POWERPOOR

Empowering Energy Poor Citizens through Joint Energy Initiatives

The POWER-ACT Tool

Working on the ground with energy-poor households and policymakers to mitigate energy poverty levels.

April 2021

www.powerpoor.eu

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Work Package 2: Tools and methods for mitigating household energy poverty

Deliverable D2.3: The POWER-ACT tool

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Abbreviation	Explanation
EC	European Commission
EU	European Union
WPx	Work Package number x
Dx.y	Deliverable number y belonging to WPx

1. Introduction

POWERPOOR aims at developing support programmes/schemes to support citizens suffering from energy poverty and to encourage them to use alternative financing schemes (e.g., establishing energy communities/cooperatives, or using crowdfunding). POWERPOOR will facilitate experience and knowledge sharing, as well as the implementation of small-scale energy efficiency interventions and the installation of renewable energy sources, increasing the active participation of citizens prompting them to take part in joint energy initiatives and innovative financing schemes.

Within the course of the project, pilot energy poverty support programmes/schemes will be designed, developed, and implemented in eight different countries across Europe, namely Bulgaria, Croatia, Estonia, Greece, Hungary, Latvia, Portugal, and Spain, led by a network of trained and certified Energy Supporters and Mentors. The Energy Supporters and Mentors will support households suffering from energy poverty. The former will mainly support citizens to plan and implement energy efficiency interventions (both of small and large scale), the latter to participate in joint energy initiatives such as energy communities or cooperatives and to organise crowdfunding campaigns. Citizens suffering from energy poverty will be supported through various planned activities, as well through the establishment of Local Energy Poverty Offices, and through the uptake of ICT-driven tools included in the Energy Poverty Mitigation Toolkit. Three tools are being developed to support this whole process.

- The POWER TARGET tool follows a data-driven approach aiming at supporting local and regional authorities to identify citizens suffering from energy poverty as well as groups or communities suffering from the phenomenon. This tool will use qualitative and quantitative indicators, such as energy-related data, building characteristics and other sociodemographic data. More information can be found in D2.1.
- The POWER ACT tool will be a citizen centred application, utilised by citizens to facilitate behaviour change and support them in implementing energy efficiency measures. The rationale behind the POWER ACT tool will be presented in the deliverable at hand.
- The POWER FUND tool will provide citizens with information on funding opportunities for a variety of projects that can help alleviate energy poverty, including: (a) an on-line marketplace for becoming a member of or creating an energy community/cooperative; and (b) information on how to organise crowdfunding campaigns. More information can be found in D2.4.

Figure 1: The three tools as they are displayed in the POWERPOOR website

1.1 Purpose & Scope

The purpose of this document is to delve into the POWER-ACT tool. In particular, the functionalities of the POWER-ACT tool will be described by providing a guidebook of how to optimally use the tool and by also describing the methodology employed to provide the users with a list of proposed behavioural changes they can implement to improve their energy efficiency, by implementing small scale energy efficiency measures and by lowering their energy expenses. Within this document, step by step instructions for the tool's optimal usage are presented. Then the methodology and rationale behind POWER-ACT are given.

1.2 Structure of the document

The structure of this document is as follows:

- Section 2 describes the stepwise guidelines to optimally use the POWER-ACT tool.
- Section 3 describes the literature and assumptions that the POWER-ACT tool is based on
- Section 4 concludes the deliverable at hand.

2. Stepwise instructions for using the POWER-ACT tool

2.1 Accessing the tool

The POWER-ACT tool is accessible via the POWER-POOR website[1] or via the stand-alone, dedicated webpage[2] that includes the toolkit. On the website, users can navigate to the tools' page by clicking on the respective category on the navigation bar that lands the user to the respective page as depicted below. A shortcut to the tools' page has been also added in the project's website homepage.

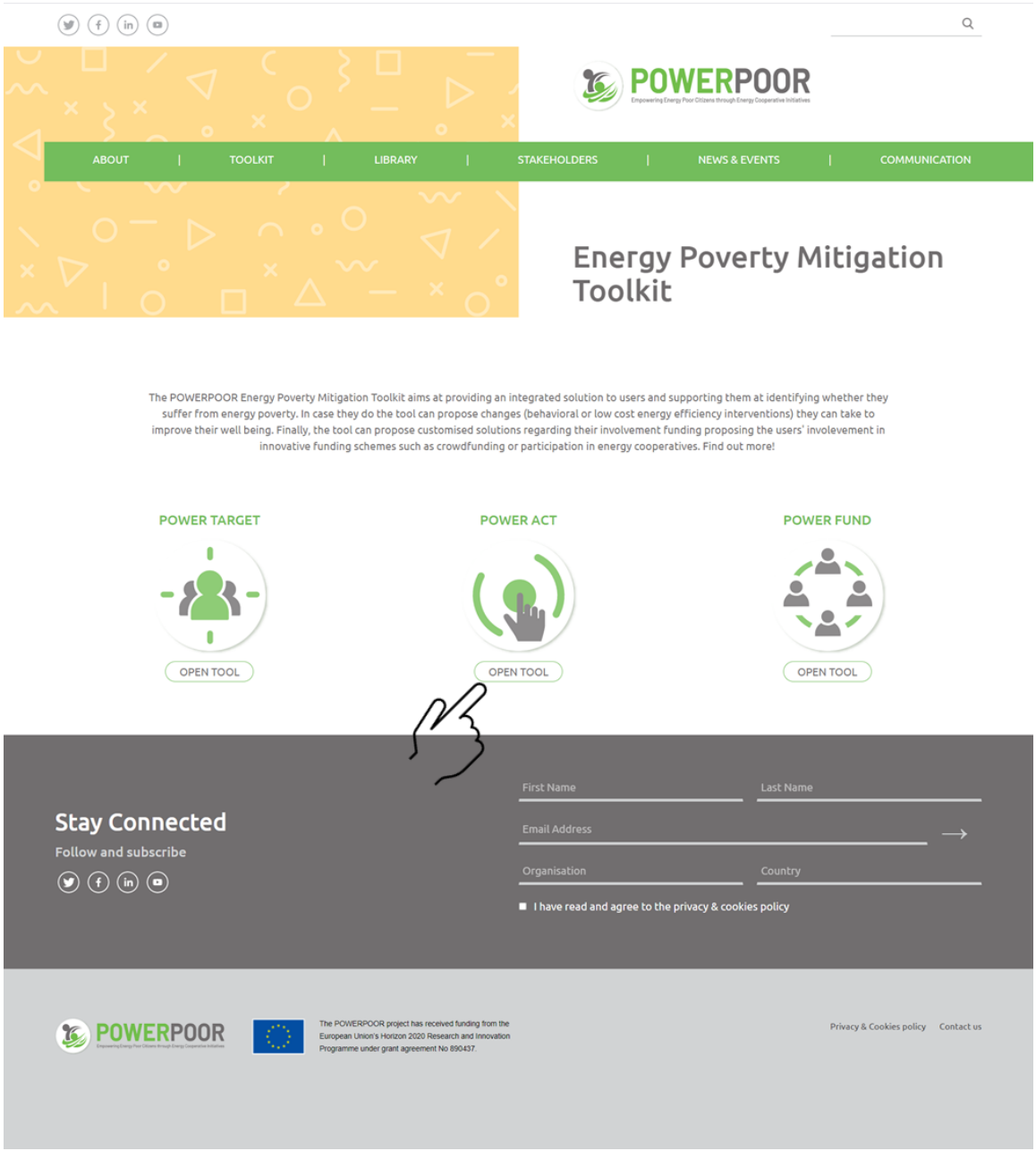

Figure 2 Accessing the POWERPOOR-Toolkit

[1] www.powerpoor.eu
[2] http://powerpoor.epu.ntua.gr/powerpoor-toolkit/

A view of the standalone webpage of the POWERPOOR toolkit is depicted below.

Figure 3 View of the tools in the stand-alone webpage.

2.2 Creating an account

Before the user can take the POWER-ACT assessment survey to receive personalised suggestions to improve their energy spending and/or reduce their energy expenses, they need to create an account as depicted below.

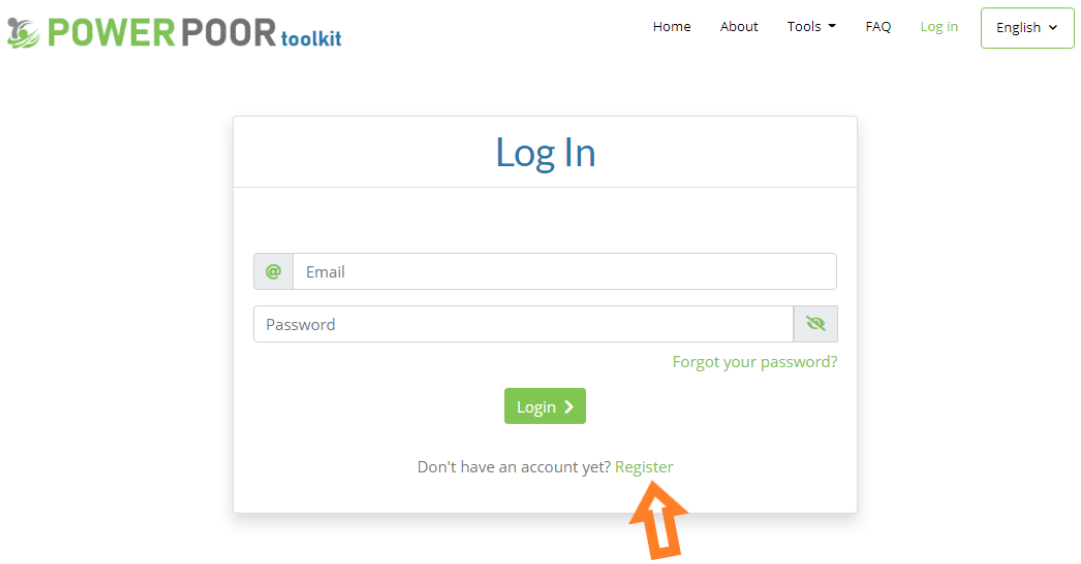

Figure 4 Navigating through the registration

The account's aim is to maintain continuity in users' assessments. Data entered by the user already in the POWER-TARGET tool can be also automatically transferred to the POWER-ACT assessment. The users can also retake the assessments to evaluate whether their assessment has changed after for instance they have implemented the proposed behaviour changes and/or implemented (small or large scale) energy efficiency interventions.

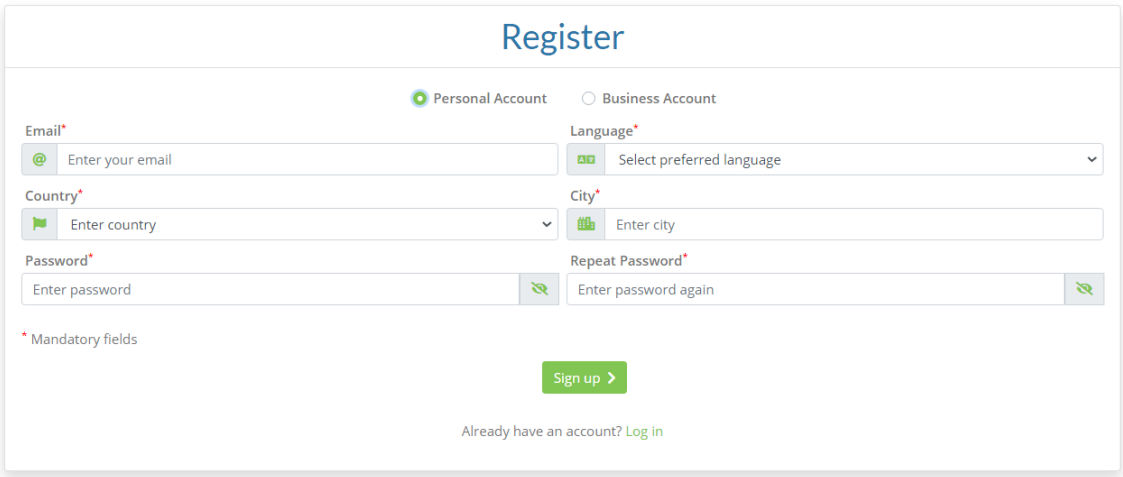

Figure 5 Filling in registration information

During the registration process the users add their email and select their preferred language for the tool's interface. It is worth noting that except for the 8 national languages of the pilot countries namely: Bulgarian, Croatian, Estonian, Greek, Hungarian, Latvian, Portuguese, and Spanish, the tool also supports Basque, to better accommodate the potential users' needs from the Basque region in Spain. Users should add the country and city they currently reside in the form fields: country and city.

2.3 Starting an assessment

After creating an account, the user can take a new POWER-ACT assessment by clicking on the POWER ACT button, while on the dashboard their personal information is displayed as depicted below.

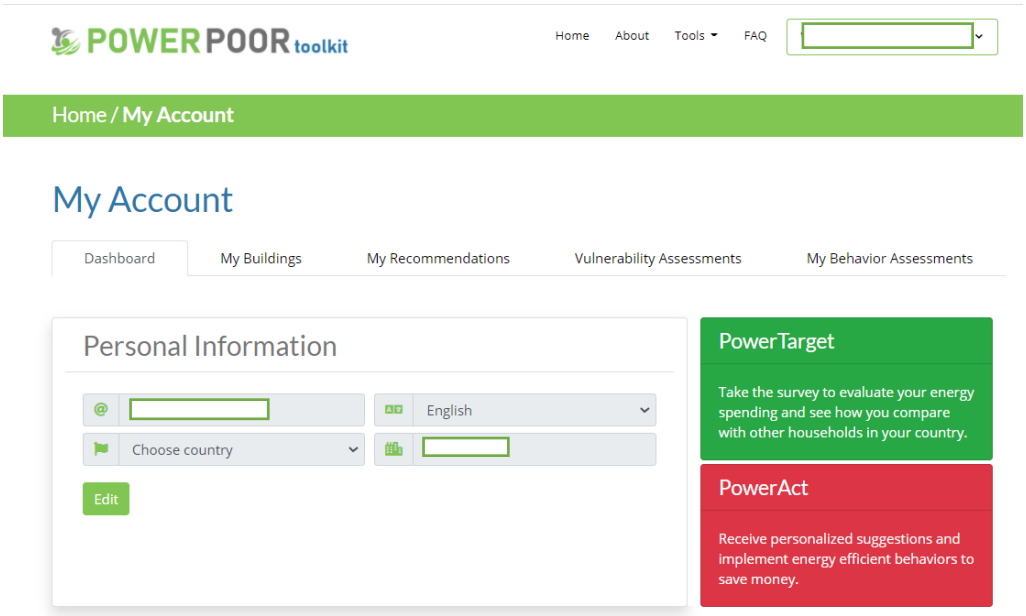

Figure 6 Navigating to the Power-Act tool

2.4 Building Selection

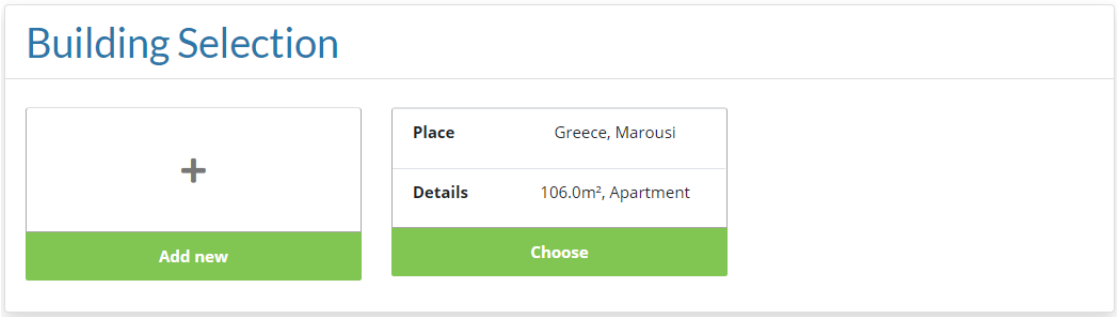

Figure 7 Building selection fields.

The first area is the building selection section. There the user selects one of the existing buildings created in user's account or input details for a new building. The term building covers all the different types of dwellings rather than buildings themselves. The term can be replaced with the word dwelling to better reflect this fact as the issue was brought forward in the 1st Internal Capacity Building Workshop. For instance, if an Energy Supporter supports several apartments within the same block of flats, then each one of them will be a "Building" entry in the tool. What is more, each apartment or house will be accompanied by a unique code that will act as an identifier so that the Supporter can better keep track of all the homes they have visited and more easily report back to the national partners so they on their turn can keep track of all the homes getting support in a national level.

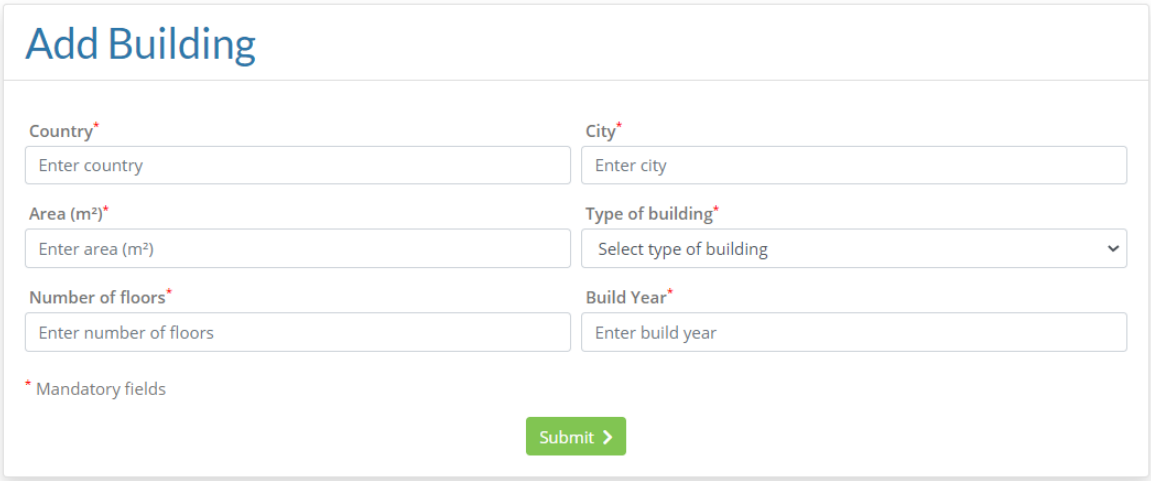

Figure 8 Add a new building field.

To add a new building the user needs to fill the information presented in Figure 8 and click the submit button. The building will then be saved and will be accessible through both the POWER TARGET and the POWER ACT tools.

2.5 Additional building information

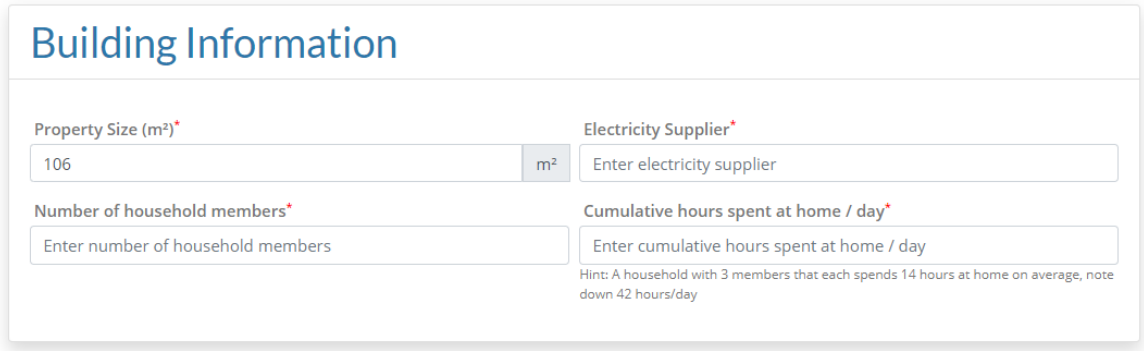

Figure 9 Adding building information

After selecting one of the saved buildings in the previous step the property size field will be already populated with the stored value from the specific building. The user then proceeds to fill in more information such as the electricity supplier (company name) for the building and the number of household members residing in the building. In the cumulative hours spent at home the user enters the sum of hours that all the members spent at home on average on a workday. For example, if a household has three members, and each member spends on average 14 hours at home, the user fills in 42 hours in that field. It is important here to consider the daily habits of the time period that is covered in the bills used so that the respective habits can be included in the "Cumulative hours spent at home per day" field. For instance, if the bills taken into account in the tools reflect a pro covid condition then the respective hours spent at home at the time must be taken into account.

2.6 Heating fuel consumption

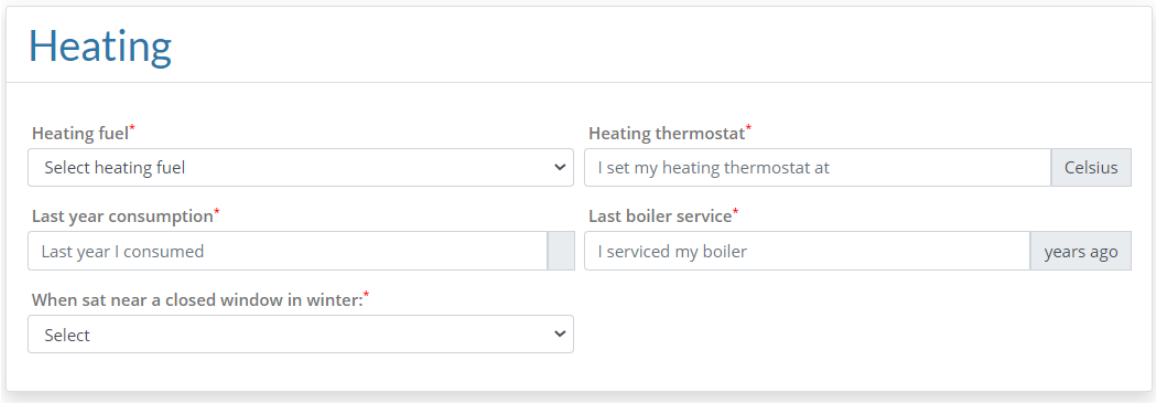

Figure 10 Filling in heating fuel consumption data

In this section the heating fuel predominantly used during winter for heating (oil, natural gas) needs to be specified. The user also needs to select when the last service of the boiler was. If boiler service is not applicable for them, users should enter 0. The qualitative question about the perceived thermal comfort in winter must also be filled in.

2.7 Air-conditioning operation

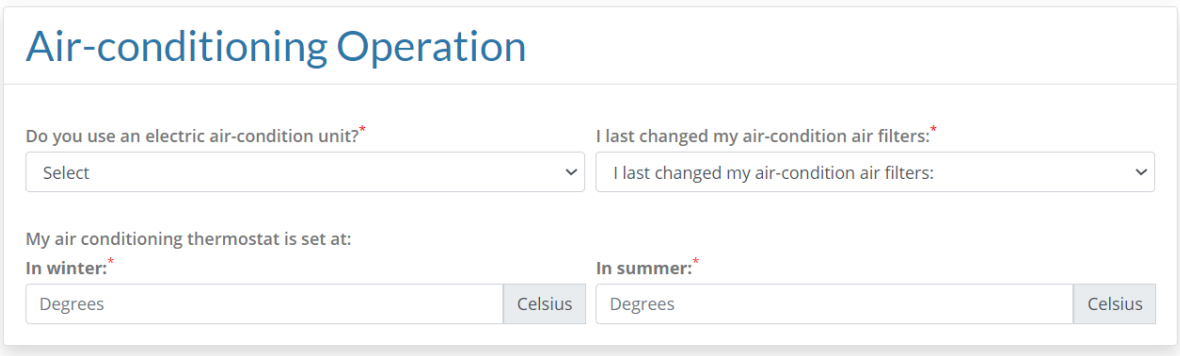

Figure 11 Air-conditioning operation page

In the next section the user can specify whether they are using an air-conditioning unit in winter or summer. In the field "I last changed my air-conditioning filters", the user should set the appropriate answer (if applicable). In the fields for thermostat levels for Winter and Summer, the user should enter the most commonly used temperature one sets the air condition unit each season respectively.

2.8 Electric appliances information

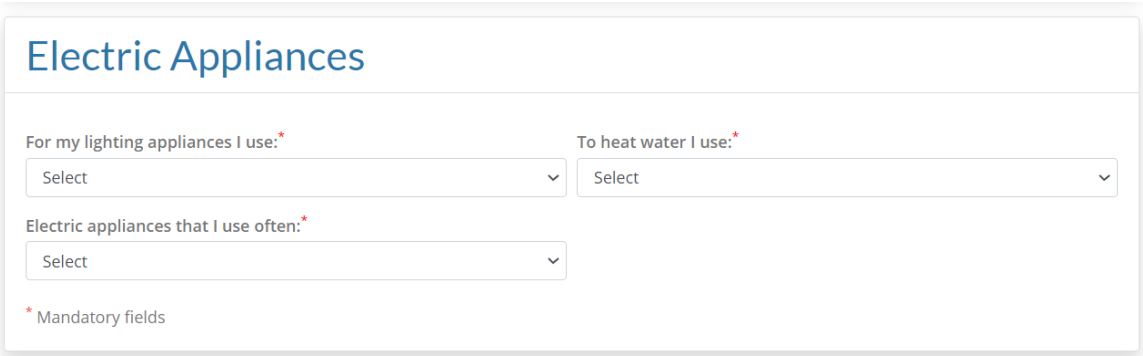

Figure 12 Electric appliances selection fields

In the Electric appliances section: the user selects whether the lightning appliances are energy efficient. The user also indicates the devices used to heat the water. The final question provides insight to whether the user has multiple appliances in stand-by mode when they are not used. This question does not have to do with the thermal comfort, however electric appliances can be an important driver of cost and with small behavioural changes, the users can lower their electricity bills.

2.9 Results Page

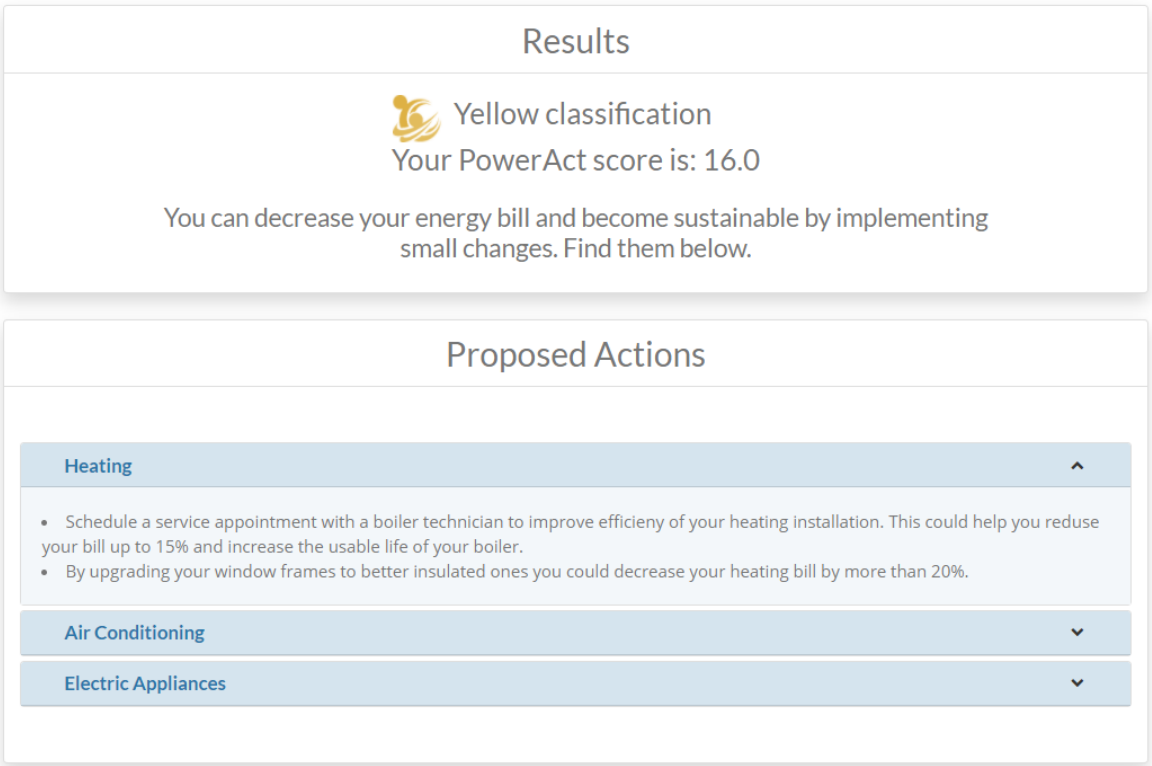

Figure 13 Results page

The POWER ACT score is calculated based on the responses submitted by the user. Low scores indicate margin for improvement in terms of energy behaviour while higher

scores indicate more efficient behaviours and limited room for improvement from behavioural changes. Scores range from 0-100 with score equal to zero achieved when a user submits responses that indicate the least efficient behaviours possible. A score equal to 100 is achieved when responses indicate the most efficient behaviours possible given the available responses.

In the proposed actions tabs, personalised suggestions are generated based on the responses from the users. The suggestions section will be continuously updated.

2.10 Reviewing previous assessments

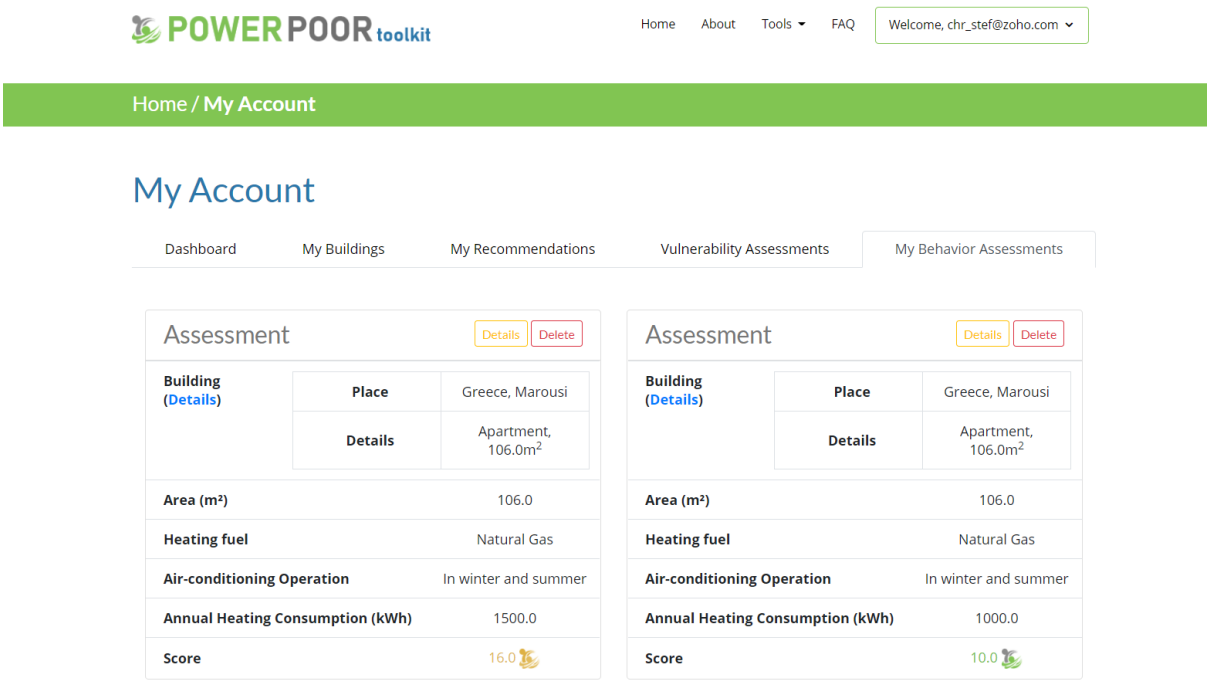

Figure 14 Reviewing existing assessments via "Vulnerability Assessments" tab

In the POWERPOOR toolkit pages, under the "My account" section and the "My behaviour assessments" tab users can review their previous assessments and monitor their progress. The objective of the POWER ACT tool is to add elements of gamification to users' efforts to improve their household's energy efficiency. It is essential that users can retake the assessment after improving their energy spending patterns or implementing energy efficiency improvements in their household, to review whether the score has increased after each action.

3. Delving into the POWER-ACT methodology

The development of all the POWERPOOR tools is based on a co-creative approach where all the consortium partners contribute with their expertise and their knowledge of the national contexts. The aim of the POWERPOOR energy poverty mitigation toolkit is to be user friendly and concise, so that citizens suffering from energy poverty can be easily identified and offered support.

The initial understanding of what the toolkit should include resulted from the workshops held under task 2.1 and the requirements elicitation process. After that, initial mock-ups of the POWER-ACT tool were developed and distributed to the partners for the first round of feedback (after they have already provided feedback on the POWER-TARGET tool). Once all the partners contributed with their feedback, these were integrated in the development process of the tool and a first version was deployed. This first version was demonstrated to the partners in one of our bi-monthly plenary calls where the partners contributed once again, and a second round of feedback was initiated. The second round of feedback was embedded to the tool, and another deployment of the tool took place. This version was distributed to the partners to be translated, and this brought forward some minor issues that were corrected in the stable deployment of the POWER-ACT tool which was then made available online. Extensive user testing and future feed will lead to updates and improvements to the content of the POWER-ACT tool

3.1 The POWER-ACT score

The POWER-ACT score is a metric that aims at measuring the degree of energy efficient behaviour adoption the residents have in the households. The objective for the POWER-ACT score is to provide an intuitive method to motivate households to improve their energy consumption behaviour. The score is primarily influenced by responses of the user to structured questions that provide insights to their energy consumption and can help identify common inefficient behaviour patterns.

Low scores indicate margin for improvement in terms of energy behaviour while higher scores indicate more efficient behaviours and limited room for improvement with behavioural changes. Scores range from 0-100 with score equal to zero achieved when a user submits responses that indicate the least efficient behaviours possible while score equal to 100 achieved when responses indicate the most efficient behaviours possible given the available responses in the structured questions.

Table 1: Classification of the POWER-ACT users

Score	Description
0-30	Red classification: Responses to multiple structured questions indicate significant margin for improvement in the behavioural aspect.
30-50	Yellow Classification: Responses indicate user has adopted a limited number of energy efficient practices but substantial margin for improvement remains.

Score	Description
50-75	Blue Classification: Responses from structured questions indicate adoption of multiple energy efficient practices. There is still some margin of improvement.
75-100	Green classification: Responses from structured questions indicate exceptional adoption of energy efficient practices. There is very limited room for improvement with implementing only behavioural changes.

The objective of the POWER-ACT score is to add elements of gamification to users' effort to improve their energy spending habits. Simple to implement behavioural changes can drastically decrease energy spending and/or expenses in households, leading to mitigation of energy poverty. Financially vulnerable households may need to proceed with multiple behavioural changes. Such changers usually occur over time, in a progressive manner. POWER-ACT score acts as a gamified incentive, nudging users to continue adopting efficient behaviours and retaking the test until they achieve their desired score.

3.2 Definitions

Energy Efficiency

Energy efficiency is defined as the portion of total energy input to machine or system that is consumed in useful work and not wasted as useless heat or otherwise [1].

Energy Efficient behaviour

In the context of the POWER-ACT tool energy efficient behaviour is defined as actions and habits of individuals that prevent waste of energy input for household heating and appliances. Adoption of energy efficient behaviours from financially vulnerable households can also contribute significantly to the mitigation of energy poverty [2].

Energy Efficient Interventions

In the context of the POWER-ACT tool energy efficient interventions are defined as long term changes to physical infrastructure of households such as heating boilers or window frames that prevent waste of energy input for household heating and appliances.

Comfortable living Conditions

The World Health Organization considers satisfactory living conditions in 23°C in the living room and 18°C in other rooms, achieved for 16 hours every day for households with older residents or residents with disabilities or chronic illnesses. For younger residents comfortable heating conditions are considered as: 21°C in the living room and 18°C in other rooms for a period of 9 hours every day (or 16 each day over the weekend) [3].

3.3 Selection of questions

Thermostat level

The thermostat level set in a household is considered in the POWER-ACT score, as it provides indications to household occupants' habits in terms of heating. Thermostat levels higher than 22 degrees increase costs significantly without an equivalent increase in thermal comfort and are penalised in the POWER-ACT score.

Heating Boiler Service

This structured question is not applicable for user groups that use district heating. For households that use natural gas, heating oil or pellets, frequent boiler service intervals can increase efficiency of the systems [4].

Qualitative questions on thermal comfort

In the POWER-ACT tool qualitative questions that provide insights to thermal comfort do not affect the score calculation. They offer complementary insights to the score required to identify and test potential correlations such as: Users with high POWER-ACT scores that demonstrate energy efficient behaviours also demonstrate high degree of thermal comfort at home.

Airconditioning operation

Operating an air conditioning unit or any other electric appliance as a main source of heating in winter can be less efficient overall than a natural gas furnace.

Lightning Appliances

Use of halogen lamps for lighting purposes are penalised by the POWER-ACT score as they are less energy efficient than LED lamps.

3.4 Calculation of the POWER-ACT score

Explanation of the methodology

Energy behaviour has a significant impact in household energy consumption and consequently on the financial impact of energy services for household budgets [5]. For the purposes of the POWER-ACT tool energy behaviour is broken down to:

1. Heating adjustment and fuel selection. Selecting more efficient heating fuel such as natural gas or district heating instead of heating oil and setting the thermostat to the appropriate comfort levels is considered efficient behaviour. Deviations from efficient behaviour lead to a lower POWER-ACT score;
2. Airconditioning operation and adjustment. Operating air-conditioning and electric appliances in the winter and maintaining too high thermostat levels in the winter or too low in the summer are considered inefficient and lead to a lower POWER-ACT score;
3. Electric appliances. Using out-dated lightning appliances or leaving devices on

standby mode is considered inefficient. Using LED lamps and shutting down devices when not in-use improves the POWER-ACT score.

The tool focuses on structured questions that are applicable to most households and require minimum technical knowledge. The aim of the tool is to be easy to use by the household members as well as by the Energy Supporters without the need for guidance.

Negative score weighted questions

Answers in most structured questions in the POWER-ACT tool carry score weights. Users start with a running score balance of 100. Answers that indicate inefficient behaviours are tied to a negative score that is cumulatively subtracted from the initial 100 points. The answer that indicates the best practice in each question is tied to zero valued negative score. In other words, when users pick the optimal answer for a specific question their running score balance is not affected. The running score of the user, after answering all the questions is the final POWER-ACT score.

The formula to calculate the POWER-ACT Score is the following

$$PowerAct\ Score = 100 - \sum_{1}^{n} NW_i$$

Where:

n = count of negative score bearing questions in the survey

NWi= negative weight of answer selection for question i by the user

$$0 \leq \left(\sum_{1}^{n} NW_i\right) \leq 100$$

Thermal Comfort Qualitative questions

In the POWER-ACT tool qualitative questions that provide insights to thermal comfort do not affect the score calculation. They offer complementary insights to the score required to identify and test potential correlations between the results derived from negative score weighted questions and users' consensual thermal comfort levels.

4. Conclusions

POWERPOOR aims at enabling citizens suffering from energy poverty to alleviate the phenomenon through implementing small scale interventions and behavioural changes as well as through participating in joint energy initiatives, including innovative financing schemes that can support large scale interventions and enable them to all together mitigate energy poverty.

The aim of POWER-ACT is to be easy to use, to include the vastly different conditions in each country so it can be of use to the Energy Supporters working on the field. The objective of the tool is also to add elements of gamification and motivate users to progressively improve their energy spending habits. Simple to implement behavioural changes can drastically decrease energy spending in households, leading to mitigation of energy poverty. The proposed methodology will be tested on the field during the first engagement cycle and will be accordingly adjusted if needed in the POWERPOOR toolkit integration and roll-out planned to take place on December 2021.

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