REVERTER

Brezovo, Bulgaria

Roadmap II (2024)

Multi-Family Buildings in Brezovo

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Area characteristics

The Municipality of Brezovo is located in the transitional-continental climate zone - warm summers and mild winters are present. Average January temperatures are positive, while average July temperatures vary between 22-24 °C. Precipitation has a pronounced autumn-winter maximum. The annual amount is about 500 mm/m^2. The prevailing winds are westerly with an average annual speed of 1.1 m/s.

Characteristic for the western parts of the climatic region of Eastern Central Bulgaria, where Brezovo is located, are the mild winter with frequent warming under the influence of Mediterranean cyclones and the protective effect of Stara Planina in relation to the invasions of cold continental air, as well as hot summer with a small temperature amplitude and relatively low relative air humidity.

Seasonal precipitation amounts in the area almost equalize, with the maximum often occurring in spring and autumn, which indicates a transition to a Mediterranean-continental climate regime, more pronounced in the southern parts of the municipality. Under the influence of warm air masses the winter is warm and mild. As a result of the rapid rise in temperatures at the end of winter, spring starts early. The average temperature in October is 2-3 °C higher than in April. The average annual temperature is 12.5 °C, and the average January temperature is 0.2 °C. The average daily temperature at the beginning of March exceeds 5 °C, and at the beginning of April it is 10 °C.

- The average annual air temperature is 11.4 °C.
- The average annual maximum air temperature is 16.9 °C, and the minimum is 5.7 °C.
- The average monthly air temperature is 11.2 °C.
- Average monthly relative air humidity is 74%.

Precipitation depends on the characteristics of atmospheric circulation, altitude and landforms.

Population characteristics

According to data from Census 2021, Brezovo Municipality has 16 settlements with a total population of 6170 inhabitants. Of these, 1,604 people live in the city of Brezovo, and the remaining 4,696 live in the surrounding villages. The predominant ethnic group is Bulgarians. There is a total of 3,241 people of working age, of which 1,839 are men and 1,402 are women. The reduction of the population in the last 10 years is clearly outlined. In numbers, it has decreased in 2021 from the previous national census in 2011 by 1128 people or 15.4%.

The conclusion of the analysis of the population census by age is that the population is ageing. The highest number of the population is occupied by people over 70 years (Figure 1).

The conclusion of the analysis of the population census by age is that the population is ageing. The trend in population dynamics is characterized by a decrease in the population and, respectively, the number of households.

According to the Municipal action plan for the period 2021-2023, the Municipality of Brezovo has an unfavorable socio-demographic structure. The plan states that unemployment among the able-bodied population in the municipality is 20%. This is an important economic and social problem, which probably affects many spheres of life of the people in the municipality. According to the plan, only three people found work through the Regional Employment Program. This fact may indicate limited opportunities for employment and economic development in the region, which may be a challenge to increase employment. Based on Eurostat indicators, about 30% of the population in the municipality are below the poverty line.

Housing characteristics

In 2021, there were a total of 6,422 dwellings in the Municipality of Brezovo. As can be seen from the figure below, among the total dwellings, 2,679 (42%) were used for permanent or usual residence. There were 2,315 (36%) dwellings designated for seasonal or vacation residence. According to the Census data, there were 2 cases where apartments were classified as "collective", which refer to housing units shared by multiple unrelated individuals or families. The Census analysis indicates that there were 1,426 (22%) apartments unoccupied for reasons other than being a seasonal or vacation residence. This category may include vacant properties for various reasons, such as being in the process of sale, renovation, or other non-residential purposes.

The total number of households in the Municipality of Brezovo is 2,774, which is almost close to the number of dwellings for permanent use, and the ratio of the two figures is 1.035.

Table 1. Number of households and household members.

Households and number of members as of 07.09.2021							
Number of persons in the household	1	2	3	4	5	6 and more	Total
Brezovo	1098	886	341	222	116	111	2774

The majority of dwellings are private single houses with low levels of efficiency (>95%). In 2019, the final energy consumption of the Municipality was estimated at 44.85 GWh. The housing sector is responsible for 26.64 GWh of the total energy consumption, taking the largest share or 59.4%. The use of raw wood for domestic heating is dominant (47%), followed by electricity (39%) and coal (12%). This is a prerequisite for high PM pollution during the heating season. The housing sector is responsible for 10,247 tons of greenhouse emissions. The technical potential of the possible recovery of the waste streams from the agricultural sector and animal waste is calculated for the production of 5,900 MWth. The Municipality is also rich in forestry. Residual biomass from logging is equal to 7,460 tons of wood, whose energy equivalent is equal to 38,250 MWh of heat.

According to the Municipal Energy Efficiency Program, the residential sector of the municipality of Brezovo occupies the largest percentage of the municipality's final energy consumption – 59.4%, consuming a total of 26.6 GWh of energy. Looking at the percentage of energy sources used, the dominant use is for raw wood for heating (47%), followed by the consumption of electricity (39%) and coal (12%). Heating is based mostly on the use of wood and coal and a minor share of electricity. The high levels of use of wood and coal are a prerequisite for influencing the air quality in Brezovo.

Table 1. Number of residential buildings.

Total number of residential buildings	Number of households using woods and coal for heating	Number of households using wooden pellets for heating	Number of households using electricity for heating
2710	2249	54	407

Table 2. Final energy consumption by energy source.

Energy Source	Final energy consumption MWh/y	Distribution of the energy sources in Residential buildings, %
Electricity	10466,3	39,3%
Woods	12594,4	47,3%
Coal	3148,6	11,8%
Pellets	432	1,6%
Total	26641,3	

The results from the National Census show that 74% of the dwellings in Brezovo have no renewed windows, and 91% of the dwellings are without insulation.

For this roadmap, only the two multi-family residential buildings are considered, which are briefly described hereinafter (Figure 3- 4).

MULTIFAMILY RESIDENTIAL BUILDINGS

MFB 1 - there are three sections in the building: The three sections have 3 floors each.
Total built-up area for the building - 1 794 m^2

MFB 2 consists of two sections of 4 floors, each section with six apartments.
Total built-up area for the building - 1 380 m^2

The dominance of brick constructions, both with concrete slabs and joists (without reinforced concrete), signifies a reliance on traditional building materials and methods in the region. This is typical of the region's historical construction practices and the availability of locally sourced materials.

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Energy poverty status

As shown in **Error! Reference source not found.**5, the share of population living in a dwelling with leaks, damp or rot in the area of the Bulgarian pilot is higher than the national share (almost by 1-2%). The same is true for the share of population not able to keep home adequately warm. However, the difference decreases over the years (i.e., from 8.9% in 2017 to 1.5% in 2021). In contrast, the share of population having arrears on utility bills is lower in the pilot area compared to the national indicator. Again, the difference decreases over the years (i.e., from 10.3% in 2019 to 3.1% in 2021). In general, it appears that

the consensual EP indicators in the pilot area are approaching the corresponding national indicators over time and, as is the case nationally, are improving.

In order to explore whether certain housing characteristics and households' living conditions are related to EP vulnerability, the difference in EP rates of the investigated indicators relative to their average rate in the pilot area was examined.

Households living in large buildings are less prone to arrears and more capable of keeping their apartments adequately warm compared to those living in small buildings, detached or semi-detached houses. Also, those living in small buildings face higher problems with leaks. These findings can be related to the fact that a large part of detached houses was built before the introduction of national energy efficiency legislation, while a large part of multi-family residential buildings was built after 1960, when the first norms and requirements for energy efficiency were introduced.

The size of the house is also associated with the three basic EP indicators. Those living in one- or two-room houses have higher EP rates compared to the average, while those living in houses with four or more rooms have lower EP rates. Again, the most likely explanation for this result is the difference in income. For example, the average income of the households that live in one- or two-room houses ranges between 3,200-4,200 EUR, while the average income of the households living in houses with more than four rooms is more than 9,500 EUR, on average.

Households experiencing great difficulty in making ends meet have differences in EP rates of up to 30% compared to the average rates. On the contrary, those who can pay easily for their usual necessary expenses have quite lower EP rates (e.g., differences from the average of more than 30% in the ability to keep their houses warm).

Willingness to participate in energy retrofit actions

82% of the total households in Brezovo have implemented new energy efficient windows and doors, but only 40% have wall/ceiling insulation. 63% have installed energy-saving lamps and 39% have new energy efficient appliances. Regarding the RES installations in the households, 4% have installed solar water heater and 7% have PV panels on the roof. Surprisingly, only 3% indicated that they had new heating or cooling sources, but this may be due to deep-seated habits of using wood stoves and reluctance to change habits.

According to the Social Survey in D3.2. , 96% of the respondents haven't participated in any subsidy programs for energy efficiency. Asked if they had not participated in funding programs, whether they would participate in the future, 67% answered positively, but a quarter answered that they would not participate.

Asked about the reasons for not applying for financing programs for energy saving measures, more than a half (62%) indicated that they don't know about any programs (Figure 8). This is one of the key findings of the analysis to focus on raising awareness of funding opportunities. Interesting that no small part - 22% have answered that they don't think that this will reduce their energy costs. This means again that more information campaigns should be focused among the population. It also turns out that the worry of excessive bureaucracy and administrative obstacles in the participation and implementation of energy efficiency measures under financing programs is not a small problem – 19% have answered about this reason.

Asked if they plan EE measures, and if so, what value they are willing to pay, 81% of the households have indicated that they don't know (meaning that they are not planning, or don't thinking about energy efficiency in their homes). Only 10% indicated that they are willing to pay less than 100 BGN (or 50 EUR) per month and 5% are willing to pay between 100-200BGN (50-100 EUR).

This is also a clear sign that emphasis should be placed on raising awareness among citizens, working on their involvement and encouraging them to be involved in EE programs and to be supported in the overall renewal process.

Renovations triggered by REVERTER

REVERTER is expected to contribute to the renovation of multi-family buildings in the period of five years after the completion of the project (2026-2030) through the establishment and operation of the physical and digital one-stop shops, visits to homes of energy-poor households by REVERTER Ambassadors who will inform them about energy renovation issues and awareness-raising and training activities that will reinforce the existing level of knowledge of energy-poor households.

As mentioned, there are two multi-family buildings, with about 30 households. They will be reached by social engagement events, media campaigns and home visits, and will be invited to visit the OSS. Considering that the Bulgarian legislation, and more specifically the Law for territorial planning, requires to renovate the whole building and that the National Decarbonization Fund will support energy-poor households with 100% financing, it is envisaged that all energy-poor households will participate.

The contribution of the REVERTER project, including post-project period, is summarised in Table 1.

Table 1. Contribution of REVERTER project to the implementation of the specific roadmap for the renovation of the two multi-family buildings in the period 2026-2030.

Impacts	Energy-poor households Tenants – Multi-family houses-Apartments (MFB)
Number of renovated dwellings	**24**
Resulted cumulative final energy savings (GWh)	0.174
Resulted cumulative primary energy savings (GWh)	0.321
Resulted cumulative CO$_2$ reduction (ktn CO$_2$)	0.058
Resulted employment impacts (person-years)	9.4
Resulted cumulative multiple benefits (million €)	0.0037
Required new investments (million €)	**0.6**

The REVERTER project

The REVERTER stands for Deep REnovation roadmaps to decrease households VulnERability to Energy poveRty. The REVERTER project is funded under the LIFE Programme with under the Grant Agreement No 101076277.

9 Roadmaps

The roadmaps are tailor-made to the characteristics of the building stock, the characteristics of the vulnerable households and the climate conditions, to cover a sufficiently cohesive group of cases that will allow for a larger-scale rollout and replication of the proposed actions for the effective analysis and tackling of the problem. The roadmaps will target the worst-performing homes first ("worst first" principle), will cope with split-incentive dilemmas and will address market, information and behavioural failures through the creation of "one-stop shops" (OSS) in 4 countries as defaults for the enrolment of vulnerable households in subsidised energy efficiency improvement programmes for buildings.