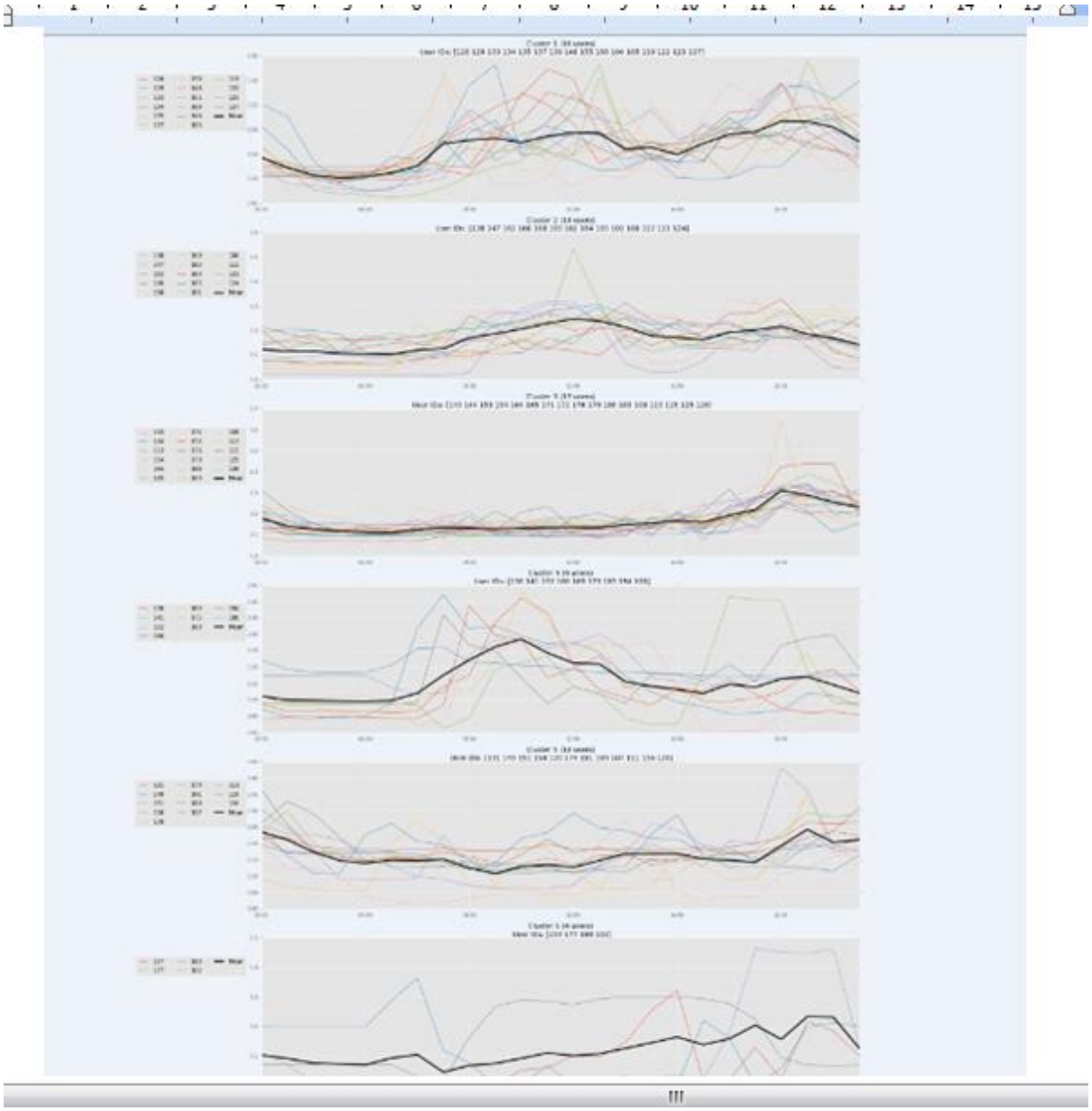

Figure 8: Energy consumers clustering / profiling to identify optimal timeslots/day for the operation of DR events (we send DR event recommendation only to the end users, who can actually contribute or else they have large energy consumption during the DR event)

3 Pilot tests for behavioural change without gamification

The scenarios (DR events) that were executed were 5 for the non-gamification case and 5 for the case, where gamification features were utilized.

Results:

- We show results from behavioural Demand Response (DR) scenario and compare them with Business as Usual (BAU) scenario of the previous section. We show that now that the end users have been trained in SOCIALENERGY platform, they seem to be more engaged (e.g. they use the system immediately after a recommendation has been made).
- End users get gradually more engaged with GSRN, GAME and LCMS. They get more SOCIALENERGY points. Their behavioural datasets are much more improved and their energy datasets are somehow improved for some of them.
- The most engaged end users can become EC leaders and get more incentives from SOCIALENERGY. Then, they can organize competitions, cooperative challenges, enable social network effects and activate real cash savings, bill discounts and discount offers in the SOCIALENERGY marketplace.

Table 3: DR Events summary example for scheduling the DR events on GSRN without Game mechanics

DR Event	Time of Event	Duration	Scope	Status	DR outcome
1	20:00-21:00	1 hour	Reduction	DR was successful	-16,3%
2	19:00-20:00	1 hour	Reduction	DR was successful	-2,4%
3	20:00-22:00	2 hours	Reduction	DR was successful	-3,94%
4	21:00-00:00	3 hours	Reduction	DR was successful	-6,34%
5	12:00-17:00	5 hours	Reduction	DR was successful	-1,66%

Below, we have the full table of the executed scenarios without the gamification part. The end users, through GSRN, have received specific notifications, as shown below:

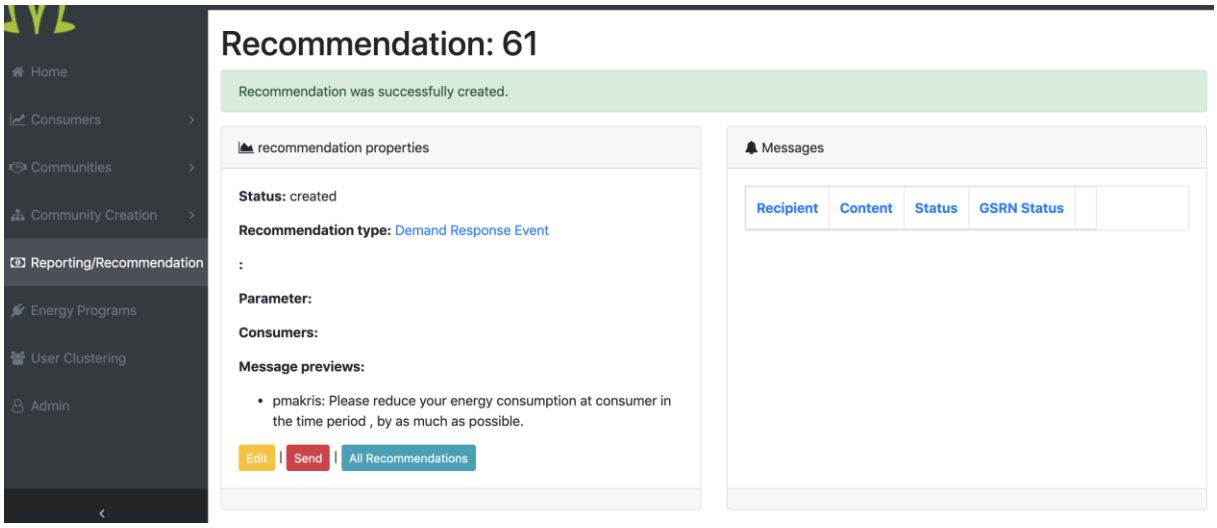

Figure 9: Notification shown in the admin panel, from the admin perspective, before the message is being forwarded to the end users (respective cluster of users, identified by RAT)

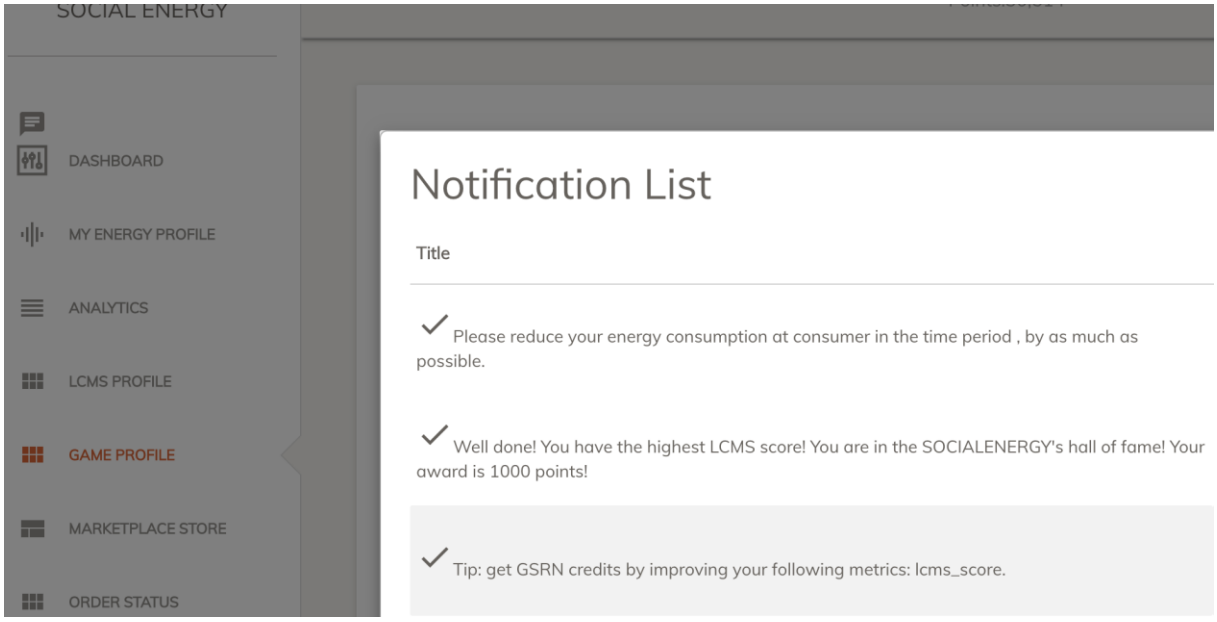

Figure 10: Notification about the DR event as shown at the GSRN end user's interface (i.e. frontend)

When the end users engage, the GSRN is sending back a "Thank You" or else "Congratulations" like message:

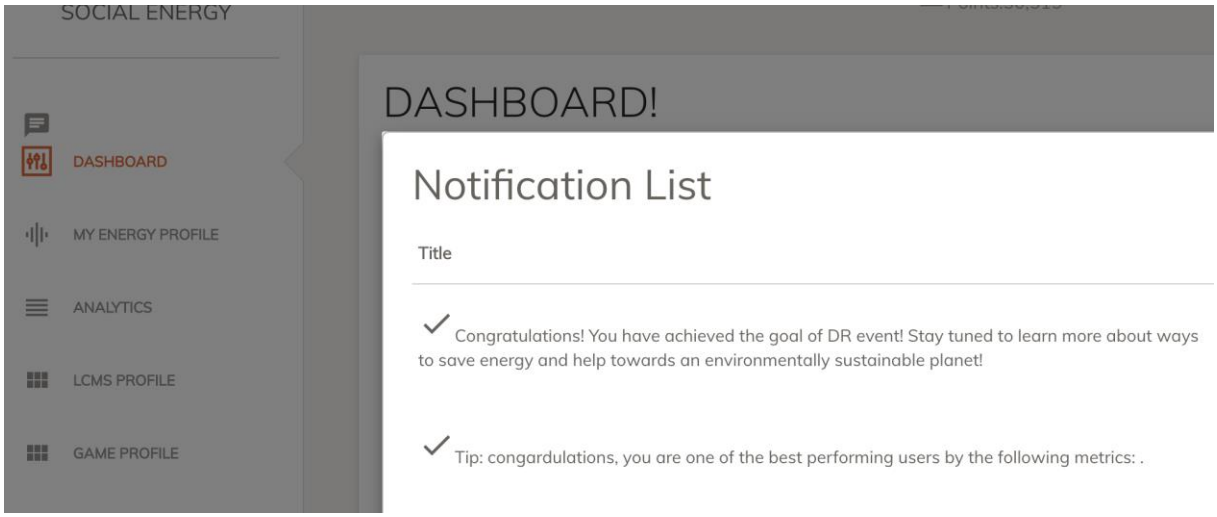

Figure 11: The end user receives a "Congratulations" message in GSRN in case s/he achieves the DR event target of energy consumption reduction

In the opposite case, when the end user does not succeed to achieve the DR event goal, then GSRN acknowledges him/her and encourages the end user to follow up SOCIALENERGY guidelines and learn about the benefits that s/he can gain.

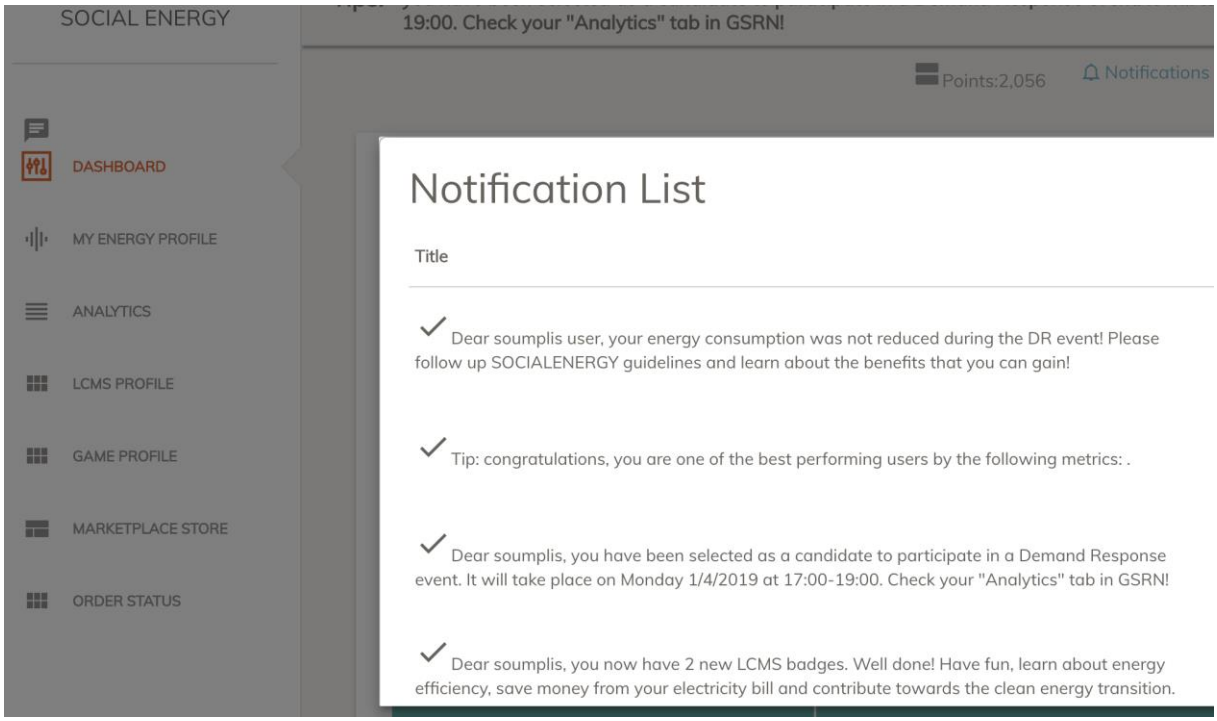

Figure 12: SOCIALENERGY encourages the end user in case of an unsuccessful DR event

The end users have achieved the efficiency (based on their baseline) calculated below in each one of the 5 respective DR events:

DR Event 1

The 1st DR event run on from 20:00 till 21:00. The objective of DR was energy consumption reduction and only data for 20 participants out of the total 26 invitees, was analysed due to data invalidity issues and non-participation. From those participated, 17 reduced their

consumption during the DR event compared to the baseline and the rest 3 of them didn't make it. Taking into account all participants' consumption, the DR event **was successful** touching the average percentage reduction of 16.3% compared to the baseline.

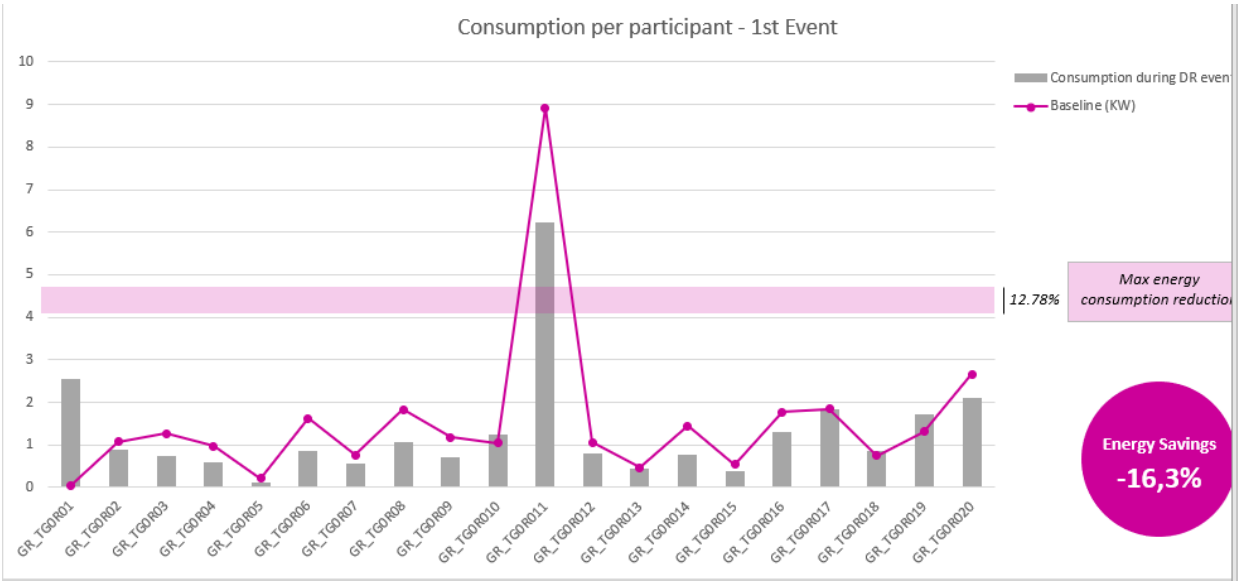

Figure 13: Summary of energy consumption reduction for DR event 1 of the non-gamification case. End users achieved an average of 16,3% energy savings

DR Event 2

The 2nd DR event run on from 19:00 till 20:00. The objective of DR was energy consumption reduction and only data for 24 participants out of the total 26 invitees, was analysed due to data invalidity issues and non-participation. From those participated, 12 reduced their consumption during the DR event compared to the baseline and the rest 12 of them didn't make it. Considering all participants' consumption, the DR event was (marginally) successful touching the average percentage reduction of 2.4% compared to the baseline.

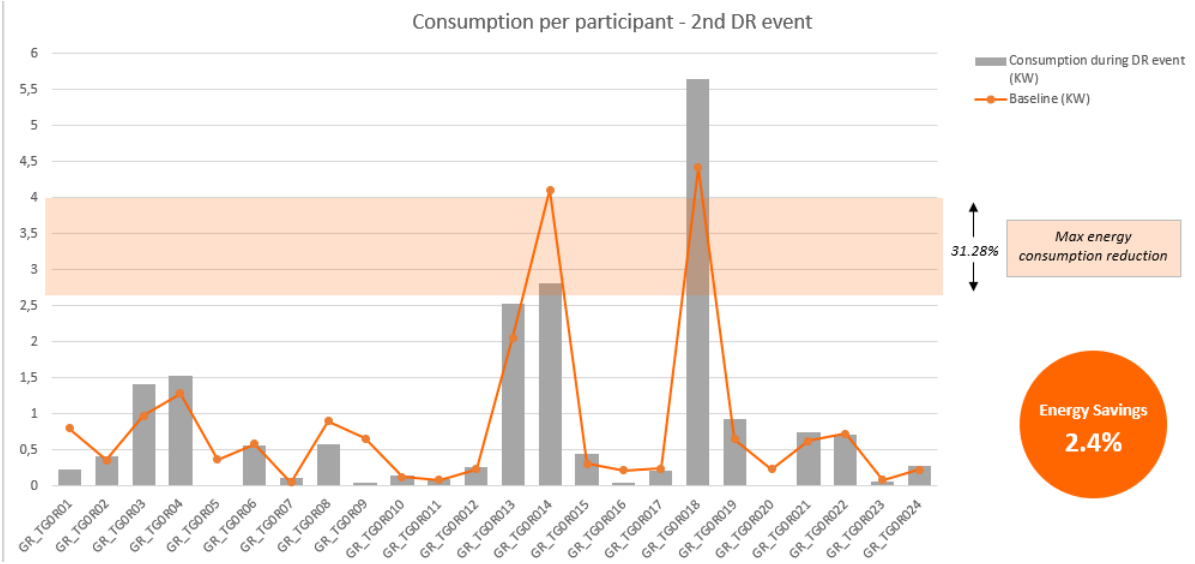

Figure 14: Summary of energy consumption reduction for DR event 2 of the non-gamification case. End users achieved an average of 2,4% energy savings

DR Event 3

The 3rd DR event run on from 20:00 till 22:00, a two-hour event. The objective of DR was energy consumption reduction and only data for 24 participants out of the total 26 invitees, was analysed due to data invalidity issues and non-participation. From those participated, 15 reduced their consumption during the DR event compared to the baseline and the rest 9 of them didn't make it. Taking into account all participants' consumption, the DR event was marginally successful touching the average percentage reduction of 3.94% compared to the baseline. We use the term "marginally" because we consider energy savings below 5% to be not totally reliable meaning that it could be within statistical error limits.

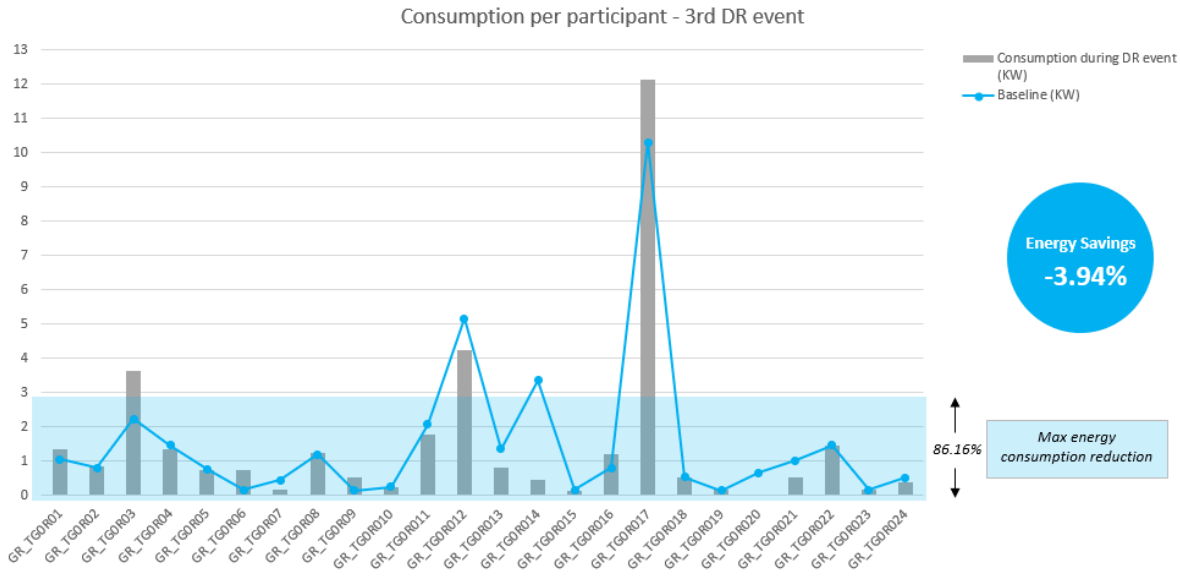

Figure 15: Summary of energy consumption reduction for DR event 3 of the non-gamification case. End users achieved an average of 3,94% energy savings

DR Event 4

The 4th DR event run on from 21:00 till 00:00, a three-hour event. The objective of DR was energy consumption reduction and only data for 22 participants out of the total 26 invitees, was analysed due to data invalidity issues and non-participation. From those participated, 14 reduced their consumption during the DR event compared to the baseline and the rest 8 of them didn't make it. Taking into account all participants' consumption, the DR event **was successful** touching the average percentage reduction of 6.34% compared to the baseline.

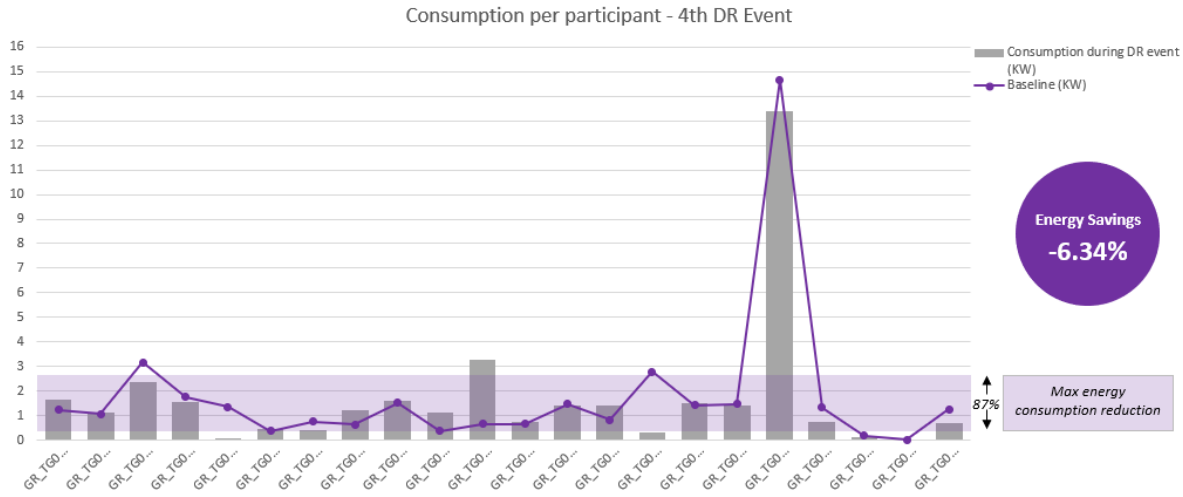

Figure 16: Summary of energy consumption reduction for DR event 4 of the non-gamification case. End users achieved an average of 6,34% energy savings

DR Event 5

The 5th DR event run on from 12:00 till 17:00, a five-hour event. The objective of DR was energy consumption reduction and only data for 21 participants out of the total 26 invitees, was analysed due to data invalidity issues and non-participation. From those participated, 9 reduced their consumption during the DR event compared to the baseline and the rest 12 of them didn't make it. Taking into account all participants' consumption, the DR event was marginally successful touching the average percentage reduction of 1.66% compared to the baseline.

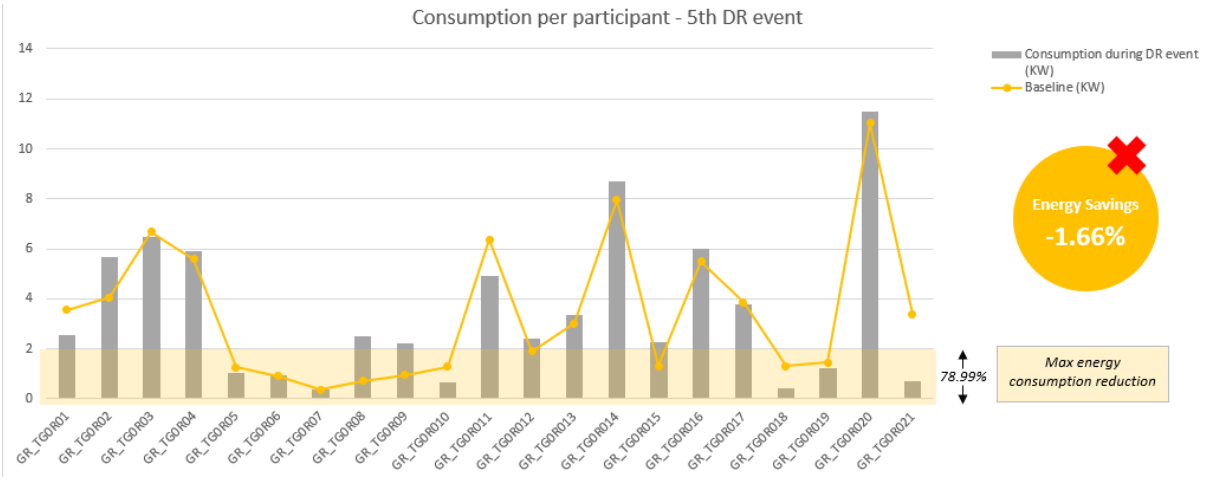

Figure 17: Summary of energy consumption reduction for DR event 5 of the non-gamification case. End users achieved an average of 1,66% energy savings

4 Pilot tests for behavioural change with gamification

The scenarios that were executed were 5 for the non-gamification case and another 5 for the gamification case.

Results:

- We show results from behavioural DR scenario and compare them with BAU scenario of the previous section. We show that now that the end users have been trained in SOCIALENERGY platform, they seem to be more engaged (e.g. they use the system immediately after a recommendation has been made).
- End users get gradually more engaged with GSRN, GAME and LCMS. They get more SOCIALENERGY points. Their behavioural datasets are much more improved and their energy data are somehow improved for some of them.
- The most engaged end users can become EC leaders and get more incentives from SOCIALENERGY. Then, they can organize competitions, cooperative challenges, enable social network effects and activate real cash savings, bill discounts and discount offers in the SOCIALENERGY marketplace.

Table 4: DR Events summary example for scheduling the DR events on GSRN with gamification

DR Event	Time of Event	Duration	Scope	Status	DR outcome
1	20:00-21:00	1 hour	Reduction	DR was successful	-29.4%
2	19:00-20:00	1 hour	Reduction	DR was successful	-25,68%
3	20:00-22:00	2 hours	Reduction	DR was successful	-8.1%
4	21:00-00:00	3 hours	Reduction	DR was successful	-5.5%
5	12:00-17:00	5 hours	Reduction	DR was successful	-8,88%

Below, we have the full table of the executed scenarios with the gamification part included. The end users, through GSRN, have received specific notifications and thank you messages, like the ones shown below:

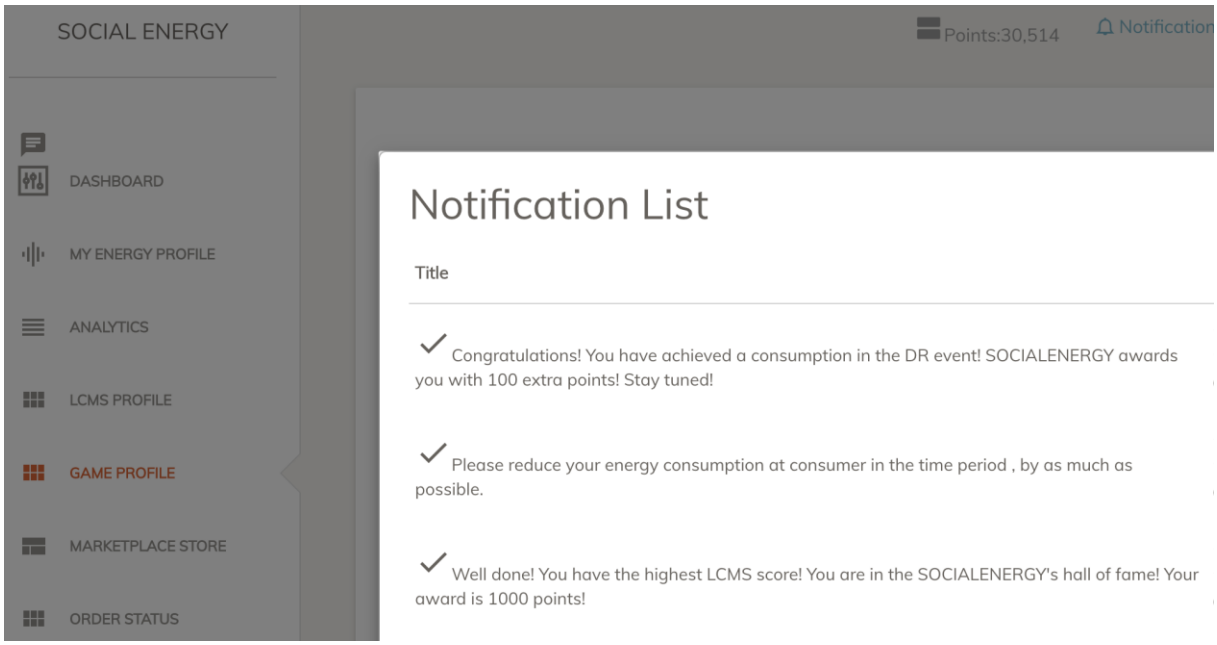

Figure 18: The end user receives a notification when s/he succeeds in a DR event. SOCIALENERGY awards the end user with SOCIALENERGY points

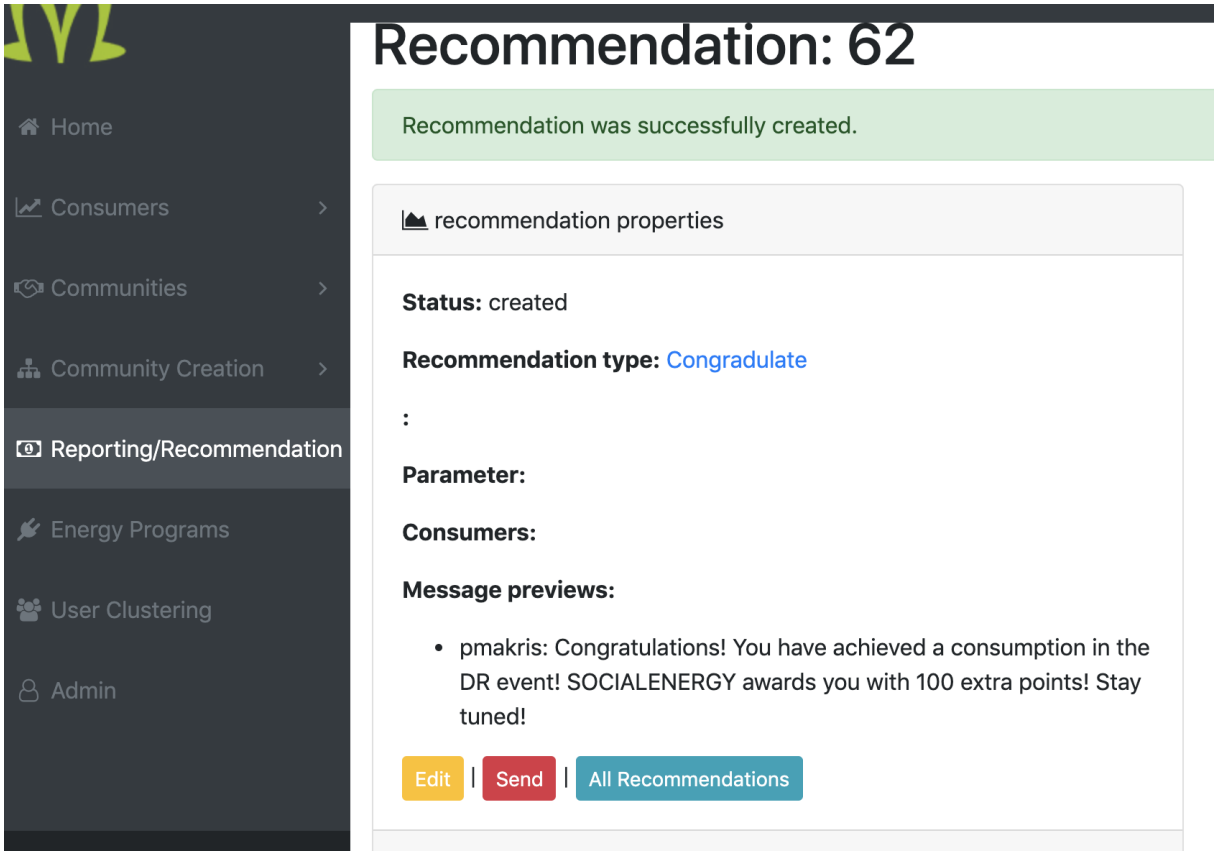

Figure 19: The admin user prepares and sends notification messages after a successful DR event awarding the end users

The users have achieved the efficiency (based on their baseline) calculated below in each one of the 5 respective DR gamified events (the events were at the exact same duration and time, so that to have a common base for comparisons):

DR Event 1

The 1st DR event run on from 20:00 till 21:00. The objective of DR was energy consumption reduction, by offering gamification points to the users and only data for 20 participants out of the total 26 invitees, was analysed due to data invalidity issues and non-participation. From those who participated, 19 reduced their energy consumption during the DR event compared to the baseline and only 1 person did not make it. Taking into account all participants' energy consumption, the DR event **was very successful** touching the average percentage reduction of 29.4% compared to the baseline.

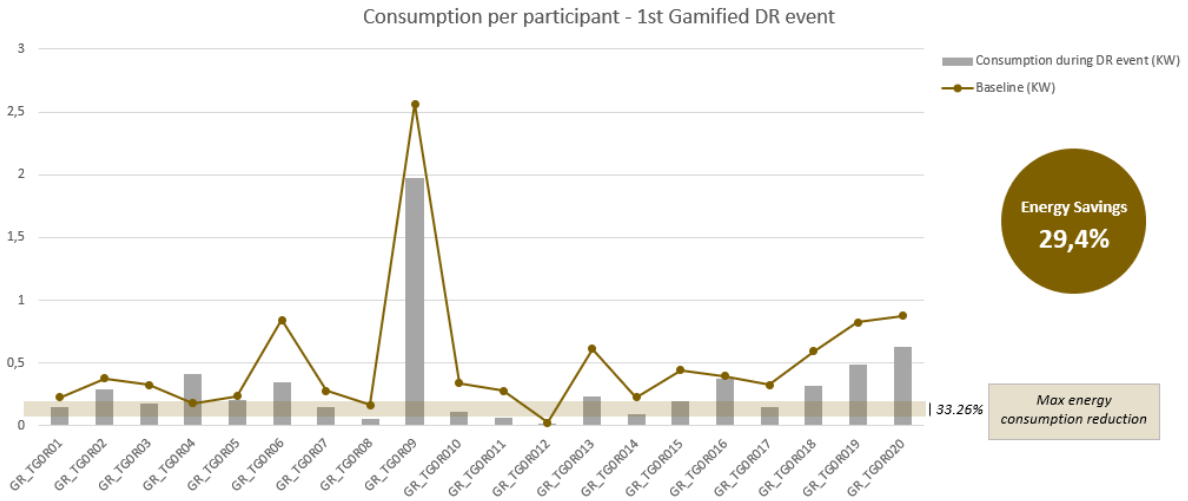

Figure 20: Summary of energy consumption reduction for DR event 1 of the gamification case. End users achieved an average of 29,4% energy savings

DR Event 2

The 2nd DR event run on from 19:00 till 20:00. The objective of DR was energy consumption reduction, by offering gamification points to the users and only data for 21 participants out of the total 26 invitees, was analysed due to data invalidity issues and non-participation. From those who participated, 17 reduced their energy consumption during the DR event compared to the baseline and only 4 people did not make it. Taking into account all participants' energy consumption, the DR event **was very successful** touching the average percentage reduction of 25.68% compared to the baseline.

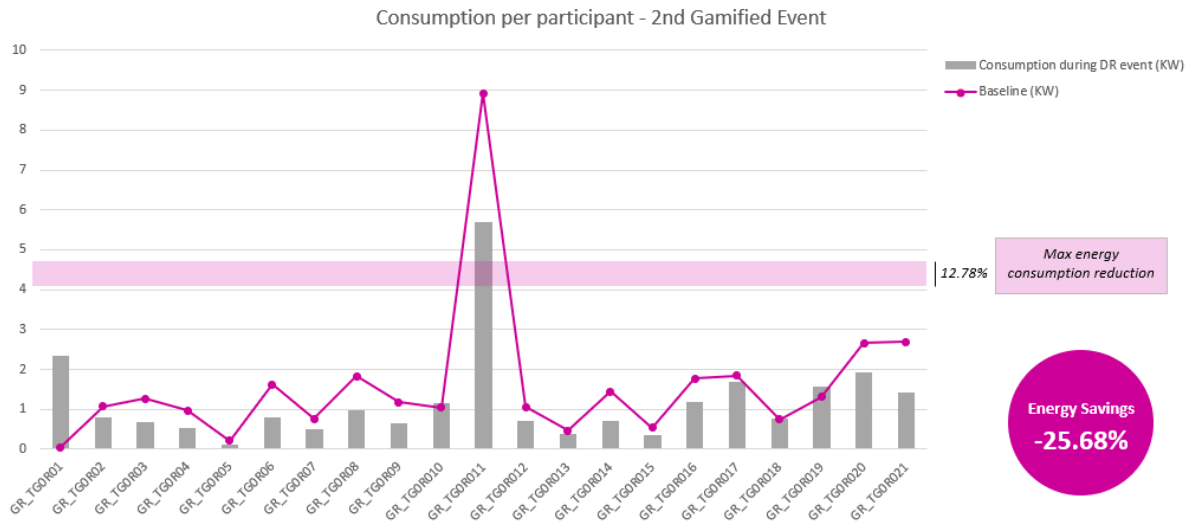

Figure 21: Summary of energy consumption reduction for DR event 2 of the gamification case. End users achieved an average of 25,68% energy savings

DR Event 3

The 3rd DR event run on from 20:00 till 22:00 for two hours. The objective of DR was energy consumption reduction, by offering gamification points to the users and only data for 21 participants out of the total 26 invitees, was analysed due to data invalidity issues and non-participation. From those who participated, 15 reduced their energy consumption during the DR event compared to the baseline and only 6 people did not make it. Taking into account all participants' energy consumption, the DR event **was successful** touching the average percentage reduction of 8,1% compared to the baseline.

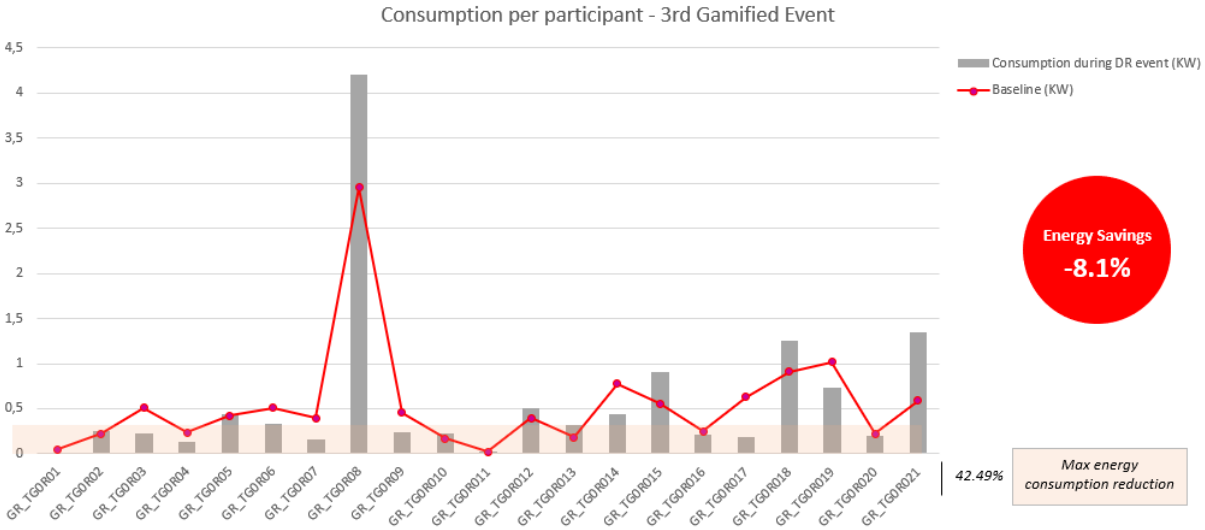

Figure 22: Summary of energy consumption reduction for DR event 3 of the gamification case. End users achieved an average of 8,1% energy savings

DR Event 4

The 4th DR event run on from 21:00 till 00:00 for three hours. The objective of DR was energy consumption reduction, by offering gamification points to the users and only data for 19 participants out of the total 26 invitees, was analysed due to data invalidity issues and non-participation. From those who participated, 13 reduced their energy consumption during the DR event compared to the baseline and only 6 people did not make it. Taking into account all participants' energy consumption, the DR event **was marginally successful** touching the average percentage reduction of 5,5% compared to the baseline.

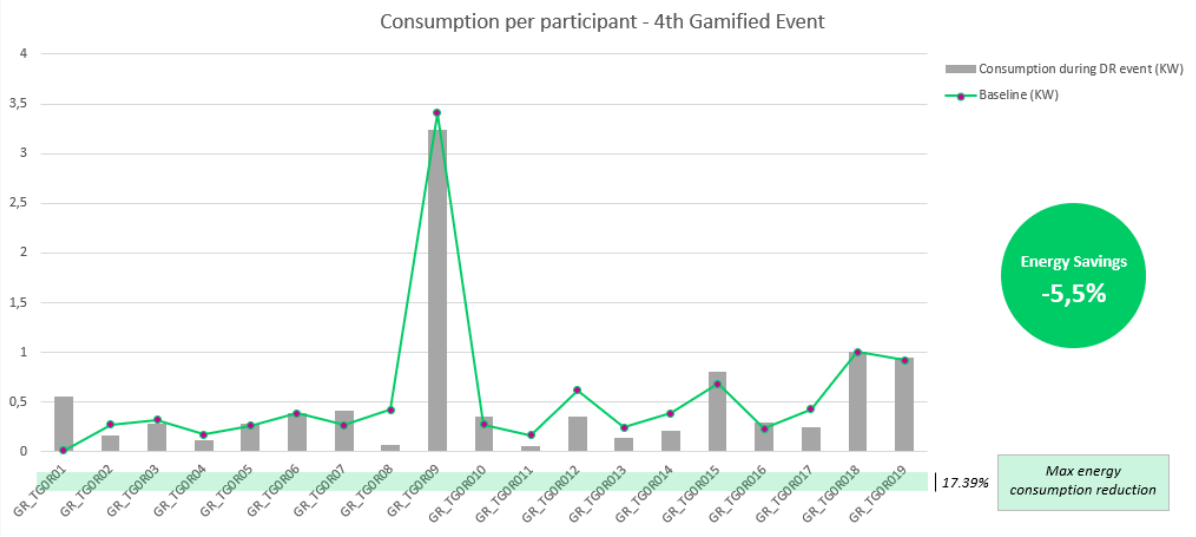

Figure 23: Summary of energy consumption reduction for DR event 4 of the gamification case. End users achieved an average of 5,5% energy savings

DR Event 5

The 5th DR event run on from 12:00 till 17:00 for five hours. The objective of DR was energy consumption reduction, by offering gamification points to the users and only data for 18 participants out of the total 26 invitees, was analysed due to data invalidity issues and non-participation. From those who participated, 12 reduced their energy consumption during the DR event compared to the baseline and only 6 people did not make it. Taking into account all participants' energy consumption, the DR event **was successful** touching the average percentage reduction of 8,88% compared to the baseline.

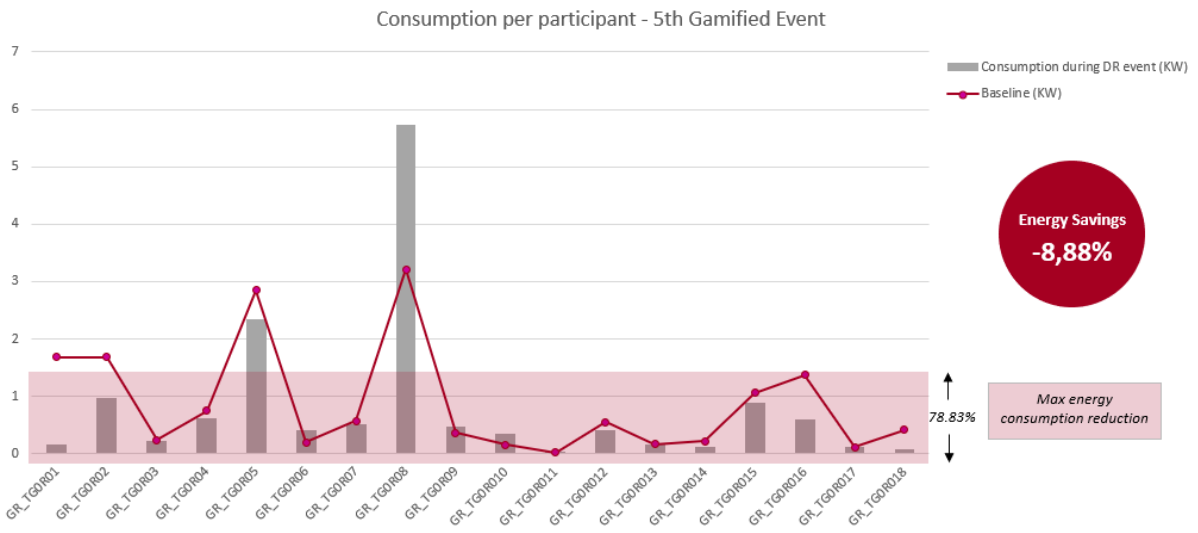

Figure 24: Summary of energy consumption reduction for DR event 5 of the gamification case. End users achieved an average of 8,88% energy savings

Participants and Sustainability of Results

Participants were clustered based on their consistency to perform energy savings when requested. The results revealed 4 different levels of engagement reported as "Highly Engaged Participants", "Engaged Participants", "Low Engaged Participants" and "Not at all engaged Participants". The percentage of participants assigned to each group correspond to 6.8%, 50.8%, 23.7% and 18.7% of the entire sample population, respectively (Figure 25).

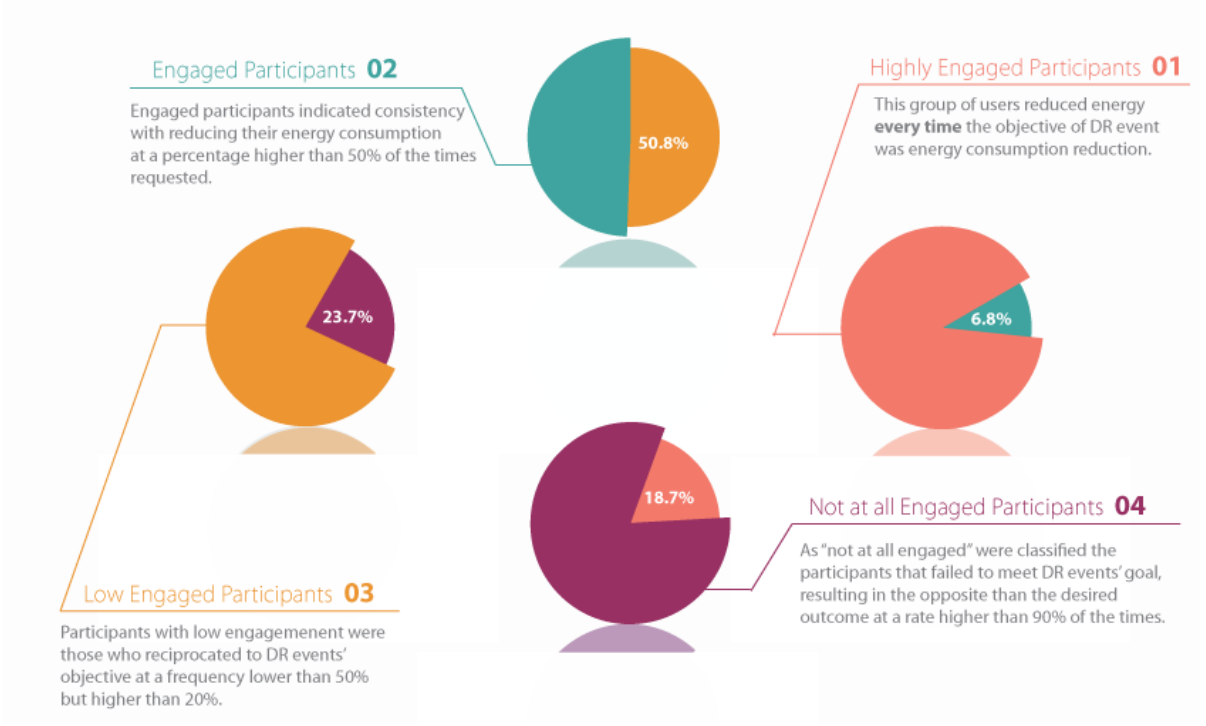

Figure 25: Clustering based on end users' engagement factor

In general, the results showed a trend of people to save more when there is some kind of incentive or compensation from the electric utility company.

Furthermore, when the events last longer, the savings drop, because humans tend to forget or to stay engaged in a specific target for a long time (social human norm).

Analysis also run to evaluate the effectiveness of DR events with differences in duration. The findings showed that shortest in duration DR events (up to 2 hours) were much more effective than the long-lasting DR events (more than 2 hours).

Finally, from a relevant comparison that was made in the user clusters (control and conditions group), we observed that when GSRN sent back a "Thank you" message and a feedback on the energy consumption, this group was more engaged and produced additional savings in the next DR event (Figure 26).

DR event (feedback effect from GSRN)

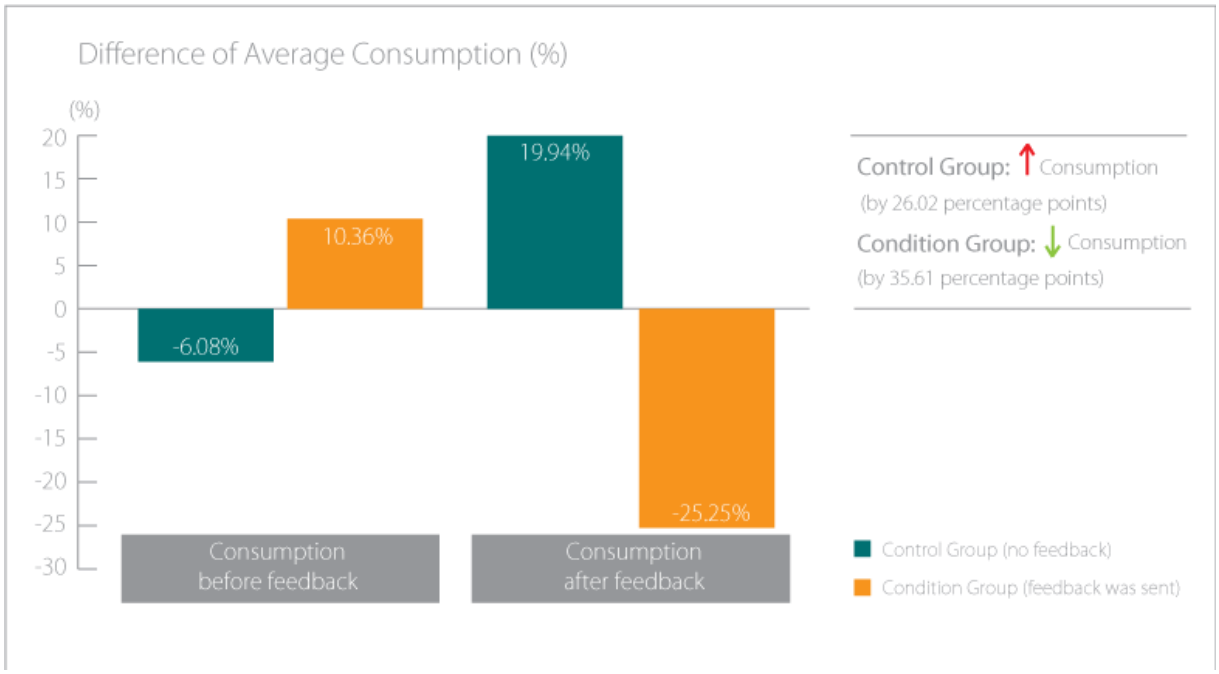

Figure 26: The energy savings observed due to the feedback effect

5 Compliance with GDPR standards

Various GDPR issues were faced during the utility pilot analysis, customer selection and onboarding phases, for the SOCIALENERGY pilots' realization.

Utilities (i.e. EDP in Portugal) were very interested to participate in SOCIALENERGY pilots, but there were some issues with every utility DPO (Data Protection Officer) and the Consent Forms that every end user has to sign (DPO procedures). This has put some serious delays in the pilot phases preparations and the availability of various European utilities to participate in the pilots.

A solution to the above delays was the collaboration of the SOCIALENERGY project with other projects (i.e. UtilitEE that has electric utility companies as partners) as a whole, so the onboarding phase could be accelerated and the data protection procedure is integrated in the "project collaboration agreement".

In general, GDPR introduces strict data protection procedures, end user information for consensus and substantial delays in every H2020 pilot site.

To that extend, a **more general GDPR strategy and framework should be followed** by the consortium, in order to deal with any potential GDRP risk in the future. This includes the analysis and modelling of any potential risk and the formulation of some general legal terms, that should be followed in any market and any country, before the data gathering inquiry process.

SOCIALENERGY business models require data gathering from electric utilities, energy loads and potential customers (i.e. end users). This data inquiry should follow a specific methodology in terms of GDPR compliance. This means that the specific proposed methodology will be in two steps:

1. Identification of all potentials legal/GDRP issues that are related to personal data protection.
2. Formulation of Terms and Conditions/Legal Terms that all clients (i.el. end users) should accept, based on the data gathering and data processing service, offered by SOCIALENERGY business models.

5.1 The main potential ethical issues of the project are related to personal data protection

The project description describes some of the personal data treatments required in the research:

- **Personal data collection** will be realized through surveys and questionnaires on active involvement of users, combined with opportunistic sensing (smart meters). Towards this direction, data feeds from social networks and data feeds from social media will be exploited.

- **From the analytical perspective**, the project considers forecasting and clustering algorithms, statistical analysis algorithms as well as classification and association types of algorithms. The

proposed algorithms will also take into account the interaction among humans, LCMS, GSRN platform and the SOCIALENERGY Game. The interactions from the perspective of human dynamics will be examined in order to increase quantitative and qualitative understanding of the human behaviors. Given that the main goal of the human dynamics is to understand human behavior using methods, techniques and technologies from statistical physics, in SOCIALENERGY we are going to propose mechanisms to extend human dynamics with new techniques such as data mining in order to extend and exploit data available through the smart networking infrastructure.

- **Gamification and Gaming** is one of the core concepts of SOCIALENERGY, in order to increase awareness, promote the importance and the potential benefits of the energy efficiency domain for the sustainable development of the cities and the society in general and to engage general population to more proactively take part in the energy efficiency activities, the project will leverage the serious gaming concept.

The game mechanics available in the SOCIALENERGY Game system is going to include among others: points used to track interaction with the gamified service and report to the system and the player the effect of their choices, badges as visual representations of accomplishments, skills or reputation, leaderboards as means of player-to-player and group-to-group performance comparison to enable competition, levels as mediators of difficulty progression to enable skill acquisition, challenges to drive players to perform pre-defined tasks and incentive mechanisms (as rewards) to support and encourage the player in the game. The developed framework will produce collaborative and adaptive user centered intrinsic and extrinsic motivators aimed at supporting (and educating) the users on the effects of their choices in terms of energy efficiency, use and wastage.

The project consortium confirms that it will assure that if the items mentioned hereunder are applicable to the project they will be conformed to:

- Directive 95/46/EC (Protection of personal data)
- Opinion 23/05/2000 of the European Group on Ethics in Science and New Technologies concerning ‘Citizens Rights and New Technologies: A European Challenge’ and specifically those relating to:

- ICT (Protection of privacy and protection against personal intrusion)
- Ethics of responsibility (Right to information security)
- Article 15 (Freedom of expression and research and data protection)

In addition, with respect to Directive 95/46/EC (Protection of personal of data), individual work packages will be specifically requested to ensure that any models, specifications, procedures or products also enable the project end users to be compliant with this directive” (page 92).

The project has correctly identified the applicable law at the initiation of the project, but the ethical assessment will also consider the Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation o GDPR).

Moreover, according to Research Data Management process of the project, "with regard to electric energy data, sensor data and other personal user data such as preferences and application transaction statistics, the 2014 Commission Recommendation regarding Data Protection Impact Assessment (DPIA) Template for Smart Grid and Smart Metering Systems will be followed in order to take the appropriate technical and organizational measures for data transmission, storage and processing to meet the requirements of Directive 95/46/EC and ensure the protection of personal data in SOCIALENERGY pilots. The DPIA definition includes the fundamental rights defined in Articles 7 and 8 of the European Union Charter of Fundamental Rights, which are the right to privacy and the right to the protection of personal data. The DPIA aims at safeguarding the confidentiality, integrity and availability of information assets against attacks, malware and other vulnerabilities.

Furthermore, SOCIALENERGY consortium will also consider the Regulation (EU) 2016/679 of the European Parliament and of the Council of April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data. From May 25th 2018 onwards, the new EU-wide data protection rules have become applicable. As a result, SOCIALENERGY will follow-up the short-list of ethics requirements below:

- The informed consent procedures that will be implemented for the participation of humans must be kept on file.
- A description of the technical and organisational measures that will be implemented to safeguard the rights and freedoms of the data subjects/research participants must be included in the existing Data Management Plan (DMP).
- In case personal data are transferred from a non-EU country to the EU (or another third state), confirmation that such transfers comply with the laws of the country in which the data was collected must be included within the existing Data Management Plan.
- In case of further processing of previously collected personal data (e.g. in the context of smart metering), an explicit confirmation that the consortium/project has a lawful basis for the data processing and that the appropriate technical and organisational measures are in place to safeguard the rights of the data subjects must be included within the existing Data Management Plan.
- The beneficiary must evaluate the ethics risks related to the data processing activities of the project (e.g. large scale processing of consumer data). This includes also an opinion if data protection impact assessment should be conducted under art.35 General Data Protection Regulation 2016/679. The risk evaluation and the opinion must be included within the existing Data Management Plan.

5.2 Terms and Conditions/Legal Terms used in the Business process and Data Business Models

The protection of natural persons with regard to the processing of personal data is of the utmost importance for SOCIALENERGY consortium partners (from now on referred as the "Company"). Consequently, the Company collects and processes personal data strictly in conformance with the General Regulation and the applicable legislation in general and to the extent necessary in connection with some aspect of labor relationships and the business of the Company. The Company limits the access to such data to authorized persons only and

takes enhanced data security measures to secure data against -among others- loss, mishandling, unauthorized access, alteration or disclosure.

5.3 Processing of personal data in SOCIALENERGY's GSRN application

The SOCIALENERGY consortium takes care to ensure the right of persons to be informed about and request changes in/deletion of data possessed about them by all holders of it. In the following subsections, the GDPR-related strategy of SOCIALENERGY (or else referred as the "Company") is detailed with respect to the explicit agreement terms to be made with each end user (i.e. natural person):

5.3.1 Categories of personal data

When one (i.e. a natural person) visits GSRN application, the Company may process:

(a) The data that you have entered for the purpose of your registration with the website and the services offered (username, full name, contact phone, e-mail address, Connection Number, communication content);

(b) Details of your smart energy meter installed in your premises for which an electricity and/or gas supply contract has been concluded, bills issued, data on electricity consumption, details of transactions and payments conducted in the context of the contractual relationship with the Company, details relevant to your contact (including requests, complaints, new orders, upgrades);

(c) Personal data automatically collected, while you browse GSRN (IP address, device type, browser, redirection website, GSRN pages that you visited, visit date and time);

(d) Personal data automatically collected or provided by you, while using GSRN (answers at questionnaire, quiz and surveys, reading of announcements or energy-saving tips and your preferences, settings and preferences provided in the app, the games you are participating into, promotional or informative campaigns taken through GSRN and your response to them).

5.3.2 Purpose of data processing

Personal datasets within SOCIALENERGY context are processed for the following purposes:

(a) To serve our contractual relationship in order for you to obtain personalized information and access your personal documents as well as in order for us to respond to your requests or contact you as per your requests;

(b) To document a legitimate legal claim or defense of the Company against an attempt at fraud, cyber-attack or other unlawful activity;

(c) To create anonymized statistics on the number of visits and accessibility of GSRN, for the purpose of proceeding with necessary action aimed at improving your browsing experience;

(e) To conduct customer satisfaction surveys, advertising campaigns, energy consumption analyses and market stratification, or other promotional activities or events;

(f) In the context and for the purpose of conducting energy analyses and market stratification, the Company may prepare energy profiles for optimally responding to the needs of its customers and/or providing energy saving advice.

5.3.3 Legal basis for data processing

The processing of your personal data is necessary in order to fulfill the above mentioned purposes. Unless otherwise stipulated at the time of collection of personal data, the legal basis for the processing of such data is one of the following:

(a) processing is necessary for the fulfillment of our contractual relationship with you (Article 6(1)(b) of the General Regulation) for the purposes a;
(b) processing is necessary for the purposes of the legitimate interests pursued by the Company (Article 6(1) (f) of the General Regulation) for the purposes b, c;
(c) you have given your explicit consent to the processing of your personal data (Article 6 (1) (a) of the General Regulation) for the purposes e, f.

5.4 Data recipients and transfers

Third-party IT companies (e.g. data processors) or other commercial partners (e.g. companies related with the energy efficiency sector such as electric appliance retailers/vendors, house construction/renovation companies, etc.) that SOCIALENERGY has strategic B2B partnership, including SOCIALENERGY consortium partners, manage GSRN platform. In such cases, we make sure, via contractual provisions and regular inspections, that the data processors have only the necessary access to the data so as to fulfil their services to us and for the specific purposes only, they operate strictly under our instructions and that they have applied all necessary technical and operational measures for the security of the data.

5.5 Personal Data of Minors

The Company and its websites are addressed to persons having completed their eighteenth (18) year of age. The Company has no liability if minors visit its websites on their own initiative. If during the data collection process, it becomes evident that the user is of a younger age, the Company will not process the minor's personal data.

5.6 Data Retention Period

The Company shall store your personal data for as long as is necessary to achieve the purposes described in the present policy, unless the applicable legislation stipulates or allows a longer time period. The criteria governing the determination of the data retention period include the following: (a) as long as the contractual relationship is in effect; (b) as long as is necessary for the Company to be in compliance with a legal obligation it incurs; (c) as long as is necessary having regard to the legal situation the Company finds itself in (such as defense of rights in court, audits by regulatory authorities, etc.).

5.7 Technical and organizational measures

The Company effectively implements, both at the time of determination of the means of processing and at the time of processing, appropriate technical and organizational measures such as pseudonymization, designed for the application of data protection principles, such as data minimization, and the integration of the necessary safeguards into the said processing in a manner fulfilling the requirements of the applicable legislation and protecting the rights of natural persons.

5.8 Right to withdraw your consent

In case you have given us your consent to process specific personal data, you have the right to withdraw your consent at any time, with future effect. Such withdrawal of consent shall not affect the lawfulness of processing based on consent before its withdrawal. In case of such withdrawal, the Company may further process your personal data only in cases where there is some other legal ground for such processing.

5.9 Rights of the data subject

Under the applicable legislation on personal data protection and provided the relevant legal conditions are met, you have the following rights:

5.9.1 Right of access

The following list of rights of access are applied for the data subject:

1) You have the right to be informed as to whether or not the Company processes your data, to have access to such data and obtain supplementary information in connection with such processing.
2) You have the right to rectification or else you have the right to request that your personal data be updated, rectified or completed.
3) Right to erasure: You have the right to submit a request for the erasure of your personal data, and such request shall be granted provided no other legal grounds for processing are in place (such as, indicatively, compliance with a legal obligation to process personal data).
4) Right to restriction of processing: You have the right to request the restriction of the processing of your personal data in the following cases: (a) when you object the accuracy of your personal data, and pending verification of the accuracy of your data; (b) when you oppose the erasure of your personal data and you request the restriction of their use instead; (c) when your personal data are no longer needed for the purposes of the processing, but are required by you for the establishment, exercise or defense of legal claims, and (d) when you object to the processing and till the verification that our grounds for processing override yours on which you base your objection.
5) Right to object to the processing: You have the right to object at any time to the processing of personal data concerning you which is based on the legal basis of the processing (Article 6 (1) (e) or (f) of the General Regulation) and your objection shall be granted unless the Company demonstrates compelling legitimate grounds for the processing.

6) Right to data portability: You have the right to receive, at no cost, your personal data in a structured, commonly used and machine-readable format or to request, if technically feasible, that we transmit your data directly to another controller.
7) Right to oppose automated decision-making: You have the right to request that you be excluded from decision-making which is based on automated processing, including profiling.

Important note: If the data subject (i.e. natural person or else end user) wishes to exercise one or more of his/her above-mentioned rights, a dedicated form provided by the Company will be formed.

5.10 Data Controller

The Data Controller is "SOCIALENERGY Consortium" located at …….. The Company provides support for all questions, comments, concerns or complaints relating to personal data protection. Should you wish to exercise any of your rights in connection to the protection of your data, you may contact our Data Protection Officer per email at …….

6 Appendix - Consent Form for GDPR

SOCIALENERGY Participant's Consent Form

Name of Participant:
E-mail:
Pilot at: Greek site

Purpose of the study

This data collection is part of research activities within the larger context of a EU H2020 research project from the Energy/ICT field named **SocialEnergy - Grant agreement ID: 731767**

SOCIALENERGY aims at undertaking innovation actions to: a) apply and evolve recent incentive technologies (localized social externalities) towards effective use of behavioural economics in energy efficiency sector, b) educate and effectively incentivize utility customers via advanced gaming and gamification technologies, c) guarantee efficient and sustainable user engagement via self-organization and management of virtual energy communities, d) provide a single point of hosting and advertisement services to consumers, utilities and companies related with energy efficiency products and services, e) perform real-life small-scale but diverse experiments to validate proposed platform's functionalities, f) provide energy information distribution as a service to interested stakeholders.

The research to be conducted aims to be in full compliance with EU REGULATION 2016/679 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation) and the most recent GDPR regulation.

Purpose of Research: The Social Energy project's purpose is to develop, validate and demonstrate a gaming and social network platform for educating energy consumers and virtual energy communities towards evolving EU energy markets' operation. In SOCIALENERGY's virtual world, users are seamlessly educated via advanced gaming techniques in good practices and decision making related with energy efficiency. Subsequently, users are able to interact in SOCIALENERGY's "real-world" platform, which will facilitate the easy, rich and deep communication among involved stakeholders from individual energy consumers and virtual energy communities, to utilities, policy makers, and even other indirect stakeholders (such as electric appliance retailers and building renovators) that will allow them to: i) discover each other, ii) educate themselves in order understand the difficulties and challenges that each one faces and iii) finally interact and trade among.

In this context, it is necessary to collect data about daily routines/ business process and energy consumption, operational set points of specific devices (status, mode, set point). During the pilot implementation of the system in pilot premises the business processes/ daily routines inside building/apartment and their respective energy consumption data will be extracted in an aggregated level per apartment and operational process.

To this end, you are asked to participate as a pilot user in SOCIALENERGY project by tracking of parameters about daily routines in your living/working environment along with appliances consumption/ environmental data/operational set-points at group level, in order to extract some energy related metrics and indicators that will further facilitate the demonstration of the energy efficiency through Gamification and DR.

Participants will be able to quit the experiment at any point, if they wish, without any consequences. In addition, the participants can exercise their right to access, correct and delete his/her data at any moment.

Duration of the Research Activities: The Research Activities last from 1 January 2017 to 30 June 2019

Risks or Inconveniences: No risks are foreseen. You are only requested to be available to participate.

Privacy and Confidentiality: As a voluntary participant in the SOCIALENERGY pilot site experiments and analyses, responses you give in the questionnaires and interviews will be recorded. Your recorded data will not include any personal identification; hence it will not be possible to identify you afterwards. Information will be held and used on an anonymous basis only for the purpose of the project SOCIALENERGY on research servers at NTUA (Greece) and Intelen (Cyprus) for processing.

Benefits: The results of the survey will provide a feedback to the project partners on the system operation and on the opinion of the users. This will consent to implement corrections and improvement to the system, with potential benefits on the overall project results, but also on the demand respond innovations.

Data destruction: After the end of the project, the data will be only accessible to the European Commission until a 5-year period has passed. After this period the data will be destroyed.

Contact persons: Your participation is voluntary, consent can be refused, and withdrawal is possible at any time per email to either the scientists in charge **Dr. Vassilis Nikolopoulos (email: v.nikolopoulos@intelen.com) or Dr. Prodromos Makris (email: prodromosmakris@mail.ntua.gr).** You can also obtain information and ask for rectifying it. If you decide to exercise your rights, including the withdrawal from the project, please contact the SocialEnergy scientists in charge, and they will explain the best way for you to exercise them or stop taking part.

In the next pages of this document the consent form for the data collection through measurements in your workplace, is provided.

Voluntary Participation Form for the needs of SOCIALENERGY project

1. Study Information

Location of study	Athens, Greece
Pilot spaces that affect the participants	Residential
Representatives of the study	Vassilis Nikolopoulos Prodromos Makris

2. Participant's Questionnaire

I have been informed orally about the purpose, the expected duration and the procedures of the study from the study Manager.	**Yes**	**No**
I have been informed about the potential benefits of the study.	**Yes**	**No**
I have been informed about my right to deny participating or to quit from the study and about the corresponding consequences (as documented in the ethics management document).	**Yes**	**No**
I have been informed that participation in the evaluation phase will not result in more work.	**Yes**	**No**
I have been informed about the contact person in case that I have questions and queries about the study.	**Yes**	**No**
I have been given a copy of my consent.	**Yes**	**No**
I had adequate time to make my decision concerning my participation in the study.	**Yes**	**No**
I comprehend that I can quit from the study at any time without having to justify my decision.	**Yes**	**No**
I have been informed about potential effects, difficulties and dangers from the study manager and have access to the ethics manual document.	**Yes**	**No**
I have been informed about the sensors equipment which will be installed to my workplace for collecting data also documented in ethics manual document.	**Yes**	**No**
I have been informed about the security of the study data and results.	**Yes**	**No**

I have been ensured about the confidentiality of my personal information. Publications of the study results do not allow the personal data recognition, due to the principle of anonymity. In addition, the main goal of the project is business driven monitoring and thus no special interest for individuals is considered.	**Yes**	**No**
I have been ensured that the data will be used within the scope of the project and no incidental findings are expected within the project.	**Yes**	**No**
I have been informed that no extra work is required through my participation and the overall involvement is part of my daily activities.	**Yes**	**No**

I agree to participate in the study.	**Yes**	**No**

Date: _____

Signature:_____