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TITLE - Double energy vulnerabilities in France: when residential choices lock households into patterns of energy dependence

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1. Introduction

The 2022–2023 energy crisis in Europe has impacted households' energy consumption in a myriad of ways, prompting calls for a research agenda on how householders are changing the way they use energy, to understand how new behaviours emerge in the short term (1) and how they persist in the longer term (2). Of particular interest is how different segments of society are coping with high prices, and the trade-offs that they make between different types of expenditure. These questions, pertinent in the short-term of everyday energy practices, can also gain insights from a focus on the longer term of residential mobility, to explore how energy is factored in the move to a new home in a context of both energy and real estate price concerns.

The aim of this paper is to analyse this residential mobility in the light of energy concerns, and thus to highlight the socioeconomic and geographic factors that underlie households' choices and strategies in a European context. To do so, this paper applies an energy vulnerability framework to residential trajectories of mobility, studying how these changes either expose or protect households in the context of rising energy prices. Residential mobility approaches have theorised the driving forces of households' moves, from family to work and, more recently, the appeal of remote rural locations, while placing them in structural and contextual real estate dynamics (3,4). They have also distinguished levels of agencies, residential *choices* being the least constrained by income, while residential *strategies* are characterised by trade-offs (3). The energy drivers, however, have thus received attention in this literature. The energy vulnerability framework brings a holistic and spatial perspective on household energy consumption, showing how deprivation situations have geographically embedded underlying causes (5), from the characteristics of the place in which people live, to, increasingly, their

dependence on car-fuelled mobility (6,7). Starting from the French accounts of ‘residential costs’ (8,9,10), this framework articulates the cost of housing with domestic energy and mobility needs (11,12). It sheds light on the existence of ‘double energy vulnerabilities’ at the intersection of domestic and transport poverty (6). This literature as focused mainly on low-income households, but it offers an analytical framework capturing the dynamic nature of sensitivity and adaptive capacity to rising energy prices, which we choose to apply to a wider social spectrum with a survey on residential mobility conducted in the Southwest of France in the Nouvelle-Aquitaine region.

The survey targeted households who moved during the winter of 2022–2023, in three French coastal *départments*¹, aiming to capture metropolitan dynamics as well a selective rural decline, and strong car dependency dynamics. A series of questions targeted the drivers of residential mobility, articulating individual, contextual and structural drivers with energy concerns such as thermal comfort and proximity to jobs, family and services. We collected a total of 905 questionnaires and performed multi-factor analysis and clustering to develop a household typology. Based on this typology, we selected 62 households for qualitative interviews to better understand the drivers of residential choices and strategies.

The paper builds on these empirical results to nuance the observation that energy drivers are secondary in residential mobility. It demonstrates both the transversal dimensions of energy concerns, and the structural importance of life cycle stages, homeownership and income in households’ capacities to control the energy-related expenses embedded in their residential choices and strategies.

In the next section, we draw on existing work on energy vulnerability and residential mobility to set out an approach for understanding and analysing the role of energy in households’ residential choices and strategies. It is followed by a section explaining the rationale and the implementation of the methodology (section 3). The main body of the paper (Section 4) draws on a typology of the surveyed households, highlighting two key dimensions: the importance of energy efficiency in the home and the distances travelled, emphasising the structural roles of income and life cycle stages. This analysis is supported by in-depth surveys conducted in Nouvelle-Aquitaine in Southwest France. Finally, section 5 draws out critical reflections on the socioeconomic inequalities affecting households’ capacity to integrate energy concerns into their lifestyles. The conclusion summarises the argument and suggests some issues for future research.

2. Placing energy vulnerability in residential mobility

To explore energy drivers in the dynamic of residential mobility, we develop a conceptual framework combining insights from long-standing work around residential mobility with strands of energy vulnerability, highlighting articulation between domestic and mobility energy costs.

2.1 Residential mobility literature: choices and strategies

Residential mobility – defined as one or several people’s move to a new home – results from trade-offs implying several dimensions of existence. We adopt a framework developed by

¹ A department is an administrative division in France, situated between the regional and municipal levels (see Figure 1).

Authier et al. (3), exploring the main drivers and trade-offs in the process of choosing a new residence.

First, this framework acknowledges the influence of income on residential migrations by examining the gap between what households identify as desirable characteristics, such as size, location, and price, and what is achievable given their range of income, capital and family constraints. In this framework, residential *choices* reflect lower levels of constraints for the more privileged households. In contrast, residential *strategies* correspond to a wider gap between the desirable and the achievable, highlighting agency even in the most constrained choices. This framing helps interpreting why lower income first-time buyers often relocate to peripheral locations in Western agglomerations, using distance as an adjustment. This perspective echoes economic approaches that aim to explain how rational individual choices optimise the attributes of a housing package (13), with each household elaborating budgetary equations between distance, transportation and housing costs (14,15,16).

However, residential choices and strategies go beyond rational evaluations. Authier's (3) approach strives to elaborate the most exhaustive list of their structural dimensions, which underpins the approach of this paper. First, age and family structure emerge as the most determining factor, as young households at the beginning of their life cycle (single individuals or childless couples) tend to exhibit greater mobility. However, significant intra-generational inequalities shape residential trajectories, as intergenerational financial transfers (from parents to children) play a crucial role in enabling younger households to transition from renting to homeownership (17). Work-related factors also play a critical role, largely determined by commuting distance. Beyond these individual determinants, the housing affordability crisis, driven by the widening gap between income and real estate prices (17,18,19), has increasingly constrained household residential mobility. In this context, the rise of housing asset-based welfare systems in Western countries including USA, the UK and France, characterised by pro-homeownership and rental investment policies driven by fiscal incentives and credit innovations, has played a major role in exacerbating housing inequalities and reinforcing unequal wealth accumulation (18).

In this paper, we combine this analytical approach centred on the choice of a new home with the contributions of the 'double energy vulnerability' literature investigating the impacts of rising energy prices on household budgets.

2.2 Bringing energy in the residential choices

French accounts initiated research on the weight of energy in residential choices in the 2010 decade (8,9). The 'residential cost' approach articulates quantitative and qualitative accounts of 'the sum of expenses induced by the choice of a residence', and is driven by the assessment that household's financial difficulties stem from the cumulated expenses of housing, mobility and domestic energy (14). Further developments are addressing measuring challenges and highlighting how energy expenses increase with income and distance to the city centre (11,12). These studies have focused on lower middle to low-income households in the peripheries of French agglomerations (20,21), and shown how these individual residential strategies tend to use distance and energy efficiency as an adjustment variable for accessing homeownership in the peripheries. They paint the portrait of energy drivers as an afterthought, especially for everyday mobility, with car-fuel cost being frequently underestimated (10,16,22,23). This can have dire consequences, as households are trapped in their choices,

unable to change the patterns of their mobility or invest in significant energy retrofits, leaving them vulnerable to rising energy prices.

The focus of this paper is to contribute to the understanding of the dynamics leading to this exposure, an increasingly pressing concern for local administrations in our French case study (24). In order to do so, we ground our analytical framework in the 'double energy vulnerability' concept, where these situations are defined as 'an increased likelihood of negative impacts upon well-being, owing to the intersection of domestic energy poverty and transport energy poverty: the inability to attain a socially and materially necessitated level of domestic energy services' (6)². This framework is inherently dynamic and aims at identifying both the current and future deprivation situations, the configurations in which households are not yet, but could be impacted by rising energy prices. We argue that, although it has first been devised to identify low-income households in severe deprivation situations (26), it can also be used on an expanded social spectrum. Its two-part analytical framework has indeed been elaborated to deepen the understanding of deprivation beyond fixed indicators at a given time and space.

First, it conceptualises vulnerability as sensitivity (27), the degree to which a household can be affected by rising energy prices. The vulnerability factors here are the income and housing costs, the level of car dependency for everyday mobility, the energy efficiency of the home and the access to specific energy carriers, but also a set of factors specific to social groups and encompassing employment, age, gender, disability and family composition – for a systematic review, see Simock and al. (6). These factors can be approached as a spectrum to seize the configurations that expose households, but also the ones that protect them from current and future – possibly higher – energy prices.

The second part of the analytical framework is the adaptive capacity, the ability to adjust, to take advantage, and to respond to consequences. More difficult to conceptualise than sensitivity (28), it points both to households' choices and strategies and how they are facilitated or hindered by larger social and material structures such as homeownership and service infrastructure. For example, the impact of rising fuel prices is associated with the alternatives such as the availability of public transportation systems (28), and tenancy status are central in households' (in)capacity to invest in energy retrofits (29,30,31). Again, applying this framework to a larger social spectrum brings insights not only on the vulnerable households, but also on how more privileged households factor energy into their residential choices, therefore informing the design and perimeter of energy policies.

3. Methodology: household survey in the Southwest of France

The paper builds on a mixed-method design combining survey questionnaire data and in-depth interviews to explore the role of energy concerns in the process of choosing a new home. The survey was conducted in the Southwest of France, in the Nouvelle-Aquitaine region with a focus on three coastal departments highlighted in the Figure 1. We targeted households that have recently moved because moving is a key phase corresponding to the investment in a new home (which may lead to the performance of energy-efficient works) and possibly to the reconfiguration of individuals' and households' daily mobility. Moreover, choosing a house

² The vast literature on energy vulnerability in domestic spaces, and its sources and departures from energy poverty could not be addressed in this paper, and we chose to focus on double vulnerability as an analytical framework. For more detailed accounts on the conceptual roots on energy vulnerability, see (25).

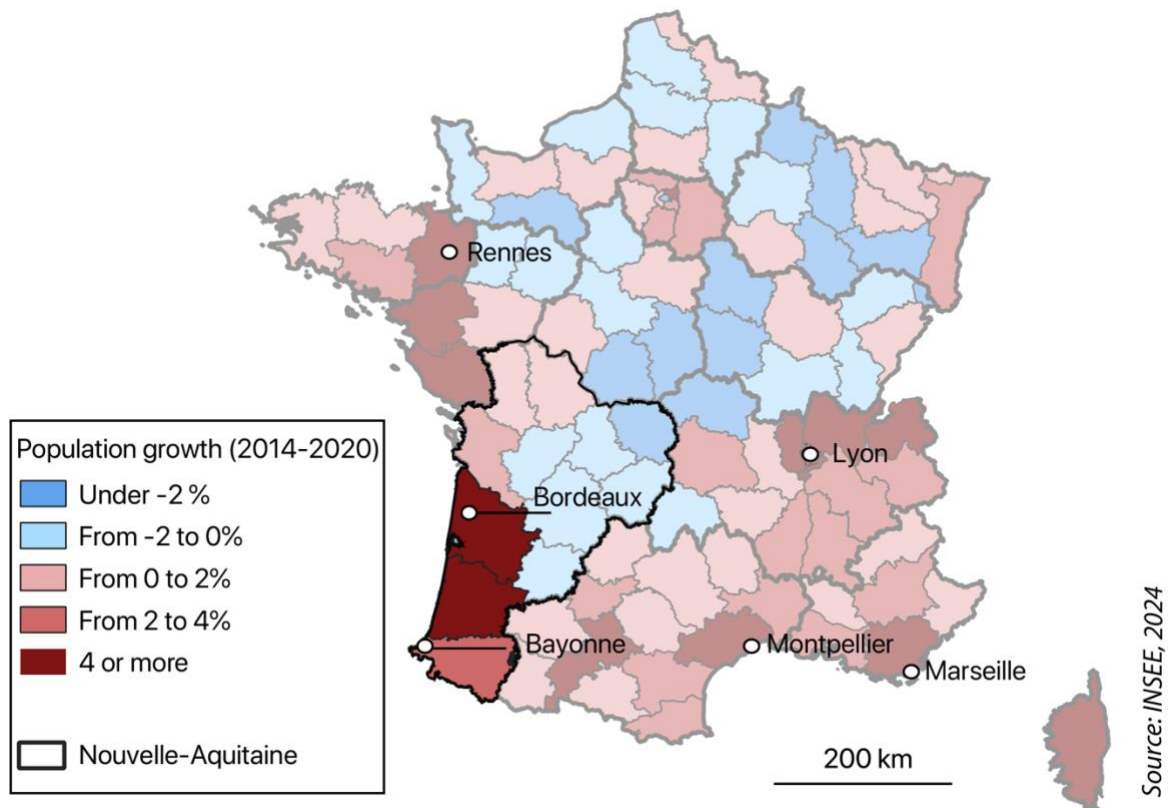
is a constrained choice (32,33) reflecting an adjustment between socially constructed aspirations and real estate prices.

3.1 Sociodemographic dynamics in Nouvelle-Aquitaine

To examine the interaction between energy and residential mobility, we focused on households that had recently moved within three *departments*³ in the Southwest of France, located near the Atlantic coast (Figure 1). This choice is based on four distinctive traits of the region.

First, unlike the many studies focused on the Paris Region, which emphasises global city dynamics, this region provides greater representativeness of the country’s varied residential trajectories. The studied area is characterized by population growth and issues related to housing affordability. The attraction of Bordeaux, which is a secondary metropolis in France, is similar to the dynamics of Lyon, Marseille and Rennes, with strong centrifugal dynamics pushing households away from the city centres toward the countryside (34). Furthermore, along the Atlantic coast, issues of littoralization and housing prices along with the tech development of the Basque Country echo the population growth dynamics of the Mediterranean Basin and of some of the Western French departments, as shown in the following figure.

Figure 1 – Population growth in France and the three studied departments



The choice of these three *departments* also allows seizing dynamics of selective rural decline and impoverishment (35), at work in France, exposing resident households to rising energy prices. ‘Far away from urban centres’, concludes the French national statistical institute,

³ The three studied departments are Gironde, Landes, and Pyrénées-Atlantiques. highlighted in the Figure 1.

'heating and mobility weigh in household budgets' (8). The following Figure 2 and Figure 3 represent the share of households disproportionately burdened by housing energy and everyday mobility expenses, as estimated by the national observatory for energy poverty (ONPE). These geographical representations highlight the impoverishment dynamics in the margins of the agglomerations of Bordeaux, Bayonne and Pau, and mirror similar dynamics in the French countryside.

Furthermore, these three *departments* illustrate a range of configurations of car dependence, measured by the percentage of car commute from home to work (from 70% in Bordeaux to 86% in the Landes department). This situation partly results from the high number of small-scale agglomerations under 200,000 inhabitants, which have less developed public transportation networks and cycling infrastructure, and which is representative of the French *departments* outside of Paris Region (36).

Figure 2 – Domestic energy poverty in Nouvelle-Aquitaine

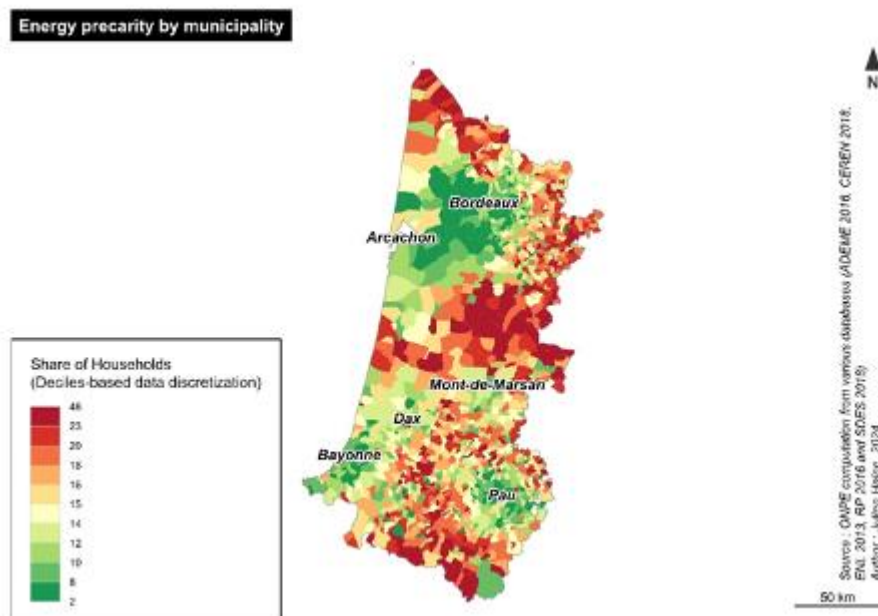
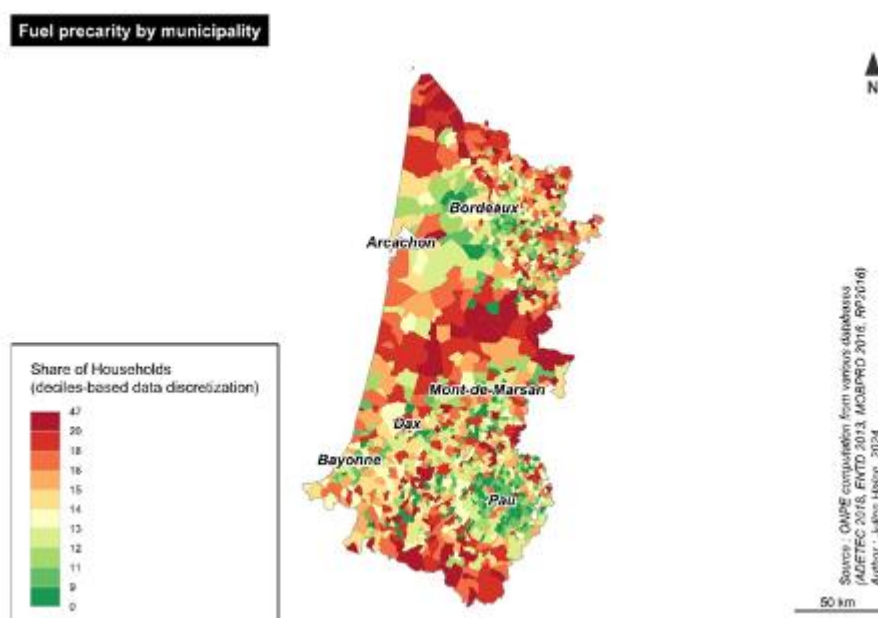


Figure 3 – Transport energy poverty in Nouvelle-Aquitaine



3.2 Surveying residential migrations

The survey targeted households that had recently moved into a new primary residence during the winter 2022-23⁴. The questionnaire was sent and returned by postal mail using the address files of La Poste, the French postal service. A total of 905 responses were digitised to create a database, with which we conducted a factor analysis to build a typology of households. Among these respondents, we conducted 62 interviews to embody this typology and explore certain questions in greater depth during interviews.

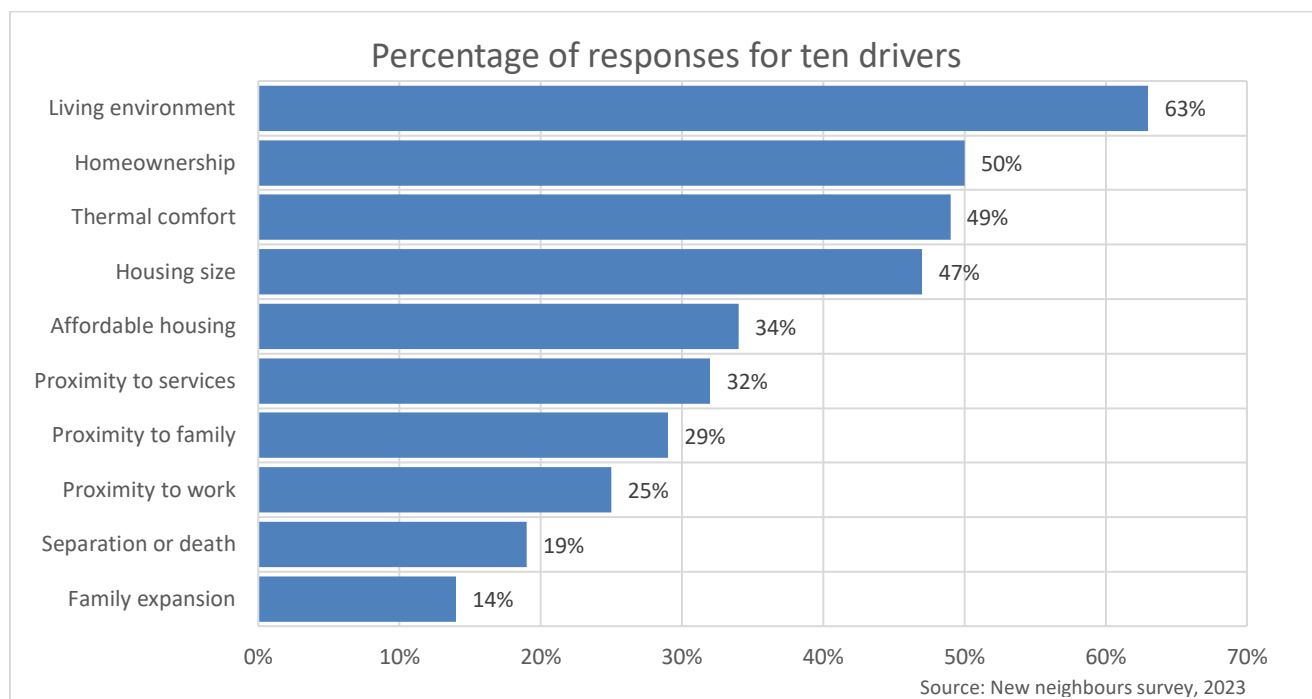
The questionnaire included three sections: household priorities for moving into their current residence, patterns of energy consumption, from home to mobility issues, and socioeconomic characteristics, including ownership trajectories. This design articulating residential and mobility issues is new in the French statistical context, as existing national surveys treat these questions separately. Furthermore, it provides recent data on domestic energy consumption patterns, as the most recent national surveys date from 2013, for the Phébus survey, and 2020 for the National Housing Survey, both prior to the energy crisis.

The respondents were asked to select among ten non-exclusive items the ones to which they had given priority, and their responses are represented in the Figure 4. Two thirds of the households identified surrounding amenities as a primary criteria for choosing their residence. The second most frequent motivation for moving is homeownership, reflecting its importance in France, where 60% of households are homeowners, supported by public policies fostering the above-mentioned national asset-based welfare model (17). Thermal comfort ranks third among households' drivers in the questionnaires, with half of the respondents seeking thermal comfort improvements in their new homes. This indicates the need for a more nuanced understanding of the secondary role of energy efficiency in residential choices and strategies

⁴ The relocation period spans from July 2022 to February 2023, coinciding with the peak of the energy crisis when energy prices soared.

such as life cycle events (birth, separation, divorce, death) and the characteristics of the residence itself (price, size and location).

Figure 4 – Main drivers for choosing the residence



A second set of questions asked in the questionnaire targeted energy consumption patterns. Households were asked about their energy-related home equipment and their energy bills, as well as other housing-related expenses such as rent and mortgage. The questionnaire also asked about mobility equipment; fuel expenses, everyday mobility patterns and the annual car mileage of each of the two main vehicles of the household, including cars, motorcycles, and vans. We addressed domestic energy vulnerability issues through questions regarding thermal comfort in current and previous homes, their difficulties for paying the bills, and we calculated the share of income spent in bills for each household. This allows us to compare the survey with the French official fuel poverty indicator, called “energy precarity” (the French “précarité énergétique”), which measures the percentage of households who dedicate more than 8% of their income to the payment of energy bills, and who belong to the first three income deciles (37).

Transport energy vulnerability was more difficult to measure, as travel needs vary among households and cannot be compared with standards (9,28). We relied on a subjective indicator asking respondents whether they were confident in their capacity to pay their car fuel costs, and on the distance travelled by car. Additionally, the questionnaire targeted planned or completed renovations and whether households had conducted thermal works, such as installing double-glazing windows or insulation.

Two analyses were conducted on the responses to the survey. First, we compared the sample’s results with the broader French population, to show distinctive socioeconomic characteristics (Table 1). The comparison reflects a more affluent and educated population compared to national averages. This relatively common sampling bias may be amplified by the greater propensity of less vulnerable populations to relocate, especially in a context of housing crisis. Indeed, younger adults (<30 years), as well as elderly people (75+ years), are

underrepresented compared to national averages, while those aged 60–75 are overrepresented. Moreover, the sample includes a higher proportion of first-time homeowners and private tenants with less social housing tenants. Median income per consumption unit is significantly higher (€2.166 vs. €1.907). There is also an over-representation of highly educated respondents (bachelor's or master's degree: 66% vs. 28.1%).

In terms of energy vulnerability, however, the sample shows fewer discrepancies compared to national averages. A similar proportion of households experience fuel poverty (10.1% vs. 10.8% nationally). The same observation can be made for the proportion of households experiencing cold during winter (21.2% vs. 22%). However, the proportion of households experiencing excessive heat during summer is significantly lower in the sample (37.2% vs. 59%), likely reflecting differences in regional housing characteristics and exposure to extreme temperatures.

Table 1 – Households socioeconomic characteristics

Variable	Questionnaire	Interviews	France	
	N = 905	N = 62	Sources :	
Age			RP 2020 (i.e census)	
Less than 30 years *	7.2 % (n=62)	4.8 % (n=3)	15%	
30 to 44 years	26 % (n=225)	24 % (n=15)	24%	
45 to 59 years	25 % (n=211)	34 % (n=21)	25%	
60 to 75 years	32 % (n=279)	31 % (n=19)	23%	
75 years and older	9.7 % (n=83)	6.5 % (n=4)	14%	
Household Composition			RP 2020	
Single person	24 % (n=173)	25 % (n=13)	39%	
Couple without children	39 % (n=281)	30 % (n=16)	26%	
Couple with children	27 % (n=194)	30 % (n=16)	25%	
Single-parent family	10 % (n=72)	15 % (n=8)	10%	
Housing Occupation Status			SDES 2023	
First-time homeowners	32 % (n=265)	41 % (n=23)	20%	
Homeowners	28 % (n=232)	27 % (n=15)	37%	
Private sector tenant	33 % (n=276)	27 % (n=15)	23%	
Social housing tenant	7.1 % (n=59)	5.4 % (n=3)	18%	
Median Income (per Consumption Unit)	€ 2.166	€ 2.222	€ 1.907 (Filosofi 2019)	
Income Class (per CU)			Obs. des inégalités 2023	
Modest income household (below €1.600)	28 % (n=237)	26 % (n=16)	30%	
Intermediate income household (between €1.600 and €2.800)	53 % (n=449)	44 % (n=27)	50%	
Affluent income household (above €2.800)	19 % (n=164)	31 % (n=19)	20%	
Education Level			RP 2020	
Bachelor's degree	34 % (n=288)	35 % (n=22)	28,1% **	
Master's degree	32 % (n=275)	42 % (n=26)		
CPE, CSE or no degree	6.8 % (n=58)	6.5 % (n=4)	16%	
High school degree (general, technological, professional)	15 % (n=130)	8.1 % (n=5)	19%	
Vocational training certificate	11 % (n=97)	8.1 % (n=5)	22%	
Municipality fonctionnal area			Functionnal area and RP 2020	
Rural	6,6% (n=57)	7% (n=4)	France 7%	South-West 7%
Peri-urban	41% (n=350)	32% (n=20)	43%	46%
Urban	53% (n=451)	61% (n=28)	51%	47%
Energy vulnerability index			ONPE 2024	
Cold during winter	21,2% (n=182)	17 % (n=10)	22%	
Hot during summer	37,2% (n=313)	35 % (n=21)	59%	
Household in energy precarity ***	10,1% (n=71)	9.8 % (n=5)	10,8%	

*Only individuals older than 19 years old are considered; **In national datasets, statistics on university degrees are aggregated, leading to reduced precision;***Combines 'modest households' belonging to the first 3 income deciles (less than €1,450 per month) and having an energy expenditure rate greater than 8% of their income

Secondly, we carried out a multiple correspondence analysis (MCA) combined with a hierarchical type analysis (HCA) to build a typology of households based on their priorities for moving into their current residence, their patterns of energy consumption, and their socioeconomic characteristics⁵. We identified seven different types of movers (Table 2).

Table 2 – Types of residential and daily mobility characteristics

	Overall, N = 760	Cluster 1, N = 89	Cluster 2, N = 197	Cluster 3, N = 157	Cluster 4, N = 45	Cluster 5, N = 151	Cluster 6, N = 78	Cluster 7, N = 43	p-value
Avg. Annual Mileage (km)	16,522	19,621	15,63	24,422	23,656	10,037	13,471	6,184	<0.001
Avg. Moving Distance (km)	178	94	220	169	99	193	270	65	<0.001
Avg. Housing sqm	97	122	115	110	79	77	71	57	<0.001
Energy label efficiency									0.6
Efficient Housing	32%	28%	32%	39%	30%	22%	38%	20%	
Moderately Efficient Housing	55%	62%	55%	52%	55%	59%	47%	70%	
Inefficient Housing	13%	10%	13%	9.1 %	15%	19%	15%	10%	
Winter confort evolution									<0.001
Keeping warm	62%	42%	81%	58%	49%	67%	53%	38%	
Persisting cold	5.9 %	7.1 %	1.6 %	4.0 %	19%	4.8 %	12%	10%	
Improvement	17%	25%	9.3 %	23%	14%	12%	20%	33%	
Deterioration	15%	26%	7.7 %	16%	19%	16%	15%	20%	
Conducting Energy Retrofit	29%	45%	45%	36%	18%	13%	5.1 %	2.3 %	<0.001
Criteria : Affordable Housing	37%	26%	31%	61%	44%	6.6 %	51%	72%	<0.001
Criteria : Closer to Family	30%	26%	43%	8.3 %	27%	26%	58%	23%	<0.001
Criteria : Closer to Work	26%	45%	2.5 %	28%	44%	17%	74%	19%	<0.001
Criteria : Closer to Services	33%	52%	34%	23%	42%	9.9 %	73%	35%	<0.001
Criteria : Housing Size	51%	92%	59%	50%	64%	28%	27%	49%	<0.001
Criteria : Thermal Quality	54%	73%	57%	75%	62%	7.3 %	69%	60%	<0.001
Criteria : Living environment	67%	85%	73%	75%	64%	45%	73%	44%	<0.001
Criteria : New Children	15%	63%	5.1 %	7.6 %	36%	4.6 %	10%	12%	<0.001

⁵ The following active variables were included in the MCA: socio-economic characteristics (such as age, income, housing occupancy status), housing surface, annual mileage, level of concern given to the housing energy efficiency, housing size and affordability, and the spatial proximity to work, services or family

To embody these types, we conducted interviews with 62 of the households having responded to the questionnaire and representing the main variables of the overall sample. These interviews, lasting from one to two hours, were conducted by the survey team in the respondents' home (55) or by phone (7), with the person in the household having filled and mailed the questionnaire, within a period of three months after its reception. All were adults and had accepted a specific appointment for the interview.⁶ Interviewees were asked a similar range of questions, but each interview was adapted to explore the reasons for moving that the interviewee identified as important in the questionnaire. Interviewees were supplied with a plain language statement and interviews were recorded with written consent. Recordings were transcribed reviewed by the field researchers.

These interviews were used to place the current moment in the household's larger life cycles and ownership trajectories, in order to tell their individual stories. We also extracted the parts of the interviews where respondents discussed their current and past mobility practices, the description of their energy appliances and the energy efficiency of their homes, and the renovation works that they were conducting or planning to conduct. This dense empirical material has been used in other publications addressing evolving everyday energy practices during the energy crisis (38).

The current paper uses these interviews as illustrations for the typology elaborated with the factor analysis. For each type based on quantitative data, we identified the corresponding interviewed households, ranging from five to six households for each type. We then selected one for each type and presented it as a case story of dynamics identified in the typology.

4. How life cycles and income structure the hierarchy of residential drivers: seven types of households mobility based on energy drivers

The following sections present the main findings of this study, linking survey data and questionnaire responses through quantitative and qualitative analyses. It presents and illustrates seven types of households depending on their residential criteria and socioeconomic characteristics through MCA and HCA (see Annexe 1 for the choices made in the typology). As shown in the Table 2, the seven types reflect diverse socioeconomic and housing profiles, shaped by life cycle and income differences.

Type 1 consists of affluent young first-time homeowners, while Type 2 includes retired affluent homeowners, highlighting financial stability across different life stages. In contrast, Type 3 captures middle-class families, both couples and single parents, who are also first-time homeowners. Type 4 consists of very young transitional couples without children, often navigating private rental or first-time homeownership. Meanwhile, Type 5 represents retired tenants with more stable but modest living arrangements, whereas Type 6 includes midlife modest tenants facing greater economic challenges. Finally, Type 7 consists of social housing tenants, the most economically vulnerable group, emphasising the stark disparities in housing and financial stability across these types.

⁶ The privacy of the questionnaires and interviews has been validated by the national RGPD protocol, the legislation on private data protection, and a form was signed by all stakeholders in the survey.

Table 3 – Types of socioeconomic characteristics

	Overall, N = 760	Cluster 1, N = 89	Cluster 2, N = 197	Cluster 3, N = 157	Cluster 4, N = 45	Cluster 5, N = 151	Cluster 6, N = 78	Cluster 7, N = 43	p- value
Average Age	54	41	67	51	27	60	48	57	<0.001
Household Composition									<0.001
Couple with children	28%	65%	2.4 %	48%	23%	20%	33%	16%	
Couple without children	38%	22%	71%	26%	65%	31%	14%	0%	
Single-parent family	11%	10%	3.0 %	14%	5.0 %	9.3 %	18%	32%	
Single person	23%	2.6 %	24%	11%	7.5 %	40%	35%	52%	
Housing Occupation Status									<0.001
First-time homeowners	33%	82%	14%	66%	44%	15%	6.4 %	0%	
Homeowners	27%	7.9 %	80%	5.7 %	2.2 %	21%	1.3 %	4.7 %	
Private sector tenant	33%	10%	6.6 %	27%	44%	63%	88%	7.0 %	
Social housing tenant	6.7 %	0%	0%	1.9 %	8.9 %	2.0 %	3.8 %	88%	
Average Income in € (per CU)	2,192	2,472	2,486	2,152	2,143	2,111	1,974	1,151	<0.001
Education Level									<0.001
2 to 3 years post-secondary	34%	33%	33%	42%	42%	33%	35%	12%	
5 years or more post-secondary	33%	52%	32%	33%	38%	25%	35%	7.3 %	
Certificate, CEP, or no diploma	6.8 %	0%	8.3 %	3.8 %	0%	11%	3.9 %	24%	
High school diploma	15%	12%	14%	12%	18%	16%	10%	46%	
Vocational training certificate	11%	3.4 %	12%	10%	2.2 %	15%	16%	9.8 %	
Functional Area									0.003
Urban	52%	49%	44%	46%	52%	59%	70%	63%	
Peri-urban	41%	48%	46%	44%	38%	37%	29%	35%	
Rural	6.5 %	3.4 %	9.5 %	9.8 %	9.5 %	4.1 %	1.3 %	2.3 %	
Energy vulnerability index									
Cold during winter	21%	32%	9.5 %	20%	38%	22%	26%	29%	<0.001
Hot during summer	38%	43%	22%	41%	45%	39%	57%	48%	<0.001
Household in energy precarity ***	9.4 %	3.7 %	5.9 %	11%	2.5 %	9.9 %	9.7 %	35%	<0.001

To show how this typology highlights diverse housing and exposure to energy vulnerability patterns, we represented the types in relation to each other, and for this we placed them in the Table 4 structured by two axes. The vertical axis positions the seven categories according to the importance given to energy efficiency in the choice of a new residence, from low to high. The horizontal axis positions them according to the type's mean car mileage, seizing the proximity/distance factor, which varies between urban centrality (minimising transport costs), peri-urban or rural centrality (controlling mobility costs), and the longest travel distances.

The first axis is one of the determinants of exposure to thermal discomfort and, consequently, to energy vulnerability. The second axis on the other hand, is a key determinant of exposure to fuel poverty. Additionally, the typology captures the absence of residential choice among the most constrained households of the social housing stock.

This table deliberately confronts a more subjective information – the declarative preoccupation with energy efficiency – with a more objective information – a travelled distance by car or motorcycle. This choice was made in light of the mismatch between households' selection of

one or several items of proximity (to jobs, services or family), and the actual distances travelled by the two main vehicles of the household. Types 4 and 5 have the highest mean mileage, around 20 000 km per year. Types 1 and 2 follow, between 10 000 and 20 000, and types 5, 6 and 7 have the lowest figure, under 10 000km per year.

Table 4– Seven categories of households regarding energy drivers

	Research of urban centrality to minimise transports	Research of suburban or rural centrality and control of mobility costs	Biggest travelled distances
Lower energy efficiency drivers	Type 5: retired tenants Middle income, retired, living in small city-centre apartments, with very few residential criteria Sensitivity: low Adaptive capacity: medium	Type 2: affluent retired homeowners High-income, retired homeowners, conducting thermal renovation in large rural houses, with important but controlled fuel costs Sensitivity: low Adaptive capacity: medium	Type 4: young transitional couples without children Middle-income, young couples with no children, living close to jobs and services, very mobile Sensitivity: low Adaptive capacity: high
Higher energy efficiency drivers	Type 6: midlife modest tenants Lower middle-income tenants in small apartments, trying to limit their residential costs (housing, energy, and fuel burden) Sensitivity: high Adaptive capacity: medium	Type 1: affluent young first-time homeowners High-income first-time buyers, young couples with children, conducting thermal renovation in large houses, prioritising thermal efficiency and proximity (jobs and services) Sensitivity: medium Adaptive capacity: low	Type 3: middle-class families of first-time owners Middle income first-time buyers, mid-life couples with children, choosing distance to minimise housing costs, prioritising thermal efficiency Sensitivity: high Adaptive capacity: low
Absence of residential choice	Type 7: social housing tenants Low-income tenants in social housing apartments, with high preoccupation over housing affordability, little motorised Sensitivity: high Adaptive capacity: medium		

The Table highlights two structuring elements in household differentiation: life cycles, on the one side, with age and children influencing residential choices and strategies, and the income on the other side, emphasise the transversal weight of energy drivers for the lowest income type.

4.1 The structuring role of life cycles

The factor analysis highlighted four household categories defined by medium to high incomes, with financial stability and relatively low levels of constraints, enabling them to make residential *choices* – with a limited gap between what is desirable and what is possible – rather than *strategies* marked by more compromises (3). While they share an ideal of homeownership common to most households, they are in financial capacity to reach it. When considering energy efficiency criteria, they focus on factors such as the construction period or installed appliances rather than official ratings, and they are more likely to invest in energy retrofit. These households are further differentiated by their respective stages in the life cycle, which influence their attention to energy and shape distinct patterns of sensitivity and adaptive capacity.

- **Type 4, young transitional couples without children**

Age is a critical factor in residential energy efficiency drivers. Type 4 is characterised by households in their late twenties, with no children, who are tenants or first-time buyers. In what can be identified as a residential strategy, they tend to live closer to city centres, jobs and services to minimise residential costs. These households show less interest in the energy efficiency of their homes, which can be explained by the smaller size of their homes. Their focus on proximity to jobs and services translates into central city locations. However, this proximity is not converted into reduced travel distances and costs, which the interviews suggest result from high leisure and holiday mobility. The following case story illustrates one of the most representative households of this type.

Type 4 Thomas and Adèle (all names have been changed)

They are a young couple, both sales representatives, in their late twenties, and together, they earn between €5.000 and €6.000 per month. They have been interviewed in their 50m² apartment in Pau, their first real estate investment, which they have bought with a loan and no prior heritage. Before moving, they were also living in an apartment which they rented, in the city centre of Pau. Although they had energy efficiency standards for this purchase, these were low (a D-Type) and mostly motivated by the perspective of renting the apartment in a mid-term future where they will buy a house when they start having children. In spite of this low efficiency, the small size of their apartment limits their energy bill to €196 for a winter month, well in line with their income. They prioritise proximity, living in the city centre, cycling to commute and walking to buy groceries and social activities. Besides these everyday trips, they are also very mobile. They own two cars, which they use for work trips and for spending regular holidays in other French regions and abroad, with a total of 15.000 km per year. They also frequently travel by train in France and Europe, and, more occasionally and decreasingly due to environmental concerns, by plane.

This example highlights the low sensitivity of the households in this type having been able to choose – rather than strategise – small apartments with reduced energy needs, low car dependence and double incomes. As such, they report very low fuel poverty (2.5%) but slightly above-average thermal discomfort due to smaller, less efficient homes. These choices protect them from energy prices in the present and future projections, where they will be able to adapt, either by spending more on fuel and electricity, or by switching to available public transports and reducing the amount of leisure trips.

- **Type 1, affluent young first-time homeowners**

A decade older, households in Type 1 comprises more high-income couples, between 30 and 44 years with young children, first-time buyers, and moving in large houses compared to the survey's mean size. Their preoccupation over energy efficiency is also expressed by a higher proportion (45%) of thermal renovations conducted when investing their new homes. They also value proximity to services, family and jobs in their residential strategies, but without impacts on the distance travelled by car, further highlighting the relative perception of proximity.

Type 1 Vanessa and Valentin

They are a first-time buyer couple in their thirties with a two-year-old child, having built a 110m² house 30 km in the north of Pau, and earning around €4.000 per month. They invested close to €260.000, and sold a rental property for their first down payment. For them, efficiency drivers were structured by thermal regulations mandatory for this new building, and the interview highlighted their close scrutiny of electricity and pellet costs, with winter expenses reaching €250 per month: for them, efficiency issues were mandatory and carefully pondered, as stated by Vanessa, *'We wanted to have the comfort of a chimney, like a cocoon, but without the hassle, and we hesitated between wood and pellet stoves, it might have been a mistake because it consumes a lot of electricity, but it is better than classic electric heaters.* They were also sensitised by their previous accommodation, an inefficient rental house in the Pau suburbs.

Their mobility driver's concerns included a proximity with services and jobs, which they defined by their motorised accessibility: the first location criteria was to be close to a highway entrance: *'We were looking in the whole area, we wanted to be in the middle of everything and here is perfect: I am 15 minutes away from my job, and with the highway, my husband can go to work in Lacq in 40 minutes, and we can go to the seaside, or visit my family up north'*. For this couple, the cost of this high mobility (70.000 km per year for their two cars) appears as controlled, thanks to their investment in a hybrid car, and to the fuel cost of the husband's car being paid by his employer.

This example illustrates the strategies developed by households choosing more remote locations for their larger new home, where more constraints have to be taken into account, and more compromises have to be made, with impacts such a higher value in the energy precarity indicator in this class (9,4%) and one of the highest car mileage.. But its main interest is to highlight the drivers that allow this relatively well-off household to make the choice of distance and to limit its sensitivity to energy prices: first, their homeownership status which allows them to invest in efficient appliances and insulation and second, the availability of a hybrid car and, above all, the payment of fuel expenses by the employer. Adaptive capacity, on the other side, is limited by their car dependence, as there are no public transport solutions in their municipality.

- **Type 2, the young retirees moving in rural towns**

On the opposite side of the efficiency driver's spectrum, older households are characterised by lower levels of preoccupations over thermal regulations and certificates. For example, the Type 2 is composed of high-income retired households, not only homeowners but also with

more frequent cases of multi-ownership, with enough capital to invest in energy renovations in their new homes (45% of them have conducted retrofits in their new homes). This type would be most efficiently described as an example of amenity migrations, up to their preference for larger homes in rural and suburban locations and lack of concern for proximity to services and jobs. And for some of them, the interviews highlight a form of indifference to energy efficiency, which can be linked to the knowledge, financial capacity, and ownership status to conduct thermal works in older buildings, often among older households with higher capital. Indeed, all the interviewed homeowners in this type who have experienced cold in the new homes have responded with energy renovations such as installing double glazing windows, replacing ageing heating systems and/or insulating the roofs.

Type 2 Philippe and Catherine

A couple in their late sixties, earning more than €6.000 per month, they bought a large ancient farm in the heights of the Pays Basque after Phillippe retired from a senior executive position in Paris, and sold their house in the Parisian western suburbs, while still owning a rented apartment. *“Few people were willing to buy this 750m² house (we needed all the space to welcome our grown children), because of the energy problem, all this space must be heated, and with an oil boiler!”* They installed a swimming pool upon coming, and their next steps are to insulate the roofs, install two heat pumps and a range of solar panels, for which they expect an increase in government subsidies. In parallel, they have developed new mobility habits leaving the Parisian region and rely mostly on their four cars, including a hybrid VUS, with which they travel more than 20.000 km per year. They summarise their motives for moving to their new region and home as such: *‘Ah, the surroundings are very different from the Parisian region. We were attracted by the South, of course, but also because there is less stress, and everything is green, with untouched natural spaces. And we feel that the people are different, more welcoming, we can take our time buying groceries... even if we now need a car for everything instead of public transports.’*

Albeit this household is the wealthiest of this type, its characteristics are illustrative of these households able to make residential choices rather than strategies and attracted by the residential amenities of the southwestern countryside. This result echoes similar dynamics in the Grenoble suburbs, where wealth is associated with both higher mobility expenses and a smaller burden of these expenses in household budgets (11,12). For them, in spite of greater distances, and larger homes, the impacts on mobility costs and following sensitivity appear as controlled: they have the lowest levels of sensitivity to winter (9.5%) and summer discomfort (22%). Higher incomes and the absence of commute increase their adaptive capacity, as the capacity to invest in efficient appliances and thermal renovations.

- **Type 5, older households in city centre apartments**

Following the age dynamic, the Type 5 is also composed of retired households, albeit older, living alone, and choosing small city centre apartments, either to buy or to rent. Here, the relative indifference toward energy efficiency standards – with only 7,4% of the households expressing preoccupation with energy efficiency, the lowest in all the household types – can be explained by their limited expenses. Their mobility costs are also reduced, along with frequent expressions of a desire to be closer to services or family, translated into an over-representation of urban locations.

Type 5 Marie-Christine

She is a seventy-year-old former executive, who has been retired for eight years and has been looking to leave the Parisian region for a smaller town close to the Atlantic Coast after selling her apartment. Her main income is her retirement pension, around €2.000 per month. She has chosen to buy a two-bedroom apartment in the centre of Pau (Type D), where housing prices were lower than her initial choice on the Brittany Coast. Proximity to the city centre and its public transportation was a central element of her choice, as she does not own a car, and favours walking and buses for her every day trips, and carpooling for the activities of her culture club.

The more uneven income in this type suggests that both residential choices and more constrained strategies are being made, but their sensitivity is lowered by their limited energy needs, with small apartments, and little car dependence because they live close to services and because they are retirees (they present one of the lowest car mileage of the seven types.. Their adaptive capacity, however, can be constrained by their income and the limits to their mobility because of their age.

4.2 The role of income and homeownership

MCA and HCA highlighted other configurations marked by compromises helped identify three categories (3, 6 and 7) on the other side of the income spectrum, with low and lower-middle income who are more often tenants. These less affluent households show patterns of residential mobility characterised by constraints, but also by a high awareness of the importance of energy efficiency criteria, often due to previous uncomfortable winter and/or high energy bills. For each of these three types, the cost of housing – seeking a more affordable housing – was an important factor.

- **Type 3, families choosing distance to own their house**

The Type 3 is characterised by couples in their forties and fifties, for whom proximity was not part of the residential criteria. Often first-time homeowners, they favoured lower housing prices and more square metres in suburbs, resulting in greater distance to jobs and services. This choice significantly impacts their mobility, with the highest car travel distances between the types. Energy efficiency remains a driver, with a relative high percentage of thermal renovations. This type echoes the research on residential remoteness (21), highlighting the strategies of households compelled to move further away to secure affordable housing. For most of these households, in line with the residential cost literature observations (23), travel time is a more common criterion than fuel costs.

Type 3 Aurélie and Nicolas

A couple in their early forties, they have two children, and have followed Aurélie's job from their previous home in Normandy where they sold their previous house. They earn between €2.500 and €3.000 per month, while Nicolas is temporarily unemployed. They have bought a house 30 km in the north of Bordeaux, outside of the Bordeaux agglomeration, in a small village within their budget range, and with no public transports to Bordeaux, where Aurélie commutes daily. They have invested €50.000 in the renovation of their house, have replaced the oil fuel boiler with a heat pump and are working themselves on insulating the roof and walls. They have also installed a swimming pool. As for Vanessa and Thomas in Type 1, they cope with the price of the commute because Aurélie's employer provides her with an electric car that she can recharge at her job site. To reduce the fuel expense of their second car, they combine several trips in one, such as picking up their child and grocery shopping. During their interview, they express strong negative feelings toward public powers and sufficiency policies, stating that *'they come and tell us that I shouldn't take my car to go to work, but the rich travel by helicopter and nobody blames them: it's the poor and the rich now, there is no more middle class. And meanwhile, prices go up, we couldn't have renovated our home with the actual prices of materials now that there is the war in Ukraine, and they keep putting up prices and more complicated construction permits...'*

This configuration echoes Ortar and Lejoux's (4) observation that, despite increasing importance in the residential choices and strategies, efficiency standards are often sidelined when compromises are made over price, size or location. This can result in an uncomfortable home, for other interviewed households in this typology, but mostly in a car dependency lock-in. As such, these households are also sensitive to rising energy prices – their annual travel distances exceed those of affluent families in Type 1 – but have less adaptive capacity in the mobility domain because of their car dependence.

- **Type 6, central energy drivers for lower-middle income tenants strategies**

The Type 6 includes low-income households, with a higher proportion of single parents and no defining age type. Their residential mobility appears constrained, with an over-representation of tenants in the private sector and no property assets. They tend to live in small city-centre apartments, balancing high concerns for efficiency and proximity with housing cost considerations in their strategies, resulting in reduced travel distances and more generally in a better control over the household budget. Indeed, a common trait of their interviews is the valuation of the construction standards, either by the construction date, or by the energy efficiency rating, especially for the tenants having experienced cold in their previous homes.

Type 6 Céline and her husband João

A couple in their early fifties, they live in a rented apartment in a village 30 km from the city of Pau, while saving money to buy a house in Portugal for their retirement. They moved from a social housing block in a small city in the Basque Country, because it was both uncomfortable in winter and too far from João's job in the industrial city of Lacq, where he earns between €2.500 and €3.000 per month. Indeed, their budget could no longer accommodate neither the fuel costs up to €400 per month to commute. They were also driven away by the electricity bills in their previous apartment: *'We were living in a thermal*

*sieve*⁷, states Céline, ‘with leaking roofs and windows that did not close, it was starting to be unhealthy and we had bills from €150 to €200 per month’. They looked for a calm town with public transport systems for their children’s schools, and connected by bus to Pau and its hospitals because their teenage son has a disability which needs frequent medical attention. The insulation of the apartment was a central criterion in their research, and they divided their fuel expenses by a factor of four. Céline, who has stopped working to care for her son, monitors every aspect of her domestic energy consumption, from heating to cooking and using domestic appliances with a peek/off peek option contract. This monitoring extends to air conditioning in the summer: ‘We turned it on a bit last summer’ adds Céline, ‘but I was a bit of a control freak with it, I only used in off-peak hours, same for the laundry and the oven’.

Because of their lower income, and the prevalence of tenants, the households in this type have a higher sensitivity to rising energy prices. They face severe summer discomfort (57%), above-average winter discomfort (26%), and financial constraints linked to poorly insulated homes. Tenancy among interviewees is commonly associated with either insufficient income or temporary circumstances, such as frequent moves to follow job postings. It also corresponds to transitional periods, where households test their new location or scout for properties to buy. The interviews highlight the coping mechanisms that they develop, adapting their lifestyles to match these constraints, some by moving closer to their jobs, others by reducing and monitoring their everyday activities. This type is interesting, because it showcases individual moving strategies where energy is a determinant factor.

- **Type 7, social housing tenants**

Type 7 is different in that it corresponds to households in social housing apartments with little control over their residential mobility and the energy efficiency of their homes. They applied for a housing type at a certain price in a certain area, but the selection of the apartment itself was not their choice. Hence, energy efficiency drivers are less represented in this type. They also travel short distances by car compared to others, especially because they do not own a car and rely heavily on affordability and access to urban services. As such, they are sensitive to rising energy prices, they experience significant levels of fuel poverty (35%) and persistent winter discomfort (29%). On the other side, they are also protected by their low car dependency, and by the energy efficiency of the French social housing estate compared to the low-cost private sector: indeed, they report the highest rates of improvement (33%) due to upgrades in social housing stock.

Type 7 Marie

She is a 64-year-old retiree, and lives in a social housing in Bordeaux, after leaving an apartment in the private sector on the Basque Coast because of its rental price, but also because she wanted to get closer to her children and medical services. With an income under €1.500, she closely monitors every expense, from housing energy to car travels (she

⁷ The term of “thermal sieve” has a particular regulatory meaning in France, where it qualifies homes with an F or G energy efficiency rating, forbidding owners to increase their rents, in some cases, to rent them. In this case, the use of this term signifies both that the interviewee was very attentive to the energy efficiency of her home, and that she has specific knowledge of the national regulatory framework.

never buys a full tank), and favours free public transports in the city centre. Her move has made her gain winter thermal comfort and reduced her bills, but she fears for the summer heat in her well-insulated apartment.

These results nuance previous literature on residential migration, which has portrayed energy drivers as secondary (20,39). They provide new insights into residential drivers, highlighting the influence of energy vulnerability, income and residential market dynamics.

5. Discussion

Reflecting back on elements from the conceptual framing of the paper, here we outline the lessons that can be drawn from applying an energy vulnerability framework to the residential strategies of mobility. This framework has been developed to identify the drivers of vulnerability, and in the case of 'double' energy vulnerabilities, the populations at the nexus of domestic and mobility poverty, highlighting economically precarious households (26). In this paper, we reflect on three insights that can be drawn from expanding the social spectrum of energy vulnerability to more affluent households.

First, applying an energy vulnerability framework articulating sensitivity and adaptive capacity allows for a coherent and dynamic understanding of residential mobility in a context of energy crisis and rising energy prices. All households consider distance and energy efficiency, but with different degrees of urgency and compromise, varying preoccupations in the housing and mobility domains, but also varying levels of agency allowed by their income, age and wealth. All configurations, from alignment to compromises and radically different choices can be observed: for some households, rising energy prices are the determining driver in all aspects of their residential mobility, while for others, a close scrutiny to the efficiency of the home can coexist with the choice of distance and complete car dependency. These mechanisms vary over the course of the life cycles, with moments where energy becomes more important, and others where it is secondary. Households with children and first-time buyers exhibit peaks of energy-related concerns in their residential strategies, whereas younger households living in city centres and older households generally exhibit fewer preoccupations. Among older households, the ability to conduct renovations or the choice to live in small apartments reduces energy concerns. This life cycle pattern is well documented in residential choice literature, but incorporating energy into the analysis provides a more comprehensive understanding (34). The analytical framework of double energy vulnerability is a useful tool to create a typology that positions households in relation to each other, and to gain a better understanding of the extremes of the social spectrum.

Indeed, widening the spectrum beyond economically precarious households highlights situations of vulnerability that can be overlooked by energy and transport poverty indicators and their metrics. For example, households that can be classified in the Type 3 are not poor by any of the French standards, they are often homeowners and can conduct renovations in their homes, they own cars and are employed, but they are also very sensitive to rising energy prices and have a reduced adaptive capacity, because of their residential choice. Because they do not belong to the categories of social assistance, they can remain invisible for public policies. This result echoes Eric Charmes's and Nathalie Ortar's accounts of the centrifugal dynamics in Lyon (20,21), and contributes by highlighting the dynamics that invisibilize and mitigate mobility costs in favour of distance, such as owning an electric car – a perverse side

effect of decarbonation policies – or the payment of fuel costs by the employers. This vulnerability framework also sheds light on the adaptive capacity of lower-middle-class households who integrate rising energy prices in their residential strategies, opting for closer locations, as illustrated by the Type 4: tenants, exhibiting the highest energy efficiency and mobility drivers, and often driven by past experiences of thermal discomfort. These households emphasise energy efficiency as a critical factor in their residential strategies, as supported by literature results (40,41) showing fuel consumption adjustments. On the other side, the vulnerability framework also shows how households belonging to more classical categories of the urban poor can be protected, and become less sensitive, by the low rents and better thermal efficiency of the social housing estate and their reduced mobility needs. These observations have significant implications for public policy. They underscore the importance of identifying more diverse vulnerable households, including homeowners above the poverty line, and specifically those who move further away from urban centres to find affordable housing and who experience higher mobility costs.

A third contribution of the paper is to apply a vulnerability framework to the residential choice of the wealthy, at the opposite of the social spectrum. This, we argue, opens up important research avenues on less investigated social contexts (42), where economical constraints are reduced, and where income and wealth allow for greater adaptive capacity in a context of rising energy prices. The choices made by wealthy households are important because, as shown by the survey's results, they are driven by the dual logic of homeownership and centrality. This centrality can be translated into city centre localisation, reducing mobility needs, or by the choice of close suburban areas where higher mobility costs can be managed by higher incomes. Both choices have impacts on the housing market, driving less affluent households in the more remote suburbs. Homeownership and wealth also open up the possibility to conduct thermal renovations, reducing the importance of energy efficiency when choosing a new home, and allowing investing in more efficient appliances, from solar panels to electric and hybrid cars. As such, these households are at the forefront of energy transition dynamics and markets. But, as shown by the survey's results, all these choices cannot be summarised by the search for a greater efficiency: wealth also allows households to make less compromises, and to overlook the costs of the energy services that contribute to their comfort expectations. This raises important justice issues, as the lack of policies targeting the consumption at the higher end of the social spectrum, in contrast with their disproportionate contribution to greenhouse gas emissions (43,44,45). These questions will guide the following research, joining an international research agenda investigating the power dynamics behind the primacy given to voluntary actions and incentives, rather than eco-social political measures such as caps and rationing approaches (12,42,46,47).

6. Conclusion

This study investigated the role of energy among the drivers of residential mobility, articulating an energy vulnerability framework with the concepts of residential choice and strategies developed in the residential mobility literature. By using a household survey implemented in the Nouvelle-Aquitaine region in the wake of the energy crisis, in 2023, we explored the socioeconomic determinants for the inclusion of energy concerns in households' decision to move to a new home. Then, we elaborated a typology of seven types of households articulating, on the one side, the importance of energy efficiency in the home, and, on the other side, the travelled distances, highlighting the structural roles of income and life cycle stages.

Our findings suggest that, although they are transversal for all households, energy drivers in residential decision-making are partly shaped by life cycle stages, income and ownership status. Higher income households, and especially more well-off retired couples, can afford to make residential choices driven by amenities, with low levels of concern for energy efficiency or travelled distances, as increased energy costs are offset by energy renovations. In contrast, economic vulnerability is associated with a prioritisation of energy efficiency in residential strategies characterised by trade-offs. Between these two poles, the choices of middle-income households are influenced by their life cycle stages, with accession to property for couples with young children being the moment where energy drivers are the strongest.

These findings point to directions for further research. They emphasise that, along with studying how vulnerable households cope with rising energy prices, more work is needed to expand energy vulnerability approaches to consider the adaptive capacity of middle- and high-income households. Their residential choices, rather than strategies, are characterised by fewer compromises, higher levels of energy intensity, and a greater control over their energy costs, especially through energy retrofits.

These results have implications for policy: on the one side, for a better understanding of vulnerability issues among households who are not identified as economically poor, and especially of the cost of their everyday mobility. This represents a challenge for French local authorities, whose competences are focused on social assistance and housing, and who lack technical tools to integrate transportation costs in planning policies (24). The policy implications are even more challenging on the other side of the social spectrum, where local and national authorities not only lack both tools to define and identify high consumption and the networks to reach these publics, but also the legitimacy to aim at curbing individual consumption in a liberal society (48,49)

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