POWERPOOR

Empowering Energy Poor Citizens through Energy Cooperative Initiatives

D2.2: The POWER-TARGET tool

Working on the ground with citizens suffering from energy poverty to alleviate the phenomenon.

March 2021

www.powerpoor.eu

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

Deliverable D2.2: POWER-TARGET

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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
WHO	World Health Organization
°C	Degrees of Celsius
EPOV	Energy Poverty Observatory
OECD	Organisation for Economic Co-operation and Development

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.

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.
- 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 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.

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-TARGET tool. In particular, the functionalities of the POWER-TARGET tool will be described by providing a guidebook of how to optimally use the tool and by also describing the methodology employed to identify whether a citizen or a household, community or area suffer from energy poverty.

Within this document, step by step instructions for the tool's optimal usage are presented. Then the methodology and rationale behind POWER-TARGET are given. The POWER-TARGET score is a metric used to identify households suffering from energy poverty. It is based on the 10% indicator and it is adjusted including more variables that resulted from a concise literature review of the various metrics, tools, and indicators currently employed to measure the phenomenon

across Europe. This document thoroughly explains the rationale behind the selection of variables and the formulas used to calculate this score.

1.2 Structure of the document

The structure of this document is as follows:

- Section 2 describes the stepwise guidelines on optimally using the POWER-TARGET tool.
- Section 3 describes the literature and assumptions that the POWER-TARGET tool is based on to produce the "enhanced 10%" indicator.
- Section 4 concludes the deliverable at hand.

2. Stepwise instructions for using the POWER-TARGET tool

2.1 Accessing the tool

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

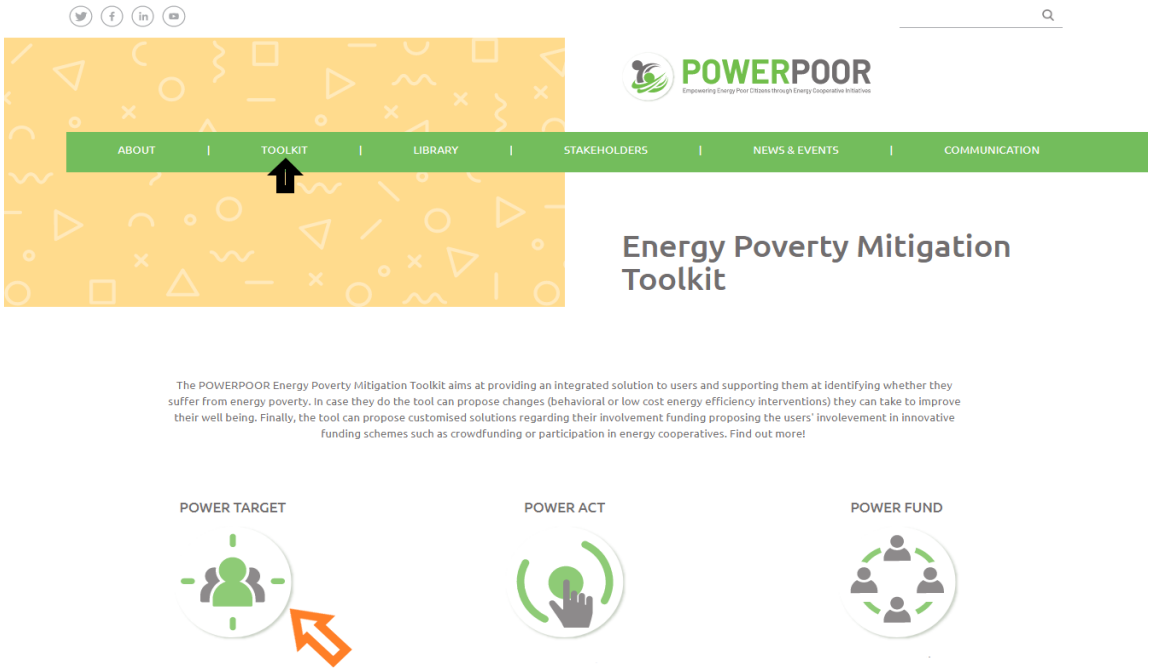

Figure 2 Accessing the POWERPOOR-Toolkit

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

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

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

2.2 Creating an account

Before the user can take the assessment survey to determine whether they suffer from energy poverty, they need to create an account as depicted below.

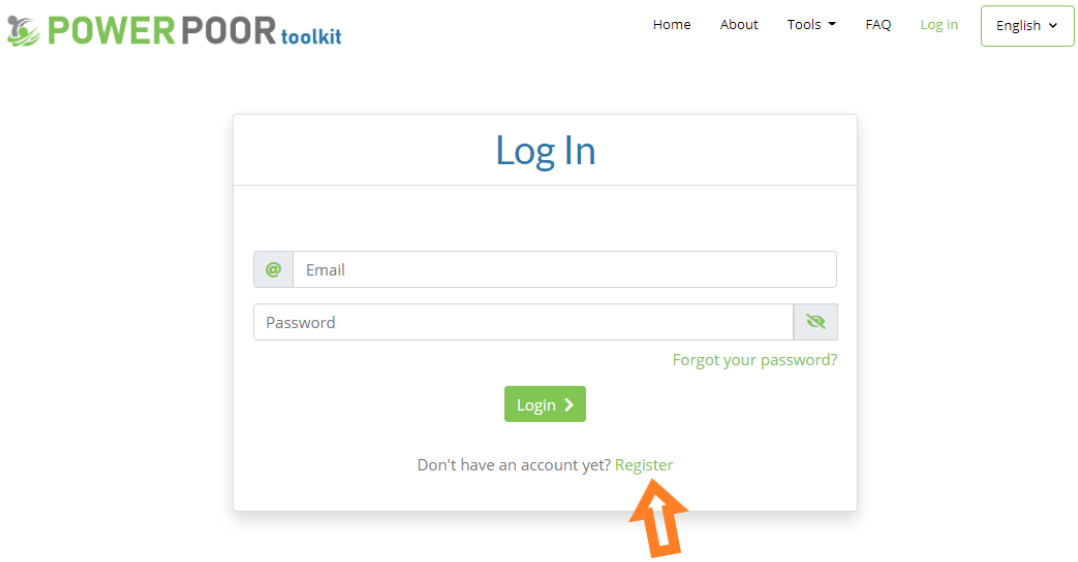

Figure 4 Navigating through the registration

The account's aim is to maintain continuity in users' assessments. Data enterer by the user in POWER-TARGET can be also automatically transferred to POWER-ACT. The users can also retake

the assessments to evaluate whether their scores have improved after for instance they have implemented the proposed behaviour changes and/or implemented (small or large scale) energy efficiency interventions.

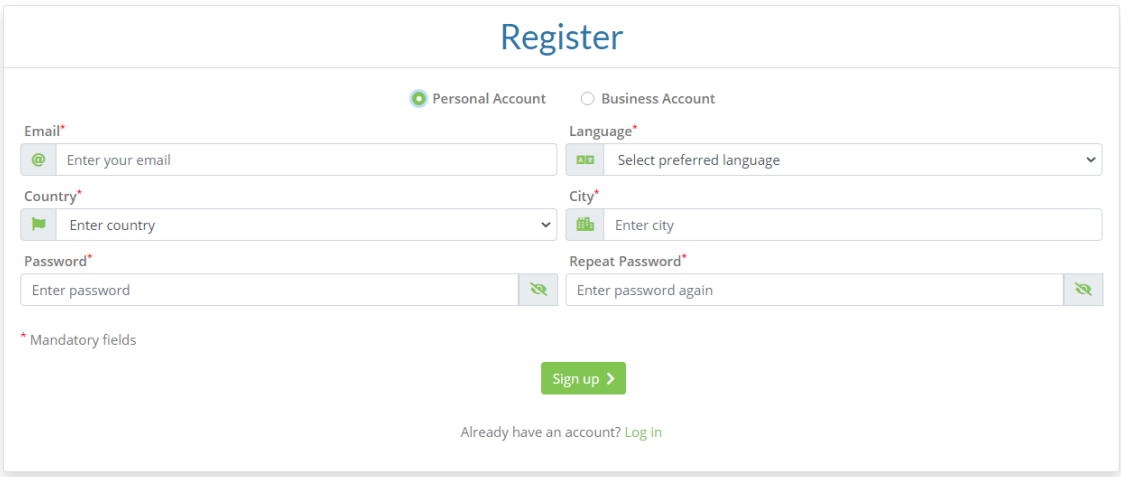

Figure 5 Filling in registration information

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: Greek, Bulgarian, Hungarian, Croatian, Spanish, Portuguese, Estonian, and Latvian the tool also supports Basque, to better accommodate the potential users' needs from the Basque region, 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-TARGET assessment by clicking on the PowerTarget button, while on the dashboard their personal information is displayed as depicted below.

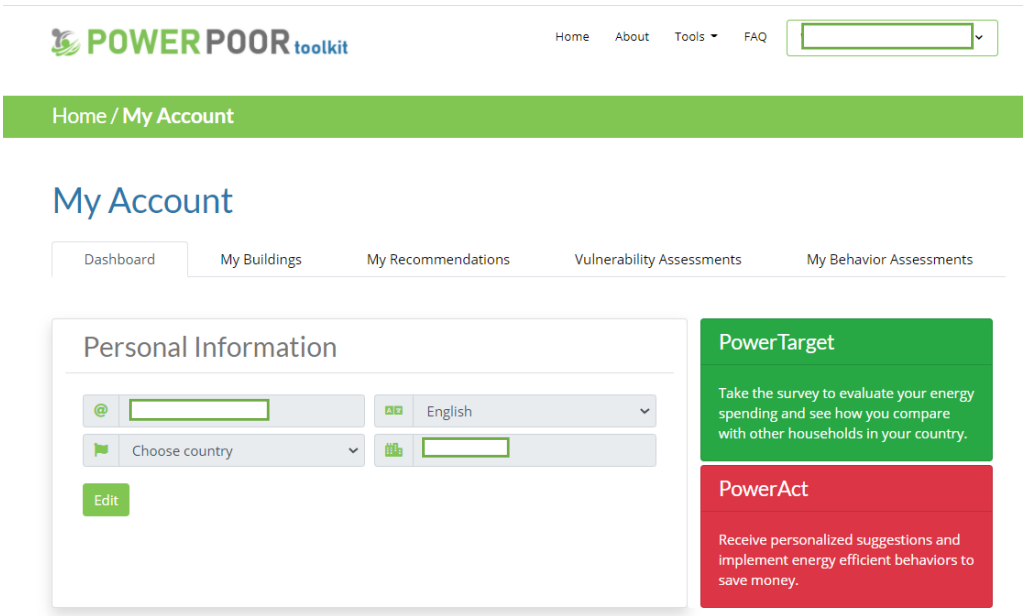

Figure 6 Navigating to the Power-Target tool

2.4 Income information

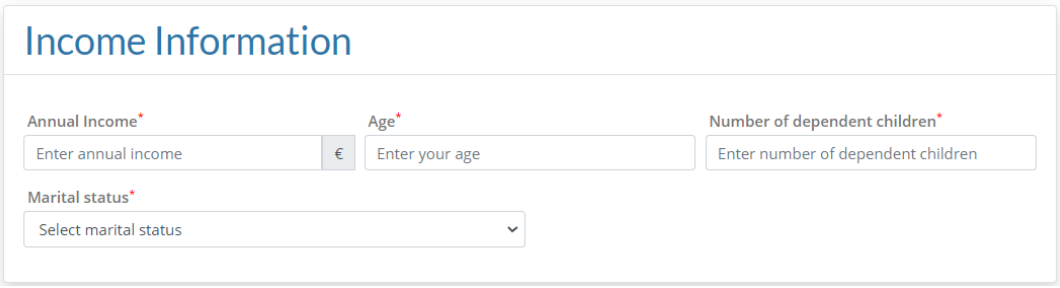

Figure 7 Income information fields

The first area is the income information section. There the user must enter the gross household's annual income including the income of any spouse, partner, or roommate living there, adding any state subsidies any of them may have received. After that, the number of not financially independent children or the number of overall tenants living in the household should be added. If financially independent children reside in the household, the number of children field in the tool should not be increased. The Age of the oldest occupant of the household needs to be included in the age field.

2.5 Electricity consumption information

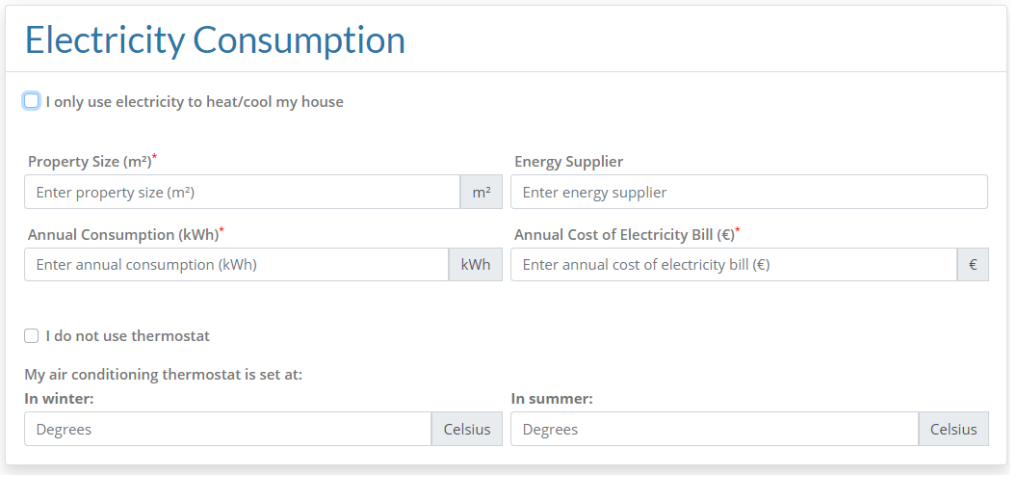

Figure 8 Filling in electricity consumption data

The box "I only use electricity to heat/cool my house" should be ticked if they user is using solely electric appliances such AC units, electric heat pumps or radiators. In this case the heating fuel filed (described in subsection 1.6) will be hidden. If the household uses other forms of heating as well (e.g., natural gas, district heating, oil) then the Heating fuel consumption data need to be filled in as described in 1.6.

The annual consumption in kWh and the cost based on the users' yearly electricity bills should also be filled in. This information can be requested to be provided from the utility provider or simply can be a sum of all the bills for one year, or even there are available applications online that can provide an estimation.

In the Thermostat setting fields the user should enter the temperature most commonly set for the heating and the cooling temperature in winter and summer respectively. If the heating system does not feature a thermostat (e.g., district heating, electric radiators, fans) please tick the "I do not use a thermostat button" and this thermostat fields will be hidden.

2.6 Heating fuel consumption

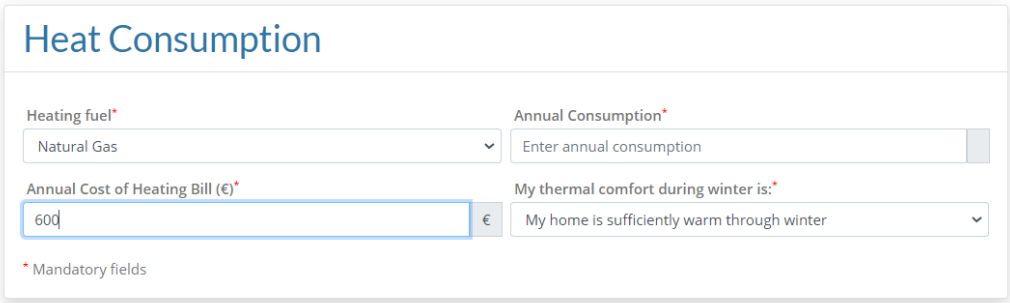

Figure 9 Filling in heating fuel consumption data

In this section the heating fuel predominantly used during winter for heating (oil, natural gas) needs to be added. If only electric appliances are used for heating then 0 must be added in the annual cost of heating bill, since these costs have already been accounted for in the previous section. The qualitative question about the perceived thermal comfort in winter must also be filled in.

2.7 Results evaluation

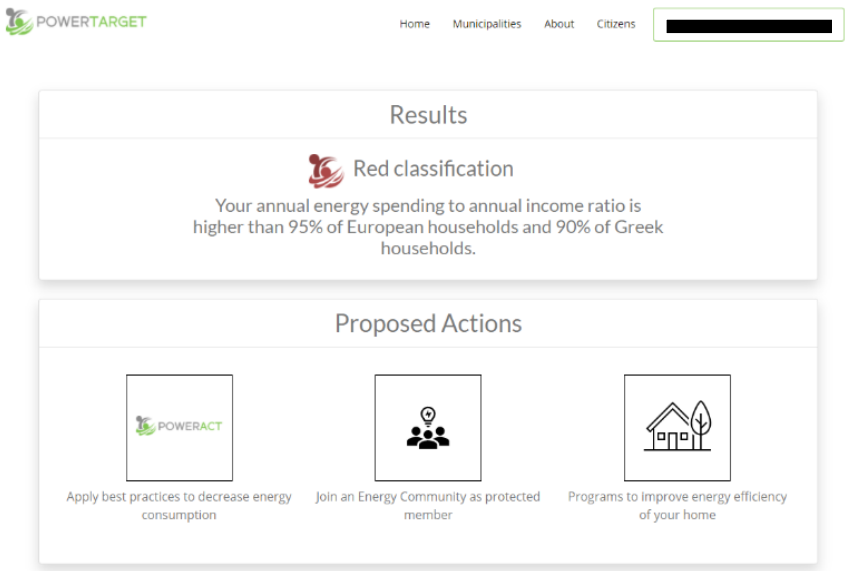

Figure 10 Results' page

After the survey participant presses the submit button, they are redirected to the Score page. There they receive their score and classification, which is presented in section 4. Based on country specific input from partners, relevant support programs and guidelines will be displayed in this section.

2.8 Reviewing previous assessments

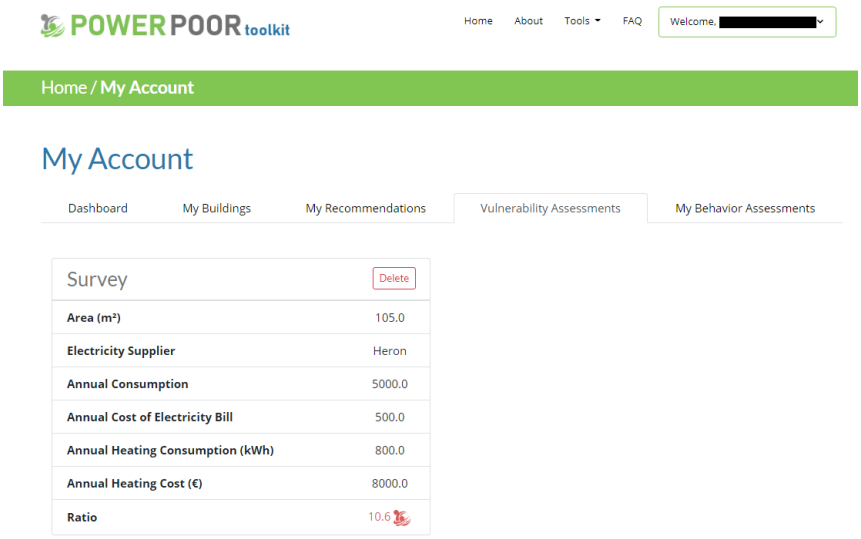

Figure 11 Reviewing existing assessments via "Vulnerability Assessments" tab

In the POWERPOOR toolkit pages, under the "My account" section and the "Vulnerability Assessments" tab users can review their previous assessments and monitor their progress.

3. Delving into the POWER-TARGET score

The development of all the POWERPOOR tools is based on a co-creative approach where all the consortium partners contribute with their expertise. 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-TARGET tool were developed and distributed to the partners for the first round of feedback. 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 final deployment of the POWER-TARGET tool which was then made available online. The subsection below focuses on how the POWER-TARGET enhanced 10% indicator was developed.

3.1 Introduction to the POWER-TARGET score

POWER-TARGET aims at identifying energy poor citizens through a simple survey that is based on an enhanced 10% indicator. In this section the rationale that the score is based on and the methodology behind the enhanced 10% indicator are explained.

Individuals identified as vulnerable by the tool will receive guidance to adopt more efficient behaviours, to implement small scale interventions and will be encouraged to participate in joint energy initiatives so that they can finance large-scale energy efficiency interventions when necessary. Individuals taking the survey receive a score between 0-100 and are assigned in one of four classifications. The score is an expenditure-based poverty metric (enhanced 10% indicator) that has been developed within the scope of the project based on a literature review on the metrics and indicators available aiming at measuring energy poverty. The classifications a POWER-TARGET user can be assigned to are:

Green Classification: Not close to the energy poverty threshold.
Yellow Classification: Not technically suffering from energy poverty, but close to the energy poverty threshold.
Orange Classification: Suffering from Energy Poverty, the adjusted percentage of energy spending is above threshold
Red classification: Suffering from Energy Poverty, the adjusted percentage of energy spending significantly above threshold

The rationale behind assigning a score and multiple classifications to users rather than a one on-off criterion is to enable us to identify vulnerable citizens hierarchically so that citizens in need of imminent support measures can be brought forward (Orange and Red classifications) or citizens that need to take immediate actions at an individual level can also be distinguished (Yellow classification).

3.2 The POWER-TARGET score

The POWER-TARGET score is used to determine the degree of vulnerability of individuals and households with regards to energy poverty. The objective for the POWER-TARGET score is to provide an enhanced and more inclusive 10% indicator in each household rather than relying on single thresholds. The score is primarily influenced by the annual energy spending of the household and the household's annual gross income. The enhancement occurs since other factors such as the number of financially dependent individuals and qualitative indices such as the

perceived heat comfort in the household are taken into account in the final POWER-TARGET score.

POWER-TARGET scores can take different values between 0-100, with the score 0 indicating that energy spending is insignificant in comparison to the total annual household income and score of 100 indicating energy spending that fully depletes household annual income.

Table 1: Classification of the POWER-TARGET users

Score	Description
0-6.99%	**Green** Classification: Not close to the energy poverty threshold
7%-9.99%	**Yellow** Classification: Not technically suffering from energy poverty, but close to the energy poverty threshold
10%-15%	**Orange** Classification: Suffering from Energy Poverty, adjusted percentage of energy spending is above threshold
>15%	**Red** classification: Suffering from Energy Poverty, adjusted percentage of energy spending significantly above threshold

To better understand the rationale behind the POWER-TARGET tool and the proposed enhanced 10% indicator employed to calculate the scores it is worth looking into the Energy Poverty phenomenon and the relevant 10% indices that are prominently used in the literature to measure the phenomenon.

3.3 Definitions

Energy Poverty

According to the Energy Poverty Observatory households suffering from energy poverty "experience inadequate levels of essential energy services, due to a combination of high energy expenditure, low household incomes, inefficient buildings and appliances, and specific household energy needs"[1]. The phenomenon is gaining attention especially in an EU level as mitigating it is crucial for achieving just transitions towards sustainability [2].

The 10% indicator

The 10% indicator was developed and used in a policy level in the UK. The indicator is a threshold used to characterise a household as suffering from energy poverty if it requires more than 10% of its income to maintain comfortable levels of warmth in a given time [3]. Since the 10% indicator is comprehensive and easy to use it has been widely employed to easily identify whether a household suffers from energy poverty. Scotland, Northern Ireland, and Wales use the 10% method as an official threshold [2]. Household income and energy spending are the most important variables in quantitative energy poverty metrics encountered across EU countries. The 10% method in particular indicates that when households need to dedicate more than 10% of their annual income including subsidies to maintain comfortable heating or cooling conditions, they are considered as energy poor [4]. The POWER-TARGET score is based on enhancing the already established 10% indicator.

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)[5].

3.4 Selection of variables

The rest of the variables selected to adjust the expenses to income ratio and to develop the enhanced 10% indicator utilised for the POWER-TARGET tool are described below.

Thermostat level

The thermostat level set in a household is taken into account in the POWER-TARGET score, as it provides indications regarding how comfortable the heating conditions are (i.e., perhaps the thermostat is set too low) and lead to adjustments in the annual energy expenses to income ratio. For example, in households where the thermostat is set lower than 21 degrees of Celsius the annual energy spending is adjusted upwards and this higher notional annual energy expense is used to calculate the energy expense to income ratio,

Age

As mentioned above, the WHO indicates that people older than 75 years old achieve comfortable heating conditions at higher room temperatures than younger individuals. 23 °C is recommended for the former and 21°C for the latter. POWER-TARGET uses the age of the oldest individual in the household and similarly adjusts the target temperature based on WHO guidelines.

Number of dependent children

Energy spending over the annual income ratios for households with dependent children or financially independent individuals are calculated after adjustments to the annual income, an increase in the number of children leads to a lower adjusted income used for the calculations. Child raising cost fluctuates depending on the country of residence across Europe and the age of the child [6]. This cost is also highly subjective as well as dependent on the number of children in the family [7]. For the POWER-TARGET case, a European average cost per child is taken into account resulting from data available in OECD [8].

Qualitative questions

Literature indicates the necessity of incorporating qualitative metrics as well. If energy expenses do not exceed the 10% of the household income but households still fail to maintain comfortable heating conditions, appropriate adjustments need to be made to their energy spending over the annual income ratio. After such adjustments, these households may appear to be suffering from energy poverty. POWER-TARGET incorporates qualitative questions that lead to adjustments in the energy expenses over the annual income ratio. If users state that they fail to maintain adequate thermal comfort in winter, POWER-TARGET adjusts their energy spending amount to a higher notional amount (the amount they would have to pay to achieve adequate thermal comfort gets higher).

3.5 Calculation of the POWER-TARGET score

Explanation of the methodology

The proposed enhanced 10% indicator employed in the POWER-TARGET tool to calculate the score aims at combating cases of data flattening and simplification in energy poverty assessments. Such issues have been identified and are available in the Energy Poverty Observatory official reports [3]. When a flat energy poverty threshold is used in a National Level, it often disregards sub-national and contextual factors that may affect the vulnerability of citizens with regards to energy poverty. To address this, the POWER-TARGET score operates both as a threshold and as a continuous scale of energy poverty to measure the vulnerability of households (by using the distance from the energy poverty threshold).

Selection of absolute expenditure ratio approach

The POWER-TARGET score is predominantly an expenditure-based approach since it is most heavily influenced by financial information. Countries that have legislated definitions and a threshold for Energy poverty, such as UK, Scotland and Northern Ireland use similar metrics. These metrics are calculated as a ratio of energy spending over annual household income including subsidies and involve the definition of a threshold. When the ratio exceeds the threshold in a household, it is considered to be suffering from energy poverty. Thresholds may be absolute (10% of the annual household income) or relative (threshold crossed when specific household income ratio is 100% greater that the median ratio for all households nationwide). Literature indicates that the relative threshold might underestimate the magnitude of energy poverty issues during times of economic recession or high energy prices. In such cases the ratio of energy expenditures to annual income increases across all households, while the total number of households identified as energy poor may not be significantly affected [9]. Consequently, an absolute expenditure ratio was selected for POWER-TARGET.

The alternative of expenditure-based indicators in assessing household vulnerability are consensual indicators for energy poverty. In such methods simple qualitative questionnaires or interviews are utilised (e.g., are households able to keep their home adequately warm in winter, have they fallen behind on electricity bills, do they need to compromise on other living expenses to make their energy services payments, and other relevant questions.) Within the workshops held under the scope of T2.1, the national partners indicated that qualitative datapoints are not fully in line with quantitative/expenditure-based methodologies and suggested that qualitative data points should be used in addition to quantitative metrics. Consensual indicators can be used to adjust energy spending upwards or downwards depending on the qualitative self-assessment. For example, energy spending in households that set higher than necessary the temperature in the thermostat and report high thermal comfort the energy spending might be adjusted downwards to a notional energy spending to calculate the ratio. Vice versa if a household reports poor thermal comfort, actual energy spending needs to be adjusted upwards to notional annual energy spending (the spending that would be required to achieve satisfactory thermal comfort) and the ratio calculation would use the notional amount, leading to higher energy vulnerability.

Selection of the threshold

POWER-TARGET scores that exceed 10% are considered over the energy poverty threshold. In countries where there is a legislated definition of energy poverty (e.g., UK, France, Cyprus, Slovakia, Ireland [2]), households are considered to be suffering from energy poverty when annual energy spending exceeds 10% of the annual household income. The POWER-TARGET score proxies this ratio while adjusting energy spending and annual household income from actual to notional amounts according to the factors described above. The adjustments are introduced to account for contextual factors.

Calculation of the ratio

POWER-TARGET score is calculated using the following formula:

$$Score = (\frac{HL}{WTL} * HES * 100 + \frac{STL}{CL} * ES * p_{ac} + ES * (1 - p_{ac}) * 100/(AGI - CC * NC - 30 * \max[(AGE - 50), 0]))$$

Where:

HL= Adequate heating level in winter, default = 21 degrees Celsius

WLT= Winter Thermostat Temperature (user input)

HES= Heating Energy Spending (user input)

STL= Summer Thermostat temperature (user input)

CL = Adequate cooling level in summer, default= 27 degrees Celsius

ES = Electricity bill spending (user input)

pac= % of electricity bill costs attributable to air condition (country specific input, default= 0.3)

AGI= Annual gross household income including state subsidies (user input)

CC= Annual Child Raising costs (European average)

NC= Number of dependent children (user input)

AGE= Age of the older individual of the household

The effectiveness of the scoring system will be also tested when POWER-TARGET starts to be utilised in the field in order to identify citizens suffering from energy poverty from the first engagement cycle onwards. If needed, the formula will be adjusted in accordance to input gained from the energy supporters that will be in touch with households suffering from energy poverty that the POWERPOOR project aims at supporting.

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. To be able to support citizens suffering from energy poverty the project needs to be able to identify them. The national partners that are aware of the national conditions can steer the Energy Supporters to the right direction when it comes to identifying the energy poor however the ICT-driven tool POWER-TARGET will also enable them to easily target those in need.

The aim of POWER-TARGET 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 willing to alleviate the phenomenon as well as to be based on an easy to comprehend and already established methodology. The 10% indicator is accepted by practitioners and academia alike. The adjustments made for the POWERPOOR project can make the 10% indicator more inclusive, making sure that no one is left behind in alleviating 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.

Bibliography

[1] What is energy poverty? | EU Energy Poverty Observatory, https://www.energypoverty.eu/about/what-energy-poverty

[2] Bouzarovski, S., Thomson, H.: Towards an inclusive energy transition in the European Union: Confronting energy poverty amidst a global crisis. Publications Office of the European Union. (2020)

[3] Sareen, S., Thomson, H., Tirado Herrero, S., Gouveia, J.P., Lippert, I., Lis, A.: European energy poverty metrics: Scales, prospects and limits. Glob. Transitions. 2, 26–36 (2020). https://doi.org/10.1016/j.glt.2020.01.003

[4] Rademaekers, Koen, Yearwood, Jessica, Ferreira, Alipio, Pye, Steve, Hamilton, Anisimova, N.: Selecting Indicators to Measure Energy Poverty. 1–130 (2014)

[5] World health organization: PUblic hEAlTh ADvicE. World Heal. Organ. 1–37 (2011)

[6] Letablier, M.-T., Luci, A., Math, A., Thévenon, O.: The costs of raising children and the effectiveness of policies to support parenthood in European countries: a Literature Review. A Rep. to Eur. Comm. 1–164 (2009)

[7] Spitzer, S., Greulich, A., Hammer, B.: The Subjective Cost of Young Children: A European Comparison. (2018)

[8] Net childcare costs for parents using childcare facilities, OECD, https://stats.oecd.org/Index.aspx?DataSetCode=NCC#

[9] Moore, R.: Definitions of fuel poverty: Implications for policy. Energy Policy. 49, 19–26 (2012). https://doi.org/10.1016/j.enpol.2012.01.057