Cooltorise

Raising summer energy poverty awareness to reduce cooling needs

Coordination and support action

Call H2020-LC-SC3-EC-2-2020: Mitigating household energy poverty

Deliverable 1.1

Methodological action framework: energy poverty definition, understanding and policy framework and summer energy poverty specificities.

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Abstract:	Public report that will gather existing methodologies, solutions and approaches to tackle summer energy poverty conditions and specifically in relation to the European context.
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V1.0	28/02/2022	Final version	UPM

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Index

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Abbreviations

2M: According to EPOV indicators, the 2M indicator aims to capture the burden that energy bills put on households relative to their disposable income, using the national median as a reference point.

AROPE: This indicator (At Risk Of Poverty and/or Exclusion) corresponds to the sum of persons who are either at risk of poverty, or severely materially and socially deprived or living in a household with a very low work intensity.

EHF: Excess Heat Factor, is an index used to study heat waves. For its determination, statistical temperature data from both extreme heat days and previous days are used. It also considers the ability of people to acclimatize.

EPOV: The EU Energy Poverty Observatory was part of the European Commission's policy efforts to address energy poverty across EU countries.

EPAH: Building on the EU Energy Poverty Observatory legacy, EPAH is the leading EU initiative aiming to eradicate energy poverty and accelerate the just energy transition of European local governments

HEP: The Energy Poverty Barometer defines HEP as households whose energy bills are "abnormally low" according to what would be considered adequate according to the number of people in the household and the size of the dwelling and taking into account energy efficiency of the building.

LIHC: Low-Income High Costs indicator considers that household is energy poor if its income after energy costs falls below poverty line AND the share of its income spent with energy is above the national median.

M/2: Regarding EPOV indicators, the M/2 indicator aims to capture underconsumption of energy services relative to the national median of energy expenditures. The indicator considers households whose energy expenditure is below half the national median value energy poor.

UHI: Urban Heat Island refers to the urban summer phenomenon that occurs when a city experiences higher temperatures than the surrounding rural areas.

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1. Executive Summary

This report presents the methodological action framework: energy poverty definition, understanding and policy framework and summer energy poverty specificities. It gathers existing methodologies, solutions and approaches to tackle summer energy poverty conditions and specifically in relation to the European context.

It has been elaborated after a collaborative collection of documents that relate to summer energy poverty topics. More than 150 resources have been identified and analysed, assembling a diverse and up-to-date body of literature. The review is structured considering the objectives of the report, as follows:

1. ***Research on methodologies to evaluate energy poverty in different countries of the UE.***

   The first section regards multiple definition and measurement of energy poverty. Within the documents analyzed, different definitions arisen attending to each country characteristics. Also set of indicators have been identified and discussed. After quantitative aspects were defined, qualitative analysis was also described. For that aim, the search was focused on occupant behavior and household lived experience. Information from surveys and interviews was collected and also frameworks analyses for qualitative approaches were gathered. It also was included those studies that deepen the connection between adaptive setpoint and energy poverty.

2. ***Document analysis on housing stock and urban microclimate conditions in summer.***

   The analysis of the documents collects different technical approaches to urban microclimate, by which urban-scape features are evaluated, measuring their influence to outdoors temperatures. Urban canyons, presence of greenery, water bodies, urban density and materials albedos or inertial mass are some of the key parameters that arise to understand the performance of the UHI phenomenon. After setting general microclimatic conditions research, specific insights on cooling strategies and cooling loads are gathered.

3. ***Verification and analysis of the heat-waves prevention plans and energy poverty related plans and policies in each participant country.***

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This document addresses the existence of initiatives and policies that have been implemented on this issue, and annexes a series of projects carried out in the field of energy poverty to serve as inspiration for good practices.

After all the information analysis, conclusions argue that summer energy poverty is an overlooked issue in Europe. In order to tackle the phenomenon, new indicators for summer conditions should be developed and incorporated to energy and health plans.

Conclusions follow the same structure of the rest of the document. Regarding the first section, it is remarkable the lack of a common definition and specific indicators to measure and characterise summer energy poverty. Because of that, the number of studies focused on summertime conditions is low compared to those focused on wintertime scenarios. Further research should be done in order to improve the knowledge about, for example, which strategies does people use to cope with heating or how summer energy poverty is articulated with gender or age.

The second section reveals the lack of data available to measure and characterize the use of AC systems. Although multiple and diverse documents were found focused on urban context for this section, no indicators for policy makers and regulators were arisen.

The third section, focused on health and policies, highlights the impact that rising temperatures have specially on vulnerable people. The documents analyzed present different policies to tackle the phenomena from focus on financial aids for energy bills to grants for self-generation with renewable energy.

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2. Introduction

This report was carried out in the framework of the project ***COOLTORISE: Raising summer energy poverty awareness to reduce cooling needs*** funded by the European Commission within its Horizon 2020 programme under the topic LC-SC3-EC-2-2018-2019-2020 Mitigating Housing Energy Poverty.

The COOLTORISE project is the first project to be funded by the European Commission in the field of summer-specific fuel poverty. Traditionally, energy poverty has been associated with cold climates where people experienced difficulties in meeting the costs of heating their homes. However, in Southern European countries, due to rising temperatures and increasing energy prices, cooling homes in summer is becoming increasingly difficult for certain sectors of the population.

Given the novelty of the topic, a first report in which existing experiences related to summer energy poverty are gathered was considered necessary in order to explore the knowledge of this problem within the European framework.

2.1. Aims and objectives

This report aims to describe the coordination and delimitation of summer energy poverty existing methodologies or approaches in Southern participant countries (Spain, Italy, Greece and Bulgaria). By doing so, its specific objectives are:

1. Gathering methodologies to evaluate energy poverty in different countries.
2. Setting general conditions of housing stock in summer, analysis of housing cooling loads by region and climate, and evaluation of the degree of air conditioning penetration.
3. Verification of the existence of heat waves and/or health prevention plans by local and regional authorities responsible for them in each participant country.

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3. Methodology: collaborative process within a consortium

3.1. General description

A collaborative collection and revision of nearly 150 resources was conducted from Italy, Greece, Bulgaria and Spain by screening, examining and incorporating the main ideas, current debates, as well as limitations and frontiers in summer energy poverty related issues. Four different approaches were identified within the documents to develop a common framework for southern EU countries:

- Resources that incorporate **technical aspects**: exploring Urban Heat Island (UHI) or simulating cooling needs and building/urban performance.
- Resources that explore the **socio-economic dimension**: including adaptive approach and qualitative research methods to explore lived experience in relation with the heat.
- Resources focused on **health** and recommendations for heat waves events.
- Specific **policy and good practices** to tackle summer energy poverty.

3.2. Compilation of documents

All the project consortium members were asked to incorporate in a common database documents related to summer energy poverty within their territory. At the same time, a search for available framework documents in the context of de EU was carried out. By sharing a common database, members were asked to specify for each document its name, year of publication, short characterization -a triple choice question for identifying methodologies, reports or health and energy plans- and whether the document had a local focus or not. This first exercise was committed to incorporating different views from different countries, considering that it would have been more challenging to assess documents in a foreign language for a single member and taking advantage of the consortium diversity, also in terms of specialization.

After a first-round, more than 120 documents were collected, ranging from scientific papers, guides and manuals, to plans and policies in the contexts of Spain, Italy, Greece and Bulgaria. A first screening process was performed, in order to evaluate the correct distribution of papers in the different countries, and among the other kind of document that was asked to look for (health and/or energy plans, methodologies related to

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summer energy poverty and special reports). Apart from these types of documents, a relation of projects being carried out in the context of Europe and oriented to similar topics was incorporated into the database. The projects found were related to the vulnerable population suffering thermal stress, climate change in the city, financial education to tackle energy poverty, energy, identification of poor households or tailor-made solutions to improve SEP situations.

This first process resulted in a wider variety of studies, scales and outcomes. First research lines when identifying a methodology for assessing SEP were drafted, that enabled the review to be structured according to 3 big families of approaches, taking into consideration the sub-tasks previously announced:

Approach 1: Summer energy poverty methodologies.

Approach 2: Urban climate and building characterization.

Approach 3: Health and policies.

3.3. Analysis of the documents. Filter criteria and categorization

An *analysis sheet* was created in order to evaluate more than 150 documents contributed by the project partners. As above-mentioned, three main approaches were identified in the first screening round: methodologies, urban climate and health and policies approach. Urban climate and building characterization approach was compounded mainly by research on urban microclimate, Urban Heat Island (UHI) characterization, temperatures and humidity measurements or different cooling strategies evaluation, and mainly conformed by quantitative research; Methodologies on summer energy poverty approach was integrated by information on energy poverty indicators in the EU context, papers focused on adaptability of users under overheating, interviews and surveys, and mainly conformed by qualitative research, closer to ethnography and social studies; Policies and health plans were generally focused on heatwaves events, as well as energy consumption and vulnerable population. No specific plan for tackling summer energy poverty was found, neither specific methodology nor report on this phenomenon. In order to analyse the documents and with the objective of establishing first comparisons and argumentative structure for the report, a series of categories were created.

Firstly, two mutually exclusive categories were created, related to the temporality to which any document was referring. By doing so, it was possible to identify those

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documents oriented to summer conditions and those related to the whole yeartime. Secondly, documents were classified according to the three typologies asked to the contributors: methodologies, reports and plans. Finally, this first categorization exercise was completed by considering the location of every document: considering if it was located in Europe, a division between southern countries and the rest of Europe was made, in order to locate those studies and papers specialized in southern climates and their associated controversies. Apart from that, documents not specifically located in Europe were also marked.

A second categorization exercise was conducted to disaggregate the results and have more detailed information on the database, that would allow further comparisons of similar information and the structuration of the report. Three families of categories where defined: nature of the document, methodology that is present in the document, and whether the document has or not a specific focus of any kind. Among the nature of documents, we created five categories that were found: repositories, guidelines, evaluations and overviews, case studies and reviews. For methodologies we created four subcategories: data-driven research, policies analysis, simulation and modelling, and qualitative methodologies (surveys, questionnaires, etc.). For specific focus, we identified 5 categories in the documents: research focused on material performance, on Urban Heat Island monitoring and/or simulation, on specific local health needs, on gender perspective related issues, or those incorporating focus on Covid-19 context.

By building an array matrix, and by a binary codification for the categories (Yes/No), it was possible to have a quick overview on all the available Figure 1. Some outcomes of this database analysis are explained next.

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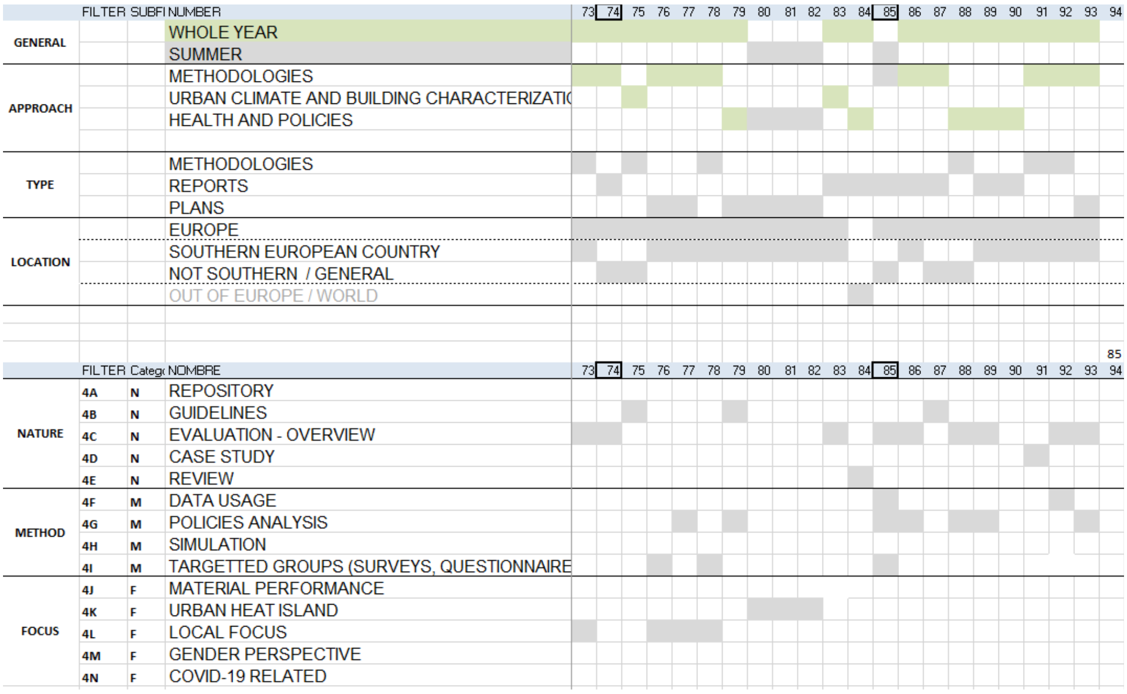

Figure 1

In terms of general characterization, a predominance of documents not concerning specifically summer conditions were noted. This fact, although it could be seen as a weakness, wasn't considered so as many of the year time documents where specifically structured attending also to summer conditions, but not only. For example, thermal comfort evaluation or building performance simulations consider separately both winter and summer seasons. Distribution of approach types was mainly dedicated to technical or sociological approaches, with less presence of health and policies related topics. It was identifiable a certain bias from the partners, being more prone to incorporate documents closer to their speciality. This was again not considered as a limitation, as the consortium is integrated by different experts from different fields, and the collection exhibited that diversity. Considering the distribution of types of documents that was asked to consign in the database by the partners (plans, reports and methodologies) it was identifiable a generalized determination of the methodologies type. This circumstance was related to the fact that the other two options (reports or plans) are easier to identify, while methodologies are not presented normally as so, but appear in different studies and formats. Regarding the location of the documents, an equilibrated division was found between south of Europe (generally integrated by texts from the consortium countries) and those for the whole European territory. Less documents were found that specifically pointed to other parts of the planet or to the world as a whole.

In addition, a second characterization exercise made it possible to identify predominance of case study documents among other types, such as repositories,

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guidelines or general evaluations. The characterization of the nature of the document was key to understand the diversity of information gathered after the call for contributions. Case studies were generally related to scientific papers, offering up-to-date knowledge on specific fields and experiments. Despite the high number of case studies founded, repositories were considered especially relevant for their content, in which specific plans and policies from European countries were indicated. When analysing methodologies present in the available documents, it is relevant to note that many of the documents with a technical approach used simulations as methodology to address the objectives of the study. Many other documents, especially those related to sociological or political approach, used data and statistics for the specific contents. Special analysis on political issues was found less often, and methodologies to target specific population (for example, vulnerable or exposed to heat) were found the least. When analysing specific focus on each document, a predominance of technical characteristics was found, expressed in UHI focused documents, as well as those related to building simulation and thermal performance, or specific material performance in the context of urban microclimate. Many documents were also marked as local focused, generally containing local prevention plans for heat waves or energy national plans.

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4. Summer Energy poverty literature review

4.1. General characterization

After a first categorization of document, a more specific analysis was carried out, in order to structure the final review of all the literature gathered. The first decision was to keep non-European plans and research out of the analysis, in order to set a common framework for all documents and to narrow the report to specific local conditions. By doing so, some approaches on summer energy poverty -if not directly enunciated as so, related to it by different angles- of high value were removed from the final review, but it became more likely to have a closer look at the state of art for each participating country. After doing so, previously mentioned categories were used as filters, and documents with the same approach were studied together. The three enunciated categories for approach were used as analytical frameworks to read documents together: 1) Summer energy poverty methodologies; 2) Urban climate and building characterization; 3) health & policies approach.

- **Document screening and keyword selection.**

Once the three main families of documents were established, a closer look at the contents was done. By having a look at each document, keywords where identified. For every document, it was necessary to assign at least three keywords that summarize the document contents. The objective was to have a better understanding of the topics that were treated in the documents of the database. In this moment there was an identifiable recurrence of certain topics, for each approach category, as listed below:

1) In Summer energy poverty methodologies related documents, topics are commonly related to:
    a. Social vulnerability indicators
    b. Adaptive comfort assessment
    c. Behavioural characteristics
    d. Policies and good practices

2) In Urban climate and building characterization documents, topics are commonly related to:
    a. Urban Heat Island.
    b. Urban microclimate.
    c. Simulation and monitoring.
    d. Energy and building efficiency.

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3) In health and policies approaching documents, topics are commonly related to:
    a. Heatwaves and high temperatures.
    b. Public health.
    c. Prevention and strategies.

- **Argumentation structure**

The previous keywords resulted useful for the configuration of an analysis argumentation structure, on each approach type.

1. When considering Summer Energy Poverty methodologies, different scales are articulated through an analysis of European and national definitions and measures of energy poverty. Some highlights contained within this section point out the lack of a common definition of energy poverty, and the variety of approaches to measure the phenomenon using indicators. It is also analysed within this section the different experiences related to summer energy poverty from the households perspective, including qualitative and adaptive approaches focused on occupant behaviour. On the contrary to the growing body of literature focused on qualitative methods applied to measure and characterise energy poverty during winter time, there is not such a number of experiences developed during summer conditions. Apart from a framework proposed to analyse adequately indoor cooling, no more studies deepen on the phenomenon which means that further research should be carried out in order to explore more aspects of summer energy poverty for a complete characterisation.

2. When considering Urban climate and building characterization approach to SEP, and taking into account the state of art expressed by the gathered documents, a common concern on summer urban specific conditions was pointed out. After common initial conditions are established, the question that rises from the collected information is on which ways, from a technical point of view, is it possible to tackle summer energy poverty. Answering this question, two types of knowledge emerge. On one side, there is specific literature evaluating different cooling strategies for the city. On the other side, added to it, there is growing concern and literature on energy efficiency and building thermal performance. A question arises from the literature review on what of the studied strategies and simulations can be transferred to public initiatives and be finally implemented.

3. When considering the health plans and specific policies related to summer energy poverty that have been gathered, at the European level, legislation on the transition to cleaner energy has already been introduced, taking into account

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the energy poverty perspective and the importance of conducting studies and monitoring. Although large-scale projects such as the Energy Poverty Observatory (EPOV) have been carried out, there is still a long way to go, since not all European Union countries have managed to deepen their energy poverty policies. Nevertheless, as a result of the increase in temperature observed in recent decades, and the consequent succession of heat waves that occur every summer, the implications for people's health have taken on greater importance in the political and administrative spheres, as observed in the documents.

The last three paragraphs enunciate the first outcomes of the literature review, that are detailed and expanded below. Considering our aim to bridge gaps from scientific knowledge to health and policy plans, we will first pay attention to the state of art in SEP methodologies and summer urban climate and building characterization. After identifying up-to-date knowledge on SEP for the south of Europe, we will focus on local plans and policies. By doing so, we will try to identify indicators that could be useful to develop SEP specific plans and programmes.

4.2. Definitions of energy poverty

Energy poverty is a multi-dimensional phenomenon that currently does not have a commonly agreed definition. In the European context, some new proposals have been included to boost policies and packages of directives. In this sense, European Parliament drafted an energy poverty definition during EU social climate fund overhaul, establishing that,

"[…] Energy poverty means poverty affecting households in the lowest income deciles whose energy costs exceed twice the median ratio between energy costs and disposable income after deduction of housing costs."

Nevertheless, European Commission within its Proposal for a Directive on Energy Efficiency contains another definition,

"'[…]'Energy poverty' means a household's lack of access to essential energy services that underpin a decent standard of living and health, including adequate warmth, cooling, lighting, and energy to power appliances, in the relevant national context, existing social policy and other relevant policies"

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Regarding this background, and instead of establish a common and unique definition from EU, Energy Poverty Observatory (during 2017-2020) and currently the Energy Poverty Advisory Hub proposes a suite of indicators as a common approach to measuring energy poverty. By doing so, each member state has room for establish its own definition of energy poverty. To the date, only five of them (Spain, France, Cyprus, Slovakia and Ireland) have adopted a formal definition of energy poverty (Corovessi et al. 2020).

Regarding the Spanish context, The National Strategy against Energy Poverty (Ministerio para la Transición Ecológica 2019) proposes since 2019 a definition to frame the phenomenon: Energy poverty is the situations that suffer those households who are not possible to successfully satisfy the needs of energy, as a consequence of a low income and increased by an inefficiency dwelling.

For other countries as Italy, there is not a common definition of energy poverty. Instead of giving a definition to frame the phenomenon, the Italian government adopted an official measure of energy poverty since 2017 based on a number of indicator assessed (Faiella and Lavecchia 2021). However, some reports described summer energy poverty as a special issue for Mediterranean countries. Actually, it is possible to find a proposed definition of summer energy poverty as the condition for those households who fall below the poverty line trying to satisfy a minimal requirement of energy to get the "minimal thermal comfort" during summertime (Faiella et al. 2020).

The initiative co-funded by Greece and the European Union to inform and raise awareness among citizens and policymakers is The National Energy Poverty Observatory. Greece also lacks of an official definition of energy poverty (Corovessi et al. 2020) but a specific methodology was proposed by The National Energy Poverty Observatory based in an energy consumption survey conducted during 2011-2012. Besides, several policy measures in the energy sector that concern vulnerable population groups have been developed.

Within the Bulgarian context, no definition of energy poverty is still established (Turai, Schmatzberger, and Broer 2021). Until The National Recovery and Resilience Plan adopts an official definition during 2022, alternative definitions of energy poverty are proposed based on five aspects: those households that spend more than 10% of their income on energy; those who cannot provide an adequate heating to their homes; those households who cannot pay their heating bills and have accumulated energy debts; those households who remain with a disposable income below the average monthly cost after paying for adequate thermal comfort; those households who have not access to

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modern energy services (Tzanev 2019). Not cooling aspects are included within this proposed definition.

As there is not a shared European definition of energy poverty, four principal indicators were developed by EPOV to measure the phenomenon. A methodology guidebook (Thema and Vondung 2020) gathers the approaches proposal as a recommendation for measurement and characterisation of phenomenon. It is based in a collection of consensual and expenditure-based methods of measurement, resulting in a suite of four primary indicators:

- (2M): Share of (equivalised) energy expenditure (compared to equivalised
- disposable income) above twice the national median.
- (HEP M/2 EXP): The absolute per capita spending on energy is less than half of the median equivalised spending.
- Ability to keep home adequately warm: percentage of households that are unable to keep their home in an adequately temperature.
- Arrears on utility bills: percentage of households that are unable to pay the utility bills.

A total of 19 secondary indicators are included also within EPOV recommendations. These secondary indicators are related to energy prices (fuel oil prices, biomass prices, coal prices, household electricity prices, district heating prices and household gas prices), consensual-based (dwelling comfortably cool in summer time, comfortably warm in winter time, presence of leak, damp or rot), expenditure-based (share of energy expenditure in income by income quintile), building stock features (dwellings with energy label A, dwellings in intermediately populated areas, dwellings in densely populated areas, equipped with heating, equipped with air conditioning, number of rooms per person by ownership status and total) and poverty and health risk (Poverty risk AROPE and excess winter mortality and deaths).

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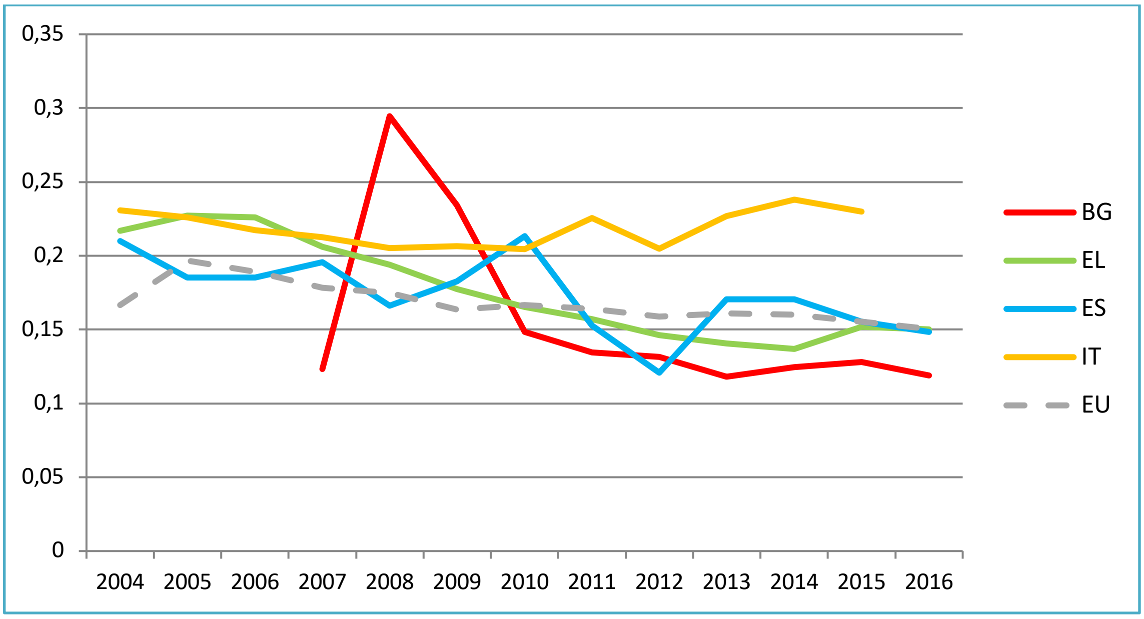

Figure 2 Share of population with leak, damp or rot in their dwelling, based on question "Do you have any of the following problems with your dwelling / accommodation? Answers: a leaking roof/damp walls, floors, foundation/ rot in window frames or floor. Source: EPAH, Eurostat.

Between those secondary indicators, existing differences are founded related to data coverage. Some of them are not available for determined years or countries.

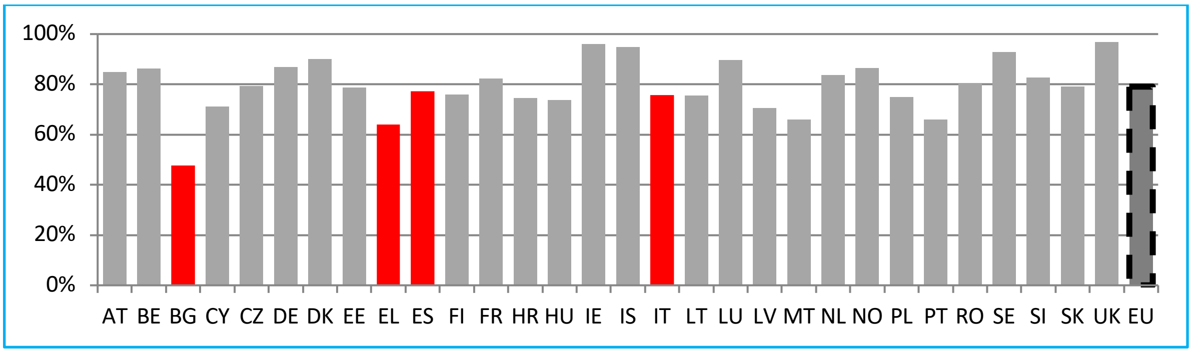

Figure 3 Share of population, based on question "Is the cooling system efficient enough to keep the dwelling cool?" and/or "Is the dwelling sufficiently insulated against the warm?", 2012. Source: EPAH, Eurostat

In the case of Spain, energy poverty is measured following the indicators proposed by EPOV (Foronda, Romero, and Tobías 2021). It is remarkable that, for "ability to keep home in an adequate temperature" (referred for the rest of countries only to keep home adequately warm) it is available data for summertime conditions only for 2007 and 2012 years. This is because National Institute of Statics (Instituto Nacional de Estadística) collects this indicator through a national survey and only in those two years was included a specific question for cooling during summer. This question has been not longer included through this national survey, which constitutes a limitation to characterise and study summer energy poverty.

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The primary indicators proposed by EPOV, are complemented by secondary indicators. Not all secondary indicators proposed by EPOV are implemented in the Spanish context. For example, energy prices and the presence of a leak, damp or rot in the dwellings are not included in the characterisation.

Furthermore, in Italy energy poverty measurement is developed by analysing some proposed indicators and a special indicator derived from the Low-Income High Cost approach adapted to the Italian context (Faiella and Lavecchia 2021). The measure of energy poverty is focused on heating.

The first group of indicators includes measuring energy poverty by quantifying those households whose share of energy expenditure exceeds a 10% of income or twice the average/median); measuring energy poverty by individual thermal comfort perception such as whether their home is adequately warm or not; by quantifying those households that have high energy costs and, at the same time, after these costs are deducted from their budget they are left with a residual amount of resources (income or expenditure) below the official poverty line (Low-Income High-Costs - LIHC).

The second group of indicators is composed by Low-Income High-Cost approach but with two main innovations: it is based on expenditure data and includes hidden energy poor households as those with an equivalent expenditure below the median and with no heating expenditure. Household heating' demand is estimated by integrating technical information on heating requirements with expenditure data based on an aggregate residential heating demand. Data is provided by RSE (Ricerche sul sistema energetico) and Italian Household Budget Survey.

The indicators proposed by Greece to characterise the phenomenon are based in households' ability to accommodate their energy needs and the percentage of income spent on accommodating these needs (Corovessi et al. 2020).

In Bulgaria, energy poverty is measured through three national indicators: number of households experiencing restriction on heating their homes; number of households that cannot meet unexpected financial expenses with their own funds; households that cannot pay dwelling-related expenses on time (Turai, Schmatzberger, and Broer 2021). Cooling characterisation is not included as a primary indicator.

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4.3. Summer energy poverty from the household's experience and behaviour.

Regarding occupant behaviour and households' experiences, some studies within Europe are carried out. Focused on interviews and qualitative research methods, some researches deepen strategies coping with heating (Horta et al. 2019) or cooling (Thomson et al. 2019). Results show that, although there is a growing body of energy poverty studies focused on inadequate indoor heating, yet there are not such a body of literature for indoor cooling.

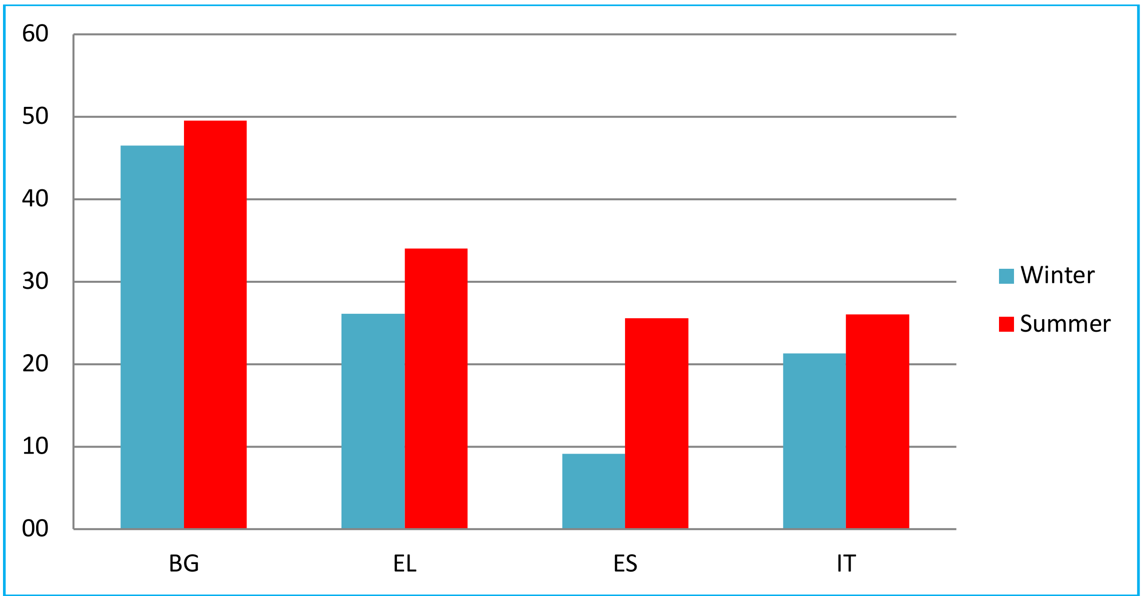

Figure 4 Percentage of households unable to keep home adequately warm/ cool during winter/ summer, 2012. Source: Eurostat.

When the issue is focused on measure and characterise adequately indoor heating, some works collect composition data from centralised installation (Gaetani, Hoes, and Hensen 2018). Other studies resort to interviews and surveys to reach out strategies and behaviours related with adequately indoor heating (Horta et al. 2019). Some of the results shows that strategies coping with heat at home try to get thermal comfort without using electricity consumption because the energy prices.

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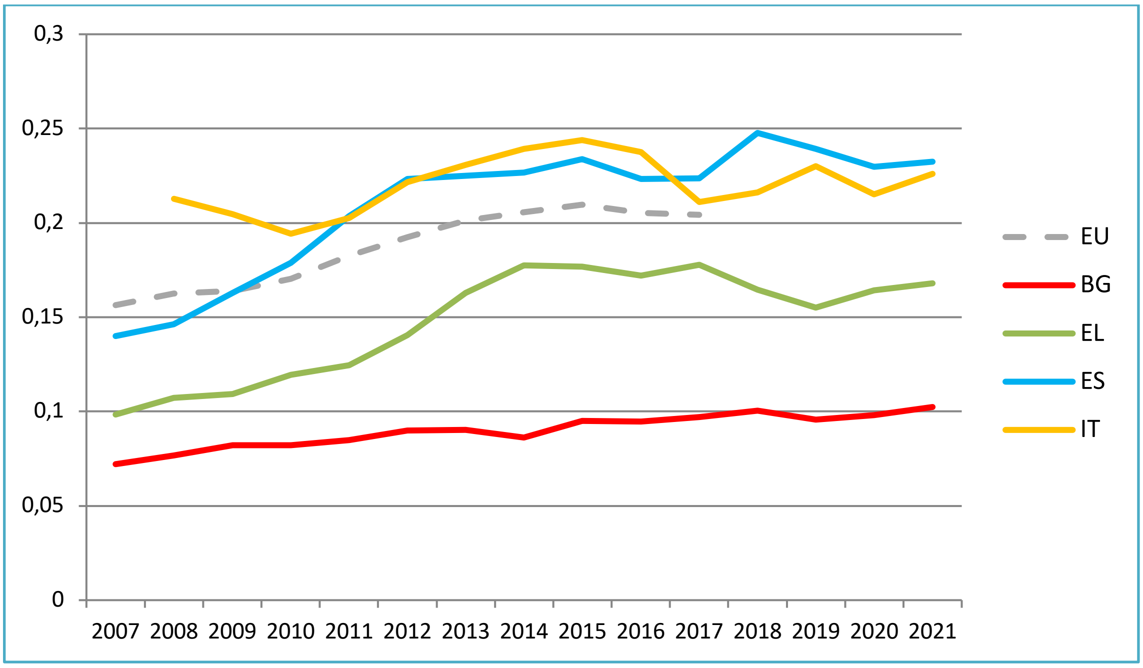

Figure 5 Electricity prices for household consumers, band DC 2500-5000 kWh/year consumption, all taxes and levies included. Source: Eurostat

On the other hand, when the issue is to measure adequately indoor cooling, a framework analysis based in three aspects related to vulnerability to excessive heat arises as the more suitable strategy to characterise the phenomenon (Thomson et al. 2019). These three groups of indicators are: the risk of excessive indoor warmth (measure by size and orientation of windows, presence or absence of shading, number and orientation of windows, building material and presence of absence of insulation), the capacity to adapt (based on the size of home, the accessibility of cool spaces, the incomes, tenancy relations and built environment flexibility) and the sensitivity to harmful consequences (based on age and health status).

After analysing these three dimensions (based in quantitative and qualitative data), some insights arisen. Those households located in warmer countries not necessary are more exposed to excessive indoor heat, but a combination of natural weather and the material characteristics of neighbourhoods which influenced in Urban Heat Island. Moreover, those dwellings with more deprived orientations (south or west) find in windows able to be shaded, trees or neighbourhood buildings a help to reduce the risk of overheating. Respondents reported that insulation in walls and/or ceiling could also help to prevent overheating.

Regarding participant's physical health and sense of wellbeing, this research confirms what it was developed by other work before: that morbidity and mortality risk of people with pre-existing medical conditions get worse during heat waves episodes (López-

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Bueno et al. 2020). Also, that young children and older people are more affected by high indoor temperatures.

In relation with strategies to cope with indoor heat, short-term measures are preferred (because there are more accessible) than long-term solutions. Those outdoors places that stay cooler than dwellings are also a resource for those households who experiment disconfirmed indoor temperatures. However, when summer energy poverty is framed by analysing strategies to cope with heat, socio-economic status and restrictive tenancy relations are the most important factors which conditioned the phenomenon.

Within the documentation analysed for this report, only Greece and Spain contribute with qualitative studies to characterise energy poverty. Nonetheless, there are not qualitative studies regarding specifically summer energy poverty carried out.

Feminisation of energy poverty in the city of Madrid (Sánchez-Guevara et al. 2020) brings some results related to summer energy poverty by use of qualitative analysis through interviews. Here, people (the sample was represented mostly by women) lack of knowledge about air conditioning maintenance, which conditioned its use. Low electricity contracted power together with high electricity prices were also reasons for not to use air conditioner. Related to the air conditioner usage, some of the participants reported that they use air conditioner in punctual moments rather than manage the periods during day to turn on the systems (which it is a constant with heating system usage).

In a broad sight, participants pointed out that they find more difficult to cope with indoor heat during summer than cope with indoor cool during winter. Also, interviews declared of suffer from sleep problem and try not to spend time at home.

Some works also explores the connection between adaptive setpoint and energy poverty (Bienvenido-Huertas, Sánchez-García, and Rubio-Bellido 2021). Simulation with energyPlus was runned and incomes databased were analysed concluding that the great potential of using adaptive setpoint temperature to reduce energy poverty is in the summer months. Also in Spanish contexts, another research proposes that changes in behaviour could reduce the incidence of energy poverty and compares it with static models (Bienvenido-Huertas et al. 2021). Results are analysed regarding socioeconomic characteristics for a 2030-2100 scenario, concluding that summer energy poverty is a growing problem and that the traditional static operational pattern will put the most underprivileged households in financial distress. This situation is expected to be worsening in 2050 and 2100. The study forecast the statement of a future of “cool or food” instead the existing “heat or eat” defined by literature.

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Greece presents several qualitative studies focused on energy poverty. Although most of them deepen indoor conditions during winter time (S.-N. Boemi, Panaras, and Papadopoulos 2017), summer energy poverty aspects are considered in some of them. Regarding these studies, different techniques are adopted: questionnaires and surveys, energy cafés and home visits from Energy Advisors.

Results show that, for some studies, the climatic conditions may vary the results obtained through analysing the phenomenon with common indicators (S. N. Boemi and Papadopoulos 2019) also for summer time periods. Comparative analysis of mountainous areas in Greece versus lowlands shows that, in summer, due mountainous areas host higher heating degree-days, people there have lower incomes and building stock is old, mountainous areas are more vulnerable to suffer energy poverty in general, and specifically summer energy poverty (Papada et al. 2021).

Home visits have also been carried out to study the phenomenon in Greece. Within this experience, with no specific mention to summer energy poverty, indoor temperature was monitored and a set of surveys were gathered by Energy Advisors (Papada et al. 2021).

4.4. Urban climate and Building characterization

4.4.1 Definitions

With the aim of setting general conditions of housing stock in summer, analysing housing cooling loads by region and climate, and evaluating the degree of air conditioning penetration in the participant regions, specific research focused on urban climate and building characterization was carried out.

When focusing on housing stock performance in summer, two main research fields have been identified among the gathered information. Firstly, it is importance to notice that every participant has contributed with studies oriented to urban summer heat analysis. Under this concept are located the documents that identify and analyse the Urban Heat Island phenomenon, as well as those that tackle microclimate conditions of the urban scape, not necessarily related to the UHI. Secondly, related housing stock performance in summer, we also find documents that analyse specifically building performance in summer, offering various approaches to it: from energy efficiency measurements, heating and cooling loads simulations to adaptive comfort evaluation.

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When focusing on analysing housing cooling loads by region and climate, it is relevant to notice that, mainly, contributions are related to cooling strategies specifically. We have also included research that directly analyse cooling loads under the section that focuses on energy efficiency, but research on cooling strategies at an urban scale offer valuable information on specific urban and housing conditions and necessities.

Related to the third objective expressed above, we have not found specific contributions that evaluate regionally penetration of air conditioning in the participant locations. Further research should be carried out in order to evaluate this parameter.

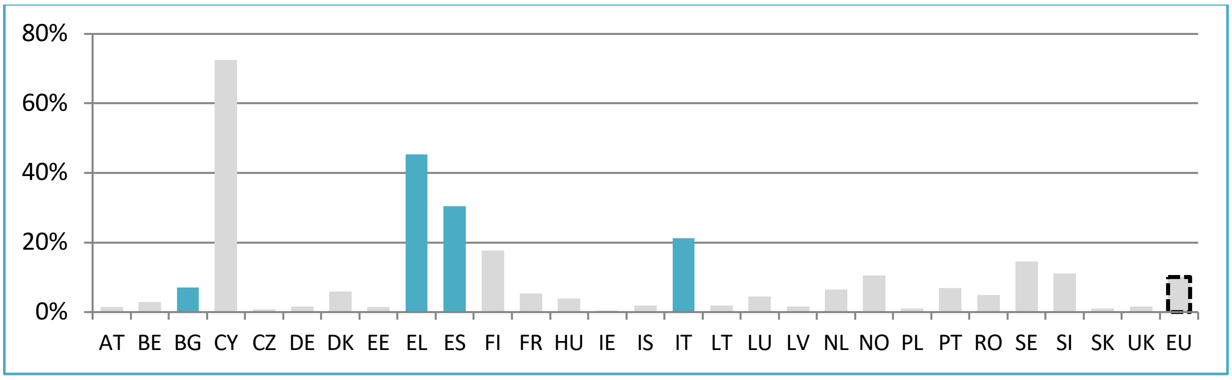

Figure 6 Share of population living in a dwelling equipped with air conditioning facilities, 2007. Source: EPAH, Eurostat

Documents in this section are titled following this reference:

LOCATION_REF N_YEAR_TITLE, as shown in the Appendix 1.

4.4.2 Urban Summer Heat

Urban summer heat arises as a concerning issue from the review of all the contributions. By diverse means and leading to different outcomes, we identify research experiences in monitoring and mapping Urban Heat Island effect or analysing urban microclimate at a regional level. Considering the UHI characterization, GR_20 offers specific analysis for a small Greek city (Vardoulakis et al. 2013). SP_59 and SP_147 analyse the UHI distribution for Barcelona and Madrid respectively (Matin-Vide et al. 2015)(Núñez-Peiró, Sánchez, and Neila 2015), offering in-detailed information on the characterization methods. For the case of Italy, relevant research has been found oriented to the analysis of the urban canyon and other local urban conditions that define microclimatic conditions, but no characterization of mapping of the UHI has been reported. In the case of Bulgaria, neither microclimatic analysis of the urban scenario, nor Urban Heat Island characterization is being found.

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Urban Heat Island analysis

GR_20_2013_Vardoulakis, the urban heat island effect

The article studies the effect of the Urban Heat Island phenomenon in a small Mediterranean city (Agrinio, Greece), focusing on the intensity per time and temperatures registered. By doing so, it analyses the parameters associated with the UHI appearance, and identifies some trends of its performance, for the specific location. The article presents a wide spectrum of measurements of Urban Heat Islands in Europe, explaining different outcomes and methodologies carried out. It specifies the lack of studies for smaller towns. The results show that the effect has a predominant night character, with greater presence of cool island effect in the mornings in summer. The article claims for remediation and adaptation actions to cool down cities and towns under similar risks.

SP_59_2015_L'illa de calor a l'àrea metropolitana de Barcelona_2015

The document analyses the UHI phenomenon in Barcelona. It is structured in four parts. 1st part identifies the UHI of Barcelona, its intensity and temperatures records. 2nd part shapes the UHI phenomenon by distributing it within smaller heat islands around the city. 3rd part analyses the phenomenon of the UHI at a synoptical level, taking into account the geographical situation and wind patterns. 4th part analyses the relation of the UHI effect with the reduction of the fraction of sky sawn at a street level.

SP_60_2018_Pla Clima, Efecte Illa de Calor_2018

The document presents the plan against urban overheating due to Urban Heat Island phenomenon. It is a document aimed to serve to anyone interested (scientists, academics, general population, politicians…). With that purpose, it presents schematically different factors that play a role in the formation on the UHI, as well as a general identification and distribution of it. Some trends and future forecasts are presented, as well as the main adaptive measures carried out by Barcelona municipality to mitigate the effects of climate change in the urbanscape.

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SP_13_2019_Guevara, Assessing population vulnerability

The paper explores the spatial distribution of UHI connected with socioeconomic and building characteristics factor and identifies summer energy poverty areas.

SP_16_2021_Nuñez, ExposureAndVulnerabilityToward.pdf

A hot spot analysis was developed. The analysis combines the spatial distribution of energy performance of the housing stock with the spatial distribution of CDH during night and day and different type of women main breadwinner households. Results and conclusions discuss strategies to cope heat waves, target single women over 65 as especially vulnerable at summer energy poverty and single women with children as especially vulnerable at heat waves events

SP_147_2017_Nuñez, Sánchez-Guevara Actualización de la isla de calor urbana de Madrid

With the objective of delimiting the effect of the UHI phenomenon in the building's performance of Madrid, the article actualizes current models for UHI characterization and microclimate definition in the city of Madrid.

Microclimate conditions: Urban canyon, monitoring.

IT_ 26_2016_Vallati, influence of street canyon

The study focuses on the relation of microclimatic conditions around buildings in their heating and cooling demand. Attending to the urban canyon scale, it argues that most of the thermal effects of urban microclimate can be modelled and quantified. For doing so, it proposes a model that can be applied in similar situations. The parameters that were taken into account where multiple inter-reflections, thermal radiative exchange and reduced convection heat transfer due to the protection against wind. It concludes that, for the climate studied, the cooling demand is less in cases of urban canyon buildings than in those stand-alone ones. It also compares different heat exchanges for summer and winter seasons and stand-alone and street canyon buildings. The relevance of the article is relying on the detailed attention to different physical phenomena and their relation with spatial configuration of buildings.

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EU_34_2012_Allegrini, influence of the urban microclimate

Similar to #26, the study assesses the influence of urban microclimate on the space cooling and heating of buildings, comparing stand-alone ones to those forming urban street canyons. Again, it analyses microclimate parameters in detail. The study is carried out in Basel. Some of the findings point out that the exchange of long wave radiation with neighbouring buildings has a determining impact on the net radiative heat exchange at the building façade.

IT_ 146_2017_Urban Imperviousness Effects on Summer Surface

This article develops a reproductible framework to lead building-proxy thermal analyses by using remote sensing data.

SP_149_2022_ Geographical inequalities in energy poverty in a Mediterranean city: Using small-area Bayesian spatial models.

In this article a novel method to characterize urban space is tested for the city of Barcelona, resulting in 6 EP indicators. Geographical inequalities in the distribution of EP in Barcelona is shown.

4.4.3 Cooling strategies.

A special analysis has been paid to those aspects found in the documents that have relation to cooling strategies, in order to assess housing cooling loads and needs for the participant regions. Research on this topic is characterized for being assisted by energy simulation of buildings, generally developed in specific study cases. In that sense, in order to achieve a correct general view of the housing cooling loads that cover the different realities of each country, further information into databases and statistics needs to be carried out. Looking at the documents, we found valuable research on cooling strategies for the following participant countries: Greece, Italy and Bulgaria. In GR_23, different vegetation densities are analyse to evaluate their urban cooling potential (Tsoka, Leduc, and Rodler 2021), in IT_41 cooling needs of buildings are

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identified while comparing them with ventilation potential as passive cooling strategy (Campaniço, Hollmuller, and Soares 2014).

GR_ 23_2021_Tsoka, assessing the effects of urban street

The article presents a detailed study on the effects of different tree planting patterns and foliage densities in the improvement of the building cooling needs, for a specific location in Thessaloniki, Greece. Pointing at the increasing needs for cooling the article focuses on the challenging issues on urban microclimate and high temperatures attenuation. It points at urban greenery as one of the most recommended and cited strategy to do so, when strategically planted. Mainly, this is due to two physical processes: the shading of buildings envelopes and the evapotranspiration of plants. In this case study, different simulations for different scenarios of varying LAD values (foliage densities) are carried out. The conclusions show that the cooling potential of trees is mainly attributed to shading, directly related with foliage density and planting patterns.

ALL_34_2012_Allegrini, influence of the urban microclimate

Similar to #26, the study assesses the influence of urban microclimate on the space cooling and heating of buildings, comparing stand-alone ones to those forming urban street canyons. Again, it analyses microclimate parameters in detail. The study is carried out in Basel. Some of the findings point out that the exchange of long wave radiation with neighbouring buildings has a determining impact on the net radiative heat exchange at the building façade.

PT_36_2011_Panao, assessment of the Portuguese

The paper proposes a method to evaluate Portuguese thermal code and implement corrections related to adaptive thermal comfort approach. It suggests that methodologies for calculating heating and cooling demands should be compared to detailed simulation results. By carrying out detailed evaluations, it proposes improvements in Portuguese energy simulations and in European comfort standards. One example of it is the inclusion of longwave radiative heat transfer.

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IT_41_2014_Campanico, assessing energy savings in cooling

The articles develops a simplified method to compute savings in cooling demand of buildings based on the use of ventilation oriented passive cooling. To do so, it evaluates different passive cooling strategies related to ventilation: natural night ventilation, evaporative cooling, controlled thermal phase-shifting and air-soil heat exchangers. The object of study is an office building located in Geneva.

ALL_148_2021_Beating the heat

This report is a sustainable handbook for policymakers and citizens interested in decreasing urban microclimatic temperatures. It explains different strategies to passively cool cities, as well as active strategies of greater energy efficiency, such as district cooling models.

4.4.4 Energy performance

Simulation, models, cooling consumption (CDD)

When evaluating housing summer performance and cooling loads of the participant countries, special attention has been paid to energy-performance related topics. On one side, documents focus on energy poverty and vulnerability identification, analysing the building stock and the way certain typologies and materialities foster energy overdemanding, both in summer and winter. Such is the case for the document presented from Greece, GR_97, and from Bulgaria, BU_69 (Plovdiv 2021). Some similar observations are found in Spain SP_83, where an analysis is paid for the residential sector of the building stock.(Proyecto Sech-Spahousec 2016). In this case, the study incorporates information from the users, as well as consumption records.

EU_10_2021_Cooling Degree models.pdf

The paper shows the effects of future temperatures variation in the residential sector cooling demand by the year 2050. The results show a noticeable increase in CDD and CDH with specifically effect in northern countries and forecast that structural modifications in the building stock and (more important for our study) in occupant

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behaviour should be anticipated. The paper includes Greece and Spain as cases of study among others, which are in our scope.

EU_54_2020_Antepara, improving energy poverty measurement

The study doesn't include specific measurement of summer energy poverty, it is included and mentioned as heating/cooling

GR_97_2020_A multi-sourced data-based framework for assisting utilities identify energy poor households: a case-study in Greece

The paper includes heating/cooling in the same weight. Estimation of cooling needs are done with CDD.

Households, building performance

BU_68_2021_RES Systems for vulnerable groups

The document explains a project carried out in Bulgaria of an innovative hybrid of PV and Battery Energy Storage System as a possible solution to achieve an important share on renewable self-consumption in social housing. Defining it as a way of tackling energy poverty and decarbonisation in Europe, the document shows the state of development of such pilot study.

BU_69_2021_Energy poverty and renewable energies - state of the art in Bulgaria.

The document introduces the state of art in matter of Energy and Climate Plan in Bulgaria. It first explains Bulgarian energy markets, that functions mainly on the principles of free market. Bulgaria has elaborated its own Energy and Climate Plan in order to ensure coordination with EU. It sets the main goals within the context of the European legislation. That affects directly objectives of decarbonisation, reduction of fuel dependent energies, ensuring affordable energy to consumers, among others. It summarizes some of the key numbers contained in the Plan, targeting at 2030: i.e. an increasing of share of electricity in 10% for heating and cooling, or transport. What is found important for this project, is its attendance of Energy poverty drivers, focusing on the very specific characteristics of Bulgarian context.

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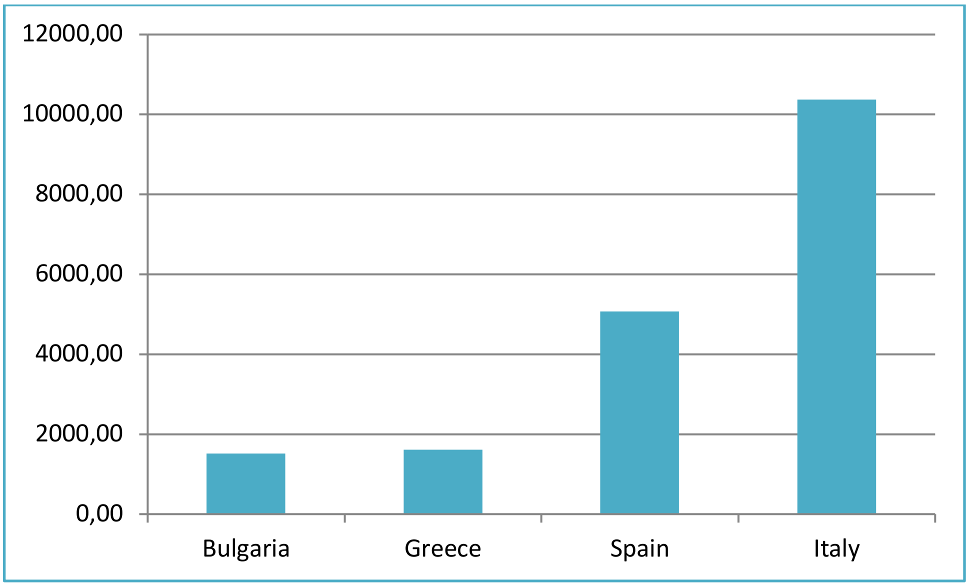

Figure 7 Use of renewables for heating and cooling by Thousand tonnes of oil equivalent. Source: Eurostat.

BU_70_2021_Energy poverty good practices

The document serves as a Guide of Good Practices in matters of renewable energies connected with social housing and vulnerable groups in Europe. It presents a methodological framework for the compilation on cases, characterizing them in four topics: renewable energy technologies, financing mechanisms, normative and empowering of citizens and local authorities. For every one of the topics, specific practices have been collected for all the countries collaborating in the project: Spain, France, Bulgaria, Poland, Lithuania and a last general view for "Other Countries". All the practices are shown in a table and detailed with a summary and stakeholders' identification. It proposes to be enlarged and perfectioned during the development of the project to which it belongs.

GR_75_2021_Educational materials for energy advisors

This document belongs to ComAct project (Community Tailored Actions for Energy Poverty Mitigation). It collects a number of educational materials for energy advisors. It is oriented to both expert and non-expert students, so also basics knowledge about energy and energy efficiency are explained. The training is structured in several parts, being the first sections dedicated to legal and engineering background, as well as energy pricing. Next sections are divided by type of measure: simple measures, measures for the building envelope, heating system, preparation of hot water and electric energy. By

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a quite profound level of detailed, the intention of the document is to provide practitioners with the advantages and drawbacks of every measure.

SP_83_2011_SPAHOUSEC Análisis del consumo energético del sector residencial en España.

The document presents the methodology and results of massive surveys carried out in Spain with the objective of determining energy consumptions, aggregated by services, uses, climate zone and type of dwelling. The methodology has a bottom-up approach (mainly relying on telephonic interviews), but also integrates a top-down perspective with the usage of data bases, in order to make comparisons. The results of the project make it possible to discover residential equipment and real consumption, confirming the high level reached by Spain and the need to influence rational use policies aimed at households. Another relevant outcome is the lower consumption rates recorded by bottom-up means, while top-down registrations suggest 6-7% higher levels of consumption.

GR_ 143_2021_Energy Efficiency trends and policies in Greece

The document presents an overview of Greek policies in matter of Industry, energy and transport, evaluating its relation with energy saving and efficiency. It resumes an average decrease of energy consumption of around 6% in the period of 2007-2013. The next period analysed, from 2013 to 2019 presents a total increase in the final energy consumption of 5%.

GR_ 144_2018_Energy efficiency promotion in Greece in light of risk: Evaluating policies as portfolio assets

This article evaluates policy instruments under a set of transdisciplinary technical and financial methodology, with the purpose of support the optimal budget allocation to reduce energy efficiency measures, viewing at the 2020 national targets.

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GR_ 145_2018_Country report on the energy efficiency services market and quality.

This document compiles evidence to inform the development of European and Greek quality criteria for the implementation of quality assurance schemes for energy efficiency services.

4.5. Energy poverty, health and wellbeing

Awareness on overheating

Although the increase in temperatures has been observed for several decades, the year 2003 became a milestone in terms of high summer temperatures, especially because of the negative effects observed in France, with more than 15,000 deaths (Martínez Navarro, Simón-Soria and López-Abente, 2004). The World Health Organization highlighted (WHO 2004) knowledge gaps in health and environmental effects of heat waves and problems with the public health response. The impacts of rising temperatures on people's health will be exacerbated over the next twenty years, considering that according to the latest IPCC report (2021), global temperatures will rise or exceed 1.5°C, which will lengthen the warm seasons and shorten the cold seasons. We are thus approaching thresholds that are particularly critical for health as well as for agriculture.

The impact of climate change and rising temperatures on people’s health was formally recognized at the international level in the early 1990s. The need to address this problem from a political point of view was pointed out, intersecting the fields of meteorological monitoring, climate forecasting and health. Of the main observed health effects of high temperatures, cardiovascular and respiratory problems lead to an increase in mortality and morbidity, and it should be noted that even these negative effects do not have the same intensity on individuals, therefore the existence of more vulnerable groups is recognized (Ministerio della Salute, Direzione Generale Prevenzione Sanitaria, 2006).

In the Spanish context, in 2004, under the regulatory framework Order PRE/1518/2004, of May 28, the Interministerial Commission was created to implement in Spain the National Plan of Preventive Actions on the effects of excess temperatures on health, which is activated every year between June and September. Its objective is to "*reduce the impact on the health of the population as a result of excess temperature*". In 2015, an analysis of the implementation of this plan from its inception in 2004 to 2014 was

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published in order to identify areas for improvement, synthesize lessons learned and systematize results (Comunidad de Madrid, Dirección General de Salud Pública, 2020).

Based on studies carried out by various researchers, for the Community of Madrid, a temperature was established above which the percentage of mortality begins to increase. For each degree that the temperature rises above this threshold (36.5°C), there is an increase in daily mortality of 12.5% in the general population, and 28.4% in women over 75 years old. In this matter, heat waves can trigger mortality especially in the most vulnerable people (Instituto de Salud Pública de la Comunidad de Madrid 2006).

Another methodology for analyzing heat waves and establishing baseline criteria that can be used by administrations to develop prevention and action plans is the one applied in a study in Greece (Tolika, 2019), which used an index called excess heat factor (EHF), which considers the temperatures of three consecutive days. One of its advantages is that it combines statistical data on heat waves and impacts on people by analyzing the thermal conditions of the previous thirty days to assess people's ability to acclimatize to these unusual thermal changes.

Monitoring is an essential aspect to better understand the effect of heat waves, especially because of the added value of having a historical database. An analysis also carried out in Greece (Katavoutas & Founda, 2019), reviewed the response of urban heat stress to heat waves in Athens during the period 1960-2017. The results show a higher heat stress during the night in urban sites compared to non-urban sites and during midday heat stress is equalized between urban and non-urban areas.

In Italy, since 2004, the Department for Civil Protection and the Ministry of Health have implemented a national program in order to prevent heat-health effects during summer (Michelozzi et al., 2010). This plan consists of a nationwide summer mortality surveillance plan to identify whether an increase in mortality associated with heat waves is occurring. It also has an alarm communication network, national prevention guidelines and a registry of vulnerable population subgroups.

Energy Poverty and wellbeing

The Wellbased document (Soriano, Pellicer, Jordá and Muñoz, 2021), provides a comparative analysis of public policies on energy poverty carried out across Europe. It also explores the impact that energy poverty can have on people´s health and how this affects quality of life. As observed in the document, pre-existing circumstances such as reduced access to heating, hot water, refrigeration, cooking, among others, can affect

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on health. It also has implications for indoor comfort conditions and at a social level it may increase social isolation because of the concern that inviting others into their homes could generate. The vulnerable groups identified on this report, are children: affected by the intergenerational transmission of poverty; older adults; single parent households; people living alone and/or with illnesses that could exacerbate their vulnerabilities. Therefore, energy poverty should be approached from a multidimensional perspective that also considers the social determinants of health, health inequalities and living conditions.

Health impacts are the result of complex interaction between climatic, environmental and economic determinants. Therefore, its effects will not only be direct due to the impact of high temperatures, but also indirect, such as an increase in the transmission of vector-borne diseases, reduced availability of water, incidence on food availability, among others (Ministerio della Salute, Direzione Generale Prevenzione Sanitaria, 2006).

According to the Social Determinants of Health established by the World Health Organization, there are a series of non-medical factors that can have negative impacts on health. These determinants are the conditions in which people find themselves in relation to the environment in which they live, socioeconomic systems and policies, work environment, housing environment, among others.

Housing is a key determinant when we talk about health (Provivienda, 2018): between 1996 and 2014, there were 7.100 deaths associated with energy poverty in households. This situation can lead to the development of respiratory problems, mental health conditions in adolescents, colds, implications in people's diet due to restrictions in the use of energy in the home.

first, from the administration, there is no integrated approach between actors, policies that manage housing and housing in terms of health. Therefore, the need to generate policies aimed at reducing social inequality in health through the promotion of more decent housing is indicated.

From the perspective of housing pathologies, one of the most common is excess humidity, caused mainly by lack of proper ventilation inside the home or an adequate indoor temperature. In terms of health, excess humidity can cause the appearance of mold and contribute, above all, to the development of respiratory diseases, with children and the elderly being more vulnerable to these circumstances.

The importance of the housing environment is also pointed out. An environment with high noise pollution will influence the development of stress-related pathologies, lack of

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sleep and will also influence ventilation habits, since people will prefer to keep the windows closed instead of ventilating to avoid outside noise.

Oliveras et. Al (2021) explores the relationship between energy poverty and how affects children's health. In this matter, findings suggest an association between energy poverty and cases of asthma, overweight, and mental health. Regarding the latter, the study conducted in Barcelona, shows affections on an emotional scale, specifically internalizing behaviors such as anxiety, withdrawal and dysphoria. Asthma was the respiratory disease with the highest percentage in children living in energy poverty, with a presence three times higher compared to those who are out of energy poverty. Finally, poor nutrition in children is a consequence of economic deprivation to buy healthier and better quality food.

Several countries have prepared their own documents on energy poverty, identifying in them the vulnerable groups that should be given special attention. Italy, for instance, in its document for the development of heat wave monitoring and response plans (Ministerio della Salute, Direzione Generale Prevenzione Sanitaria, 2006), considers for the definition of population at risk, the use of the vulnerability register to be used in combination with data provided by local health and social assistance services. In this recognition, sharing criteria observed in other documents, e.g. Spain, factors of a health precondition, such as cardiac problems, diabetes, or being under a regimen of a drug consumption, are added to the characteristics of these vulnerable groups. Similarly, other personal and environmental factors; characteristics of the built environment and social factors, can exacerbate the vulnerability.

Plans, policies, regulations, prevention

Since the negative effects of rising temperatures on people's health have been noted, at the administrative and political level, the implication of climate change on people´s health has become more relevant. Thus, subjects such as energy poverty are now part of the focus of action.

The European Commission has taken initiatives in the energy field, starting by establishing requirements in energy legislation (Soriano, Pellicer, Jordá & Muñoz, 2021). The Clean Energy for all Europeans Package agreement (2016) aims to facilitate the transition to a cleaner energy through an energy policy framework. Specifically, for the purpose of reducing energy poverty, it contemplates actions in energy efficiency, protection against supply cuts and monitoring. The Governance Regulation (2018/1999) contains that Member State must include in national plans indicative objectives to reduce energy poverty and to integrate reporting such as data, information, policies,

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measures, and others; the Electricity Directive (2009/72) establishes the need to define a set of criteria to measure energy poverty at each Member State.

The Energy Poverty Observatory (EPOV) financed by the European Commission, aims to collect and analyse information at the European level on energy poverty, broadening knowledge in this area. This allows networking, disseminating knowledge and providing technical assistance. As a result, each Member State has a Report containing information on policies, Observatory publications and indicators on energy poverty. Now, this observatory is transitioning to the Energy Poverty Advisory Hub (EPAH) whose mission is to provide direct support, online trainings and research results in order to take informed action-making to reduce energy poverty.

Two European initiatives are worth mentioning: the Green Deal Going Local Roadmap for 2021 and the EU Covenant of Mayors for Climate and Energy. The former pursues political priority to accelerate the carbon-neutral transition of cities and regions. It incorporates measures to reduce the carbon footprint of buildings, while generating new jobs, and the right to clean and affordable energy and building renovation. The second initiative aims to commit cities to mitigating and adapting to climate change. It mentions taking specific measures to address energy poverty involving authorities, institutions and citizens in the search for a just and inclusive society.

Energy poverty, being multifaceted and multidimensional problem, must also be addressed through a variety of key actors. In this sense, in addition to administrations at national and European level, local public administrations, as well as civil society, the private sector entities and the academic sector, should be considered as key actors to tackle energy poverty. Civil organisations, on the one hand, play a key role because of the proximity work they have done with the most vulnerable people. They can provide direct and specific assistance, share work experience, play an intermediary role between policies, plans and concretize changes. On the other hand, Public Administration has the capacity to finance actions, monitor, measure, involve citizens, plan and conduct awareness-raising campaigns.

The private sector can be implicated through the participation in international agreements, adopt measures that favour gender equity. Furthermore, they can invest in research and share knowledge and experiences. Finally, the academic sector plays a key role in generating knowledge, establishing methodologies for studies, analysis and implementation. Expand knowledge networks to the communities, and being able to involver society and the administration.

In the matter of public policies, actions and interventions, Wellbased report gathers information from the EU countries. Italy, for instance, from a governance perspective, has proposed their own definition of energy poverty and had established specific objectives and policies to tackle energy poverty in their National Energy and Climate Action Plan. At the national level they offer subsidies for building insulation; heating installation subsidies; household appliances; financial aids for energy bills; grants for self-generation with renewable energy.

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According to the Wellbased report, Greece and Spain stand out in the southern countries regarding energy poverty. Greece has a general social approach, providing grants to those households that cannot pay their energy bills. As a national strategy, they set up the Greek Energy Poverty Observatory and specific measures for EP, including obligations for energy companies and a social tariff. Interventions are implemented for financial aids for energy bills; subsidies for insulation of buildings; heating installation; self-generation with renewable energy; information and education. In the Energy Poverty in Greece document (Heirinch Böll Stiftung, 2020), the developments the European and national level are indicated, highlighting for the latter the "Saving at Home II" programme, and the market-based instruments. It also lists a number of proposals to address energy poverty that encompass new policy lines; public awareness and training; increasing building's efficiency and renewable energy sources utilisation.

Spain has linked the energy poverty to energy inefficiency and the government pursues "ensure access to affordable, safe, sustainable and modern energy for all". At national level, financial aids are available to pay bills; insulation of buildings; heating installation; protection from disconnection; self-generation with renewable energy. Spain has a National Strategy against Energy Poverty (2019-2024) (Ministerio para la transición ecológica, Gobierno de España, 2019), one of its objectives being to reduce each of the EPOV indicators by 25% for 2025.

Bulgaria current situation is different with respect to the above-mentioned countries. They have not developed a legal definition of energy poverty, although the European REACH project carried out a report on a national scale. There is no specific national strategy and they presented an undeveloped energy poverty policy, although the issue is generally included in social policies focused on financial aid and renewable energies poverty policy.

In order to collect energy poverty initiatives carried out in Bulgaria, Greece, Italy and Spain, a summary of projects contained in the "Atlas of energy poverty initiatives in Europe" (2018) is shown in the Appendix 2.

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5. Conclusions

Regarding energy poverty definition, there is a current debate around this topic, that has been intensified by the urgency for designing new policies in the context of climate change and sustainable development. In addition of lacking a common definition for several countries, the official definitions of energy poverty do not include summer energy poverty as an issue to have into account. Related to the analysed documentation, only Italy registers a proposed definition of the summertime phenomenon as the condition for those households who fall below the poverty line trying to satisfy a minimal requirement of energy to get the “minimal thermal comfort” during summertime (Faiella et al. 2020).

Analyzing indicators and measurement of energy poverty, some insights arisen. Within the primary indicators proposed by EPOV it is not possible to measure summer energy poverty. Only secondary indicators enable to measure the phenomenon. Those secondary indicators which allows to characterize summer energy poverty are: the consensual-based indicator based on question “Is the cooling system efficient enough to keep the dwelling cool/ Is the dwelling sufficiently insulated against the cold?”, the household electricity prices, the expenditure-based indicator, some of the building stock features indicators and the poverty risk indicator. Besides, not all data is available within these secondary indicators; for instance, data related with building and dwelling equipped with air conditioning is only available in 2007 period, for 20 countries. Despite the fact that some of indicators take into account wintertime associated problems (as winter mortality/deaths or specific question “Can your household afford to keep its home adequately warm?”) there are not available for all countries such specific questions related to summertime conditions.

In relation to methodologies and approaches to measure summer energy poverty from households’ lived experience and stakeholders’ reports info, it is remarkable the lack of studies focused on evaluate summertime conditions. From analyzed documents, insights show that energy prices and type of tenancy determine using or even having air conditioner system at home. Some studies present how to cope with heating using passive strategies (from shading windows to the influence of urban vegetation). Focusing on phenomena’ characterization and description, it is also possible to find a proposed framework within the documentation. Also, gender perspective is introduced to understanding some aspects of summer energy poverty. Within this section, some studies forecast that adaptive setpoints could reduce the risk of energy poverty.

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When addressing the second aim of the report, a generalized lack of available information on the distribution of AC systems has been encountered. However, it relation to setting general conditions for housing stock in summer, diverse and in-depth research has been registered from all the members. Summer urban microclimatic conditions seem to be experiencing growing concern among the participant countries, with studies that relate different features of the urban scape with the final experiences of heat. However, it has been identified a total absence of indicators that could serve for policy makers and regulators to address summer energy poverty and heat exposure vulnerability.

Several studies show the negative impact of rising temperatures on people's health, and the existence of vulnerable groups has also been identified. Energy poverty, being a multidimensional problem, plays a key role in that it can exacerbate these vulnerabilities, directly affecting people's health.

The Health & Policies review reveals an interest on the part of the European Union to address the problem of energy poverty, reflected in directives such as 2009/72/EC or in large-scale projects such as EPOV and the current EPAH, giving member countries the opportunity to develop their own national policies in this area.

It was found that although there are European policies that address this problem, some countries show greater progress in terms of public administration involvement and the development of energy poverty plans. In general, the policies implemented focus on financial aids for energy bills; grants for self-generation with renewable energy; subsidies for building insulation and heating installation.

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Appendix I

References

REF N	TITLE	YEAR	LOCATION
1	Atlas of energy	2017	EU
2	Plan Andaluz Temperaturas Excesivas 2020	2020	Andalucía
3	Heatwaves risk and responses	2004	EU
4	The good home dialogue	2021	UK
5	Guidelines on recreational water quality	2021	Global
6	Plan de actuacionPOCS castfullinfo	2021	Cataluña
7	Identification-and-analysis-of-technical-meas	2021	EU
8	Overview report on the energy poverty	2021	EU
9	Report on Public Policies and inter	2021	EU
10	Cooling Degree models	2021	Global
11	estudio pobreza energetica_aca	2016	España
12	Informe Cuando la casa nos enferma	2018	España
13	Guevara, Assessing population vulnerability	2019	Madrid-Londres
14	Moore, Dwelling performance and adaptive summer comfort	2016	Australia
15	Tabata, fuel poverty in summer	2020	Japan
16	Nuñez, ExposureAndVulnerabilityToward	2021	Madrid
17	Tsoulou_Andrews_He_Summertime thermal conditions and senior	2020	EEUU
18	Yoon, an arquetype-in-neighbourhood	2019	China
19	Akbari, Cool surfaces and shade	2001	US
20	Vardoulakis, the urban heat island effect	2013	Greece
21	Nicholls, Heatwaves, cooling and young childre	2018	Australia
22	Alboeata, reducing outdoor air temperature	2021	Cairo
23	Tsoka, assessing the effects of urban street trees on building	2021	Tesalonica
24	Yi, correlating cooling energy use	2017	Seoul
25	Meggers, urban cooling primary energy reduction	2016	New york
26	Vallati, influence of street canyon	2016	rome
27	Amasyali, machine learning for ocupant behaviour sensitive cooling	2016	USA
28	Keyvanfar, user satisfaction adaptative behaviours	2021	
29	Morakinyo, estimates of the impact of extreme heat events	2014	Hong Kong

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30 BienvenidoHuertas, adaptative setpoint temperatures to reduce the risk of energy poverty	2021	Sevilla
31 PorrasSalazar, energy poverty analyzed considering the adaptative	2020	Chile
32 Thomson, energy poverty and indoor cooling	2019	Europe
33 Masttucci, improving the sdg energy poverty targets_residential cooling needs	2019	Global South
34 Allegrini, influence of the urban microclimate in street canyons	2012	Basel
35 Du, energy flexibility for heating and cooling based	2019	China
36 Panao, assessment of the portuguese	2011	Portugal
37 Irshad, effect of gender difference on sleeping comfort	2019	
38 Bao, the influence of sleeping habits on cooling energy use	2018	Shanghai
39 Feng, space cooling energy usage prediction based on	2021	USA
40 BienvenidoHuertas, analysing natural ventilation	2020	Cadiz
41 Campanico, assessing energy savings in cooling	2014	Genova
42 Yun, behavioural, physical and socioeconomic factors in household cooling	2011	USA
43 Mazzone, thermal comfort and cooling strategies in the brazilian amazon	2020	Brasil
44 Feeny, temperature shocks and energy poverty	2021	vietnam
45 Wang, typical energy related behaviors and gender difference	2019	China
46 Gaetani, estimating the influence of occupant behaviour	2018	Delft
47 Llorca, objective vs subjective fuel poverty and self-assessed health	2020	España
48 Garshasbi, urban mitigation and building adaptation	2020	Sydney
49 WHO, heat and health	2021	EU
50 Wolf, heat waves and cold spells	2010	UK
51 EPAH_inspiring cases from across Europe	2021	EU
52 Oliveras, the association of energy poverty with health	2021	Barcelona
53 Oliveras, the association	2020	EU
54 Antepara, improving energy poverty measurement	2020	EU
55 BienvenidoHuertas, applying mixed-mode	2021	Spain
56 Mafalda, linking Energy Poverty	2022	Portugal
57 Kyprianou, Energy policies and measures	2019	EU
58 Horta, Energy poverty in Portugal	2019	Portugal
59 L'illa de calor a l'àrea metropolitana de Barcelona 2015	2015	Spain - Barcelona - AMB
60 Pla Clima, Efecte Illa de Calor 2018	2018	Spain - Barcelona - Barcelona
61 Indicadors municipals de pobresa energètica a la ciutat de Barcelona	2018	Spain - Barcelona - Barcelona
62 Pla de Barris	2021	Spain - Barcelona - Barcelona
63 La vulnerabilitat urbana a Barcelona: Persistència, concentració i complexitat	2020	Spain - Barcelona - AMB
64 Pla d'actuació per prevenir els efectes de les onades de calor sobre la salut (POCS)	2021	Spain - Catalunya
65 Pla pel dret a l'habitatge	2016	Spain - Barcelona - Barcelona
66 Temperatura i Mortalitat a Barcelona	2021	Spain - Barcelona - Barcelona
67 What mitigation measures affecting vulnerable citizens should be adopted at National level before the household sector goes to the	2020	Bulgaria, Plovdiv
68 RES Sytems for vulnerable groups	2021	Bulgaria, Plovdiv
69 Energy poverty and renewable energies - state of the art in Bulgaria	2021	Bulgaria, Plovdiv
70 _Energy poverty good practices	2021	EU level
71 Present status of energy poverty in 8 pilot EU countries of Powerpoor project	2021	8 EU countries: Bulgaria, Croatia,

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72	POWERPOOR Certification Scheme	2021	Bulgaria
73	Technical measures for EE in energy poor households	2021	Bulgaria
74	Overview report on the energy poverty concept	2021	EU level
75	Educational materials	2021	EU level
76	Estrategia de Inclusión	2016	Madrid
77	Dos años de estrategia contra la pobreza energética_2021	2021	Spain
78	Identificación, localización y caracterización de la	2021	Barcelona
79	Estrategia Nacional contra	2019	Spain
80	Vigilancia y Control efectos olas de calor	2016	Madrid
81	Variables Meteorológicas y salud	2006	Madrid
82	Plan Nacional de Actuaciones preventivas de los efectos del esceso de temperaturas sobre la salud	2021	Spain
83	SPAHOUSEC Análisis del consumo energético del sector residencial en España	2011	Spain
84	What are the effects of energy poverty and interventions to ameliorate it on people’s health and well-being?	2022	Worldwide
85	Energy poverty and indoor cooling: An overlooked issue in Europe	2019	Europe
86	Evaluación de un programa para reducir la pobreza energética en Barcelona: "Energía, la justa"	2021	Spain
87	European Energy Poverty: Agenda Co-Creation and Knowledge Innovation (ENGAGER 2017-2021)	2017	Greece
88	Report on the Status Quo of Energy Poverty and its Mitigation in the EU	2020	EU
89	Energy Poverty in Greece: Policy developments and recommendations to tackle the phenomenon	2020	Greece
90	Assessment of heating and cooling related chapters of the national energy and climate plans (NECPs)	2021	EU-Greece
91	Comparing different methodological approaches for measuring energy poverty: Evidence from a survey in the region of Attika, Greece	2019	Greece
92	Measuring energy poverty in Greece	2016	Greece
93	Reforms and investments to combat energy poverty	2019	Greece
94	Energy poverty and indoor cooling: An overlooked issue in Europe	2019	EU
95	Surveillance of Summer Mortality and Preparedness to Reduce the Health Impact of Heat Waves in Italy	2010	Italy
96	Energy poverty indicators: A critical review of methods	2017	EU
97	A multi-sourced data based framework for assisting utilities identify energy poor households: a case-study in Greece	2020	Greece
98	An assessment of Energy Poverty in Greece_A comparative study regarding the phenomenon in Greece	2019	Greece
99	Energy poverty and energy efficiency improvements: A longitudinal approach of the Hellenic households	2019	Greece
100	Report on replicable best practice national and European measures	2018	Europe
101	Report on national and European measures addressing vulnerable consumers and energy poverty	2018	Europe
102	Report on vulnerable consumers and energy poverty	2018	Europe
103	National Energy Plan	2019	Italy
104	National Energy Plan	2017	Italy
105	Mapping fuel poverty risk at the municipal level. A small-scale analysis of Italian Energy Performance Certificate, census and survey	2021	Italy
106	Energy poverty. How can you fight it, if you can’t measure it?”	2021	Italy
107	Annual report on energy poverty	2020	Italy
108	health Ministry heat wave alarm system	2021	Italy
109	Health Institute (ISS) info page	2018	Italy
110	Red Cross info Campaign	2021	Italy
111	LINEE GUIDA	2006	Italy
112	National health Plan	2005	Italy
113	Lazio Regional Heat Plan	2021	Italy

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114	Emilia Romagna Heat Plan - : Linee regionali di intervento per mitigare l'impatto di eventuali ondate di calore – estate 2021, in	2021	Italy
115	Parma - Heat plan	2021	Italy
116	EmCliC	2021-2023	Warsaw-Madrid
117	Climate-fit	2017-2019	EU
118	ComAct	2021-2023	EU
119	DOOR	2019-2021	Zagreb
120	EFFyPE	2011	Spain
121	ELIHMED	2011-2014	Cyprus
122	EmpowerMed	2019-2023	EU
123	ENPOR	2020	EU
124	Enpover	2019-2021	EU
125	LifeNadapta	2017-2025	Navarra
126	Lightness	2021-2023	EU
127	Ni Un Hogar Sin Energía	2013	Spain
128	PowerPoor	2020-2022	EU
129	Powert	2019-2023	EU
130	RADAR	2018-2020	Madrid
131	REACH	2014-2017	Eu
132	Replace	2019-2022	EU
133	SocialWatt	2020-2022	EU
134	STEP	2019-2021	EU
135	Voluntariado Energético	2022	Spain
136	Wellbased	2021-2025	EU
137	Assessing Heat Waves over Greece Using the Excess Heat Factor (EHF), January 2019	2019	Greece
138	A database of high-impact weather events in Greece: a descriptive impact analysis for the period 2001–2011, March 2013	2013	Greece
139	Response of Urban Heat Stress to Heat Waves in Athens (1960–2017), August 2019	2019	Greece
140	Energy Poverty during the Era of Economic Crisis in the Island of Crete, Greece, June 2020	2020	Greece
141	Fighting Energy Poverty Using User-Driven Approaches in Mountainous Greece: Lessons Learnt from a Living Lab, March 2021	2021	Greece
142	Residential Heating under Energy Poverty Conditions: A field study, 2017	2017	Greece
143	Energy Efficiency trends and policies in Greece , March 2021	2021	Greece
144	Energy efficiency promotion in Greece in light of risk: Evaluating policies as portfolio assets, December 2018	2018	Greece
145	Country report on the energy efficiency services market and quality, February 2018	2018	Greece
146	Urban Imperviousness Effects on Summer Surface	2017	Italy
147	Actualizacion de la isla de calor urbana de Madrid	2017	Spain
148	BeatingTheHeat	2021	Worldwide
149	Geographical inequalities in energy poverty	2022	Barcelona
150	Identificacion, localizacion y caracterizacion	2021	barcelona

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Appendix II

ENERGY POVERTY INITIATIVES COLLECTED FROM "ATLAS OF ENERGY POVERTY INITIATIVES IN EUROPE"

BULGARIA	

Energy advising and home visits by volunteers

Fighting energy poverty is one of the 3 main areas of action in the Schneider Electric Foundation, together with training in the energy field and improving awareness of sustainable development. Together with the Energy Agency of Plovdiv, the Foundation implements a small project in Bulgaria which:
1) Enables 50 vulnerable households in the city of Plovdiv to reduce their energy and water
consumption.
2) Aims at changing consumption habits in order to improve the public energy culture,
and to build an understanding of how much energy certain devices use and how much
electricity or water is spent.
This was accomplished by training 10 volunteers from Schneider and 10 more from the Red Cross, on how to recognise and tackle energy poverty issues. In a month they implemented 60 visits to households, offering personalised advice, packages of energy-saving devices, and a guidebook on general energy saving measures.

Type of intervention	Household energy efficiency, Financial support, Information and engagement
Geographical Scope	Municipal level practice (Bulgaria, Plovdiv)
Implementation time frame	Several months In 2016 and 2017
Target Group / beneficiaries	60 vulnerable households, mainly single mothers and elderly people

Outcomes

Planned outcomes: 60 households aware of different energy efficiency measures; 60 hours of energy audits and energy advising; 300 LED bulbs installed; 120 tap aerators installed; 60 power switches installed; 20 efficient shower heads installed

Budget / Funding	5.000€ from the Schenider Electric Foundation

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement No 101032823

GREECE	

Observatory of Energy Poverty

The observatory was developed in order to inform both citizens and decision-makers about the phenomenon of energy poverty in Greece. The main aims are:
1) Assessment of energy poverty levels in Greece through the estimation of representative indicators and the monitoring of fluctuation
2) Identification of the parameters that affect and intensify the phenomenon of energy poverty
3) Design and implementation of efficient policy measures for the alleviation of energy poverty

Type of intervention	Transparency and information sharing
Geographical Scope	National level practice
Implementation time frame	Ongoing
Target Group / beneficiaries	The entire Greek population and energy-poor citizens

Outcomes

Estimation of representative indicators and monitoring of their fluctuation over the years; Identification of those parameters that affect and intensify the phenomenon of energy poverty; Design and implementation of efficient policy measures for the alleviation of energy poverty

Budget / Funding	Financed by the project National information System for Measuring Energy Efficiency"

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ITALY

Bonus to Know project

From 2009 to 2014, over 2 million families received the financial support for energy improvement. This barely represented 34% of the families that were entitled to receive electric financial support, adn 27% of those families entitled to gas financial support. As such, in 2016 Cittadinanzattiva launched the "Bonus a Sapersi" (Bonus to Know) project, whose aim was to promote the use of 'social energy' financial support (electric/gas bonuses) for vulnerable consumers through 75 meetings/training sessions. It was targeted at social workers and other intermediaries responsible for supporting vulnerable consumers in requesting the support. The project was carried out by all the main Italian consumers associations.

Type of intervention	Transparency and information sharing
Geographical Scope	National level practice
Implementation time frame	2016
Target Group / beneficiaries	Social workers and intermediaries assisting vulnerable consumers

Outcomes

Over 80% of respondents from the 15 associations who worked in 2016 on the project ‘Bonus a Sapersi’ claim to have intercepted citizens who met the criteria for the bonus request but who were unaware of it

The project allowed social workers to access valuable information to determine their future actions (see future prospects section). For example:

>> About 39% of citizens said that the procedure to request the bonus is complex or very complex

>> 47% of the respondents affirm that information is not sufficiently disseminated or accessible

Budget / Funding	Funded by the Italian Ministry of Economic Development

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under the Grant Agreement No 101032823

ITALY

Customized Energy project

The Energia su Misura (Customized Energy) program analyses the effects of consumption reduction using feedback tools in social housing. This facilitates the identification of the most effective solutions to reduce energy costs. Special attention is given to the most vulnerable consumers. It aims to foster good practices among end users in order to stimulate energy efficiency in their homes.
The main project objectives are:

- Monitor domestic consumption through the use of smart plugs
- Get consumption data in order to provide adequate measures to families, so as to improve energy efficiency in their homes
- Analyse family changes and feedback to the measures provided

Type of intervention	Information and engagement
Geographical Scope	National level practice
Implementation time frame	2016-2019
Target Group / beneficiaries	Focuses on those suffering energy poverty and vulnerable consumers in general

Outcomes

Initial results have shown that the energy consumed by the families involved is very low, therefore the amount of energy that may be saved through behavioural measures during the day appears to be almost negligible. Nevertheless, appropriate measures are taken in order to improve home energy efficiency and comfort in a way that such measures may be assessed by institutions (e.g. the municipality of Milan, where about 50 families have been involved in the initial phase of consumption monitoring), and replicated in similar contexts.

Budget / Funding	Funded by the Italian Ministry of Economic Development

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement No 101032823

SPAIN

Alliance Against Energy Poverty

The Aliança contra la Pobresa Energètica, APE (Alliance Against Energy Poverty) was founded by neighbourhood associations, workers' assemblies, water and housing advocacy groups, and Non-Governmental Organisations (NGOs) concerned with the overall impact of the national energy model and existing inequalities.
The APE aims to guarantee universal access to basic services (water, electricity and gas), to avoid indiscriminate service cuts and to defend human rights. Creating a 'social outcry' is an important objective for the APE. The project aims to make the problem of energy poverty more visible on a societal level, by interacting with and mobilising those experiencing energy poverty. The mobilisation was achieved via collective advisory assemblies, advocacy campaigns, and demonstrations. The APE operates at as a grassroots movement to influence both citizens and institutions.

Type of intervention	Transparency and information sharing / Information and engagement
Geographical Scope	National level practice
Implementation time frame	2016-2019
Target Group / beneficiaries	Focuses on those suffering energy poverty and vulnerable consumers in general

Outcomes

The core grassroots element of the APE's approach is to hold bi-monthly assemblies in which people who have trouble paying their bills or who have had their energy or water cut, explain their problem to the group so that they all can find a possible solution. Assemblies are places where those affected come together with activists to defend their rights and to collectivise problem-solving mechanisms; it is underlined that the problem goes beyond the issue of 'being able to pay the bills'.
APE has also produced a 'Red BOOK': a basic guide to energy poverty and to tackle it. The book is available in Spanish and Catalan.
APE have collaborated with another social movement; the PAH (Platform for People Affected by Mortgage Terms) and an NGO (Observatori DESC - Drets Econ mics Socials i Culturals) to submit a Popular Legislative Initiative (ILP). This was presented to the Catalan Parliament and focused on housing rights and energy poverty demands, which was unanimously approved in the final parliamentary session of July 2015. Though its housing provisions were later disputed and annulled at the Constitutional Court of Spain, its energy poverty articles remained and the law is today one of the most important rights-based laws at a European Union level, which legislates over supply cuts for vulnerable people. APE organises numerous initiatives every year, which are not only connected to energy-poverty emergency cases, but also to political decisions and changes in the law.

Budget / Funding	Public funding

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement No 101032823

SPAIN	

Energy Bank

The Banc d'Energia (Energy Bank) is an association that promotes energy saving and efficiency to anyone suffering from energy poverty or vulnerability. Any organisation or individual can take
part in the Energy Bank; contributions are from individuals, companies and entities that decide to dedicate some of their energy savings to collaborate in the fight against energy poverty. This money goes towards both energy education and to household investments.
Banc d'Energia is a public-private partnership that aims to (1) educate the public on energy poverty and (2) alleviate energy poverty.

Type of intervention	Household energy efficiency / Transparency and information sharing
Geographical Scope	Municipal level practice
Implementation time frame	2014 and ongoing
Target Group / beneficiaries	Private and public entities and individuals, who have volunteered to make energy savings in a socially responsible manner / Beneficiaries: Vulnerable households in Premià and Sabadell

Outcomes

Energy savings are transformed into funds for energy efficiency investments in energy-poor households, while pioneering and transformative projects are funded.
Public entities reinvest 35% of the savings attained by internal energy efficiency improvements, while another 35% is allocated to anti-energy poverty measures. Private entities or individuals also donate at least 35% of the savings made.
There are tax deductions provided by law for contributors: 75% of the first €150, 30% of the rest for citizens, and 35% of the total amount of the donation for legal entities.

Budget / Funding	25% of all donations come from private entities / 75% of individuals contributed up to €150

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SPAIN

Renovating the Neighbourhoods

This municipal authority has led the project Renovem els Barris (Renovating the Neighbourhoods) for the renovation of 360 dwellings. The council has simultaneously contracted renovation work and transferred the costs to homeowners through various fractional payment formulas, which are adjusted to their income level. They have also offered the possibility to link the debt to the building, and not to the owner, thus avoiding upfront costs to the most vulnerable households.

Type of intervention	House energy efficiency
Geographical Scope	Neighbourhood level practice
Implementation time frame	2014 to 2019
Target Group / beneficiaries	650 home-owners / 1,250 residents

Outcomes

Energy-efficient retrofitting (a 30% reduction of estimated energy consumption), health improvements (combatting the cold at home), improvements in neighbourhood infrastructures by empowering its more dynamic sectors (a 50% reduction in police actions in one year).

Budget / Funding	€2 million

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SPAIN

Energy Assessment Points

This project was initiated after a successful pilot phase in which 100 people were trained and employed for 6 months as energy agents. They reached 3,000 vulnerable households in three districts within Barcelona. These agents focused optimized energy bills and low cost energy efficiency measures for households suffering from energy poverty or energy vulnerability.
10 Punts d'Assessorament Energ tic, PAEs (Energy Assessment Points) cover the whole city of Barcelona. Citizens can ask information about energy efficiency, energy poverty, energy bills and any energy use related queries. It is a universal service, which specifically focuses on identifying energy poverty situations that do not reach social services or charities. Furthermore, 60 new staff members were trained and employed as energy advisors, as part of an employment plan for long-term unemployed citizens. The management of the PAEs is administered by third sector organisations.
PAEs also communicate with social services, the Housing Department and the Energy Agency of Barcelona City Council. They identify potential abuses and violations of the Catalan Law Against Energy Poverty (Law 24/2015).

Type of intervention	Information and engagement
Geographical Scope	Municipal level practice
Implementation time frame	The PAE pilot phase lasted for 5 months, from November 2015 to February 2016. The employment plan pilot phase lasted from January to July 2016. The new plan, combining the two pilot projects, will be implemented for two years, starting from January 2017.
Target Group / beneficiaries	Energy advisors / Vulnerable households

Outcomes

During the pilot phase, 100 long-term unemployed people were trained to become energy advisors during a month-long training cycle. Between March and July they visited 3,200 households. In total, 450 cuts were handled by PAE service providers.

Budget / Funding	PAE pilot project: €88,000 / PAE extension plan: €4,450,380 / Employment plan: around €2.5 million

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SPAIN	

Workshops on energy saving and the optimisation of eletric bills

The volunteers of the Energy Transition Board of C diz (an area for citizen participation promoted by the City Council of C diz) received specific training and behaviour workshops on domestic energy savings and the optimisation of electric bills for the different neighbourhoods of the city at local social associations. This project promotes collaboration and co-responsibility among neighbours, civil organisations and the City Council itself, for the adoption of an energy model based on solidarity and mutual help.Its main goal is: to help families pay much lower bills, to promote a conscientious and responsible energy culture, and to involve families in a positive and empowering way. Although people of all ages and conditions have participated, the beneficiaries have mostly consisted of people over the age of 50.

Type of intervention	Transparency and informationn sharing / Information and engagement
Geographical Scope	Municipal level practice
Implementation time frame	Ongoing since January 2016
Target Group / beneficiaries	Cádiz residents

Outcomes

In 2016, 25 workshops were held, with between 10 and 40 participants. More than 400 residents of Cádiz have received energy saving training.

Budget / Funding	Training: Volunteers / Avertising and posters: €15,000 / Materials: €500

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SPAIN

A Catalogue of Good practices against Energy Poverty for the Province of Barcelona

The aim of the catalogue was to understand how the social services of the municipalities are dealing with energy poverty and what barriers and needs they have encountered. It sought to diagnose the state of energy poverty problems in the region, in order to be able to plan a more informed response. The main gaps and barriers were identified within these actions, as well as any hidden opportunities.

Type of intervention	Transparency and information sharing
Geographical Scope	Regional level practice
Implementation time frame	6 months in 2015
Target Group / beneficiaries	Municipal administrations in the region

Outcomes

Methodology: 310 municipal groups were investigated through surveys, interviews and focus groups. In a third focus group, both sectors were mixed. The municipal actions were classified in three
main domains: Detection and Diagnosis, Awareness Raising, Training and Capacity Building. The catalogue showed a clear picture of the energy poverty in the Province of Barcelona and the responses undertaken at local level. They were accompanied by specific recommendations on improvements, a catalogue of actions, and a list of national and international best practice. It served as a guide for municipal governments on how to take action against energy poverty, and it illustrated the need for cooperation between different relevant actors.

Budget / Funding	Funded by the Provincial Government of Barcelona

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Cooltorise

SPAIN

Self-Financing Communities (CAF-ACCIO)

A large subgroup of the vulnerable population is composed of newcomers from impoverished countries. The lack of a relationship network, access to bank credit in their new country, and conditions of economic uncertainty, are often contributing factors to energy poverty.
This project combines the expertise of Ecoserveis in fighting energy poverty, with the experience of self-funded communities (CAF) from the Associaci   de Comunitats Autofinan ades, ACAF (Association for Self-Funded Communities). The project was implemented between October 2015 to October 2016 in seven self-funded communities in Catalonia, which were selected after taking into account geographic diversity, different kinds of users, and various operating group models. During 2016-2017, the ACAF and Ecoserveis took a step forward and began training newcomers in the methodology of self-funded communities, to provide a real solution against energy poverty by means of mutual aid.

Type of intervention	Information and engagement / Financial support
Geographical Scope	Neighbourhood level practice
Implementation time frame	Phase 1: October 2015 to 2016 / Phase 2: October 2016 - still ongoing
Target Group / beneficiaries	The initial part of the project targeted migrants from Africa and South America who had been living in Catalonia for at least 3 to 4 years, and who were members of established communities with strong relationships and trust levels (usually around 10-15 people). The projects targeted migrants who do not have money to spend on energy efficiency improvements in their homes and who were likely to stay in their dwelling for at least three years.

Outcomes

The activities in the project consisted of meetings, interviews and planning actions for each CAF:
• The preparation of a workshop on domestic energy use and the prevention of energy poverty among CAF members
• Workshops on basic supply bills for residents and CAF members
• Service-learning workshops in the homes of CAF members (in which they learn to install energy-efficient, low-cost materials)

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• The co-financing replacement of electrical energy-inefficient appliances • An explanation of the social intervention modelling order to prevent energy poverty in volunteer projects which are against energy poverty A guide was developed, explaining the self-financing system, the methodology developed for Catalonia on reducing energy consumption and bills, and the intervention model. Training for social workers was conducted at the end of the initial phase of the project.	
Budget / Funding	The final budget approved for the development of the project ‘Self-funded Communities: A Collective Tool to Prevent Energy poverty’ was €37,200, of which €27,800 was awarded by the ‘La Caixa’ social projects organisation, which represented funds amounting to 75% of the grant. Phase 2: €57,900 grant from ‘la Caixa’ (2016-2017)

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SPAIN

Fuel Poverty Group

The Fuel Poverty Group, FPG, is a network of people and organisations acting against energy poverty. It was set up by Ecoserveis, an energy and environmental non-profit organisation, and by ABD, a social foundation with experience working with engaged volunteers. The project timeline was as follows:
1) ABD created a team of volunteers from universities, neighbourhood organisations, and companies
2) Ecoserveis trained the volunteers to become energy advisors
3) The volunteers became a tool for mobilisation and citizen engagement against energy poverty. As such, they visited households and advised vulnerable consumers on how to increase energy efficiency in their homes
The Fuel Poverty Group has developed a strategy based on prevention and direct action against energy poverty, by training volunteers to be energy advisors in neighbourhoods, and by carrying out on-site visits within households.

Type of intervention	Transparency and information sharing / Information and engagement
Geographical Scope	Municipal level practice
Implementation time frame	Founded in 2013 and it is on going
Target Group / beneficiaries	1) Volunteers with various professional backgrounds, from universities, social sector organisations and companies 2) Socially vulnerable groups who receive the information

Outcomes

The Fuel Poverty Group has over 100 volunteers, who have supported approximately 1,100 vulnerable people.
Since the beginning of 2013, 8 training courses for volunteer groups of around 20 people have been carried out. The volunteers attended a 10-hour training course on the specifics of energy literacy (use of energy, energy and water bills, tariffs and energy market), how to carry out assessment procedures, and social approaches to inform people about strategies for reducing energy consumption.
The volunteers were permitted to carry out three main activities with the support of the two NGOs. A minimum of two people were needed to organise community workshops on energy use. This included managing helpdesks; offering individual assessment and advice for people who suffer from energy poverty. A further step involved conducting a simple energy audit or diagnosis in vulnerable households, by Ecoserveis professionals and volunteers. The NGOs were responsible for finding venues for conducting workshops and advisory sessions, and did so through partnerships with local organisations, such as neighbourhood associations, the social services, and training centres.

Budget / Funding	The project was backed by municipal grants, grants from the Catalan Regional Government, and grants from private companies

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SPAIN

Catalan Law 24/2015 on Urgente Measures to adress Energy Poverty Emergencies

Electricity prices in Spain are the fourth most expensive in Europe, as consumption accounts for only 40% of electricity, water and gas bills. A 60% increase in electricity prices has occurred since 2008. The price of water has increased by 65% since 2008 and the Spanish Association of Environmental Sciences has noted that in the Barcelona Metropolitan Area alone, the number of water supply cuts rose from 27,359 in 2011 to 72,039 in 2012.

In Spain, when a consumer does not pay their energy bills for a specific period of time, they receive a notification, and if they do not pay the next bill then their electricity supply is cut. A new Catalan law aims to change this practice. Law 24/2015 states that the supply company must notify the social services about any upcoming supply cut off due to non-payment. If after investigation the social experts conclude that the household is vulnerable, then the supply cut will be prevented.

The law ensures the right of access to drinking water, electricity and gas supplies for those living in Catalonia. It resulted from a legislative citizens' initiative that was made law by a majority vote in the Catalan Parliament July 2015. The main contributors were the Alliance Against Energy Poverty, the PAH and the DESC Observatory.

Type of intervention	Consumer protection
Geographical Scope	Regional level practice
Implementation time frame	Adopted in July 2015
Target Group / beneficiaries	1) Volunteers with various professional backgrounds, from universities, social sector organisations and companies 2) Socially vulnerable groups who receive the information

Outcomes

The law guarantees the right of all people to basic supplies of water, electricity and gas. The breach of the imposed obligations can result in fines of up to €90,000. A legal process against those energy companies that break the law may be initiated by public institutions, such as a regional government, as in a recent energy-poverty death case in Reus, in the Province of Tarragona in November 2016. An 81-year old woman living alone, died in her home because of a fire, which had been started by a candle – this had been her only light source for the previous 2 months, after her electricity had been cut off.

Many electricity, gas, and water providers operating in Catalonia follow the provisions of the law. It has prevented around 39,000 supply cuts, according to the Regional Government of Catalonia (December, 2016). The number of companies applying the law grew after the death case in Reus, as companies sought to prevent more tragedies and avoid the associated media
attention.

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Budget / Funding	There are incurred costs for energy suppliers and the municipal social service offices. A targeted solidarity fund for paying the energy debt of vulnerable households is envisaged.

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SPAIN

Run4Energy

Run4Energy was the first charity race held for the energy poverty cause in Spain. It took place during the 'Dignity Week' in the city of Cornell del Llobregat in 2015 NGOs organized various activities for the public which focused on social issues. The aim was to collect money for interventions in vulnerable households, while local residents took part in enjoyable physical activities.
It was an awareness-raising race for local residents with energy poverty-related problems, as parallels can be established between domestic energy consumption and human energy consumption while exercising. Participants who contributed to the energy saving initiative were also locals who took part in various activities, such as dancing workshops, riding electric bicycles, making lemonade, etc. Part of the awareness campaign was based on transforming the energy used by the runners for the race into kWh for the vulnerable households. At the end of the event, the City Council noted the kWh accrued with the organised activities and the calories burned by the participants, and matched it to an equivalent sum of kWh for intervention projects, which are currently being carried out in vulnerable households (including billing optimisation, the distribution of low-cost material packs and individual energy diagnosis and training).

Type of intervention	Household energy efficiency / Information engagement / Financial support
Geographical Scope	Municipal level scope
Implementation time frame	The first event took place in May 2015, the second in 2016 and the third in 2017
Target Group / beneficiaries	All the local residents of Cornell de Llobregat were targeted as participants in the race, while the energy poor/vulnerable citizens from the city were the beneficiaries, as defined by social service criteria.

Outcomes

In 2015, 800 people participated. In 2016 the number rose to 1,000. Each participant received a bag containing information materials and energy-efficient light bulbs.
With the sum gathered from the race in 2015, 15 households were supported through low-cost energy-efficiency measures, advice, and training.
In the weeks before and after the race, four workshops were organised in the neighbourhood on topics such as energy and gas bills, energy consumption and habits, sound, and efficient lighting.
A guide was produced for municipal councils in the Barcelona Metropolitan Area on how to organise a charity race against energy poverty (i.e. offering awards for the best photos shared on the social media).

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Budget / Funding	All interventions were paid by the municipal council, while Ecoserveis contributed with an awareness campaign and human resources

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