

## DELIVERABLE D.T3.1.4

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Upstreaming GreenSoul energy-related  
human behaviour

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## **D.T3.1.4: Upstreaming GreenSoul energy-related human behaviour**

Activity A.T3.1 Adjustment of strategies, roadmaps and action plans

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## 1. Introduction

The deliverable D.T3.1.4 belongs to the activity related to the adjustment of strategies, roadmaps and action plans (A.T3.1), with the aim to capitalized non-technical EE solutions, provided by the selected transnational projects.

The H2020 GreenSoul project solution(s) from the Deliverable D4.4 “Holistic socioeconomic model to increase eco-awareness of users in public spaces” are being adjusted and tailored in a way that they can be easily used and better deployed in the new PAs, on national, regional or local levels. The obtained results will be available through the BOOSTEE-CE OnePlace platform.

In the following paragraphs there will be a short description of the used GreenSoul deliverable with a short theoretical background, the used strategies and how the practical solutions were applied. Following this abstract is a description on how the GreenSoul outputs should and will be used in Target-CE and which benefits the GreenSoul outputs can bring to Target-CE. The next paragraph of this report describes the involved target groups and how outputs from GreenSoul and Target-CE can provide an added value for these target groups.

## 2. GreenSoul solutions - Description

The main objective of the H2020 project GreenSoul was to achieve higher energy efficiency in public buildings by altering the way people use energy consuming shared devices (like lights, printers, etc.) and personal devices (personal pluggable appliances). To achieve this goal, GreenSoul applied a strategy which persuaded users to increase their energy-awareness and changed their energy-consumption habits through a variety of techniques, from persuasive social applications to physical interaction mechanisms linked to the networked devices.

Another goal of GreenSoul was to create a holistic socioeconomic model (Figure 1) which should help increase the eco-awareness of users in public buildings. This, in GreenSoul, developed model may predict (1) likely energy-related behaviour, (2) can help select the appropriate persuasion strategies and (3) drive the desired energy-efficient behaviour. To do so, the model will define and quantify interconnections between factors, user profiles and persuasion/incentivisation strategies. The GreenSoul socio-economic model will be able to recommend which persuasion/incentivisation strategies and communication tools should be the most effective in driving energy related behavioural change. Figure 1 shows the main operating elements of the socio-economic model. First a user profile is created from the GreenSoul questionnaire and then users are clustered according to their profiles while the suitability of persuasion/incentivisation strategies is defined by the user profile and additional socio-economic factors (like workplace culture, organisation, etc.). The self-improvement mechanism is expected to optimise and also adapt the model to the evolving realities of the pilot sites. The persuasion module is responsible for the application of the persuasion & incentivization strategies (different types of users need different types of strategies).

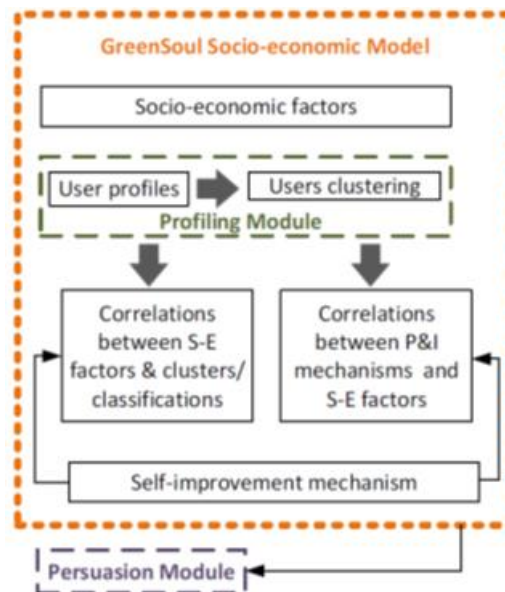


Figure 1: GreenSoul socio-economic model

The methodology for the development of the socio-economic model takes into account the existing behavioural change theories (like the Theory of Planned Behaviour (TPB) and the Nudge Theory), available research results and also work previously performed in other GreenSoul WP's.

To define a quantitative version of the model the GreenSoul team has developed an energy behaviour questionnaire for people working in public buildings.

The key factors of the questionnaire are:

User demographics: age group, gender, family status, education, country

Behavioural change profile: decision making - attitudinal (Pinball [users don't care/think about decisions and/or don't make decisions], Shortcut [users want the easiest way / don't want decisions at all], Thoughtful [users care about decisions and know what they want]), state of change - intentional profiles (Precontemplation [no intention to change their behaviour], Contemplation [intention to eventually change their behaviour], Action [act on the intention to change their behaviour])

Employment profile: type of employment (full time/part time), position, office level (floor), office settings (alone, sharing with others), presence at office (% of working time)

Working conditions: thermal comfort

Work culture: organisation/team culture

Persuasion profile: influencer, follower.

The GreenSoul questionnaire was analysed to provide basic statistics and conclusions (like which are the most popular persuasion strategies among the responders) and to identify socio-economic factors that are important to determining certain persuasion strategies.

In GreenSoul applied behavioural change strategies are limited to the following two: persuasion and incentivization. 18 persuasion principles were suggested by the GS-team (Table 1).



Table 1: Suggested behavioural change strategies by GreenSoul

Persuasion Principle	Potential GreenSoul Persuasion Strategies
Self-monitoring	Provide energy data to the users (own performance)
Social proof	<ul style="list-style-type: none"> <li>- Show the number of followers of the system</li> <li>- Show peers feeling happy using a system</li> <li>- Provide positive opinions of the crowd that already reduced energy</li> </ul>
Real-world feel	<ul style="list-style-type: none"> <li>- Provide info about the measurement equipment</li> <li>- Provide information about the researchers and their organization behind the experiments</li> <li>- Provide a contact in case of failure/doubts.</li> </ul>
Verifiability	<ul style="list-style-type: none"> <li>- Provide references and links to external sources of data</li> <li>- Follow standards</li> <li>- Provide info about measurement equipment.</li> </ul>
Cause and effect	<ul style="list-style-type: none"> <li>- Provide a means to visualise the outcomes if the desired action was achieved</li> <li>- Cause and effect of everyday actions.</li> <li>- Comparative feedback between current consumption and potential future consumption (if the desired behaviour was formed)</li> </ul>
Similarity	<ul style="list-style-type: none"> <li>- Find peers that can give advices to target users through social networks or platform.</li> <li>- Find specific language or information close to the user to give advices.</li> </ul>
Reciprocity	<ul style="list-style-type: none"> <li>- Provide a positive experience to people</li> <li>- Give hints about the efficiency gained by the interactive/smart system</li> <li>- Provide ideas / sources of enhancing their energy efficiency and then ask participants to help the smart/interactive system</li> </ul>
Liking	<ul style="list-style-type: none"> <li>- Create appealing experience</li> <li>- Show to the user other colleagues using the system</li> <li>- Personalise the object</li> <li>- Visually attractive</li> </ul>
Cooperation	<ul style="list-style-type: none"> <li>- Make the user think that the computer/system is a teammate towards achieving a green goal</li> <li>- The idea would be to provide cues to users that help the understand that they are not alone towards saving energy.</li> </ul>
Authority	<ul style="list-style-type: none"> <li>- Experts on energy efficiency</li> <li>- Make the people think that the system proposed is an expert on energy efficiency</li> <li>- Informed automation would serve as an strategy</li> </ul>
Tailoring	<ul style="list-style-type: none"> <li>- Provide relevant content for each user</li> <li>- Send messages to the user using its name or something that is related to it</li> <li>- Shape content to the user</li> </ul>
(Social) Recognition	<ul style="list-style-type: none"> <li>- Showing in Social networks or in public that someone is the XXX ranking of the month</li> <li>- Show attainments in public or social networks</li> </ul>
Conditioning	<ul style="list-style-type: none"> <li>- (positive) Provide incentives for certain actions.</li> <li>- (negative) Remove undesirable information if the behaviour is accomplished.</li> </ul>
Physical attractiveness	<ul style="list-style-type: none"> <li>- Create digital or physical interfaces with aesthetics in mind</li> </ul>
Reduction	<ul style="list-style-type: none"> <li>- Ease the action by providing steps of completion.</li> </ul>
Praise	<ul style="list-style-type: none"> <li>- use praise via words, images, symbols, or sounds as a way to provide user feedback information based on his/her behaviours.</li> <li>- use appraisal when a goal is achieved/reached</li> </ul>
Personalization	<ul style="list-style-type: none"> <li>- Provide relevant content for each user</li> <li>- Send messages to the user using its name or something that is related to it</li> </ul>
Suggestion	<ul style="list-style-type: none"> <li>- Provide hints/cues just-in time or about-to moments</li> </ul>



Out of these 18 suggested behavioural change strategies (*Table 1*) the following three were the top rated (most effective) principles by the GreenSoul participants:

1. Cause and effect
  - Visualize outcomes if the goal was achieved
  - Comparative feedback between current and potential future consumption
  - Everyday action
2. Conditioning
  - (+) Incentives for certain actions
  - (-) Remove undesirable information when goal is achieved
3. Self-Monitoring
  - provide energy data to the users

These principles were used in different ways which can be seen in Figure 1. These interventions, to change user behaviour, were used in different group settings to see if and which principle is most effective. Unfortunately, the final version of this GreenSoul deliverable was cancelled by the commission so there is no concrete suggestion on how to induce a behavioural change towards energy efficiency. Also the final version would have provided a fully defined socio-economic model. But the results of an additional validation of the behaviour model (GreenSoul deliverable 6.3) indicates that the initial assumption from deliverable 4.4 for the top 3 treatments deployed at the GreenSoul pilots was correct. Also the validation of the behaviour model observed that an occasional absentmindedness occurred at the end of the GreenSoul project so as a solution a suggestion is that there should be a frequent subtle feedback to keep the pro-environmental actions in mind.



Figure 1: Used persuasion principles to increase energy efficient behaviour



## 2.1 GreenSoul questionnaire - Adaptation to new pilot areas

The benefit for Target-CE from the GreenSoul project is to create an approach to affect personal beliefs related to ecological and energy saving and therefor create an improved energy efficient behaviour. Therefor the GreenSoul-model used in Target-CE will be coupled with other selected outcomes in Target-CE and can be applied to citizens, schools, policy makers, etc. The results of the behavioural change aims to affect personal beliefs and the way to improve them.

The outputs from GreenSoul are beeing used in the Target-CE pilot projects by using the GreenSoul intervention strategies to improve the awareness about potential actions to be done towards energy efficiency. Because the suggested interventions/persuasion strategies in GreenSoul were developed for public buildings the use of these actions in the Target-CE pilot action public buildings (offices, schools) is evident.

The first step is to use the questionnaire developed in GreenSoul to determine user behaviour relating to energy efficiency.

### **Action plan: Use of GreenSoul outputs in Target-CE**

#### **Create user profile:**

The GreenSoul questionnaire is used to create user profiles from employees in the target area buildings. This first user profiles will be compared to user profiles at milestone points of the project to determine if the provided interventions had the intended behavioural effect of change towards energy efficient behaviour and therefor help optimize energy consumption.

In the Target-CE pilot actions there is one selected intervention strategy to increase/change energy efficient behaviour.

**Intervention:** Energy saving sticker (at workspace / office entrance / light switches / printers / doors / ...).

Unfortunately other GreenSoul intervention strategies are not applicable in the selected Target-CE pilot action buildings (the GreenSoul App was discontinued after the GreenSoul project ended and is therefore no longer available and an intervention strategy for energy consumption comparisons needs necessary measuring devices which would have had to be installed, which is not possible in Target-CE due to time and also budgeting reasons).

At defined milestone dates (approximately one year after the first questionnaire round) the questionnaire will be used again to determine if the intervention/persuasion strategy had the intended effect on the user´s behaviour and therefore show a more energy efficient behaviour.



### Using the GreenSoul questionnaire:

The GreenSoul questionnaire was developed for office buildings. There is no need to modify the questionnaire specially for Target-CE, other than translating it into the national languages, for other types of buildings (schools / public buildings) because the questionnaire should mainly be used by people who are primarily in these target buildings anyway and are therefore directly or indirectly responsible for the energy consumption in these buildings. Also visitors in public buildings and pupils in school's normally don't have access to / control over heating/cooling and/or lights, equipment and so on, so interventions on this group doesn't affect the long-term energy consumption in the targeted buildings.

### Pilot actions using the GreenSoul solutions:

The GreenSoul behaviour questionnaire combined with the adapted (translated and modified) GreenSoul energy saving stickers is used in 11 public buildings (schools/utilities) in the cross-boarder area of PL & CZ by the PA3 (EUWT/NOVUM) and in one office building (Carmine building in IT) by PA4 (UCBR).

## 2.2 GreenSoul questionnaire - Problems occurred in capitalization

While upstreaming the GreenSoul solutions there were a few obstacles to navigate. First not all intervention strategies from GreenSoul could be adapted to the pilot buildings because, as mentioned before, the GreenSoul app is no longer available and an intervention strategy based on the energy consumption of the building (on room or even floor level) would have needed instalment of measuring devices and the creation of a database to be able to compare the energy data of different timeframes in the pilot buildings. Also due to the Covid-19 situation the energy used in the public pilot buildings is not really comparable with the existing energy data as the working environment has changed (restrictions in public buildings, increased home office, and so on). Also the accessibility to schools during covid was restricted so timing of the intervention strategy "energy saving stickers" was a bit delayed. The gathering of the user profiles through the GreenSoul questionnaire was done through the translated versions (Italian, Czech & Polish) in an online form and could therefore be carried out as planned beforehand.

## 3. Results and examples of tailored tool in new PAs

To use the GreenSoul outputs in Target-CE the following action plan was developed for those project partners who will use the GreenSoul questionnaire in their pilot buildings. After the completion of the 1<sup>st</sup> round of GreenSoul questionnaire the intervention energy saving stickers can be deployed and the intervention phase can begin. After a defined milestone point (a few months after the 1<sup>st</sup> time) the GreenSoul questionnaire will be deployed a 2<sup>nd</sup> time. Meanwhile the data from the different measuring points of the GreenSoul questionnaires will be collected and analysed to create the necessary user profiles and a comparison between the times of measurement in energy related behaviour. This analysis will determine if the set intervention was able to change the energy efficient behaviour among the participating users.





Table 2: Action plan for GreenSoul outputs in Target-CE

time	action	necessary data from PP	Additional information
07/2020	provide GreenSoul questionnaire to PP		
07/2020-01/2021	Translation in native language of PA		
09/2020-03/2021	GreenSoul questionnaire 1 <sup>st</sup> time		after this → setup intervention (energy saving stickers)
04/2020	Analyse GreenSoul data 1 <sup>st</sup> time	Completed 1 <sup>st</sup> GS questionnaires from PP	
11/2021	GreenSoul questionnaire 2 <sup>nd</sup> time		
12/2021	Analyse GreenSoul data 2 <sup>nd</sup> time	All completed GS questionnaires from PP	
01/2022	Complete statistical analysis of the GreenSoul questionnaires and report of the findings		

The users of the pilot buildings in PA3 & PA4 have already completed the first round of the GreenSoul questionnaire. But as we are now in the middle of the implementation/intervention phase, there are no concrete results on how (or if) the strategies have affected user behaviour in the pilot buildings. What can be said is that the differently designed energy saving stickers for the pilot buildings in Italy and Poland/Czech Republic were perceived very positively by the users.



Figure 3 & Figure 4: examples of the PA3 (cross boarder CZ/PL) sticker designs



Figure 5 & Figure 6: examples of the PA3 (cross boarder CZ/PL) sticker designs (in use in the pilot buildings)

The second pilot action (PA4) has also done its own sticker designs, which will be implemented in combination with a big communication campaign in the region in autumn in the pilot building.

## 4. Conclusions

The GreenSoul solutions used in Target-CE is an easy, simple and effective way to change people's behaviour towards energy efficiency in public buildings. The set intervention strategy is easy to implement and use in public buildings. Even visitors should be influenced in their behaviour by the set intervention. But the results are always depending on the willingness to change one's behaviour and how much attention is paid to the intervention strategies. Also after some time the set interventions may lose their appeal and the intervention should be changed/updated with new ones to keep the appeal of the intervention fresh.