IDEA Toolkit: Technology Enhanced Learning for Energy Poverty

Evangelia Vanezi
Department of Computer Science
University of Cyprus
Nicosia, Cyprus
evanez01@cs.ucy.ac.cy

Christos Mettouris
Department of Computer Science
University of Cyprus
Nicosia, Cyprus
mettour@cs.ucy.ac.cy

Alexandros Yeratziotis
Department of Computer Science
University of Cyprus
Nicosia, Cyprus
ayerat01@cs.ucy.ac.cy

Tomislav Tkalec
Association for Sustainable Development FOCUS
Ljubljana, Slovenia
tomi@focus.si

Ana Tesija
Society for Sustainable Development Design DOOR
Zagreb, Croatia
ana.tesija@door.hr

George A. Papadopoulos
Department of Computer Science
University of Cyprus
Nicosia, Cyprus
george@cs.ucy.ac.cy

***Abstract*—Energy Poverty is a condition where individuals cannot afford to use adequate energy services to keep their households in a comfortable living condition, comprising a significant social challenge to the European Union. Household visits to collect and analyze energy data and define potential solutions is one of the more prominent methods used by experts to fight Energy Poverty. Likewise, education and awareness are considered to be equally important. Technology Enhanced Learning (TEL) enriches education utilizing technological means. In this work, we present (1) the needs analysis in the field of fighting energy poverty; and (2) the development of a set of innovative digital tools, as a means to fight Energy Poverty including TEL in the field of Energy; dedicated training for Energy Advisors; general information for the public; tools for assisting experts during household visits and tools to help individuals estimate energy savings. The research was done under the Erasmus+ EU-funded project IDEA: "Innovative Direction in Energy Advising",**

***Index Terms*—Energy Poverty, Technology Enhanced Learning, ICT tools**

I. Introduction

Energy Poverty comprises a key societal challenge [1] in the European Union, described as the condition where individuals do not afford to keep their households adequately warm or cool, or use energy services to a decent living level. According to [2], in some countries the percentage of the population that are unable to keep their homes adequately warm exceeds 20%, reaching the highest number of 33.7% in Bulgaria. In 2016 it was estimated that about 50 million households in the EU were facing Energy Poverty[1].

One main way to face such major socio-economic issues, is by formulating appropriate national and European wide policies [3] such as the Directive (EU) 2018/844 of the European Parliament [4] and the Directive 2012/27/EU on energy efficiency [5]. Furthermore, academics, researchers, civil society organizations, state actors and energy advisors in various countries are involved in the attempts to study and find appropriate, effective ways to address Energy Poverty. Households visits for gathering and analysing data on the conditions of living, the energy consumption and potential solutions is one of the methods used by the respective bodies. Energy advisors can implement energy efficiency measures in the households, and provide energy saving devices and helpful information and advice on how to reduce energy use [6], [7].

Education is an important means against major social issues, playing a multi-dimensional role in the fight against Energy Poverty. Students, and unemployed people can be trained to become energy advisors and deploy household visits. They can subsequently educate people during the household visits. Energy advisers and other relevant stakeholders can be educated specifically on the topic of energy poverty. Individuals can be educated about energy consumption, energy efficiency and energy measures that can be undertaken by themselves to help them overcome Energy Poverty. Technology Enhanced Learning, enriches the educational ways with technological means, such as web tools and platforms offering a life-long, distance learning approach accessible by anyone at any time.

In this work, we present a set of innovative ICT tools meant to offer TEL, as a means for fighting Energy Poverty. The IDEA Toolkit was developed under the Erasmus+ EU-funded project "Innovative Direction in Energy Advising" and offers a broad range of tools with the twofold aim to cover both the area of adult education in the field of Energy, as well as to assist energy advisors during their visits to households. The tools are accessible from the project's website[2].

Paper Structure. Section 2 discusses the background and related work. Section 3 presents our methodology, section 4 presents the IDEA toolkit and section 5, discusses a use case validation and the conclusions and future work.

[1]EU Statistics on Income and Living Conditions, 2016, https://www.energypoverty.eu/

[2]http://www.project-idea.eu/

II. Background & Related Work

Background. At the EU level there is no common definition of energy poverty, nor is there a definition in place in the majority of the EU countries. Most commonly used definitions stated that a household is energy poor if it spends more than 10% of its annual income on having adequate energy services, or spends twice the median fuel expenditure as a proportion of income [8]. For the purpose of this article we can use a descriptive definition that a household is energy poor if it cannot afford to to use adequate domestic energy services needed for decent, comfortable living conditions, that is, to guarantee itself a basic standard of living.

According to the Regulation (EU) 2018/1999 [9] on the Governance of the Energy Union and Climate Action, Member States must address the topic of energy poverty in their National Energy and Climate Plans, that are due in 2020. Accordingly, the Member States should prepare a definition of energy poverty, set goals for reducing it and set in place measures for achieving the goal.

For evaluating situations in various EU Member States we can refer to European Domestic Energy Poverty Index, which ranks Member States based on their progress in alleviating winter and summer domestic energy poverty. The EDEPI shows a strong divide in the distribution of energy poverty in the EU, reflecting differences in geography, climate, income levels and policy action. Sweden ranks first and Bulgaria ranks last. Overall, according to [10] there is a clear division between Western/Northern countries with high scores in rankings and Eastern/Southern-Eastern countries low scores in rankings. This index does not suggest the share of people within countries who are affected by energy poverty, but it shows where four factors that determine energy poverty are more or less prevalent. When referring to the causes of energy poverty, three factors are the most important. These factors are shown in table I. We should bear in mind these factors when preparing and conceptualizing measures for alleviating energy poverty. These should specifically focus on energy efficiency measures, such as: a) low-cost energy efficiency and energy saving measures, b) replacement of household appliances, c) replacement of inefficient heating systems, d) deep renovation of buildings etc. [11]. Most efficient measures for alleviating energy poverty are infrastructural measures. Nevertheless, these must be interlinked with soft measures, in form of educational and awareness raising programs and energy advising, that are essential for comprehensive addressing of the complex issue of energy poverty.

TABLE I
FACTORS RELATED TO ENERGY POVERTY

No.	***Factors that determine energy poverty [10]***
(1)	energy expenditures as share of total household expenditures
(2)	inability to keep home warm in winter
(3)	inability to keep home cool in summer
(4)	living in a dwelling with leaky roof.
	Factors causing energy poverty [6]
(1)	low income of households, often linked to general poverty
(2)	high energy prices
(3)	poor energy efficiency of homes and used appliances

Related Work. An EU Energy Poverty Observatory (EPOV) was formed with an aim of increasing the importance and visibility of energy poverty. It serves as a platform for EU, national and all other actors working on energy poverty, where data on the topic can be found, but especially important, where knowledge and resources materials on energy poverty are gathered in one place [12]. Provision of complete descriptions on current policy measures to alleviate energy poverty, the [13] mentions a couple of projects. [14], a Horizon 2020 EU funded project, published a series of reports and database on solutions. Short-term remedies and resolution of long-term drivers of energy poverty were analysed and presented in studies requested by the European Parliament's Committee on Industry, Research and Energy (ITRE). Noteworthy is that they had considered social policies addressing energy consumption in combination to examining the degree to which energy efficiency policies should specifically target low-income households. In [14], factors impacting risk to households of energy poverty were expanded upon and included: i) rate of energy price rises versus income growth, ii) ability to access cheaper energy prices, iii) household energy needs, iv) efficiency of energy use, v) policy interventions and vi) reluctance to ask for help. Several types of interventions proposed, had considered the aforementioned factors. In brief, [14]: financial intervention for the most vulnerable; additional consumer protection; energy efficiency & build quality of a vulnerable consumer's home; and information provision & raising awareness. Similar measures are proposed by [15] (e.g. refurbishing and making dwellings more energy efficient). Shorter-term measures include protection from disconnection, individual behavior and information provision and education. [16] views are also in line with the aforementioned. They examined the evolution of policies and measures for 5 EU countries (Cyprus, Spain, Portugal, Bulgaria and Lithuania); countries under-studied in the existing literature. Four types of measures were identified: consumer protection, financial Interventions, energy savings measures and information provision. Interestingly, results showed that the topic of public awareness and information provision for improved energy performance was the most under-represented. This could explain why many relevant stakeholders lack knowledge or understanding of the energy poverty problem. Hence, an essential starting point for all activities addressing energy poverty is educational tools that are specifically designed to focus on energy poverty. Relevant to the project IDEA, training and educational materials and energy advising tools were developed in IEE projects ACHIEVE and REACH. In project ACHIEVE, training material on the topic of energy poverty and an excel tool for energy audits and calculation of energy savings were developed. These were used for energy advising in households [17]. Both tools were subsequently updated in project REACH [18]. ICT tools developed in project IDEA were conceived from the notion that the existing tools from project REACH should be upgraded, updated and combined with additional tools identified by relevant stakeholders as necessary and suitable. This is in line with several studies

discussed, which identified public awareness and information provision as a common measure. In some countries it was an under-represented measure which further supports its use and application in project IDEA. Moreover, it provided us with an opportunity to test and exploit this measure by utilising the developed ICT tools. The goal therefore was to prepare a complete toolbox for energy poverty. Shortcomings of the existing REACH tools were determined during their practical application. Lack of user-friendliness of the excel tool was especially pointed out. Calculating energy savings with this tool was deemed too complex for the majority of users, visual appearance was considered inappropriate, it was outdated regarding contemporary IT solutions and possibilities and moreover it did not provide an optimal user experience. Yet, the tool was still considered as beneficial, useful and functional. Therefore an upgrade made sense. The need of the existing training materials from project REACH to be updated and upgraded with additional content and topics, in order to be up-to-date with science and new knowledge production and practice was also evident. These tools were then completed to form a comprehensive toolbox with tools for education, information, awareness raising and energy advising.

III. Methodology

Figure 1 presents the methodology followed: first a needs analysis was conducted with the assistance of stakeholders. User requirements were collected through a needs analysis questionnaire, and the responses were analysed leading to the decision on the set of tools to be developed to address the problem of energy poverty. Subsequently, each tool was designed in terms of its UI and functionality, based on the factors that determine energy poverty, and the causes of energy poverty as shown in table I. Next, a preliminary validation of the tools design in the form of focus group sessions with experts was conducted. The experts' feedback was utilized in the tools design process through many iterations, ensuring thus the improvement of the design. Using the feedback from the validation, the design was finalised and the tools were developed.

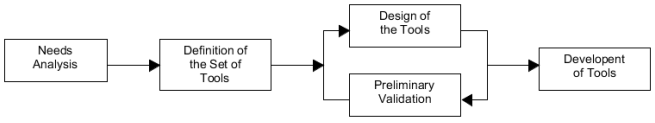

Fig. 1. The methodology followed

A. Needs Analysis towards Defining the Tools

In order to study and identify the gap and the needs in area of energy poverty, at the beginning, a database of stakeholders was created in each of the four countries of the partners: Cyprus, Croatia, Slovenia and Bulgaria. In addition, already existing known methods and practices, were recorded.

A state-of-the-art research and needs analysis was conducted as a next step, during which a questionnaire[3] was created and distributed to the stakeholders. The questionnaire was drafted by FOCUS[4]. It was comprised out of 6 main sections, with a total number of 20 questions. The questionnaire was completed by 144 relevant stakeholders, on an anonymous basis, online, through google forms. Each partner analysed their own country results, and subsequently all the results were combined in an overall report, describing the key findings from the needs analysis. For the sake of brevity, we present the most important of them. Table II displays the responses to the question *"In the case of gaining more knowledge or external support, what kind of tools would be most suitable for your involvement in energy poverty?"*. The respondents marked each tool based on a scale of 1-5, with 1 being "not suitable at all" and 5 being "very suitable". The respondents have stated that the most suitable tool or format would be an 'Online platform with information on energy poverty (measures, relevant actors,etc)'. The second best was 'Database on energy poverty in households (on country/regional level)', and the third 'Educational seminars'.

TABLE II
MOST SUITABLE TOOLS FOR RESPONDENTS' INVOLVEMENT

Tools	***Score***
Online platform with information on energy poverty	4.04
Database on energy poverty in households	3.82
Educational seminars	3.77
Educational material as text documents	3.73
Workshops	3.72
Set of statistics on relevant indicators of energy poverty	3.67
Database of relevant stakeholders	3.66
Questionnaire and tool for energy audits in households	3.53
Videos and case studies on energy poverty	3.46
Managing stakeholders' dialogues	3.43

Table III presents the respondents' input on the question *"Which topics do you see as important for education about energy poverty and measures for alleviating energy poverty?"*. The respondents marked each tool based on a scale of 1-5, with 1 being "not important at all" and 5 being "very important". As the most important topic for education about energy poverty and measures for alleviating energy poverty, respondents have selected 'Energy use of domestic devices and appliances', followed by 'Practical training' and 'Detecting energy poverty'.

Other important results of the survey were that stakeholders focus more on knowledge about the issue of energy poverty and related measures, and less on communication skills and social aspects of the problem. When it comes to energy poor households, respondents have stated that practical and infrastructural measures for reducing energy use, as well as training about measures they can implement themselves are most beneficial for that specific target group. According to the survey, this should be done in the form of practical activities, applications, web based tools, and lectures. Finally, an important outcome and advice for the consortium was that, when developing the IDEA ICT tools, us developers should have in mind that currently in all four countries there is a lack of definition for energy poverty, as well as a lack of educational

[3]https://forms.gle/XG2MCvWMMjkXw2vX7

[4]https://focus.si/english/

TABLE III
IMPORTANCE OF TOPICS FOR EDUCATION ABOUT ENERGY POVERTY

Topics	*Score*
Energy use of domestic devices and appliances	4.29
Practical training	4.16
Detecting energy poverty	4.15
Soft and infrastructural measures and devices for reducing energy and water consumption	4.11
Social security aspect and related services	4
Heat Energy, Electric Energy and Water	3.99
Information about energy and social actors and schemes that can help energy poor household	3.96
Renewable energy sources	3.92
Basics about energy and energy needs	3.86
Methodology of energy advising in households	3.82
Communication training	3.79
Climate change and other environmental impacts of energy use	3.72
Entrepreneurship	3.33

materials and programs specifically related to energy poverty. Thus, developers should include the relevant stakeholders from the beginning of the design and development cycle, in order to make them as useful and relevant as possible, as well as to ensure that there will be end users to use the tools eventually.

B. Designing the Tools and Preliminary Validation

Most of the tools were designed in order to combine functionality-wise several different aspects regarding importance of topics or suitability of material and means associated to fighting energy poverty, as voted by the users in the questionnaire. Furthermore, each tool's functionality was designed to also accommodate the factors determining and causing energy poverty (see table I), where suitable. Most of the factors are directly related. Tackling, for example, the poor energy efficiency of appliances factor, affects at the same time the high energy expenditures factor and the inability to keep the home warm or cool factors. To tackle the low income factor and the high energy prices factor requires a combination of tools to keep records of the energy poor households status, along with energy advisors' efforts towards creating appropriate frameworks and policies. Taking this into account, some tools were designed in order to educate individuals about the energy efficiency of their households and their appliances, while other tools were designed to measure and compute the factors as numbers. The inability to keep their homes warm or cool, together with the condition of the building itself, e.g. a leaky roof, are taken into account in the underlying computations of the corresponding tools, or are explained in the training material for training energy advisors. By combining the needs analysis requirements and the factors of energy poverty, the tools were divided in two main categories: tools educating for energy, and tools directly assisting household visits.

As previously mentioned in Section 3, it was shortcomings of existing tools from project REACH that spurred on the project IDEA. Shortcomings related to upgrading and updating the existing tools and developing new ICT tools in particular, all of which would need to be determined with input from relevant stakeholders. Moreover, lack of user-friendliness, unpleasant visual appearance, poor user experience and the fact of being outdated tools in terms of IT solutions were pointed out as negative aspects.

Based on the aforesaid, it was important to therefore collect some qualitative user feedback too during the design phase of the tools. This would ensure that not only our proposed tools were in line with the needs of stakeholders' and energy advisors', thus assessing their usefulness, but also equally important, that they were easy to use.

Focus groups help obtain attitudes, reactions and opinions about a product, design or idea. They are especially useful in helping a development team to better understand user requirements. It is regarded as an informal technique to assess user needs and feelings before interface design and after implementation. [19] suggests that the group consist of six to nine users and the session last for about two hours. It is required to have a moderator to the session, who controls and maintains focus and interest. Having a free-flowing and relatively unstructured style to the session is key. Hence, a focus group session was deemed as a suitable option to collect initial user feedback from Energy Experts. The session was organized in Cyprus during the design phase of the tools and included 9 stakeholders. The session lasted for 1 hour and included an initial presentation on the proposed ICT tools, describing their purpose and justification supporting their inclusion. This was followed by an open-ended discussion between stakeholders and the project team, including the development team. This session was moderated by a member of the project team who maintained a free-flowing and relatively unstructured style to the session, but at the same time directed the discussions to ensure that all tools could be discussed within the hour and that there was equal participation from participants. To conclude, qualitative data were collected from stakeholders participating regarding the specification and design of the tools and the data collected contributed to the final design of the IDEA toolkit.

IV. IDEA TOOLKIT

The architecture of the system is presented in figure 2. The consumption toolbox utilizes components from the Advisors Toolbox's Logic module, as indicated by the respective green crosses in the figure. However, the consumption toolbox does not store any data in the database; rather, it utilizes the components in a stand-alone fashion, aiming to provide users with exercises on how to calculate their energy consumption in the respective areas. The Toolkit was mainly developed using web technologies, namely PHP, JavaScript, HTML, CSS and MySQL. On the side, the 3D Game was developed using Unity and built for integration into the web. The final deployed IDEA Toolkit, consists of two sets of tools: (1) Ten open access tools; and (2) Five restricted access (advisors only) tools. The tools comprising the IDEA toolkit can be seen in figure 3.

A. Open Access (OA) Tools

The set of open access tools includes 10 tools, available online for free, open and direct use. The tools can be accessed from the Main Menu, under the "Open Tools" sub-menu link.

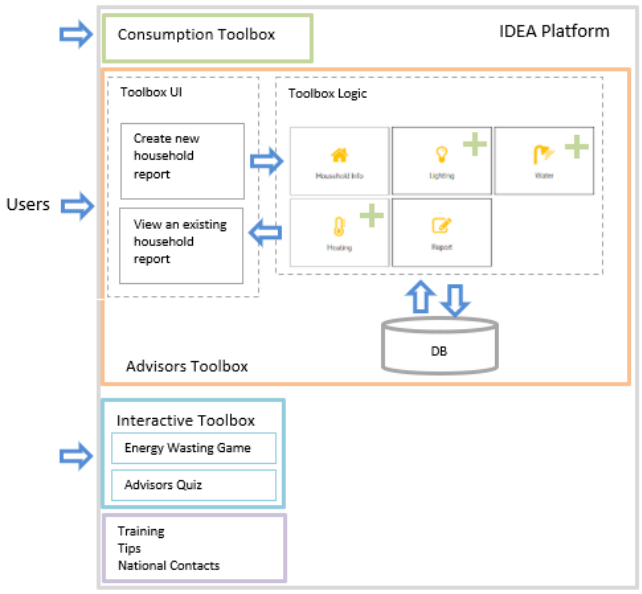

Fig. 2. Architecture of the System

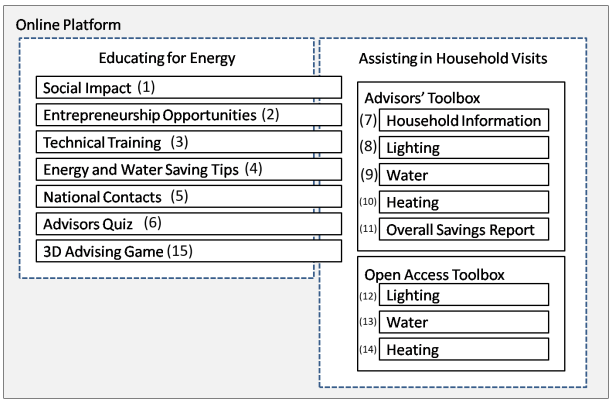

Fig. 3. Tools Diagram

A dashboard is then available, providing access to the different tools (Figure 4).

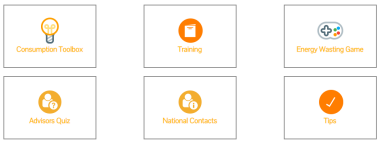

Fig. 4. Open-Access Tools Dashboard

The *Consumption Toolbox*, consists of three different tools, as discussed previously: Lighting, Water, and Heating. In order to proceed with using any of these tools, one needs to select a country. Subsequently, the menu as well as all the functionality are translated into the selected country chosen language: English for Cyprus, Slovene for Slovenia, Croatian for Croatia and Bulgarian for Bulgaria. In all three tools, the user can add as many rows as needed with potential replacement of devices, for water savings at the shower and at the tap, heating saving losses by the window and by the doors, and lighting savings. In figure 5, the water tool (shower section) is shown. For each specific case, different data regarding the old and the new devices are asked. In some of the cases, additional information is asked such as the number of people living in the household.

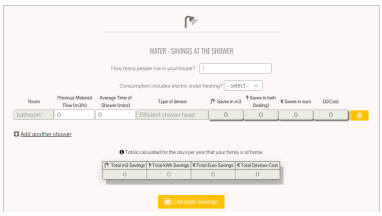

Fig. 5. "Water Savings at the Shower" OA

For calculation purposes, many constant and variable values are included, some of them being country specific and applied based on the country selection done initially. No user data is stored. By clicking the *"Calculate Savings"*, the savings are calculated in regards to the potential replacements, concerning saves in KWh or in m3, saves in euro, and additionally the cost of the new devices.

The *Training* page includes the three tools, dedicated to educational material regarding Energy and Energy Poverty. They constitute together a complete educational program to educate advisors on how to tackle energy poverty. When entering each tool, the country should be selected first. Subsequently, the country specific material is displayed, translated in the predefined language for the specific country. The material is presented within the tool, organised in several different chapters, but is also available for download as a pdf file.

The *Energy Wasting Game*, i.e. a 3D Advising Game, is a fun educational way to learn about potential savings within a household, using an avatar visiting a household to help them correct any problems regarding energy savings.

The *Advisors Quiz*, translated in all selected languages, assesses the advisors knowledge gained after the training, with a total of 18 questions, based on the material to be studied. The quiz is scored based. Once the "Submit Responses and Get Your Score" button is clicked, the user can no longer interact with the quiz, the score is calculated and the correct answers are shown to the user. The quiz can also be used by individuals to assess their knowledge or even learn information through the correct responses presented at the end.

The *National Contacts* tool, is a database presenting information about selected contacts of services, stakeholders and actors that will be helpful for individuals and households in each of the partner countries in order to seek help or advising regarding social issues and energy issues, as well as info on various financial mechanisms.

Finally, the *Tips* tool provides tips on energy efficiency and energy behavior change, for households in an interactive way. One can choose their country, in order to activate some calculations for savings based on the country price per kWh or m3. The main tool is provided in English. At the same time, tips translated in the other three languages are available to download in pdf format.

B. Advisors Only Tools

The restricted access tools, i.e. advisors only, similar-wise to the consumption toolbox, consists of distinct tools regarding savings within a household. They aim to allow users, and specially energy advisors to monitor and analyze the energy

performance and consumption of the household and to assess the potential for energy savings. The tools can be accessed from the Main Menu, under the "Advisors Toolbox" sub-menu link, given that you have access to a set of credentials. These tools, in contrast to the open access consumption toolbox, are enriched with data storing in the database, a general household information tool, and an overall savings report tool. Additionally, it includes the Lighting, Water and Heating tools in a similar fashion with the respective open access tool. One basic difference is that, when the replacement devices are added, there is no option to calculate on the spot the savings. The data are stored in the database, and one has to visit the overall savings report tool to calculate the savings, including much more detail than the calculations of the open access tool. At the same time, country specific values, constants and variables, are included in the tools mechanisms. The tools are meant to be used by advisors during household visits. The advisor can find from the records a household that has already saved information before for, or create a new record. Each advisor can only view records that she has created. The records are kept in the database anonymously, without any data able to identify the individuals. The personal data are kept separately, depending on each advisor's methods. The tool only knows the households' ids. The tool is highly interactive and each form provides fields of different types, and questions appearing based on previously chosen replies.

V. Discussion, Conclusion and Future Work

A use case was conducted for validation of the advisors' toolbox, being the most sophisticated tool in our toolkit, by Focus[5] and DOOR[6] energy experts, with information regarding real households and potential device replacements. The results were positive, as in reduced time in comparison to the manual pen and paper process, the experts were able to acquire useful information about energy savings for the households and submit the data to the online repository (database). The experts'effort was reduced to a great extent, while data portability was increased, as these were now electronic and thus immediately available for use and analysis.

The IDEA ICT tools will be used in the scope of new Horizon2020 project EmpowerMed – Empowering women to take action against energy poverty in the Mediterranean [20]. The tools are already included in the project's database and will be used in practice: energy consumption tool for energy advisers, e-manual for educational purposes for training of energy advisers, tips (and national contacts) directly for households and wider dissemination, quiz in training of energy advisers.

At the moment, some tools are functioning using values specific for the four countries participated in the project, for the accuracy of the calculations or information provided. They can, later on, be enhanced with values for more EU countries. A more detailed and specific needs analysis can take place for the household visits assisting tool, in order to enhance it with even more sophisticated functionality.

[5]https://focus.si/

[6]https://door.hr/

Acknowledgment

The current publication is created within the project "Innovative Direction in Energy Advising" (IDEA). The project is funded by the European Union's Erasmus+ Program under Grant Agreement No. 2017-1-CY01-KA204-026725. The content of this publication represents the views of the author only and is his/her sole responsibility. The European Commission does not accept any responsibility for use that may be made of the information it contains.

References

[1] H. Thomson and S. Bouzarovski, "Addressing energy poverty in the european union: State of play and action," *EU Energy Poverty Observatory, Manchester*, 2018.

[2] EU Energy Poverty Observatory, "Inability to keep home adequately warm," Accessible:https://www.energypoverty.eu/, 2016.

[3] S. Bouzarovski, S. Petrova, and R. Sarlamanov, "Energy poverty policies in the eu: A critical perspective," *Energy Policy*, vol. 49, pp. 76–82, 2012.

[4] European Union, "Directive (eu) 2018/844 of the european parliament," 2018.

[5] ——, "Directive 2012/27/eu on energy efficiency," 2012.

[6] L. Živčič, T. Tkalec, and S. Robić, "Energy poverty: Practical and structural solutions for south-east europe," *Sociology and Anthropology*, vol. 4, no. 9, pp. 789–805, 2016.

[7] S. Robić and B. Ančić, "Exploring health impacts of living in energy poverty: Case study sisak-moslavina county, croatia," *Energy and buildings*, vol. 169, pp. 379–387, 2018.

[8] L. Živčič, M. Moisan, and T. Tkalec, "Project achieve–reducing energy consumption in fuel-poor households projekt achieve–zmanjševanje rabe energije v energetsko revnih," *Volume 7/Issue 1 FEBRUARY 2014*, p. 67, 2014.

[9] European Union, "Regulation (eu) 2018/1999 of the european parliament and of the council of 11 december 2018 on the governance of the energy union and climate action." Accessible:https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.328.01.0001.01.ENG&toc=OJ:L:2018:328:FULL, 2018.

[10] OpenExp, "European energy poverty index (eepi): Assessing member states' progress in alleviating the domestic and transport energy poverty nexus," Accessible:https://www.openexp.eu/european-energy-poverty-index-eepi, Feb 2019.

[11] InventAir, "Policy recommendations on energy poverty identification and segmentation," ProjectInventAir, 2019.

[12] EU Energy Poverty Observatory, "Training resources," Accessible:https://www.energypoverty.eu/training-resources, 2019.

[13] European Energy Network, "Enr position paper on energy poverty in the european union," Retrievedfrom:http://enr-network.org/wp-content/uploads/ENERGYPOVERTYEnRPositionPaper-Energypoverty-Jan-2019.pdf, 2019.

[14] ASSIST, "Support network for household energy saving," Asummaryof theNationalandEuropeanmeasuresaddressingvulnerableconsumersandenergypoverty.Retrievedfrom:https://www.assist2gether.eu/documenti/risultati/report_on_national_and_european_measures_addressing_vulnerable_consumers_and_energy_poverty.pdf, 2018.

[15] N. DellaValle, "People's decisions matter: understanding and addressing energy poverty with behavioral economics," *Energy and Buildings*, vol. 204, p. 109515, 2019.

[16] I. Kyprianou, D. Serghides, A. Varo, J. Gouveia, D. Kopeva, and L. Murauskaite, "Energy poverty policies and measures in 5 eu countries: A comparative study," *Energy and Buildings*, vol. 196, pp. 46–60, 2019.

[17] ACHIEVE, "Final publishable report," ProjectACHIEVE, 2014.

[18] REACH, "Project publications," ProjectREACH.Accessible:http://reach-energy.eu/publications, 2017.

[19] J. Nielsen, "The use and misuse of focus groups," *IEEE software*, vol. 14, no. 1, pp. 94–95, 1997.

[20] FOCUS, "Empoweremed," Accessible:https://focus.si/projekti/empowermed/, 2019.