



SOCIALWATT

CONNECTING

OBLIGATED PARTIES

TO ADOPT INNOVATIVE SCHEMES TOWARDS
ENERGY POVERTY ALLEVIATION



D3.3

Guidebook for the use of the
SocialWatt tools (1st version)

August 2022



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PREFACE

SocialWatt aims to develop and provide **utilities** and **energy suppliers** with appropriate tools for effectively engaging with their customers and working together towards **alleviating energy poverty**. SocialWatt also enables obligated parties under **Article 7** of the Energy Efficiency Directive across Europe to develop, adopt, test and spread **innovative energy poverty schemes**.

SocialWatt contributes to the following three main pillars:

- 1 Supporting utilities and energy suppliers contribute to the fight against energy poverty through the use of **decision support tools**.
- 2 Bridging the gap between energy companies and social services by promoting collaboration and implementing **knowledge transfer** and **capacity building activities** that focus on the development of schemes that invest in Renewable Energy Sources / Energy Efficiency to alleviate energy poverty.
- 3 **Implementing** and **replicating** innovative schemes to alleviate energy poverty.



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CONNECTING OBLIGATED PARTIES TO ADOPT INNOVATIVE SCHEMES TOWARDS ENERGY POVERTY ALLEVIATION

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Contributors	Apostolis Arsenopoulos, Andriana Stavrakaki, Panagiotis Kapsalis & Konstantinos Koasidis (ICCS)
Reviewer	John Psarras (ICCS)

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Executive Summary

Within the framework of SocialWatt, three decision support tools have been developed to facilitate utilities' efforts to alleviate energy poverty. In particular, these user-friendly tools aim to facilitate utilities identify energy poor households, select the most appropriate energy efficiency and renewable energy actions, design targeted schemes that can be included under their energy efficiency obligation, monitor their effectiveness and evaluate their actual impact.

The purpose of this guidebook is to present the three SocialWatt tools being developed, i.e., SocialWatt Analyser, SocialWatt Plan and SocialWatt Check, as well as provide step by step instructions for their use. Thus, it can be considered as a manual for running the tools, including information on inputs required by each tool and outputs produced when these are run successfully. In addition, it also includes case studies related to the use of the tools and how these have led to the development and implementation of the SocialWatt schemes to alleviate energy poverty, so that other energy stakeholders can benefit from the experienced gained and are encouraged to replicate the innovative schemes developed.

A report specifically focusing on the SocialWatt tools is also available that provides information on the modelling methodology of each tool, data requirements and resources, the development process, the interconnections between the tools, the testing and validation process and the tools configuration.¹

Finally, two further reports are available^{2,3} that present the analysis undertaken by the SocialWatt utilities/energy companies, with the help of the tools, so that energy poor households are identified within customer databases and the suitability of schemes and finance mechanisms to alleviate energy poverty are assessed.

¹ Apostolis Arsenopoulos, Andriana Stavarakaki, Konstantinos Koasidis and Simos Ntanopoulos, *D1.5 SocialWatt Decision Support Tools*, 2022

² Louise Sunderland *et al*, *D2.1 Evaluation of schemes to tackle energy poverty*, 2020

³ Miguel Alves, João Bravo Dias, Andriana Stavarakaki and Apostolis Arsenopoulos *D2.5 Evaluation of schemes to tackle energy poverty by EDP*, 2022

1 INTRODUCTION

SocialWatt, a project funded by the EU's Horizon 2020 Research and Innovation Programme, aims to enable energy suppliers and utilities develop, adopt, implement and spread innovative energy poverty schemes across Europe. More specifically, the project aims to enable energy suppliers and utilities to build their capacity and use tools developed within the framework of the project to effectively engage with their customers and implement schemes that aim to alleviate energy poverty.

This guidebook aims to facilitate the use of the SocialWatt tools as well as the further uptake of innovative schemes targeting energy poverty. Therefore, this guidebook outlines the key features of the tools and helps users benefit from all their functions in order to better target and support energy-poor households.

1.1 THE SOCIALWATT TOOLS

Three different decision support tools have been developed to facilitate utilities/energy companies alleviate energy poverty. More specifically:

- › **SocialWatt Analyser** for identifying energy poor households among clients, based on utilities/energy companies' real energy consumption and cost data as well as other readily available data;
- › **SocialWatt Plan** for evaluating the performance of several actions/schemes and selecting the optimal ones (in terms of cost minimisation and energy savings maximisation) to implement, in order to elaborate Energy Poverty Action Plans; and
- › **SocialWatt Check** for monitoring and assessing the effectiveness of schemes implemented.

Overall, the SocialWatt tools are a set of user-friendly decision support tools, with intelligible features to ensure ease of use. The three tools are designed to be used jointly, in order to support utilities/energy companies efforts to alleviate energy poverty in an integrated manner. Nevertheless, these can also be used independently, to meet specific needs of users.

Figure 1 below illustrates the interplay between the Social Watt tools, where the number of energy poor households identified by SocialWatt Analyser has a key role. This number can be used in SocialWatt Plan (alternatively the user needs to set a target in terms of number of energy poor households to be engaged), along with other data and inputs, in order to provide users with a set of conventional and innovative optimal portfolios, comprising different combinations of schemes to alleviate energy poverty. In this context, SocialWatt Check can utilise the results associated with the optimal portfolios produced by SocialWatt Plan (or alternatively the results of scenarios implemented by utilities/energy companies, if these are not the modelled optimal ones), to evaluate the performance of the schemes, using key performance monitoring indicators, such as CO₂ emission reductions, energy savings, and cost reductions.

Figure 1: The SocialWatt tools



It should be noted that the SocialWatt tools have been developed after following a long process. Model requirements and specifications were developed, the tools were tested by developers and users and consequently, the tools were improved to meet users' needs and offer the necessary flexibility to users. More information on the process and methodology employed is available.⁴

Finally, it should be clarified that the SocialWatt Tools are in compliance with the General Data Protection Regulation 2016/679 (GDPR), as these were developed and tested using anonymised data, respecting data ownership, privacy and security. In addition to this, all three SocialWatt Tools are developed as Desktop Applications, thus each user downloads and uses them locally, so any personal data and information imported and analysed are not shared with any other organisation or stored in any open database or repository.

1.1.1 SOCIALWATT ANALYSER

The aim of SocialWatt Analyser is to help utilities/energy companies identify energy poor households among their clients. It is designed to facilitate users to more effectively target and engage with consumers in actual need.

Therefore, the key objectives of SocialWatt Analyser are:

- › To identify energy poor households amongst utilities/energy companies' customers;
- › To provide in depth information about energy poverty at national, regional and municipal level.

1.1.2 SOCIALWATT PLAN

SocialWatt Plan aims to enable the evaluation of the performance and potential replicability of different schemes considered to tackle energy poverty. This tool facilitates utilities elaborate Energy Poverty Action Plans, by evaluating energy poverty schemes and actions that can help alleviate energy poverty.

Thus, the fundamental objectives of SocialWatt Plan are:

⁴ Apostolis Arsenopoulos, Andriana Stavrakaki, Konstantinos Koasidis and Simos Ntanopoulos, *D1.5 SocialWatt Decision Support Tools*, 2022

- › To enable the evaluation of different energy poverty schemes, which consist of behavioural measures, low and high-cost energy efficiency actions as well as renewable energy sources; and
- › To provide utilities with a set of conventional and innovative optimal portfolios, comprising different combinations of energy poverty schemes (or part of schemes), along with a budget allocation for each scheme and expected number of energy poor households to be involved throughout the examined time horizon. The optimisation process considers a set of customised targets and constraints and aims to minimise the investment cost from the utilities' perspective, as well as to maximise the total energy savings.

1.1.3 SOCIALWATT CHECK

SocialWatt Check aims to assist utilities and other stakeholders effectively monitor and verify schemes being implemented.

The objectives of SocialWatt Check are:

- › To monitor the effectiveness of schemes and evaluate their actual impact, in terms of energy savings, CO₂ emission reductions, energy cost reduction and increase in renewable energy production;
- › To enable utilities track progress, identify in a timely manner risks/threats, exploit opportunities and safely meet targets in a sustainable way; and
- › To predict the long-term impact of the examined schemes based on their current performance, using special extrapolation methods.

2 SOCIALWATT ANALYSER

2.1 STEP BY STEP INSTRUCTIONS

2.1.1 STEP 1 INSTALLING THE TOOL

In order for the user to successfully install and run SocialWatt Analyser at a personal/work computer, a cloud-based repository is required. The docker hub has been selected for this purpose.⁵ It should be noted that the user must select and install the most appropriate version of docker, according to the computer's specifications (e.g., software - Windows, Mac, Ubuntu).

Once the docker is installed successfully, the user should follow the instructions below:

1. Open PowerShell/command prompt (Windows user) or Open terminal (Mac and Ubuntu users)
2. Execute the following command:

```
docker run --rm -d --publish 1313:8000 socialwatt/socialwatt_analyser:latest
```

Important note: Port 1313 can be any port the user prefers.

3. Once the following screen appears (Figure 2), the user should open the browser and paste the link: <http://localhost:1313/>

Figure 2: Successful installation command window for SocialWatt Analyser



```
> docker run --rm -d --publish 1313:8000 socialwatt/socialwatt_analyser:latest
Unable to find image 'socialwatt/socialwatt_analyser:latest' locally
latest: Pulling from socialwatt/socialwatt_analyser
afb6ec6fdc1c: Pull complete
2cf47e503ea9: Pull complete
9c34fc54941b: Pull complete
10f0f49e307b: Pull complete
37894e158256: Pull complete
62d0afacb630: Pull complete
9e672829ea5b: Pull complete
2fa008471baa: Pull complete
4cdea5d7f07e: Pull complete
263a07509036: Pull complete
Digest: sha256:298120bbd7d1a386fc29a0f2b166ea51c12f9f07833a569750197c8ebee23c57
Status: Downloaded newer image for socialwatt/socialwatt_analyser:latest
c48caf439dc566aa8b2d44baea3c291d27ef0d1f93287dee75660007571bfd4a
```

4. The user should be able to access the SocialWatt Analyser application.

In order to re-access SocialWatt Analyser, the docker should be running and the link <http://localhost:1313/> should be used.

Finally, when a new version of the tool is available, the user should follow the following steps:

1. Execute the command **docker ps -a** in the PowerShell/command prompt or terminal

⁵ Detailed information on how to install docker hub can be found at: <https://docs.docker.com/engine/install/>

2. Identify the **CONTAINER ID**. It should be found by the name **socialwatt/socialwatt_analyser:latest**
3. In case there is no container ID with this name, execute the following command:


```
docker rmi socialwatt/socialwatt_analyser:latest
```
4. Stop the container by executing the following command:

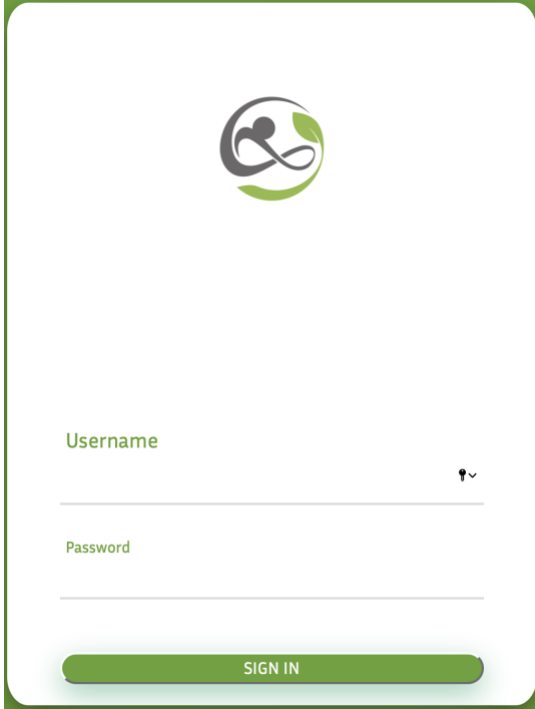

```
docker stop <CONTAINER ID>
```
5. Delete the old version of SocialWatt Analyser by executing the following command:


```
docker rmi socialwatt/socialwatt_analyser:latest
```
6. Install the latest version of SocialWatt Analyser by following the abovementioned steps, starting from Step 3.

2.1.2 STEP 2 LOGIN TO THE TOOL

Once the SocialWatt Analyser is installed successfully, the user should enter his/her credentials in order to login.

Figure 3: Accessing SocialWatt Analyser



Currently, there is a common username and password for all users of the tool. Users cannot create a new account on their own, so they should use the following credentials in order to login:

Username: admin

Password: admin

Prior communication with the developers of the tool (ICCS) is required to obtain a personalised username and password.

2.1.3 STEP 3 SELECTING YOUR SETTINGS

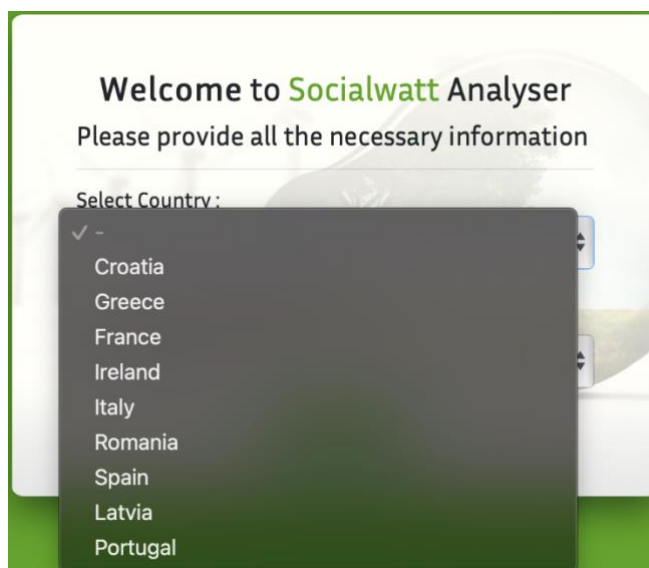
After accessing the SocialWatt Analyser, the user is asked to specify the following inputs, by providing the necessary data in order to continue with the analysis. The following step-by-step approach will explain in detail what is required by the user.

Select a Country

The first field that should be completed by the user is the country for which the analysis will be conducted. Currently, nine (9) countries have been incorporated into the tool. More specifically:

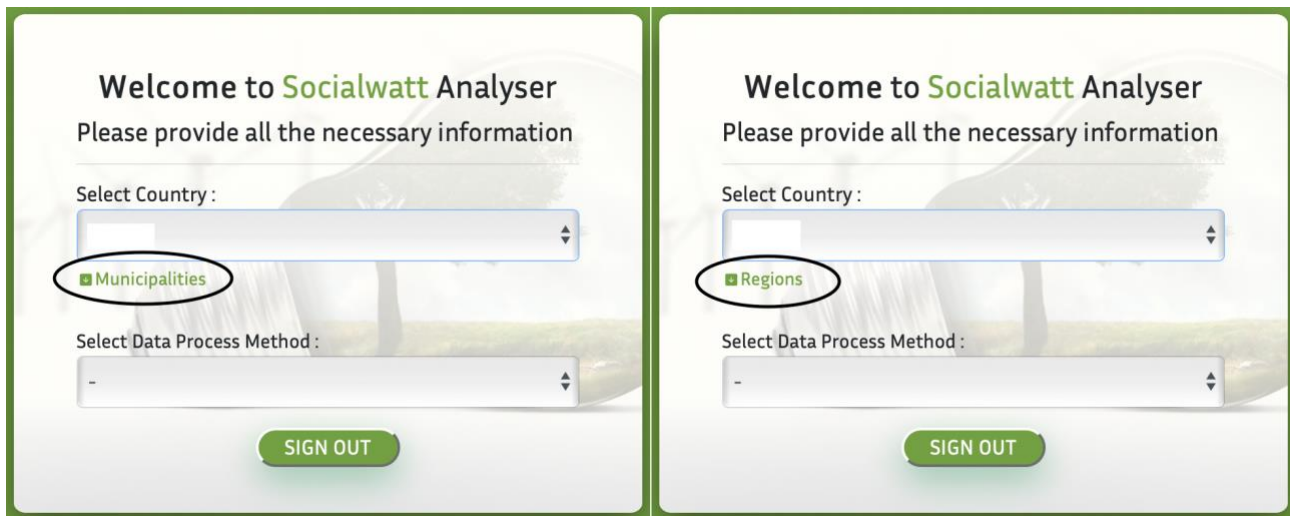
- > Croatia;
- > Greece;
- > France;
- > Ireland;
- > Italy;
- > Romania;
- > Spain;
- > Latvia; and
- > Portugal

Figure 4: Country selection in SocialWatt Analyser



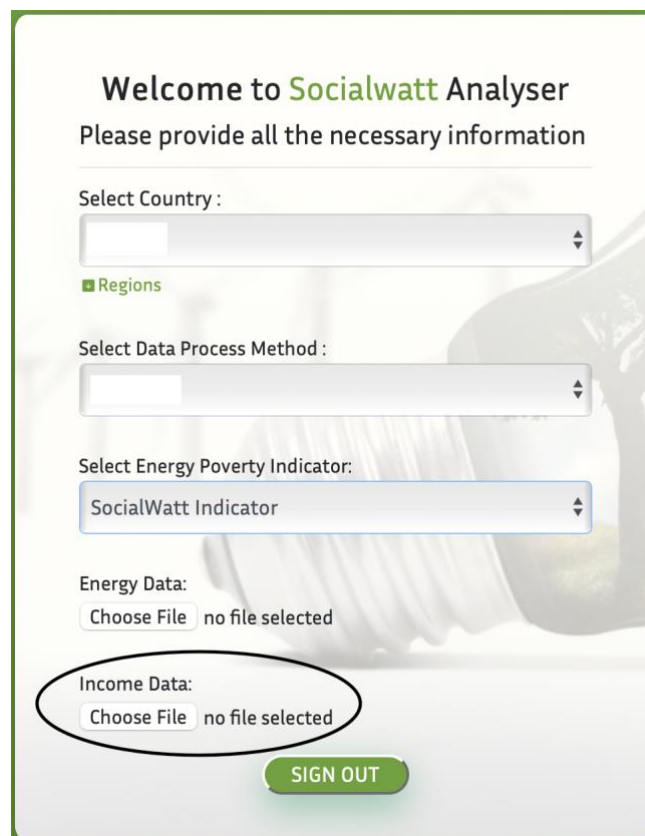
When a specific country is selected, a pop up 'Regions' icon appears, along with a download button. This functionality enables users to download a .csv file of the selected country's regions and provide the income per capita for each region. In some cases, the 'Regions' icon may be replaced with a 'Municipalities' icon, or a 'Counties' icon, or even a mix of them (e.g., 'Municipalities/Regions') in order to provide further flexibility and allow the user to enter the income per capita at municipal or country level, when such data are available.

Figure 5: Income per capita downloadable files in SocialWatt Analyser



The completed income-related .csv file should be imported in SocialWatt Analyser as indicated in Figure 6 below. This screen will appear once the user has selected the Data Process Method and the Energy Poverty Indicator (please see below for further instructions on these inputs).

Figure 6: Import income per capita file in SocialWatt Analyser



It should be noted that the user may continue with the rest of the analysis without downloading and completing any of these files (i.e., Regions, Municipalities, Counties, etc.). However, in this case, income data need to be provided in the tool at national level.

Select a Data Process Method

Once the country for the analysis has been selected, the user should select the data import and process method from the respective drop-down menu (see Figure 7). Ten (10) process methods have been integrated into the tool so far. Each one of them has been developed based on a different set of input data from a pre-defined list, structured in columns accordingly. The user can check the type and structure of input data incorporated in each method. A green tick indicates that this type of data is used by the selected method, a red ban sign indicates that such data are not considered by the method (Figure 8).

Figure 7: Data process method selection in SocialWatt Analyser

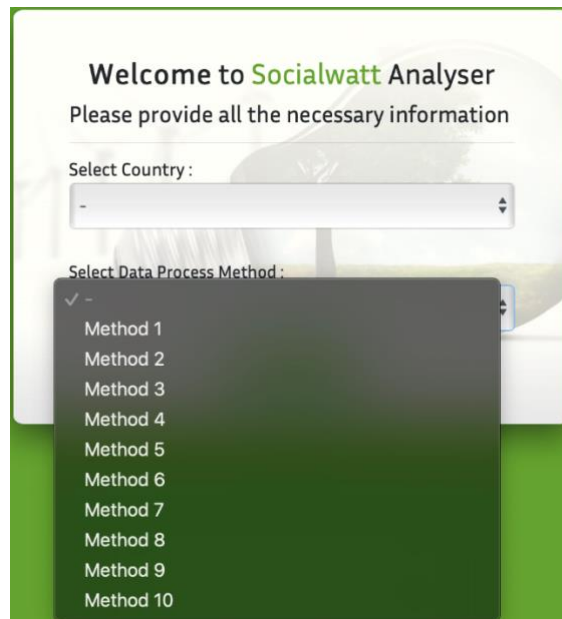


Figure 8: Example of data input types per data process method in SocialWatt Analyser

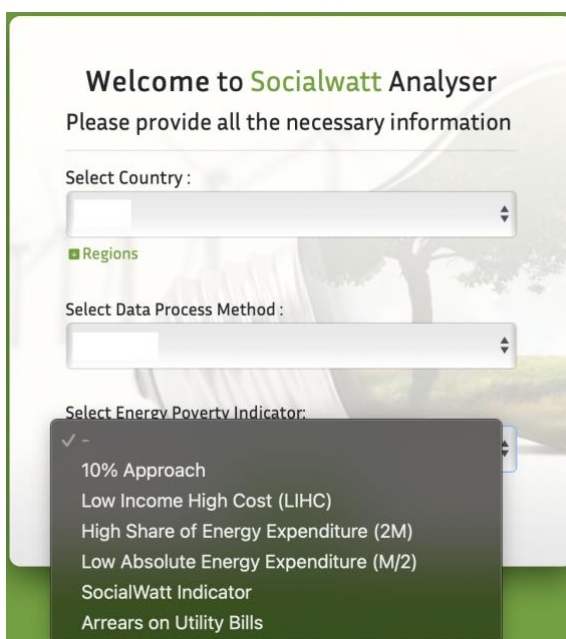
Method 2 Data input			Method 6 Data input		
Data	Required	Column	Data	Required	Column
Customer ID	✓	A	Customer ID	✓	A
Electricity consumption	✓	E	Electricity consumption	✓	D
Natural gas consumption	✗	-	Natural gas consumption	✗	-
Type of invoice	✓	B	Type of invoice	✓	I
Total cost	✓	K	Total cost	✓	M
Date of Measurement	✓	C	Date of Measurement	✗	-
Municipality	✓	D	Municipality	✗	-
Province	✗	-	County	✓	B
Region	✗	-	Region	✗	-
Floor area	✗	-	Floor area	✗	-
Year of construction	✓	J	Year of construction	✗	-
Number of residents	✗	-	Number of residents	✗	-
Payment frequency	✗	-	Payment frequency	✗	-
Age of customer	✗	-	Age of customer	✗	-
Overdue Debt	✓	F	Overdue Debt	✗	-

Select an Energy Poverty Indicator

Subsequently, the user should specify the Energy Poverty Indicator to be used in the analysis. Several indicators have been integrated in SocialWatt Analyser, that is to say:

- › 10% approach;
- › Low Income High Cost (LIHC);
- › High Share of Energy Expenditure (2M);
- › Low Absolute Energy Expenditure (M/2);
- › SocialWatt Indicator; and
- › Arrears on utility bills

Figure 9: Selection of an Energy Poverty Indicator in SocialWatt Analyser



The screenshot shows the 'Welcome to Socialwatt Analyser' screen. It prompts the user to 'Please provide all the necessary information'. There are three dropdown menus: 'Select Country:', 'Select Data Process Method:', and 'Select Energy Poverty Indicator:'. The 'Select Energy Poverty Indicator:' dropdown is open, showing a list of options: '10% Approach', 'Low Income High Cost (LIHC)', 'High Share of Energy Expenditure (2M)', 'Low Absolute Energy Expenditure (M/2)', 'SocialWatt Indicator', and 'Arrears on Utility Bills'. A green 'Regions' button is also visible below the 'Select Country:' dropdown.

Once the user has selected the Energy Poverty Indicator, a new tab appears allowing the user to customise crucial parameters that are closely associated to the specified indicator. Furthermore, an 'info' tab is available, with brief descriptions of the aforementioned parameters to increase clarity and facilitate the analysis process.

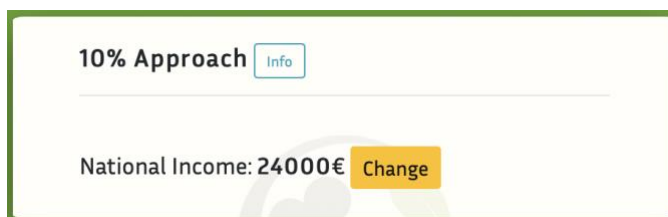
10% Approach

A household is classified as energy poor if it needs to spend more than 10% of its income on energy expenditure to maintain an adequate level of thermal comfort.

If the 10% approach is selected, the user can customise the national income per capita parameter accordingly or continue with the default value (Figure 10). The 'info' button provides a detailed description of this energy poverty indicator.

However, if an income-related data file of any level (i.e., regional, municipal or county) has been imported at the previous step, then the national income per capita value entered, is not used in the analysis. The exception to this is when a municipality/region/county in the imported file does not have a value assigned, in which case the national income per capita is used.

Figure 10: The 10% approach in SocialWatt Analyser



Low Income High Cost (LIHC)

A household is classified as energy poor if its actual energy costs are above the national average level and its residual income (i.e., energy costs subtracted from income) is below the official poverty line.

If LIHC is selected, the user can customise the national income per capita, the national poverty line and the national average energy cost (Figure 11). The 'info' button provides a detailed description of this energy poverty indicator.

Figure 11: The LIHC indicator in SocialWatt Analyser



The national poverty line represents the context-specific minimum income level required to meet basic needs. The national average energy cost represents the average amount of money that households in the selected country spend on energy.

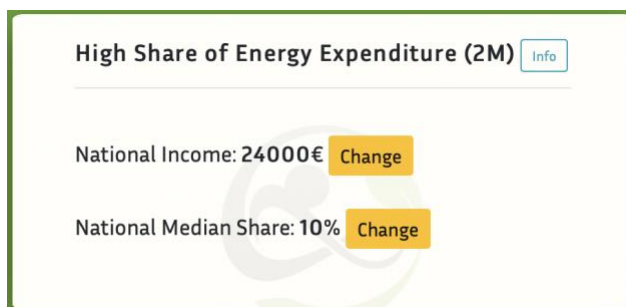
It should be noted that, if the user does not enter any values for these parameters, the respective default value is considered in the analysis (the default value is shown when the specific tab opens). Regarding the national income parameter, if an income-related data file of any level (i.e., regional, municipal or county) has been imported at the previous step, then the national income per capita value entered, is not used in the analysis. The exception to this is when a municipality/region/county in the imported file does not have a value assigned, in which case the national income per capita is used.

High Share of Energy Expenditure (2M)

A household is classified as energy poor if its share of energy expenditure in income is more than twice the national median share.

If 2M is selected, the user can customise the national income per capita and the national median share percentage (Figure 12). The latter represents the share of income (%) spent on energy. The 'info' button provides a detailed description of this energy poverty indicator.

Figure 12: The 2M indicator in SocialWatt Analyser



High Share of Energy Expenditure (2M) [Info](#)

National Income: 24000€ [Change](#)

National Median Share: 10% [Change](#)

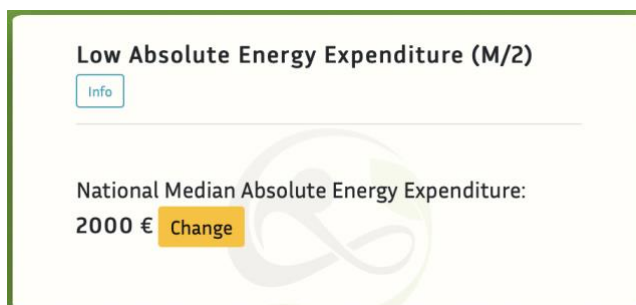
It should be noted that if the user does not enter any values for these parameters, the default values are considered in the analysis (the default values are shown when the specific tab opens). Regarding the national income parameter, if an income-related data file of any level (i.e., regional, municipal or county) has been imported at the previous step, then the national income per capita value entered, is not used in the analysis. The exception to this is when a municipality/region/county in the imported file does not have a value assigned, the national income per capita is used.

Low Absolute Energy Expenditure (M/2)

A household is classified as energy poor if its absolute energy expenditure is below half the national median.

If the M/2 indicator is selected, the user can customise the national median absolute energy expenditure, which represents the absolute costs spent on energy (Figure 13). The 'info' button provides a detailed description of this energy poverty indicator.

Figure 13: The M/2 indicator in SocialWatt Analyser



Low Absolute Energy Expenditure (M/2) [Info](#)

National Median Absolute Energy Expenditure:
2000 € [Change](#)

It should be noted that if the user does not enter any values for this parameter, the default value is considered in the analysis (the default value is shown when the specific tab opens).

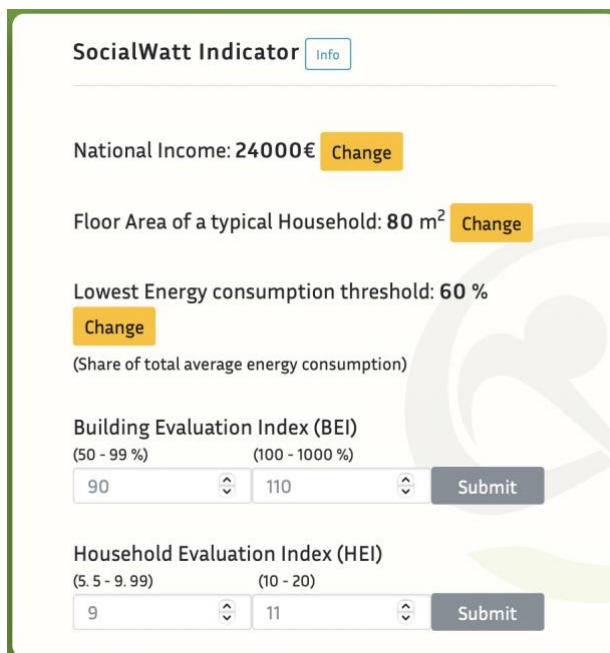
SocialWatt Indicator

If the actual energy consumption of a household is lower than the theoretically required for maintaining thermal comfort, the household is classified as energy poor. Otherwise, the ratio between energy cost and income is taken into consideration.

Given that energy poverty is linked to dwelling characteristics and income, a new energy poverty indicator was developed within the framework of SocialWatt, in an attempt to consider both variables. The 'SocialWatt Energy Poverty Indicator' deconstructs energy poverty using two core factors (i.e., energy needs and poverty) and examines them jointly. The 'info' button provides a detailed description of this energy poverty indicator.

The SocialWatt Indicator requires the user to enter values for a number of parameters, shown in figure 14 below.

Figure 14: The SocialWatt Energy Poverty Indicator in SocialWatt Analyser



SocialWatt Indicator [Info](#)

National Income: 24000€ [Change](#)

Floor Area of a typical Household: 80 m² [Change](#)

Lowest Energy consumption threshold: 60 %
[Change](#)
(Share of total average energy consumption)

Building Evaluation Index (BEI)
(50 - 99 %) (100 - 1000 %)

90 110 [Submit](#)

Household Evaluation Index (HEI)
(5.5 - 9.99) (10 - 20)

9 11 [Submit](#)

The typical floor area refers to the average floor area of the country's building stock.

The minimum energy consumption threshold is entered as a share of the total average actual energy consumption of all households included in the energy data. This parameter ensures that a dwelling that is not used at all or that is used as a secondary residence (e.g., during holidays), and as a result its actual energy consumption is by default lower than the theoretically required to maintain thermal comfort, is not wrongly classified as 'energy poor'.

The Building Evaluation Index (BEI) compares the actual energy consumption of a household to the latter's modelled energy needs. In this respect:

- > If a household's actual energy consumption is below the minimum BEI threshold, then the household is classified as 'Energy Poor';
- > If a household's actual energy consumption is between the minimum and the maximum BEI thresholds, then the household is classified as 'At risk of poverty'; and
- > If a household's actual energy consumption is greater than the maximum BEI threshold, then and only then, the analysis moves on to the next stage ('HEI index').

Example of the Building Evaluation Index (BEI)

Consider a household with the following data:

- Energy needs = 1000 kWh
- Actual energy consumption = 999.9 kWh
- Minimum energy consumption threshold = 599.94 kWh

Assuming the following BEI thresholds (share of energy needs) were selected:

- Minimum BEI threshold = 100% \Rightarrow 1000 kWh
- Maximum BEI threshold = 100% \Rightarrow 1000 kWh

Then, the household would be classified as: "Energy Poor", as actual energy consumption (999.9 kWh) would be smaller than the minimum BEI threshold (1000 kWh) and, at the same time, higher than the lowest energy consumption threshold set.

For the same household, if the minimum and maximum BEI thresholds were changed, then the final classification of the household could also change. For example:

- Minimum BEI threshold = 90% \Rightarrow 900 kWh
- Maximum BEI threshold = 110% \Rightarrow 1100 kWh

In this case, the household would be classified as: "At risk of poverty", as its actual energy consumption would be greater than the minimum BEI threshold and lower than the maximum BEI threshold, and, at the same time, higher than the lowest energy consumption threshold set.

The Household Evaluation Index (HEI) considers a household income and energy costs. It has been designed to further consider customers that have not been classified as energy poor based on the BEI index. In this respect:

- › If a household spends less money on energy than the minimum HEI threshold (expressed as a share of income), then it is classified as 'Non-energy poor';
- › If a household's energy costs are between the minimum and maximum HEI threshold, then it is classified as 'At risk of poverty'; and
- › If a household spends more money on energy than the maximum HEI threshold, then it is classified as 'Energy poor'.

Example of the Household Evaluation Index (HEI)

If the abovementioned household was classified as “Further Analysis – HEI”, then the analysis would move on to consider total energy costs and income.

Assuming the following input data were entered:

- Income per capita = 20000 €
- Total energy costs = 1600 € (derived for this specific household from the energy data file imported)
- (Energy costs/Income) calculation: $1600/20000 = 8\%$

Assuming the following HEI thresholds (share of income per capita) were also selected:

- Minimum HEI threshold = 9%
- Maximum HEI threshold = 11%

The household would be classified as “Non-Energy Poor”, as (energy costs/Income) indicator (8%) is lower than the minimum HEI threshold (9%).

It should be noted that if the user does not enter values for these parameters, the default values are considered in the analysis (the default values are shown when the specific tab opens). Regarding the national income parameter, if an income-related data file of any level (i.e., regional, municipal or county) has been imported at the previous step, then the national income per capita value entered is not used in the analysis. The exception to this is when a municipality/region/county in the imported file does not have a value assigned, the national income per capita is used.

Arrears in Utility Bills

A household is classified as energy poor if it has arrears on utility bills

If this energy poverty indicator is selected, then there are no parameters that need to be entered by the user (as all information required is incorporated in the energy data imported).

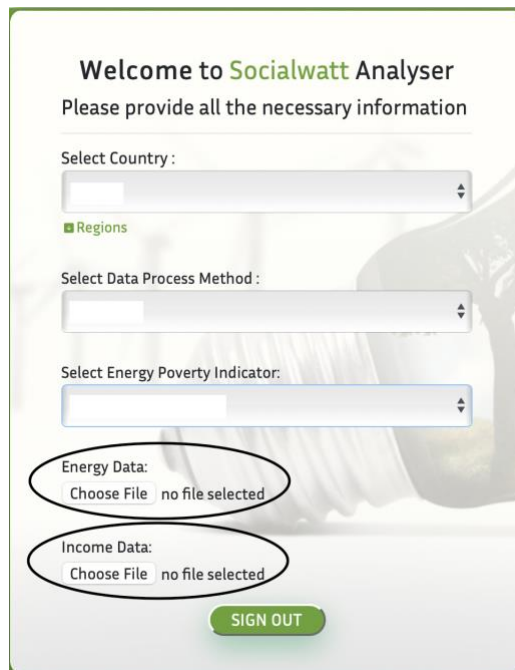
Import input files

Once the energy poverty indicator has been selected, the user should import the .csv file with the energy data to be analysed. It is important to note that the file imported must be customised and structured to match the data process method selected (i.e. data types structured so as to match the columns indicated by the data process method selected).

“Method 10”, is designed to handle all types of available data, as long as data imported are structured to match the columns indicated by the data process method. In this case only, data with a “check mark” in the respective pop up window may be disregarded if the user does not intend to provide such information).

Finally, the user can select to import income data (at regional, local or county level).

Figure 15: Import input data in SocialWatt Analyser



Welcome to Socialwatt Analyser
Please provide all the necessary information

Select Country :

 ■ Regions

Select Data Process Method :

Select Energy Poverty Indicator:

Energy Data:
 Choose File no file selected

Income Data:
 Choose File no file selected

SIGN OUT

2.1.4 STEP 4 RESULTS

Once the user has provided all the required information, the 'Analyse' button should be clicked to initiate the Energy Poverty Analysis.

Figure 16: Analyse button in SocialWatt Analyser



After the analysis is completed, the following screen appears.

Figure 17: Results in SocialWatt Analyser



The results are presented in the form of graphs, and include statistics on energy poverty allocation. Graphs can be downloaded or printed or viewed in full screen. The user can select the level of analysis (national, regional etc.) by clicking the first drop-down menu in the left-hand side of the screen. If the user has provided data for more than one year, the second drop down menu enables him/her to select the year to be presented.

Moreover, depending on the input data, especially the energy data imported, the user can further customise the analysis and obtain additional results, such as energy poverty allocation by:

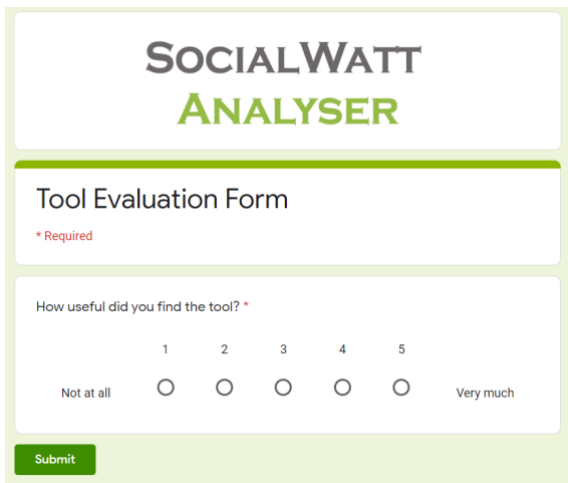
- › Year of construction of dwellings;
- › Floor Area of dwellings; and
- › Number of residents per household.

Finally, the user can download the data in a .csv file format. The downloadable file includes

detailed information about each customer and their energy poverty status (i.e., Energy Poor (EP), Non-Energy Poor (NEP), At risk of poverty (ARP)) across the years (if the user provides data for more than a year).

After the analysis has been completed, the user has the opportunity to evaluate the tool, as shown in figure 18 below, via the tab "Evaluate" on the right-hand side on the top of the screen (see previous figure).

Figure 18: Evaluation Form for SocialWatt Analyser



2.1.5 MOCK EXAMPLE

This section presents an example of using SocialWatt Analyser in order to enhance clarity in configuring the tool and interpreting the results. As such, the following input data were selected:

- › Selection of country: *France*
- › Selection of a data process method: *Method 7* (this method covers the type of data the user has)
- › Select an Energy Poverty Indicator: *SocialWatt indicator*
Indicator's input requirements: *Default values* (note: a file will be imported with income data per region, therefore the national income per capita value is not considered in the analysis).
- › Import Input data:
A *.csv file was imported with energy data* (i.e., data the utility/user has with the energy consumption and costs of customers) re-structured to meet the requirements of the data process method selected.
The *'Regions'* button was selected (below the country selection field), in order to download and complete the.csv file with income per capita per region.
A *.csv file was imported with income data* (at a regional level).
- › Run SocialWatt Analyser: *Analyse*

Figure 19: Example of using SocialWatt Analyser

Welcome to Socialwatt Analyser
Please provide all the necessary information

Select Country: France

Select Data Process Method: Method 7

Select Energy Poverty Indicator: SocialWatt Indicator

Energy Data: Choose File no file selected

Income Data: Choose File no file selected

SIGN OUT

SocialWatt Indicator Info

National Income: 24000€ Change

Floor Area of a typical Household: 80 m² Change

Lowest Energy consumption threshold: 60 % Change
(Share of total average energy consumption)

Building Evaluation Index (BEI)
(50 - 99 %) (100 - 1000 %)

90 110 Submit

Household Evaluation Index (HEI)
(5.5 - 9.99) (10 - 20)

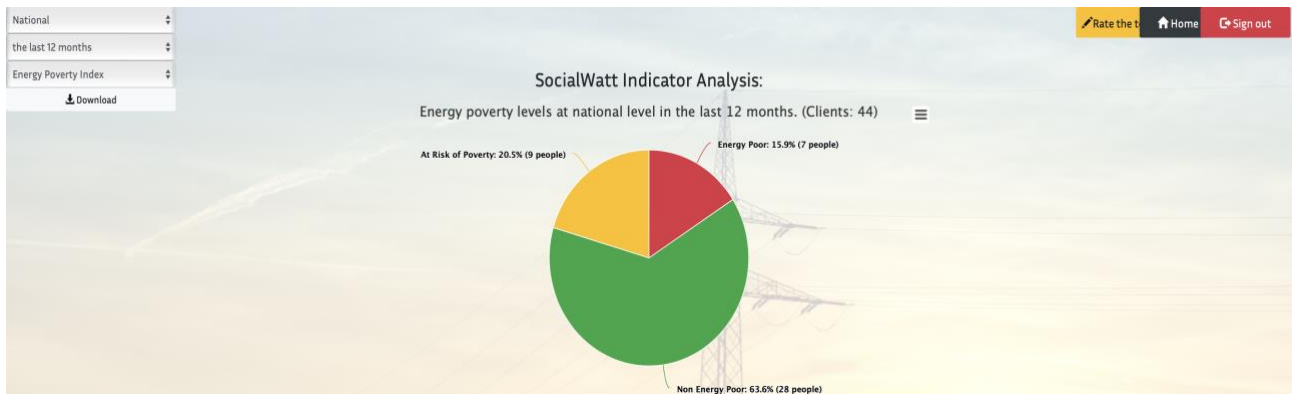
9 11 Submit

Method 7 Data input

Data	Required	Column
Customer ID	✓	A
Electricity consumption	✓	K
Natural gas consumption	✓	L
Type of energy	✓	J
Type of invoice	✓	Q
Total cost	✓	P
Date of Measurement	✗	-
Municipality	✗	-
Province	✗	-
Region	✓	H
Floor area	✓	G
Year of construction	✓	F
Number of residents	✓	D
Payment frequency	✓	T
Age of customer	✗	-
Overdue Debt	✗	-

The results are presented in the form of graphs that indicate the energy poverty allocation at national level in the last 12 months. Energy poor households are presented in red colour and non-energy poor ones in green.

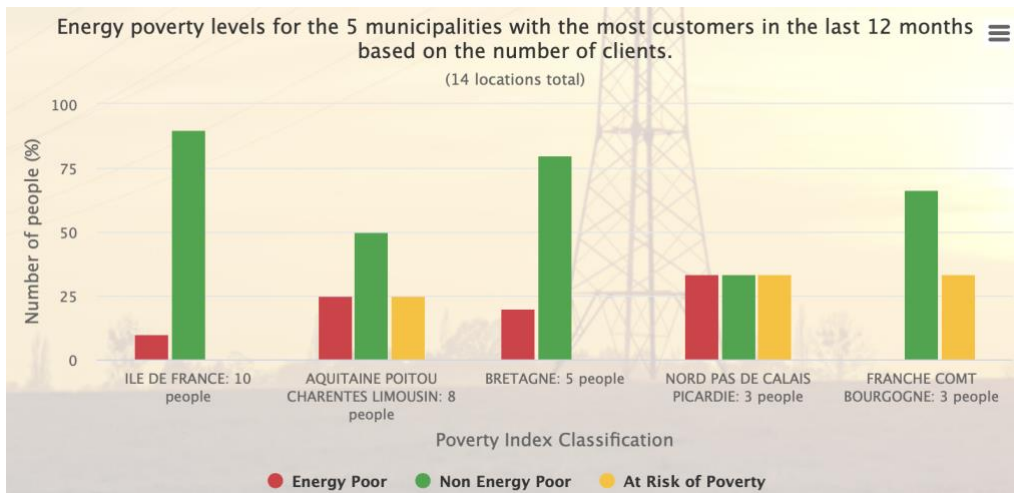
Figure 20: Mock results from SocialWatt Analyser



Results are also presented per municipality, as shown in the figure below. For example, in the Ile de France region, among the 10 households included in the analysis, 90% are characterised as Energy Poor, while only 10% as Non Energy Poor. ⁶

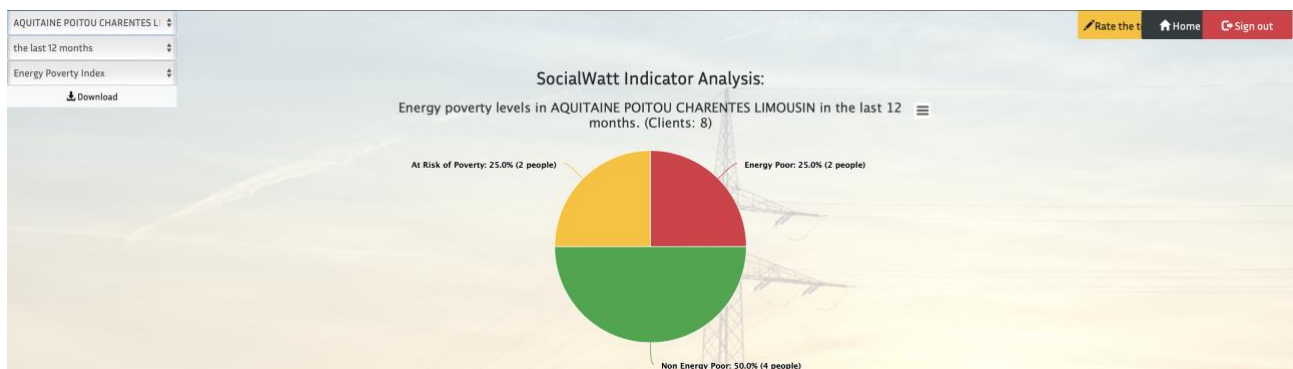
⁶ Numbers are illustrative and based on mock data.

Figure 21: Mock results per municipality from SocialWatt Analyser



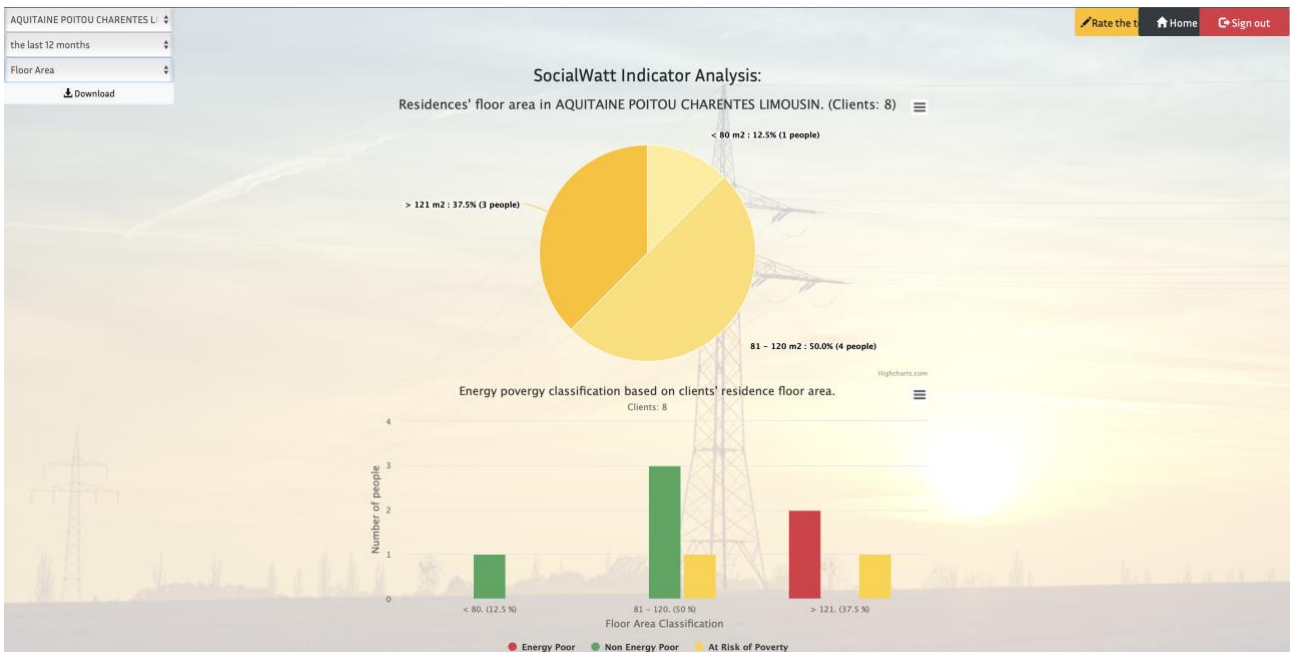
Results can also be viewed per municipality, by using the first drop-down list on the left-hand side of the screen.

Figure 22: Mock results for a municipality from SocialWatt Analyser



Further options are available by using the third drop-down menu on the left-hand side of the screen. For instance, figure 23 below presents the results per year of construction of dwellings.

Figure 23: Mock results from SocialWatt Analyser per year of construction of dwellings



By selecting the 'Download' button at the end of the drop-down menu on the left-hand side of the screen, the user can download a file in .csv format with detailed results per household.

Figure 24: Mock results per household from SocialWatt Analyser

1	Customer	Year	Annual Energy Consumption (kwh)	Annual Energy Cost	Poverty Index	Location	Floor Area	Number of Residents
2	1	last 12 months	29567.39	4179	EP	AQUITAINE POITOU CHARENTES LIMOUSIN	220	2
3	2	last 12 months	59932.53	842	EP	LANGUEDOC ROUSSILLON MIDI PYRNES	200	2
4	3	last 12 months	15247.31	787	EP	BRETAGNE	89.9	2
5	4	last 12 months	19484.64	3164	EP	AQUITAINE POITOU CHARENTES LIMOUSIN	260	2
6	5	last 12 months	16766.56	942	EP	CENTRE	81.81	1
7	6	last 12 months	31878.23	2484	EP	FRANCHE COMT BOURGOGNE	61	2
8	7	last 12 months	24825.64	354	EP	ILE DE FRANCE	62	2
9	8	last 12 months	35062.14	4823	EP	RHNE ALPES AUVERGNE	210	2
10	9	last 12 months	20388.16	1430	EP	ILE DE FRANCE	69	6
11	10	last 12 months	7727.28	882	NEP	BRETAGNE	79	2
12	11	last 12 months	26570.53	1385	EP	AQUITAINE POITOU CHARENTES LIMOUSIN	100	2
13	12	last 12 months	36639.3	3425	EP	NORD PAS DE CALAIS PICARDIE	87.88	1
14	13	last 12 months	12177.91	1062	NEP	PAYS DE LOIRE	73.37	1
15	14	last 12 months	25905.07	2327	EP	NORMANDIE	143.27	3
16	15	last 12 months	12074.09	1652	NEP	AQUITAINE POITOU CHARENTES LIMOUSIN	137	4
17	16	last 12 months	16464.13	1184	EP	FRANCHE COMT BOURGOGNE	80	1
18	17	last 12 months	16811.77	1118	EP	CHAMPAGNE LORRAINE ALSACE	90	4

2.2 CASE STUDIES

SocialWatt Analyser has enabled SocialWatt utility partners to analyse their customer data in order to identify levels of energy poverty within their customer base and which households are likely to be suffering energy poverty. It has also enabled the partners to test the suitability and sensitivity of the different commonly used indicators of energy poverty for their context. SocialWatt partners have also used the tool to identify geographical regions that are likely to have a higher concentration of energy-poor households in order to focus area-based schemes. Key findings from the analysis are presented in this section.

Croatia

Scope: HEP ESCO is an energy service company, so it does not have direct access to a full customer database. As such, two datasets with a very limited number of customers were analysed, one of “regular” customers and one of “vulnerable energy” customers defined according to national criteria.

Output: Interestingly, when using the 10% and the 2M indicator, which both heavily rely on average income data, **a high number of households were found to spend more than 10% of national average income on energy** to maintain an adequate level of thermal comfort, and thus were identified as energy poor. When using the M/2 indicator, which does not rely on income data, approximately 40% of “vulnerable energy” customers and less than 2% of “regular” customers were identified as energy poor. This suggests that **a considerable number of households spend on electricity more than half of the national median.**

Greece

Scope: PPC focused on analysing “vulnerable” customers, as defined by national law, from its customer database, using all six energy poverty indicators incorporated in the tool.

Output: Notably, **the SocialWatt indicator identified more than 85% of vulnerable customers as energy poor**, which is in line with expectations, as one would expect that a high percentage of vulnerable households are also energy-poor households. On the other hand, most other indicators identified less than 30% of vulnerable customers as energy poor. **Further analysis of the results has revealed the importance of using correct input parameters and accurate data when using these indicators.** For example, for most indicators using income data, low percentages can be explained by the fact that the national average income used in the analysis is not representative of vulnerable customers. In addition, the LIHC indicator identified households as energy poor if they spent more than €2,000 on electricity, revealing an inherent limitation of this indicator, when using national average income, instead of actual income, to which actual energy costs (and in this case only electricity costs) are subtracted to identify households below the national poverty line.

Italy

Scope: eVISO used the SocialWatt indicator to identify energy poor households, within its' direct customers and the customers of its' resellers.

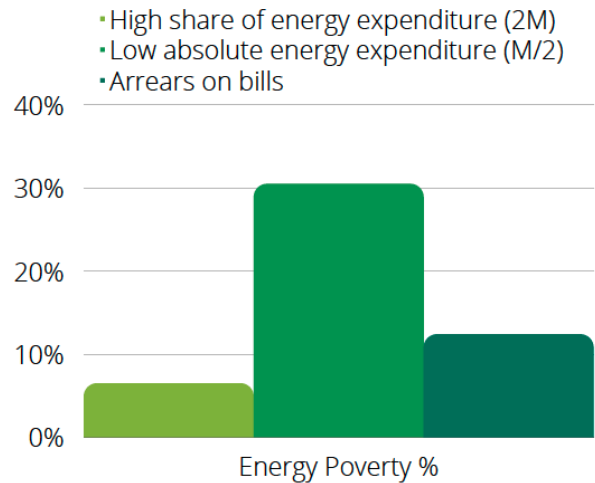
Output: Overall, **approximately 22% of all customers were identified as energy poor, with a further 4% identified as at risk of energy poverty.** Moreover, a sensitivity analysis revealed that a small change in the lowest energy consumption parameter, which is designed to exclude properties that are infrequently/not occupied or used as holiday homes, has a large impact on the energy poverty assessment. For instance, decreasing the parameter

from 10% to 5% leads to an increase of 21% in energy-poor households. On the other hand, a strong correlation between the number of energy-poor households in eVISO's customer base in a region with the average income of that region was not shown. Finally, **the impact of the COVID-19 pandemic was also examined**. Notwithstanding a small variation in absolute customer numbers, **the percentage of energy-poor households increased by 10%** when the first semester of 2020 was included in the analysis, reflecting changes in energy consumption in households during lockdown. In conclusion, **SocialWatt Analyser could be very effective at tracking households' energy poverty history over time**.

Latvia

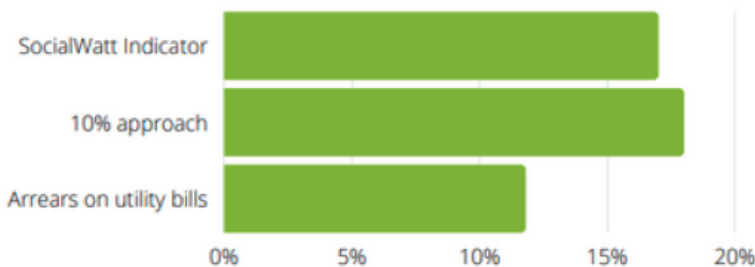
Scope: GREN Jelgava used all six energy poverty indicators incorporated in the tool to identify energy poor customers. However, it should be noted that GREN Jelgava is a district heating provider, where energy consumption is typically measured at the building level, and as such it has limited data on end users' and households' energy consumption for the analysis.

Output: The indicators that rely on the use of income data (i.e. 10% and LIHC), in combination with the fact that only heat consumption data and not total energy consumption were used, did not return any results. **The 2M indicator identified 6.5% of customers as energy poor, whilst 12% of households were found to have arrears on utility bills** for a period of 30 days or more. By contrast, **the results for the M/2 indicator show that about a third of households spend below half the average district heating costs**, thus are considered energy poor. Taking into account data gaps and data limitations, arrears on utility bills could be the most suitable method for identifying energy-poor households for GREN Jelgava.



Romania

Scope: CEZ Vanzare used five of the energy poverty indicators incorporated in the tool to identify energy poor customers. CEZ Vanzare customer data were analysed, which included customers on regulated prices.



Output: **The SocialWatt indicator and the 10% approach identified about a fifth of customers as energy poor**, whilst **arrears on utility bills identified approximately 12% of households as energy poor**. In addition, the LIHC and 2M

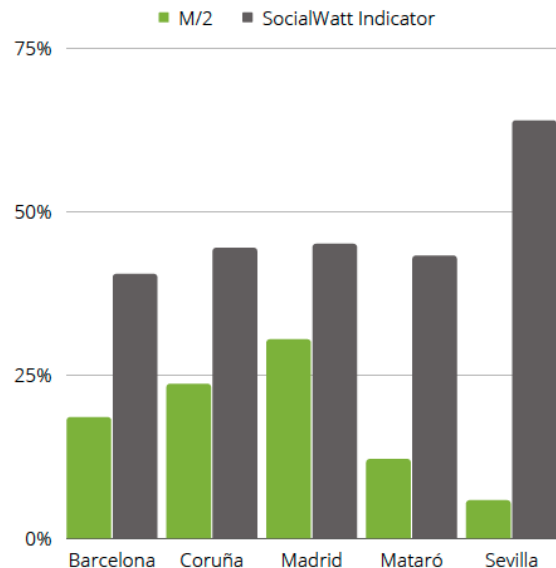
indicators identified a very low number of customers as energy poor. Once again, the limitations of the LIHC indicator were revealed, as it identified households as energy poor when energy costs were higher than €4,200. On the other hand, the low number of energy-poor households identified when using the 2M indicator implied that **for the vast majority of**

energy-poor households identified under the 10% approach, **the share of energy expenditure in income is between 10% and 16%.**

Spain

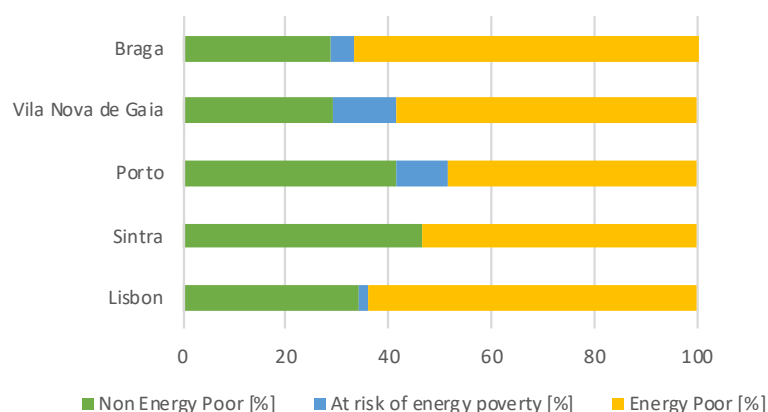
Scope: NATURGY used five of the energy poverty indicators incorporated in the tool to identify energy poor customers. NATURGY included in the analysis customer data from five cities (i.e. Barcelona, Coruña, Madrid, Mataró and Sevilla), for which the company provided both gas and electricity.

Output: Income-based indicators (i.e. 10%, 2M and LIHC) identified a very low number of households as energy poor. Interestingly though, **the M/2 identified up to a third of customers as energy poor, depending on the city.** This indicator **was considered more suitable for identifying energy poor households in Spain,** although less suitable for Madrid, which can be explained by the fact that Madrid has many district heating systems and NATURGY does not capture such heating costs in its customer database (natural gas is used for cooking purposes only by these households).



Portugal

Scope: EDP focused on direct customers included in the Social Tariff from its customer database, using two of the energy poverty indicators incorporated in the tool: M/2 and the SocialWatt indicator. These indicators were selected as they do not rely on income data or in the case of the SocialWatt indicator the analysis is not driven by income data.



Output: **When using the SocialWatt indicator, about 56% of customers were identified as energy poor** with a further 3% identified as at risk of energy poverty. Interestingly, when using the M/2 indicator, 82% of customers that receive a social tariff were identified as energy poor. This means that **about a fifth of these households spend above half the national median electricity**

costs. These estimates are in line with expectations, i.e. that a high percentage of households under the Social Tariff are also energy poor households.

Overall, from the experience of the SocialWatt partners using SocialWatt Analyser the following key lessons learnt have been extracted:

- › There is no one perfect indicator of energy poverty that is suitable for all countries and contexts, especially when one considers the lack of relevant data.
- › The SocialWatt indicator, which introduces a comparison of actual energy use

against deemed energy need, is a useful development on the existing indicators used at European level when utility data on consumption is available.

- › Utility data on actual energy consumption can make a significant contribution to better analysis and targeting of energy poverty, particularly in identifying those who are energy rationing.
- › The availability of a calculation tool like SocialWatt Analyser can support the successful assessment of the complex issue of energy poverty. The analyses can be used to assess significant issues within client base – like energy rationing, or to identify geographical areas where energy poverty is more prevalent – and therefore to target initial outreach.
- › Any analysis, calculation tool or assessment is only as good as the data that is put in. Although SocialWatt Analyser has helped utilities/energy companies assess energy poverty within their customer base, the results are imperfect, especially for income-based indicators, due to a lack of household-level data.
- › When running SocialWatt Analyser, the results need careful consideration and engagement. The ability to fully engage with, and therefore use, the results of the various indicators relies on a concrete understanding of the dynamics of the indicators and which ones are likely to be more or less suitable for the types of data available to the individual utility/energy company. Some of the indicators are based on complex assessments and each looks for a different indicator of energy poverty – e.g., low energy use, high use or arrears on bills. They, therefore, may deliver different and even contradictory results.

2.3 UNCERTAINTIES AND LIMITATIONS

Although, SocialWatt Analyser has been developed to be as inclusive and customisable as possible, there are a number of assumptions used, as well as inherent uncertainties associated with the tool.

More specifically, a tool can be as good and accurate as the input data used. As such, the more accurate the energy data the user holds, the more accurate the results. In addition, the use of aggregated income data (as utilities/energy companies do not hold household-level income data) also introduces uncertainties to the analysis, especially for energy poverty indicators that are highly dependent on income (i.e., the 10% approach, LIHC, and 2M).

On the other hand, there are inherent uncertainties associated with the energy poverty indicators incorporated in SocialWatt. The table below summarises the strengths and weaknesses associated with each indicator, when also considering the available data used in the tool.

Table 1. Strengths and weaknesses of the energy poverty indicators incorporated in SocialWatt Analyser

Energy Poverty Indicator	Strengths	Weaknesses
10% approach	<ul style="list-style-type: none"> It captures households that have a high level of energy costs relative to income 	<ul style="list-style-type: none"> It relies on household income data, which are unavailable to utilities. The use of (sub)national income data means that it captures households that have relatively high energy expenditure – expenditure which is more than 10% of the average income it is highly sensitive to the 10% threshold, which may be more or less relevant to different national contexts For utilities that hold data on only one energy carrier, for example just electricity use, the 10% indicator does not adjust for this but compares the partial energy use data to the fixed 10% threshold
Low-Income-High-Cost (LIHC)	<ul style="list-style-type: none"> It captures households that spend a high share of income for energy needs and at the same time have a low income after energy costs 	<ul style="list-style-type: none"> It is particularly sensitive to the accuracy of household income data, as one of the two tests that a household must pass to be classified as energy poor relies solely on income compared to the national poverty line. Average income compared to the national poverty line is unlikely to reveal energy-poor households. Thus, it significantly underestimates energy poverty
High Share of Energy Expenditure (2M)	<ul style="list-style-type: none"> It captures households that have a high level of energy costs relative to income 	<ul style="list-style-type: none"> It relies on household income data, which are unavailable to utilities. The use of (sub)national income data means that it captures households that have relatively high energy expenditure It may underestimate energy poverty in countries where national median energy expenditure is high and/or income is low
Low Absolute Energy Expenditure (M/2)	<ul style="list-style-type: none"> It captures households with a very low energy expenditure (i.e. hidden energy poverty) It does not rely on household income data, which are unavailable to utilities. Instead, it relies on actual consumption data which utilities uniquely hold 	<ul style="list-style-type: none"> It is likely to pick up households living in very efficient homes or holiday homes and second homes only occupied for part of the year It may fail to identify households who spend higher sums on energy but at the expense of other household necessities

Energy Poverty Indicator	Strengths	Weaknesses
SocialWatt Indicator	<ul style="list-style-type: none"> • It captures households that consume less energy than theoretically needed (energy rationing), along with households with a high level of energy costs relative to income • It allows the user to set sensitivity thresholds to identify customers whose actual energy consumption is slightly below or significantly below its energy need • It also allows the user to define a lower threshold for energy consumption, in order to ensure that households that spend very low amounts on energy are not classified as energy poor (such as holiday homes and second homes) • It only partly relies on household income data (only to capture additional households), which are unavailable to utilities 	<ul style="list-style-type: none"> • Introduces uncertainties associated with modelled energy needs
Arrears on Utility Bills	<ul style="list-style-type: none"> • Households unable to pay their energy bills on time are captured • Simple indicator that does not rely on household income data, which are unavailable to utilities 	<ul style="list-style-type: none"> • Households in arrears are not necessarily (energy) poor

As mentioned in the table above, the use of the SocialWatt indicator also introduces uncertainties, as it considers that energy poverty is closely connected to building conditions. In particular, data and assumptions are used to estimate the energy needs of the “reference households” (e.g., building transmission coefficient, efficiency of equipment, and base temperatures that ensure comfort to the user), which may also change over time. On top of that, it is assumed that the “reference households” used for conducting the analysis represent average type of households. If other representative types of “reference households” were to be considered, different results would be obtained. In this respect, results are expected to be more accurate in areas where households display similar characteristics to “reference households” in terms of floor area, efficiency of heating/cooling systems, wall and window surface and construction materials etc. The same applies with the occupancy of a “reference household”, since one typical occupancy profile has been tested (a single-family house with three members, one of which is a dependant member). Especially for occupancy schedules, due to their deterministic nature, they typically represent environments where the occupants’ behaviour is foreseeable and repeatable. Although the DREEM model builds on the simplicity of this approach, using a heuristic approach to address the limitation of repeatability, inaccuracies might arise.

2.4 TROUBLESHOOTING

The table below presents potential issues that a user may encounter when using SocialWatt Analyser, along with how these can be resolved.

Table 2. SocialWatt Analyser troubleshooting

Error type	Resolution
Failure to install	<ul style="list-style-type: none"> • Check that the Docker installed is compatible with the specific Windows version used. Please note that Docker is not available for most older Windows versions. • When a newer version of the tool becomes available, make sure to delete the older version before installing the new one. Detailed information to do so are included in Section 2.1 and the respective installation instructions' file.
Failure to run	<ul style="list-style-type: none"> • Check that the energy data imported include all the data types required by the data process method used (this applies to methods 1-9). For method 10, as an absolute minimum, the imported data need to have the following information per customer: energy consumption, date/year of measurement, energy costs and location. • Check that the energy data imported comply with the data structure required by each data process method. It is of great significance that data types marked with a 'green check' in the data process method are structured as defined by the method (i.e. placed in the columns defined). For method 10, if such data are not available, it is paramount to keep the structure and use blank data. • Check that all imported data files are in .csv format (both energy and income files). • Check that all imported data files comply with the UTF-8 encoding format. • Check that dots are used as a decimal separator, whilst commas or nothing are used as a thousands separator for each data file imported. Space cannot be used as a thousands separator. • Check that dots are used as a decimal separator, whilst nothing is used as a thousands separator for inputting data in the interface. Comma or space cannot be used as a thousands separator.

Error type	Resolution
Error in results	<ul style="list-style-type: none"> • Check that the energy data imported comply with the data structure required by each data process method. It is important that data types marked with a 'green check' in the data process method are structured as defined by the method (i.e. placed in the columns defined). For methods 1-9, the minimum required data are all data types marked with a 'green check'. For method 10, blank data can be used in data types marked with a 'green check', as these will not be taken into consideration in the analysis. Minimum required data per customer for this method are: energy consumption, date/year of measurement, energy costs and location. • Check that the name of the location of each customer (municipality, region, county, province) in the energy data file imported, is exactly the same as the respective location name included within the income-related input file. If this is not the case, then SocialWatt Analyser will use national income per capita data for all customers with an ambiguous location. • Check that the imported data and the data entered for each indicator through the tool's interface are consistent. For instance, if energy data imported include only electricity costs, then for the M/2 indicator ensure that the relevant input parameters also refer to only electricity (i.e. absolute electricity expenditure).
Access to results	-

3 SOCIALWATT PLAN

3.1 STEP BY STEP INSTRUCTIONS

3.1.1 STEP 1 INSTALLING THE TOOL

In order for the user to successfully install and run SocialWatt Plan at a personal/work computer, a cloud-based repository is required. The docker hub has been selected for this purpose (see SocialWatt Analyser's installation steps). It should be noted that the user must select and install the most appropriate version of docker, according to the computer's specifications (e.g., software - Windows, Mac, Ubuntu).

Once the docker is installed successfully, the user should follow the instructions below:

1. Open PowerShell/command prompt (Windows user) or Open terminal (Mac and Ubuntu users)
2. Execute the following command:

```
docker run --rm -d --publish 1313:8000 socialwatt/socialwatt_plan:latest
```

Important note: Port 1313 can be any port the user prefers.

3. Once the following screen appears (Figure 25), the user should open the browser and paste the link: <http://localhost:1313/>

Figure 25: Successful installation command window for SocialWatt Plan

```
> docker run --rm -d --publish 1313:8000 socialwatt/socialwatt_plan:latest
Unable to find image 'socialwatt/socialwatt_plan:latest' locally
latest: Pulling from socialwatt/socialwatt_plan
69692152171a: Already exists
66a3c154490a: Pull complete
a1aac2599825: Pull complete
b7d9b1f22943: Pull complete
b29abb17a8f4: Pull complete
1ef6b5b357d0: Pull complete
207c3326b188: Pull complete
fe13ff4e708e: Pull complete
02fa3c8f73df: Pull complete
Digest: sha256:61f4a7ebd9d69b1ad7abfb8322e9ee357d622f5b5635767566500624e25224bb
Status: Downloaded newer image for socialwatt/socialwatt_plan:latest
ebc665644ca123ce53357af3c1e5ae53e04a2165de6b6a764f3fb8c401c191e2
```

4. The user should be able to access the SocialWatt Plan application.

In order to re-access SocialWatt Plan, docker should be running and the link <http://localhost:1313/> should be used.

Finally, when a new version of the tool is available, the user should follow the following steps:

1. Execute the command **docker ps -a** in the PowerShell/command prompt or terminal
2. Identify the **CONTAINER ID**. It should be found by the name **socialwatt/socialwatt_plan:latest**
3. In case there is no container ID with this name, execute the following command:

```
docker rmi socialwatt/socialwatt_plan:latest
```

4. Stop the container by executing the following command:

```
docker stop <CONTAINER ID>
```

5. Delete the old version of SocialWatt Plan by executing the following command:

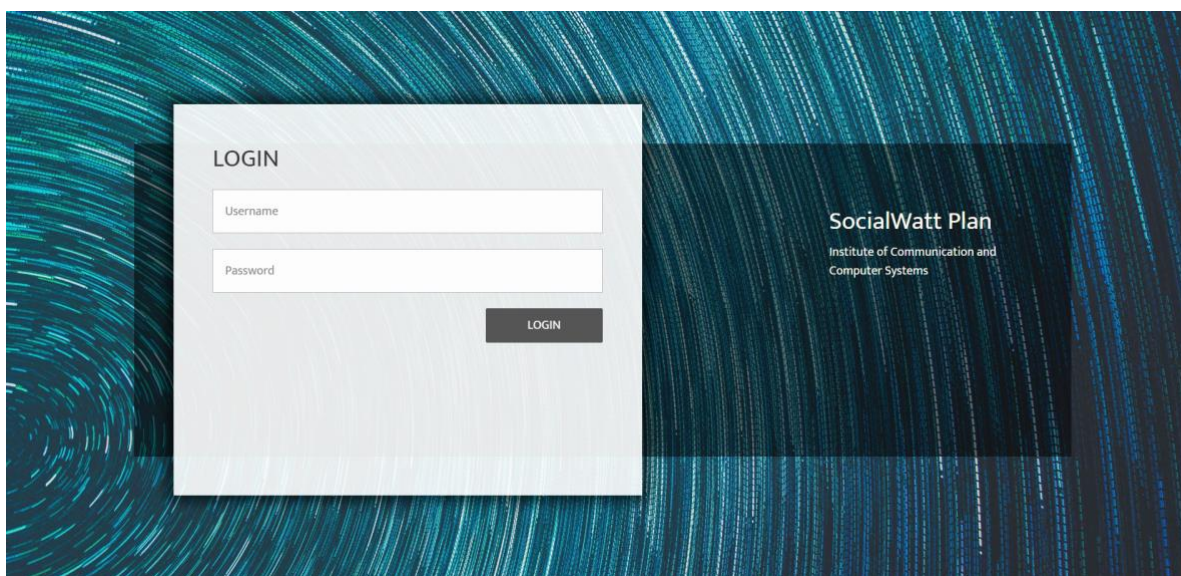
```
docker rmi socialwatt/socialwatt_plan:latest
```

6. Install the latest version of SocialWatt Plan by following the abovementioned steps, starting from Step 3.

3.1.2 STEP 2 LOGIN TO THE TOOL

Once the SocialWatt Plan is installed successfully, the user should enter his/her credentials in order to login.

Figure 26: Accessing SocialWatt Plan



Currently, there is a common username and password per country (i.e. Croatia, Greece, France, Ireland, Italy, Romania, Spain, Latvia, Portugal) for all users of the tool. Users cannot create a new account on their own, so they should use the following credentials in order to login:

Username: (name of the country – with capital first letter)

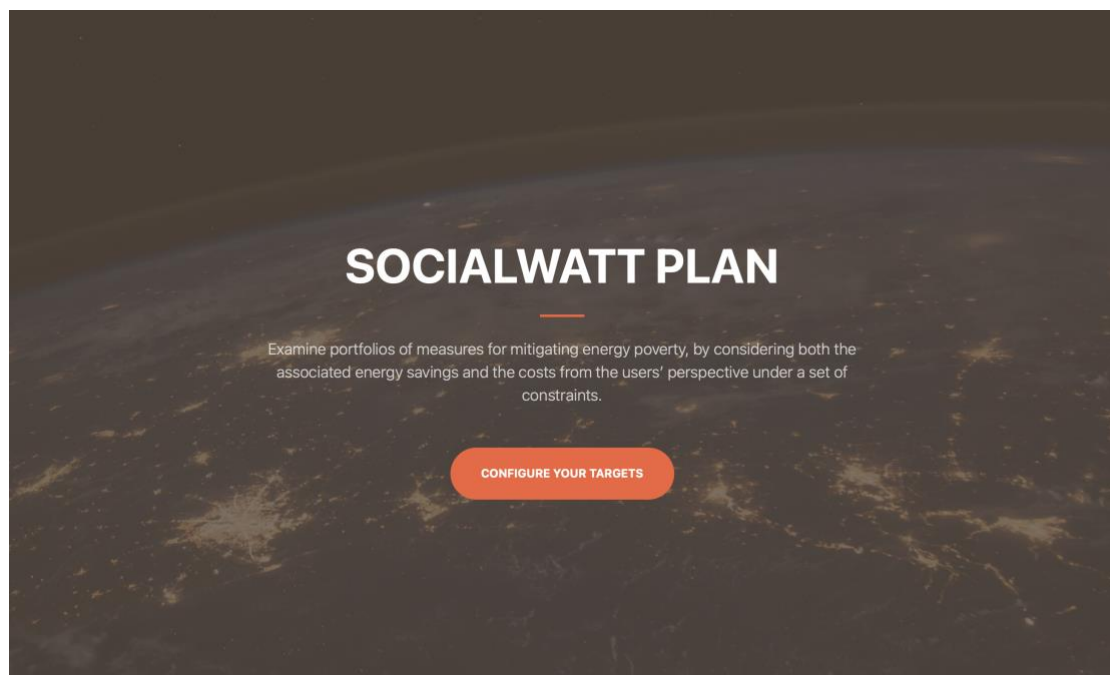
Password: demosite

Prior communication with the developers of the tool (ICCS) is required to obtain a personalised username and password.

3.1.3 STEP 3 CONFIGURE YOUR TARGETS

The user should configure the tool, defining targets and constraints in order to run it, and produce optimised portfolios of schemes for mitigating energy poverty, minimising investment costs from the utility's perspective and maximising energy savings triggered.

Figure 27: Configuration of targets screen in SocialWatt Plan



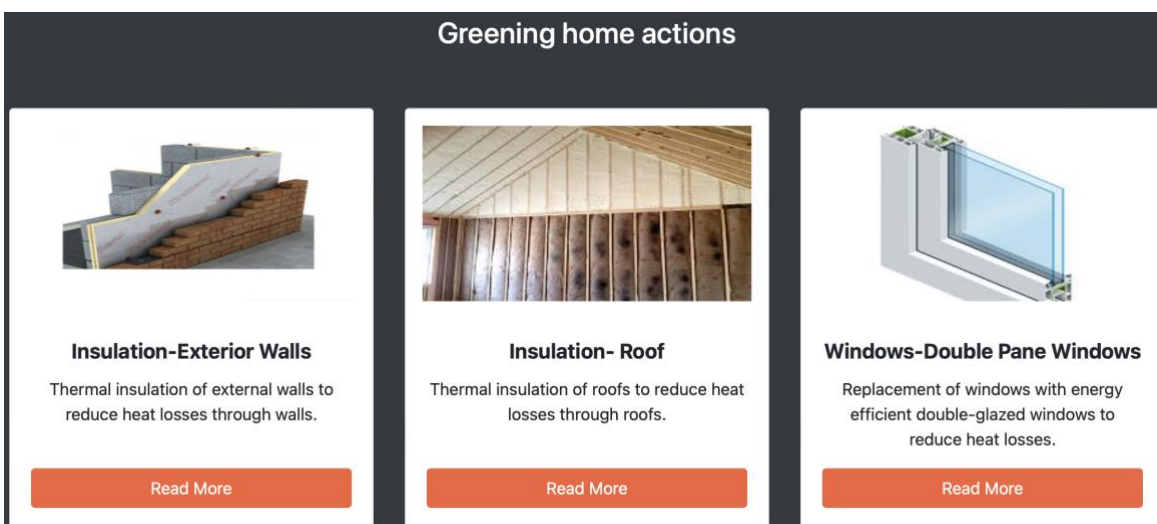
Review intervention schemes

In order to better define targets and constraints, the user should review the schemes incorporated in SocialWatt Plan. The schemes are evaluated in terms of their performance in meeting a set of predefined targets, whilst in parallel minimising the total cost from the utility's perspective and maximising the energy savings triggered. Each scheme consists of different actions. The figures below present the schemes included in SocialWatt Plan and an indicative example of the actions included in a specific scheme named 'Greening home'. By selecting an action, the user can access the technical details related to this action, including assumptions and underlying data incorporated (energy consumption per typical household, energy savings and investment costs per climate zone and type of building etc.).

Figure 28: Schemes incorporated in SocialWatt Plan



Figure 29: Actions included in the 'Greening Home' scheme in SocialWatt Plan

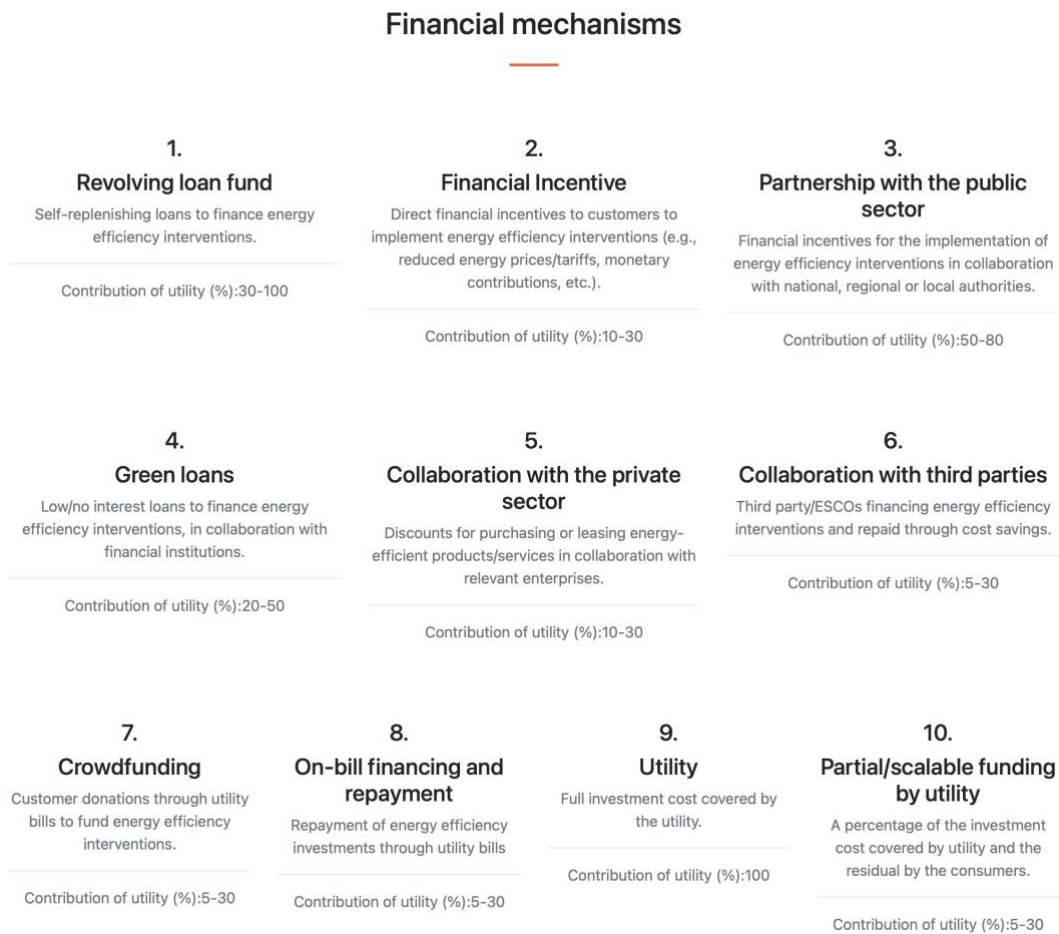


It should be noted that actions aiming to trigger behavioural changes are included under 'Information and Communication'.

Review financial mechanisms

An overview of the financial mechanisms that are considered to support the implementation of the examined schemes is also included in the SocialWatt Plan tool (Figure 30) that the user should review in order to better interpret the results. Each mechanism is assigned a different range of participation, in terms of utility contribution, and a different risk for each included action.

Figure 30: Financial mechanisms included in SocialWatt Plan



Portfolio Optimisation

Once the user has a better understanding of the types of schemes and actions included in the portfolio analysis, he/she should set targets and constraints. The portfolio optimisation interface is shown in figure 31 below.

Figure 31: Portfolio optimisation targets and constraints in SocialWatt Plan

The screenshot shows a web interface titled "PORTFOLIO OPTIMISATION" with the subtitle "Configure your targets". It contains several input fields for setting targets and constraints:

- Total Energy Saving Target (kWh):** A field with a "Minimum" label and "(kWh)" unit.
- Total Energy Poor Households (number):** A field with a "Minimum" label and "(number)" unit.
- Utility Annual Budget (million €):** A field with a "Maximum" label and "(million €)" unit.
- Share of Total Interventions (%):** Two fields for "New buildings (%)" and "Old buildings (%)".
- Total Renewable energy production target (kWh):** A field with a "Minimum" label and "(kWh)" unit.
- Share of Energy Saving (%):** Two fields for "New buildings (%)" and "Old buildings (%)".
- Total Number of portfolios (number):** A field with a "Portfolios" label and "(number)" unit.
- Risk:** A field with a "Maximum" label and "(%)" unit.

At the bottom of the interface, there is a prominent orange "Run Solver" button and a "Reset Targets" button.

The user should enter values for the following parameters:



- › Number of energy poor households to be targeted (note: the outputs from the SocialWatt Analyser can be used to inform this target);
- › Share of total interventions in old/new buildings;
- › Share of total energy savings in old/new buildings;
- › Maximum annual utility budget/investment (2021-2030)
- › Maximum risk threshold
- › Renewable energy production target;
- › Energy savings target; and
- › Number of portfolios to be included in the pareto front

All fields should be completed appropriately in order to run SocialWatt Plan.

3.1.4 STEP 4 RESULTS

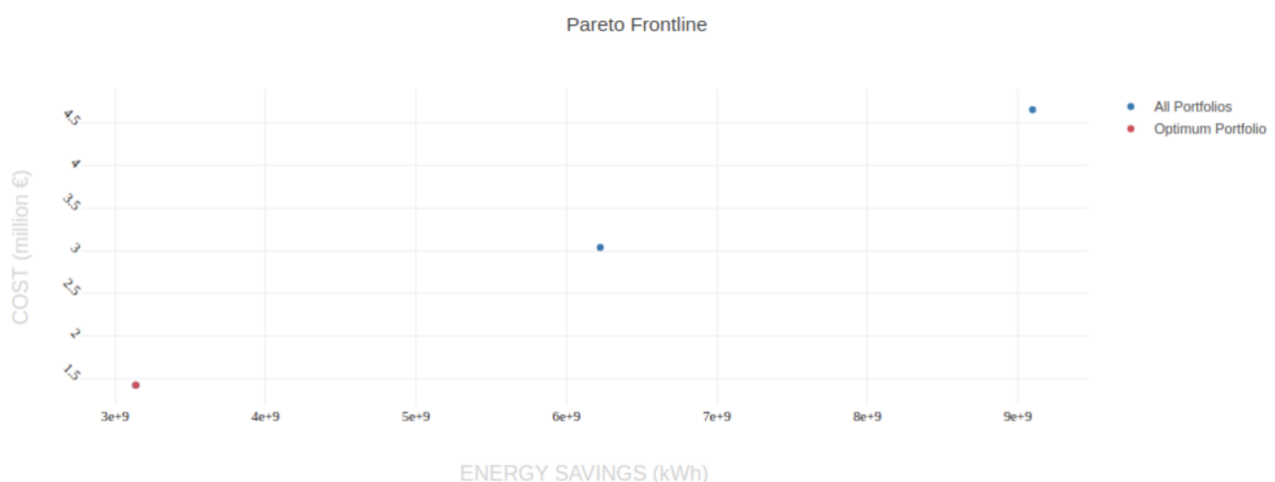
Once the targets have been set, the user can click on the orange button 'Run Solver' in order to start the portfolio optimisation analysis.

Figure 32: Run the solver button in SocialWatt Plan



When the analysis has been completed, the user is directed to the screen shown below, with the outcomes of the analysis. The results are presented using a Pareto front which includes the optimal solutions that meet the pre-defined targets and constraints.

Figure 33: SocialWatt Plan results: Pareto front comprising three optimal portfolios



The graph normally consists of multiple dots (based on the respective input parameter), each one of which features a specific combination of schemes, and a unique pair of costs-energy savings. The user can click on each dot to view the final results of each portfolio, including investment costs (based on the selected financial mechanism but also the total cost), energy savings and number of interventions per scheme. A comprehensive analysis of each portfolio is also available for the period 2021-2030, whilst detailed results can be downloaded.

In order to facilitate the process of selecting a portfolio that best suits the user's needs and priorities, one portfolio considered optimal is clearly marked in red (cost-driven optimal portfolio). More specifically, an indicator has been created, with the difference in costs between two consecutive dots (i.e. portfolios) as the numerator, and the respective difference in energy savings as the denominator. The lower the indicator (e.g. low numerator to keep the cost to a minimum, and high denominator to ensure maximum energy savings), the more optimal the two portfolios examined. When the user wants to keep the cost to a minimum, while at the same time benefiting from increased energy savings, then the optimal scenario is the dot on the left (cost-driven optimal portfolio), whilst when the user wants to keep energy savings to a maximum, then the optimal scenario is the dot on the right (energy savings-driven portfolio).

Finally, the user can download a file in .csv format with detailed results.

3.1.5 MOCK EXAMPLE

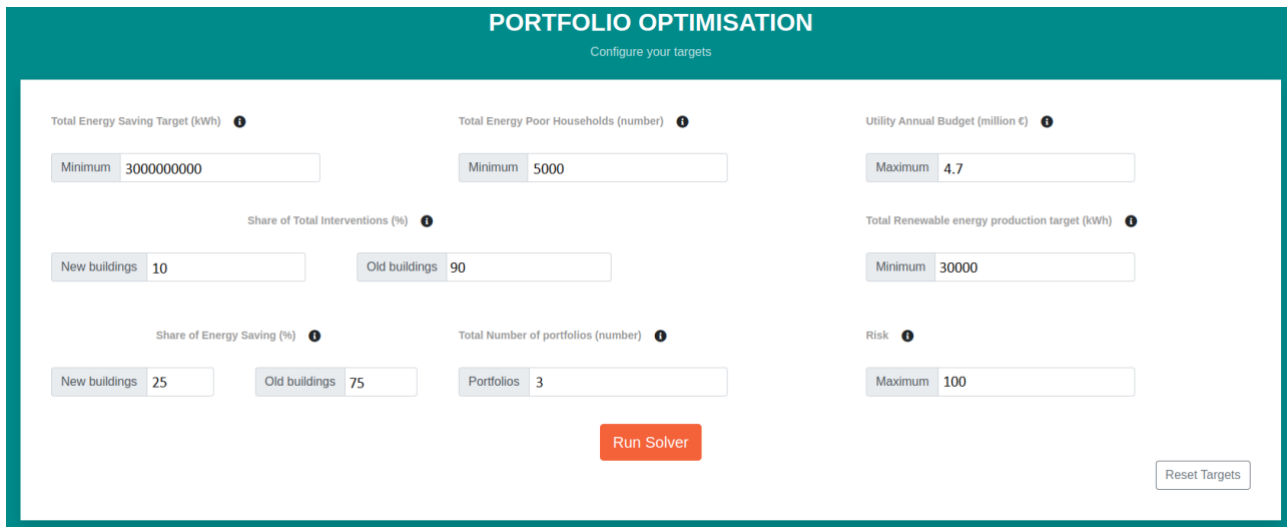
This section presents an example of using SocialWatt Plan to enhance clarity in configuring the tool and interpreting the results.

In this example, it is assumed that a utility in France aims to help 5000 energy poor households by annually investing 4.7 million Euro. In addition to this, the following targets and constraints are set:

- › Total energy saving target: 3,000 GWh
- › Total energy poor households to be engaged: 5000
- › Maximum annual utility budget: 4.7 million Euro (€)
- › Share of total interventions in old/new buildings: 90% and 10% respectively
- › Share of energy saving between in old/new buildings: 75% and 25% respectively
- › Maximum risk threshold: 100%
- › Total renewable energy production target: 30 MWh⁷
- › Total number of portfolios: 3
- › Analysis of results: Run Solver

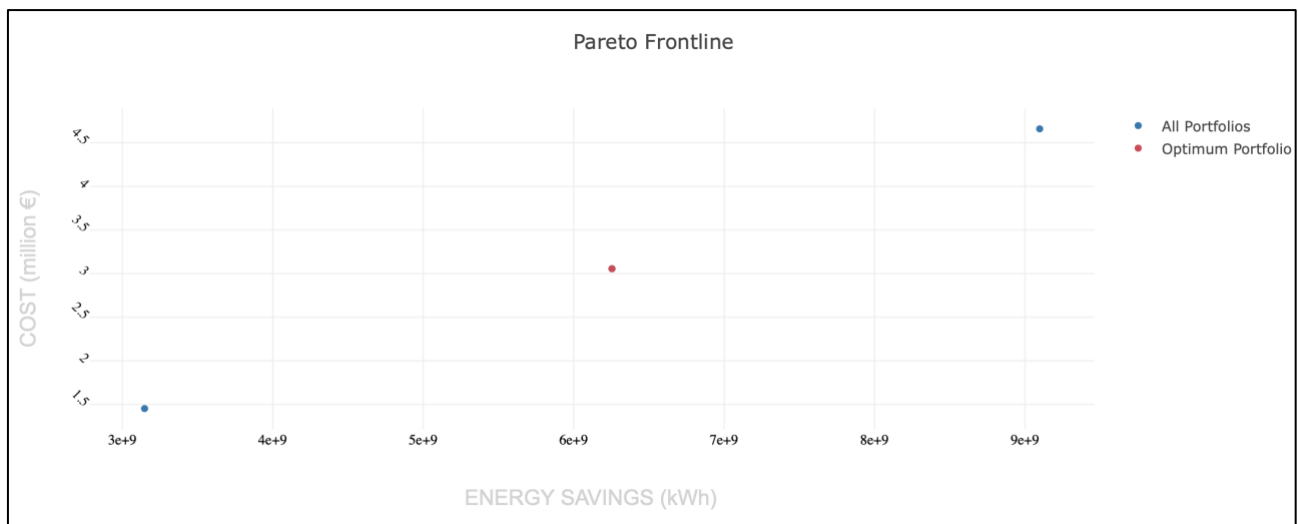
^{7 7} Numbers are illustrative and based on dummy data.

Figure 34: Example of targets set for portfolio optimisation in SocialWatt Plan



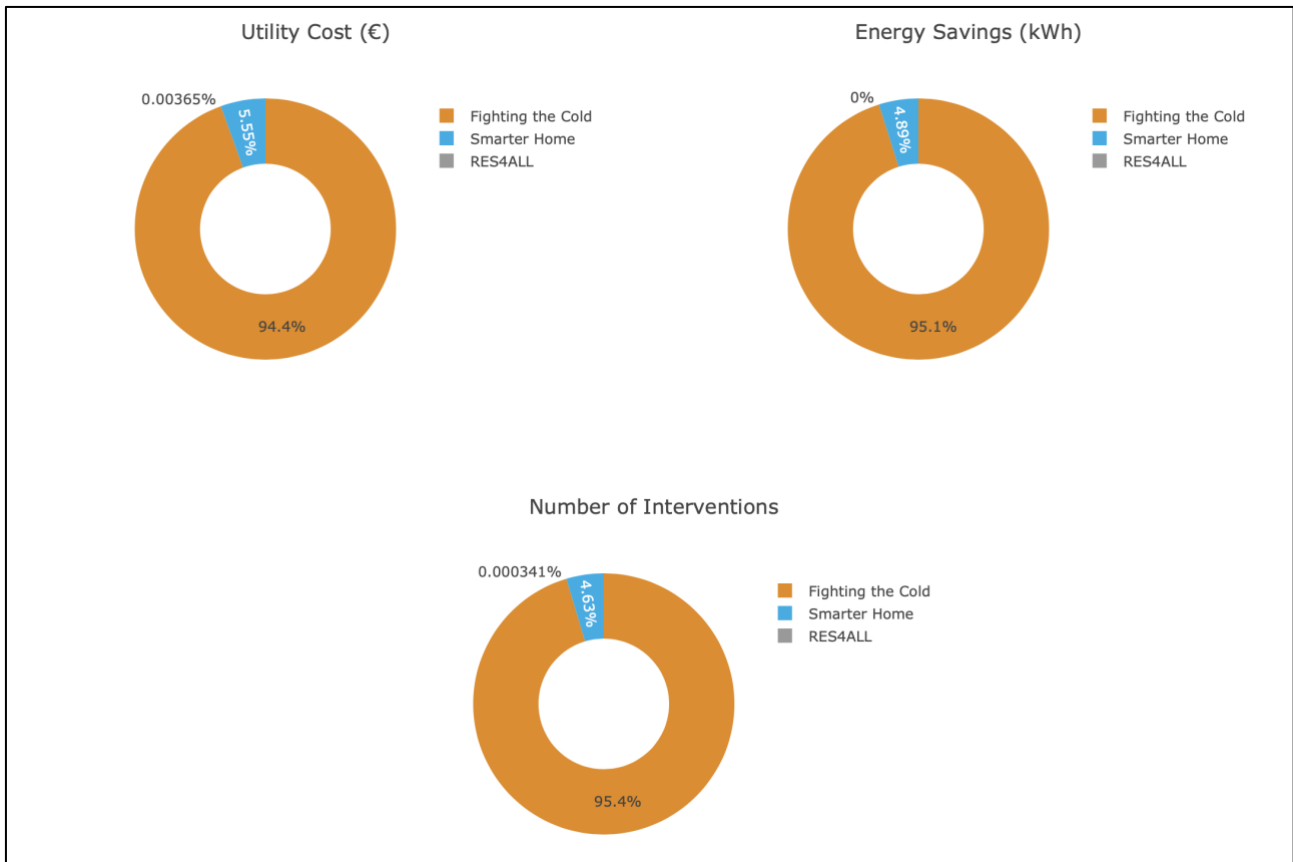
The graph below presents the results from the portfolio optimisation process. The graph includes the optimal solutions that meet the pre-defined targets and constraints set.

Figure 35: Mock results from SocialWatt Plan: Pareto front



The user can select any point of the Pareto front to view and download the analysis of the portfolio and the related pie charts.

Figure 36: Mock graphical portfolio analysis from SocialWatt Plan



Furthermore, when selecting a portfolio from the Pareto front, a table with a detailed plan for 2021-2030 appears, which breaks down the number of interventions per each action proposed per year and per building type, whilst there is also an option to view the results per climatic zones.

Figure 37: Mock detailed portfolio analysis from SocialWatt Plan

Detailed Analysis for Portfolio #3

Cost: 4.658 (Million €)
 Energy Savings: 9097.14952 (GWh)
 Financial mechanism: Collaboration with third parties
 Utility's participation: 5%

Number of interventions

Buildings Type	Action	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Old Buildings	Smart Thermostats Marseille	13600	0	0	0	0	0	0	0	0	0
Old Buildings	Energy Efficient Air Conditions Marseille	79996	80000	40000	40000	0	0	0	0	0	0
New Buildings	Energy Efficient Air Conditions Paris	40000	0	0	0	0	0	0	0	0	0
Old Buildings	PVs Marseille	1	0	0	0	0	0	0	0	0	0

It should be noted that above the detailed table, there is an overview of the main results

associated with the selected portfolio, including, among others, the optimal financial mechanism to support the implementation of the examined actions, as well as the optimal utility's contribution.

Finally, by selecting the 'Download' button, the user can download a file in .csv format with detailed results.

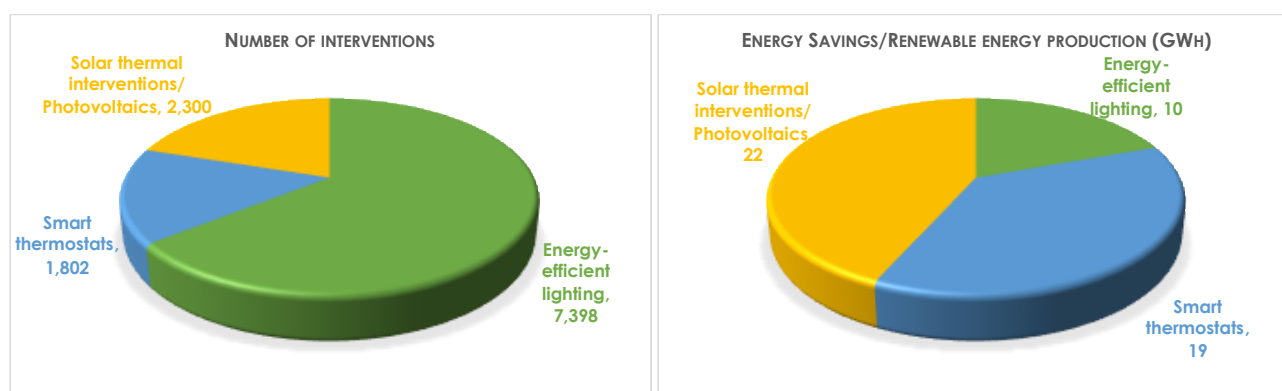
3.2 CASE STUDIES

SocialWatt Plan has been effective at introducing utilities to a range of potential schemes and providing input into the design of energy poverty action plans. It has also provided much-needed insight into the comparative cost-effectiveness of different interventions. Of the many scenarios produced by the tool to meet the utility targets and constraints, all energy companies/utilities considered the cost-optimal portfolio. Key findings from the analysis are presented in this section.⁸

Croatia

SocialWatt Plan estimates that HEP ESCO can meet its' energy savings, renewable energy production and CO₂ emissions savings targets cost-effectively, by implementing the following actions:

- › Replacement of old inefficient lighting with LED lamps;
- › Installation of smart thermostats; and
- › Installation of solar thermal interventions and small-scale photovoltaic systems.



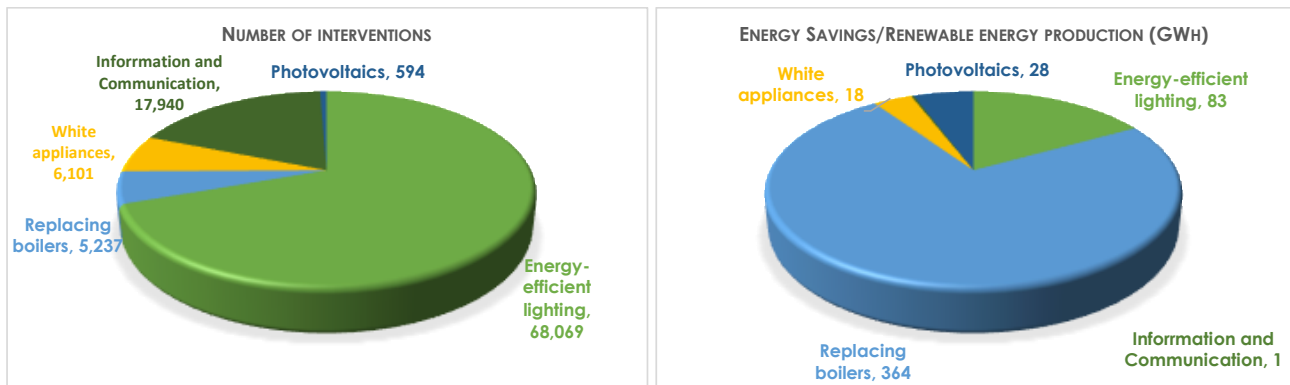
Greece

SocialWatt Plan estimates that PPC can meet its' energy savings, renewable energy production and CO₂ emissions savings targets cost-effectively, by implementing the following actions:

- › Replacement of old inefficient lighting with LED lamps;
- › Replacement of boilers with more energy-efficient gas boilers;
- › Replacement of white appliances, especially replacing kitchen cookers and hobs, with more energy-efficient ones;

⁸ It should be noted that when running the tool, some utilities/energy companies selected specific actions to exclude from the analysis, as these were not considered in line with business priorities.

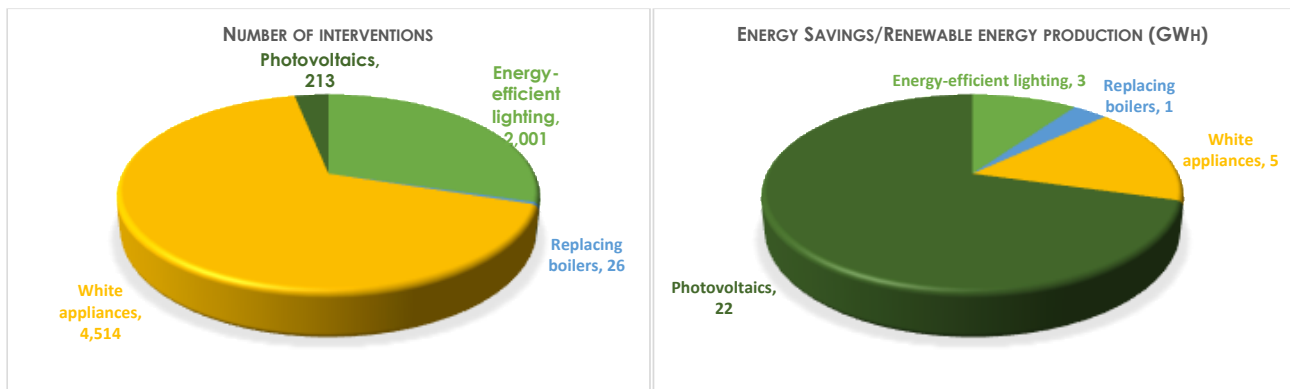
- › Information and communication campaigns to change energy consumption habits and educate consumers about energy-saving options; and
- › Installation of small-scale photovoltaic systems.



Italy

SocialWatt Plan estimates that eVISO can meet its' energy savings, renewable energy production and CO₂ emissions savings targets cost-effectively, by implementing the following actions:

- › Replacement of old inefficient lighting with LED lamps;
- › Replacement of boilers with more energy-efficient gas boilers;
- › Replacement of white appliances, especially replacing washing machines with more energy-efficient ones; and
- › Installation of small-scale photovoltaic systems.



Interestingly, when the tool was re-run, with a third of the budget as a target, the remaining targets were met without considering small-scale photovoltaic systems, but instead increasing the number of interventions proposed for replacing white appliances.

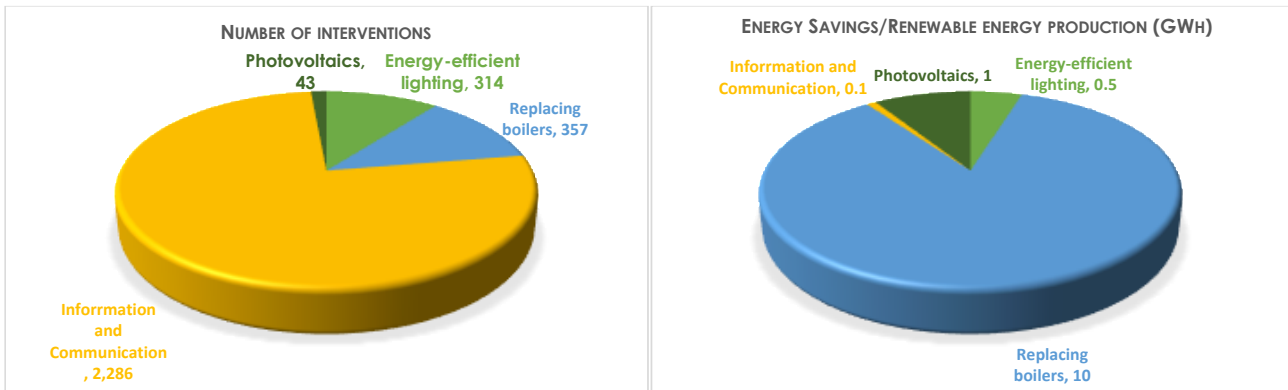
Latvia

SocialWatt Plan estimates that GREN Jelgava can meet its' energy savings, renewable energy production and CO₂ emissions savings targets cost-effectively, by implementing the following actions:

- › Replacement of old inefficient lighting with LED lamps;
- › Replacement of boilers with more energy-efficient gas boilers;

- › Information and communication campaigns to change energy consumption habits and educate consumers about energy-saving options; and
- › Installation of small-scale photovoltaic systems.

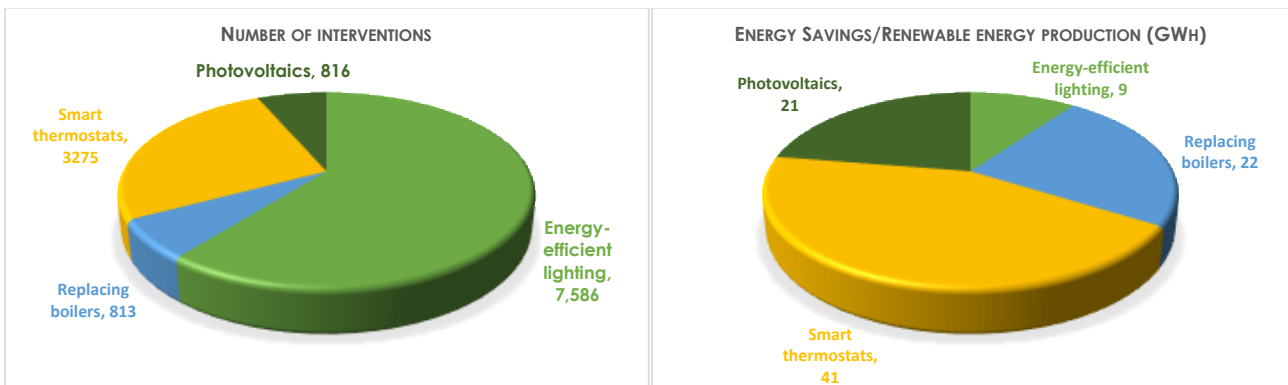
It should be noted that GREN Jelgava customers do not use natural gas as a heating source. However, targeting households that use old gas boilers to invest in district heating would be a feasible action that would not only increase energy efficiency but would also reduce fossil fuel consumption.



Romania

SocialWatt Plan estimates that CEZ Vanzare can meet its' energy savings, renewable energy production and CO₂ emissions savings targets cost-effectively, by implementing the following actions:

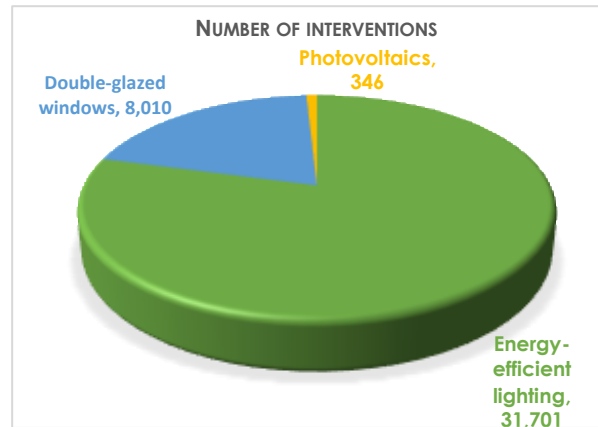
- › Replacement of old inefficient lighting with LED lamps;
- › Replacement of boilers with more energy-efficient gas boilers;
- › Installation of smart thermostats; and
- › Installation of small-scale photovoltaic systems.



Spain

SocialWatt Plan estimates that NATURGY can meet its' energy saving target, as well as its' renewable energy production and CO₂ emissions savings targets cost-effectively, by implementing the following actions:

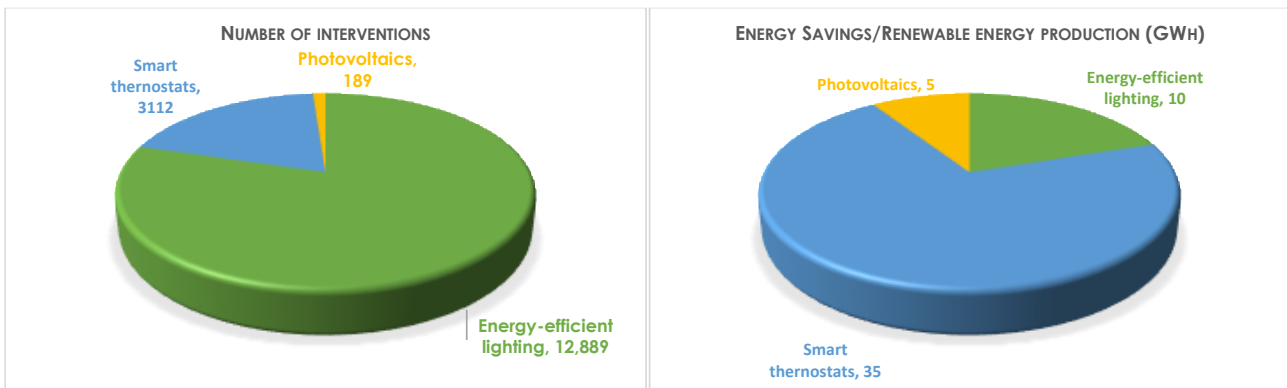
- › Replacement of old inefficient lighting with LED lamps;
- › Replacement of old windows with energy efficient double-glazed windows; and
- › Installation of small-scale photovoltaic systems.



Portugal

SocialWatt Plan estimates that EDP can meet its' energy saving target, as well as its' renewable energy production and CO₂ emissions savings targets cost-effectively, by implementing the following actions:

- › Replacement of old inefficient lighting with LED lamps;
- › Installation of smart thermostats; and
- › Installation of small-scale photovoltaic systems.



From the experience of the SocialWatt partners using SocialWatt Plan, key lessons learnt/observations include:

- › Renovate your Home scheme, which installs low-cost measures like efficient lighting, and the Smarter Home scheme, which installs smart thermostats, consistently appear to be the most cost-effective schemes in the portfolios for SocialWatt partners.
- › Information and communication schemes were assessed as less cost-effective. Despite being low-cost measures, these activities trigger low levels of energy savings.
- › The cost-effectiveness calculations for each of the schemes assessed in the SocialWatt Plan tool are based on country-specific costs and other data from the utility. Therefore, the cost-effectiveness of schemes cannot be directly compared between countries on a like-for-like basis.
- › SocialWatt Plan calculates the savings generated by the measures within the 10-year

investment period, not over the measures' lifetime. Measures that are installed in the early years of the portfolio therefore contribute more calculated savings than measures installed later in the investment period. Although this raises the value of early investment, which is positive, it can produce results that are not always directly comparable across scenarios.

- › The availability of a calculation tool like SocialWatt Plan can support the assessment of different energy efficiency and renewable energy interventions and inform utilities/energy companies' decision-making process. SocialWatt partners carefully considered the results obtained by the tool. However, business strategies and priorities, as well as other risks and constraints (bureaucratical barriers or resource availability) had a significant effect on the final selection of schemes to be implemented within the framework of the project.

3.3 UNCERTAINTIES AND LIMITATIONS

Although, SocialWatt Plan has been developed to be as inclusive and customisable as possible, there are a number of assumptions used, as well as inherent uncertainties associated with the tool.

More specifically, the tool can be as good and accurate as the input data used. Energy savings are estimated by considering the energy needs of "reference households". As such, the analysis is subject to the uncertainties linked to the assumptions used to determine "reference households", including size, type, occupancy level etc. (see section 2.3 for more details).

In addition, there are limitations linked to the use of the DREEM model⁹, the outputs of which are used to determine the effectiveness and the respective costs of each intervention. For example, the actions focused on boiler replacement presume a fixed efficiency (e.g., 90% efficiency for biomass boilers), the renewable energy installations include standard PV panels of up to 3 kW installed power, and the replacement of existing lamps with more efficient ones, refer to 12 led lamps of 12 kW. This affects the overall performance of the actions in terms of both energy savings and cost.

Furthermore, a specific number of climate zones has been considered per country. As such, assumptions have been made regarding the aggregation of areas in order to depict populated cities in the different climate zones considered. These assumptions may result in approximated values; results would be more accurate if more climate zones were introduced or areas with similar geographical characteristics were only considered.

In order to ensure transparency and ensure that users fully understand the underlying assumptions used on costs and impacts when running the tool, these are clearly presented in the tool itself. Thus, users can view investment costs, energy savings and other information per action, building type and climate zone through the tool's frontend.

⁹ V. Stavarakas, A. Flamos, «A modular high-resolution demand-side management model to quantify benefits of demand-flexibility in the residential sector» Energy Conversion and Management, volume 205, 2020

3.4 TROUBLESHOOTING

The table below presents potential issues that a user may encounter when using SocialWatt Plan, along with how these can be resolved.

Table 3. SocialWatt Plan troubleshooting

Error type	Resolution
Failure to install	<ul style="list-style-type: none"> • Check that the Docker installed is compatible with the specific Windows version used. Please note that Docker is not available for most older Windows versions. • When a newer version of the tool becomes available, make sure to delete the older version before installing the new one. Detailed information to do so are included in Section 3.1 and the respective installation instructions' file.
Failure to run	<ul style="list-style-type: none"> • Check that the credentials used are the correct ones. The username is the country of interest (as long as this is one of the following countries: Croatia, Greece, France, Ireland, Italy, Romania, Spain, Latvia, Portugal), and needs to be written with a capital first letter. • Check that the number of portfolios requested as an output is reasonable, as a very high number of portfolios may severely delay the running time of the tool and return an error. Please note that the higher number of portfolios, the longer the running time. • Check that all targets and constraints are defined. Blank values will lead to failure to run. • Check that the targets and constraints set are within reason. For example, a very high target in energy savings combined with a very low budget allocated, will result to infeasible mathematical solutions. • Check that dots are used as a decimal separator, whilst nothing is used as a thousands separator for inputting data in the interface. Comma or space cannot be used as a thousands separator.
Error in results	<ul style="list-style-type: none"> • Check that the input parameters used are reasonable and in alignment with the values requested by the tool. For example, enter millions of Euro and not thousands of Euro, kWh and not MWh, the annual utility budget and not the one for the whole examined time horizon, etc, in line with what is requested in each case by the interface of the tool,.
Access to results	<ul style="list-style-type: none"> • When viewing the Pareto front, ensure that the dot/portfolio of interest is clicked in order to view the respective results.

4 SOCIALWATT CHECK

4.1 STEP BY STEP INSTRUCTIONS

4.1.1 STEP 1 INSTALLING THE TOOL

In order for the user to successfully install and run SocialWatt Check at a personal/work computer, a cloud-based repository is required. The docker hub has been selected for this purpose (see SocialWatt Analyser's installation steps). It should be noted that the user must select and install the most appropriate version of docker, according to the computer's specifications (e.g., software - Windows, Mac, Ubuntu).

Once the docker is installed successfully, the user should follow the instructions below:

1. Open PowerShell/command prompt (Windows user) or Open terminal (Mac and Ubuntu users).
2. Execute the following command:

```
docker run --rm -d --publish 1313:8000 socialwatt/socialwatt_check:latest
```

Important note: Port 1313 can be any port the user prefers.

3. Once the following screen appears (Figure 38), the user should open the browser and paste the link: <http://localhost:1313/>

Figure 38: Successful installation command window for SocialWatt Check

```

+ docker run --rm -d --publish 1313:8000 socialwatt/socialwatt_check:latest
Unable to find image 'socialwatt/socialwatt_check:latest' locally
latest: Pulling from socialwatt/socialwatt_check
69692152171a: Already exists
66a3c154490a: Already exists
91aac2599825: Already exists
b7d9b1f22943: Already exists
77cacf443dcc: Pull complete
ae565a5e9f85: Pull complete
81180747e861: Pull complete
51055a466c65: Pull complete
eb56017f91dc: Pull complete
Digest: sha256:2553d72971ca3afff0f3f9ad1d7be55da2a43341090ce0f493971c4600e0d1db
Status: Downloaded newer image for socialwatt/socialwatt_check:latest
205cdb56c9c8103d73ce2135a78c260a40618eebf4c64afc3232953e5c303e40

```

4. The user should be able to access the SocialWatt Check application.

In order to re-access SocialWatt Check, docker should be running and the link <http://localhost:1313/> should be used.

Finally, when a new version of the tool is available, the user should follow the following steps:

1. Execute the command **docker ps -a** in the PowerShell/command prompt or terminal
2. Identify the **CONTAINER ID**. It should be found by the name **socialwatt/socialwatt_check:latest**
3. In case there is no container ID with this name, execute the following command:

```
docker rmi socialwatt/socialwatt_check:latest
```

4. Stop the container by executing the following command:

docker stop <CONTAINER ID>

5. Delete the old version of SocialWatt Check by executing the following command:

docker rmi socialwatt/socialwatt_check:latest

6. Install the latest version of SocialWatt Check by following the abovementioned steps, starting from Step 3.

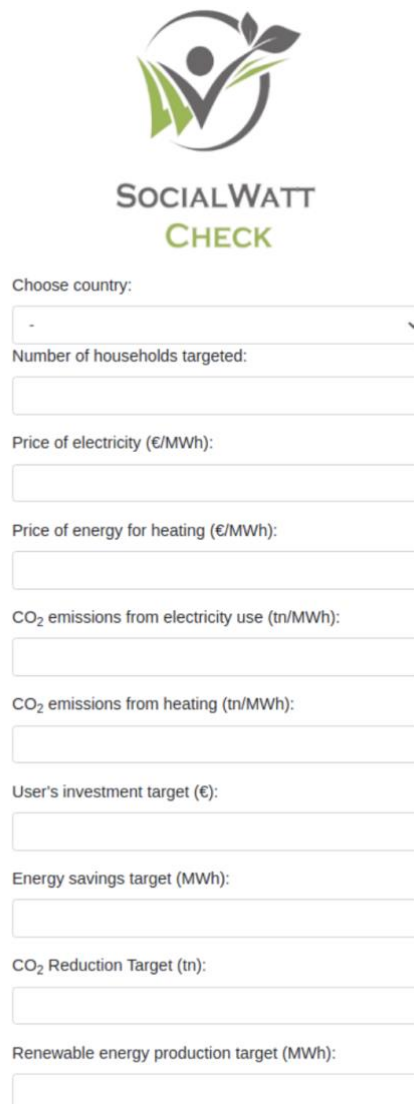
4.1.2 STEP 2 CONFIGURE YOUR TARGETS


The user should enter values for the following parameters:

- › Country: Country for which the analysis will be conducted. Currently, nine (9) countries have been incorporated into the tool, each one of them representing the country of the utility participating in SocialWatt. More specifically:
 - Croatia
 - Greece
 - France
 - Ireland
 - Italy
 - Romania
 - Spain
 - Latvia
 - Portugal
- › Number of households targeted: Number of households targeted by all actions/schemes to be monitored.
- › Price of electricity (€/MWh): Although the electricity price may vary per utility/energy company and according to income quantiles, consumption and other social criteria, the user should enter an average national electricity price.
- › Price of energy for heating (€/MWh): Although the price of energy for heating may vary per utility/energy company and according to income quantiles, consumption and other social criteria, the user should enter an average national price of energy for heating.
- › CO₂ emissions from electricity use (tn/MWh): Conversion factor of electricity consumption (MWh) to CO₂ emissions (tn).
- › CO₂ emissions from heating (tn/MWh): Conversion factor of thermal energy consumption (MWh) to CO₂ emissions (tn).
- › User's investment target (€): Total amount of money to be invested for all actions/schemes to be monitored.
- › Energy savings target (MWh): Energy savings target for all actions/schemes to be monitored.

- › CO₂ reduction target (tn): CO₂ emissions reduction target for all actions/schemes to be monitored.
- › Renewable energy production target (MWh): Renewable energy production target for all PV actions to be monitored.

Figure 39: Input parameters in SocialWatt Check





Choose country:

Number of households targeted:

Price of electricity (€/MWh):

Price of energy for heating (€/MWh):

CO₂ emissions from electricity use (tn/MWh):

CO₂ emissions from heating (tn/MWh):

User's investment target (€):

Energy savings target (MWh):

CO₂ Reduction Target (tn):

Renewable energy production target (MWh):

4.1.3 STEP 3 CONFIGURE YOUR SETTINGS

After accessing the tool, the user is requested to select the action(s) of the respective schemes to be monitored, from an indexed drop-down list (Figure 40). The process described below, must be followed thoroughly for each action separately, namely the user cannot select all of the actions to be monitored, at the beginning of the analysis.

Upon selecting an action, the user is requested to provide the monetary contribution of the user to the implementation of the action. This is done by setting either the corresponding percentage of investment or the fixed investment cost per intervention, and then finalising it by checking the respective option (Figure 40).

Figure 40 Scheme selection example in SocialWatt Check – user’s contribution

Choose:

Select

Plot

Please select an Action

Please tick the relevant box and enter a value to determine users' monetary contribution to the action

Percentage of investment by the user (%)

OR

Investment covered by the user (€)

Description of Solar thermal panels:

Replacement of typical Domestic Hot Water (DHW) systems, with Solar Domestic Hot Water (SDHW) systems, which include a supplementary heater (e.g. an integrated electric heater) to cover the total annual hot water demand of a household.

The user is then requested to provide input on the number of interventions implemented in new and old buildings, in each climate zone (e.g., Athens). Upon selecting the climate zone, an overview of built-in data is shown, regarding the energy savings in kWh/year and retrofit cost per action, enabling the user to manually modify these if needed. When the data associated with an action for a specific climate zone are successfully submitted, a message appears on the screen, marked in green, informing the user that the submission is completed (e.g., "Climate Zone Athens submitted"). The user may then proceed to submitting data for another climate zone.

Having added/modified data for every climate zone of an action, the user can then follow the same process for every additional action he/she wishes to analyse and return to the main page to see the results.

Figure 41 Intervention data input example in SocialWatt Check

Please select an Action

Athens

Please find below the assumptions for the interventions on a typical household

Old	New	You have submitted:
Energy savings(kWh/year)	Energy savings(kWh/year)	x Athens number of interventions:44
<input type="text" value="1962"/>	<input type="text" value="2651"/>	Total number of interventions:44
Cost(€)	Cost(€)	User contribution to cost:22%
<input type="text" value="5000"/>	<input type="text" value="11654.72"/>	
<input type="text" value="22"/>	<input type="text" value="22"/>	

Number of interventions →

4.1.4 STEP 4 RESULTS

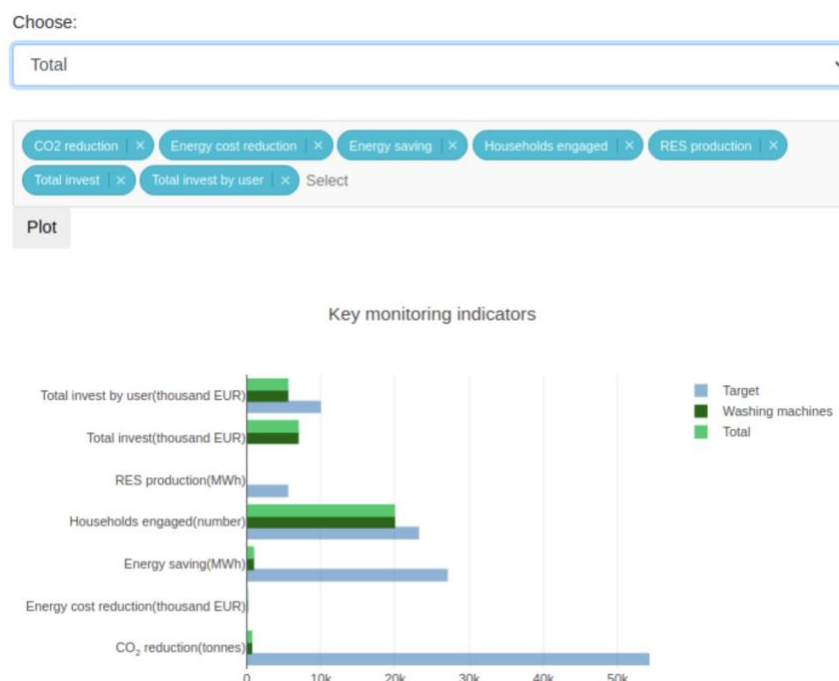
SocialWatt Check is designed to allow for multiple actions to be evaluated simultaneously. Once the user has provided all the required information, SocialWatt check proceeds with the calculations of the following key monitoring indicators:

- › Households engaged;
- › Energy savings;
- › CO₂ emissions reduction;
- › Energy cost reduction;
- › Renewable energy production;
- › Total investment; and
- › Total investment by the user.

A plotter tool visualises the above calculated data, as presented in figure 42. It should be noted that the graph of key monitoring indicators may include:

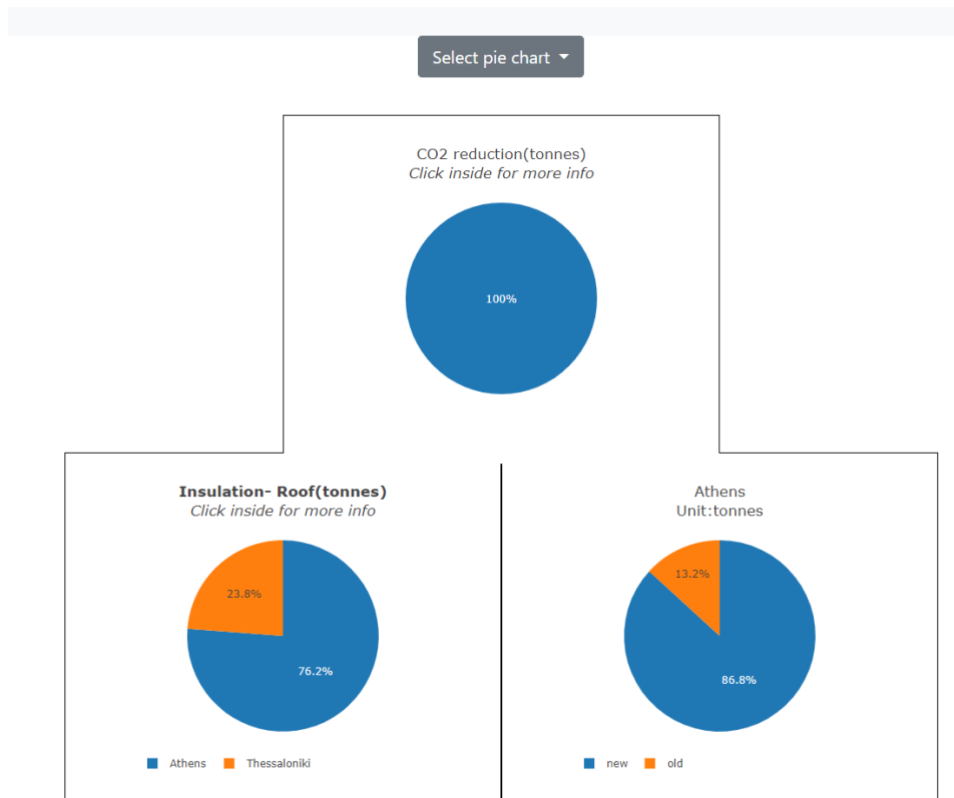
- › Targets (see figure 39)
- › Selected action;
- › Total (if more than one action is included in the analysis)
- › Mix of the above

Figure 42 Graphical representation of SocialWatt Check results



The tool also enables the visualization of the results in the form of pie charts that also enable users delve into detailed results on the performance of the actions per key performance indicators, climate zone and household type.

Figure 43 SocialWatt check detailed results in the form of pie charts



Finally, the user can download a file in .csv format with detailed results.

4.1.5 MOCK EXAMPLE

This section presents an example of using SocialWatt Check to enhance clarity in configuring the tool and interpreting the results.

In this example, it is assumed that a utility in Greece aims to help 23,230 energy poor households by investing 10 million Euro in energy efficiency interventions. In addition to this, the following targets and constraints are set:

- › Price of electricity: 120 €/MWh
- › Price of energy for heating: 50 €/MWh
- › CO₂ emissions from electricity use: 0.757 tn/MWh
- › CO₂ emissions from heating: 0.202 tn/MWh
- › Energy savings target: 27,100 MWh¹⁰
- › CO₂ reduction target: 54,300 tn
- › Renewable energy production target: 5,600 MWh

¹⁰ Numbers are illustrative and based on dummy data.

Figure 44: Example of targets set in SocialWatt Check

SOCIALWATT
CHECK

Choose country:

Greece

Number of households targeted:

23,230

Price of electricity (€/MWh):

120

Price of energy for heating (€/MWh):

50

CO₂ emissions from electricity use (tn/MWh):

0.757

CO₂ emissions from heating (tn/MWh):

0.202

User's investment target (€):

10,000,000

Energy savings target (MWh):

27,100

CO₂ Reduction Target (tn):

54,300

Renewable energy production target (MWh):

5,600

Submit

The figures below present the input data for the two climate zones that are incorporated in SocialWatt Check for Greece, i.e., Athens (Figure 45) and Thessaloniki (Figure 46), including number of interventions implemented in old and new buildings for each climate zone respectively.

Figure 45: SocialWatt Check input data – Athens climate zone

Choose:

Target

CO2 reduction x Energy cost reduction x Energy saving x Households engaged x RES production x
Total invest x Total invest by user x Select

Plot

Please select an Action

Select Action

Athens

Please find below the assumptions for the interventions on a typical household

Old	New	You haven't submitted anything yet. User contribution to cost:80%
Energy savings(kWh/year)	Energy savings(kWh/year)	
49	49	
Cost(€)	Cost(€)	
350	350	
5000	5000	

Submit Climate Zone Athens Cancel

Figure 46: SocialWatt Check input data – Thessaloniki climate zone

Choose:

Target

CO2 reduction x Energy cost reduction x Energy saving x Households engaged x RES production x
Total invest x Total invest by user x Select

Plot

Please select an Action

Select Action

Thessaloniki

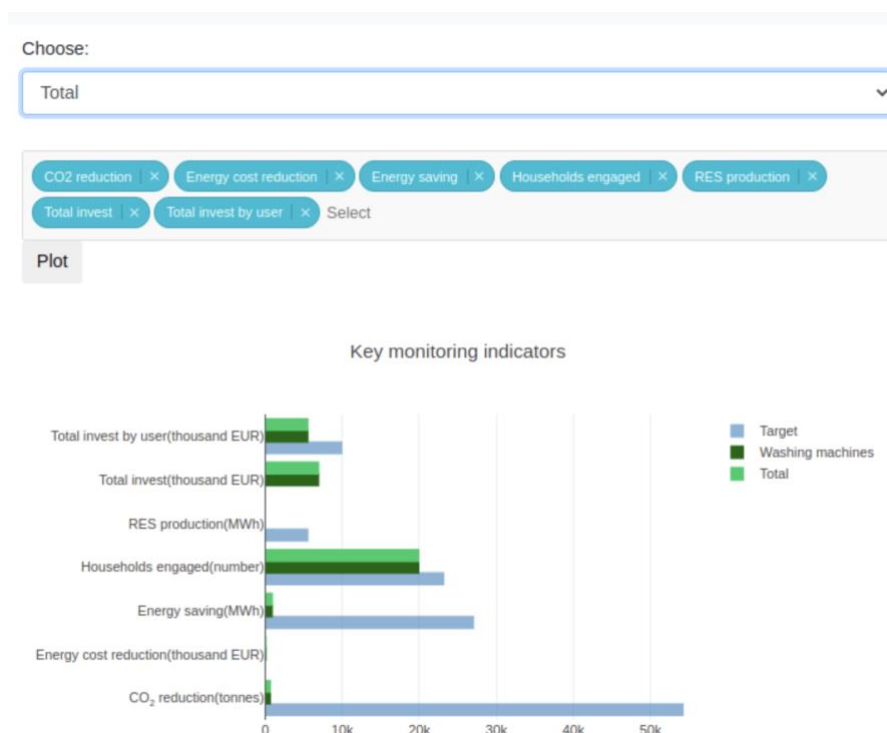
Please find below the assumptions for the interventions on a typical household

Old	New	You have submitted: x Athens number of interventions:10000 Total number of interventions:10000 User contribution to cost:80%
Energy savings(kWh/year)	Energy savings(kWh/year)	
49	49	
Cost(€)	Cost(€)	
350	350	
5000	5000	

Submit Climate Zone Thessaloniki Submit actions Cancel

The graph below presents the results from the monitoring process. The graph includes the targets set at the beginning of the process (see Figure 44), and the impact of the actions implemented so far (total and per action). In this example, only one action was selected to be monitored and thus, the total per performance indicator is the same to that of the action.

Figure 47: Mock results from SocialWatt Check



4.2 UNCERTAINTIES AND LIMITATIONS

Although, SocialWatt Check has been developed to be as inclusive and customisable as possible, there are a number of assumptions used, as well as inherent uncertainties associated with the tool.

More specifically, SocialWatt Check, has been designed based on a 'deemed savings' approach to enable the user to keep track of the impact of actions/schemes implemented in an easy and simple way (relying on the number of interventions implemented to estimate energy savings, CO₂ emission reductions, cost savings, etc.) as well as to monitor progress against user-defined targets. However, the 'deemed savings' approach estimates energy savings on a theoretical basis, without requiring the measurement of energy use after the implementation of an energy efficiency intervention.

In addition, the tool can be as good and accurate as the input data used (energy prices, conversion factors, energy savings and costs per intervention etc.). In order to minimise uncertainties associated with input data and ensure full customisation, the user is the one that sets these values, even the predetermined energy savings per intervention. As such, the user can set, review and revise all the underlying assumptions used by the tool, as deemed necessary. This is particularly important if one considers that some assumptions change with time (e.g. costs of an intervention).

Finally, the use of the 'deemed savings' approach, does not enable the user to monitor progress and assess impact at a household level. Thus, the user cannot identify citizens that have escaped energy poverty due to the actions/schemes implemented. To deal with this issue, SocialWatt Check can be used in combination with SocialWatt Analyser. In particular, the user can re-run the latter, using the most recent energy data that the utility/energy company holds (i.e. after the implementation of the action/scheme) and compare the

status of each customer, in terms of energy poverty, with that before the implementation of the action/scheme (i.e. results produced by SocialWatt Analyser when planning the scheme or for a year preceding the interventions). In this way, changes at household level, in terms of escaping energy poverty, are clearly identified.

4.3 TROUBLESHOOTING

The table below presents potential issues that a user may encounter when using SocialWatt Check, along with how these can be resolved.

Table 4. SocialWatt Check troubleshooting

Error type	Resolution
Failure to install	<ul style="list-style-type: none"> • Check that the Docker installed is compatible with the specific Windows version used. Please note that Docker is not available for mostly older Windows versions. • When a newer version of the tool becomes available, make sure to delete the older version before installing the new one. Detailed information to do so are included in Section 3.1 and the respective installation instructions' file.
Failure to run	<ul style="list-style-type: none"> • Check that all targets are defined. Blank values will not allow the user to proceed with the analysis. • When entering the monetary contribution of the user to the implementation of the action, ensure the check box (defining whether a percentage of investment or fixed investment cost per intervention is entered) is ticked. • Check that dots are used as a decimal separator, whilst a comma or nothing is used as a thousands separator for inputting data in the interface. Space cannot be used as a thousands separator.
Error in results	-
Access to results	<ul style="list-style-type: none"> • When viewing the Pie Chart results, ensure to click on the charts in order to gain access to more disaggregated results.