DELIVERABLE D5.2

ANALYSIS OF HOUSEHOLDS' FINANCIAL CAPACITY IN FOUR PILOT AREAS

Task 5.2 Mapping of households' financial capacity: risk analysis per target group

The PadovaFIT Expanded project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 847143.

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LIST OF ABBREVIATIONS

OSS	One Stop Shop
Consortium	Municipality of Padova, Università Commerciale Luigi Bocconi, SINLOC S.p.A., Sogesca S.r.l., Forum per la Finanza Sostenibile, Climate Alliance, Municipality of Timisoara, Energy Agency of Plovdiv
CPD	Municipality of Padova
Uni Bocconi	Università Commerciale Luigi Bocconi
FFS	Forum per la Finanza Sostenibile
EE	Energy Efficiency

SCOPE OF WORK

SINLOC leads task 5.2, with contributions also from CPD and other consortium partners since WP2, WP3 and WP4 are all interconnected and thus influencing each other in accomplishing their specific goals. In fact, they contribute to the definition of the framework in which the OSSs are going to operate, looking at the picture from different angles. This kind of preparatory analysis is fundamental to successfully implement the OSS.

In particular, Task 5.2 aim is twofold. On one hand, the activities are oriented to the identification of all possible risks and barriers that could undermine the deployment of energy solutions and of sustainable and bankable interventions. The nature of risks is variegated, going from technical issues, low awareness of the population about renewable energy, information asymmetry between tenants and owners, risk aversion and so on. These factors have different level of riskiness; therefore, it is important to identify these layers. After that, risks will be combined with the relative probability of occurrence and expected impact, in order to have a matrix that matches risks and their levels with clusters of households or other actors.

On the other, this task is dedicated to collect all the possible economic and financial information about households in the pilot areas of Padova (Italy), Timisoara (Romania), Vidin and Smolyan (Bulgaria). This is so in order to gather useful insights for the implementation of a One-Stop-Shop which will occur at first in Padova, and later in Timisoara. Bulgaria will take the lessons learnt in these experiences and replicate the model in its Action Plans.

Mapping households' financial capacity is crucial in order to set-up services which take into adequate consideration the economic status of people beneficiaries of the interventions developed through the OSS. The analysis is based on the aggregation of different parameters, in order to have the best possible picture of the reality. These are: contract type (ownership vs leasing), amount of rental fee, Equivalent economic status Indicator, average delays of bills, energy certification per energy class, average annual expenditure for gas and electric energy consumptions and residual mortgages and duration. Nevertheless, the availability of data is heterogeneous. In theory, it would be optimal to have them for each householder; in reality, mainly due to privacy constraints, the analysis stops at different levels: national, regional or provincial/municipal.

The results of this analysis are necessary also for the interviews that will be developed in the following Task 5.3, concerning the involvement of relevant financial players, and Task 5.4 related to the identification of case studies.

In addition, the characterization of the pilot areas and their households should not ignore the geographical characteristics of the cities, which are essential to better understand needs and peculiarities. Therefore, a general overview of territorial/geographical characteristics is provided for each pilot area. In particular, Task 4.2 aims at developing a map of the building stock and energy-related data and needs. In the further tasks, the analysis will be combined and integrated, achieving an integrated output which represents the input for the activities foreseen in Task 2.2, related to the strategic assessment.

The report is structured as follows:

- Chapter 1 describes the methodological approach to be adopted when developing the risk analysis. In particular, it identifies the risk factors potentially affecting the development of a OSS and defines a matrix to further develop the analysis;

- Chapter 2 regards the pilot area of Padova. It presents the general overview of the Province of Padova, and implies the mapping and analysis of households' financial capacity, through the detection of relevant features on the economic status of people living in the pilot area;

- Chapter 3 is focused on Timisoara pilot area, presenting the characteristics of the city starting from the same features collected in Padova and applying the same methodology. The analysis results in a preliminary step for the identification of potential target groups for the OSS, which could be enriched with future studies before the implementation of the OSS;

- Chapter 4 represents a first-step towards the identification of target clients of the OSS to be implemented in Bulgaria, retrieving the same methodology applied in Padova and Timisoara. The output feeds into the Action Plan for Vidin and Smolyan.

1. DEFINITION OF THE METHODOLOGICAL APPROACH FOR RISK ANALYSIS

Setting a One-Stop-Shop is a complex process which should take into consideration different factors that could foster or obstacle its implementation.

The first step to be accomplished for those players willing to implement a One-Stop-Shop is understanding the context in which they are going to operate. In this sense, a risk matrix may represent a useful tool to investigate the main barriers/opportunities existing in the market at a local level.

The analysis will be developed in 2 steps:

- **Risk recognition** | In this step, all relevant risks will be identified. In particular, starting from a general list mapping typical categories of risk factors, relevant risks are identified. Risks may be related to the implementation of energy efficiency solutions (designing and construction phase) and to the social, economic and regulatory environment. Risks will be divided on the basis of their nature and, for each category, a series of general risks that are usually associated and their detailed description are defined.

- **Structuring of a risk matrix** | Once all relevant risks are identified, a risk matrix will be structured. The matrix will associate to each risk information about *(i)* its probability of occurrence, and *(ii)* measure of impact, resulting in an overall estimation of the riskiness of each factor. In addition, for each risk the subject who bares it will be identified.

1.1. Risks recognition

Generally speaking, the risk analysis starts from the recognition of all relevant risks affecting the project. Typical categories of risks are the following:

- Regulatory
- Construction
- Market
- Operational & technological
- Counterparty
- Bankability
- Behavioural
- Other

When referring to private buildings, mainly if residential, the deployment of energy efficiency solutions may encounter several barriers in its implementation phase. Most of these barriers are related to the final beneficiaries of the interventions, i.e. householders and tenants, both in terms of behavioural aspects of their decision-making process and financiability of the interventions.

In fact, it is well-known how new solutions in the market are often difficult to spread due to the difficulties incurred in making people understand their benefits and the related potential savings and impacts.

On the other hand, to successfully design an OSS, it is crucial to identify solutions ("stand-alone" or packages of interventions) which can adequately respond to the needs at local level but are – in at the same time – affordable for the tenants.

The main risks identified in this preliminary phase are reported below.

1.1.1. REGULATORY

This risk generally refers to changes in the regulatory framework affecting a specific sector and/or country. Regulatory risk related to EE investments exists at different level of government. At European level, there exist a set of Energy Directives to steer the real estate markets toward efficiency. National governments and regional and local authorities implement these directives and standards with different timing and instruments[1]. Thus, changes in government policies can arise from different prospective and be addressed to several issues. In

[1] Stevens, D., Fuerst, F., Adan, H., Brounen, D., Kavarnou, D., and Sigh, R. (2018), Risks and Uncertainties Associated with Residential Energy Efficiency Investments, SSRN Scholarly Paper ID 3254854, Social Science Research Network, Rochester, NY

concrete terms, they can be represented in an increasing adjustment in energy rating standards, resulting in downgraded properties and consequent negative price impacts. Moreover, real estate values are influenced also by changes in planning, zoning, and transport policies.

Regulatory risks

- Changes in subsidy / incentives programs
- Unfavorable financing regulation
- Conflicting guidelines
- Changing regulation on financial markets

The influence can be negative and results in decreasing prices if, for example, mobility and accessibility is reduced in the area. When these factors are fostered, prices tend to increase. Despite not directly addressed to the residential sector, some climate policies may indirectly affect price trends in housing markets including part of a larger energy policy plan. Moreover, regulatory risk also is associated with the revision of building codes, cancellation of subsidies or incentives schemes offered to promoters. These changes can materially impact on operating costs, the attractiveness of an investment and the competitiveness of the sector.

1.1.2. CONSTRUCTION

Construction risks involve unpredictable negative impacts or uncertainties concerning technical features of the projects. These may be related both to the design and the construction phase. More in details, during the design phase negative externalities can occur with reference to the quality and the timing of the project design. Examples are the occurrence of necessary design changes resulting from design errors or omissions, and risks of delays that could affect the expected timing and consequently the following operational phase. These externalities result in an increase of estimated costs, in particular in terms of capital. Needs of additional capital injections may arise also in case of increase in construction costs related to the ongoing/scheduled investments. Similarly, delays in the estimated investments time schedule could result in an increase in estimated expenditure and in a reduction of margin or penalties according to the contract.

Construction risks

- Delays in designing and design errors
- Increasing construction Costs
- Delays in construction

1.1.3. MARKET

Market risks are usually not related to project features and for this reason tend to be uncontrollable, also called extrinsic[2]. They include volatile energy price, changing in the inflation rate, increase in O&M/subcontracts costs and raw materials costs. Despite being extrinsic, some of them can be managed through hedging strategies and/or by means of contracting. In particular, volatility in energy price impacts both on the life cycle cost of an EE project and on the expected returns of the investment, affecting the expected energy savings.

Market risks

- Increase/Decrease in energy price
- Changing inflation rate
- Increase in O&M / subcontracts costs and raw materials costs

[2] Hill, Daniel R. (2019), Energy Efficiency Financing: a review of risks and uncertainties, presented at the 16th IAEE European Conference

1.1.4. OPERATIONAL & TECHNOLOGICAL

Operational / Technological risks

- Underperformance
- Increasing maintenance work

Operational and technological risks refer to uncertainties in operational and technological features of the intervention. These can involve malfunctioning in the lifespan on the installed equipment, underperformance or early plant obsolescence, as well as higher frequency of maintenance work. Such risky factors can lead to obvious higher costs of the EE intervention, for example due to the need of installing new equipment to replace the defective one or providing additional and unexpected maintenance in order to assure the right functioning. In addition to this, the impact may be worsened if we consider possible delays in the construction/implementation phase of the project, adjustments in the expected energy savings and additional costs in terms of time lost. However, it is worth saying that technological risks are often project-specific. In fact, the level of risk referred to technological aspects is strictly related to the maturity of the technology itself. Thus, technological risks can be stressed in case of a new technology installed, since future maintenance costs can be high and uncertain. In addition, as in every sector in the market, price of technological advancements is likely to reduce over time. The first occupiers are likely to pay the higher price, which is an unavoidable fact in the short-term investment amount but eventually will reduce the price premium in the future when comparable improvements can be made at a fraction of today's costs.

1.1.5. COUNTERPARTY

Counterparty risk can manifest in negative impact occurring in the relation with other parties involved in EE intervention, i.e. O&M subcontractors, electricity suppliers or householders themselves. When referring to subcontractors, risky factors are related to the fact that they could negatively affect the proper functioning of systems, which could result in higher operating costs. This is true for example in case of default/withdrawal of the local maintenance operator or equipment underperformance due to faults or improper management. Similarly, electricity supplier can be linked with default risk. Furthermore, this risk can manifest also in respect to the ESCO or the householder, exposing the counterparty to risk of monetary losses (i.e. the ESCO is not paid for its intervention) or uncompleted equipment installed.

Counterparty risks

- O&M subcontractors
- Electricity supplier
- Householder/ESCO

1.1.6. BANKABILITY

Speaking of EE in residential sector, bankability issues are even more emphasized in respect, for example, to EE investments in public buildings. This is because of high risk aversion characterising all the parties involved.

Bankability risks

- Householders' risk profile
- Low sustainability
- Small size
- Complexity of typical EE contractual arrangement
- Cost of finance
- High risk aversion of all parties involved

EE interventions are perceived as risky investments from the financers point of view maybe because of their small size, difficulty to control end-users' behaviours and the uncertainties related to future energy prices. In particular, EE interventions in the residential sector are often small size, investments, which cannot reach an adequate critical mass to assure sustainability and interesting returns. In addition, being the counterparty private, householders' risk profile has to be taken into account. Commercial bankers typically pick investments which are safest and grant medium return on investments. From the householders' prospective, these investments are viewed as risky due to the complexity typically related to EE contractual arrangement, which can be difficult to understand for a non-expert. Moreover, risks are related to the cost of finance, i.e. to the variability, for example if fluctuating loans.

1.1.7. BEHAVIOURAL

Behavioural risks are mainly related to householders' characteristics and their decision making-process. First of all, unawareness and information obstacles. Unawareness of potential economic benefits and existing financial solutions is common among end-users and stakeholders. Actually, it is possible to identify three forms of this barrier: the asymmetric information, the unavailability of information and its highly level of technicality which makes it difficult for non-experts to understand. In fact, access to information on EE is still difficult both because companies operating in this sector are reluctant to share it (i.e. there are still some monopolists in the market) and people are not ready to receive it, mainly due to its technical aspects. In addition, one of the most common obstacles is the lack of trust of stakeholders, which is again linked to the lack of knowledge about these issues. Given all these aspects, people are somehow afraid of taking EE-related decisions, and even if they are willing to, they do not know how to do it. In addition to this, people are used to think at energy efficiency interventions with no urge, given the fact that often energy expenditures are low relative to other costs. This can be identified as "low priority" risk: people tend to ignore these issues while focusing on what they feel as more relevant, i.e. cars, safety, comfort, etc. In other words, people not only have low incentive to invest in energy efficiency in their homes, but often estimate the benefits from energy saving to be outweighed by the transaction costs (i.e. costs of collecting information and installing new equipment)[3].

Behavioural risks

- Unawareness and information obstacle
- Low priority
- Difficult decision-making process
- Agency dilemma
- Bad habits

When talking about EE interventions in the private sector, it should be considered that a large share of the residential stock is represented by condominiums. In this respect, the difficulties previously identified for individuals are amplified, making the decision-making a long-run process.

[3] IEA, 2008. Promoting Energy Efficiency Investments: Case Studies in the Residential Sector, International Energy Agency, http://www.iea.org/textbase/nppdf/free/2008/PromotingEE2008.pdf, web access on October, 2019

Furthermore, the so-called agency dilemma or principal-agent problem is a relevant issue. It corresponds to split incentives when the tenant and the owner are different persons. This happens in the majority of the cases resulting in different point of views and priorities also in relation to EE issues. In concrete terms, the tenant can be seen to be responsible for the energy bills. In this case, the owner will be incentivized to provide least-first-cost equipment which means relatively low energy efficiency. On the other hand, even the tenant will not be willing to invest in EE interventions from which he could benefit only for a limited time. Considering this, both players may not be interested in EE interventions.

Finally, householders' bad behaviour is another risky factor to be taken into account. In fact, the improper utilization on EE installed equipment or bad habits can lead to lower energy savings than those potentially achievable, resulting also in lower fees for the ESCO. For example, customer habit of maintaining a high indoor temperature, or leaving the window opened with heating or ac on, can create difficulties to prove energy savings.

However, this risk can be easily mitigated by technological installations, such as presence detectors, door/window sensors or sensors to detect water leakage.

1.1.8. OTHERS

This category includes uncontrollable adverse factors related for example to natural events, thus the risk of damage to the equipment caused by natural phenomena, and thefts or acts of vandalism. These risks may be mitigated with insurances.

Other risks

- Natural events
- Thefts and acts of vandalism

One way to overcome some of the above-mentioned issues is to introduce one-stop-shop business models where a single actor offers full-service holistic renovation packages including consulting, independent energy audit, renovation work, follow-up (independent quality control and commissioning) and, financing.

1.2. Structuring of the risk matrix

After the identification of relevant risks, the second step consists in structuring the risk matrix. To do so, each risk is evaluated in respect to its probability of occurrence, scaled from 1 to 5, thus from the lowest to the highest. The same is done for the estimated impact that the occurrence of the specific risk can have on the project under analysis. Each value describes different situation:

1. *minimum risk:* the estimated impact/probability to incur in the risky event is very low and remote, contractual clauses that manage risk are strong
2. *low risk:* the estimated impact/probability to incur in the risky event is low but possible, contractual clauses that manage risk are strong
3. *medium risk:* the estimated impact/probability to incur in the risky event is low, contractual clauses that manage risk are strong, unless it is probable that the event would occur during the concession time
4. *high risk:* the estimated impact/probability to incur in the risky event is very low and remote, contractual clauses that manage risk leave room for possible delays during the implementation of the project and even more expenses
5. *maximum risk:* the estimated impact/probability to incur in the risky event is medium, contractual clauses that manage risk leave room for possible delays during the implementation of the project and even more expenses

From the joint analysis of these two aspects, each risk is appointed with a synthetic indicator of its probability and impact.

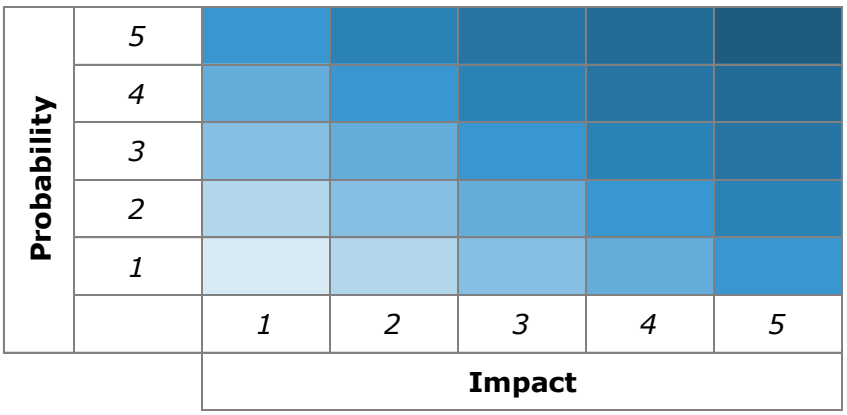


Figure 1 - Probability-Impact matrix

As we can see from the figure, some risks are expected to have a low impact and relatively low probability to incur; on the opposite, other risks are more critical having a high probability of occurrence and a grave impact.

In order to structure the matrix, it is necessary to define on whom each risk is impacting. In fact, the identified risky factors can affect different clusters of players involved in EE interventions, namely technical and financial players and householders. It is important to understand who bares the risks in order to allocate them correctly, i.e. when defining contractual clauses.

At this stage of the project, the OSS and its services are still in the process to be structured in details. Thus, deeper analysis could be developed once the structure is defined. In particular, the final step to complete the matrix, the risk allocation, will be implemented in the future, considering the following clusters of players:

- Households;
- Project designers;
- Technical players (i.e. Esco);
- Financial players.

Category	Issues	Risk
REGULATORY	Changes in subsidy/incentives programs, unfavorable financing regulation, conflicting guidelines, changing regulation on financial markets	
CONSTRUCTION	Delays in designing and design errors, Increasing construction Costs, Delays in construction	
MARKET	Increase/Decrease in energy price, Changing inflation rate, Increase in O&M/subcontracts costs and raw materials costs	
OPERATIONAL & TECHNOLOGICAL	Underperfomance, increasing maintenance work	
COUNTERPARTY	O&M subcontractors, electricity supplier	
BANKABILITY	Householders' risk profile, low sustainability, small size, complexity of typical EE contractual arrangement, cost of finance, high risk aversion of all parties involved	
BEHAVIOURAL	Unawareness and information obstacle, Low priority, Difficult decision-making process, Agency dilemma	
OTHERS	Natural events, Thiefts and acts of vandalism	

Figure 2 - Risk Matrix Draft

2. PADOVA PILOT AREA

Province of padova – General overview

In Chapter 2, the analysis focuses on the Metropolitan Area of Padova, its core is the Municipality of the Province. Therefore, to have a complete picture of the territorial distribution, it is necessary to map the province in its entirety, and then concentrate on the Municipality of Padova. So, the following description shows the setting of the city in terms of number and location of municipalities, population distribution and transport network. The approach starts from the generic to the specific, in order to better understand the final focus.

Padova is one of the seven provinces in Veneto. The citizens living therein are 937,908[4], the highest value in Veneto. Moreover, considering the geographical extension of 2,144.15 km², Padova has also the highest density, calculated as number of residents over km², that is 437. In respect to the other provinces, the distance is only 30 minutes by car from Venezia and Vicenza (one hour from the Asiago plateau), 50 minutes from Treviso and Verona (60 minutes from the famous Garda Lake), one hour from Rovigo and 90 minutes from Belluno.

From an artistic point of view, Padova is rich of monuments, paintings and historical places. Moreover, it is important even from a religious perspective; indeed, Basilica del Santo is a popular destination that welcomes many visitors during the year (more than 3 million in 2018), especially on 13th June.

The city is composed of 102 municipalities, situated in 12 macro areas: Camposampierese, Alta Padovana, Medio Brenta, Padova Sud-Ovest, Colli Euganei Nord, Colli Euganei Sud, Montagnanese, Padova Sud, Bassa Padova, Conselvano, Piovese, Padova città e Padova nord-est.

[4] Data at 2019 from Istat – Istituto Nazionale di Statistica

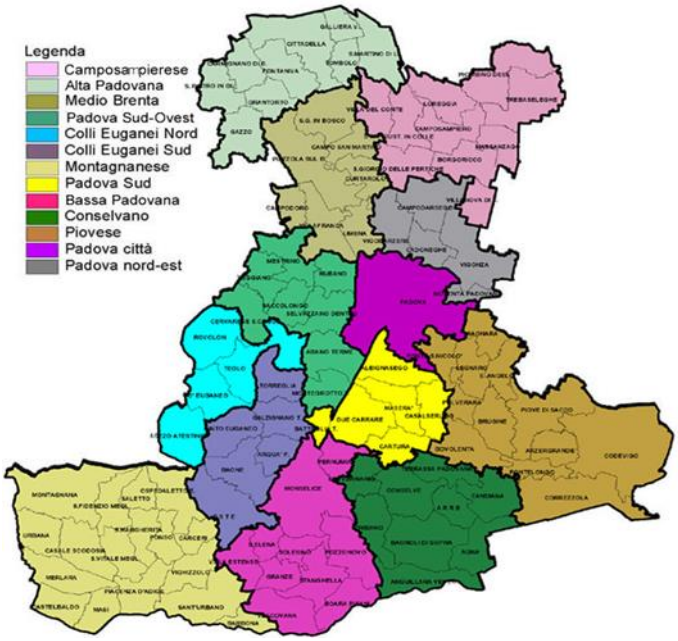


Figure 3 - The Province of Padova and its municipalities

The Municipality of Padova

Going into a deeper analysis, the most important aspect to analyse is the territorial configuration of the municipality, as it reverses on how the population is distributed not only therein, but also at provincial level.

Indeed, this structure, derived from the development along the historical road axes, follows a radially distribution based on two rings: one ring road goes externally to the ancient walls, the other is tangent and sometimes it gets into the centre of the city, following the railway track. Furthermore, the municipality is surrounded at North and West by the railway, while in the East and South it is limited by the two rivers Brenta and Bacchiglione, that are connected by a dense network of channels, some of these still navigable, bridges and overpasses that mark the territory and delimit the entry and exit from the city.

This configuration has several consequences on the distribution of the population in the Province. The municipality of Padova is, more or less, in the middle of the city. Its population is made of 212,000 inhabitants, so more than 20% is concentrated in the municipality, unless the area is certainly not even close to the 20% of the total, in fact it is only 92.85 km². Considering all the municipalities in the region, the extension is ranked only 24, even though it is the municipality of a province; whereas it is third for population. This peculiarity brings Padova to the highest density value in Veneto at municipality level (2,281.5 inhabitants per km²).

Furthermore, considering the municipalities surrounding the centre (for example Albignasego, Limena) the density remains at high level, as population decide to concentrate along transport networks. In fact, the greater the distance from the municipalities of Padova, the lower the density, due to the less developed transports.

Regarding the territorial subdivision of the municipality, the Town Council has identified six neighbourhoods, namely Q1 Centre, Q2 North, Q3 East, Q4 South-East, Q5 South-West, Q6 West.

Looking at the numbers of residents in these 6 areas, there is evidence of heterogeneous distribution, going from 46,833 people in Q4 and about one half, 25,954 in Q1. However, the density is higher in the latter case, as the picture shows, the superficies of Centre is less than a half of South-East. Therefore, even density is different among the 6 zones. Indeed, there are different reality within the neighbourhood, as in Q3 there are industries that cover the majority of the areas, thus reducing density, whereas in Q6 and Q5 there are more green areas and fields for agriculture.

Figure 4 - The Municipality of Padova and its neighbourhoods

2.1. Mapping and analysis of households' financial capacity

Given the context in which the OSS is going to be implemented, the activities focus on mapping and analysing householders' financial capacity.

The methodology behind this task is the following:

- Defining the checklist of all the characteristics that could provide evidence of householders' financial capacity;
- Sharing required data input with CPD, that could provide the requested information;
- Starting data collection, from CPD response to the previous request, other online databases or other offices;
- Data analysis;
- Aggregating results from the analysis.

In order to accomplish this task, the Consortium decided to define a checklist on relevant features to gather useful data. At this point, the goal is to have as more details as possible. This because the deeper the analysis the better the quality of the result of the study.

In particular, the aim is to gain information on householders, who are the beneficiaries of the activities of the OSS and shall bare EE investments. Thus, their financial capacity is on one hand the focus to evaluate the

financiability of the intervention from the financial players' point of view; on the other hand, it is a key element to adequately define the services offered by the OSS.

Going into more details concerning the checklist, from the financial point of view relevant data identified by the consortium are:

- Contract type (ownership or lease)
- Amount of rental fee
- Equivalent Economic Status Indicator (or similar)
- Average delay of bills
- Average late bills payment (percentage or amount)
- Building permits, commencement notice (or similar) released according to type of intervention:
    - New construction
    - Renovation
    - Refurbishment/retrofitting
    - Renewable installations (power, year, KWh,..)
- Total costs and location of the interventions (in the last 10 years)
- Energy Certification per energy class
- Average annual expenditure in gas and electric energy consumptions
- Residual mortgages and duration

As far as the pilot area of Padova is concerned, data have been collected in collaboration with the partners from the Municipality, Sogesca, Forum per la Finanza Sostenibile and Università Bocconi starting from databases available at local level – inquiring technical offices at the Municipality and other subjects, such as Veneto Region, Banca d'Italia, Italian National Institute of Statistics (ISTAT), SIATEL, SIT, the Revenue Agency (Agenzia delle Entrate), Real Estate Market Observatory (OMI).

Nevertheless, the collection of data encountered some criticalities, mainly related to GDPR compliance, being information required related to personal features. For this reason, some data are not available and others have been gathered only at different levels. Indeed, eight features are presented in this section and they differ in terms of depth of testing:

- For contract type, the analysis provides evidence at national, regional level and local level;
- Rental fees are described for the municipality of Padova;

- For equivalent status, the examination is for Italy;
- The same as the precedent is for bill late payments;
- Total costs of intervention are available at national level in terms of overall EE investments in the private sector;
- For energy certification, major data are at national level, unless one value is available for Veneto region;
- For energy expenditure in gas and electricity, the availability is for Italian values, but also for Padova;
- Mortgages and duration are examined at three levels: national, regional and provincial;
- Data on average delay of bills and building permits are not available.

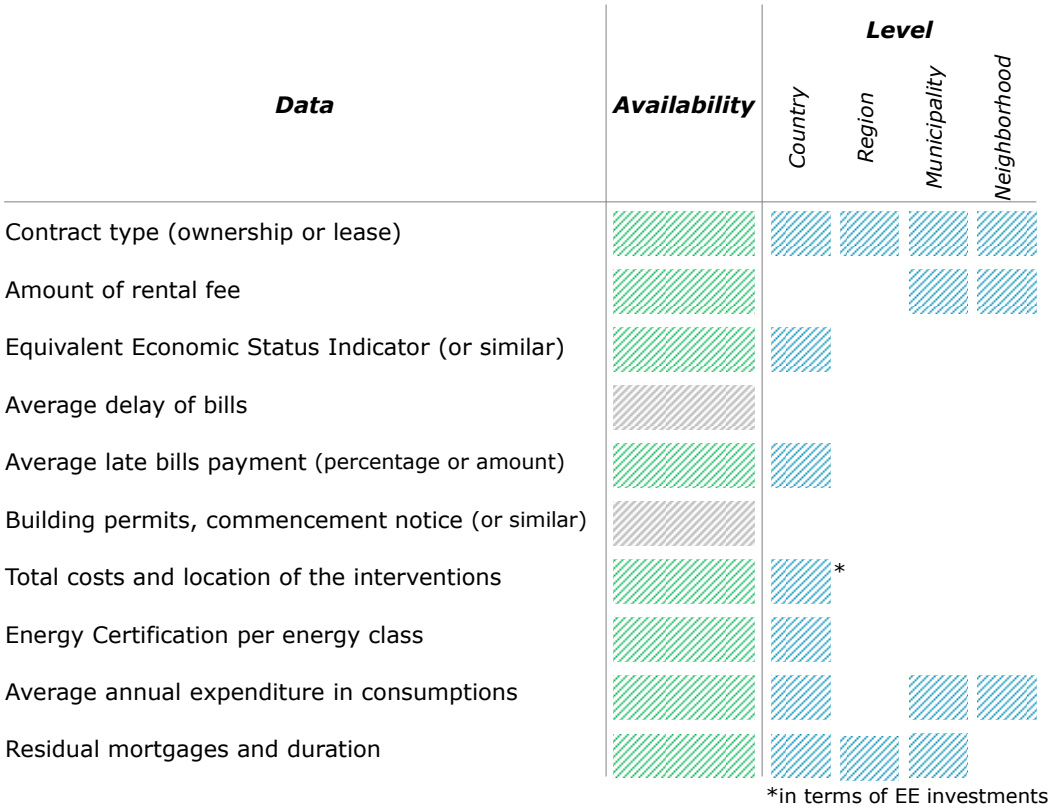


Figure 5 - Data input availability and level of testing

It is clear that the majority of data are available at a national level. Despite being significant information, these data are less useful in term of implementing a OSS in Padova, being unable to reflect the specific characteristic of the city and its residents.

The absence of homogeneous data at local and neighbourhood level has been overcome with some assumptions, as reported in paragraph 2.3.

The following paragraph will focus on the analysis of data gathered.

2.2. Analysis of financial indicators

The aim of this section is to provide layers of inhabitants in Padova based on their financial characterizations, namely their financial capacity, in order to be able to identify the best solution for each category identified. In fact, the more the offer is tailored at resident level, the higher the possibility to succeed. It is important to cluster inhabitants to provide them affordable solution to create a win-win logic.

Therefore, the analysis deals with different aspects that gather all the possible information about dwelling, people behaviour and their economic conditions. Each of those could be declined in different ways. For example, rental fees can vary considerably depending on the location of the building, its type and the energy class. The examination of various parameters gives the possibility to take all relevant factors affecting financial capacity into account. Then, parameters are grouped and analysed in a combined way, thus achieving a comprehensive evaluation, which is useful for the OSS set-up.

Contract type

In Italy, the percentage of people owning a house is 72,3%, whereas for the remaining 27,7% the contract type is leasing. This level is an average between the highest and the lowest values in UE. In Romania ownership contract is 96%, instead in Germany it is only 51,7%[5]. Moreover, the Italian trend is different according to the geographical area. Indeed, looking at the distribution in 2014[6] divided in macro areas, we notice that in South and Islands the percentage is 82,9%. On the contrary North and Centre provide evidence of lower values, 75,3% and 73,9%. Despite the macro area trends, in Veneto the percentage is closer to South and Islands values, since inhabitants with their own houses are about 80%.

Furthermore, it is possible to perform a deeper analysis for the Municipality of Padova. In fact, the mean value of leasing is 17%, that is in line with the regional value. More in detail, the map describes the trend of the Real Estate Market Observatory[7] (OMI) areas, evaluating the number of families with lease contracts over the total number of families living in the area. Indeed, the percentage of people owning a house is higher in areas which are further from the centre, whereas there is an increasing pattern in the middle of the city for leasing contract type. In some cases, the percentage goes up to about 40%. The reason of this distribution could be the high demand coming from students, because they are near to the University and the main services. Moreover, in the centre of Padova, the percentage of lease is about 26%, so higher than the regional value but not the highest in the province as living there is expensive.

[5] Data related to 2016 and provided by Eurostat
[6] Italian Ministry of Economy and Finance's press release N° 90, 29/05/2017
[7] Osservatorio del Mercato Immobiliare – OMI, which is responsible for the collection and processing of technical and economic information relating to real estate values, the rental market and rates of return and the publication of studies and elaborations and the statistical exploitation of the archives of the Revenue Agency in Italy

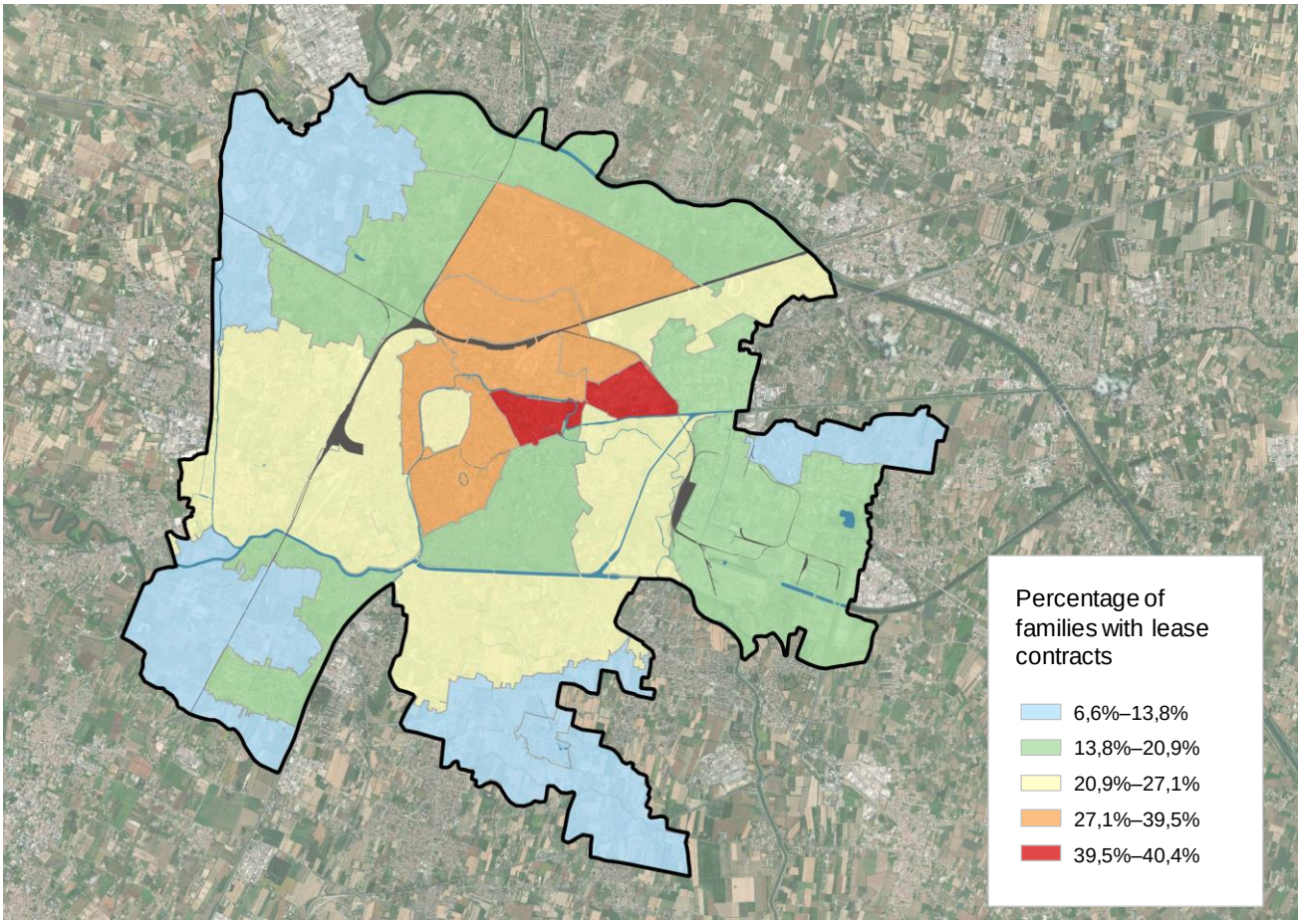


Figure 6 - Percentage of families with lease contracts in Padova (OMI areas)

Amount of rental fee

The analysis of rental fees is based on data gathered by the Real Estate Market Observatory. In addition, in order to have a deeper insight of the areas under exam, Sinloc suggests to examine also the house cost per square meter, in order to combine the information.

Data are collected by OMI every semester, both for rental fees and real estate values. The reported data refer to the first semester of 2019. The Observatory collects data on different type of buildings, such as civil houses, economic houses and villas, taking also into account their status, optimal or normal. In addition, for each statistic, it registers both the lower and the maximum value measured.

The study focuses on civil houses as they are the most common typology in the Province, considering normal and optimal status. The analysis is limited to the Municipality of Padova and the neighbouring municipalities of its Metropolitan area, namely: Abano Terme, Albignasego, Ponte San Nicolò, Legnaro, Saonara, Noventa Padovana, Vigonza, Cadoneghe, Vigodarzere, Limena, Villafranca Padovana, Rubano and Selvazzano Dentro. For each municipality, data are collected referring to different areas, usually central, semi-central and suburban[8].

[8] Data on rental fees and real estate values are available in Annex II

Each area is identified with a letter reflecting its distance from the centre (from B – central area to R – rural). In the same area, sub-areas (i.e. B1, B2, C1, C2, etc.) can be identified in order to design homogeneous zones in terms of market-related characteristics (i.e. urban and buildings pattern). Within the Municipality of Padova, 22 different zones have been identified. Smallest Municipalities are divided in approx. 6 sub-areas.

Data collected for rental fees and real estate values have been clustered in classes, and each of them is associated with a colour[9]. For rental fees, the size of the ranges is established in 0,50 Euros, thus 13 classes are created. For real estate values, 9 classes are identified and the size is 250 Euros.

The following maps represent an original elaboration of data collected by the Observatory. The first is describing the average rental fee in Euros per square meter paid monthly in each of the subareas in the municipalities under analysis. The second shows the average real estate value in Euros per square meter in the same subareas. Some areas are mainly rural and dedicated to offices or industries, thus data on residential values are not available.

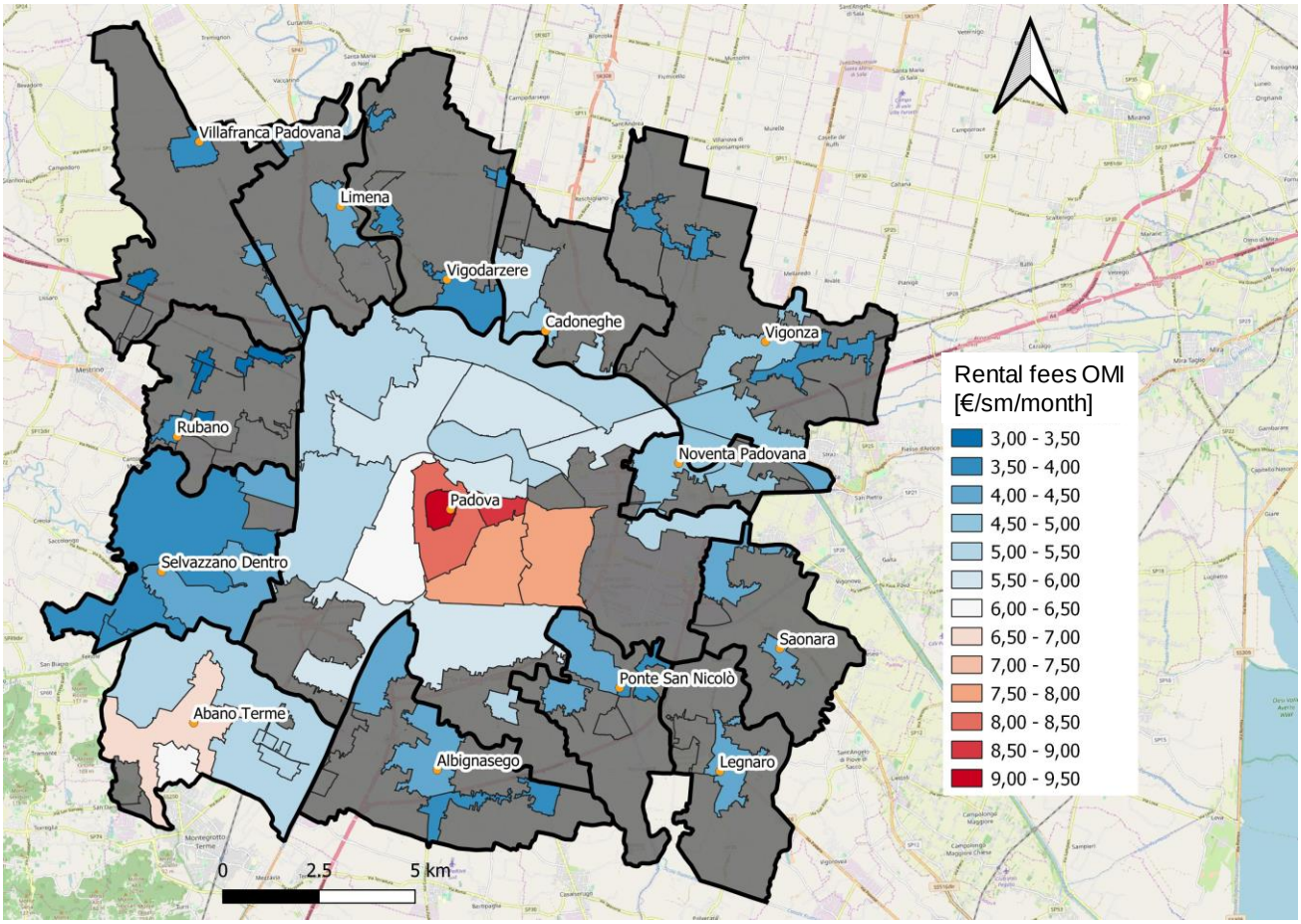


Figure 7 - Rental fees registered in the I semester 2019, Padova and Neighbouring municipalities (OMI areas)

[9] Grey colour indicates no data available referring to the area in question

The comparison between the two pictures (Figure 7 and Figure 8) is straightforward as the tonality, from hot to cold, provides an immediate evidence whether leasing fee and buildings value are in line or at odds.

Indeed, from the maps it is possible to observe that rental fees for civil houses goes from a minimum of 3.40 €/sq.m to a maximum of 9.20 €/sq.m. Real estate values have a minimum of 975 €/sq.m, while the maximum is 2,950 €/sq.m.

Both with reference to rental fees and real estate values, the highest values are registered in the Municipality of Padova and in particular near the city centre, B1 zone. The longer the distance the lower the values collected, thus from strong red colour to a dark blue one.

Furthermore, the two maps provide evidence of quite the same result for most of the areas identified. In fact, they are blue or red in the same way. However, the ideal case would be to have an exact match, thus the same tone of blue or red in each area; nevertheless, staying in the same colour category, blue, white or red, is still a good result, because it shows consistency between rental fee and real estate values.

Abano Terme, areas B1 and B2, and zones C1, C5 and D8 of Padova represent the exception, as the shade of colours change between the two pictures. For Abano, the rental fee is in the hotter tonality than buildings values. The reason behind this evidence could be the tourism, as people around the world come for the famous spas and thermal treatments, but also the proximity to Colli Euganei could attract visitors. Therefore, despite the high number of hotels situated therein, some tourist could prefer to ask for leasing to a private. However, the difference is not so marked, as the transition is from blue tones to white, and not to red.

Regarding the other two exceptions, the difference is more pronounced due to the different tonality that is more evident than in the previous case. As before, the rental fee level is higher than real estate one. The possible explanation could be the closeness to the centre of the city, thus the demand, mostly from university students[10], is high. Whereas, the buildings are not valuable as the ones founded in the centre.

[10] It is notable that Padova can count 15.000 students coming from different provinces and region. Data from University of Padova, year 2018-2019

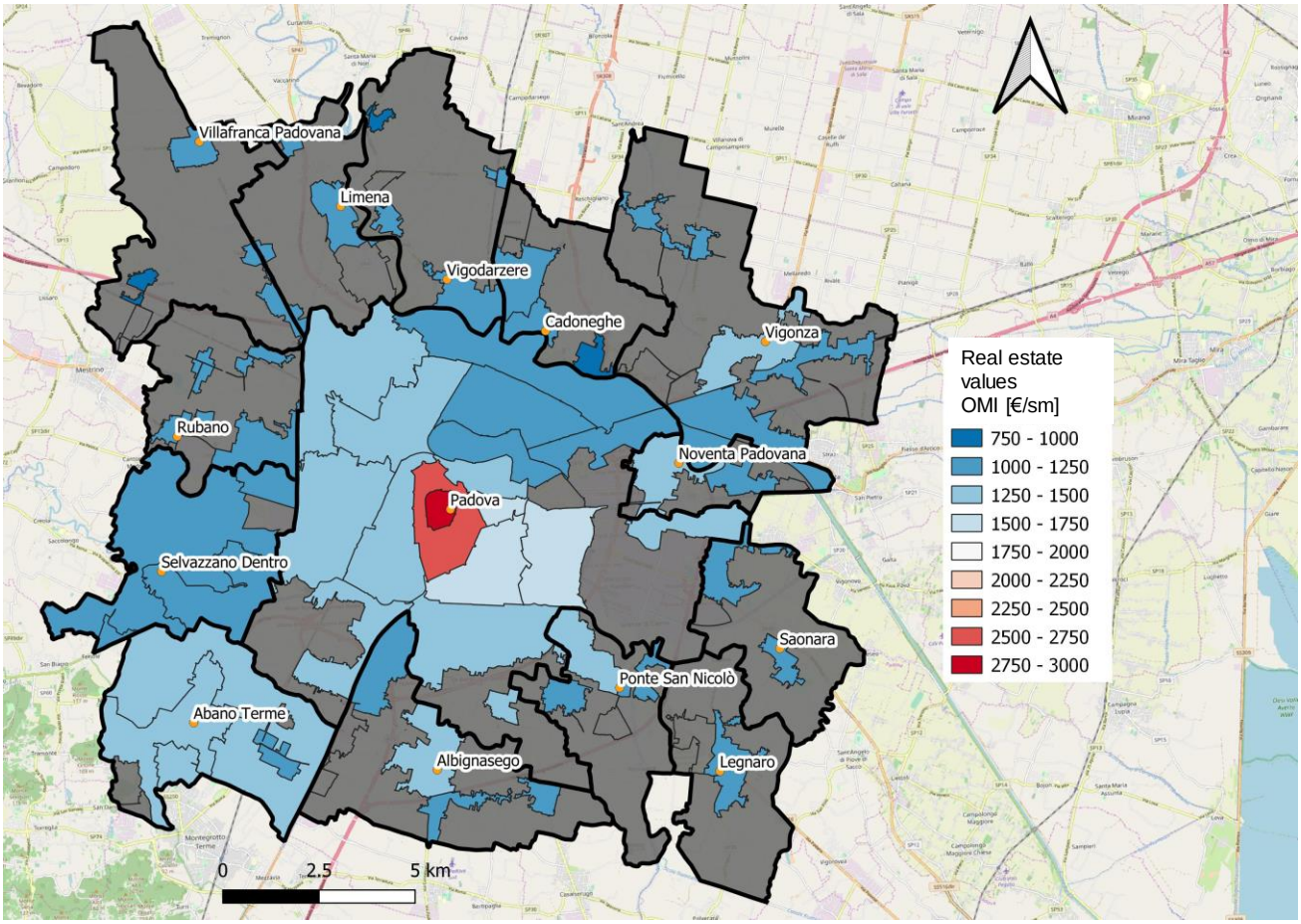


Figure 8 - Real Estate Values in the I semester 2019, Padova and Neighbouring municipalities (OMI areas)

Equivalent Economic Status Indicator

In 2009 leasing costs were about 27.8% of family income capacity, 121% higher than in 1991. Considering also that for houses costs the percentage on total expenses is 34%, this topic is fundamental for family economies. Thus, it is crucial to give residents tools to reduce the incidence and absolute value of these expenses.

Average late bills payment

One of the biggest problems in Italy is days of payment, indeed there is a surprising level of 94% payments that are not due on time[11]. Regarding gas, energy and other bills, the private persons trend is in line with the overall situation: they are prone to delay them. There are different providers, so also the contracts are various. However, companies usually give a lag of 20 days to pay bills. After two delays in a year, not necessarily consecutive, energy suppliers usually ask for default interest and stop to furnish clients with their services, such as water or gas. Nevertheless, some of them could not been taken out from these services, as they stop the contract before

[11] Data referring to corporate payment, not individuals. From Barometro Atradius sul Comportamento in Materia di Pagamenti – Risultati Primavera 2016

being suitable for default interest and switch to another provider, therefore they do not pay bills. In fact, the level of debt not paid for gas and electric energy in Italy in 2017 was about 11.8 billion[12].

Investments in energy efficiency[13]

The analysis focuses on the so-called Home&Building sector, which includes residential buildings, private offices and the services industry (large scale retail distribution and hotel).

In 2017, this sector registered approx. 4,4 billion Euros invested in energy efficiency intervention. Overall investments can be represented as follow:

Investment	*Residential*	*Offices*	*Large-scale Distribution & Hotels*	*Total*
Billion €	3.580	645	145	4.370
%	82%	15%	3%	100%

82% of the overall investments refers to interventions in private buildings and houses, for an economic value of 3.6 billion Euros.

15% share is represented by investments in offices for a total amount of 0.6 billion Euros. The remaining share is invested in large scale retail distribution and hotels.

Compared to the investments realized in 2016, in 2017 the overall amount invested increased by 10%. In particular, investments in the services industry registered a slight decrease, while those in residential buildings and private offices were almost stable.

[12] Centro Studi Unirec, "Servizi a Tutela del Credito VIII Rapporto Annuale", 2018
[13] Data from "Energy Efficiency Report 2018: Il mercato dell'efficienza energetica in Italia dalla prospettiva degli utenti finali" – Energy Strategy Group – Giugno 2018 – Politecnico di Milano, Dipartimento di Ingegneria Gestionale

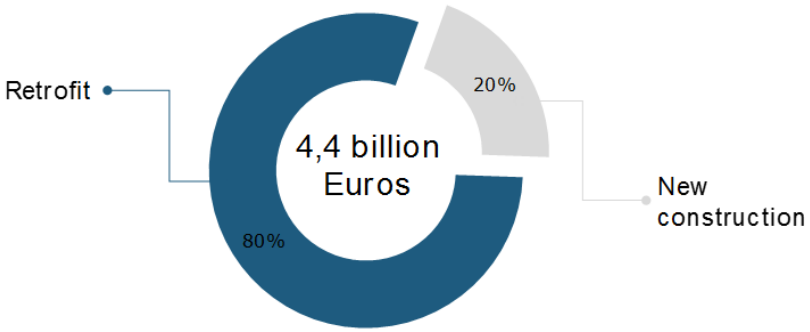


Figure 9 - Energy Efficiency interventions

According to the data collected by Italian Trade Associations and key informant, the majority of the interventions financed in the Home&Building sector are related to retrofit of existing building:

80% of the investments aimed at retrofitting existing households and only 20% was addressed to news contractions.

Focusing on the interventions realized in the residential sector, the majority of the 3.6 billion Euros invested covered interventions on heat pumps (38%), vertical cladding (25%) and lighting (17%).

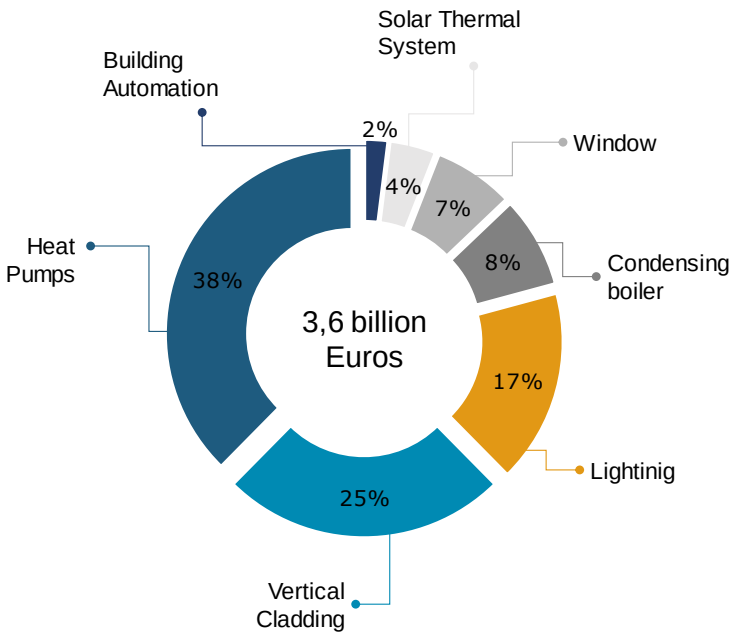


Figure 10 - Energy Efficiency Investments in private sector, 2017

It is interesting to consider that between 2016 and 2017, the overall investment in Home&Building sector has increased, in particular for some technologies.

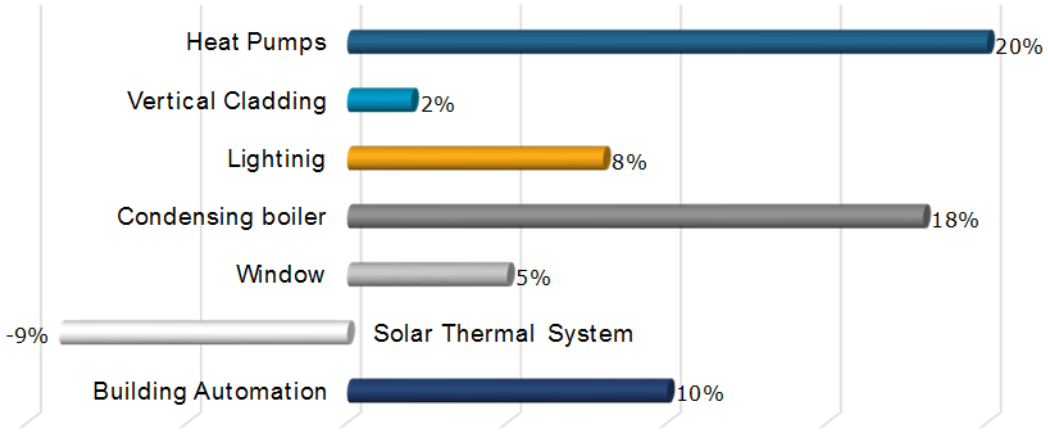


Figure 11 - Variation in investments 2016-2017

The investment in heat pumps has increased by a factor of 20% compared to the previous year. Most of these investments are carried out in residential buildings. This leads to a general increase also in private expenditure for electricity. Also, the investments in condensing boilers registered a relevant growth of 18%, as well as interventions related to Building Automation, even if their amount remains still marginal in all the sectors. However, these can be considered as relative new technologies, which can contribute to the energy efficiency in buildings by implementing smart solutions to optimize consumptions by an integrated approach and load shifting. As a whole, investments in windows and vertical cladding had a generally unvaried trend, registering a slight growth of 5% and 2%. This is also due to the typical pay-back period of these kind of investments, which is between 10 and 15 years on average. A strong decrease has been registered in investments in solar heating systems (-9%), due to the presence of competing technologies in the market, i.e. photovoltaic plants which are positioned over the roofs.

As far as the approaches adopted are concerned, the characteristic of this sectors results in difficulties in implementing “systemic” solutions, i.e. adoption of multiple technologies as a sort of energy efficiency package, in favour of “stand-alone” technologies. More in details, relevant factors are:

- Functions: in relation to the final purpose of the building, i.e. residential or office, running hours can vary significantly;
- Climate conditions: can affect the size as well as the optimization of the plants;
- Ex-ante status of the building: in case of retrofit, it can impact on the solution available.

Considering that these characteristics are extremely irregular in the Home&Building sector, the majority of the investments – in terms of value – is devoted to “stand-alone” solutions.

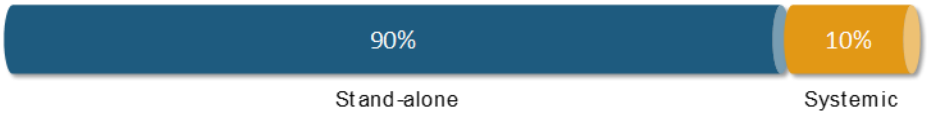


Figure 12 - Investments approaches

The share referring to “systemic” solutions includes technologies which are nowadays spread and mature, such as the joined installation of Condensing boiler, heating pumps and smart metering as well as intervention on building shell and heating systems.

Energy Certification per energy class

Unfortunately, the level of class G buildings is still high in Italy, around 37%-45%. Nevertheless, when Italians have to buy a new house, they concentrate on new buildings with energetic classes of A+, A and B, indeed the percentage of purchases of these type on total is 77%. Furthermore, there is an increasing value of investments for energy efficiency, about 3.3 billion in 2018, with a total amount of 39 billion invested in 12 years that leads to an energy saving of 100MWh[14].

Moreover, Veneto region provides during 2010-2016 more than 3 billion of tax allowances for who choose to invest in this kind of energy interventions.

Average annual expenditure in gas and electric energy consumptions

Expenditure in such type of services depends on the provider, therefore Italians try to save as much as they can, also looking at the on-line supply to find the best offer. However, Istat provides an average monthly value for expenditures in gas and electric energy consumptions per family, that is 115.86 Euros monthly in 2018 for the entire country. Through a deeper analysis, there is the possibility to calculate the amount of energy consumption for residential property in the municipality of Padova both for gas and electricity. The mean value of the total expenditure is 1,290 Euros per year for a family, which on average is made of 2 people. In particular, for gas and electricity, families in Padova spend about 517 Euros and 773 Euros respectively.

Nevertheless, it is possible to split these results and analyse the expenditure for each OMI area in the municipalities of Padova. Regarding total costs, the highest values are concentrated in the centre (zones B1, B2, C2, C4), while the remaining parts are almost heterogeneous, even if it seems that the upper part of the municipality describe a pattern of low expenditure, even because the surrounding areas are yellow or orange, except above the centre that is light blue (area C3).

[14] Data derive from: “Rapporto annuale sull’efficienza energetica dell’ENEA”

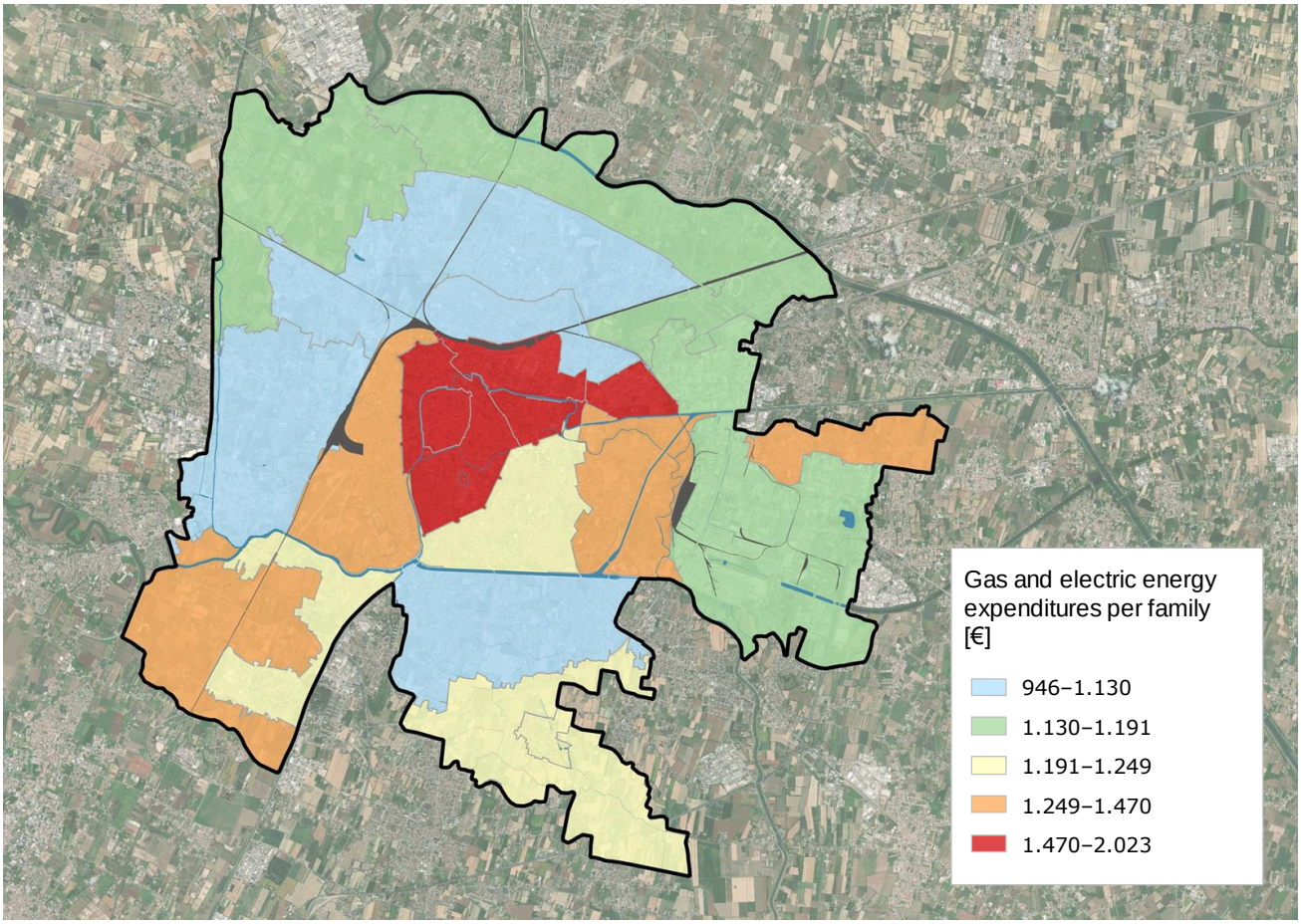


Figure 13 - Total expenditure per family in the Municipality of Padova

In the second step, the analysis concentrates to examine the differences in expenditure from the mean value for both electricity and gas consumptions. This could provide a deeper analysis in the trend of the two expenditures and whether within the same area the distance from the mean is higher or lower for both cases or there are mixed situation. Moreover, it is possible to identify which of the two cost is more constant, thus lower the situation of big differences from the mean.

The first map describes the trend of electric energy expenditure. The lowest distance from the average is -114 Euros and the highest 286 Euros. As for the picture of total costs, the centre is the most expensive zone, however also in D7, that is not close to the centre, the mean difference is huge. In this case, the surrounding area of the centre, except from C5, are coloured in green or light blue. Finally, the east part of the municipality is coloured with orange, thus the distance from the mean is important. Therefore, there are some differences with the map of total expenditure.

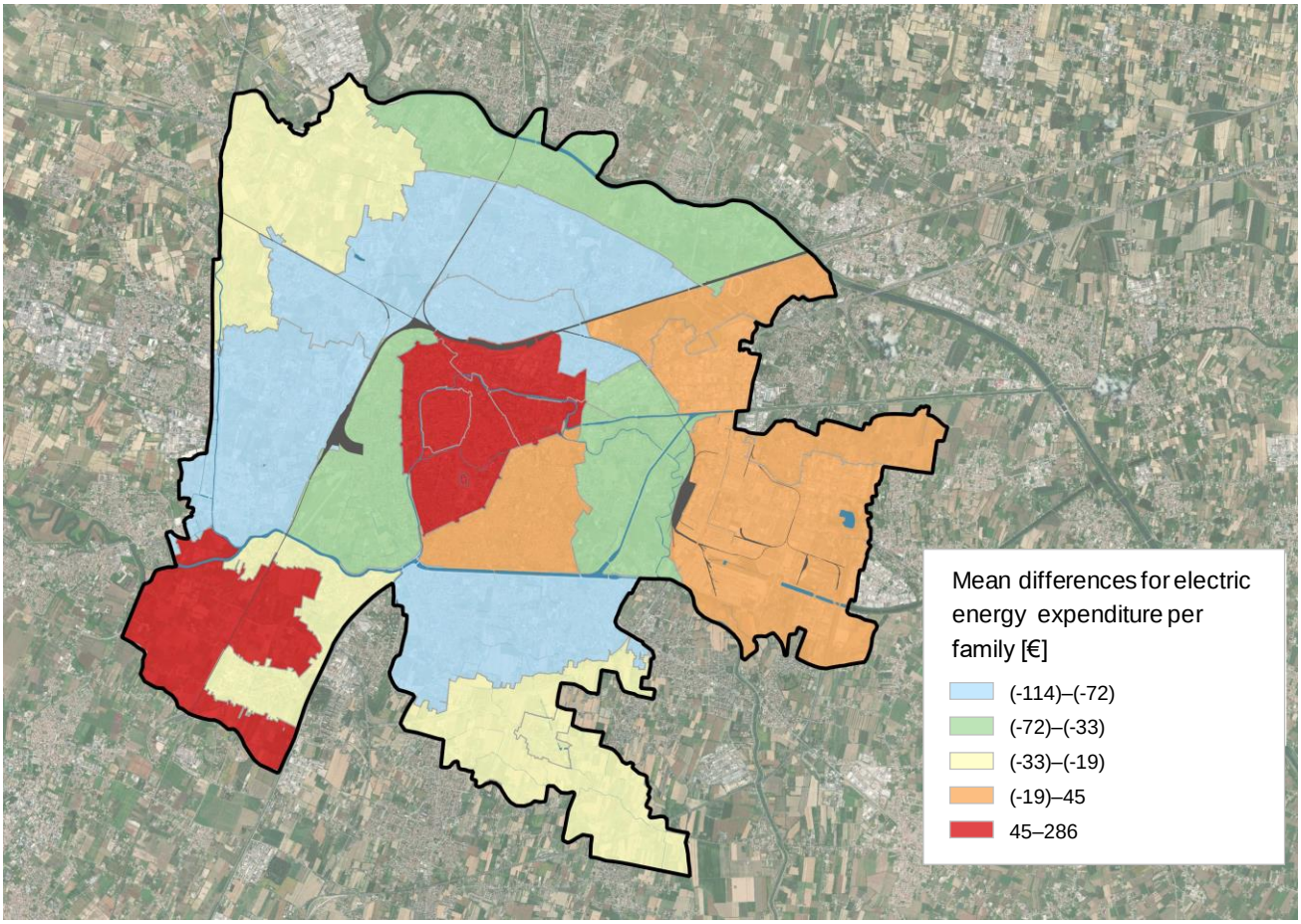


Figure 14 - Distance from the mean in electric energy expenditure in the Municipality of Padova

So, the next step is to examine the map about gas. First of all, the map shows higher variability considering the fact that the lowest distance is -238 Euros and the highest is 615 Euros. Even in this case the maximum value is registered in the centre, however also the zones surrounding this area are in orange or red, except for zone C5; and there are no other red areas as for electric energy expenditure distribution. Moreover, the east part of the map is light blue and not orange as before.

Therefore, looking at the first map with total expenditure, it is possible to state that, combining the effect of the two following maps, where it is determined the mean difference for gas and electric energy, the incidence of the former is more pronounced than the latter in the final result (e.g. there is an area coloured in light blue for gas and orange for electric energy, while in the map of total that area is green and not yellow, thus closer to the light blue, this trend is repeated more than once). This could be due to the high variation in gas values than the electric energy, where the minimum and maximum are not as distant as for gas.

With exception of the centre that is red in the three maps, also the southern part of the municipality is constant in the three representations.

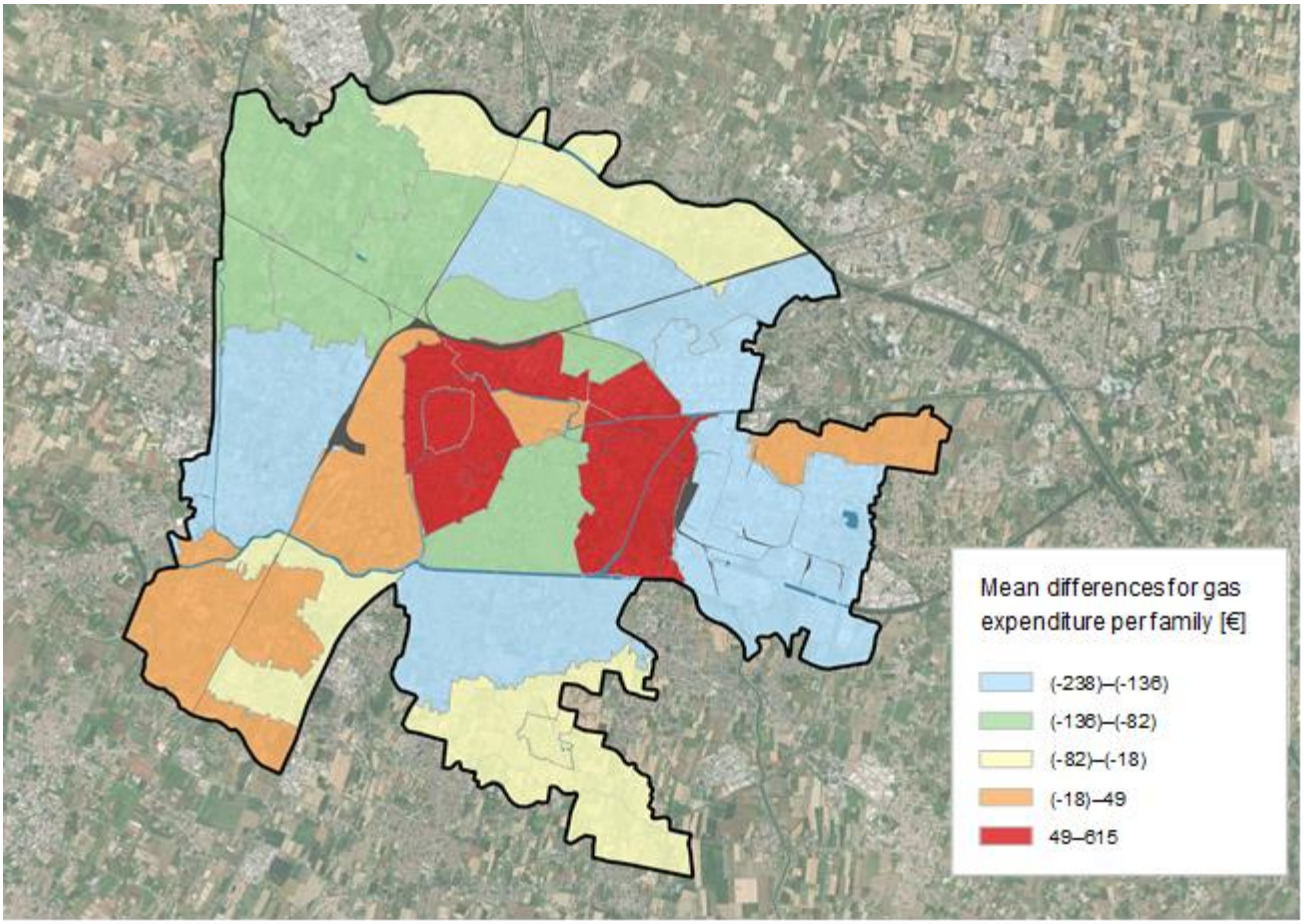


Figure 15 - Distance from the mean in gas expenditure in the Municipality of Padova

A final insight about energy consumption shows that in Veneto region the level of energy consumption derived from renewable sources[15] is 21,3%.

Mortgages

About half of the Italian population, 44%, asked for a mortgage to purchase their houses. Furthermore, they owe money to friends or family members in order to accomplish different current expenses; some of these relate to refurbishing or house expenses[16]. However, at regional level, some differences arise. Indeed, the propensity to invest is different, as people who live in the North of Italy are keener on financing new investments. The risk aversion depends also on other factors, such as the financial knowledge or the trustiness on financial institutions or advisory firms.

The situation in Veneto for mortgages shows an increasing pattern, indeed demand for house financing in the first trimester in 2018 increased by 16.9% compared to the same period in 2017. Moreover, Veneto is the third

[15] Report “Il Veneto si racconta, il Veneto si confronta” issued by Veneto Region
[16] Consob Report on financial investments of Italian households, Behavioural attitudes and approaches

region in Italy for number of new mortgages issued, namely the amount for the first 9 months of 2018 was 3,191.8 million, that is 8.72% of the total value for Italy.

Regarding the situations in the Municipality of Padova, the trend follows the regional one, with an increasing value between 2018 and 2017 of 16.7%. The amount of house financing for the fourth trimester is 270 million[17].

This increasing pattern of new mortgages could be explained by the "Quantitative easing", that keeps the interest rate low, thus facilitating credit access for families.

Indeed, the number of transactions within the Municipality of Padova provides evidence of an increasing trend from 2017 to 2018; moreover, this is linked to the lower value of Euros for square meter that could incentive people to buy a house.

The features of typical mortgages[18] are:

- Fix interest rate, 74.1% of total. This is due to the lower value of present interest rate, therefore choosing variable could be risky in case of future inflation[19],
- The average financing value is 113,700 Euros,
- 72% of people asking for loan is comprised from 18 to 44 years old,
- The average duration is 24 years.

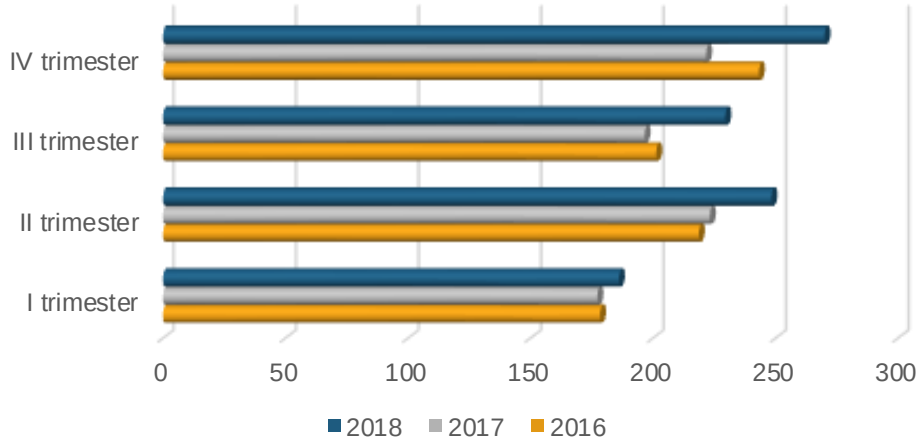


Figure 16 - Financing issued in Padua [million €]

[17] Retrieved from Ufficio Studi Gruppo Tecnocasa, that analyses all regional house market in Italy and provinces
[18] Retrieved from Ufficio Studi Gruppo Tecnocasa https://www.finanzaoperativa.com/mutui-vince-il-tasso-fisso-durata-media-24-anni/
[19] In general, it could be riskier to make fixed interest rate as the borrower take a position instead of following market movement, thus variable terms

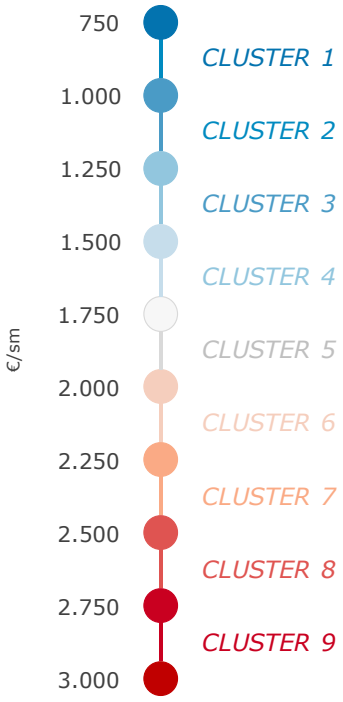
2.3. Financial capacity

In order to estimate the financial capacity of householders' in the Padova pilot area, and given the lack of specific data, we consider the average real estate values, which can be seen as proxy of the target indicator.

The assumption is that this can be an indicator of householders' financial welfare: the most expensive the house in which you live in, the higher the financial capacity.

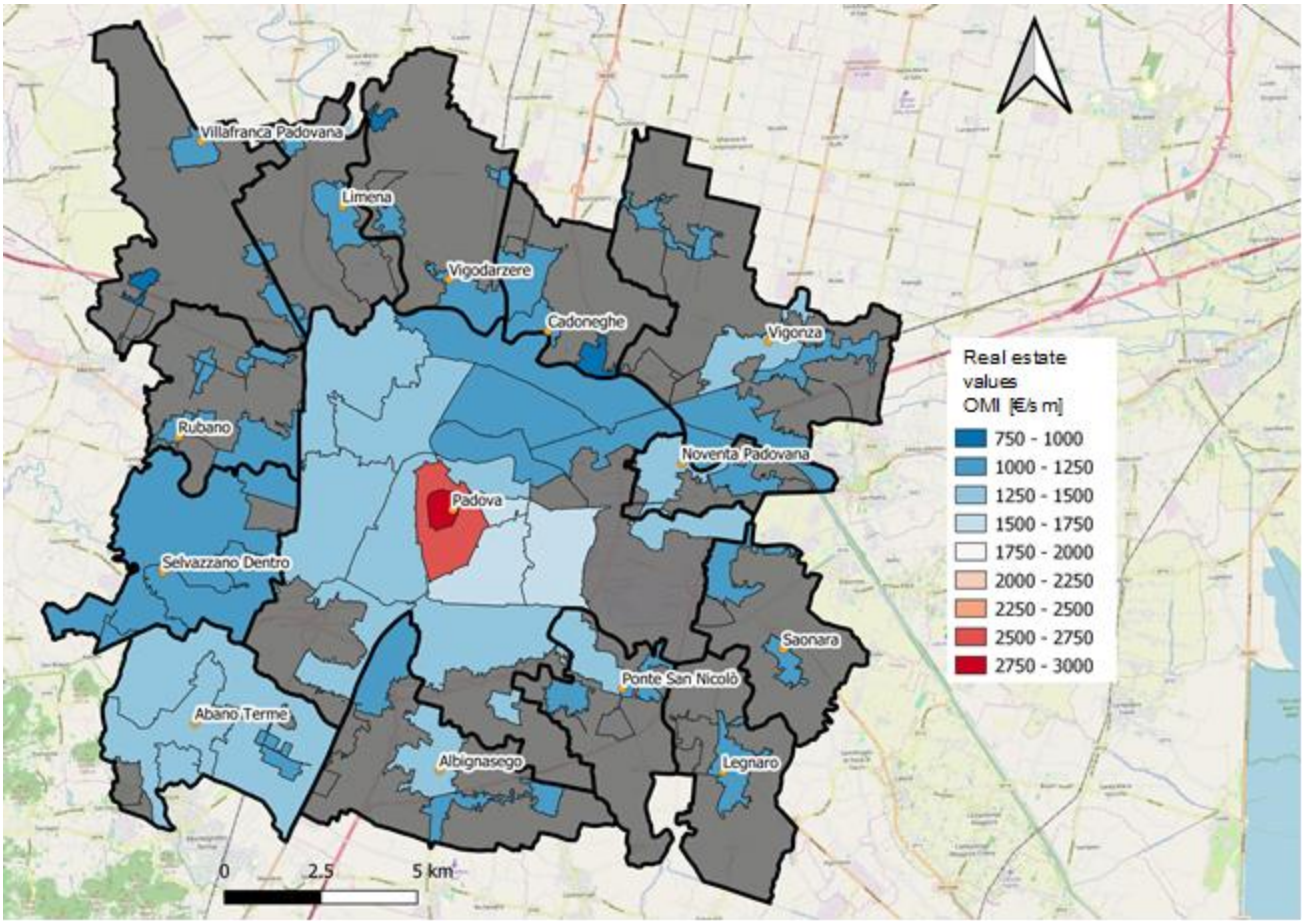
Real estate values can be relevant especially considering that ownership share in Padova is higher than leasing contracts (see paragraph 0). In addition, focusing on owners can also be supported by the fact that is really unlikely that tenants could bare energy efficiency investments in houses they do not own.

On the other hand, this can be very misleading if we consider that owning a property does not necessarily correspond to the actual financial status. This is true especially for the oldest and retirees.



The Cluster-creation process was run on the basis of available data on real estate values in Padova. In this analysis input data are represented by those collected by the Real Estate Market Observatory and presented in the previous paragraph 0. Clusters have been created considering the same range selected to represent data on the map. Thus, nine clusters have been created – reported on the left.

In addition to the described approach, cluster analysis included also some recognition about the population living in the specific area. In fact, data on real estate, as financial capacity indicator, have been matched with relevant data on numerosity. This means that looking at the picture of the pilot area, some areas can be more populated than others (i.e. Vigonza vs Cadoneghe). Since identified areas do not have the same size in terms of square meters, the numerosity of citizens living in the area could be misleading. For this reason, we decided to include in the analysis data concerning the density per area.



The following map describes the density of OMI areas in the Municipality of Padova and the surrounding municipalities. The picture has an immediate impact at first sight, as all those municipalities have low density, thus they are all coloured in blue. Indeed, red or light red areas are situated only in the Municipality of Padova, and the closest zones have still high density as they are represented with light blue. Furthermore, it is easy to identify the centre of the city, not only because it is collocated in the middle of the map, but because it is dark red, surrounded by bigger areas of blue, thus it stands out. However even in the Municipality of Padova some areas are coloured with intensive blue, therefore the high population density is strongly concentrated in few zones and there is no gradual transition from red to blue.

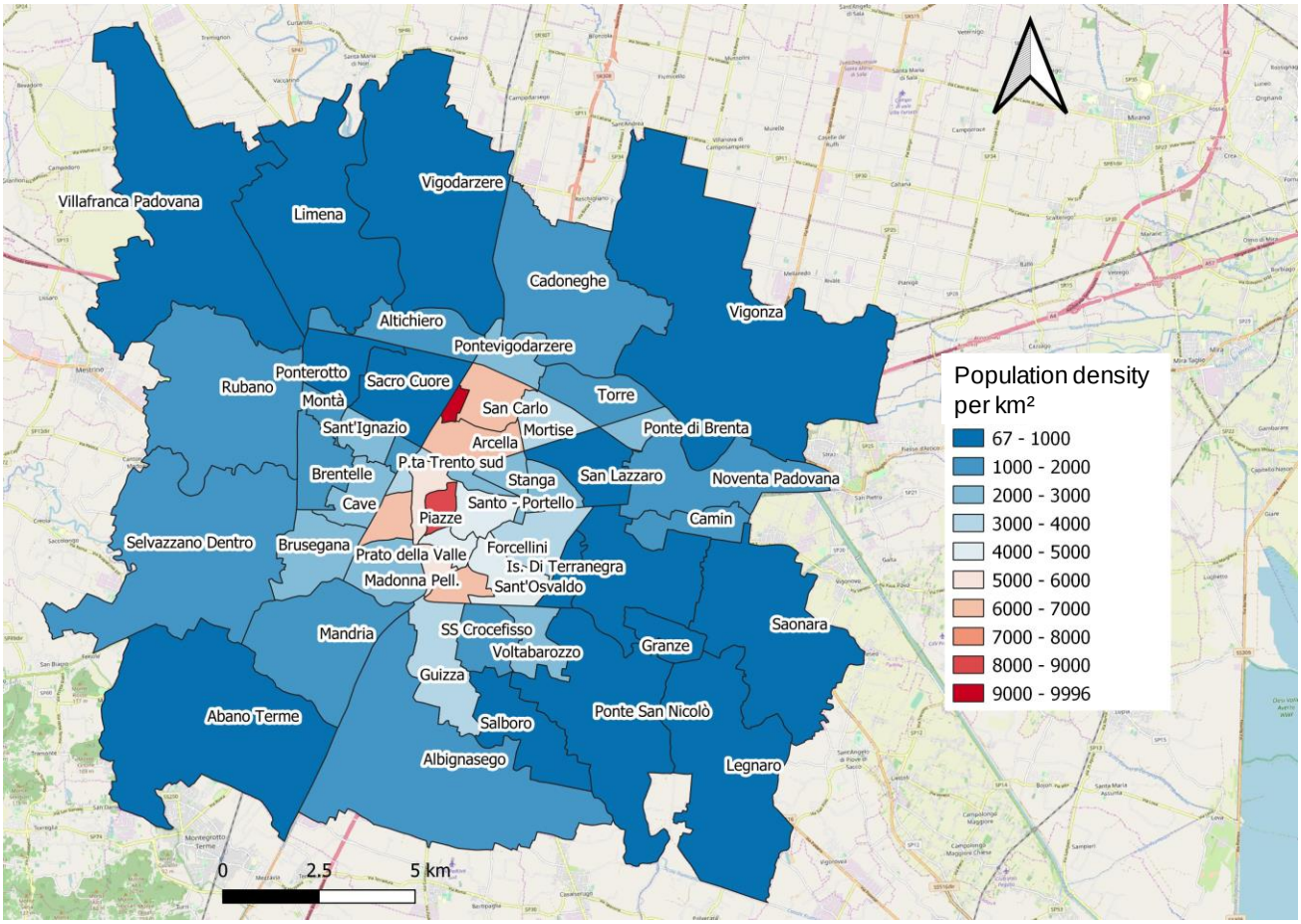


Figure 17 - Population density per km² in Padova and neighbouring municipalities

The second step is to compare this map with the one of real estate values in the same OMI areas. It is straight forward that the 12 municipalities surrounding Padova describe low population density attached with lower real estate values. The same situation is also for the zones in the centre of Padova, as the highest density population corresponds to the highest buildings value. However, there are also some dissimilarities, as the closest zones to the centre of Padova have lower real estate values but the density is still high. Thus, the colour contrast between the centre and the rest of the map is more marked in the real estate picture than in the density one.

In conclusion, the two maps evidence that the more the distance from the centre the lower the density and the real estate values, and in the middle of the city there are higher density level and buildings values.

2.4. Combined Analysis

The next step is to match all the features presented in the previous paragraphs (2.2 and 2.3), percentage of lease contracts, rental fee, real estate value, density and expenditures for each cluster.

Nevertheless, the analysis could not be available for all the nine clusters previously identified on the basis of real estate values, since several parameters (i.e. expenditures) are provided only for the Municipality of Padova, where not all the clusters are presented.

Therefore, the Municipality of Padova includes the following clusters:

- ***Cluster 2***: this cluster is focused in the north side of the city and registers average rental fee and real estate values among the lowest, despite the medium density. The total expenditure for gas and electric energy is between 900-1,200 Euros per family. For both gas and electric energy expenditure the mean difference is lower than 0. The percentage of lease contract is medium value in respect of the total municipality.

- ***Cluster 3***: this cluster is the predominant in the municipality. The real estate values are still low and also the density, although rental fee in some areas slightly increase, especially for those closer to the centre, even if they never reach relevant values (too expensive). The percentage of lease contract is mixed, depending on the OMI area and it can reach the maximum value of 40%. The total expenditure goes from 900 Euros to 1,200 Euros per family and taken singularly, gas and electricity costs are below the average.

- ***Cluster 4***: this cluster is made of 3 OMI zones, which have different percentage of lease contracts, although it never goes up to the maximum. The real estate value is increasing, but it is still below the average in the municipality, instead rental fee are about 7-8 Euros per sq.m/month, thus high in comparison with other areas. The total expenditure in gas and electric energy reaches 2,023 Euros per family in one area and it is still high in the other two. Taken singularly, they are above the mean. The density is limited.

- ***Cluster 8***: The real estate value goes up to 2,750 Euros and rental fee are up to 8.50 Euros per sm/month, but the density is not so elevated. The percentage of lease contracts goes up to 39%. Regarding the total expenditure, the value reaches the maximum level of 2,023 Euros per family and the difference with the mean average for both gas and electric energy is more than 50 Euros.

- ***Cluster 9***: This area focuses in the centre of the municipality and regards only one OMI area. Real estate value, rental fee, density and expenditures are the highest in the municipality and so above the mean. The only low values are for lease contracts as it stops between 21%-27%.

CLUSTER	REAL ESTATE VALUES [€/sm]	RENTAL FEES [monthly €/sm]	DENSITY [inh/km^2]	EXPENDITURE [€]	MEAN DIFFERENCE [€]	LEASE CONTRACT [%]
2	1.000 – 1.250	3,5 - 4	67 - 1.000	946 - 1.1.30	(-238) - (-136)	13,8 - 20,9
		4 - 4,5	1.000 - 2.000	1.130 - 1.191	(-136) - (-82)	20,9 - 27,1
		5 - 5,5	3.000- 4.000		(-82)-(-18)	27,1 - 39,5
		5,5 - 6	6.000 - 7.000		(-18) - 49	
			9.000 - 9.996		49 - 615	
3	1.250 – 1.500	3 - 3,5	67 - 1.000	946 - 1.1.30	(-238) - (-136)	6,6 - 13,8
		3,5 - 4	1.000 - 2.000	1.130 - 1.191	(-136) - (-82)	13,8 - 20,9
		4 - 4,5	2.000 - 3.000	1.191 - 1.249	(-82)-(-18)	20,9 - 27,1
		4,5 -5	3.000 - 4.000	1.249 - 1.470	(-18) - 49	
		5 - 5,5	5.000 - 6.000			
		5,5 - 6	6.000 - 7.000			
		6 - 6,5				
		6,5 - 7				
4	1.500 – 1.750	7,5 - 8	3.000 - 4.000	1.191 - 1.249	(-136) - (-82)	13,8 - 20,9
		8,5 - 9	4.000 - 5.000	1.249 - 1.470	(-18) - 49	20,9 - 27,1
			6.000 - 7.000	1.470 - 2.023	49 - 615	39,5 - 40,4
8	2.500 – 2.750	8 - 8,5	4.000 - 5.000	1.470 - 2.023	49 - 615	27,1 - 39,5
9	2.750 – 3.000	9 - 9,5	8.000 - 9.000	1.470 - 2.023	49 - 615	20,9 - 27,1

Figure 18 - Clusters in Padova pilot area

2.5. Conclusions and Further Steps

The analysis of financial indicators represents the preliminary step to characterise the population living in the pilot area of Padova. This step is crucial in order to define the framework in which the One-Stop-Shop is going to operate. In fact, the implementation of the OSS concerns also the definition of the services it is going to develop. Since the investments are going to be financed by householders, directly or through debt, understanding their financial capacity is crucial to set-up services that could be sustainable in economic and financial terms.

Starting from the nine clusters identified in relation to the real estate values by the Real Estate Market Observatory, the combined analysis of indicators available at municipal and neighbourhood level leads to five clusters of interests.

These clusters are heterogeneous. In fact, within the same cluster, different classes of rental fee level, density, expenditure and type of contract can be included. It is worth remembering that the real estate value is considered as a proxy of overall financial capacity: the most expensive the house, the higher the financial capacity. Thus, considering clusters in an ascending numerical order, the first (lower numbers) are those where the financial capacity is estimated to be lower. Those corresponding to higher numbers, are those in which welfare is considered to be higher.

It also notable that when financial capacity increases, also other economic features tend to be higher. In other words, in clusters with higher identification numbers, higher classes per feature are included. Namely, rental fee values, consumptions expenditure and mean differences arise in relation to the increase of the real estate value. This is consistent with the assumptions.

However, the analysis of households' financial capacity is just a preliminary step, which will be fundamental for the successful development of further activities. In particular, next steps include the involvement of relevant financial players in order to map existing financial instruments as well as the required characteristics to finance energy efficiency intervention in the private sector. These should be matched with householders' characteristics in order to structure financing schemes to be offered by the OSS accordingly.

In addition to this, the implementation of the OSS in the pilot area includes also the identification of potential target groups or areas to focus its activity. In this respect, the financial capacity is just a piece of the puzzle. In fact, the financial capacity itself is not sufficient to characterize the clusters and their needs. For this reason, the analysis will be fine-tuned considering also technical features and the characteristics of the building stock in the pilot area. The output of the integrated and combined study of this report and D4.2 represents the input for task 2.2, the strategic assessment of the OSS.

In the following chapters, the presented methodology will be replicated also for the pilot areas of Timisoara, Vidin and Smolyan. Insights coming from this activity will be useful to develop adequately the OSS in Romania and will represent useful input to structure a concrete action plan in Bulgaria.

3. TIMISOARA PILOT AREA

The Municipality of Timoșoara - General Overview

Timișoara is the capital city of Timis Country, the western among the 41 districts of Romania, located on the border with Hungary and Serbia, in the so-called Banat region. Timis Country is made of 2 provinces, 8 cities and 88 municipalities. The superficies of Timis is the largest in Romania with 8,697 km², while the population is the sixth with 701,499 inhabitants[20]. From a geographical point of view the district is surrounded by Carpathian Mountains in the eastern part and it is crossed in the southern western part by three rivers, Timis, Bega, and Poganiș.

[20] From Eurostat, 2018

Figure 19 - Romanian administrative territorial divisions

The Municipality of Timișoara

Located at 571 km far from the capital city of Bucharest, Timișoara is the largest city in Western Romania and the second most important city of the country. The Municipality of Timișoara is the capital of Timis County and one of the biggest cities in Romania. Approximately half of the population of the region is located in Timișoara, namely 319,279 inhabitants, according to the 2011 census. The population is young, mainly because of the seven universities in the city, counting over 50,000 students and more than 12,000 graduates per year.

The importance of Timisoara is also due to its geographical location, being a national transportation hub along the Pan-European Corridor IV[21], as defined in 1994 at the Second Pan-European Conference. The IV corridor represents the connection between Germany, the Czech Republic, Slovakia, Romania, Bulgaria, Greece and Turkey. In addition, there is a developed connection to Bucharest and other major cities in Romania, as well as to Serbia and Hungary. Therefore, Timișoara is a strategic link to the West with the neighbouring countries.

[21] In March 1994, there was the second Pan-European transport Conference held in Crete, where the Member State defines the so-called Pan-European transport corridors, slightly amended during the third conference in Helsinki in 1997. These were identified as the routes that needed major investment over next years

From an economic point of view, being such a hub between different countries helped to attract foreign investments, in particular in the manufacturing sector, which is still the most important sector for the city.

As a member of the European Union, Romania is expected to reach the objectives defined by the Directive 2009/28/EC and to comply with the requirements of the Energy Performance of Buildings Directive (EPBD) within 2020. Municipalities and public administrations should act as active contributor in this process, promoting and fostering energy efficiency at local level, especially considering that in Romania there are still many rural areas, meaning that biggest cities have higher responsibility for the country's transition.

In 2018, the Romanian Government published the draft of the National Energy-Climate Plan (NECP)[22], developing one-decade-long energy-climate policies starting with 2021-2030.

This first NECP 2021-2030 draft sets the 2030 national targets concerning the reduction of GHG emissions, the share of renewable energy sources (RES) in final energy consumption, and the increase in energy efficiency.

In 2012, Romania ranked 14th position among the 40 most attractive countries worldwide in the renewable energy market [23]. In fact, the country has very good potential mix of solar energy, thanks to the fact that more than half of the territory has an annual energy flow between 1,000 and 1,300 kWh/m^2*yr and has 210 days of sunshine per year[24], as well as hydropower, biomass and geothermal energy.

Nonetheless, Romanian current generating capacity does not satisfy its power needs and this mainly because the building stock suffers from bad conditions and the technology is outdated.

The building stock – key elements

In Romania, the majority of the buildings is more than 20 years old, and only 10% of the overall stock has been constructed in the last millennium (Figure 20). In fact, the share of building with more than 55 years of age is still high (25%), as well as the one related to buildings between 40 and 55 years of age (28%). The highest remains the quota between 20 and 40 years (37%).

[22] According to the policy framework on the Governance of the Energy Union
[23] Ernest & Young, Renewable energy country attractiveness indices — May 2012 Issue 33
[24] Data and figures in this chapter are elaboration from A.A. Muresan, S. Attia, Energy efficiency in the Romanian residential building stock: A literature review

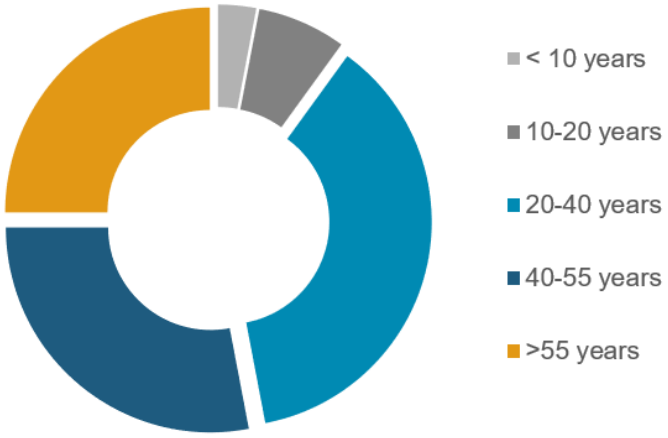


Figure 20 - Romanian buildings age

In addition to this, apartment buildings built in communist Romania were meant to be cheap, affordable housing for the large number of people migrating to the cities starting from the 1960s. Indeed, the State had to house a large amount of people in a very short amount of time. The authorities decided to meet this challenge by keeping the designs of residential apartment buildings as simple and consistent as possible, so the building process could be more or less identical across the country.

Because of this, most apartment buildings built after the 1970s in Romania fall under one of the three building types, namely Pa, Pb and Pc, called *tipuri*. These types were meant for the varying living situations at the time, from single people to large families and high-ranking officials. Of course, it was not possible to build the exact same three designs everywhere. Depending on the characteristics of the location, these types were modified into a number of sub-types, called *sortotipuri*. There are four subtypes for each type of building, named Pa1 or Pc3 for example. The factors conditioning the choice of a certain sub-type were: location within the city, orientation, type of neighbourhood, who was meant to be living there, etc[25].

Nonetheless, it's also worth to notice that in Romania there are significant rural areas that should be properly taken into consideration in the analysis. In 2011, residential buildings in those areas amounted to 46% of the overall building stock in Romania, with a trend which remained almost stable in the last 20 years (Figure 21).

[25] From Romanian Sustainable Energy Cluster ROSENC

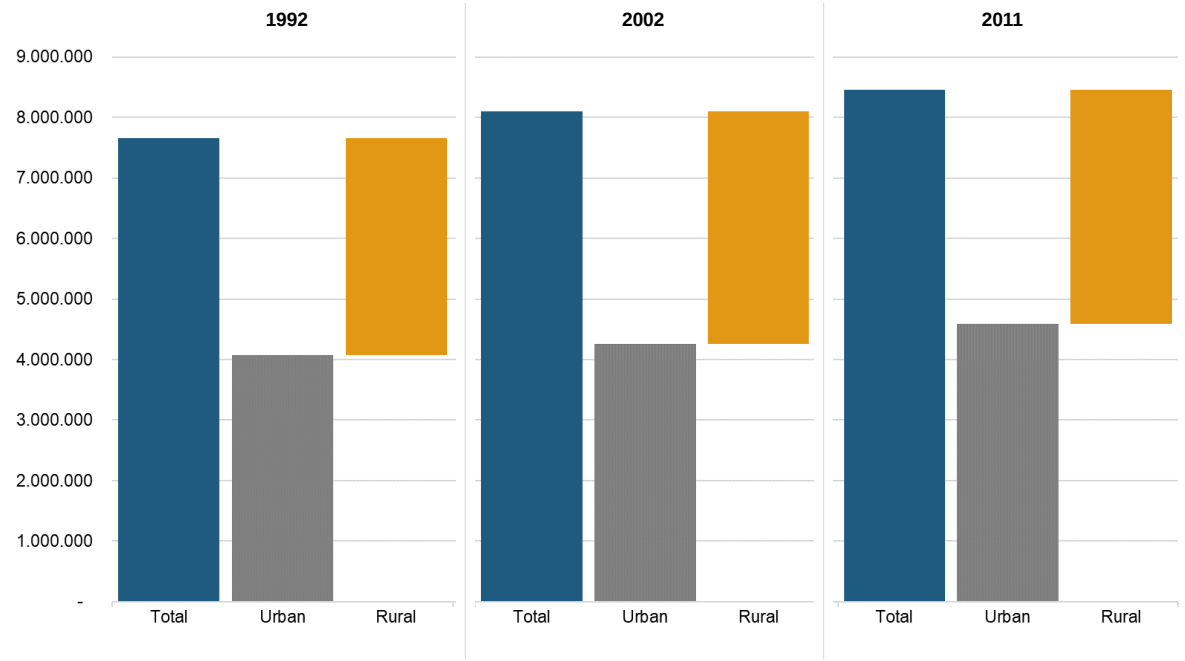


Figure 21 – Number of residential dwellings in urban and rural areas in Romania

Among other relevant factors to be considered, is the average size of the dwellings in Romania: 27% of citizens live in houses of up to 50 m^2, while 23% live in houses with a surface of over 100 m^2. There is also a relatively high share of multi-generational dwellings, where children, parents and grandparents live together. This contributes in ranking Romania among the countries with the highest average household number, which is 2.92 against the EU average of 2.46. Due to the high percentage of unemployment (5.5% in 2005) and the high price of households in the real estate market, many young families cannot afford to live independently.

In 2015, Romania's overcrowding rate was 49.7%, the highest of the EU-28 countries, exceeding three times the average of 16.7%. The overpopulation rate among the population at risk of poverty in Romania was 63.7%[26].

More recent data from the Romanian National Institution of Statistics show new construction works decreased by 3.2% between 2013 and 2014. The same trend is registered in the amount of the general maintenance works (-17.9%) and current maintenance works (-9%).

As a result, given the average age of buildings in Romania, the need for energy efficiency interventions is significant, especially in terms of thermal rehabilitation. On the other hand, statistics show a decreasing trend in maintenance works and in constructions – meaning in new buildings with higher efficiency standards.

One of the reasons is the cost of energy efficiency interventions, that could be considerably high in comparison with the average income of citizens. The unavailability of modern materials on the market and the poor degree of training in the field of energy performance of buildings could represent additional barriers.

[26] From Municipality of Timisoara

According to the 2011 population and housing census, in Timișoara there are 29,279 buildings, most of which with conventional dwellings (99%), counting for 137,200 units, 127,676 occupied[27].

Among these, 94.8% are equipped with water supply, 99.5% have electric installations, 80.2% central heating through the district heating or own thermal power plant and 3.1% heating with stoves and gas.

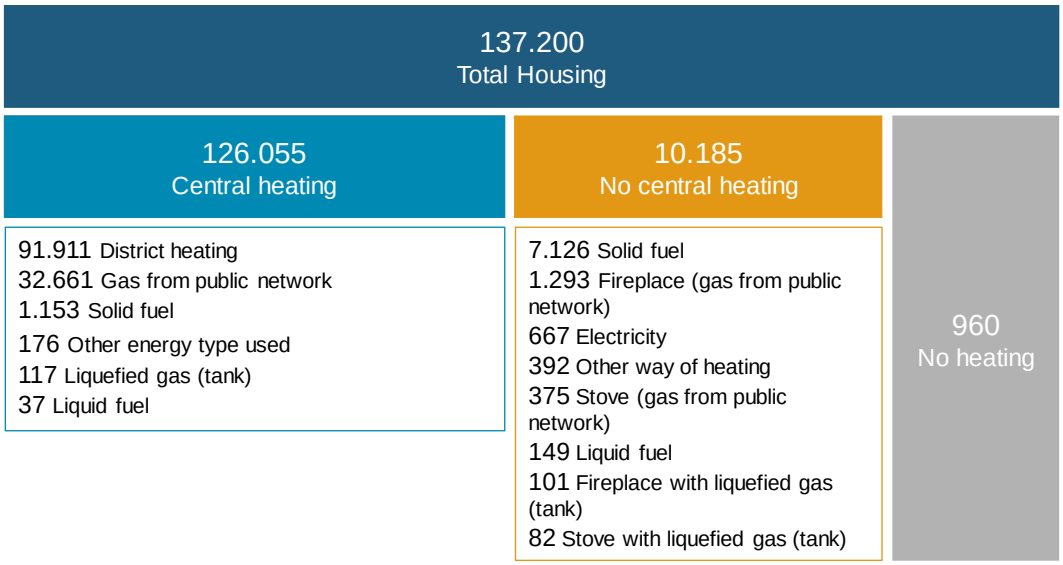


Figure 22 - Housing and heating systems in Timișoara

Regarding the building age, on the basis of the previous census (2002), about 40% of the residential buildings were built before 1944 and about 30% before 1970.

In addition, Timișoara suffers from poor housing: the construction of socialist-type housing made full use of reinforced concrete and prefabricated concrete to achieve a large number of residential units, the block apartments. Most of the buildings intended for housing offer poor comfort, approx. 60% due to age and 40% being collective buildings built under the communist regime. Thus, the main negative aspects regarding the comfort of living in Timișoara are:

- Advanced state of disrepair – buildings requiring repairs, refurbishment and modernization work;
- Degraded façades, which generate major degradation of the buildings as a whole over time;
- Degraded state of the technical-urban installations;
- Sub-dimensioning of the interior space (as number of rooms and living space) and inadequate partitioning of some dwellings;
- Inadequate quality of thermal, sound and waterproof insulation;

[27] Romanian National Statistical Institute – Timis County Regional Directorate

Thermal rehabilitation registered positive, albeit modest, developments in the period 2009-2011[28] when the local administration of the Municipality of Timișoara, through the Local Multi–Annual Program for Increasing the Energy Performance of Condominiums, monitored the intervention works for the thermal rehabilitation of 61 buildings for an overall value of 23,294,300 RON. This led to considerable increase in energy performance in the buildings involved. On the other hand, the results are too little in relation to the needs and this is especially because the allocated funds were insufficient. In fact, the program depends on the budget allocation, 50% of which derives from the State budget, 30% from the local budget, and the remaining 20% from the owners' associations.

Other interventions were focused on the roofs. An attic has been built in some buildings, where the structure allowed, and the cost of the works was borne by the developer in exchange for the space obtained.

In addition to this, Timișoara has committed to implement energy efficiency measures in order to reduce CO_2 and to deal with climate change. In particular, the Municipality signed the Covenant of Mayors along with other 61 Romanian municipalities, committing to reducing the energy consumption and promoting the use of renewable energy. In June 2010, the Municipality signed the Sustainable Energy Action Plan (SEAP), a document where authorities undertook the challenge to reduce the energy consumption by 20% by 2020. The plan aims to create synergies between different players in the city such as the municipality, the industry and other stakeholders, in order to scale up intervention of energy efficiency. More in detail, the objective is to achieve 22% in energy savings in the transport sector, 35% in the power sector, 6% in the field of solid waste, and 5% in the water sector. The overall target is a reduction of CO_2 by 315,000 tons by 2020.

3.1. Mapping and analysis of households' financial capacity

The same methodology described for the Padova Pilot area has been applied in Timișoara, in order to map and analyse householders' financial capacity and successfully structure the OSS.

Annex I is still the reference point representing the checklist for input data to be gathered and later analysed. However, similarly to what happened in the previous case, data collection encountered some difficulties especially due to privacy constraints. Moreover, databases or other sources of data to collect required information (at least indirectly) were not available. Where data at municipal level are missing, the report focuses on aggregated data, i.e. available at national level.

More in detail, the results of the activity of data collection conducted by the Municipality of Timișoara are shown in the table below:

- With regard to contract type, data are at national and local level;
- Rental fees are described at local level;
- Information about equivalent status relates both to Romania and the municipality;

[28] Emergency Ordinance no.18/2009

- With regard to average delays of bill, bill late payments and permits, data are available at local level;
- Data on investments are provided at national and local level;
- With regard to energy certification, the classification of energy classes for residential buildings at national level is available;
- With regard to energy expenditure, data are provided at national and municipality level.

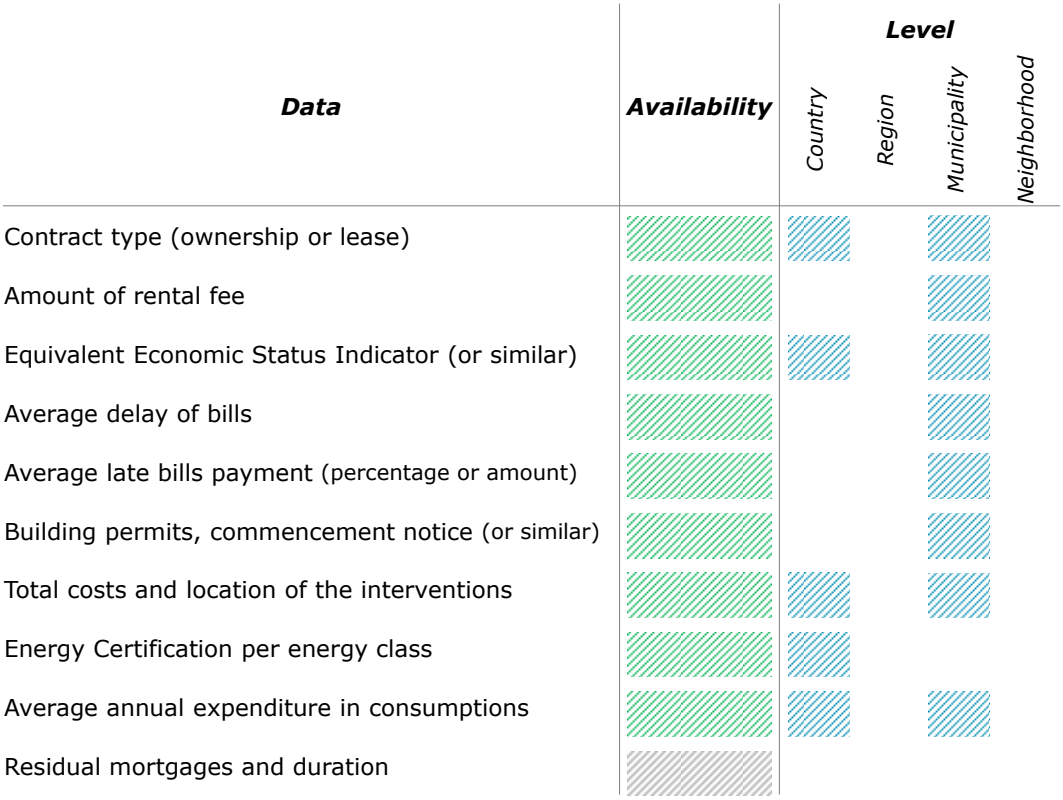


Figure 23 - Data input availability and level of testing in Timișoara pilot area

As a result, almost all data are available for the pilot area of Timișoara and the majority are available at a municipal level. The only missing information is the one related to the residual mortgages in the municipality. Nonetheless, the lack of data related to smaller divisions of the municipality makes the methodology applied in Padova not feasible for the Timișoara pilot area. In addition, the available information is aggregated at a municipal level: given the different detail of the data available, mainly linked with the databases in which information is gathered, it wasn't even possible to deduct data on neighbourhoods for the Romanian pilot. Finally, information often refers to different years, making an integrated analysis not relevant.

As a result, clusters couldn't be created starting from the financial analysis and the identification of potential target areas will rely on other factors.

3.2. Analysis of financial indicators

The aim of this section is to retrieve the largest amount of information about households' financial capacity, in order to create a first set of information useful for the identification of target areas for the One Stop Shop in Timișoara. In fact, financial indicators, alongside buildings technical features analysed in T4.2, will represent the starting point for structuring the OSS effectively. In fact, particular attention should be given to the characteristics of the building stock and the houseowners who will be the final beneficiaries of the interventions. Despite the above-mentioned lacking of adequate data at neighbourhood level, the analysis can be relevant to gather insights at a municipal level.

Contract type

In 2018, Romania registered the highest percentage of people owning a house in Europe, 96.4%[29]. This information is strictly linked with the overcrowding rates: more than half of the Romanian population lives in overcrowded houses. The rate is even higher among the population at risk of poverty, reaching 66.6% - which is also among the highest when referring to Member States[30].

The building stock in the urban areas consists of 72% of blocks of apartments and the remaining 28% are single houses. On the contrary, in the rural areas 94.5% of the building stock are individual dwellings, while only 5.5% are blocks of apartments.

Similarly, in Timișoara the overwhelming majority of dwellings are privately owned, reaching more than 95% of the overall stock. The remaining 5% is owned or managed by the local Municipality for social housing: in 2014, 1,884 buildings were administrated by the City Hall, decreased to 1,519 in 2019, while the number of dwelling owned remain stable at 253.

Amount of rental fee

First of all, it is important to set the framework on the specifics of how rental agreements are arranged and how income from rental contracts is collected in Romania and by consequence, in Timisoara as well[31].

Income tax is collected by a county level authority (AJFP Timis) from each citizen having his/her tax domicile in Timis County based on their personal numerical code (unique to each individual). Each individual has the obligation of declaring the rental contracts he/she is engaged in irrespective of where the rented property is located. Furthermore, there is no difference in tax records based on the property being rented whether it's a 2-room apartment, an individual dwelling, an automobile, a commercial space, a piece of land, etc. The only identifier is the description filled in the "object to be ceded" field.

[29] Data retrieved from: https://www.pordata.pt/en/Europe/Population+by+tenure+status+(percentage)-3388
[30] Eurostat. Housing Statistics. Eurostat. Statistics Explained; Nov-2015
[31] Timiș County Public Administration, The Service Of Taxpayers Register with Tax Returns For Individuals Persons, addresse registered with no.7781 issued on February 25, 2020

Furthermore, there can be more than one rental contract for the same space registered with the taxing authority when there are multiple part-owners of the same space. Thus, in fiscal records there are a number of rental agreements (which assign different types of property for use) with different periods of validity, as follows:

Year	2015	2016	2017	2018	2019
Rental contracts	15,183	15,677	16,947	13,172	12,397
Resulting gross income	142,149,724 lei	142,196,255 lei	167,039,068 lei	165,579,282 lei	179,958,350 lei
Lei per contract per month	780 lei	793 lei	821 lei	1,048 lei	1,210 lei

Table 1 - Rental contracts per year

In conclusion, rental contracts refer to goods regardless where they are located as long as the taxpayer is based in the fiscal region of Timis County. Therefore, the data is not specific to taxpayers based solely in Timisoara.

A more accurate estimate can be made considering a specific dwelling, i.e. to an apartment with two rooms of comfort type 1, built between 1980 and 2000[32]. In the first quarter of 2019, Timișoara registered on average the rental price of 300 EUR per month. Thus, Timișoara took the third place in the rental fee ranking - not far from Bucharest (first place) and Cluj-Napoca (second place).

In the second quarter of 2019, the average rental fee for the same apartment increased from 300 to 340 EUR per month. The city confirms its third-place ranking at national level.

As a result of this increasing trend, the average price reached 350 EUR/month by the end of 2019.

[32] Data from www.imobiliare.ro

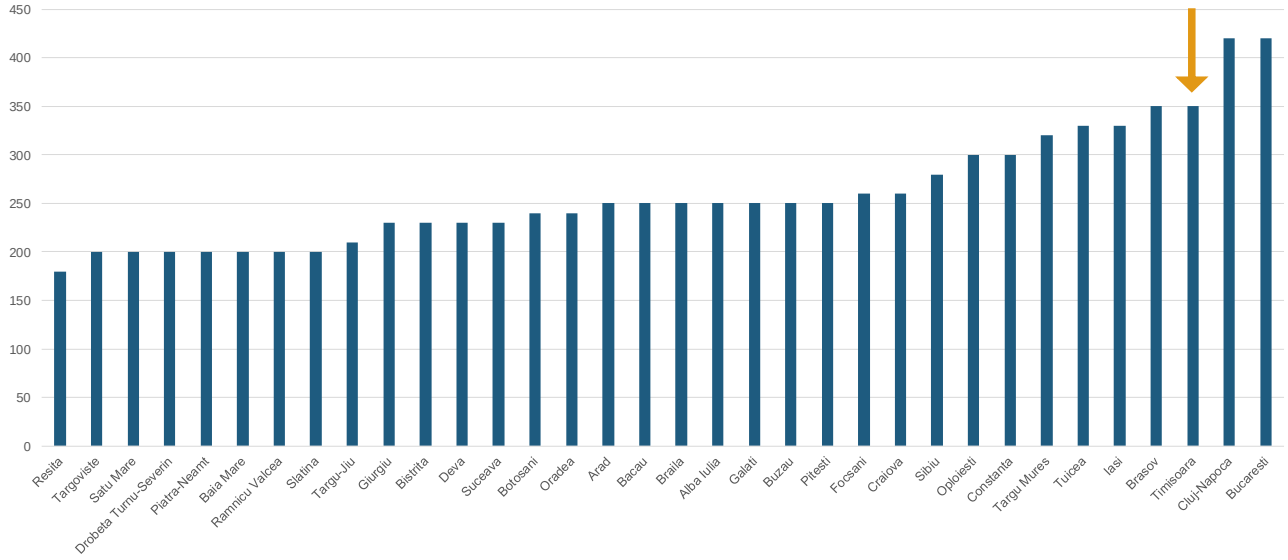


Figure 24 - Average monthly rent for a 2-room apartment, comfort type 1, built between 1980-2000

The value of the fees differs depending on the neighbourhood, position, facilities available in the area (i.e. access to transport, parking lots on the city streets/parking garage, proximity to the educational and health care facilities, but also to the commercial spaces), arrangement and endowment (full or partly equipped with furniture and appliances, etc.), but also on the floor level. On average, in Timișoara the monthly rental fee is 14€/sqm, which remains lower than the value in Bucharest, 19 €/sqm.[33]

For Social housing buildings, owned or administrated by the Municipality, the value of the rental fee varies from 12.53 RON (approx. 3 EUR) for a social housing with 8 sqm room and 400 RON (85 EUR) for the houses built by the National Housing Agency (NHA)[34].

Equivalent economic status indicator

This information is not available in Timișoara. However, similar considerations could be derived from the analysis of the average income. Data for 2011 are the following:

Year	2014	2015	2016	2017	2018
RON	976	1.059	1.189	1.264	1.611
€[35]	230	250	280	298	380

[33] Data retrieved from: https://www.statista.com/statistics/913427/prime-office-rents-in-romania-by-city/
[34] The National Housing Agency was established under the Law no.152/1998 and carried out its activity under the authority of the Ministry of Regional Development and Public Administration, in particular offering housing construction programmes, i.e. Mortgage-Financed Dwellings and Rental Housing Units for Young People
[35]Banca d'Italia, Average annual exchange rate RON – EUR: 4,24

Table 2 - Total monthly average incomes per person – Region West[36]

Average delays and late bills payment

Information about average late bills payment in Timișoara is available only with reference to district heating, managed by the public company Colterm SA[37].

In Timișoara, 80,2% of buildings are connected to the central heating, corresponding to approximately 72,000 apartments and 200,000 inhabitants. Thus, the following table has high significance.

	N. of contracts	Delays	Average days	Cumulative debts value [RON]
2015	1,639	13,531	73	22,256,069.16
2016	329	11,999	96	18,113,954.74
2017	404	12,466	70	21,177,182.11
2018	215	11,541	64	17,042,417.77
2019	237	10,040	67	13,519,146.56
			Total	**92,108,770.34**

Table 3 – Delays in payments to the Local District Heating Company, 2015-2019

The number of contracts affected by delays in the payment of the bill is decreased over the last five year, passing from more than 1,600 to 237. As a consequence, also the overall debt value is being reduced over the time. However, the cumulative debt value is still relevant, reaching more than 92 million RON.

Building permits

According to the 2011 census, in Timișoara more than 23,000 buildings are total rehabilitated homes (17%). Approximately 12% had the external walls insulated and an addition 8% had windows and doors. Only 6% of the overall buildings has *Termopan* (Double Glazed) type windows and 4% has the roofs isolated from thermal and water[38].

[36] Romanian National Statistical Institute – Timis County Regional Directorate
[37] Colterm SA is owned 100% by the Local Council Timisoara and has as object of activity: production, transportation, distribution and supply of heat power; production and sale/supply of electric power; supply of cold water; design and execution of exterior/interior electrical installations for enclosures/civil and industrial constructions, open-air and underground branches of 0.4 kV nominal voltage
[38] Romanian National Statistical Institute – Timis County Regional Directorate

Total homes (number)	**137,200**	
Total rehabilitated homes	23,527	17%
External walls insulation	16,216	12%
Insulation of windows and doors from balconies	11,821	8%
Closing the balcony with energy efficient windows (so-called Termopan - double glazed - type windows)	8,333	6%
Thermo-waterproofing of the roofs	5,617	4%

Table 4 - Buildings status at 2011 in Timisoara

In addition to this, between 2017 and 2019, Timosara registered more than 350 requests for permits. Unfortunately, this information is partial since data for 2018 are not available.

The most common permits issued are related to “Dwellings building”, new dwellings. Some more permits are requested to attic and thermal isolation, Façade restoration, rehabilitation of block of flats and only one was asked to install a photovoltaic panel.

Requested data	2017	2018	2019
Attic and thermal isolation block	24	NA	36
Block roof covering	3	NA	-
Carpentry replacing	2	NA	-
Dwellings building	21	NA	230
Building rehabilitation	8	NA	
Façade restoration	1	NA	11
Installation of photovoltaic panels	2	NA	1
Block of flats rehabilitation	28	NA	9
Total	**89**	**NA**	**287**

Table 5 - Number of permits between 2017 and 2019

Eurostat data for 2019 shows an annual ratio of 20% of new constructions on the overall existing building stock in Romania. This index seems to be in line with the average of other European states.

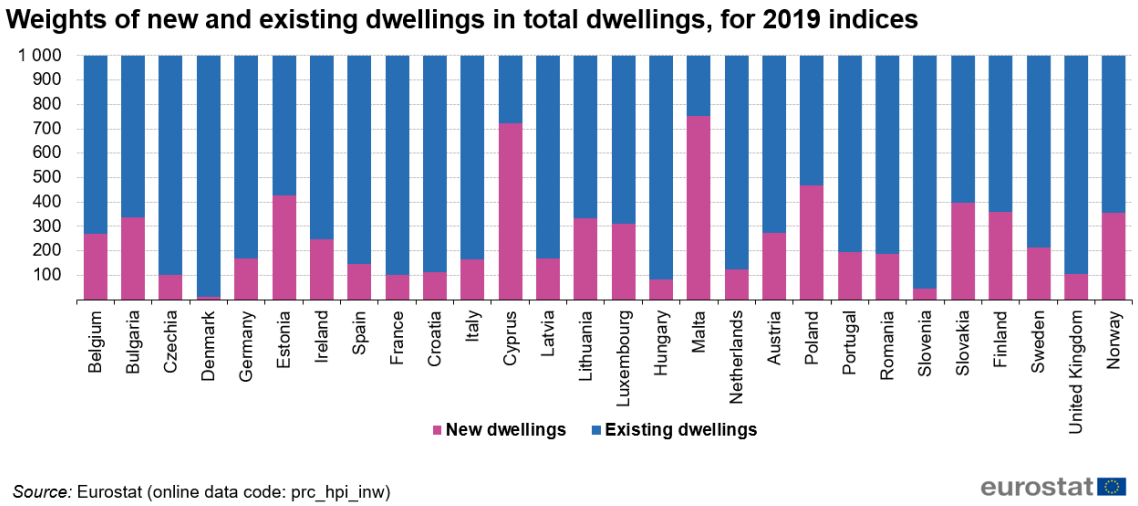


Figure 25 - New construction of dwellings in Romania

Investments in energy efficiency

The transition period after the end of the communist regime with the 1989 Revolution led to significant changes in the social and economic life of the residents of Timișoara. However, less markable results affected the average living conditions in the country. Although the average building age is 20-40 years, thus relatively recent, generally speaking the quality of materials and installations is low and deteriorating because of the lack of maintenance. Common issues are represented in the following picture (Figure 26)[39].

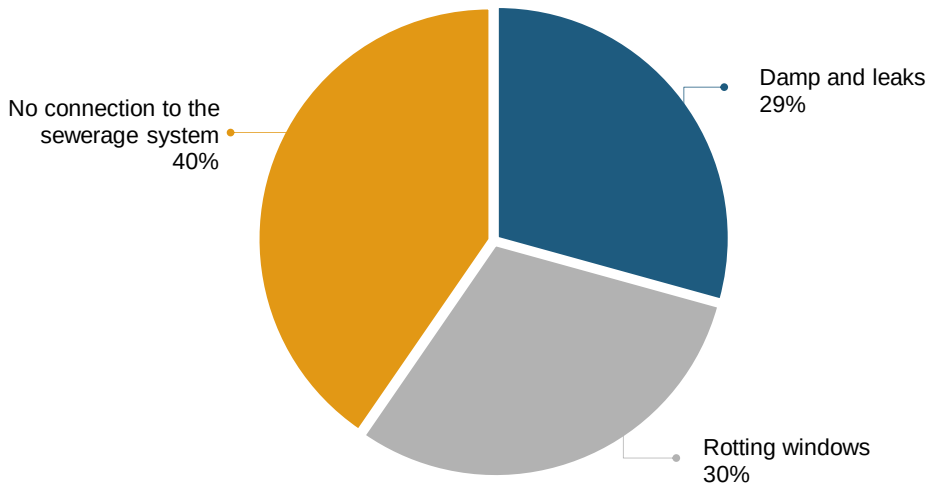


Figure 26 - Romanian building stock - common issues

[39] A.A. Muresan, S. Attia, Energy efficiency in the Romanian residential building stock: A literature review

In addition to this, Romanian buildings suffers from earthquake risk – especially in the Vrancea area – and risk of flooding.

In order to improve buildings and living conditions, the Romanian Authorities launched different support programs. Among these, in early 2000s the Government initiated a social housing construction program with international funds, a program for the rehabilitation of old buildings that do not meet earthquake safety standards and a support program for implementing nZEB in residential buildings such as the National Program for Thermal Rehabilitation of block of flats.

In addition, European funds from the programming period 2007-2013 financed energy efficiency interventions through EPC contracts. The financing scheme envisaged 60% of the investments covered by Regional Operational Programme (ROP) funds, while the remaining 40% was financed by ESCOs, which received their capitals invested back by the homeowners on the basis of the savings obtained.

After 2011, at national level, Romanians applied for the “Green House” Program, supported by the Environment Fund Administration (Administratia Fondului pentru Mediu). The purpose of this program was to improve the air quality and to reduce water and soil pollution caused by burning wood and fossil fuels, used traditionally to produce thermal energy for heating and hot water, fostering investments in renewable energy sources.

At local level, in Timișoara 85 buildings have benefited from the facilities of the “Green House” Program (81 solar panels and 4 heat pumps) from 2011 to 2014. The program consists of fixed amounts reimbursable grant from the Environment Fund budget, depending on the type of installation: solar panels, heat pumps and biomass boilers (pellets, briquettes, wood chips and waste from agriculture and forestry). The main eligible expenditures were: solar panels, boilers, automation, circulation pumps and expansion vessels, works for installation.

On average, the price of a complete system was 17,000 RON (approx. 4,000 EUR), including 3,000 RON for unpressurized solar panels, 6,000 RON for pressurized solar panels and 8,000 RON for air-to-air heat pumps, so even if the grant couldn’t cover the full cost the investment, it supported homeowners keen reduce their fuel bills and to improve air quality.

Before this, thermal rehabilitation registered positive, albeit modest, developments during the period 2009-2011. The local administration of the Municipality of Timișoara, through the local multi-annual Growth Program the Energy Performance of the blocks of flats, according to the Emergency Ordinance n.18/2009, monitored the intervention works for the thermal rehabilitation of 61 buildings whose value stands at 23,294,300 RON and achieved a considerable increase in energy performance. Due to the fact that this program depends on the budget allocations (50% of the costs are allocated from the state budget and 30% from the local budget, the associations of owners with only 20% of the costs), the allocated funds only financed a small number of buildings and the results are too poor in relation to the needs.

The problems of the roofs have been partially solved by building new attics over the buildings, where allowed by the structure. The cost of the works was borne by the developer in exchange for the attic space obtained.

Starting from 2018, the above-mentioned “Green House” Program was launched by the Government and financed the installation of photovoltaic panels on residential buildings. The program was addressed to individuals who wanted to become electricity producers (prosumers). The beneficiaries received 20,000 RON (4,165 EUR) per project. According to the Environment Fund Administration, the budget allocated for the program would allow about 33,000 houseowners to buy and install such equipment. The minimum installed power is 3 kW.

More recently, some buildings in Timișoara obtained the financing in the frame of the Regional Operational Program (ROP) 2014-2020. In particular, two interventions were developed:

- In September 2018, thermal rehabilitation of 6 housing blocks with 324 apartments. Total amount of the intervention 5,723,962.63 RON (approx. 1,190,805.24 EUR).
- In June 2019, thermal rehabilitation of 9 blocks of flats with 308 apartments, and in particular: thermal insulation of the exterior walls, replacement of the existing exterior window frames with more EE windows, closing of balconies with insulating joinery, thermal insulation of the floor above the basement and insulation of the floor over the last level (roof). Total amount of the intervention 8,062,565.62 RON (approx. 1,677,324.96 EUR).

The investments will lead to a decrease in energy consumption for heating, a reduction in CO_2 emissions and an improvement of the urban environment.

Energy certification per energy class

From the energy performance point of view, the vast majority of buildings in Romania ranges between class C and D, even if most buildings could be closer to class E or even F. The energy performance level of the buildings ranges between 150 and 400 kW h/m^2.

Average annual expenditure in gas and electric energy consumptions

Between 1948 and 1989, when Romania was under the communist regime, the economy was centralized. After the Revolution, the economy had a period of instability and the modernization of the energy sector did not start until the late 1990s, thanks to the continuation of the state-owned monopolies, to high levels of consumer subsidy and to the resistance to privatization of the coal, electricity and gas industries[40]. This led Romania to be one of the European states that are less dependent on energy imports according to the National Institute of Statistics Romania. In 2006, only 29% of Romania's energy supply was imported and imports were mainly oil and gas.

According to Eurostat, in 2015 the energy price was 0.13 EUR/kWh and the natural gas price was 27.11 EUR/GJ.

In Romania, more than 55% of the energy consumption is due to heating (Figure 27[34]). As previously mentioned, the majority of the buildings in urban areas are connected to the district heating networks, most of which date from the communist regime and are inefficient. For this reason, the district heating plant is undergoing a large refurbishment that is expected to improve the efficiency of the system.

In addition, most of the buildings need thermal rehabilitation, in order to reduce heat losses through the building's envelope and to decrease energy consumptions.

[40] Sharp M, Beware, E. Energy services: reducing the energy consumption of residents by behavioural changes. Energy Services - European Country Reports, May-2008

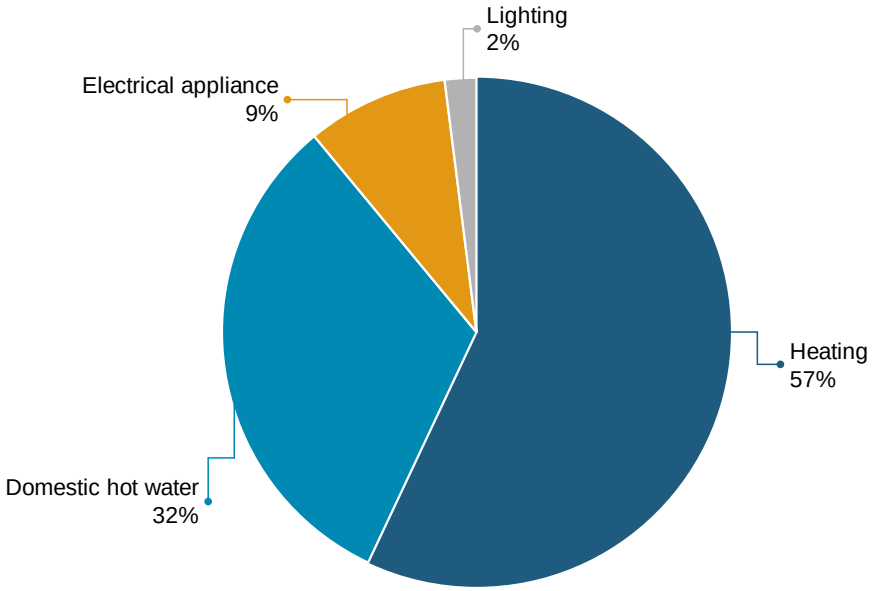


Figure 27 - The distribution of the total energy consumption of a Romanian household

With reference to Timisoara, data on energy consumptions are available for 2013-2014 for 1,500 buildings included in the project “Feasibility study for the Energy Service Company (ESCO) System and increasing the acceptability of the ESCO System in the energy efficiency market of collective dwellings”, provided by the Romanian Sustainable Energy Cluster ROSENC and financed in the frame of Sectoral Operational Program "Increasing Economic Competitiveness" - co-financed by the European Regional Development Fund.

The panel was composed by 1,500 building, built between 1831 and 1995, with an average age of 40 years. The average consumption in those buildings was approx. 70 Kwh/m2*year.

Mortgages

No data available.

3.3. Conclusions and Further Steps

The financial analysis conducted on the Romanian pilot area pointed out as the existing building stock is needing for energy efficiency interventions. On the other hand, households’ financial capacity is often insufficient to bear such intervention, making subsidies and financial incentives from third parties (mainly public) key factors. Indeed, what resulted is that in Timisoara the majority of the citizens are owners. In case of leasing contracts, rental fees tend to be very close to the average income. More, building stock needs deep energy efficiency interventions, being old, constructed with poor materials and - in many cases - not retrofitted, registering also high consumptions. This means that costs for energy efficiency interventions are expected to be relevant and, on average, considerably high in comparison with the average income of citizens. These issues combined together leads to the need of financial support to fund the interventions and this is why the Government designed supporting schemes in the past years. Such measures included grant schemes financing even more than 50% of the investments, considering that bearing such investments can be difficult for households.

Despite these interesting findings, the study couldn't identify specific clusters of residents to be targeted by the One-Stop-Shop within the PadovaFit Expanded! Project. In fact, data gathering encountered some criticalities mainly associated to the methodology of collecting and storing the required information: despite different database and sources of data exist, information is very often sorted in an aggregated way. This made it difficult to grasp or deduct data referring to groups of householders living in the same municipal division.

For this reason, the identification of target clusters of citizens and areas in the pilot couldn't rely on the analysis of households' financial capacity. Thus, the main findings from the technical analysis conducted within *D4.2 - Mapping Households' energy needs* have to be considered. In particular, three key factors have been identified:

- **Build Urban Environment** | Type of building present in the area and suitability for integrated refurbishment measures;
- **Projected Impact** | Number of people who will be potentially affected by refurbishment, based on population density;
- **Observed Willingness of Owners** | Likelihood of owners' associations to participate in a program focused on building rehabilitation, based on past experiences.

4. BULGARIAN PILOT AREAS

BULGARIA – GENERAL OVERVIEW

Bulgaria is located in the south east of Europe, precisely in the eastern part of the Balkan Peninsula. It borders five countries, namely Greece and Turkey in the south, Romania in the north and Macedonia and Serbia in the west. The superficies of the country is 110,994 km^2. In the west, there are the well-known Balkan Mountains and the border with Romania is marked by the Danube, connected with the Danubian Plain. Finally, in the south-west, there is the Rila-Rhodope massif and in the east the Black Sea, thus there is a complete mix of topographical characteristics. This configuration brings a lot of variability to climate in the country.

The territorial subdivision is based on 28 management units that are divided into 265 municipalities. The focus of PadovaFit Expanded Project is the district of Smolyan, in particular the Municipality of Smolyan and the district of Vidin, in particular the Municipality of Vidin.

As Figure 28 shows, the former is situated in the South-Centre of Bulgaria, precisely in the Rhodope Mountains, on the border with Greece. The name of the district derives from the administrative and industrial centre, namely Smolyan city. The territory of the province is about of 3192.8 km^2, divided into 10 municipalities with a total population of 127,752[41]. Thus, the Population of Smolyan district is 33 inhabitants[42] per km^2. As the figure shows, the density is one of the lowest in the Bulgarian State due to its territorial configuration.

The second district, Vidin, is located in the north-west of the country, sourrounded by the Danube river, on the border with Romania in the north and Serbia in the west. The district embraces an area of 3,032.9 km^2. Also in this case the management unit takes the denomination from its administrative city, namely the Municipality of

[41] Data by 2011 Census, National Statistical Institute
[42] Retrieved from National Statistical Institute, STATISTICAL REFERENCE BOOK 2019

Vidin. The population is 101,108 inhabitants, so the density is 28 inhabitants per square kilometer [43], the lowest in Bulgaria. The possible reason is the presence of several rivers that allow to use lands for agricultural activities. Therefore, people concentrate on the urban areas of the 11 provinces of Vidin.

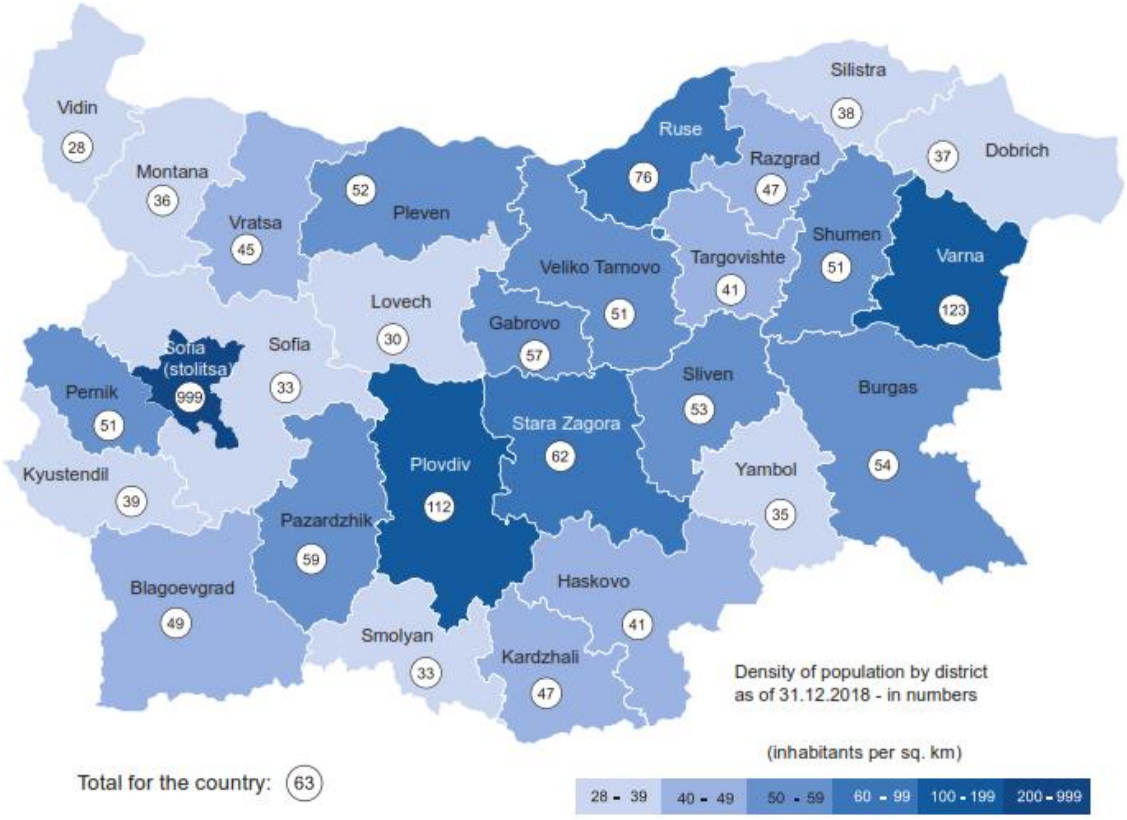


Figure 28 - Density of population by district - Source: National Statistic Institute

The Municipality of Smolyan

The municipality of Smolyan is characterised by high mountainous landscape in south Bulgaria, on the Greek-Bulgarian border. The location is in the valley of two rivers, Cherna and Byala, meaning Black and White River. Moreover, the municipality of Smolyan is situated 1,010 meters above sea level, thus being one of the highest municipalities in Bulgaria. Smolyan City is an important centre for the Region as well as a relevant touristic and environmental site. Historically, the city has evolved as a merge of nearby towns and due to its high mountainous terrain, it has grown to be the longest city in Bulgaria with a total length of 25 km. The area covers a territory of 854 sq. km in the middle of the Rhodope Mountains.

[43] Retrieved from National Statistical Institute, STATISTICAL REFERENCE BOOK 2019

The population of Smolyan municipality is 37,607 inhabitants, of which 28,160 live in the city of Smolyan where the population is decreasing. The net migration rate was -12%[44] in 2016. The municipality comprises 86 settlements, predominantly villages, distributed in 42 mayoralties, that are the administrative subdivisions within a municipality.

The biggest issue for the city is the underdeveloped infrastructure, both technological and urbanistic. In fact, only 60% of population has access to internet and 71% to public sewerage, both under the Country average[45]. Therefore, Smolyan goal is to enhance the infrastructure system, in particular referring to energy efficiency interventions on private buildings[46], by taking part in several European projects.

Figure 29 - Municipalities subdivisions of Smolyan District[47]

THE BUILDING STOCK – KEY ELEMENTS

From the energy efficiency perspective, another important problem in Bulgaria is the presence of old buildings, most of which were constructed more than 30 years ago. In particular, it is possible to analyse the building status for the Municipality of Smoylan, looking at the distribution of the stock per year of construction over the last decades[48]. Despite the increasing trend until 1989, a change occurred in the construction sector, starting from 1949. Buildings have started to include a large number of dwellings. Therefore, even if the number of buildings has been decreasing over time, the increase in the number of dwellings means that new buildings tend to be multifamily, with more and more units. The peak of constructions was reached between 1980 and 1989. After this date, the pace of constructions has declined considerably.

[44] https://www.regionalprofiles.bg/var/docs/Profiles-2016-EN/19-Smolyan-District-ENG.pdf
[45] https://www.regionalprofiles.bg/var/docs/Profiles-2016-EN/19-Smolyan-District-ENG.pdf
[46] https://urbact.eu/sites/default/files/iap_smolyan_smartimpact_fin.pdf
[47] https://www.regionalprofiles.bg/var/docs/2017e/Smolyan.pdf
[48] Data from the National Statistical Institute (NSI)

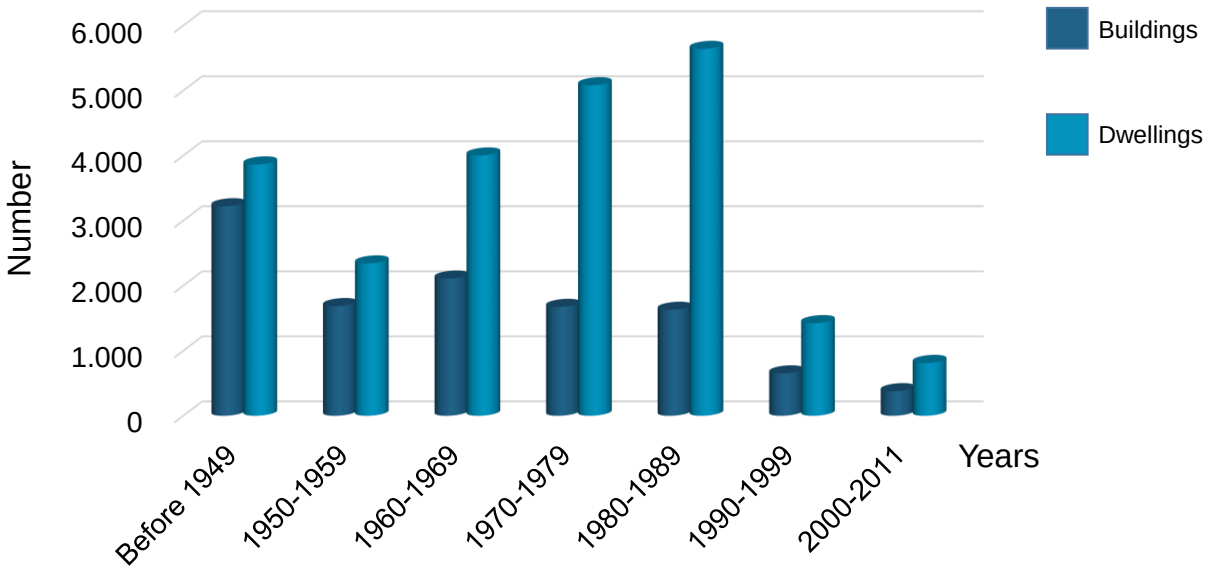


Figure 30 - Buildings per year of construction in Smolyan

This means that the overwhelming majority of the Bulgarian building stocks are over 30 years old. As a consequence, more than 90% of buildings are in bad conditions and need deep interventions, in order to improve their energy efficiency and certification.

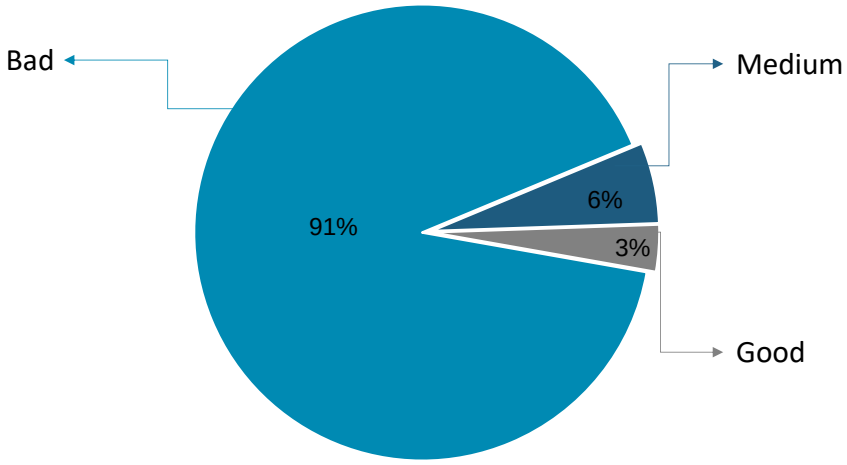


Figure 31 - Buildings status in Smolyan

The Municipality of Vidin

The Municipality of Vidin is located in a strategic position, allowing the connection between the North and the Black Sea, as well as between the Central and South-Eastern Europe. This thanks to the Danube River (Rhine - Main - Danube European transport corridor № 7). This configuration allows Vidin to exploit opportunities, through its port, for the economic development of the city, but also of the district and the entire country. Moreover, these favourable geographic features create good conditions for the transport and industrial sector in the north-western part of Bulgaria.

The Vidin - Calafat Bridge (New Europe Bridge) is a road and rail bridge between the cities of Vidin, Bulgaria, and Calafat, Romania. It is the second bridge on the shared section of the Danube between the two countries. It was opened on 15 June 2013. The Vidin-Calafat Danube Bridge is of key significance not only for the development of the Pan-European Transport Corridor IV, but also for the entire South-East European Transport Axis and the Trans-European Transport network. It gives opportunities for combined transport and for transferring certain volumes of traffic from road to rail. The traffic statistic for 2019 shows that around 1,064,420 vehicles have been crossing the bridge.

In addition, the Municipality of Vidin is remarkable for its history, which makes it a cultural and touristic site. Despite all these positive factors, the population is decreasing, mainly due to the last years of recession that prompted young people to migrate to other regions. In fact, in 2017 the population was 54,737, about ten thousand inhabitants less than the value of the last census in 2011 (63,348).

In order to cope with all these issues, the city aims to attract the interest of investors. In particular, the main focus is on increasing energy efficiency in the public transport sector and facilities, but also in private buildings.

Figure 32 - Municipalities subdivision of Vidin District[49]

THE BUILDING STOCK – KEY ELEMENTS

As in Smolyan, the majority of buildings in Vidin was built between 1950 and 1980[50], even if the trend was constantly increasing until 1980, when a slow decline started. In addition, numerous dwellings have been included in the same building, especially since the 1960.

Again, the majority of the buildings are in a bad state of repair and only 3% are in good condition.

[49] https://www.regionalprofiles.bg/var/docs/2017e/Vidin.pdf
[50] Data from the National Statistical Institute (NSI)

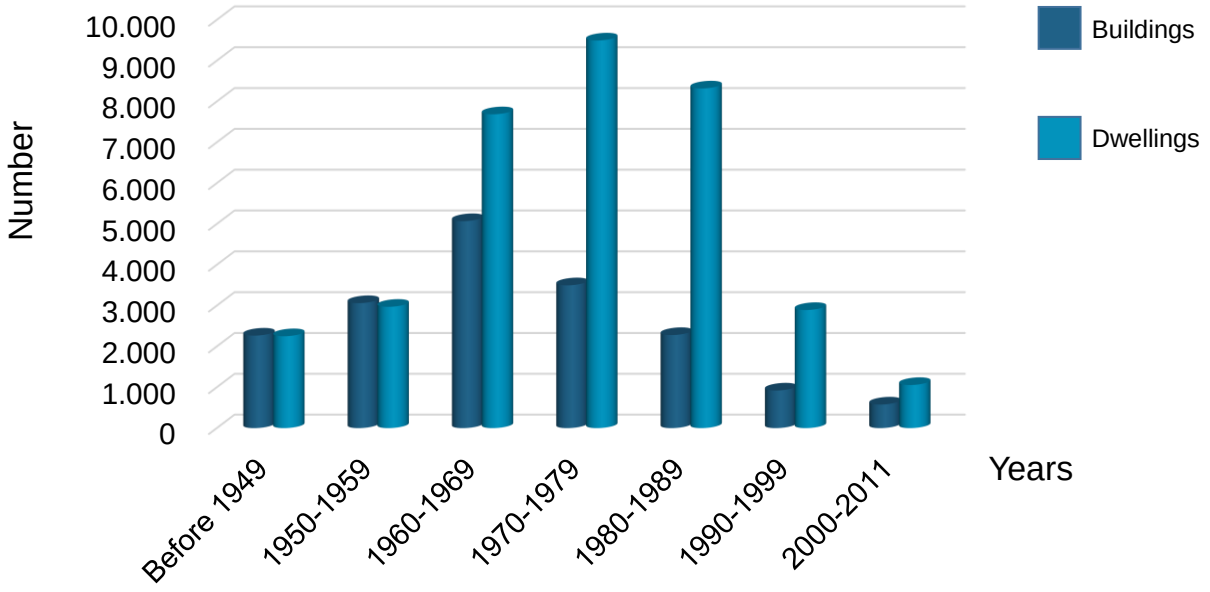


Figure 33 - Buildings per year of construction in Vidin

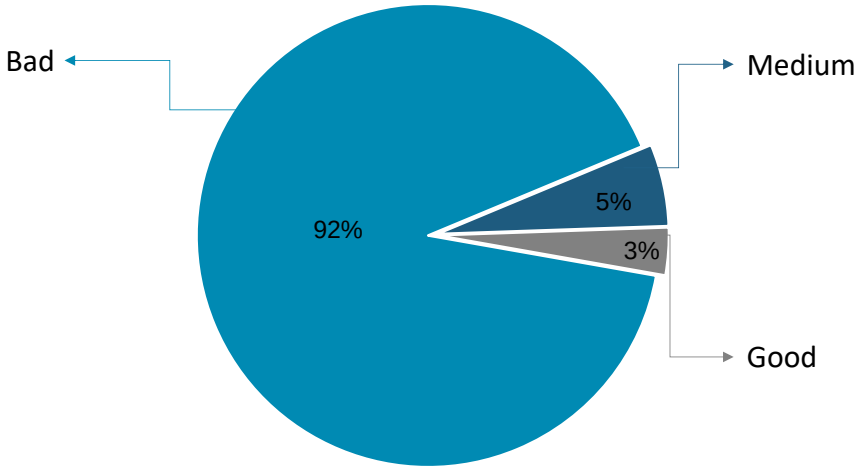


Figure 34 - Buildings status in Vidin

4.1. Mapping and analysis of households' financial capacity

The same methodology applied in Padova and Timisoara should be applied also in the Bulgarian pilot areas in order to map and analyse householders' financial capacity and successfully structure the OSS.

In this report, a first step is made in order to gather and analyse input data, starting from the checklist in Annex I. Data collection encountered some difficulties as in Padova and Timisoara. This is because data are related to personal features. In addition to this, it was not possible to access database or other data sources in order to reach (at least indirectly) the required information. The Energy Agency of Plovdiv analysed data from the

municipal programs, strategies and surveys in order to collect more information. Nonetheless, statistical data from the National Statistical Institute are mainly aggregated and not available at district level since in Bulgaria there are no territorial subdivisions of the municipalities. Thus, collected data in Smolyan and Vidin pilot areas address properly only few requirements of the checklist and most of them are at national level.

Taking into consideration the difficulties encountered in collecting financial indicators, it has not been possible to replicate the combined analysis carried out in Padova for these two cities. This report focuses on implementing the general analysis to feed the Action Plan to be developed within the PadovaFit Expanded project, leaving further in-depth studies for the coming months. Moreover, more data could be available since the results of the last census are being currently elaborated.

At the current stage, eight features are presented in this section and they differ in terms of depth of testing:

- With regard to contract type, data are at national level;
- Rental fees are described for both the Municipalities of Smolyan and Vidin;
- Information about equivalent status only relates to Bulgaria;
- With regard to bill late payments, it was not possible to isolate the effect of the specificity of energy bill, however data are available at national level;
- Data on the National Program for Energy Efficiency of Multifamily Buildings provides information on the total costs of the interventions developed in Bulgaria;
- With regard to energy certification, the classification of energy classes for residential buildings at national level is available;
- With regard to energy consumption, data are provided at municipality level, while the energy expenditure for gas and electric is at national level;
- For mortgages, the analysis provides evidence at national level;

Data or assumptions about the average delay of bills and building permits are not currently available.

Data	Availability	Level: Country	Level: Region	Level: Municipality	Level: Neighborhood
Contract type (ownership or lease)	■	■			
Amount of rental fee	■			■	
Equivalent Economic Status Indicator (or similar)	■	■			
Average delay of bills	■				
Average late bills payment (percentage or amount)	■	■			
Building permits, commencement notice (or similar)	■				
Total costs and location of the interventions	■	■			
Energy Certification per energy class	■	■			
Average annual expenditure in consumptions*	■	■		■	
Residual mortgages and duration	■	■			

* Expenditure is at national level, while consumptions is specific for both municipalities

Figure 35 - Data input availability and level of testing in Bulgaria pilot area

The following paragraph will focus on the analysis of data gathered.

4.2. Analysis of financial indicators

The aim of this section is to retrieve the largest amount of information about households' financial capacity, implementing the above-described methodology and performing a general analysis. In fact, at this stage of the project, the Bulgarian pilot areas have the opportunity to leverage on the lessons learnt in developing this analysis in other European contexts, and include them in the Bulgarian Action Plan. Starting from this, further in-depth studies could be conducted once more data are available and the OSS is going to be structured.

CONTRACT TYPE

In Bulgaria, the percentage of people owning a dwelling is 84.3%, ranking above the average value in the EU countries, which is 70.1%[51]. Most of them also live in their own property.

[51] Data from Eurostat at 2014

The distribution of the dwellings by tenant status is available for 2011 and only at district level. Based on statistical data, the Energy Agency of Plovdiv estimated the distribution at municipal level:

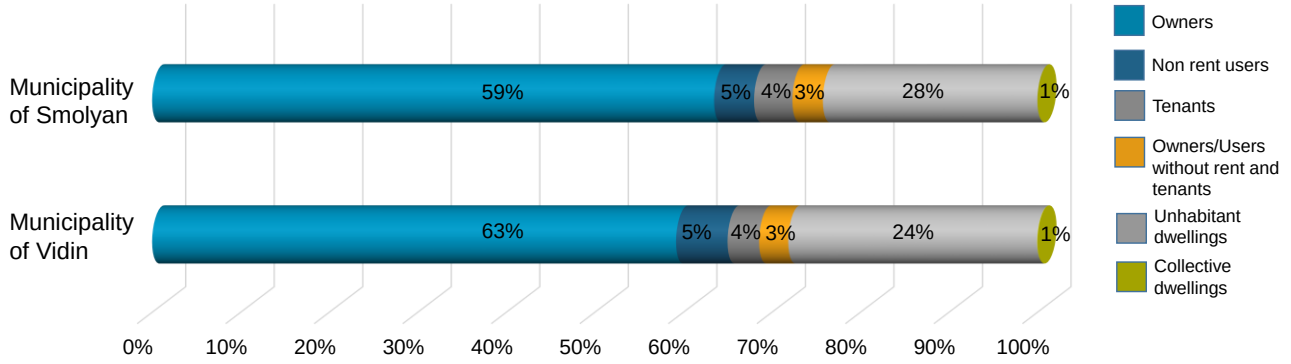


Figure 36 - Building status in the two municipalities

Amount of rental fee

The amount of rental fee in Smolyan varies from a minimum of € 70 to a maximum of € 300 monthly. Whereas in Vidin it varies from € 100 to € 150 monthly. In Bulgaria the economic situation of poor life condition is reflected in the high percentage of people, 16.6%, who live in rental free or subsidized houses while the rest pays rent at market price.

Equivalent economic status indicator

The average total expenditures in Bulgaria for housing was about 17.6% in 2018[52]. In general, the expenditure composition remained quite stable over the last 5 years. Indeed, the biggest share derives from food, alcoholic beverage and tobacco. In 2018 it was about three percentage points lower than in 2014. The housing expenditure increased between 2014 and 2015 and between 2016 and 2017, while it decreased in 2018. However, the delta is about 1%, so on average the share did not change significantly. While the remaining component remained stable during the analysed period, other expenditures and taxes slightly increased during those years, passing respectively from 20.9% to 22.7% and from 4.9% to 5.5%.

[52] https://www.nsi.bg/sites/default/files/files/publications/StatBook2019_en.pdf

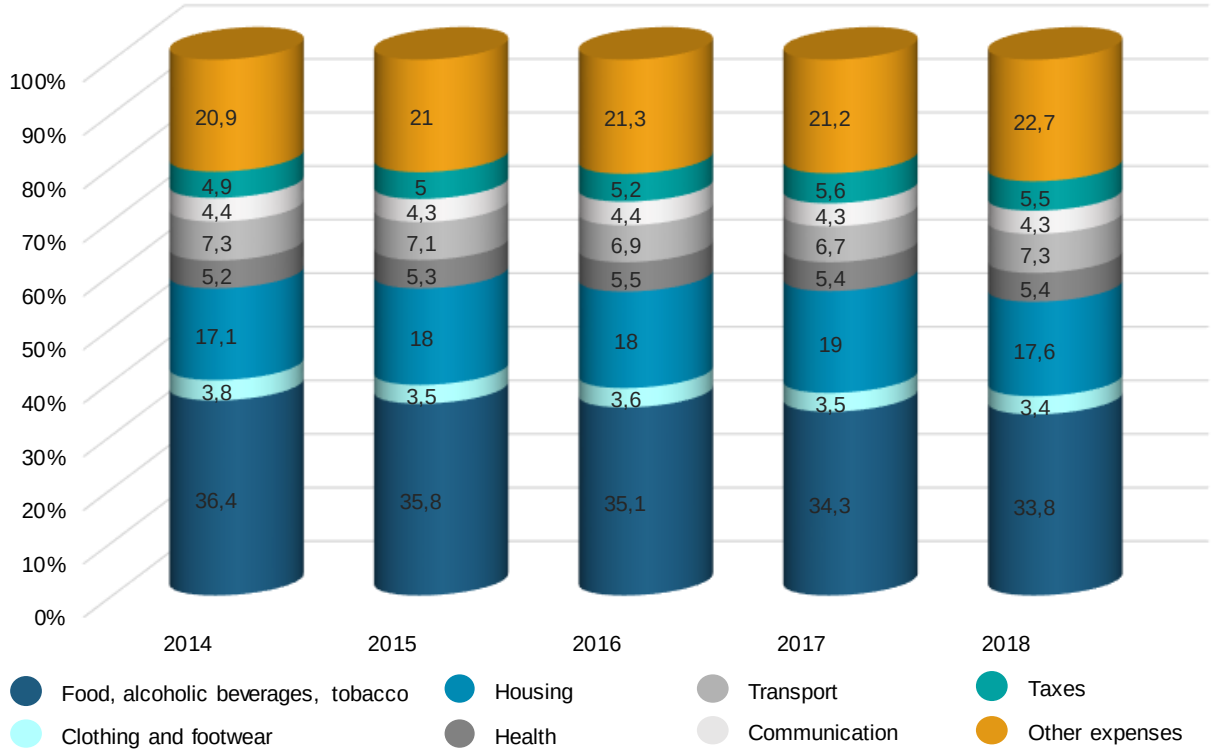


Figure 37 - Structure of total households' expenditures in Bulgaria

For the purpose of the analysis, it is important to underline a key ratio derived from the high level of poverty, namely the overcrowding rate. Indeed, it is common that families share the same dwelling because of their financial conditions. In fact, even though in Bulgaria the number of houses is higher than the number of families, almost 30% of dwellings are inhabited and families are used to live in small apartments[53]. In addition, the at-risk-poverty rate in 2017 was 23.4%[54].

What is also relevant to consider is energy poverty condition in the country. In Vidin, over 39% of the district's population lives below the national poverty line. In the municipality of Smolyan the percentage is 21%[55]. In fact, Bulgarian households are often unable to keep adequate temperature and internal comfort in their homes due to low incomes and relatively high energy costs.

In the following graphics some indicators of Energy poverty at EU level are presented. It can be seen that Bulgaria is characterised by the worst values for these indicators. The indicators offered by the Methodology based on input from the Energy Poverty Observatory.

[53] World Bank, Bulgaria housing stock overview, 2017
[54] Eurostat glossary definition: "The at-risk-of-poverty rate is the share of people with an equivalised disposable income (after social transfer) below the at-risk-of-poverty threshold, which is set at 60 % of the national median equivalised disposable income after social transfers."
[55] https://www.regionalprofiles.bg

First of all, the above-mentioned difficulties in keeping home adequately warm affect 35% of the Bulgarian population, representing also the highest value in EU.

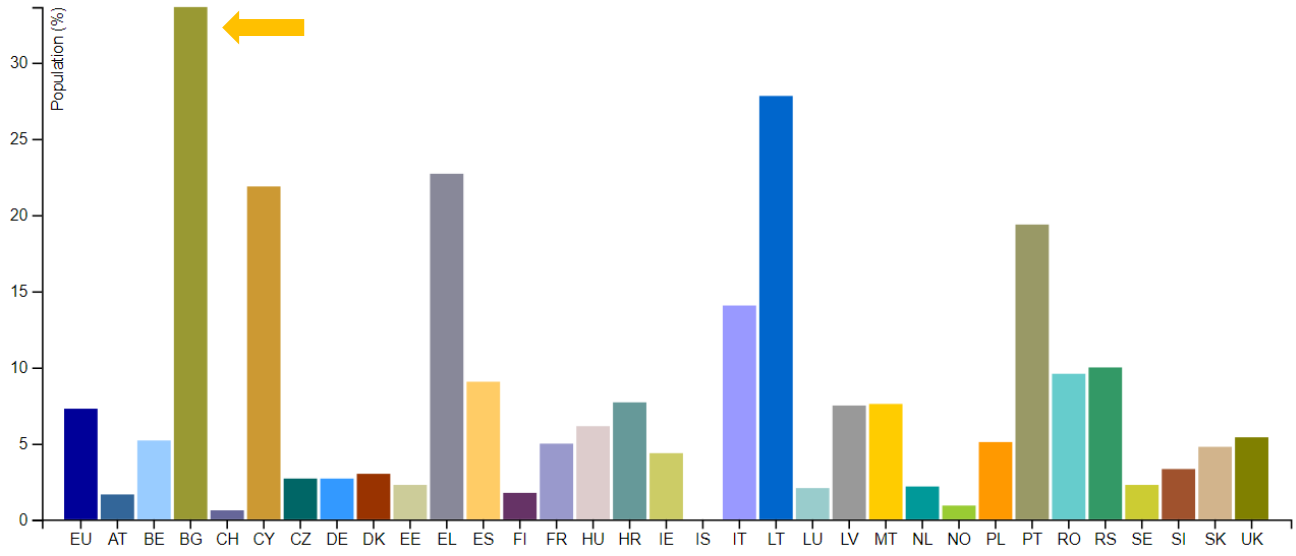


Figure 38 - Inability to keep home adequately warm in 2018

In addition, the Observatory registered the share of population having arrears on utility bills, being unable to pay on time due to financial difficulties for utility bills (heating, electricity, gas, water, etc.) for their main dwelling. This indicator is among the highest in EU.

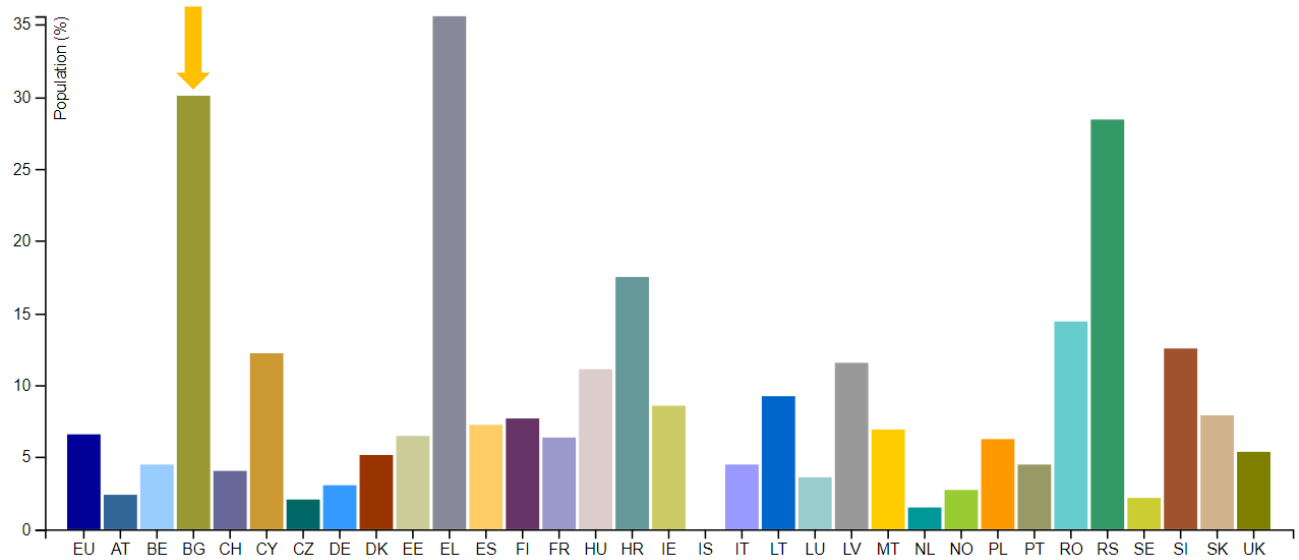


Figure 39 - Arrears on utility bills in 2018

The following graph shows the M/2 indicator, which represents the share of households whose absolute energy expenditure is below half the national median, being abnormally low. According to the Observatory, this could be due to high energy efficiency standards, but may also be indicative of households dangerously under-

consuming energy. Nonetheless, the indicator is influenced by the underlying distribution of absolute energy expenses in the lower half of households. If the median is relatively high and the distribution below very unequal, the M/2 indicator is high.

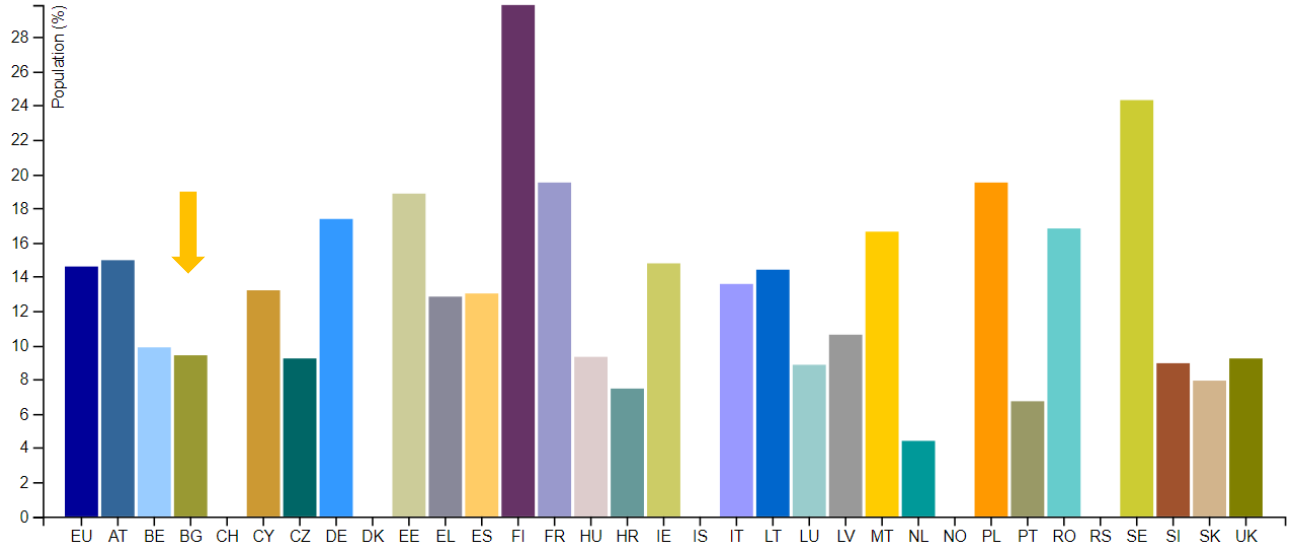


Figure 40 - Low absolute energy expenditure (M/2) in 2015

As a complementary information, the 2M indicator represents the share of households whose ratio between energy expenditure and income is more than twice the national median. The Observatory points out that where income distributions are more equal, variance in energy expenditure translates to higher 2M shares. High variance in energy/income shares can occur due to structural differences in energy expenditure between household groups, as well as in situations where energy is often, but not exclusively, included in rent.

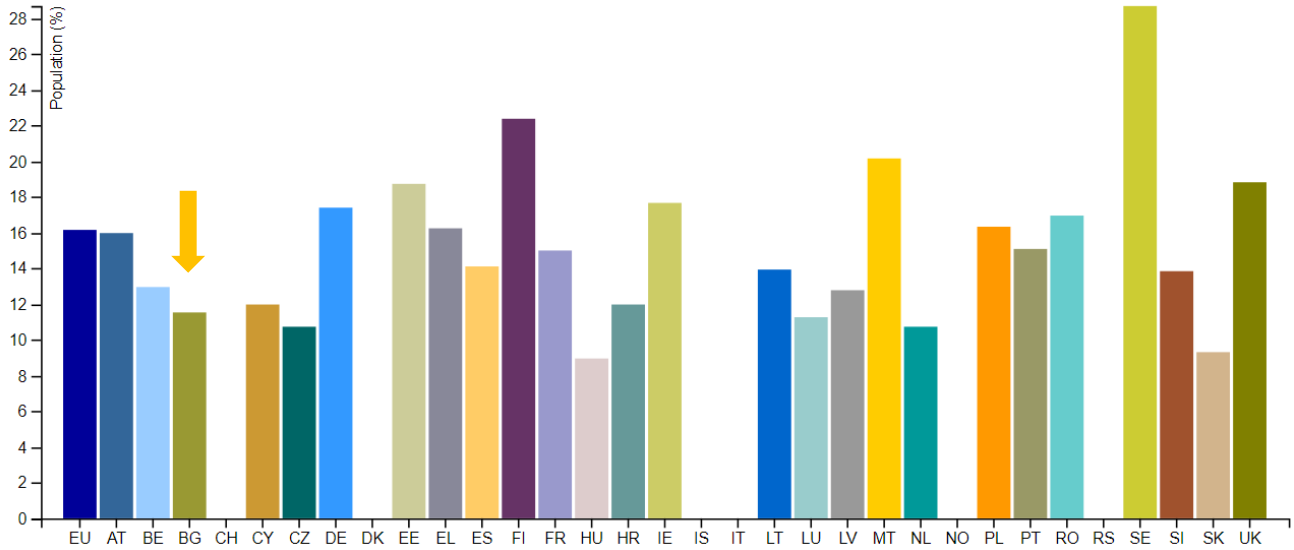


Figure 41 - High share of energy expenditure in income (2M) in 2015

Average late bills payment

Both Vidin and Smolyan do not have a district heating plant and gas infrastructure. So, the production of heat for the residential buildings is based on woodstoves and biomass stoves for single apartments and biomass boilers for single family houses. The households use also small electrical heating devices (electric heaters, etc.) to supplement the stoves. The domestic hot water is either boiled on the domestic stoves or through electrical boilers.

The only energy bills paid in both municipalities are for electricity and it is difficult to split the electricity consumed for heating from the overall bill, so estimations are not reliable. Also, more than 60% of the households in Vidin and 78% of the households in Smolyan use wood and coal which are being bought by the households once a year at the start of the heating season and throughout the season households limit their energy consumption to the amounts they have.

Nevertheless, the percentage of people that do not pay bills (water, energy, heating, etc.) is about 30%[56], one of the highest values in EU.

Investments in energy efficiency

Bulgaria is the most energy-intensive economy in the European Union. Coal is the source for 38% of the overall energy production. The Government endeavours to reduce pollution in order to meet the criteria required by the EU[57]. In addition, energy efficiency is fundamental to increase energy savings of the country and the quality of living for the population.

This is reflected in the programmes passed for renovation in residential buildings.

The Energy Renovation of Bulgarian Homes started in 2012 and ended in December 2015. The project was implemented in 36 cities, which belonged to the six regions for planning of the country and 158 multifamily buildings were renovated. In the Vidin municipality were renovated 2 residential buildings. In the city of Smolyan were renovated 15 residential buildings.

Eligible energy efficiency measures included:

- Replacement of joinery;
- Thermal insulation, construction of installations for utilization of renewable energy efficiency sources;
- Repair or replacement of an internal heating /cooling/ventilation installation, including radiator thermostatic valves and distributors in the common areas of the building/block section;

[56] https://www.energypoverty.eu
[57] Directive 2012/27/EU aims to establish a common framework to promote energy efficiency within the Union. The objective is to save 20 % of the Union's primary energy consumption by 2020, and then to set up conditions for the future

- Repair of electrical installation in the common parts and introduction of energy-saving lighting in the building/block section*;*

- Attendant construction assembly works, related to the implementation of energy efficiency measures and recovering the common areas of the building/block-section as a result of the implemented measures with energy saving effect.

More recently, the National Program for Energy Efficiency of Multifamily Buildings promoted by the Government was launched for the first time in 2015 with a budget of 1 billion BGN (500,000 €), then renovated in 2017 with additional 1 billion BGN (500,000 €) from the budget of the Ministry of regional development and public works[58]. The program aims to increase the energy efficiency of multifamily residential buildings and decrease energy expenditures, to extend the lifetime of buildings and reduce air pollution. The number of renovated buildings in the city of Smolyan was 33. The number of renovated buildings in the Vidin municipality was 14.

Within the program, the National Energy Efficiency Targets are:

- Energy savings at Final Energy Consumption (FEC) level: 716 ktoe/y;

- Energy savings at Primary Energy Consumption (PEC) level: 1,590 ktoe/y, including 169 ktoe/y in energy transformation, transmission and distribution process.

The main characteristics of the Programs are the following:

- *Targets*: multifamily apartment building renovations in all the 265 municipalities in the country. To be eligible for the Program the building should include pre-1999 panel, monolithic cement and brick buildings with three or more floors and six or more apartments. Moreover, in order to meet the criteria for eligibility, homeowners need to form and register in Homeowners' Associations (HOA), in accordance with the Condominium Ownership Management Act.

- *Financial support*: the Program provides the HOAs with 100% grant support to finance interventions. The municipalities manage the process after having signed the contract with the registered HOAs. To finance the Program, the Bulgarian State borrows money from International Financial Institutions (IFIs). The Bulgarian Development Bank (BDB) is in charge of mobilizing the financing. BDB will pay the contractors based on requests by municipalities acting on behalf of the HOAs. Because the grant is 100%, the State Budget reimburses all the expenditures to cover the Bulgarian Development Bank's repayment obligations towards the IFIs.

- *Eligible expenses*: eligible expenses include *(i)* Energy efficiency measures, i.e. thermal and hydro insulation, replacement of windows and doors, treatment of the external façade panel joints; *(ii)* Refurbishment on common parts related to EE and safe habitation; *(iii)* Replacement of old internal plumbing systems and replacement of the vertical main water supply and waste drain pipes; *(iv)* Renovation of surrounding public areas.

[58] http://www.seea.government.bg/documents/TRA%20BG%20NEEAP%202017%20EN.pdf

- *Implementation*: the different municipalities deploy the project and supervise it.

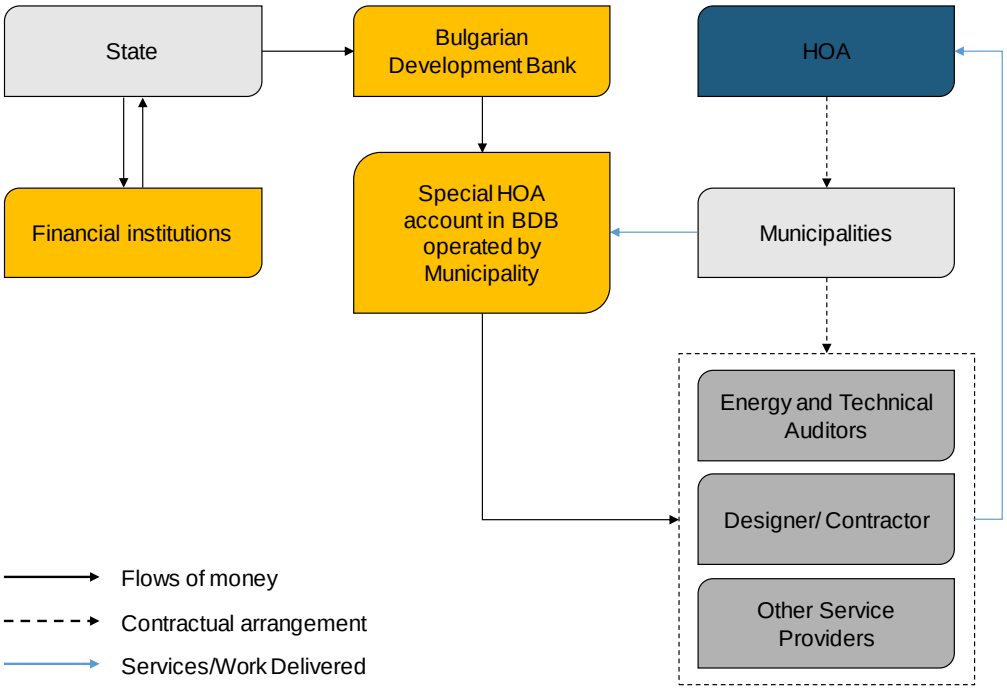


Figure 42 - Scheme of the National Program for Energy Efficiency of Multifamily Buildings

The Government is aware of the impossibility to guarantee the 100% grant also from 2020 onwards. The Bulgarian Government could not economically sustain the financing of further EE measures.

The World Development Bank has analysed the Bulgarian Program for Energy Efficiency. In particular, the focus was the examination of the first-phase results and then the possible development for phase two. The institution underlines the impossibility to continue with the same scheme of phase 1, the 100% grant. Thus, in the analysis, it suggests a future mechanism that might be a mix of grant and own funds, the former no lower than 20% of investments costs. In particular, the WDB proposes to avoid the recourse to loans financing, considering them less attractive for homeowners and a more complicated delivery mechanism than a grant. The reason is that loans require covenants or other contractual agreements and the initial contribution of homeowners. Instead, the mechanism of the grant would be a repayable one. In fact, homeowners would receive the upfront value of the investment, so, initially, they do not require to use own funds. However, they would repay part of the grant thanks to the savings achieved through lower energy consumption and expenditures. Therefore, this mechanism would increase the responsibility of homeowners making them more careful in energy use. In this way, the transition from a 100%-grant scheme to a decreasing amount of grant in favour of private funds would be softer, even if still difficult for houseowners to accept, being reluctant to invest in such interventions.

Energy certification per energy class

The goal of the Government is to enhance the level of energy class, as defined by Ordinance number 7[59] for energy efficiency in buildings, reaching at least class C. Indeed, more than 75% of buildings in Bulgaria were built more than thirty years ago and the certifications related to their energy performance are often ranked among the lowest classes. In addition, due to high poverty level and low life conditions, Bulgarian houses were built with prefabricated stock[60]. For these reasons, about 91% of buildings in Bulgaria are between classes E, F and G, accounting respectively for 39%, 34% and 18% of the overall building stock. Class G buildings offer the higher potential for energy efficiency renovation measures, particularly multifamily residential buildings, given the possibility of obtaining economies of scale. Moreover, homeowners may share the cost of measures and be less reluctant to invest, while in single-family houses the willingness to invest would be much lower[61].

Energy class	EP min, kWh/km²	EP max, kWh/km²	Residential buildings
A+	<	48	
A	48	95	
B	96	190	
C	191	240	
D	241	290	
E	291	363	
F	364	435	
G	>	435	

Figure 43 - Energy class certification for residential buildings in Bulgaria

Average annual expenditure in gas and electric energy consumptions

Both in Vidin and Smolyan, 75% of the overall energy consumptions derives from the housing stock. The energy mix in the residential sector is comprised of electricity, wood and coal, and pellets. This is so also because both the municipalities do not have a district heating plant and gas supply infrastructure. Therefore, the production of heat in the residential buildings is based on solid fuels and stoves for wood, wood and coal and biomass for single apartments and biomass boilers for single family. In addition to this, they may use also small electrical

[59] Ordinance no. 7 on energy efficiency buildings is contained in the Energy efficiency Act of 2015 and it was amended in respect of the previous version of 2004. It defines the classification of energy classes for buildings in Bulgaria
[60] World Bank, Bulgaria housing stock overview, 2017
[61] Data from the Energy Agency of Plovdiv

heating devices to supplement the stoves. The domestic hot water is most commonly boiled on electrical boilers or with domestic stoves. The deployment of PV and solar thermal installations is relatively low.

The energy mix consumption is different between the two municipalities. In Vidin, energy consumption shows a high share of electricity, while in Smolyan wood is the prevailing fuel, as described in Figure 44.

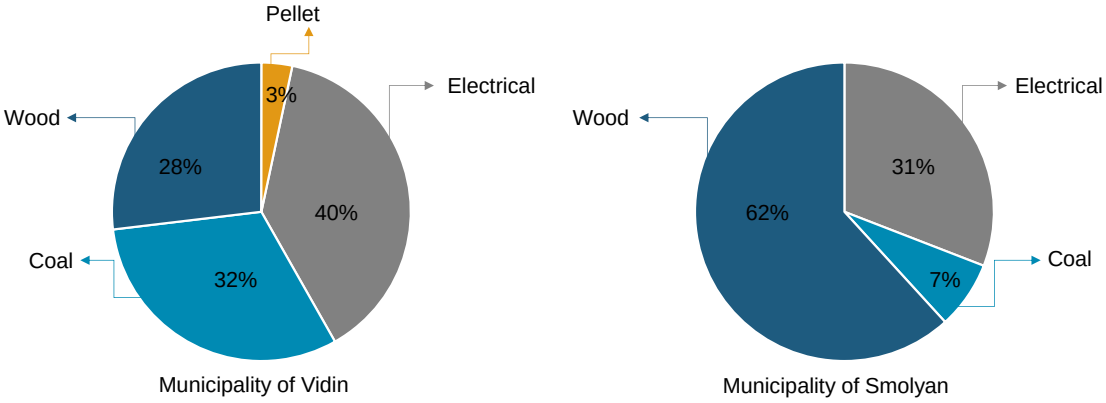


Figure 44 - Energy consumptions in the Municipality of Smolyan and Vidin

In both cases the majority of CO2 emissions in the municipalities derives from the residential sector where it is therefore fundamental to intervene with energy efficiency interventions.

Unfortunately, no data are available on the average annual expenditure for energy consumptions in the Municipalities.

However, it is important to notice that, in 2016, households' electricity prices in Bulgaria were considerably below the EU average level. In fact, the price in Bulgaria was 0.08 €/KWh[62], while the average in EU was 0.21. The same was true also for gas expenditure, since in Bulgaria gas price was 0.031 €/KWh, while the average in the Union was 0.064 €/KWh.

Mortgages

In Sofia, the capital city of Bulgaria, the average value for a mortgage ranges between 80,000 – 90,000 BGN (approx. 40,800 – 45,900 EUR[63]), while for other cities is around 50,000 BGN (25,500 EUR). Even if loans can be customized and thus the technical features vary from one to another, it is possible to identify some standard parameters as follows[64]:

Purpose | the majority of loans are issued for the purchase of the first house; other common purposes are related to construction, repair and reconstruction of the property;

[62] https://eur-lex.europa.eu/legal-content/DE/TXT/?uri=CELEX:52017SC0386
[63] Banca d'Italia, average exchange rate at February 2020, 1 BGN=0,51 EUR
[64] World Bank, Bulgaria housing stock overview, 2017

Loan amount | up to 85% of the appraisal value of the real estate provided as collateral;

Maximum repayment term | up to 35 years, even though the average repayment period is 18 years;

Currency | it is possible to choose between EUR and BGN. Usually, customers prefer the national currency;

Debt to income ratio | about 60%;

Non-performing loans | only 3%.

4.3. Conclusions and Further Steps

The lack of punctual data on homeowners' financial capacity both in Vidin and Smolyan, together with the absence of districts division in the two municipalities (e.g. census divisions) do not allow the identification of clusters of homeowners, since it is not possible to segment the population on the basis of an objective parameter. This led to the impossibility of identifying feasible target groups for the interventions supported by the OSS to be implemented, at least from a financial point of view.

For this reason, at this stage of the project, the best option is to replicate the methodology applied in other European projects focusing on energy efficiency. Indeed, Smolyan and Vidin have implemented energy efficiency measures in order to reduce CO2 emissions and increase the use of RES. Moreover, they have started to identify the so-called Positive Energy District – PED, *"a district with annual net zero energy import and net zero carbon emissions, working towards an annual local surplus production of renewable energy*" as defined by the European Strategic Energy Technology Plan (SET Plan). The areas identified to apply to Horizon 2020 projects were the complex Himik in Vidin and the Old City Center in Smolyan. The identification of the PED was regulated by the following criteria:

- Presence of renovated buildings to be taken as example for other buildings in the PED;
- Presence of both residential and private buildings; the two municipalities would implement EE measures in public buildings in order to encourage homeowners to invest for their private dwellings;
- The intervention should focus on buildings with class G;
- Presence of different type of buildings: apartments, single houses, multifamily buildings and so on;

As aforementioned, homeowners are usually reluctant to invest own funds in such projects and this could stop the process for the PED implementation. In fact, whereas the public buildings participate per se in the PED, the residential buildings are reluctant to apply for renovation (i.e. to increase their energy efficiency) without specialised municipal support. So, the municipal authorities seek approaches and methodologies to encourage the citizens to undertake actions for renovation of their homes. Therefore, the One-Stop-Shop would be fundamental to overcome these issues and to foster energy efficiency measures.

For the purpose of the analysis, according to the Energy Agency of Plovdiv, the two areas could represent the target for the OSSs to be implemented in Vidin and Smolyan and to be included in the Action Plan to be developed within the PadovaFit Project. This will allow the Municipalities to leverage on their previous

experiences and interventions to further foster energy efficiency in those areas, covering also residential buildings. Moreover, additional studies could be developed in the future to fine-tuning the areas to be addressed.

ANNEX I - CHECK LIST DATA INPUT

Input: Buildings characteristics

- Per capita or family income
- Late rental payments (insolvency risk)
- Late bills payments
- Number of dwellings in the same condominium
- Number of occupants
- Type of occupants (single, n. of children,..)
- Average age of occupants

Input: Financial capacity

- Contract type (ownership or lease)
- Amount of rental fee
- Equivalent Economic Status Indicator (or similar)
- Average delay of bills

- Average late bills payment (percentage or amount)
- Building permits, commencement notice (or similar) released according to type of intervention:
    - New construction
    - Renovation
    - Refurbishment/retrofitting
    - Renewable installations (power, year, KWh,..)

Total costs and location of the interventions (in the last 10 years)

- Energy Certification per energy class
- Average annual expenditure in gas and electric energy consumptions
- Residual mortgages and duration

ANNEX II - RENTAL FEES AND REAL ESTATE VALUES IN PADOVA

			REAL ESTATE VALUES [€/sm]						RENTAL FEES [monthly €/sm]					
		STATUS	NORMAL			OPTIMAL			NORMAL			OPTIMAL		
	MUNICIPALITY	AREA	MIN	MAX	AV	MIN	MAX	AV	MIN	MAX	AV	MIN	MAX	AV
	Abano Terme	B1	1.150	1.550	1.350	950	1.250	1.100	5,2	7,0	6,1	4,0	6,0	5,0
	Abano Terme	B2	1.150	1.450	1.300	1.450	1.850	1.650	5,3	7,9	6,6	5,5	8,1	6,8
	Abano Terme	D3												
1	Abano Terme	E1	1.100	1.400	1.250	1.300	1.550	1.425	4,5	5,9	5,2			
	Abano Terme	E2												
	Abano Terme	R1	1.200	1.400	1.300	1.300	1.550	1.425	4,5	5,9	5,2			
	Abano Terme	R2												
	Albignasego	B1	1.100	1.450	1.275	1.450	1.850	1.650	3,6	4,6	4,1			
	Albignasego	D1	1.100	1.400	1.250	1.550	1.900	1.725	3,6	4,6	4,1			
	Albignasego	D2	850	1.200	1.025	1.100	1.550	1.325	3,6	4,2	3,9			
2	Albignasego	D3												
	Albignasego	E1	1.000	1.300	1.150	1.250	1.700	1.475	3,6	4,2	3,9			
	Albignasego	R1												
	Albignasego	R2												
	Cadoneghe	B1	1.000	1.250	1.125	1.250	1.650	1.450	4,5	5,5	5,0			
	Cadoneghe	D1	1.000	1.300	1.150	1.300	1.700	1.500	5,3	5,7	5,5			
3	Cadoneghe	D2												
	Cadoneghe	E1	830	1.150	990	1.200	1.500	1.350	4,6	5,5	5,1			
	Cadoneghe	R1												
	Legnaro	B1	1.050	1.250	1.150	1.200	1.500	1.350	3,8	4,5	4,2			
4	Legnaro	D1												
	Legnaro	R1												

			REAL ESTATE VALUES [€/sm]						RENTAL FEES [monthly €/sm]					
		STATUS	NORMAL			OPTIMAL			NORMAL			OPTIMAL		
	MUNICIPALITY	AREA	MIN	MAX	AV	MIN	MAX	AV	MIN	MAX	AV	MIN	MAX	AV
5	Limena	B1	1.100	1.400	1.250	1.400	1.650	1.525	3,8	5,2	4,5			
	Limena	D2												
	Limena	E1	1.000	1.200	1.100				3,6	4,6	4,1			
	Limena	E2	1.000	1.250	1.125	1.250	1.500	1.375	3,8	4,4	4,1			
	Limena	E3	1.000	1.250	1.125	1.250	1.500	1.375	3,8	4,4	4,1			
	Limena	R1												
6	Noventa Padovana	B1	1.100	1.500	1.300	1.500	1.950	1.725	4,5	5,5	5,0			
	Noventa Padovana	C1	1.050	1.450	1.250	1.450	1.850	1.650	4,2	5,2	4,7			
	Noventa Padovana	D1												
	Noventa Padovana	D3												
	Noventa Padovana	E1												
	Noventa Padovana	E2	900	1.300	1.100	1.400	1.750	1.575	3,8	4,8	4,3			
	Noventa Padovana	R1												
7	Padova	B1	2.400	3.500	2.950	3.400	4.700	4.050	7,5	11,0	9,3			
	Padova	B2	2.250	3.000	2.625	3.100	4.300	3.700	7,0	10,0	8,5	7,3	11,5	9,4
	Padova	C1	1.400	2.100	1.750	2.250	3.200	2.725	6,7	10,5	8,6			
	Padova	C2	1.100	1.500	1.300	1.900	2.600	2.250	5,0	7,0	6,0			
	Padova	C3	900	1.200	1.050	1.400	1.900	1.650	4,5	6,0	5,3			
	Padova	C4												
	Padova	C5	1.500	1.900	1.700	2.150	2.750	2.450	6,5	8,9	7,7			
	Padova	C6	1.300	1.600	1.450	1.950	2.850	2.400	5,1	7,0	6,1	6,5	9,0	7,8
	Padova	D1	1.150	1.450	1.300	1.500	1.900	1.700	4,7	5,9	5,3			
	Padova	D2	1.200	1.550	1.375	1.600	2.050	1.825	4,6	6,5	5,6			
	Padova	D3	1.200	1.500	1.350	1.550	2.000	1.775	5,2	6,4	5,8	5,4	6,7	6,1
	Padova	D4	1.000	1.350	1.175	1.400	1.800	1.600	4,8	6,5	5,7			
	Padova	D5	1.100	1.450	1.275	1.550	1.950	1.750	5,0	6,4	5,7			
	Padova	D6	1.100	1.350	1.225	1.450	1.950	1.700	4,7	6,2	5,5			
	Padova	D7	900	1.250	1.075	1.400	1.900	1.650	4,7	6,5	5,6			
	Padova	D8	1.350	1.800	1.575	1.800	2.750	2.275	6,5	9,0	7,8	7,0	9,5	8,3
	Padova	E1	1.100	1.450	1.275	1.450	2.000	1.725	4,6	5,6	5,1			
	Padova	E2												
	Padova	E3	1.100	1.550	1.325	1.400	1.800	1.600	4,6	5,6	5,1			
	Padova	R1	1.200	1.600	1.400	1.450	1.950	1.700	4,6	5,6	5,1			
	Padova	R2												
	Padova	R3												
8	Ponte San Nicolò	B1	1.000	1.400	1.200				3,5	4,5	4,0			
	Ponte San Nicolò	D1	1.100	1.450	1.275	1.400	1.900	1.650	4,0	5,0	4,5			
	Ponte San Nicolò	E1	1.050	1.300	1.175	1.300	1.650	1.475	3,6	4,6	4,1			
	Ponte San Nicolò	E2												
	Ponte San Nicolò	R1												
	Ponte San Nicolò	R2												
9	Rubano	B1	1.000	1.400	1.200	1.350	1.650	1.500	3,6	4,4	4,0			
	Rubano	D1	1.050	1.350	1.200	1.350	1.700	1.525						
	Rubano	D2												
	Rubano	E1	850	1.200	1.025	1.250	1.600	1.425	3,2	3,7	3,5			
	Rubano	E2	1.000	1.250	1.125	1.250	1.650	1.450	3,2	3,7	3,5			
	Rubano	E3	950	1.250	1.100	1.150	1.550	1.350	3,2	3,7	3,5			
	Rubano	R1												

			REAL ESTATE VALUES [€/sm]						RENTAL FEES [monthly €/sm]					
		STATUS	NORMAL			OPTIMAL			NORMAL			OPTIMAL		
	MUNICIPALITY	AREA	MIN	MAX	AV	MIN	MAX	AV	MIN	MAX	AV	MIN	MAX	AV
10	Saonara	B1	1.000	1.300	1.150				4,3	4,6	4,5			
	Saonara	E1	1.000	1.250	1.125	1.250	1.650	1.450	4,3	4,6	4,5			
	Saonara	E2												
	Saonara	R1												
11	Selvazzano Dentro	B1	1.050	1.300	1.175	1.350	1.650	1.500	3,6	4,6	4,1			
	Selvazzano Dentro	E1	950	1.350	1.150				3,3	4,0	3,7			
	Selvazzano Dentro	E2	950	1.250	1.100	1.300	1.650	1.475	3,6	4,5	4,1			
	Selvazzano Dentro	E3												
	Selvazzano Dentro	R1	1.000	1.400	1.200				3,3	4,0	3,7			
12	Vigodarzere	B1	1.000	1.200	1.100	1.200	1.550	1.375	3,5	4,5	4,0			
	Vigodarzere	E1	850	1.100	975	1.150	1.400	1.275	3,3	4,5	3,9			
	Vigodarzere	E2												
	Vigodarzere	E3	950	1.150	1.050	1.150	1.450	1.300	3,5	4,5	4,0			
	Vigodarzere	E4	900	1.200	1.050	1.200	1.500	1.350	3,5	4,5	4,0			
	Vigodarzere	R1												
13	Vigonza	B1	1.100	1.500	1.300	1.450	1.800	1.625	4,5	5,5	5,0			
	Vigonza	D1	1.050	1.400	1.225	1.400	1.750	1.575	4,5	5,5	5,0			
	Vigonza	D2	900	1.150	1.025	1.250	1.400	1.325	3,6	4,2	3,9			
	Vigonza	D3	1.000	1.300	1.150	1.450	1.800	1.625	4,5	5,5	5,0			
	Vigonza	D4												
	Vigonza	E1	850	1.250	1.050	1.200	1.550	1.375	3,8	5,0	4,4			
	Vigonza	R1												
	Vigonza	R2												
14	Villafranca Padovana	B1	900	1.200	1.050	1.250	1.500	1.375	3,5	4,2	3,9			
	Villafranca Padovana	E1	1.000	1.250	1.125	1.300	1.550	1.425	3,8	4,4	4,1			
	Villafranca Padovana	E2	860	1.100	980	1.150	1.450	1.300	3,1	3,6	3,4			
	Villafranca Padovana	E3												
	Villafranca Padovana	R1												