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The two faces of energy poverty: A case study of households' energy burden in the residential and mobility sectors at the city level.

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Abstract

This paper proposes an innovative methodology for the analysis of households' double energy burden in the housing and transport sector by applying a new indicator – the Low-Income-High-Costs (LIHC) indicator (Hills, 2011, 2012). Whereas in its original version, the LIHC indicator only deals with residential energy expenses, in this paper, we propose to include energy cots linked to transport. Based on this modified method, we carry out a case study of of the two faces of energy poverty in the city of Strasbourg. In this case study, energy demand and expenses for dwelling and transport are modeled at the household level, taking into account technical and localization aspects. Then, data on households' income are included in order to determine the number of fuel poor households at the urban district level.

Keywords: Fuel poverty, vulnerability, LIHC indicator, energy consumption, urban planning.

1 Introduction

Environmental sustainability is a key topic in the current restructuration of the energy landscape throughout Europe. The question of how sustainable the energy market is in social terms and how households are impacted by rising energy prices has in this context gained importance, even though the level and focus of public and academic attention varies significantly from one country to another. In the academic field, two research foci have developed in parallel, one concerned with energy costs in the residential sector (see for example Boardman 1991, 2010; Hills 2011, 2012) and the other one concerned with households' vulnerability in the transport sector (Polacchini and Orfeuil 1999; Mignot 2004; Vanco 2008; Gertz et al. 2009; Jouffe and Massot 2013). While the structural reasons for high energy consumption in the housing and transport sector differ, households facing a double energy costs burden might not be an exception: households living in single family homes in suburban or rural areas are most prone to energy poverty[1]. These households are also most likely to face important transportation costs due to increased travelled distances as compared to households living in denser areas (Saujot 2012, p. 8).

However, only a limited number of studies have empirically examined the link between energy costs in the housing and transport sector (Dijoux and Rosales Montano 2009; Rosales-Montano et al. 2009; CERTU 2011). These studies treat the expenses linked to these two sectors separately, aggregating them ex post in order to provide global results on the communal level. Furthermore, the choice of an indicator that adequately measures the phenomenon rests an open question, both for the housing, and for the transport sector. A widely used approach is to put energy costs in relation to income, and to determine which households have difficulties to cope with their fuel bills via a fixed threshold. This approach has been criticised for its multiple shortcomings (Hills 2011, 2012; Moore 2012; ONPE 2013), and the way it has been applied to energy costs in the transport sector is questionable. For this reason, we use a novel method in this study, which aims to overcome the weaknesses of current approaches, and which is based on a logic that more conveniently allows for the integration of transport costs.

In the case study presented here we test this calculation method for the combined assessment of the two faces of energy poverty at the local level. The city of Strasbourg was chosen as the unit of analysis.

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[1] Energy poverty and fuel poverty are used as synonyms in this article.

The paper is structured as follows: in the following section, specificity of our approach compared to other related studies is outlined. The third section is dedicated to the discussion of indicators. In section four and five, respectively, the research method and the results are presented. The findings of our study are summed up in section five.

2 Establishing the link between housing and transport

This section gives a brief overview of the different research traditions concerning the social dimension of energy expenses in the realm of housing and mobility, respectively. Furthermore, it discusses the link between these research areas and explains the approach chosen in this study.

Fuel poverty emerged as a research field in the 1980s in Great Britain (Bradshaw and Hutton 1983; Boardman 1991). Fuel poverty is closely associated with the concept of 'affordable warmth' (Boardman 1991; WHECA 2000), but other energy services (cooking, lighting etc.) are also taken into account. The interaction between low incomes, high energy prices and a low energy efficiency of the dwelling is conventionally considered to be the main driver of fuel poverty (Boardman 2010, p. 21; Hills 2011, p. 36). Research on fuel poverty has been much concerned with means of measuring the phenomenon, in order to be able to observe its evolution over time and the potential impact of policy measures. The most prominent indicator used to quantify the number of households in fuel poverty is the 10% indicator proposed by Boardman (1991), which stipulates that a household is fuel poor if it needs to spend more than 10% of its disposable income on energy services. This indicator is based on British data from 1988, when median energy costs amounted to 5%, the double of which was considered to be unreasonably high expenses (Boardman 2010, p. 22). While being the most widely used indicator, it has been more and more submitted to criticisms recently. In this context, a new indicator has been proposed by Hills (2011, 2012) which is supposed to give a more reliable account of the phenomenon. Contrary to the 10% indicator, this new indicator, called Low-Income-High-Costs (LIHC) takes fixed housing costs into account (rent and mortgage reimbursement), a characteristic that is of interest in a combined analysis of transport and housing.

Interestingly, while the housing sector examines poverty caused by disproportionate energy costs, in the field of mobility, research is predominantly concerned with households' vulnerability to rising energy prices (Vanco 2008; Gertz et al. 2009; Jouffe and Massot 2013; Mercier et al. 2013; Vanco et al. 2013). Vulnerability may be defined as the "capacity of individuals and social groupings to respond to […] any external stress placed on their livelihoods and well-being, focussing on socio-economic and institutional contraints that limit the ability to respond effectively” (Kelly and Adger 2000, p. 347). The studies dealing with vulnerability in the transport sector are thus interested in identifying households that would be most affected by rising energy prices. Vulnerability is thus considered in terms of households’ socio-economic characteristics, but also in terms of spatial factors, such as the households’ geographical location, settlement density, car dependence and accessibility to public transports.

A vulnerability indicator has been proposed by Verry and Vanco (2009) and Nicolas et al. (2012) which is based on the same logic as the 10% indicator (used for the measurement of energy poverty). Analysing empirical data in seven French cities, the authors find that households spend on average 9-10% of their income on transport, twice of which they consider to be an indication of vulnerability. This leads to a vulnerability threshold of 18-20%.

It is striking that the same kind of indicator is used to measure different phenomenons (poverty vs. vulnerability), without discussing the rationale behind this choice. The question of why high energy cost burdens should materialize in different ways in the housing and in the transport sector remains unanswered.

In this study, we use the term energy poverty to describe a situation where a household faces serious financial problems due to disproportinately high energy costs, which might apply both to the housing and the transport sector. Energy vulnerability, in our perception, is a term used to describe the propensity of a household to be pushed into energy poverty due to a change in context factors, such as a rise in energy prices, or inappropriate urban planning. Here, we focus on energy poverty, but we also show inhowfar the indicator we apply is suited for the description of energy vulnerability.

Other studies that have examine households’ twofold energy burden (Dijoux and Rosales Montano 2009; Rosales-Montano et al. 2009; CERTU 2011) measure energy costs for each sector independently in order to show overall tendencies at the commune level. We propose a method that couples the energy costs and provides results at the household level. While fuel poverty in the housing sector has thus far predominantly been measured at the national scale, our study shows how the indicator we chose can be applied to the local level.

3 Discussion of indicators

The method we use for our analysis is based on the Low-Income-High-Costs (LIHC) indicator proposed in 2012 by John Hills (LSE). This new indicator was developed in a context of increasing critiques on the 10% indicator, which is traditionally used in Great Britain for the official fuel poverty statistics. The objective of the LIHC indicator is to draw on the strengths of the 10% indicator, and to propose solutions to the identified weaknesses.

In this section, we briefly outline the principal critics concerning the 10% indicator as well as the main characteristics of the LIHC indicator. Furthermore, we show how this indicator is adapted for the purpose of our study. For details on the differences between the 10% and the LIHC indicator, please refer to Hills (2011, 2012).

3.1 Critics on the 10% indicator

As mentioned above, according to the 10% indicator, households that would need to spend more than 10% of their disposable income on energy services are considered to be fuel poor (Boardman 1991). The threshold of 10% has been defined as twice the median of income spent on energy in 1988, but has since then remained unchanged, which means that it has not been adjusted to reflect twice the median of current budgets.

Furthermore, the indicator does not dispose of a mechanism to garantuee that wealthy households are excluded. An assessment based on the 10% indicator might thus qualify these households as fuel poor, if they spend a considerable part of their income to heat large living spaces or swimming pools, for example (Hills 2011, p. 14).

In addition, analyses based on British data have shown that the 10% indicator is very sensitive to energy prices. The evolution of fuel poverty, measured with the 10% indicator, is highly correlated with the evolution of energy prices. The impact of the other two key drivers of fuel poverty, namely the income and energy efficiency, is thus under-estimated (Hills 2011, p. 14).

3.2 The LIHC indicator

The main specificity of the LIHC indicator is that the population of fuel poor households is determined via two thresholds: the income threshold and energy costs threshold. These two thresholds are defined in relation to the national median, which presents, according to this approach, what could be perceived of as a norm in terms of income and spending. More precisely, the energy costs threshold corresponds to median normative energy costs, whereas the income threshold is equal to 60% of median income (the “risk of poverty” line as used by the European Union). In order to account for cases where households are pushed into fuel poverty due to exceedingly high energy expenses, each household’s modelled energy costs are added to the income threshold, leading to a distinct income threshold for each household. All households that are below the two thresholds are considered to be in fuel poverty (see figure 1, red area).

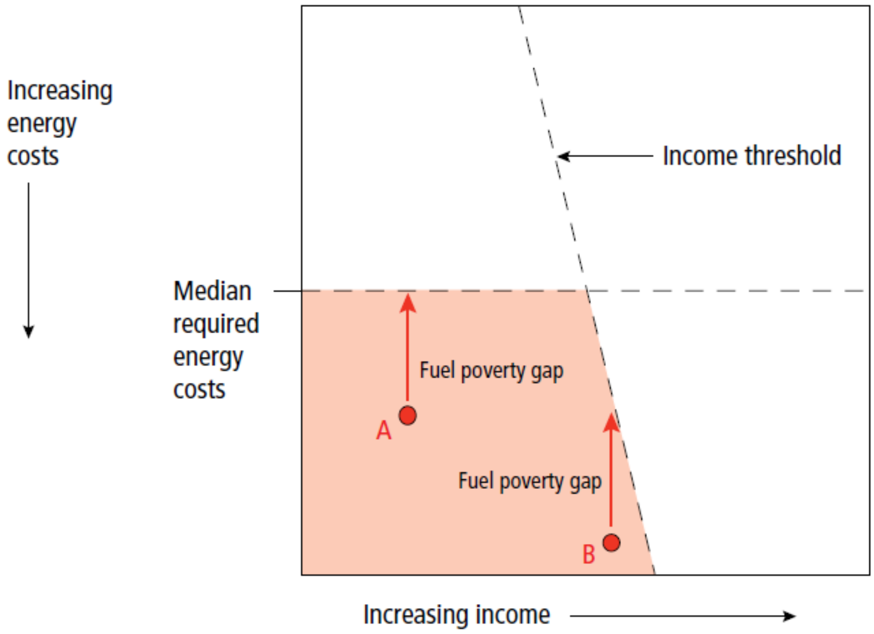

Fig. 1 The Low-Income-High-Costs indicator (Hills 2011, p. 139)

Furthermore, the indicator not only assesses the number of households in fuel poverty, it also allows measuring the depth of the problem. The ‘fuel poverty gap’ indicates the difference in energy costs of an individual household and the energy cost threshold, i.e. the “the amount by which the assessed energy needs of fuel poor households exceed the threshold for reasonable costs.” (Hills 2012, p. 9). The fuel poverty gap can be used in a longitudinal perspective as a means to detect the impact of political measures, even if the households stay fuel poor and do not cross the thresholds. As an aggregated measure, the fuel poverty gap can be used as a measure to demonstrate the profoundness of the phenomenon at the national level.

The LIHC indicator takes into account household size and composition, for both income and energy costs. By doing so, it accounts for the fact that the same income does not translate into the same living standard for different household types (e.g. single person compared to couple with two dependent children). For income, the equalization scale proposed by the OECD is used.

Household size and composition also have an impact on the level of energy costs. However, in the case of energy costs a different logic applies: we would not expect a couple to consume twice as much as a single person, since, for example, they would only heat one kitchen or living room instead of two. For this reason, economies of scale have to be taken into account. This is done by calculating an equalization scale based on empirical data.

A further novelty of the LIHC indicator as compared to the 10% is that it uses after housing costs. This means that council tax, rent and mortgage reimbursements are deduced from income. An after housing costs measure of income is expected to better reflect the income households have at their disposition and to account for the strong differences in housing costs related to spatial and occupancy characteristics.

Altogether, this indicator is expected to yield a more robust and thorough account of fuel poverty, since it provides for a more balanced representation of the key elements of fuel poverty (energy prices, income, and energy efficiency of the housing stock).

The LIHC indicator lends itself to the integration of transport costs, which can be easily added to the energy costs threshold. The energy costs thus comprise both housing and transport, and the threshold is fixed as the median of the sum of these two expenses (see figure 2). Details on the way these two energy costs are calculated and combined to determine a common threshold are given in section 4.3.

4 Research method

4.1 Data

In France, no source is available that provides data both on energy costs (related to housing and transport) and income. For this reason, we merge data from different data bases, namely the National dwelling survey “ENL” (Enquête Nationale Logement), 2006, the census “RGP” (Recencement Général de la Population), 2008, and two mobility surveys, the “ENTD” (Enquête Nationale Transports et Déplacements), 2008, for the national level and the “EMD” (Enquête Ménage et Déplacements), 2009, for the local level. Both mobility data bases are used in this study since neither one of them provides all the necessary information. The information retrieved from these different data bases is merged according to household and spatial characteristics.

4.2 Variables

4.2.1 Income

Our income calculation is based on the approach proposed by the LIHC indicator, with the single difference that not only housing costs are deduced from income, but also fixed transport costs. Our approach thus relies on an after housing and transport costs measure of income.

At the outset, a net income is calculated, comprising wages, pensions, benefits, savings and investments, as well as other sources of income. Consequently, council taxes and housing costs are deduced from net income, as well as fixed transport costs, such as public transport, assurance and maintenance costs, and potential mortgage payments for the purchase of a vehicle. The remaining income is adjusted for household size and composition, using the modified OECD equivalence scale[2].

4.2.2 Energy consumption

Housing

Corresponding to the state of the art in fuel poverty research, the LIHC indicator is based on energy requirement rather than real consumption. This approach accounts for the fact that fuel poor households may restrict their consumption in order to be able to pay their energy bill. Only by considering the energy these households would need to consume to achieve an adequate level of comfort, are we able to thoroughly assess the phenomenon.

In France, data on housing characteristics that are needed to estimate households' energy needs is very limited. For this reason, we developed an approach that is based on the method used in France for the calculation of Energy Performance Certificates (DPE/3CL) and that draws on input data from the ENL and the RGP. More precisely, data on the thermal performance, the building morphology, the environment and the system efficiency are used to obtain the normative energy consumption of a dwelling. Consumption behaviour is not reflected in the output data at this stage.

In a second step, this data is thus further differentiated according to the heating patterns used for the LIHC indicator and proposed by the British Department of Energy and Climate Change (DECC 2010; Hills 2011, pp. 98-101). These heating patterns define different heating levels in relation to the time spent at home and the extent of heated surface, thus taking into account under-occupancy. The modulation of energy data according to heating patterns yields a more fine-grained representation of required energy needs by household type.

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[2] The modified OECD equivalence scale assigns a value of 1 to the first adult in a household, the value of 0.5 to all other adult household members, and 0.3 to children.

Transport

As for housing, transport costs would ideally be based on normative mobility needs. However, contrary to residential energy needs, mobility needs are much more difficult to establish, given the great diversity of transport modes and motifs. The latter depend both on the households' geographical location (travel distances and accessibility) and on sozio-economic characteristics (income, size and composition of household, professional status) (Gertz et al. 2009, pp. 30-40; Verry and Vanco 2009, p. 13). Furthermore, alternatives would have to be evaluated, in order to determine if households could reduce their transport costs by chosing alternative modes of transportation, or if they are limited in their choice (Verry and Vanco 2009, p. 4). While Jouffe and Massot (2013) discuss the possibilities of determining mobility needs, research on this topic is not yet sufficiently advanced to serve for our study. Hence, for the time being, transport costs are derived from real consumption data.

Energy costs linked to transport depend, first of all, on the chosen transport mode. The following modes are considered in this study: bicycle, walk, public transport, car and motorized two-wheeled vehicles. Bicycle and walk have no variable energy costs associated to them. The same holds for public transport, where tariffs represent both fixed and variable costs. This means that a distinction between fixed and variable costs would be an artefact. For this reason, we consider the entire costs linked to public transport as fixed costs.

Energy costs related to individual motorized mobility (cars and motorized two-wheeled vehicles) depend on variable costs, which are determined by the type of vehicle and fuel, and the travelled distance. In order to obtain both energy consumption and travelled distance, we developed a calculation method which builds on data retrieved from the two mobility data bases, disaggregating national data whenever necessary. Energy costs are then determined as a function of energy consumption, travelled distance and energy prices. The sum of expenses of all journeys undertaken by all members of a household is calculated. The costs are weighted according to the type of day (working day or weekend) a journey is representative for, which allows us to obtain an average value for the households' yearly transport costs. The final output of our calculation is an average transport cost per household type and type of geographic area.

4.2.3 Energy costs

In order to obtain households' energy costs in the housing sector, energy tariffs provided by the data base Pegase are used (Pégase 2010). Energy tariffs differ according to time of consumption (peak and off-peak hours) and the type of subscription, and are thus attributed to households according to dwelling characterisitcs.

Data on variable energy costs in the transport sector is provided by the French Ministry of Energy and Sustainable Development (MEDDE n.d.).

4.2.4 Equivalisation of energy costs in the dwelling

As mentioned in chapter 3.2, the LIHC indicator works with adjusted energy costs according to household size and composition. This approach thus takes into account economies of scales in energy consumption. In order to determine an equivalisation scale, average required energy needs for different household types are calculated. Only households are considered whose income differs at most 20 per cent from the national median, in order to account for the fact that incomes might vary considerably within a household type (Hills 2012, p. 182).

When it comes to transport costs, we encounter two difficulties: An equivalization scale is used as a means to consider economies of scale that occur when larger households share the costs of a good or a service used by several members of the household (for example, a heated bedroom). However, the same logic does not necessarily apply in transportation. Here, a family where both parents have to commute to work but in different directions and where each child has different evening activities, transport costs might not necessarily be minimized but rather accumulated. Another difficulty is that at present, our method is based on real consumption data, not on mobility needs, which further challenges the use of an equivalisation scale, meant to represent situations defined as typical. For these reasons, the present study is based on transport costs which have not been adjusted for household size and composition.

4.3 Coupling of energy costs

From the calculation described above, we obtain two outputs: the energy costs linked to the dwelling by household type and the average energy costs linked to transportation by household type and type of space. These two energy costs are coupled via the type of household. We thus obtain a global energy costs value for each household. The median of these global energy costs for the analysed territory is then used to fix the local energy costs threshold (see figure 2).

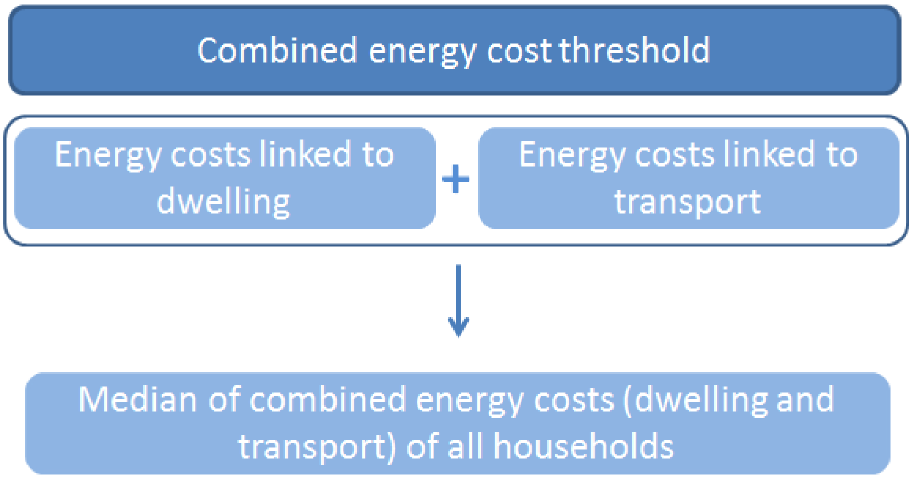

Fig. 2 The combined energy cost threshold, Source: authors.

4.4 The local level: data disaggregation

To determine the income at the local scale, equivalised after housing cost incomes are downscaled using a ratio that takes into account the fiscal income at the neighbourhood level[3] which is provided by INSEE and DGFiP (INSEE 2009)[4].

To downscale council taxes at the local scale, the data provided by the ENL is used to classify nine local area types, basically city centers, suburb and rural areas. In our case study, one single type is used, the city of Strasbourg.

The LIHC indicator deduces rent and mortgage reimbursements from income. The necessary data concerning rents at the local level is retrieved from an online portal. This allows us to attribute a specific rent per m² at the neighbourhood level. Data for rent in social housing (which we expect to be quite different from the rent in the remaining parc) are taken from the Observation and Statistics Office (SOes n.d.).

The amount of mortgage reimbursements is provided by the household survey ENL (INSEE). For the local level, we use average values according to socio-professional status to all

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[3] The IRIS level: *Ilots Regroupés pour l'Information Statistique*

[4] Direction Général de Finances Publiques (Directorate General of Public Finances).

households that live in an acquired property where the reference person is between 30 and 50 years[5].

As we calculate energy costs both for transport and dwelling at the local level, this data does not have to be further disaggregated.

5 Results

5.1 Discussion of results

Our results indicate that in the city of Strasbourg, 24 000 households, which corresponds to 19% of households, experience difficulties to pay their accumulated energy costs in the housing and transport sector. It is important to notice that this figure only refers to households with high energy costs in *both* sectors which have, at the same time, incomes below the poverty line. Households having high energy costs either in transport or in the dwelling are not considered in this method.

Unfortunately, no reference exists to which our result could be compared, since this is the first study to analyse the double energy costs burden on households at the city level. However, we know that studies analyzing energy poverty linked to the dwelling at the national level found that 13% of households were fuel poor in France in 2006 when measured with the 10% indicator (De Quero and Lapostolet 2009). In their study on energy vulnerability in the transport sector, Nicolas et al. (2012) finds that transportation costs in four principal French cities amount on average to 9%. This anecdotic evidence cannot serve as a proof of the reliability of our result, but serves at least as a first indication that our results do not deviate exceedingly from what might be expected from a measurement of an accumulated energy burden.

Furthermore, our findings indicate that the average fuel poverty gap for those households being in fuel poverty amounts to around 590 euros. This means that on average, those households that are in found to affected by double energy poverty have an energy bill (for transport and the dwelling) that is 590 euros above the median energy bill.

In the following, we present a more fine-grained analysis of the results. More precisely, we illustrate which types of households are the most affected by a two-fold energy poverty in Strasbourg, in which neighbourhoods and in which types of dwellings these households live, as well as their occupancy status.

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[5] Our analyses show that the bulk of households paying off a mortgage are in this age group.

Figure 3 shows the distribution by household type.[6] More precisely, the figure illustrates the portion of households in each household type which are considered to face a double energy costs burden compared to the representation of these household types in the whole city population. The findings show that above all, inactive single persons or couples with children and active single parents are the most affected. It seems that there are three risk factors: being a single person, being inactive and having children. For the identified households, at least two of these risk factors are present.

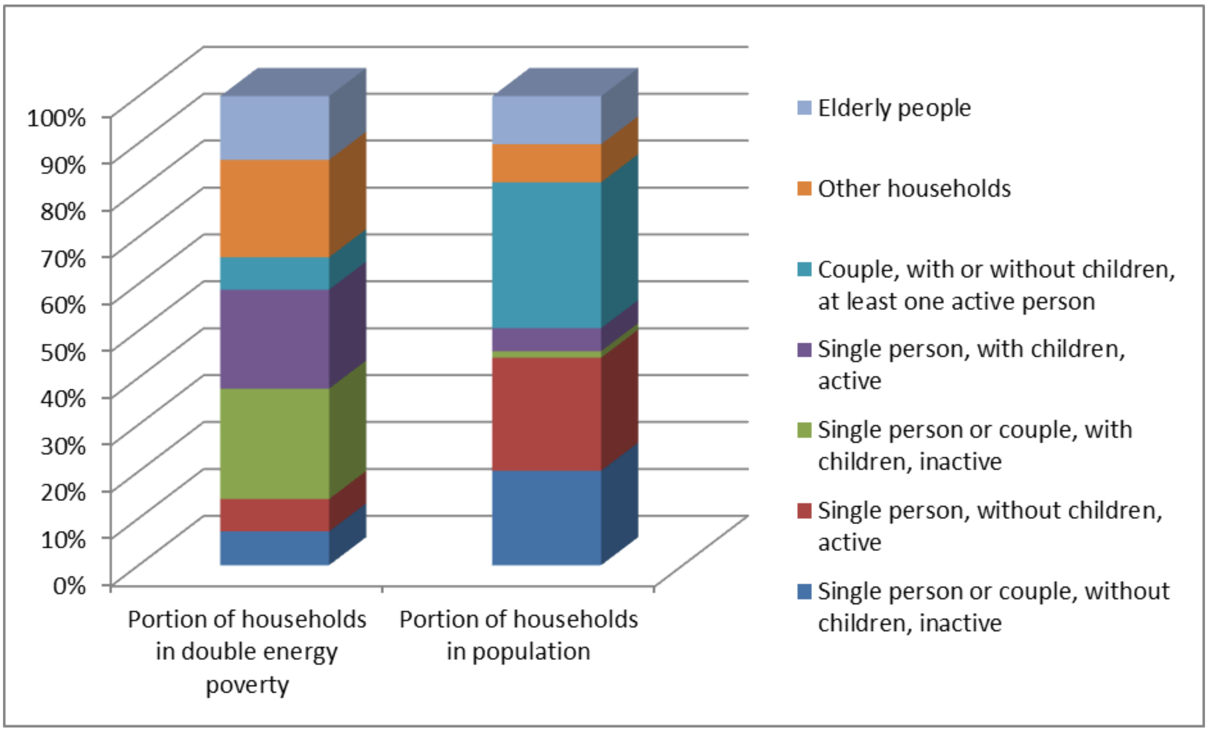

Fig. 3: Percentage of households in double energy poverty by household type compared to percentage of household type as part of the total population. Source: authors.

Figure 4 displays the distribution of households that face a double energy costs burden for each neighbourhood. The columns do not represent the total number of households in double energy poverty by neighbourhood, but the percentage of households in energy poverty in each neighbourhood as a function of all households living in this neighbourhood. The findings illustrate that the proportion of energy poor households is quite uneven when neighbourhoods are compared. Elsau, Hautepierre and Neuhof are the neighbourhoods with the highest proportion of affected households. The fact that energy poor households are

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[6] The household types presented here result from a classification that clusters households with similar mobility characteristics.

most represented in these three areas is coherent with reports on neighbourhood characteristics prevalent in the city of Strasbourg, which indicate that these neighbourhoods cumulate a great number of difficulties.

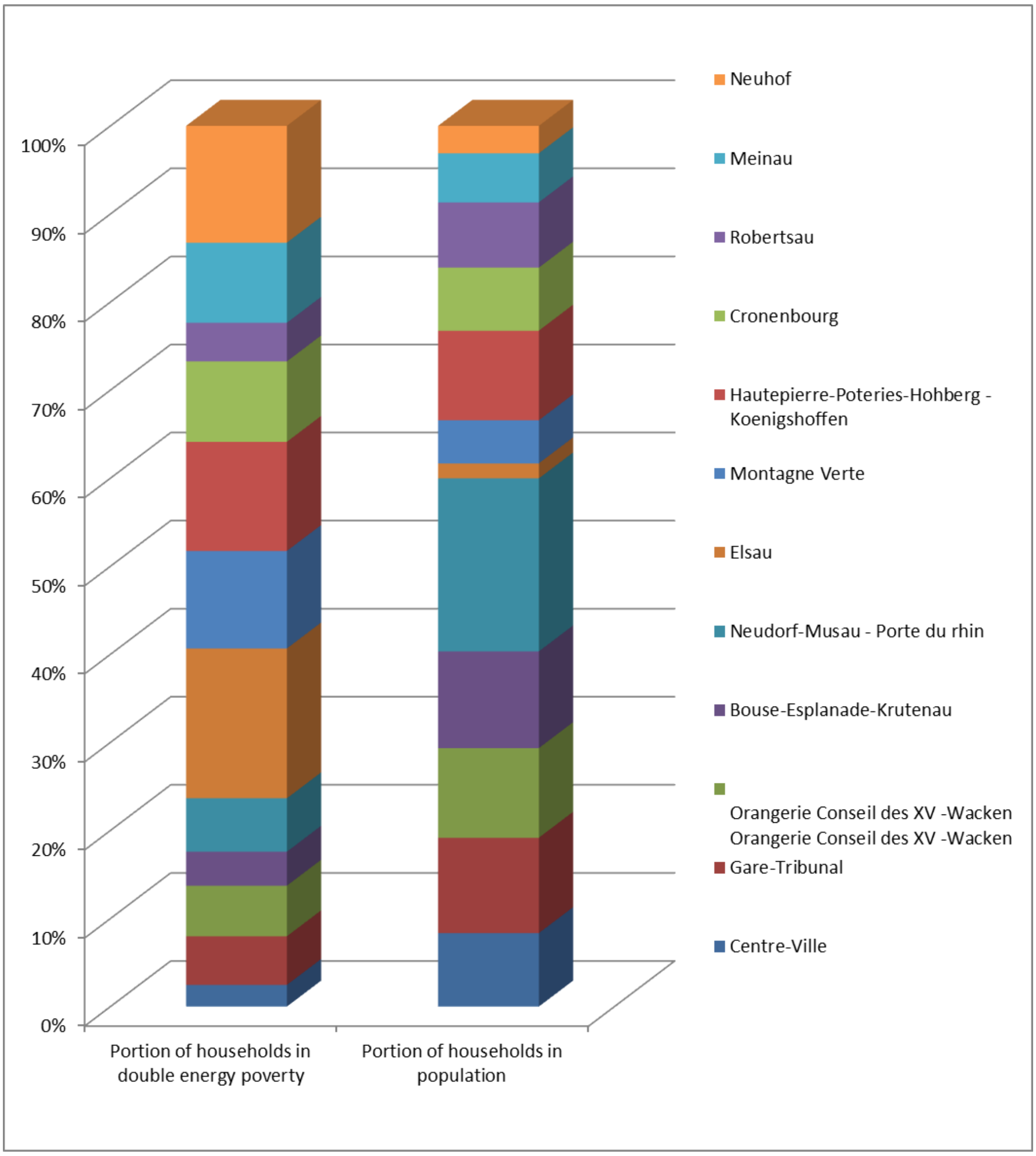

Fig. 4: Percentage of households in double energy poverty by neighbourhood compared to percentage of households in each neighbourhood as part of the total population. Source: authors.

Figure 5 illustrates the distribution by occupancy status. Our findings show that the biggest proportion of fuel poor households can be observed among households living in social housing, whereas the smallest proportion can be found among owner-occupants.

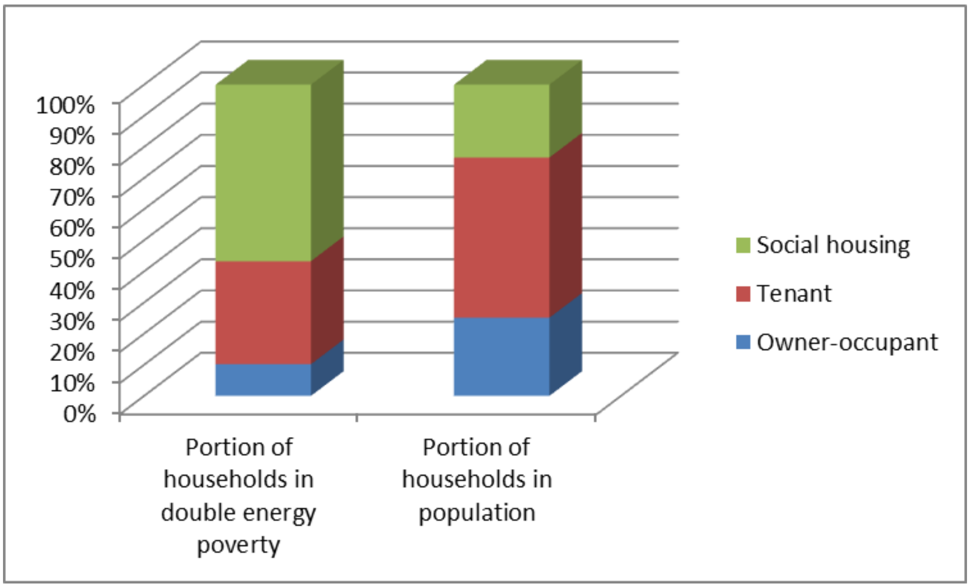

Fig. 5: Percentage of households in double energy poverty by occupancy status compared to distribution of occupancy status in the whole population. Source: authors.

For our calculation of transport costs, we have taken into account several transportation modes per household. For this reason, it is not possible to present results of energy poverty per transport mode, since there is no one prevalent mode for every household. With the use of normative mobility needs as a basis for the calculation of transport costs, it is possible to imagine that such discriminating transport modes may be defined.

5.2 Policy recommandations

The main reason for analysing the double burden of energy costs is the assumption that we we are dealing with a particular phenomenon, which is more than the sum of the two problems considered separately. While it is certainly beneficial to target each group of affected households independently (both for the housing and transport sector), both aspects, and their mutual interdependencies need to be considered conjointly in urban planning. Only then can we avoid that a reduction in energy costs in one area is bought at the expense of an increased energy cost in the other area. More precisely, urban planning should conteputally establish the link between energy efficient dwellings and mobility, both when it comes to availability and affordability. Policy recommandations both in the transport (more generally) and housing sector (concerning fuel poverty) are widely known and need not be discussed in detail here, but we believe that only an integrated approach can avoid negative reciprocation between these areas.

In what follows, we very briefly outline policy measures that are apt to reduce or prevent each one of the facets of energy poverty at the city level. These measures are not specific to the case study presented here, but may be applied to different urban environments.

Concerning affordable, energy efficient housing, a promising model has been introduced in Germany by the city of Bielefeld. In Germany, each city defines a certain level of rent permissible for households receiving unemployment benefits (ALG II). The model implemented in Bielefeld, called "Klimabonus", is based on the principle that the city administration accepts higher rents if the households provide a proof that the dwelling responds to certain energy efficiency requirements. Since it is also the city which pays for the energy costs of these households, the approach is cost-neutral but is expected to incentivise energy refurbishment in the low-income housing segment (von Malottki 2012).

More generally, refurbishments at the neighbourhood level may be a useful means of keeping down costs, since economies of scale can be activated.

Concerning mobility, accessibility can be reinforced by focusing on efficient settlement planning and revision. For example, dense infrastructures, mix of uses, urban settlement planning along public transport lines, intermodal connecting points, etc. diminish car dependence and foster the use of other (less expensive and less polluting) transport modes. Deprived neighbourhoods should be a focus of policy measures in order to promote and ensure the inclusion of vulnerable households. Carsharing and carpooling are a promising means to foster affordable mobility in areas suffering from low accessibility (cf. Gertz and Altenburg 2009; Saujot 2012).

6 Conclusion

The objective of the study presented here has been to test a new method for the combined measurement of the two faces of energy poverty, which means both in the transport and in the residential sector. Our findings indicate that two-fold energy poverty may not be negligible in Strasbourg, with about 19% of households that are potentially affected by this phenomenon. It seems that among inactive single persons or couples with children and active single parents, the proportion of affected householdsare is the highest. Concerning spatial distribution, the highest part of affected households can be found in the neighbourhoods Elsau, Hautepierre and Neuhof. Furthermore, we find that households living in social housing have the highest tendency to be energy poor. For the time being, it is not possible to determine a prevalent transport mode for each household, which implies that no information can be given concerning the distribution of energy poor households per transport mode.

Even though these results yield a first indication of two-fold energy poverty at the local level, the results have to be interpreted with caution because the data used for the analysis is not representative for the current situation at Strasbourg, but for the year 2009. It is possible that in the meantime the city administration has for example implemented refurbishment measures in social housing or that deprived areas have become more accessible.

Furthermore, we are aware that more advanced methods have been developed, especially in the transport field, which could yield more fine-grained results of households' transport costs (Verry and Vanco 2009; CERTU 2011; Nicolas et al. 2012). While the objective of the current study is to test the feasibility of linking household data on housing and transport, we intend to refine our method in the future in order to allow for a more sophisticated assessment of transport costs. Furthermore, research is needed to define norms of mobility, which would take into account accessibility and households' alternatives for chosing between different modes of transport (Verry and Vanco 2009, p. 4). This would allow for a more adequate assessment of the "second face" of energy poverty, since it would become possible to distinguist between households that have low energy costs thanks to good accessibility and persons that constrain their mobility resulting in low energy costs.

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