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Investigating fuel poverty in the transport sector: Toward a composite indicator of vulnerability

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ABSTRACT

This paper investigates the issue of fuel poverty and of its measurement in the transport sector. We seek to identify households who run the risk of facing difficulties if fuel prices increase. We show that fuel poverty indicators from the domestic sector are not satisfactory in this regard. They fail to take into account three specificities of the transport sector: (1) the diversity of travel needs, (2) restriction behaviours, and (3) variable capacities to adapt. We propose a composite indicator that targets factors of vulnerabilities. In contrast to the previous indicators, it does not solely focus on budgetary aspects but also reflects conditions of mobility. Three levels of exposition to rising fuel prices are considered, depending on the combinations of factors. We test this indicator on French data and find that 7.8% of French households are identified fuel poor, a further 7.4% fuel vulnerable and a further 3.7% fuel dependent.

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1. Introduction

Because of climate change policies or depleting fossil fuels, fuel prices are expected to rise and an increasing number of households could face difficulties to afford their energy bills, adequately warm their home and achieve their travel needs. The United Nations has identified the provision of sustainable energy for all as one of the main priority in the “Sustainable Development Goals” that will guide national and global policies to 2030 [37]. Similarly, Sovacool and Dworkin [45] refer to the concept of energy justice and define it as “a global energy system that fairly disseminates both the benefits and costs of energy services”. This concept is gaining attention and emphasizes the need to implement energy policies that tackle climate change while improving rather than worsening socioeconomic and spatial inequalities. Therefore addressing the issue of fuel poverty, and the vulnerability of households to higher energy prices, is a requisite to pursue on the pathway of deep-decarbonisation of the society.

Attention has been focused on fuel poverty in the domestic sector so far. Traveling by car is another essential energy service for

part of the population [44,21]. High fuel prices can induce restriction behaviours – households do not meet their travel needs – and it may become a barrier to access employment, and cause social and economic exclusion [35]. Therefore fuel poverty policies are necessary to accompany fuel prices rises.

The success of fuel poverty policies depends on the capacity to target the most vulnerable population [17]. If inadequately targeted, they may miss their intended purpose [20]. Indicators of fuel poverty are thus needed to guide the targeting of policies and measure their impacts.

In this paper, we focus on the evaluation of fuel poverty in the transport sector. We investigate which indicator(s) are most suitable to measure households' exposition to rising fuel prices in the transport sector. We show that transposition of current fuel poverty indicators used in the domestic sector is not satisfactory, and that it calls for the development of a multidimensional indicator, which combines information on the financial resources, fuel consumption and conditions of mobility.

Existing indicators mainly focus on income and fuel spending—assessing the ability to afford one's fuel bills [33]. Although budgetary constraints are important, they only provide a partial picture of fuel poverty. In line with Sen's poverty approach seen as capability deprivation – lacking the opportunity to achieve some minimally acceptable basic functionings [43] – we interpret fuel poverty in the transport sector as lacking the opportunity

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to adequately achieve one's travel needs. Travel needs vary from one household to another depending on a variety of geographic, technical and socio-economic characteristics. This variation raises concerns about the adequacy of conditions of mobility in regard with travel needs, as well as with households' capacity to adapt their practices in face of rising fuel prices. We show that existing indicators fail to account for the diversity of travel needs and capacity to adapt, and we develop a novel indicator to do so.

The construction of our indicator, and its comparison with existing indicators, is illustrated with an application to the French case study based on the national travel database ENT D 2008—*Enquête Nationale Transport et Déplacement*.

The rest of this paper is structured as follows. Section 2 reviews indicators of fuel poverty in the domestic sector. Section 3 describes specificities of the transport sector that have to be considered for evaluating fuel poverty in the transport sector. Section 4 describes the methodology to build indicators measuring fuel poverty in the transport sector. Section 5 presents the survey data for the application to the French case study. Section 6 presents the results and discusses the different indicators. Section 7 concludes.

2. Measuring fuel poverty in the domestic sector: a review of current indicators

2.1. Definition and measurement issues

A household is said to be in fuel poverty when its members are unable to afford to keep adequately warm at reasonable cost. This original British definition generalizes to the situation of a household whose members are unable to afford an adequate amount of energy services to satisfy their basic needs, as mentioned in the legal French definition.¹ This definition may include other domestic uses than ambient heat and hot water, as the rising uses of home appliances. Tackling vital warmth and socially constrained uses together raises justice issues. Concepts of energy justice emerge to elaborate relevant public policies related to energy services [45]. Transportation is sometimes included within the scope of energy justice, especially through the global South oriented concept of energy poverty [46]. While warmth needs may rely on physiological parameters though some socio-cultural dimensions [47], transport belongs to the energy needs that are mainly constrained by social arrangements. This specificity of transportation and others that will be detailed below, call for a “vulnerability” approach towards planning policies, more than a “poverty” approach that targets households already facing difficulties within the vicious circle of poverty [9]. A wider scope of fuel poverty implies its very reconceptualization towards a possible change of policy approach.

A common agreement has emerged to identify low income, poor energy performance, and high fuel costs as the key drivers of fuel poverty [36]. Location is also identified as a key defining feature [49,40]. However these definitions relate to the domestic energy. Similarly we propose to define fuel poverty in the transport sector as involving the following three drivers: low income, high fuel costs and poor conditions of mobility. Conditions of mobility refer to the accessibility to jobs and services, to the existence of other modes of transport – than private vehicle – to reach them, and to the energy performance of the vehicle, be it cars or two-wheelers. From this definition, fuel poverty shows different dimensions – namely economic, technical and geographic – and reflects different situations. The particular situation of each household depends on its lifestyle, its budget and its preferences, as well as on external factors. To illustrate, some households may face difficulties to meet

their travel needs because of budgetary constraints, while others because of an inappropriate spatial matching associated with long travel time, high fuel spending or physical tiredness of traveling [33]. Some households may be forced to adjust their behaviours and restrict their mobility, meaning they may reduce their number of trips. This raises concerns in regard with households' accessibility to employment areas, to healthcare centres or other critical motives [19,2]. Others may develop different strategies to cope, they may prefer to give up on other essential spending, such as food or clothing, in order to keep satisfied their travel needs.

This variety of situations rouses debates about which indicator(s) should be used to evaluate fuel poverty. In the domestic sector, several studies showed that the depiction of fuel poverty may substantially vary depending on the indicator chosen, be it in terms of the number or of the categories of households concerned [39,52,51,53]. This choice is not trivial; indicators are not neutral in their approach to fuel poverty, but points out to different political representations of the problem. It is necessary to reach a shared representation of fuel poverty, involving a common definition and consensual indicators [12]. Actually it is a requisite for fuel poverty policy to be effectively designed and implemented, because indicators are the basis on which to quantify the extent of the problem, to identify the affected population and to design mitigation policies [22,32,34]. Because fuel poverty is multidimensional, reducing fuel poverty only to budgetary aspect does not account for the more complex reality of the phenomenon, so that a good fuel poverty indicator should be enlarged to integrate information on the living conditions. Though we acknowledge both housing and mobility aspects should be considered, in this paper we focus on the transport dimension of fuel poverty. Thus information is needed on the financial resources of the households, on their car fuel consumption² as well as on their conditions of mobility. This suggests that a good indicator should capture the difficulties to afford one's car fuel bills as well as situations of restriction, and that it should assess the level of energy performance as well as the implications of one's residential choice.

2.2. Ratio indicator

Fuel poverty in the domestic sector is commonly measured with the 10% ratio indicator, which was first introduced in the UK in the 1990s. A household was said to be in fuel poverty if it needs to spend more than 10% of its disposable income on energy services [10,7]. Rather than actual energy spending, the energy spending was estimated from the energy required to provide satisfactory heating – depending on the household type and level of occupancy – plus adequate lighting, hot water, cooking and typical appliance use [15]. Alternatively the energy spending can be based on domestic energy bills and relate to actual energy spending. The 10% threshold was defined as twice the median energy spending at that time in the UK, which was considered an unreasonably high spending. This threshold has since been kept at 10%, despite variations in the median energy spending, making this ‘10%’ an arbitrary value. Analogously to poverty measurement in the European Union and the OECD, the threshold can be defined in relation to the current situation as twice the current median ratio [34]. The emphasis is then put on relative fuel poverty, as the number of fuel poor is influenced by the distribution of fuel spending among the whole population and relates to the way of life of the society in which they live. While a relative threshold may better gauge the extent of disproportionate spending, it masks the fact that significantly more households will have real difficulty in meeting their fuel spending in face of rising fuel

¹ See the Loi Besson du 31 mai 1990: <http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=LEGITEXT000006075926&dateTexte=vig>.

² Because two-wheelers are few compared to cars, we use “car fuel consumption” to refer to both car and two-wheelers fuel consumption.

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