



Households Vulnerable to Rising Energy Prices

TransFair-AT Research Brief #1

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This research brief provides an overview of the characteristics of households potentially at risk of double energy vulnerability. First, we ask what determines low-income households that are particularly affected by pricing CO₂ emissions. Based on this, we identify characteristics that are considered relevant for mapping households' vulnerability to rising carbon prices and look for suitable indicators that can quantify these categories. From the sum of identified characteristics, we identify vulnerable households and present preliminary results on how many households in Austria are potentially significantly affected by rising fuel and carbon prices.

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1 Introduction

A wide range of instruments will be needed to achieve the climate goals, including a price on CO₂ emissions also for the non-ETS sector. This will have significant social and distributional impacts, disproportionately affecting "financially weaker households". Such households may be overly affected because they have to spend a larger share of their income on energy and mobility and cannot afford the additional investments needed to switch to alternative heating systems or do not have access to alternative, affordable mobility and transport options in certain regions (e.g., European Commission, 2021; Matzinger et al., 2018; Kortetmäki & Järvelä, 2021; Tovar Reaños & Wölfing, 2018).

The following research brief provides an overview of the characteristics of households potentially at risk of double energy vulnerability. First, we ask what determines low-income households that are particularly affected by pricing CO₂ emissions. Based on this, we identify characteristics that are considered relevant for mapping households' vulnerability to rising carbon prices and look for suitable indicators that can quantify these categories. From the sum of identified characteristics, we identify vulnerable households and present preliminary results on how many households in Austria are potentially significantly affected by rising fuel and carbon prices.

2 Vulnerable households in the context of the energy transition

The starting point for this research brief is carbon pricing as a tool to achieve climate policy objectives, which hits financially vulnerable households and transport users particularly hard. In this context, the European Commission (2021) defines

- vulnerable households as "households in energy poverty or households, including lower middle-income ones, that are significantly affected by the price impacts of the inclusion of buildings into the scope of Directive 2003/87/EC and lack the means to renovate the building they occupy" (COM)2021 568 final, pp.21/22), and
- vulnerable transport users as "transport users, including from lower-middle-income households, that are significantly affected by the price impacts of the inclusion of road transport into the scope of Directive 2003/87/EC and lack the means to purchase zero- and low-emission vehicles or to switch to alternative sustainable modes of transport, including public transport, particularly in rural and remote areas" (COM)2021 568 final, pp.21/22).

Energy poverty, which is equally important in this context, is defined by the EC as 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” (COM (2021) 558 final, pp.75/76).

From this statement it can be deduced that the households most at risk are characterised by low income and energy poverty, and that factors such as housing conditions and access to transport services also play a role.

3 Literature

The literature contains numerous findings on the risk of income poverty in Austria (e.g., Statistics Austria, 2017; Till et al., 2018; Lamei et al., 2017; Dimmel et al., 2014). According to BMASGK (2019) groups at risk of poverty are single parents, large families, the long-term unemployed, people with foreign citizenship and low-skilled persons. Lamei et al. (2017) found that people at risk of poverty mainly live in rented accommodation (65%) and hardly ever own property (18% house, 6% flat). With regard to spatial aspects, Wiesinger (2014) points out that poverty is more hidden in rural areas than in cities and that mobility opportunities are more important in this context. According to Wiesinger, poverty factors "such as over-indebtedness, low income, insufficient mobility, lack of employment opportunities and childcare facilities not only have a more specific effect, but they also accumulate and reinforce each other" (p.344).

The literature on energy poverty includes contributions on the characteristics of energy poverty as well as contributions on the challenges it poses for low-income people. The papers on the characteristics of energy poverty provide insights into the extent, definition, and typology. Regarding the extent of energy poverty, Boardman (1991) already in the early 1990s defined all households unable to secure adequate energy services for 10% of their income (Boardman, 1991; in Astbury and Bell, 2018) as energy poor households. Middlemiss and Gillard (2015) point out that there is no clear definition of energy vulnerability. They therefore explore the meaning of energy vulnerability from the bottom-up, bringing together the literature on (energy) vulnerability and a qualitative study of the lived experience of fuel poverty in the UK.

Following the tradition of income poverty reporting, Matzinger et al. (2018) proposed two new definitions of energy poverty, distinguishing between a broader concept of poverty risk and a narrower concept of manifest poverty or deprivation. These two concepts build on each other: only those who are at risk of poverty can also be energy poor, i.e., poverty as precondition. According to the authors, in order for a household to be classified as energy poor, it must be disadvantaged in terms of both the household's financial situation and the quality of its housing and energy use.

Walker et al. (2014) used a fuel poverty severity index (6 categories ranging from not in fuel poverty, almost in fuel poverty, marginal fuel poverty, severe fuel poverty, extreme fuel poverty up to very extreme fuel poverty). They described three households from each category in order to compare the experiences of households in different levels of fuel poverty using a range of details (e.g., household characteristics, tenure, property age, property type, geographical location, heating system, fuel type, level of wall/window/hot water insulation system, welfare benefits received, total annual energy costs, annual income, needs to spend on energy and eligibility for subsidized energy efficiency measures). Households varied in age, number of people and children in the household. A household in very extreme fuel poverty, headed by a single pensioner in his mid-70s lives, is described as follows (p. 94): “A lone senior citizen, living in a large, detached, country house, built between 1920 and 1944.

Heating is provided by an oil-fired central heating system, powered by an old, 16–20-year-old boiler, which was last serviced two years ago. A secondary coal fire is also used to heat the living room. There is no wall insulation, little insulation in the loft (50 mm), but windows are double glazed. The householder does not receive any benefits and has an annual income of £14,000. The total energy cost for this householder is estimated to be £4198. Based on this information this person did not meet the criteria for free energy efficiency measures and was not recommended for an intervention.” Statistics Austria (2022) reports that in Austria, low-income households, single-person households, and households with people with low formal qualifications or even elderly people are disproportionately affected by energy poverty. Energy poor households are also more likely to live in older buildings, in smaller dwellings and to rent.

Mattioli et al. (2018) note that, in contrast to energy poverty, there is no established definition of "transport poverty". The notion of transport poverty can either be used in a broad way, including "all kinds of inequalities related to transport and access ..., i.e., as *poverty of transport*", similar to "transport-related social exclusion" or "transport disadvantage" (comprising issues related to travel costs, accessibility or a systemic lack of sufficient transport (Lucas et al., 2016)); or it can be used in a more narrow sense referring to the "affordability of transport costs". More generally, it can be interpreted as the inability to adequately achieve one's travel needs, which are determined by a range of socio-economic, technical and geographical factors faced by the households (Berry et al., 2016). Apart from the characteristics of energy poverty, many studies deal with the drivers of energy poverty such as low income or the stability of household income, a lack of energy efficiency of the dwelling (thermal insulation and heating system), high energy costs, inadequate building fabric of the dwelling, rent, lack of social relationships or illness (Boardman, 1991; Brunner et al., 2011; Walker et al., 2015; Middlemiss and Gillard, 2015). Transport poverty, following the broad definition, has a diverse set of drivers, "including non-economic factors such as disability, age, gender, ethnicity, household type, and cognitive and psychological factors" (Mattioli et al., 2018). Transport affordability, by contrast, has the same main drivers as energy poverty, i.e., "income, prices and energy efficiency" (ibid). According to Simcock et al. (2021) there are several overlaps in the socio-economic characteristics of energy and transport poor households as the ones described above. They also find the highest level of double energy vulnerability among households that face a combination of multiple socio-demographic factors in addition to relative spatial peripheralization, i.e., living in suburban or rural environments.

4 Indicators for characterizing vulnerable households

Based on the findings in the literature, four categories can be identified that are considered relevant for mapping the vulnerability of households to rising costs of fossil fuel use. These are income vulnerability, energy vulnerability, housing vulnerability, and mobility vulnerability. Taking into account available data sources and potential integration into the models used in *TransFair-AT* (see <https://transfair.wifo.ac.at/>), the set of indicators was refined and validated through discussions with experts and stakeholders in online workshops. A total of six indicators were selected for the four categories to be included in the structuring of vulnerable households and ultimately to construct an index:

- Income vulnerability:
 - Equalised disposable household income below 140 % of the national median equalised disposable income

- Energy vulnerability:
 - Use of fossil fuels at home
 - Indicator “It is perceived as not affordable to keep the apartment adequately warm”
- Housing vulnerability:
 - Legal relationship (rent, ownership)
 - Type of dwelling (single-family house, apartment building)
- Mobility vulnerability:
 - Household in sparsely populated region

The income indicator providing information on income vulnerability refers to the European Commission (2021) and the definition of vulnerable households. According to this definition of vulnerable households, we define not only low-income households as vulnerable, but also lower-middle-income households. Therefore, 140% of the national median equivalised disposable income was assumed as the income threshold for households. This assumption results from the defined income thresholds for low-income households and middle-income households. For low-income households, the income threshold is below 60% of the national median equivalised disposable income (at-risk-of-poverty rate), for middle-income households it is between 60% and 179% (Statistik Austria, 2022). The indicator is equal to 1 if the household income is below the threshold of 140%, and otherwise it is equal to 0.

The indicators on energy vulnerability capture, on the one hand, the heating system used in the household and on the other hand, following Matzinger et al. (2018), also qualitative aspects. The first indicator can capture the potential impact of rising fossil fuel prices at the household level; the second indicator indicates whether a household has difficulties in keeping the home adequately warm. A household is classified as energy poor if at least one of the two characteristics applies, i.e., if the heating system uses fossil fuels or if the qualitative aspect of lack of adequacy applies. The indicator is equal to 1 if at least one criterion applies, otherwise it is equal to 0.

The housing vulnerability indicators provide information on tenure and type of dwelling. These two pieces of information can be used to determine whether households are in a position to respond to rising fuel prices at all, i.e., whether they own the dwelling and whether they can even decide to make changes to the heating system independently of other co-occupants. A household is classified as housing deprived if at least one of the two characteristics applies (i.e., rent or apartment building). The indicator is equal to 1 if a household either rents or lives in an apartment building, otherwise it is equal to 0.

The mobility vulnerability indicator provides information on the location of the household, i.e., urban or rural. This information can be used to determine whether it is at all possible to switch to alternative means of transport due to rising fuel prices. The indicator is equal to 1 if the household does not live in an urban area, otherwise it is equal to 0.

The database refers to EU-SILC and the Household Budget Survey for Austria. The reference year is 2019.

5 Construction of types of vulnerable households

In total, 16 different combinations of household types can be derived from the four categories used. Some households are characterised by being affected by only one category, others by two or three. One group of households is affected by all four categories and one group is not at risk at all.

Graph 1: Combination of household types

Household N°	Income vulnerability	Energy vulnerability	Housing vulnerability	Mobility vulnerability
1	X			
2		X		
3			X	
4				X
5	X	X		
6	X		X	
7	X			X
8		X	X	
9		X		X
10			X	X
11	X	X	X	
12	X	X		X
13	X		X	X
14		X	X	X
15	X	X	X	X
16				

Source: Own illustration. The x sign marks that this category applies to this household; the colour “dark grey” highlights vulnerable households, the colour “light grey” potentially affected household.

Four of these 16 household types can be identified as vulnerable. They are highlighted in dark grey in graph 1. A further group of 4 households can be identified as potentially vulnerable, highlighted in light grey in Graph 1. Vulnerable households are characterised by being affected by both income vulnerability (I) and energy vulnerability (E), following the definition used by Matzinger et al. (2018) that only those who are at risk of income poverty can also be energy poor. In addition, vulnerability can also arise from housing vulnerability (H) or from mobility vulnerability (M), or from both. The four types of vulnerable households include (Graph 2):

- Type 1 *IE*: households that are income poor (I) and energy poor (E)
- Type 2 *IEH*: households that are income poor (I), energy poor (E), and housing poor (H)
- Type 3 *IEM*: households that are income poor (I), energy poor (E), and mobility poor (M)
- Type 4 *IEHM*: households that are income poor (I), energy poor (E), housing poor (H), and mobility poor (M)

The index for vulnerable households is 1 if the household can be classified as type 1, type 2, type 3, or type 4, and otherwise it is 0. Within the vulnerable households, the index value can range from 1 to 4, thus representing all four types of vulnerable households.

Four additional groups of households can be classified as potentially at risk because, although they are currently not at risk of income vulnerability, they are at high risk of energy vulnerability because they use heating systems that are particularly vulnerable to decarbonisation (light grey highlighted in Graph 1). These households may also be at risk of housing vulnerability or mobility vulnerability, or from both.

Graph 2: Index of vulnerable households – indicators and types

Index of vulnerable households

Income vulnerability	Energy vulnerability	Housing vulnerability	Mobility vulnerability
Equivalised disposable household income below 140 % of the national median equivalised disposable income	Use of fossil fuels at home or Perceived unaffordability keeping home adequately warm	Legal relationship (rent, ownership) or Type of dwelling (SFH, MFH)*	Household in sparsely populated region
Type 1 IE			
Type 2 IEH			
Type 3 IEM			
Type 4 IEHM			

Source: Own illustration. *) SFH ... single family homes, MFH ... multi family homes.

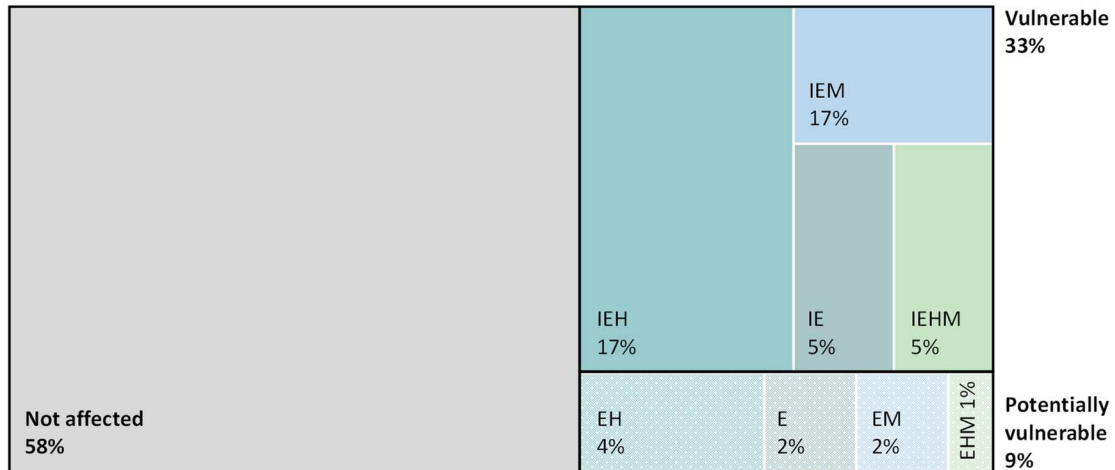
6 Results

From the available data from EU-SILC and the defined indicators, preliminary results can be derived: Almost one third of all households in Austria can be described as vulnerable (Graph 3)¹. This means that these households will be particularly affected by rising prices of fossil fuels, e.g., as a consequence of carbon pricing. Within the group of vulnerable households, by far the largest group consists of households that are characterised not only by income vulnerability and energy vulnerability but also by housing vulnerability. This is mainly due to the comparatively high prevalence of fossil fuel heating systems in Austrian households. A further almost 10% of all households can be classified as potentially vulnerable to rising energy and carbon prices (highlighted in light grey in Graph 1), which are characterised by the fact that, although they are not currently affected by income vulnerability, but they are potentially affected by energy vulnerability because they heat with fossil heating systems. Within this group of potentially affected households, the largest group is made up of households that are characterised not only by energy vulnerability but also by housing vulnerability. These households are characterised by their inability or reluctance to change their heating system, due to ownership or type of dwelling, and are

¹ If we reduce the household income threshold to 120%, the proportion of vulnerable households falls to 27%; if we increase the indicator to 160%, the proportion of vulnerable households rises to 35%.

therefore weakly responsive to rising carbon prices. Since 2019 energy prices have risen sharply, particularly in the context of the war in Ukraine. This will further increase the pressure on vulnerable households.

Graph 3: Vulnerable and potentially vulnerable households



Source: HBS, EU-SILC, own calculations. IE ... income vulnerability and energy vulnerability, IEH income, energy and housing vulnerability, IEM ... income, energy and mobility vulnerability, IEHM ... income, energy, housing and mobility vulnerability, E ... energy vulnerability, EH ... energy and housing vulnerability, EM ... energy and mobility vulnerability, EHM ... energy, housing and mobility vulnerability.

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