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Mapping fuel poverty in Portugal

Sofia G. Simoes[a]*, Vera Gregório[a], Júlia Seixas[a]*

[a]*CENSE – Centre for Environmental and Sustainability Research, Faculdade de Ciências e Tecnologia, Universidade NOVA de Lisboa, 2829–516 Caparica, Portugal*

Abstract

We defined a novel methodology to assess the potential fuel poverty of residential dwellings at LAU2 level combining data on income, level of education, unemployment rate, and number of inhabitants above 65 years old, with both the space heating and cooling gap estimated per household typology. We create an indicator of the share of potential fuel poor inhabitants in each LAU 2 region. We implemented this methodology for 29 municipalities in Portugal. On average 22% of the inhabitants are potentially fuel poor regarding their dwellings' space heating and 29% regarding space cooling. There is a large variation across the country.

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Keywords: Fuel poverty; residential buildings; thermal comfort; heating and cooling

1. Introduction

There are several definitions of fuel poverty (also known as energy poverty by some authors, including the European Commission), but more commonly the term is used to refer to persons living in households that they cannot afford to heat adequately [1]–[4]. Frequently, other energy uses are also included in the concept [1], [4], although most authors focus on heating. Following the varied definitions of the concept, there are also varied approaches to measure it across the European Union (EU) [2], [3], from considering as fuel poor the households that use 10% more than of their available income to heat their homes up to World Health's Organization Standards

* Corresponding author. Tel.:+351-212-948-397 x10168; fax:+351-212-948-554.
E-mail address: sgcs@fct.unl.pt

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(WHO) in the UK [5] and Ireland [6], to simply surveying the number of days that the dwellings have gone excessively cold (or warm), had delays in paying their energy bills, or were disconnected due to debt [7], [8].

Assessing fuel poverty is an area of work mostly developed in the UK [3], [6], [9], where the concept was brought to attention by the seminal work of Brenda Boardman [4]. Since then, studies have been developed for other countries such as for Austria [10], Bulgaria [11], France [12], Italy [13], and Spain [8], [14]. Some overviews have been made for the whole of EU, as [15] that reviewed housing and socio-economic conditions for fourteen countries using Ireland as a benchmark, or the work of [6] that used the EU Survey on Income and Living Conditions (EU-SILC) data to compare 25 EU member states looking at housing conditions, energy inefficiency and energy affordability. According to these studies Portugal, Greece, Italy and Spain were the most fuel poor countries in the EU [16] and, according to the EU-SILC data, Portugal had in 2013 roughly 20-29% of households that were fuel poor. [6] reported similar findings more recently although Southern European countries have been joined by Easter European countries as Bulgaria and Romania. In order to successfully deal with fuel poverty, authors seem to agree that the key defining features of fuel poverty have to be addressed: location, housing quality and income [6], [16].

In this paper, we present a new approach to assess potential fuel poor inhabitants considering such features, focused on space heating and cooling for households. We apply the approach to assess where the fuel poor households are located within 29 municipalities in Portugal under the ClimAdaPT.Local project. ClimAdaPT.Local is an ongoing project leveraging the capacity building at municipalities to develop comprehensive Municipal Strategies for Adapting to Climate Change (MSACC). The paper is organized as follows: section 2 describes the methodology proposed, the results are presented in section 3, and section 4 concludes and highlights some of the needs for improvement.

2. Methodology

2.1. Developed methodological approach

The approach adopted in this paper to assess potential fuel poor follows the framework of [17] to determine whether and to what extent a system is vulnerable to climate change and includes four key components: 1) exposure – variables directly linked to climate parameters (e.g. temperature, precipitation), 2) sensitivity – the degree a system is affected by exposure (e.g. physical attributes of the system, as buildings characteristics), 3) potential impact – measured by the combination between exposure and sensitivity (e.g. the potential impact on thermal comfort), 4) adaptive capacity – the ability of a system to adjust to climate change [18], mostly related with societal environment (e.g. demography, literacy, socio-economic conditions). This approach was initially developed by the authors to assess the climate change vulnerability of residential dwellings regarding thermal comfort [19] and was further adapted to map fuel poverty. The potential impact is stated as the “heating and cooling gap” and the adaptive capacity is adjusted to “capacity to implement alleviation measures”. These are explained more thoroughly in this section.

In this approach, we only look into the residential buildings and their needs aiming to ensure thermal comfort (space heating and cooling). We have adopted the definition of thermal comfort as stated in the Portuguese regulation on the thermal characteristics of buildings (RCCTE) of 2006 [20] which determines that a dwelling should maintain an indoor temperature of 20ºC during the heating season and of 25ºC during the cooling season. This is applicable to the whole of the dwelling and throughout the entirety of the heating and cooling season. The outcomes of fuel poverty are expressed in terms of the senior inhabitants living in civil parishes identified as potentially fuel poor.

As previously mentioned, we adapted the approach described in [17] (Fig. 1) which entails addressing complementarily the potential impact and the capacity to implement measures to reduce potential fuel poverty.