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Assessment of the Social Electricity Online Platform Tools and their Potential Impact on European Citizens

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Through the Social Electricity Online Platform (SEOP) European project, four learning modules, educational content and online eco-feedback platforms have been developed, to raise the awareness and knowledge of citizens about energy, the environment and sustainability. The platform allows European citizens to become educated on energy-saving practices and techniques, including the use of renewable technologies at their home. Moreover, through the Social Electricity application, people may become aware of their electrical energy consumption by means of comparisons with the corresponding electrical consumption of their friends, as well as with the total consumption in the street, neighbourhood, village, city and country where they live, in a collaborative and social environment.

In this paper, a pilot study performed in eight European countries involving more than 300 European citizens is presented, in order to demonstrate the influence of online learning modules and eco-feedback platforms on the everyday lives of people, in terms of rational energy use and energy savings. In this pilot, participants have been divided into two groups: the former uses the four learning modules available on the SEOP platform and then the Social Electricity application, whereas the latter uses only the Social Electricity application. This paper describes our overall findings after three months, exploring the completeness and educational value of the learning modules, and the potential of Social Electricity as an effective online tool for personal energy management. The results also evaluate the impact, behavioural change and the increase on energy awareness among the two groups, as well as the general effectiveness and acceptance of the platform.

KEYWORDS: Adult learning, Energy management, Good practices, ICT platform, Social Electricity.

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Introduction

Without a doubt, concerns on environmental protection due to the high greenhouse gases emissions is today a key driver for the global need for electrical energy saving. Nowadays, people realize that the electricity they use originates mainly from coal or hydrocarbon-based power plants, which emit carbon-dioxide which is severely harmful to humans and the environment. Moreover, energy should be conserved since we are consuming a disproportionate amount of energy and that day is not far when all our non-renewable energy fuel resources will be exhausted forcing us to rely just on renewable sources (Bhattacharya 2014).

Apart from the above, electrical energy saving also helps electricity consumers to save money and mitigates the numerous adverse environmental and social impacts associated with energy production and consumption. These include air pollution, acid rain and global warming, oil spills and water pollution, loss of wilderness areas, construction of new power plants, foreign energy dependence and the risk of international conflict over energy supplies. In addition, proper energy use extends the lifetime of electrical equipment and reduces the maintenance cost by operating less hours and at less than maximum capacity (Gavaskar et al. 2012).

European citizens need to understand the political, social and environmental implications of energy consumption and dedicate their efforts to consume energy more rationally (Leonard 2010). A crucial issue that hinders the awareness of citizens about energy is the absence of effective information and communication technology (ICT) infrastructures that would help people to perceive the effects of their actions on the physical and urban environment (Kat 2010). Unfortunately, current ICT platforms that aim to educate people about energy conservation are rather isolated and incomplete, not based on any methodological and analytical techniques (Mankoff et al. 2010), (Egan 1999). An example that highlights this inadequacy is the fact that in most European countries, people receive an electricity bill only once every month (in some countries even once every two months), and they cannot understand whether their electrical consumption is low, medium or high. This could be only addressed by ICT platforms that present electricity-related information to citizens in real-time, allowing them to compare their consumption with the past, and also with their neighbors or friends, in order to make more informed choices about their personal consumption.

In order to tackle these issues, the Social Electricity Online Platform (SEOP) research project has been created with the promise of developing a social ICT platform that allows European citizens to be educated about energy saving practices and techniques, helping them to perceive the crucial importance of energy conservation for the society and the environment (Social Electricity Application, 2012)– (SEOP Project, 2013). SEOP consists of a high-quality consortium, merging the experience of the University of Cyprus acquired during the design and deployment of Social Electricity application, together with the expertise of other partners (CARDET, ECC, INTEGRA and QUALED) in the domain of learning and education. A critical aspect for the success of the project and the maximization of its content quality and exploitation is the participation of public and private energy and electricity agencies from Europe such as EAC, KREA and MIEMA. In addition, the community-based organization Meath Partnership infuses to the project the elements needed to be effective and practical in local/communal level. Finally, the University of Athens assists the development procedures with its knowledge in analysis of Internet applications and online social networking. The project has two main objectives, on one hand to help people to become more energy aware and to conserve energy and on the other to develop new learning strategies and techniques to educate people effectively towards environmental sustainability.

In this paper, the SEOP project and the online tools of the SEOP platform are presented in Section 2. Further, in Section 3, a pilot study performed in eight European countries involving more than 300 European citizens is described, demonstrating the influence of online learning modules and eco-feedback platforms on the everyday lives of people, in terms of rational energy use and energy savings. The results of the pilot test are presented in Section 4, whereas the conclusions are summarized in Section 5.

The SEOP Project

The SEOP project (SEOP Project, 2013) has been funded by the Lifelong Learning Programme of the European Commission, aiming to develop a social ICT platform that allows European citizens to be educated about energy saving practices and techniques and the crucial importance of energy conservation for the society and the environment. The project has two main objectives, on one hand to help people to become more energy aware and conserve energy and on the other to develop new learning strategies and techniques to educate people effectively towards environmental sustainability.

The former goal has been approached by applying state of the art methodologies and pedagogical approaches to influence people to acquire a more sustainable, green lifestyle. These methodologies and approaches have been implemented through various modules, which will educate people about rational energy management and use. The latter aim has been approached by observing, analyzing and experimenting with the applied methodologies and their design elements, in order to assess each of them, identifying their advantages/weakness, and choosing the ones that prove to be more effective. These methodologies/features/elements have then been integrated to the online tools developed through the project.

Another important objective of the project was to encourage people to engage themselves in energy saving practices, forming communities related to sustainability and proper use of energy, increasing their willingness to help other people to become more sensitive about energy and about their physical and urban environment. People have been encouraged to contribute to the community by expressing their experience and expertise in energy saving efforts, sharing with others their best practices for energy conservation and rate other people's approaches for energy conservation.

SEOP platform has a pedagogical character based on state of the art methodologies relating to adult education and persuasion (Fogg 2003). The pedagogical approach of the online learning platform is based on the latest developments in the field of adult training and e-learning (Mankoff 2007). The platform hosts four learning courses for educating citizens on issues related to home energy management, proper use of domestic electrical appliances, as well as use of renewable technologies such as photovoltaics and wind turbines.

Finally, the project extends the award-winning Social Electricity Facebook application (Kamilaris et al. 2012a), (Kamilaris et al. 2015) (Kamilaris et al. 2016a), an online application which helps people to manage their personal consumption in a social and collaborative environment, by interacting and comparing their footprint with friends, neighbors and other users, analyzing and setting goals for future savings.

Learning Modules

SEOP platform has been enriched with four learning courses for educating citizens on issues related to home energy management, proper use of domestic electrical appliances, as well as use of renewable technologies, as shown in Fig. 1. In order for a user to complete the online modules, he needs to register to the platform and create an account (SEOP Project, 2013). Each module has separate units which are graded with end-of-course questions. By successfully completing the tests/questions of all the four courses, the user receives a certificate, signed by the consortium of SEOP.

The first module concerns *Digital Literacy*, and prepares users to apply basic knowledge regarding digital participation in online spaces. The users are introduced to online etiquette rules, as well as to various social media tools for communication, such as Facebook and Twitter. With this module, the users are also trained on how to effectively use the various tools of SEOP, in order to increase their knowledge on energy, electricity and sustainability and to be able to properly manage, compare and improve their daily energy consumption.

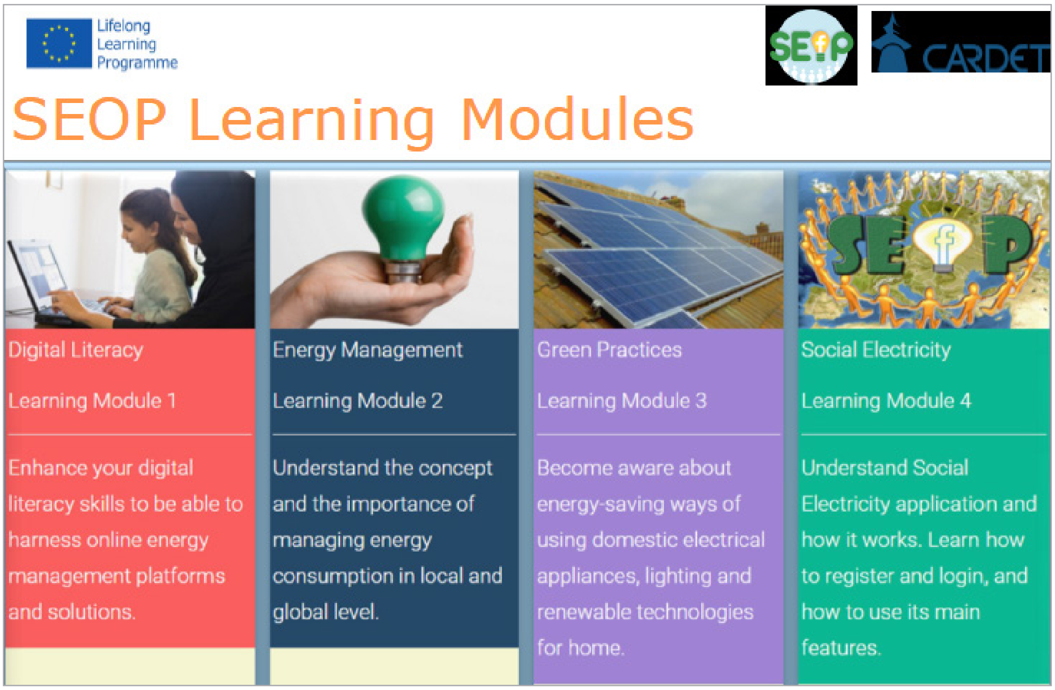


Fig. 1

SEOP Learning Modules

The second module is about *Energy Management*, providing awareness about the global need for electrical energy management and energy savings. The module provides a background on the EU policies for energy management and some good practices that can be used to achieve energy savings in houses or office environments. Also, with this module, users can become familiar with energy management techniques that can be used in daily life and learn what can be gained by applying some of these energy management techniques at their own home. Moreover, participants are able to learn about the main renewable energy technologies that exist at the market today.

The third module is named *Green Solutions and Green Practices*, aiming to increase citizens' knowledge on various electricity saving opportunities regarding household electrical appliances, as well as on the use of the most energy efficient lighting solutions and to introduce the most promising renewable energy technologies that can be used in the household for local production of electricity, such as small photovoltaic systems and small wind turbines.

Finally, the fourth module constitutes a *User Manual for the Social Electricity Application*, assisting the users to register and use the social application, which is described in the following sub-section.

Social Electricity Application

As mentioned above, the SEOP project extends the award-winning Social Electricity Facebook application (shown in Fig. 2), which helps consumers to perceive their energy behaviour by comparing their footprint with the one of their online friends and other contacts (Kamilaris et al. 2012a), (Social Electricity Application 2012). Social Electricity aims to raise the energy awareness of users by exploiting social norms, normative social influence, personalization and various eco-feedback services, which have proved to be effective in related work (Froehlich 2010), (He 2010), (Kamilaris 2013). It allows people to collaborate and exchange know-how and experiences in the domain of home energy management, towards the co-creation of knowledge and more informed choices that may lead to energy savings.

Fig. 2
Social Electricity Application

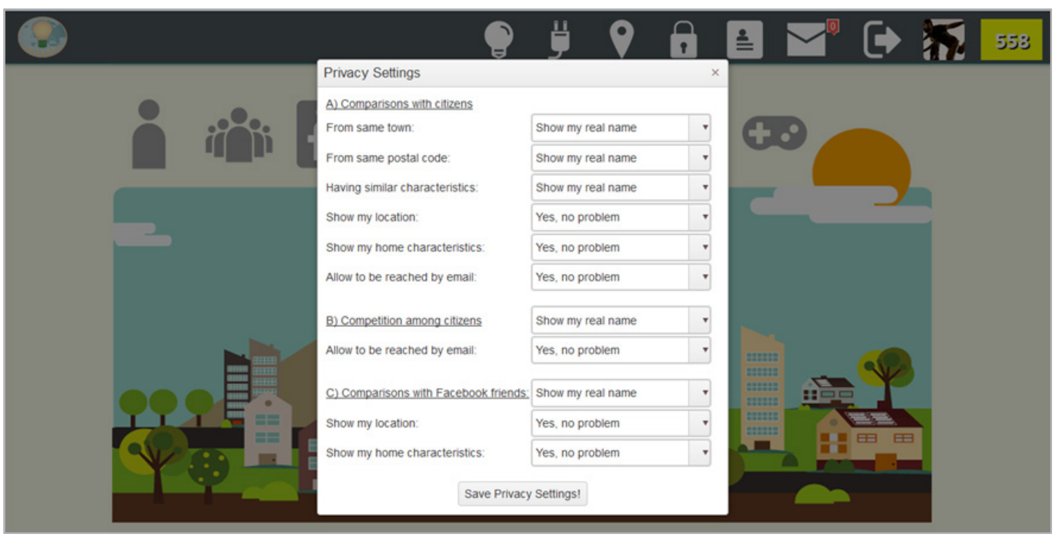


Fig. 3
Privacy of users

Detailed domestic consumption data from all around Cyprus is provided by the Electricity Authority of Cyprus (EAC), for the last three years. Respecting the privacy of citizens (Kamilaris et al. 2016b), the electricity measurements are aggregated at street level (address, postal code and city). From this data, users can select the average consumption of their street as their personal consumption, or they can add their own consumption each month, as shown in Fig. 3 (Kamilaris et al. 2012a).

Comparisons can be performed among Facebook friends, citizens living at the same street, town/village, or users sharing similar house characteristics (e.g. house size and type, heating/cooling method etc.), as illustrated in Fig. 4. Users can also compare their consumption with the average one of their local street. Rankings are offered about the most energy-efficient streets and villages near the user's location, motivating people to acquire "*region awareness*", inspired to take actions to help the local community maintain a better ranking. Temporal comparative feedback is supported too, in regard to previous months and for the same month in previous years. Users may also compare with their friends' temporal patterns.

Besides the main features, Social Electricity gives useful tips to people to save energy and become more educated about best energy-saving practices. Other features include competitions

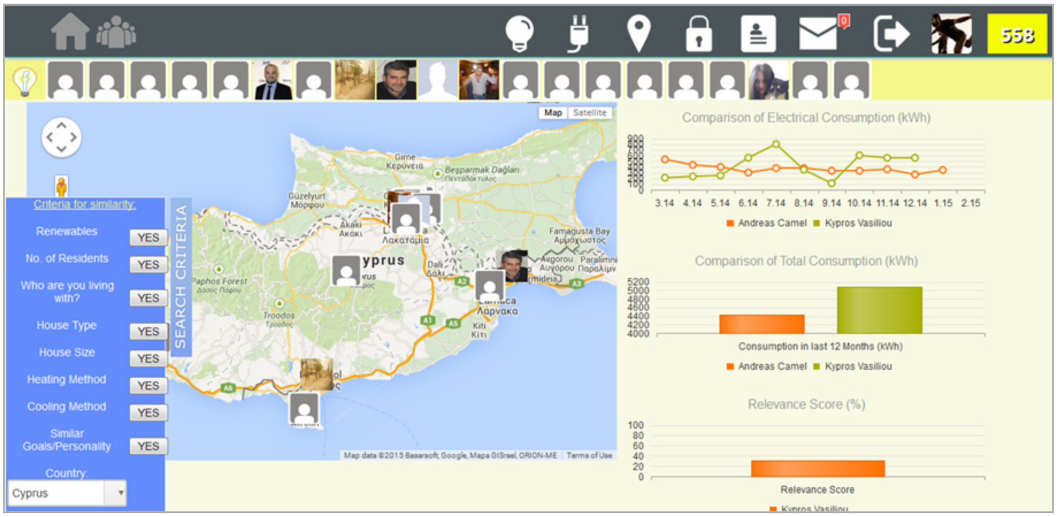


Fig. 4

Fair comparisons with similar peers around your country

for savings, learning material about green practices, online educational social games relating to energy, statistics about the areas, villages and towns with the least/most energy consumption around the country and the option to associate electricity with actual costs, enabling users to have a more meaningful view of their energy profile. Comparisons and rankings are presented by means of easy-to-understand graphs, with consumption and price figures. Moreover, users can add their personal electrical appliances and declare how they use them (e.g. specs, frequency, time of use, consumption), and then view analytical breakdowns of their overall monthly consumption according to the particular, seasonal use of their home devices, as illustrated in Fig. 5. After three years of operation, the application counts more than 2000 active users in Cyprus and more than 750 users around the rest of Europe.

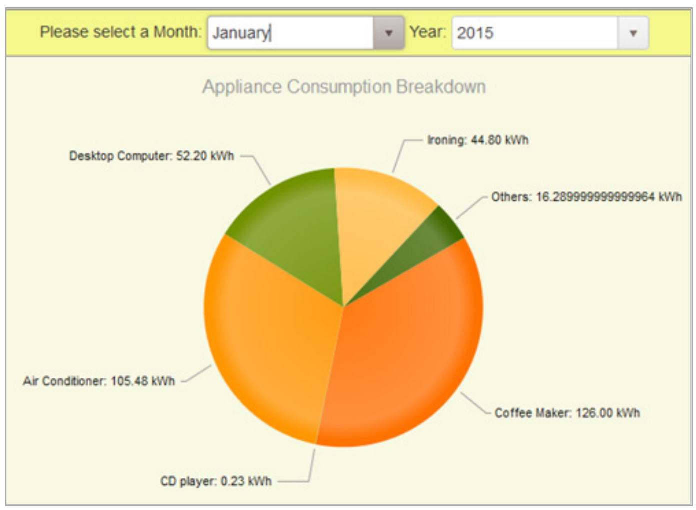


Fig. 5

Breakdowns of total consumption to individual appliances

Pilot Study Methodology

During the summer months of 2015, a large pilot study was performed in the countries of the project partners (Cyprus, Greece, Ireland, Malta, Lithuania, Austria, Slovenia and Slovakia), in order to evaluate SEOP and its online products (learning modules and Social Electricity application) on their effectiveness and acceptance regarding influencing the European citizens for more rational use of energy and reduction of their personal footprints. In the pilot study, 335 European citizens have participated from the aforementioned 8 countries.

The participants were divided in two groups. The first group completed the four learning modules before using the Social Electricity application, while the second group used only the Social Electricity application (in order to assess the impact and usefulness of the modules themselves). Each group at each country consisted of at least 30 participants. The participants needed to fill three questionnaires (before, in the middle and after the pilot study).

The first questionnaire was about the users' energy consumption habits before the treatment methods, as well as their beliefs towards the environment (captured through 22 parameters, see Table 3) (Poortinga et al. 2004). These parameters may characterize people's quality of life (QOL) and their attitudes/behaviours related to the environment (personal, social, economical and physical). The second questionnaire was completed only by the participants of the first group, and related to the evaluation of the learning modules with respect to their quality, educational value and completeness. The third questionnaire was completed at the end of the pilot by the participants of both groups and was very similar to the first one, asking about the participants' energy consumption habits, as well as the aforementioned 22 QOL parameters. The aim of the first and third questionnaire was to capture any influence of the study on the participants' behaviours and habits. Furthermore, the final questionnaire included an overall evaluation of the acceptance and effectiveness of the Social Electricity application.

Regarding the recruitment procedure, the partners of the SEOP project contacted their friends, relatives and colleagues or students aged 20 to 70 years face to face or by telephone, to explain the project and the importance to participate in the pilot testing process. Then, the partners exchanged emails with their participants regarding the pilot test categories in order to derive the most appropriate category for them to participate, based on the time they could spend on the pilots or their overall interest to become more engaged in the pilot tests. The partners tried to divide people in groups A and B equally (without informing them about the existence of the other group), to avoid possible biases such as gender, age, area of living, income etc. Finally, the partners gave instructions to the participants about (a) how to participate in the different categories of the pilot tests, (b) about the questionnaires they had to fill and (c) the deadlines for submitting them.

Results

For the purpose of this paper, only 157 participants out of the 335 participants (who completed the first questionnaire) have been considered, as only those have answered all the questionnaires, participating at the pilots till their end. By comparing these 157 subjects, we can make some conclusions about the participants' behaviour before and after the study. The reasons that some participants did not answer all the questionnaires are described in Section 4.5. The results of the analysis are described in the following sections.

Table 1

Pilot test participants' age

Age (years)	Percentage (%)
20-25	12
26-30	15
31-35	21
36-40	22
41-45	15
46-50	9
Over 50	6

Table 2

Pilot test participants' education

Education (degree)	Percentage (%)
Lyceum	1
Technical training	13
Bachelor	29
Master	42
P.H.D.	9
Other	6

Comparison of behavioural change

In this analysis, 157 participants from eight counties (Cyprus, Greece, Ireland, Malta, Lithuania, Austria, Slovenia and Slovakia) who have answered both the first and third questionnaires have been considered. Tables 1 and 2 show the age and educational level of the participants. It can be observed that although there was a variety of the age and the education of the participants of the pilot study, most of them were of age from 26 up to 45 and with a Bachelor or a Master degree.

From those participants, 74% had up to one cooling fan in their home, 76% had up to 2 heaters and 75% had up to one air conditioner in their house, as illustrated in Fig. 6.

From those having heaters in their house, it can be observed from Fig. 7 that there has not been significant change in their behaviour regarding the operational mode of the heater, which remains between 22°C and 24°C for around 85% of the participants.

Fig. 8-11 show the behavioural change of the participants regarding their habits which affect the electricity consumption of their house, before and after the study. Specifically, there was an improvement after the study, regarding the use of open windows when the fans are working during the day in summer, as 72% have rarely or never open windows compared to the respective 66% before the study. Furthermore, there was a change in the use of open windows when the heater is on, as 59% of the participants have rarely or never open windows after the study compared to the respective 55% as declared before the study. As for open windows during the operation of air conditioners, there was a slightly worse situation after the study, as 5% of the participants who never open windows before the study, after the study they rarely open the windows.

The results were improved regarding the use of daylight, turning off the lights when nobody is in the room or leaving the lights on even when there is daylight outside the house, as shown in Fig. 8 and Fig. 9. Specifically, there was 6% improvement of using more frequently the daylight after the study, 9% improvement of turn-

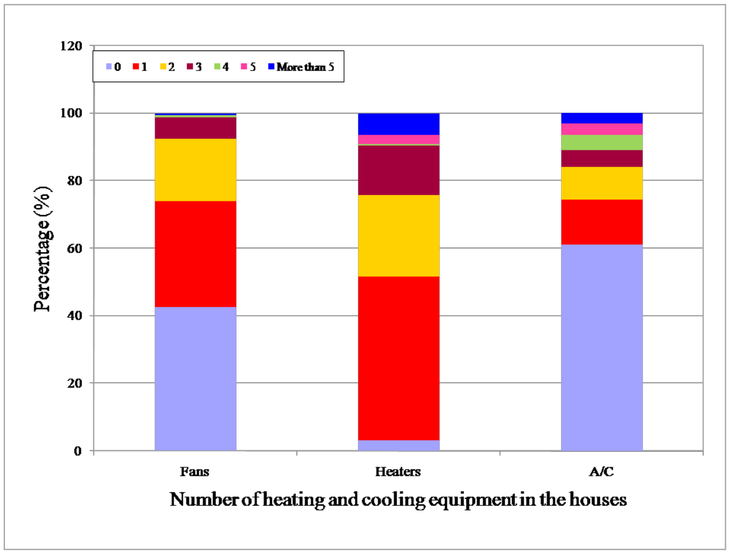


Fig. 6

Heating and cooling systems

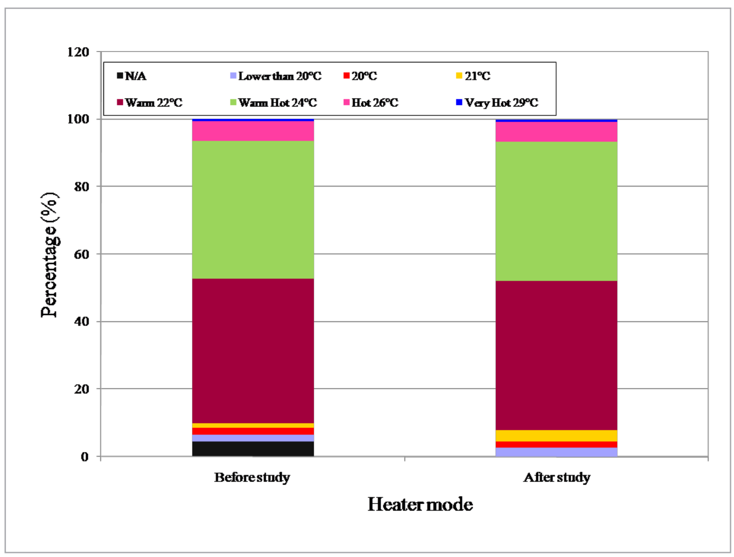


Fig. 7

Heater mode

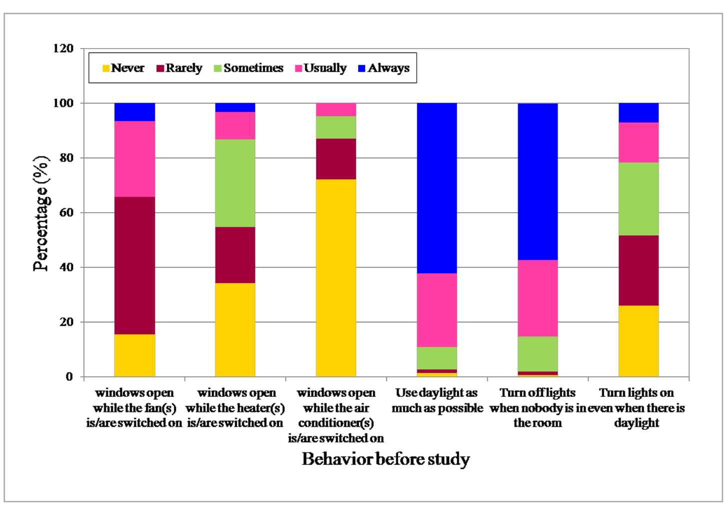


Fig. 8

Behavioural change of participants' habits before the study (Part 1)

Fig. 9

Behavioural change of participants' habits after the study (Part 1)

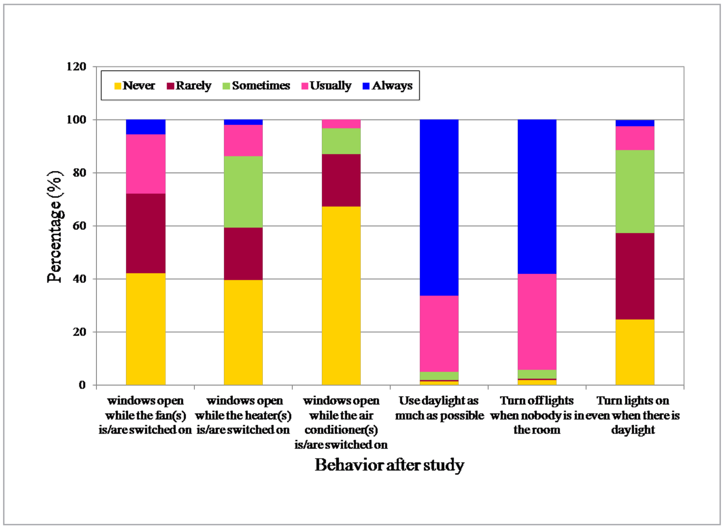


Fig. 10

Behavioural change of participants' habits before the study (Part 2)

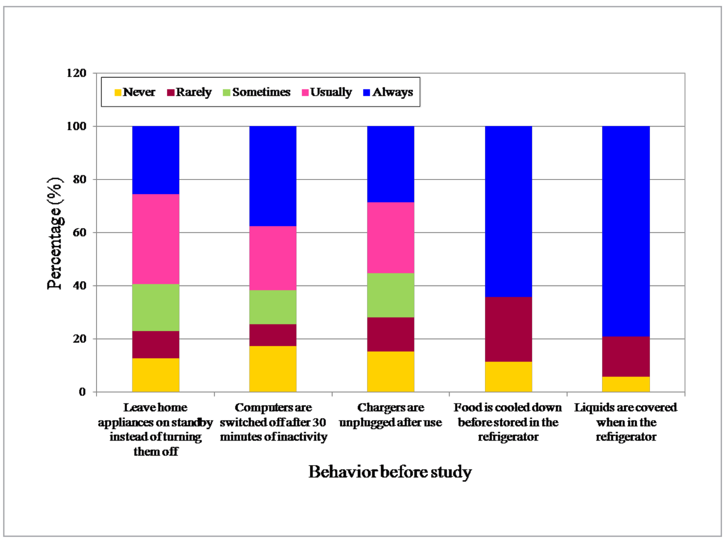
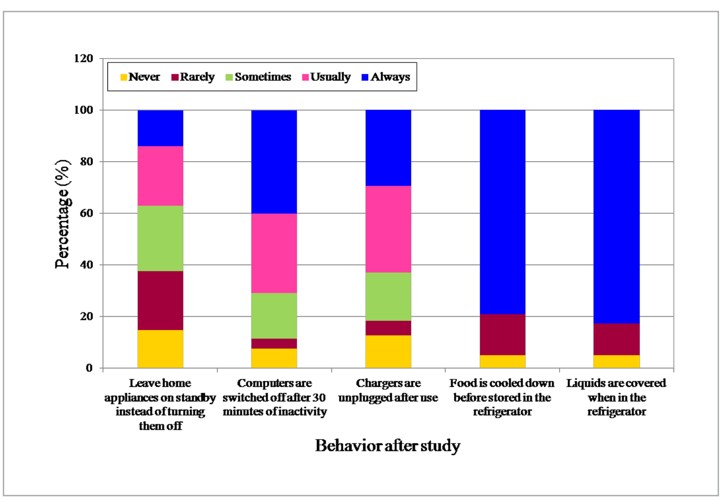


Fig. 11

Behavioural change of participants' habits after the study (Part 2)



ing off more frequently the lights when nobody is in the room and 5% improvement of not leaving the lights on even when there is daylight outside the house.

Moreover, by observing **Fig. 10** and **Fig. 11**, there was an improvement in the behaviour of the participants after the study regarding (a) leaving home appliances on standby than switching them off, (b) having computers switched off after 30 minutes of inactivity and (c) unplugging the chargers after using them. Specifically, an additional 18% of the participants after the study were rarely or never leaving the home appliances on stand by mode, an additional 9% of the participants switched off their computers after 30 minutes of inactivity and an additional 7% unplugged their chargers after use, compared to the respective numbers before the study. Also, the participants learned during the pilot test to save energy by using their refrigerator properly (an improvement of 15%), as they now always cool their food before storing it. An improvement of 3% of the participants was also observed as now they always cover the liquids before storing them in the refrigerator.

As for the environmental concern of the participants regarding having access to clean air, water and soil and to enjoy natural landscapes, parks and forest, it can be observed from Fig. 12 and Fig.13 that either an improvement or neither a deterioration has been occurred after the study and the only conclusion that can be made is that the participants became more neutral on this matter.

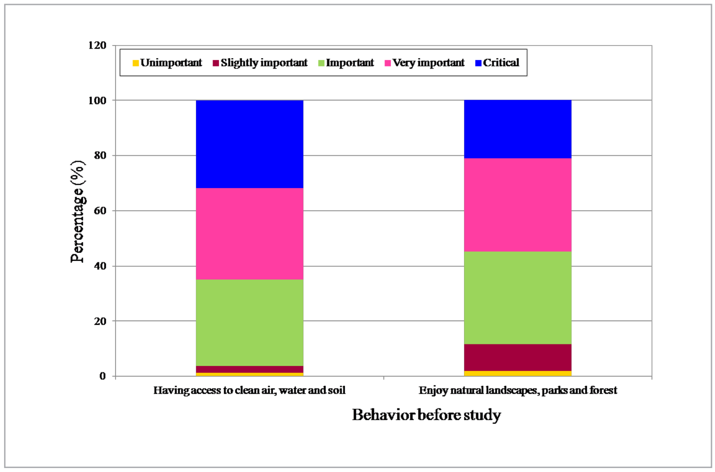


Fig. 12

Behavioural change on environmental issues before the study

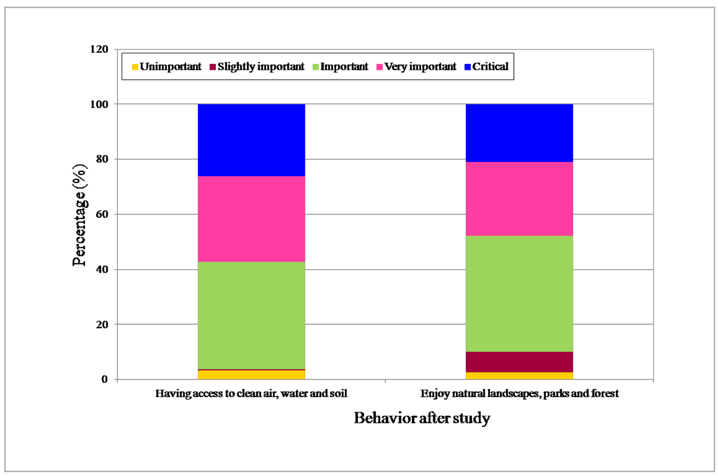


Fig. 13

Behavioural change on environmental issues after the study

Changes in Quality of Life Parameters

Regarding the changes on the attitudes of the participants in relation to the 22 QOL parameters the (Poortinga et al. 2004) through the pilot, Table 3 lists these parameters, along with the change on peoples' attitudes on each of them. As we mentioned before, the 22 parameters characterize people's quality of life and their behaviours related to the environment (personal, social, economical and physical). In the table, positive/negative change in attitude is calculated as an increase/decrease in the people's score before and after the study, on a 5-scale Likert-style answer (1: no influence, 2: little influence, 3: some influence, 4: much influence, 5: large influence).

Obviously, there is a positive increase in the attitudes of the participants towards their quality of life and the environment, in all the 22 QOL parameters. The metrics with the largest influence were aesthetic beauty, challenge/excitement, change, comfort, material beauty, security, spirituality/religion and social status. We also noticed that participants of Group A had slightly larger scores in comparison to the participants of Group B, something that indicates that the learning modules have somehow influenced this positive change.

Effectiveness of learning modules

As it is mentioned before, the second questionnaire targeted to get feedback about the opinion of the group of users who completed the learning modules before using the Social Electricity application (i.e. the first group), in order to understand the effectiveness of the learning modules on helping the participants in saving energy. From Fig. 14, it can be observed that most of the participants were pleased with the content of the learning modules, as 63% of them answered that the information was well organized and presented, 71% of them answered that the language was clear

Table 3

Influence of the pilots: QOL Metrics

No.	Metric	Change in Attitude (%)
1	Aesthetic beauty: being able to enjoy the beauty of nature and culture	29.2
2	Challenge/excitement: having pleasant and exciting experiences	29
3	Change: having a varied life, experiencing many things as possible	35.2
4	Comfort: having a comfortable and easy daily life	29.6
5	Education: having the chance to get good education and general knowledge	24
6	Environmental quality: having access to clean air, water and soil	16
7	Freedom: freedom and control over the course of one's life	18.4
8	Health: being in good health, access to adequate health care	20.8
9	Identity: having sufficient self-respect, being able to develop one's identity	21.6
10	Leisure time: having enough time after work, spending this time nicely	24
11	Material beauty: having nice possessions in and around the house	28
12	Money/income: having enough money to buy and to do pleasing things	24
13	Nature/biodiversity: to enjoy natural landscapes, parks and forests	20
14	Partner/family: having an intimate relation and a stable family life	25.6
15	Private: having opportunities to be yourself and do your own things	21.6
16	Safety: being safe at home, protected against criminality	24
17	Security: feeling attended to and cared for by others	28
18	Social justice: having equal opportunities and rights as others	20
19	Social relations: good relationships with friends, colleagues and neighbours	24.8
20	Spirituality/religion: live a life with an emphasis on spirituality	32
21	Social status: being appreciated and respected by others	30.4
22	Work: having or being able to find a job and fulfil it as pleasantly as possible	27.2

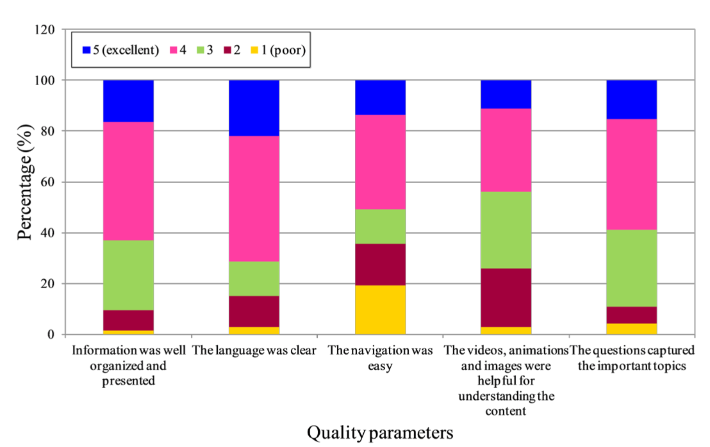


Fig. 14

Learning modules quality parameters

and 59% answered that the questions captured important topics. However, almost half of them didn't find the navigation easy and didn't find the content of the videos, animations and images very helpful. Moreover, almost half of the participants found this learning method more convenient compared to traditional learning methods, as illustrated in Fig. 15.

As to how the participants were assisted to become more aware of energy conservation by using the learning modules, it can be observed from Fig. 16, that more than half of them became more aware of the topic after studying the learning modules.

Effectiveness of the Social Electricity application

The third questionnaire also had some questions for the participants regarding the Social Electricity application's quality and effectiveness. Specifically, around 65% of the participants were satisfied with the effectiveness, the usefulness and the user-friendliness of the application, whereas 62% and 71% of the participants were positive regarding the potential and the design of the application, as illustrated in Fig. 17. Furthermore, the application influenced 77% of the participants to become more aware about their personal consumption, whereas 86% of the participants were optimistic about the future potential of the application, as shown in Fig. 18.

Lessons learned from the pilot study procedure

Although the users were at the beginning very keen to participate, they were not very engaged with

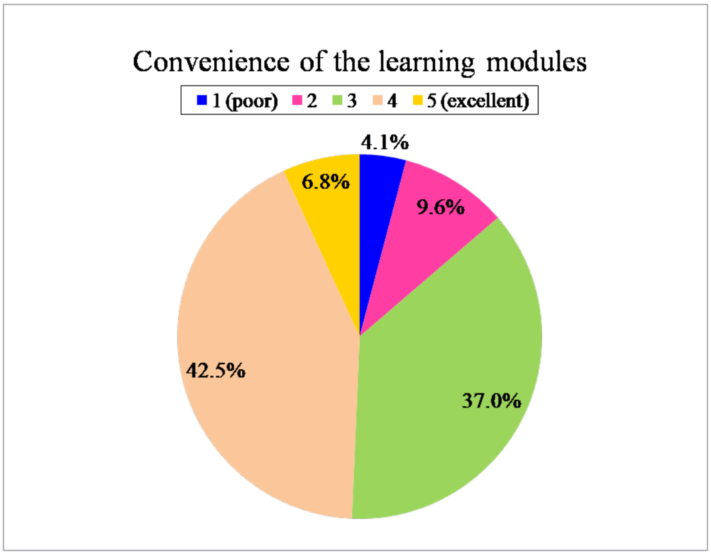


Fig. 15

Learning modules convenience

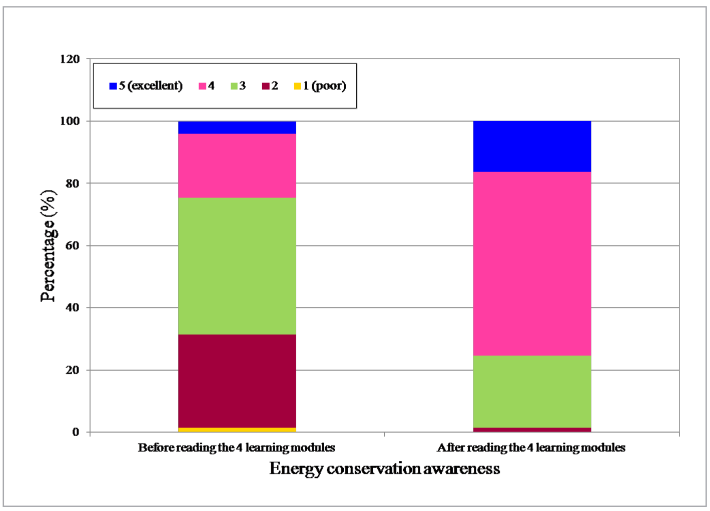


Fig. 16

Energy conservation awareness

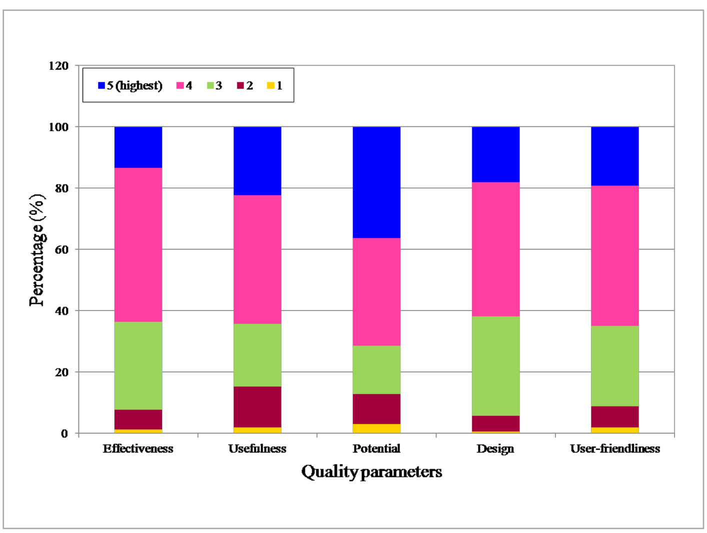
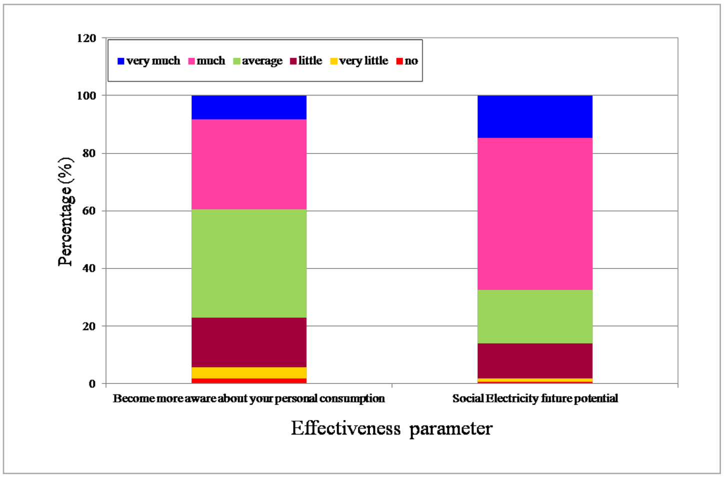


Fig. 17

Quality parameters of Social Electricity Application

Fig. 18

Effectiveness parameter of Social Electricity Application



the tests' timetables and needed to be reminded through several emails and phone calls. All participants were also receiving frequent, automatic reminders through the application. One important reason for the moderate engagement was the complicated registration process, especially for the first group, where participants had to register with personal details twice; once for the learning modules in the platform and then again for the Social Electricity application. Also, in some countries, there was a problem with some participants understanding the procedure which was at first only in English (translation in the local context took place in the middle of the pilot) and there was a need for personal advice or electronic communication at their local languages.

Another important reason for the low engagement was the timing of the pilot testing. The first group had a deadline before the summer holidays, which is usually a busy period for all European citizens. This meant that some of the users couldn't finish all the modules in time since they needed more time to go through all of them. Also, since the second part of the pilot tests (the use of the Social Electricity application), started during the summer period for both groups, many of the users did not submit their home consumption reading (from the electricity meter) in the application, as they were on holidays.

Moreover, an overwhelming majority of participants criticized the number of very personal questions (income, but also personal beliefs), and it required a lot of energy (and time) to explain the rationale and persuade them to continue with the testing.

In this work, a pilot study performed in 8 European countries involving more than 300 European citizens is presented, to demonstrate the influence of online learning modules and eco-feedback platforms on the everyday lives of people, in terms of rational energy use and energy savings. In this pilot, participants have been divided into two groups. The former uses the four learning modules of the platform and then the Social Electricity application, whereas the latter uses only the application.

The study shows that there has been a small improvement between 5%-10% on the participants' habits related to the electricity consumption in their house, during the period of the pilot study. On some habits, the improvement has been even larger, around at 15%. However, for some habits, deterioration or neutral attitude has been observed.

As for the effectiveness of the learning modules, it has been observed that most of the participants are pleased with their content, finding this method very convenient. The only drawbacks of the learning modules, according to the participants, were that the navigation was not easy and they didn't find the content of some videos, animations and images very helpful or relevant to their particular needs. Regarding the effectiveness of the Social Electricity application, most of the participants were pleased with the quality of the application and stated that the application made them become more aware of their personal consumption.

Considering the overall findings of this study, it becomes evident that EU countries should promote and facilitate the integration of smart meters in consumers' houses (Kamilaris 2010), (Kamilaris et al. 2012b), with regulatory decisions, so the consumers could improve their electricity consumption by observing consumption data of their electrical appliances in real time, getting more visibility and details on their personal footprint, and take more informed everyday decisions. Smart metering should be accompanied by ICT supporting technologies, such as mobile and web applications, carefully designed to offer context-relevant education and proper eco-feedback, considering well-accepted and effective persuasive techniques such as normative social influence, personalization, goal setting, challenge and rewards, exploiting the crowd wisdom for co-creation of new knowledge and sharing of know-how and experiences.

Finally, this pilot revealed (through the QOL metrics) that citizens are influenced positively towards the environment when ICT applications consider, respect and promote their aesthetic beauty, challenge/excitement, change, comfort, material beauty, security, spirituality/religion and social status. Hence, policy makers and eco-feedback application designers need to take into serious consideration these parameters when designing the green ICT apps of tomorrow.

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References

Bhattacharya T., Sustained Growth of Green Energy Economics, International Journal of Inventive Engineering and Sciences, 2014, 2 (4): 16-18.

Egan C., Graphical Display and Comparative Energy Information: What Do People Understand and Prefer? In Proceedings of the Summer Study of the European Council for an Energy Efficient Economy, 1999.

Fogg B.J., Persuasive Technology: Using computers to change what we think and do, Morgan Kaufmannn, 2003.

Froehlich J., Findlater L., and Landay J., The Design of Eco-feedback Technology, In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '10, pages 1999–2008, New York, NY, USA, 2010. ACM. https:/doi.org/10.1145/1753326.1753629

Gavaskar J. J., Pillai V. P., Sanker N. K., et all, Energy Economics Study on Biomass Energy Conversion Techniques, International Journal of Research in Mechanical Engineering & Technology, 2012, 2 (1): 49-54.He H. A., Greenberg S., and Huang E. M, One size does not fit all: applying the transtheoretical model to energy feedback technology design, In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, CHI '10, pages 927–936, New York, NY, USA, 2010. ACM.

Kamilaris A., Trifa V., Guinard D., Building Web-based Infrastructures for Smart Meters, In Energy Awareness and Conservation through Pervasive Applications Workshop, in Proc. of Pervasive 2010, Helsinki, Finland, May 2010.

Kamilaris A., Taliadoros G., Papadiomidous D., Pitsillides A., The practice of online social networking of the physical world, International Journal of Space-Based and Situated Computing, 2012, 2 (4): 240-252. https:/doi.org/10.1504/IJSSC.2012.050007

Kamilaris A., Tofis Y., Bekara C., Pitsillides A. and Kyriakides E., Integrating Web-Enabled Energy-Aware Smart Homes to the Smart Grid, International Journal on Advances in Intelligent Systems, 2012, 5(1 & 2): 15-31.

Kamilaris A., Kitromilides G., Pitsillides A., Energy Conservation through Social Competitions in Blocks of Flats, In Proc. of the 1st International Conference on Smart Grids and Green IT Systems (SMARTGREENS), Porto, Portugal, April 2012.

Kamilaris A., Pitsillides A., Fidas C., Kontebudi S., Social Electricity: The evolution of a Large-Scale, Green ICT Social Application through two Case Studies in Cyprus and Singapore, ICT for Sustainability Conf., Copenhagen, Denmark, Sep., 2015.

Kamilaris A., Pitsillides A., Fidas C., Social Electricity: A Case Study on Users Perceptions in Using Green ICT Social Applications, International Journal of Environment and Sustainable Development, 2016, 15 (1): 67-88. https:/doi.org/10.1504/IJESD.2016.073336

Kamilaris A., Pitsillides A., Kondepudi S., Komninos N., Privacy Concerns in Sharing Personal Consumption Data through Online Applications. In Proc. of the 12th International Wireless Communications & Mobile Computing Conference (IWCMC), Paphos, Cyprus, September 2016. https:/doi.org/10.1109/iwcmc.2016.7577124

Kat A., Ehrhardt-Martinez D., Laitner J. A., Advanced Metering Initiatives and Residential Feedback Programs: A Meta-Review for Household Electricity-Saving Opportunities, Research Report E105, American Council for an Energy-Efficient Economy, 2010.Leonard A., The story of stuff: How our obsession with stuff is trashing the planet, our communities, and our health-and a vision for change, Simon and Schuster, 2010.

Mankoff J., Fussell S. R., Glaves R., et al., StepGreen.org: Increasing energy saving behaviours via social networks, 4th International Association for the Advancement of Artificial Intelligence Conf. on Weblogs and Social Media, 2010.

Mankoff J., Matthews D., Fussell, S. R. and Johnson M., Leveraging social networks to motivate individuals to reduce their ecological footprints. In Proceedings of the 40th Annual Hawaii International Conference on System Sciences (HICSS '07), Washington, DC, USA, 2007. IEEE Computer Society. https:/doi.org/10.1109/hicss.2007.325

Poortinga W., Steg L., Vlek C., Values, environmental concern, and environmental behavior a study into household energy use, Environment and behaviour, 2004, 36 (1): 70-93. https:/doi.org/10.1177/0013916503251466

Social Electricity Application, 2012. Online at: http://www.social-electricity.com/

SEOP Project, 2013. Online at: http://www.seop-project.eu/

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