

## **LIVING CONDITIONS AS AN INDICATOR OF SOCIAL WELL-BEING. HOUSING VULNERABILITY, COMFORT, AND SOCIO-RESIDENTIAL DIFFERENTIATIONS IN PETROȘANI**

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**ABSTRACT:** *The article analyzes infrastructural housing vulnerability through the use of a composite housing comfort index based on households' access to utilities. The differentiated analysis of housing reveals that, beyond the aggregated profile of housing conditions, there are vulnerabilities associated with various factors. This suggests the existence of socio-residential disparities that affect the quality of urban life.*

**KEY WORDS:** *housing conditions, housing vulnerability, infrastructural housing comfort, utilities.*

**JEL CLASSIFICATIONS:** *I31, R10, D63.*

### **1. INTRODUCTION**

This article aims to analyze housing conditions in the municipality of Petroșani, both at an aggregated level and, more importantly, from the perspective of hidden vulnerabilities that can be identified by considering factors that generate disparities in the socio-residential profile.

A differentiated analysis is particularly relevant in the context in which Petroșani represents a post-industrial area, marked by an extensive process of deindustrialization and a pronounced demographic crisis. These processes have had significant effects not only on the population but also on the infrastructural conditions of housing.

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The factors considered in this study include the housing tenure regime, the spatial structuring of the city, household size, and families' monthly income. The overall picture of the locality was captured through the Infrastructural Housing Comfort Index, a derived indicator that aggregates households' access to utilities and is also used to outline the differentiated socio-residential profile of the locality.

In this way, the study determines the extent to which these factors influence housing vulnerability, whether they act as determining factors individually or operate in conjunction, ultimately leading to a structural vulnerability of housing from the perspective of functional adequacy, conditioned by access to utilities.

## **2. THEORETICAL CONTEXT**

Although Romania occupies a structurally weaker position compared to other European countries in terms of housing quality, studies addressing the population's access to public utilities reveal several important aspects:

1. Almost 94% of urban dwellings have access to running water, although in small towns many households obtain water through private installations (wells or boreholes) (Voicu & Voicu, 2005, p. 21).

This confirms the persistence of certain rural-type functional characteristics within small urban areas, as well as the fact that after 1989 many administrative-territorial units were elevated to the status of urban localities without possessing the necessary infrastructure to ensure typically urban housing conditions.

Differences are observed not only between large and small urban areas, but also within large cities themselves. Apartment buildings - generally constructed more recently - have almost complete access to public water supply and sewage networks, whereas individual houses record significantly lower connection rates, ranging between 40% and 60% (Voicu & Voicu, 2005, p. 22).

2. There is a strong correlation (0.794) between the size of a locality and the share of dwellings with access to hot water and heating, in favor of large cities that are better equipped technically (Voicu & Voicu, 2005, p. 26).

This observation was formulated in the context of realities existing two decades ago; in the meantime, significant transformations have occurred. On the one hand, these changes are linked to the transition toward green energy, which led to the closure of numerous coal-fired thermal power plants that traditionally supplied district heating and hot water. On the other hand, the systematic degradation of heating systems and thermal transport networks has increasingly affected even large cities such as Bucharest, which now experience interruptions in the supply of hot water and public heating.

3. Connection to the electricity network, especially in urban areas, reaches approximately 99% of dwellings. Currently, the main issue is no longer access to this utility but rather its cost, which has led to an increase in disconnections as well as illegal connections and electricity theft from the grid (Voicu & Voicu, 2005, p. 33).
4. More than three-quarters of urban households have access to the natural gas network, a utility that historically brought several advantages,

including reduced fire risk, the possibility of heating dwellings, and relatively low costs (Voicu & Voicu, 2005, p. 36).

Unfortunately, Romanian realities show that housing conditions may deteriorate not only due to structural factors but also because of rapidly increasing utility costs in recent years. If one also considers the deterioration of natural gas distribution networks, reflected in the growing number of tragic accidents in recent years, it can be argued that poorly maintained utilities affect not only the objective indicators of housing quality but also the safety of residents' lives.

5. Nearly 70% of urban dwellings are connected to the public sewage system, although once again strong correlations appear with the better-developed areas of cities and with city size. In small towns this share decreases to 54%, forcing residents to rely on wastewater collection and drainage systems such as septic tanks. At the same time, apartment buildings benefit more frequently from public sewage systems (95%) compared to individual houses (54%) (Voicu & Voicu, 2005, p. 39).

The presentation of these nationally representative data regarding access to utilities serves as a contextual benchmark intended to support the interpretation of local empirical data by enabling comparisons between Petroșani and its neighborhoods and the broader national distribution patterns.

Housing exclusion should not be understood solely in its absolute form, namely the lack of a dwelling, but also as exclusion from adequate housing (Dan, 2005, p. 4). Adequate housing implies, among many other essential dimensions, access to utilities (Zamfir, Preda & Dan, 2007, p. 248), a key dimension addressed in the present article. When individuals cannot afford a dwelling, or when the housing they occupy fails to ensure decent living conditions, they may turn to public authorities for assistance.

Through Law no. 114/1996 (Housing Law), the Romanian state attempted to mitigate the negative effects of such situations by establishing criteria that allow affected individuals to request access to social housing provided by local authorities. However, there is a considerable gap between these well-intentioned legal provisions and reality. Data indicate that in 2004 nearly half of Romanian cities (48.9%) did not have social housing. More specifically, studies show that 80% of small towns did not administer social housing, meaning that they were unable to respond to such requests (Constantinescu & Dan, 2005, p. 91).

A decade later, although the provisions of Law 114/1996 began to produce certain effects, they remained strongly constrained by broader structural conditions within Romanian society. Studies reveal two contradictory trends: on the one hand, a slight improvement, with the share of cities without social housing decreasing from 48.9% in 2004 to 43% in 2014; on the other hand, an increase in the proportion of small towns lacking social housing, from 80% in 2004 to over 90% in 2014 (Blaj, 2019, p. 24). Consequently, a clear correlation exists between urban size and the availability of social housing, which conditions the extent to which the law can produce its intended positive effects.

Another important aspect to consider is segregation, understood as a socio-spatial process, one of whose effects is reflected in the quality of housing and

neighborhoods. These effects can be operationalized through objective indicators such as housing deprivation and the reproduction of social inequalities through residential structure quality (Mionel, 2011, p. 104).

From our perspective, segregation is not exclusively the product of socio-historical processes related to urban development; it may also take hidden forms, associated with the gradual degradation of residential structures against the background of declining household incomes, which make adequate housing increasingly difficult. This situation may lead residents - voluntarily or involuntarily - to renounce certain facilities or utilities.

We argue that these forms of hidden segregation can cautiously be applied to marginalized urban areas, located at the intersection of residential degradation, unequal access to urban resources, and insufficient income. In this sense, segregation does not necessarily follow rigid spatial boundaries within urban environments.

This consideration is made cautiously, particularly given that, according to the Atlas of Marginalized Urban Areas in Romania, such areas are defined as “areas within cities and municipalities that do not meet an adequate standard” (World Bank, 2014, p. 4), provided that they simultaneously meet minimum thresholds for three criteria: low human capital, low employment in the formal sector, and poor housing conditions.

In the present article, the focus within the latter dimension is on housing insecurity, operationalized through the minimum threshold of 12% of households that do not own their dwelling privately, while the proportion of overcrowded dwellings is addressed in a separate study. It should also be noted that a community is considered to have poor housing conditions if at least one of the two priority indicators exceeds the established threshold, according to the validation criteria for marginalized urban areas established in the Applicant’s Guide – POCU, Priority Axis 5 / Investment Priority 9.iv / Specific Objective 5.1 (2016, pp. 11–12).

### **3. RESEARCH AREA AND METHODOLOGY**

The research was conducted in the municipality of Petroșani, a city that forms part of the urban micro-region of the Jiu Valley, known until 1989 as the largest coal-mining basin in Romania. In response to the requirements imposed by the national industrialization process prior to 1989, the Jiu Valley - and implicitly Petroșani - underwent an extensive process of urbanization. This process came to a halt following the systemic changes of 1989, and beginning with 1997 the area shifted from a zone of immigration to one of emigration, simultaneously experiencing premature negative deindustrialization and significant depopulation.

The urban structure of Petroșani, particularly its housing stock, largely reflects the realities of the decades preceding 1989. After that year, two notable transformations occurred: the introduction and expansion of natural gas networks for households, accompanied negatively by the gradual disappearance of the centralized district heating system, which had previously been supplied with thermal energy and hot water by the Paroșeni Thermal Power Plant.

The relative similarity of the housing stock, together with the relatively homogeneous educational and occupational background of the population, led - under

the common impact of the new socio-economic transformations - to a relatively high level of socio-economic uniformity. As a result, there are no strongly pronounced income polarizations capable of generating significant observable differences in quality of life.

The fieldwork phase of the research was conducted in May 2017, using a direct face-to-face sociological survey. The research instrument was a questionnaire, administered by trained interviewers at the respondents' homes. The questionnaire had an omnibus structure, organized into three analytical sections (human capital, labor market participation, and housing conditions), in addition to a section containing socio-demographic questions. This section was useful both in constructing the sample and in applying the statistical tests required for data processing.

The analysis focused on housing conditions, considering both the tenure status of the dwelling and access to utilities, namely cold water, hot water, sewage, heating, electricity, and natural gas. The selection of items related to housing conditions followed the indicators commonly used in specialized research on housing and urban marginalization, which are also employed by the National Institute of Statistics (INS) and included in the Atlas of Marginalized Urban Areas (Annexes 4 and 6 of the Atlas, pp. 262–264). It should be noted that, within our analysis, only housing insecurity has an explicitly defined normative threshold of 12% (dwellings not in private ownership), according to the validation criteria for marginalized urban areas established in the Applicant's Guide – POCU, Priority Axis 5 / Investment Priority 9.iv / Specific Objective 5.1 (2016, pp. 11–12).

The sample was constructed using multiple interrelated quotas (sex, age, residential area, and street). To ensure good structural representativeness, the city was divided into five zones, each having a proportional weight similar to that of the adult population. In order to maintain greater control over the selection procedure for respondents included in the sample, the freedom of interviewers in selecting subjects was limited through computer-assisted selection. Thus, age and gender quotas for each zone were randomly assigned a corresponding street and building number.

The projected sample size was 1,000 respondents. However, due to objective factors - such as refusal to participate, refusal to continue the interview, inability to locate selected subjects, or clear inconsistencies identified during questionnaire verification - 931 questionnaires were validated. Although some deviations from the projected sample size occurred, these took place in densely populated and socio-residentially uniform areas, without affecting the structural representativeness of the sample.

The research is quantitative and descriptive in nature, without attempting to highlight causal or explanatory relationships regarding the analyzed phenomena. This approach is justified by the relative socio-economic and residential homogeneity of Petroșani. It should also be noted that, regarding access to utilities, we constructed a derived indicator (as it was not measured directly) in the form of a composite index of infrastructural housing comfort, based on the cumulative access to basic utilities.

The information collected during fieldwork was organized into an electronic database and processed using the SPSS software, employing contingency analyses and non-parametric statistical tests.

#### 4. DATA ANALYSIS AND INTERPRETATION

In the following section, we analyze and interpret the data regarding housing conditions along several key dimensions: housing tenure and housing insecurity (addressing both home ownership and rental situations), access to utilities, and socio-residential differentiations.

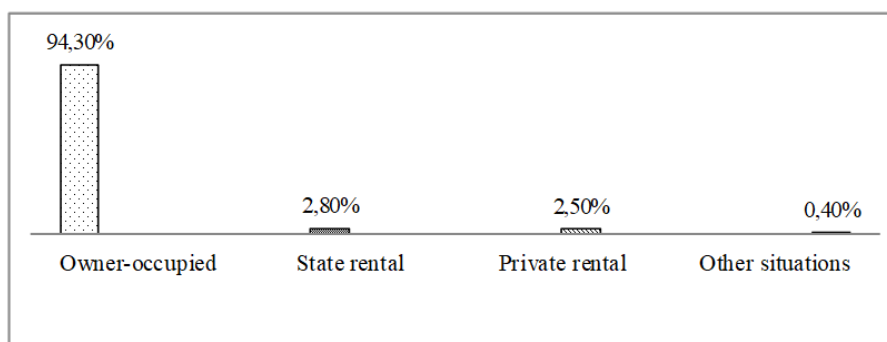
##### 4.1. Housing Tenure and Housing Insecurity

The current structure of housing tenure in Romania can be understood in the context of the years following 1989, when Romanian citizens were given the opportunity to purchase the dwellings in which they had previously lived as tenants of the state. Following the adoption of Decree-Law No. 61/1990 and Law No. 85/1992, a radical transformation of the housing tenure structure took place. Romanians shifted from being largely a nation of tenants to a nation of homeowners, with almost 98% becoming owners of the dwellings in which they resided.

Although the structure of housing tenure changes slowly, it nevertheless shows a certain degree of dynamism. In 2017, the year in which the data for this analysis were collected, the share of homeowners in Romania had slightly decreased to 96% (Eurostat, 2017). This downward trend has continued, so that by 2025 the proportion of homeowners reached 94.3% (Eurostat, 2025).

The structure of housing tenure in Petroșani, according to the data presented in Figure 1, follows the national trend observed around 2017, with very few tenants, both in state-owned and privately rented dwellings (5.3% when combined). There is also a category with a marginal share, labeled as “other situations” (0.4%), which will be discussed later.

When compared with the normative threshold of 12% previously mentioned for housing insecurity, the distribution of housing tenure forms suggests that, at the municipal level, Petroșani did not face a significant risk of housing insecurity in 2017.



**Figure 1. Housing Tenure in Petroșani – 2017**

Given the slow pace of change in housing tenure structures, it can be inferred that this risk is unlikely to be significant even by 2025. However, a simple descriptive analysis of the aggregated structure may mask certain internal differentiations, which

exist in reality but remain unnoticed. To capture these nuances, contingency analyses and association tests were conducted between housing tenure, residential area, and families' monthly income.

The share of owner-occupied dwellings is predominant in all five zones of the city, consistently exceeding 92% in four of them. However, the contingency analysis revealed that in the Bosnea area, located at the northern edge of the municipality, this share declines, and the proportion of state-rented dwellings reaches 20.8% (Table 1.1). Relative to the previously mentioned normative threshold of 12% for non-owner-occupied dwellings, widely used in housing research, the Bosnea area exhibits a heightened risk of housing insecurity. Moreover, the association between residential area and tenure type is statistically significant, although its effect size is small, reflecting the fact that Bosnea deviates from the city average (Table 1.2).

An interesting and more substantial aspect emerges from the analysis of housing vulnerability in relation to families' monthly incomes. Income intervals were constructed based on the net minimum wage in 2017. The aggregated distribution indicates a concentration between 1,066 RON and 2,130 RON. Nearly one-third of households (32.7%) have a net monthly income of up to two minimum wages, while over a quarter (26.5%) earn up to one minimum wage. This results in a significant representation of lower-income households, compared to the upper end of the distribution, which contains progressively fewer households.

Zone-specific analysis shows that Bosnea and Colonia have higher shares of low-income households, forming a socio-economically vulnerable profile relative to the municipal average (Table 2.1). This is further supported by the statistically significant, albeit weak, association between residential zones and family incomes, explained by the fact that Bosnea and Colonia deviate from municipal averages in the lower-income brackets (Table 2.2). This vulnerability is likely to manifest in the costs these households incur for housing maintenance, which may negatively impact the functionality of the dwelling due to limited economic resources. Such constraints may lead to voluntary or forced renunciation of certain facilities or utilities.

Additionally, the differentiated distribution of family incomes across zones allows for reflections on housing acquisition patterns, which, through cumulative effects, have contributed to the current socio-residential structure of Petroșani. Two distinct levels can be identified:

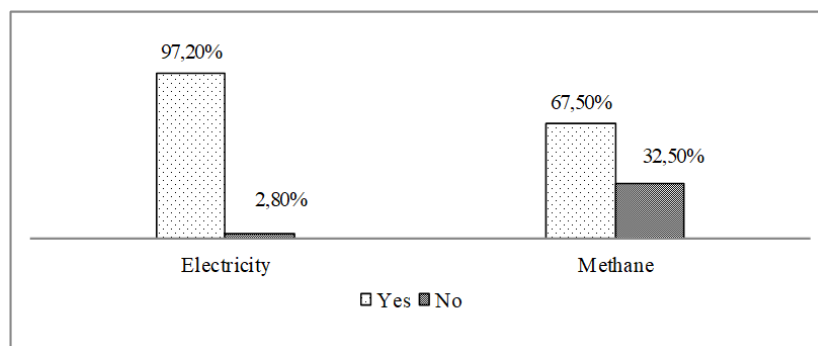
1. The administrative-institutional level, reflecting a historical advantage whereby residents could purchase dwellings at low prices following post-1989 legislation - a possibility that is largely unavailable today, given the contrast between current incomes and real estate prices.
2. The latent function of this historical advantage, through which social inequalities have been perpetuated, particularly in the older areas of the city.

#### **4.2. Access to Utilities and the Housing Comfort Index**

Continuing the analysis of housing conditions, attention is now turned to access to basic utilities, which define both the functionality of a dwelling and the quality of life of households, particularly in urban settings. Constructing a single

summary figure was not possible due to a wide range of responses to some items, reflecting the diversity of household situations. Consequently, access to utilities is presented graphically, grouped according to response categories, which allowed for aggregation. Additionally, for space considerations, the contingency analysis between residential zones and the Housing Comfort Index is presented in the appendix, with association test results for each zone discussed in the text.

Figure 2 shows that access to electricity is widespread, with almost all households in Petroșani (97.2%) benefiting from this utility. Access to natural gas is lower, available to roughly two-thirds of households (67.5%), reflecting the fact that the installation and expansion of the gas network in Petroșani occurred after 1995, and continues today, especially in peripheral areas.

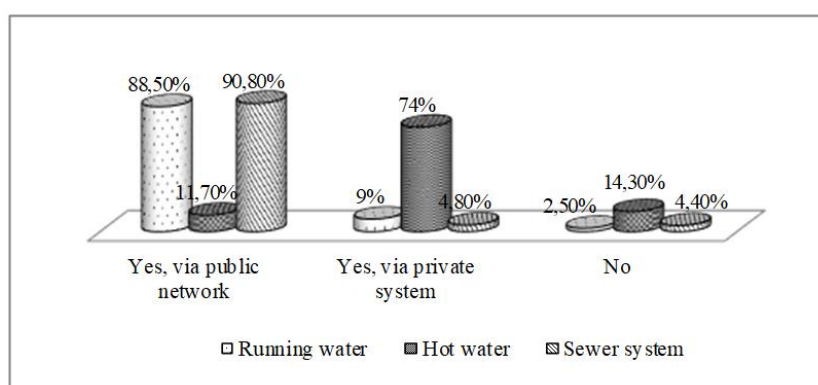


**Figure 2. Access to electricity**

From a territorial perspective, differences in access to electric current are evident. Two areas exceed the municipal average (Centru and Aeroport 2, with 99.1% and 99.6%, respectively), while two others are relatively close to this reference value (Aeroport 1 and Colonia, with 95.1% and 96.6%, respectively). The greatest deviation from the municipal average is observed in the Bosnea area, where the proportion of households without access to electric current reaches 8.3%. This accounts for the statistically significant association between residential area and utility access ( $\chi^2 = 18.615$ ;  $p = 0.001$ ), albeit of weak strength (Cramer's  $V = 0.141$ ), primarily generated by the deviation of this area from the overall municipal profile.

Access to the public methane gas network exhibits a clear lack of systematization, manifested through pronounced imbalances. Certain areas significantly exceed the municipal average (Aeroport 2, with 98.3%), while others hover around it but at higher levels (Centru and Aeroport 1, with 76% and 78.3%, respectively). In contrast, the Colonia and Bosnea areas stand in stark opposition, with 93.9% and 97.9% of households lacking access to the methane gas network. The association between residential area and gas access is statistically confirmed by the Chi-square test ( $\chi^2 = 469.56$ ;  $p < 0.001$ ) and further supported by the high value of Cramer's  $V$  coefficient (0.710), highlighting the territorial differentiation in this type of utility and emphasizing socio-residential inequalities.

Figure 3 aggregates three types of utilities, as discussed above. Regarding access to running water, it is generally widespread, with 88.5% of municipal households connected to the public network and an additional 9% relying on private water supply systems. The most underserved area in terms of running water access appears to be Aeroport 1, with only 71.9% of households connected to the public system, compared to other areas exceeding the municipal average, ranging from 91% to 97% of households. This gap is not due to structural differences in housing conditions, as buildings are equipped with water and sewage systems from construction, but rather to the high number of households disconnected from the public network and the prevalence of individual houses with private water supply systems (23.2%). In reality, the Bosnea area is the most affected, with over 8% of households lacking running water, followed by Aeroport 1, where 4.9% of households are similarly affected.



**Figure 3. Access to utilities**

The differentiated distribution of access to running water across areas is statistically confirmed by the contingency analysis, which is significant ( $\chi^2 = 117.81$ ;  $p < 0.001$ ), although the strength of the association is weak (Cramer's  $V = 0.252$ ). This is mainly due to deviations from the municipal average, particularly in the Aeroport 1 area, where a high proportion of households rely on private systems or are disconnected, and in the Bosnea area, which exhibits the highest proportion of households without access to running water.

While public infrastructure predominantly supplied municipal households with running water, access to hot water via the district heating network drops below 12%. This decrease is the combined effect of network degradation and high costs, leading to both voluntary and forced disconnections. By 2017, nearly three-quarters of Petroșani households obtained hot water through private production systems, while 14.3% did not have access to hot water in any form. Spatial disparities are again evident: the Centru area is the most connected to the public hot water system (23.6%). Other areas are either slightly above the municipal average, as in the case of Aeroport 1 (12.7%), or below it, as in Aeroport 2 and Colonia (6.8% and 2.7%, respectively), with Bosnea being completely disconnected from the public system. Provision of hot water through

private systems exceeds the municipal average in two areas, Aeroport 2 and Colonia (89.4% and 81%, respectively), while being below it in Centru, Aeroport 1, and Bosnea (71.2%, 62.5%, and 54.2%, respectively). The most affected area remains Bosnea, where 45.8% of households have no access to this utility. These spatial differences are statistically confirmed by contingency analysis, with a significant but weak association ( $\chi^2 = 151.06$ ;  $p < 0.001$ , Cramer's  $V = 0.285$ ), indicating that peripheral areas, particularly Bosnea, are deficient in access to hot water.

Regarding sewerage and wastewater disposal systems, 90.8% of Petroșani households are connected to the public network, with very few households having private systems (4.8%) or lacking this utility entirely (4.4%). Contingency analysis highlights territorial differences that might otherwise be masked: two areas exceed the municipal average, Aeroport 2 and Centru (97% and 94.8%, respectively), two others are near the average, Aeroport 1 and Colonia (89.1% and 83.7%, respectively), while Bosnea is well below the municipal average (70.8%). Indeed, Bosnea has the highest proportion of households without access to sewerage in any form (16.7%).

The association between residential areas and access to sewerage systems is statistically significant according to the Chi-square test ( $\chi^2 = 75.022$ ;  $p < 0.001$ ), but weak in strength (Cramer's  $V = 0.201$ ), explained by the fact that only the Bosnea area shows a substantial deviation from the municipal infrastructure profile for this utility.

Concerning heating, as shown in Figure 4, most Petroșani households rely on individual systems, in the form of apartment-level boilers (58.1%) or stoves (21.8%). Very few households are connected to the district heating network (9.7%), suggesting either voluntary or forced disconnections, or degradation of the system. A marginal emergency solution is heating via stove-top appliances (1.8%), while 8.6% of households do not have any form of heating, indicating potential residential vulnerability with direct implications for comfort and quality of life, especially during the cold season.

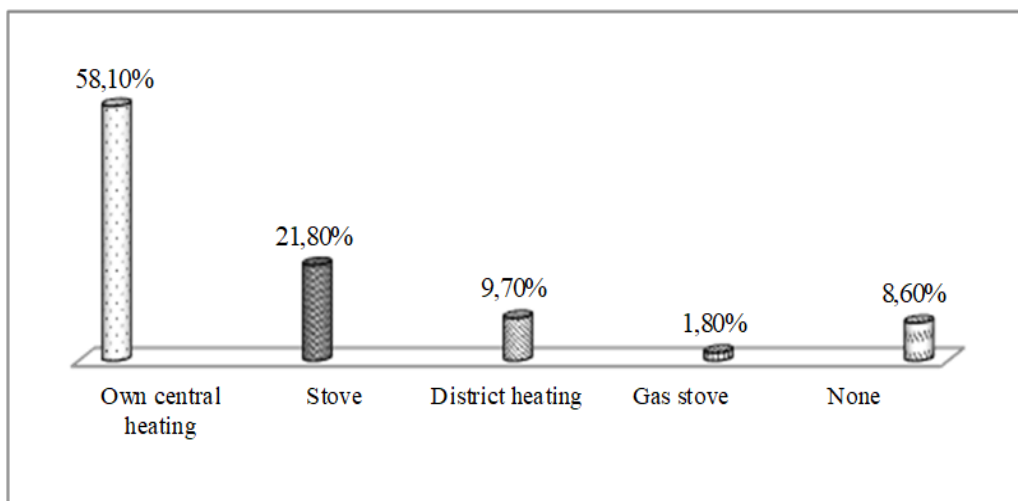


Figure 4. Residential Heating Methods

Contingency analysis further reveals patterns masked at the aggregated municipal level. The Aeroport 2 area stands out from other areas due to the extensive use of individual boilers (85.2%), compared to Aeroport 1 and Centru, where the proportion of households using individual boilers aligns with or is close to the municipal average (58.1% and 58.8%, respectively).

A deviation from the modern residential profile regarding heating is observed in the Colonie and Bosnea areas, where stoves represent the dominant heating solution (68% and 81.2%, respectively). From the perspective of a residential profile with inherited centralized infrastructure, in 2017 the Centru area stands out, with 23.2% of households still benefiting from the district heating system, followed at a considerable distance by other areas, where the shares range between 2% and 7%.

Interestingly, the area with the highest risk of housing vulnerability in terms of heating is not one of the old neighborhoods, as might have been expected, but Aeroport 1, where 23.6% of households lack any form of heating; in other areas, this risk is either non-existent or limited, such as 4.7% in Aeroport 2. Territorial disparities are statistically confirmed by the chi-square test ( $\chi^2 = 532.62$ ,  $p < 0.001$ ), indicating a statistically significant, moderately strong association (Cramer's  $V = 0.378$ ) between residential area and household heating type.

To gain concrete and objective insights into the level of comfort available to households in Petroșani, both at the aggregate and territorial levels, an infrastructural housing comfort index was constructed using SPSS. Households were assigned a value of 0 for lacking access to a utility and 1 if the utility was available, regardless of whether it was provided via a public network or a private system. The final score is cumulative, ranging from 0 to 6, reflecting access to six utilities in terms of availability, rather than technical performance, i.e., the functionality of the household. For the housing comfort index, in the absence of a universal normative threshold, we adopted an analytical threshold below which functional vulnerability begins to manifest: when the cumulative proportion of positions 5 and 6 on the scale (very high and total comfort) falls below 80%.

The aggregated distribution of the housing comfort index indicates that most households in Petroșani cluster at the upper end of the scale, with nearly three-fifths (59.6%) achieving the maximum score, corresponding to full functional comfort. Including those scoring 5, corresponding to very high comfort, the total proportion of households within a zone of adequate residential comfort reaches 86.1% (Table 3).

A contingency analysis between homeownership and the housing comfort index produced the following hierarchy (merging the top two categories for clarity): private ownership (87.8%), rented from private landlords (87%), other arrangements (75%), and rented from the state (30.7%).

The "other arrangements" category includes households residing in relatives' homes without formal rental agreements or homes in succession processes. The chi-square test confirms a statistically significant association between homeownership type and the housing comfort index (Table 4.1), of moderate strength (Table 4.2). Thus, infrastructural housing vulnerability is not primarily linked to the lack of homeownership, but rather to state-rented housing or certain "other" situations, such as improvised shelters.

Territorial differences are also evident in terms of the housing comfort index. Under the analytical threshold proposed, Aeroport 1 and Bosnea stand out (74.9% and 54.2% of households above the threshold, respectively), while the best-valued areas in terms of comfort and functionality are Aeroport 2 (97.4%), Centru (96.5%), and Colonie (82.3%) (Table 4.3).

These differences are statistically supported, with a moderate association between residential area and offered comfort, indicating that Aeroport 1 and, especially, Bosnea are at risk of infrastructural housing vulnerability (Table 4.4). Hence, the area of residence can be considered a risk factor through the accumulation of infrastructural deficits; housing vulnerability is structured territorially rather than randomly.

In Petroșani, household size distribution is concentrated around one- or two-person households (51.2%). Including three-person households brings the share of small to medium-sized households to over three-quarters (76.1%). Four-person households, and especially those with five or more persons, are less common (17.1% and 6.8%, respectively).

Nonetheless, their analytical relevance is significant, as household size can create pressures on housing conditions. Contingency analysis between household size and housing comfort index confirms the anticipated pattern: larger households (five persons or more) fall within the infrastructural housing vulnerability zone, with just over half (52.4%) achieving very high or total functional comfort (positions 5–6 on the scale).

For small and medium households, the comfort index ranges between 87.4% and 90.5% (Table 5.1). Chi-square analysis supports these findings, revealing a statistically significant, albeit weak, association between household size and infrastructural housing comfort (Table 5.2). Therefore, household size influences housing vulnerability, but not deterministically.

Monthly family income distribution in Petroșani is concentrated in the low to medium range (26.5% up to one net minimum wage, 32.7% up to two minimum wages, 27.5% up to three minimum wages). Few households receive monthly income up to four minimum wages (8.8%), and the proportion further decreases for five minimum wages (2.8%) or more than five minimum wages (1.7%).

Contingency analysis between monthly income and the housing comfort index shows that functional housing vulnerability is mostly present among households with monthly income up to one minimum wage. Only 68.4% of these households achieve functional access to utilities reflecting a modern residential profile (positions 5–6), compared with 87.5%–97.5% in higher income categories (Table 6.1). Inferential statistics confirm a weak but significant association between household income and housing comfort (Table 6.2), indicating that income affects residential comfort but is not a decisive factor; other structural factors also play a role.

## 5. CONCLUSIONS

A differentiated, multidimensional analysis of housing conditions in Petroșani shows that, beyond the aggregate picture of a relatively homogeneous residential profile in terms of utility access, infrastructural housing vulnerabilities exist, influenced by multiple factors.

- Housing tenure represents a vulnerability in the case of state-rented dwellings, with only 30.7% of these households exceeding the analytical threshold of the housing comfort index.
- Vulnerabilities exist across all city areas, but certain neighborhoods constitute risk factors due to cumulative infrastructural deficiencies, particularly Bosnea and Aeroport 1 (74.9% and 54.2% of households above the threshold, respectively).
- Household size contributes to housing vulnerability, though not determinatively. Households with five or more members face functional challenges, with only 52.4% achieving adequate comfort.
- Monthly family income affects functional housing comfort, though higher income does not guarantee total functionality. Households earning up to one minimum wage are the most vulnerable, with just over two-thirds functionally comfortable in terms of utility access.

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## APPENDIX

**Table 1.1. Residential Area and Housing Tenure (Contingency Table)**

Residential Area	Indicator	Private Ownership	Rented from State	Rented from Private	Other	Total
Aeroport 1	N	256	7	3	1	267
	%	95.9%	2.6%	1.1%	0.4%	100.0%
Aeroport 2	N	219	1	15	1	236
	%	92.8%	0.4%	6.4%	0.4%	100.0%
Centru	N	227	1	3	2	233
	%	97.4%	0.4%	1.3%	0.9%	100.0%
Colonie	N	138	7	2	0	147
	%	93.9%	4.8%	1.4%	0.0%	100.0%
Bosnea	N	38	10	0	0	48
	%	79.2%	20.8%	0.0%	0.0%	100.0%
Total	N	878	26	23	4	931
	%	94.3%	2.8%	2.5%	0.4%	100.0%

**Table 1.2. Chi-Square Test and Cramer's V for the Association Between Residential Area and Housing Tenure (N = 931)**

STATISTIC	VALUE
CHI-SQUARE ( $\chi^2$ )	90.424
DEGREES OF FREEDOM (DF)	12
SIGNIFICANCE LEVEL (P)	< 0.001
CRAMER'S V	0.180 (WEAK EFFECT)

**Table 2.1. Residential Area and Monthly Family Income (Contingency Table)**

Residential Area	Indicator	≤ 1065 lei	1066–2130 lei	2131–3195 lei	3196–4260 lei	4261–5325 lei	> 5325 lei	Total
Aeroport 1	N	71	82	75	28	7	4	267
	%	26.6%	30.7%	28.1%	10.5%	2.6%	1.5%	100.0%
Aeroport 2	N	44	84	71	25	6	6	236
	%	18.6%	35.6%	30.1%	10.6%	2.5%	2.5%	100.0%
Centru	N	44	69	84	22	10	4	233
	%	18.9%	29.6%	36.1%	9.4%	4.3%	1.7%	100.0%
Colonie	N	60	58	20	6	2	1	147
	%	40.8%	39.5%	13.6%	4.1%	1.4%	0.7%	100.0%
Bosnea	N	28	11	6	1	1	1	48
	%	58.3%	22.9%	12.5%	2.1%	2.1%	2.1%	100.0%
Total	N	247	304	256	82	26	16	931
	%	26.5%	32.7%	27.5%	8.8%	2.8%	1.7%	100.0%

**Table 2.2. Chi-Square Test and Cramer's V for the Association Between Residential Area and Monthly Family Income (N = 931)**

Statistic	Value
Chi-square ( $\chi^2$ )	79.492
Degrees of freedom (df)	20
Significance level (p)	< 0.001
Cramer's V	0.146 (weak effect)

**Table 3. Infrastructural Housing Comfort Index (6 Indicators, Cumulative Score)**

Score	Not at all	Very Low	Low	Medium	High	Very High	Total N	%
N	1	11	15	33	69	247	555	931
%	0.1%	1.2%	1.6%	3.5%	7.4%	26.5%	59.6%	100%

**Table 4.1. Housing Tenure and Infrastructural Housing Comfort Index (0–6)**

Housing Tenure	Indicator	Not at all	Very Low	Low	Medium	High	Very High	Subtotal N	Total N
Private Ownership	N	0	9	14	24	60	236	535	878
	%	0.0%	1.0%	1.6%	2.7%	6.8%	26.9%	60.9%	100%
Rented from State	N	0	2	1	7	8	7	1	26
	%	0.0%	7.7%	3.8%	26.9%	30.8%	26.9%	3.8%	100%
Rented from Private	N	0	0	0	2	1	4	16	23
	%	0.0%	0.0%	0.0%	8.7%	4.3%	17.4%	69.6%	100%
Other	N	1	0	0	0	0	0	3	4
	%	25.0%	0.0%	0.0%	0.0%	0.0%	0.0%	75.0%	100%
Total	N	1	11	15	33	69	247	555	931
	%	0.1%	1.2%	1.6%	3.5%	7.4%	26.5%	59.6%	100%

**Table 4.2. Chi-Square Test and Cramer's V for the Association Between Housing Tenure and Infrastructural Housing Comfort Index (0–6, N = 931)**

Statistic	Value
Chi-square ( $\chi^2$ )	322.720
Degrees of freedom (df)	18
Significance level (p)	< 0.001
Cramer's V	0.340 (moderate effect)

**Table 4.3. Residential Area and Infrastructural Housing Comfort Index (0–6)**

Residential Area	Indicator	Not at all	Very Low	Low	Medium	High	Very High	Subtotal N	Total N
Aeroport 1	N	1	6	8	21	31	43	157	267
	%	0.4%	2.2%	3.0%	7.9%	11.6%	16.1%	58.8%	100%
Aeroport 2	N	0	2	0	1	3	10	220	236
	%	0.0%	0.8%	0.0%	0.4%	1.3%	4.2%	93.2%	100%
Centru	N	0	0	0	2	6	56	169	233
	%	0.0%	0.0%	0.0%	0.9%	2.6%	24.0%	72.5%	100%
Colonie	N	0	1	5	3	17	113	8	147
	%	0.0%	0.7%	3.4%	2.0%	11.6%	76.9%	5.4%	100%
Bosnea	N	0	2	2	6	12	25	1	48
	%	0.0%	4.2%	4.2%	12.5%	25.0%	52.1%	2.1%	100%
Total	N	1	11	15	33	69	247	555	931
	%	0.1%	1.2%	1.6%	3.5%	7.4%	26.5%	59.6%	100%

**Table 4.4. Chi-Square Test and Cramer's V for the Association Between Residential Area and Infrastructural Housing Comfort Index (N = 931)**

Statistic	Value
Chi-square ( $\chi^2$ )	472.02
Degrees of freedom (df)	24
Significance level (p)	< 0.001
Cramer's V	0.356 (moderate effect)
Valid cases	931

**Table 5.1. Household Size and Infrastructural Housing Comfort Index (0–6)**

Household Size	Indicator	Not at all	Very Low	Low	Medium	High	Very High	Subtotal N	Total N
1–2 persons	N	1	3	6	17	33	128	289	477
	%	0.2%	0.6%	1.3%	3.6%	6.9%	26.8%	60.6%	100%
3 persons	N	0	1	2	8	11	54	156	232
	%	0.0%	0.4%	0.9%	3.4%	4.7%	23.3%	67.2%	100%
4 persons	N	0	3	2	4	8	50	92	159
	%	0.0%	1.9%	1.3%	2.5%	5.0%	31.4%	57.9%	100%
5+ persons	N	0	4	5	4	17	15	18	63
	%	0.0%	6.3%	7.9%	6.3%	27.0%	23.8%	28.6%	100%
Total	N	1	11	15	33	69	247	555	931
	%	0.1%	1.2%	1.6%	3.5%	7.4%	26.5%	59.6%	100%

**Table 5.2. Chi-Square Test and Cramer's V for the Association Between Household Size and Infrastructural Housing Comfort Index (0–6, N = 931)**

Statistic	Value
Chi-square ( $\chi^2$ )	88.365
Degrees of freedom (df)	18
Significance level (p)	< 0.001
Cramer's V	0.178 (weak effect)

**Table 6.1. Monthly Net Family Income and Infrastructural Housing Comfort Index (0-6)**

Monthly Income	Indicator	Not at all	Very Low	Low	Medium	High	Very High	Subtotal N	Total N
≤ 1065 lei	N	1	8	14	20	35	79	90	247
	%	0.4%	3.2%	5.7%	8.1%	14.2%	32.0%	36.4%	100%
1066–2130 lei	N	0	2	1	10	25	86	180	304
	%	0.0%	0.7%	0.3%	3.3%	8.2%	28.3%	59.2%	100%
2131–3195 lei	N	0	1	0	3	5	57	190	256
	%	0.0%	0.4%	0.0%	1.2%	2.0%	22.3%	74.2%	100%
3196–4260 lei	N	0	0	0	0	2	18	62	82
	%	0.0%	0.0%	0.0%	0.0%	2.4%	22.0%	75.6%	100%
4261–5325 lei	N	0	0	0	0	1	5	20	26
	%	0.0%	0.0%	0.0%	0.0%	3.8%	19.2%	76.9%	100%
> 5325 lei	N	0	0	0	0	1	2	13	16
	%	0.0%	0.0%	0.0%	0.0%	6.2%	12.5%	81.2%	100%
Total	N	1	11	15	33	69	247	555	931
	%	0.1%	1.2%	1.6%	3.5%	7.4%	26.5%	59.6%	100%

**Table 6.2. Chi-Square Test and Cramer's V for the Association Between Monthly Net Family Income and Infrastructural Housing Comfort Index (0–6, N = 931)**

Statistic	Value
Chi-square ( $\chi^2$ )	146.303
Degrees of freedom (df)	30
Significance level (p)	< 0.001
Cramer's V	0.177 (weak effect)