The challenges, dynamics and activities in the building sector and its energy demand in Romania

D2.1 of WP2 from Entranze Project

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EEG	Energy Economics Group, Institute of Energy Systems and Electrical Drives at Vienna University of Technology
NCRC	National Consumer Research Centre
Fraunhofer	Fraunhofer Society for the advancement of applied research
CENER	National Renewable Energy Centre
eERG	end use Efficiency Research Group, Politecnico di Milano
Oeko	Öko-Institut
SOFENA	Sofia Energy Agency
BPIE	Buildings Performance Institute Europe
Enerdata	Enerdata
SEVEn	SEVEn, The Energy Efficiency Center

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The ENTRANZE project

The objective of the ENTRANZE project is to actively support policy making by providing the required data, analysis and guidelines to achieve a fast and strong penetration of nZEB and RES-H/C within the existing national building stocks. The project intends to connect building experts from European research and academia to national decision makers and key stakeholders with a view to build ambitious, but reality proof, policies and roadmaps.

The core part of the project is the dialogue with policy makers and experts and will focus on nine countries, covering >60% of the EU-27 building stock. Data, scenarios and recommendations will also be provided for EU-27 (+ Croatia and Serbia).

This report provides an overview of the building stock of Romania and its related energy demand. It includes main buildings characteristics, space heating and cooling systems and energy consumption and is based on data collection that was carried out during WP2.

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Some definitions/scope of country report

The common **database year** of these country reports is 2008. This year has been chosen because it is one of the most recent years with enough available data. And year 2009 has been avoided because of structural effects caused by the global crisis.

The building sector, as it is subject of this report, refers to two main categories of buildings: residential buildings and non-residential buildings. Whereas residential buildings are relatively homogenous and can further be divided into single/two-family houses and apartments blocks, non residential buildings are more heterogeneous. They refer to buildings in the service or tertiary sector and include several building categories (esp. office buildings, hospitals, schools and universities, hotels and restaurants, buildings in wholesale and retail trade). Within the residential stock, we consider only permanently occupied dwellings.

Floor area: The floor area as it is reported in the following sections is the net floor area; it does not include the common areas in multifamily buildings (e.g. corridors, etc.).

Specific consumption for space heating is calculated at normal climate: it corresponds to the energy consumption required to heat one dwelling on average, it is calculated in final energy.

Climate correction (normal climate): Making climatic corrections enable to monitor energy indicator trends that are independent on the year-to-year variations in the winter climate. The climatic corrections are made only for the part of the final consumption corresponding to space heating.

Central heating systems: it includes district heating, block heating, individual boiler heating and electric heating; a central heating system implies that all rooms are well heated, as opposed to room heating, where generally a stove provides heat to the main room only.

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1. Building characteristics

1.1 Building sector

The total Romanian building floor area was in 2008 at around 515,8 million m², out of which around 88,5% consisted in permanently inhabited residential buildings and up to 12,5% by non-residential buildings (**Erreur ! Référence non valide pour un signet.** and

Table 1). As shown in **Erreur ! Référence non valide pour un signet.**, more than half of residential buildings are located in single-family homes, where single family houses are equivalent to 57% of the total number of dwellings and 67% of the total residential floor area. Multi-family dwellings are on average 32% smaller than single-family dwellings, with an average heated area of 48 m², compared to 73 m² for single-family dwellings.

Important note: the reported figures in this brief analysis of Romanian residential sector are well below the ones from the 2001 Census and from preliminary results of the 2011 Census (i.e. aprox 5,1 mn buildings and 8,2 mn dwellings in 2010). However, the 2011 Census reported a drop of around 2,5 mn people as comparing to the 2001 Census, partially explained by a negative demographic trend over the last 20 yrs as well as by a relative high emigration of people to other countries, following the jobs. This process was more significant in rural areas, where many houses are now used only temporarily or as holiday residences. Moreover, due to a radical change in the industrial sector during the transition period towards a free market economy, many factories had been closed and cities built near them are gradually depopulated.

Therefore, the reported figures in this report estimate and takes into account permanently inhabited dwellings only.

The type of single-family dwellings has an impact on the space heating energy performances because of different insulation characteristics implying different specific space heating consumption (due to different wall area in contact with the outdoor):): a single-family house consumes around 23% (depending on each climatic zone) more per m² than a multi-family dwelling[1].

[1] BPIE estimation based on the survey carried out for the BPIE (2011) " European Buildings under the Microscope", 2011. Available at www.bpie.eu

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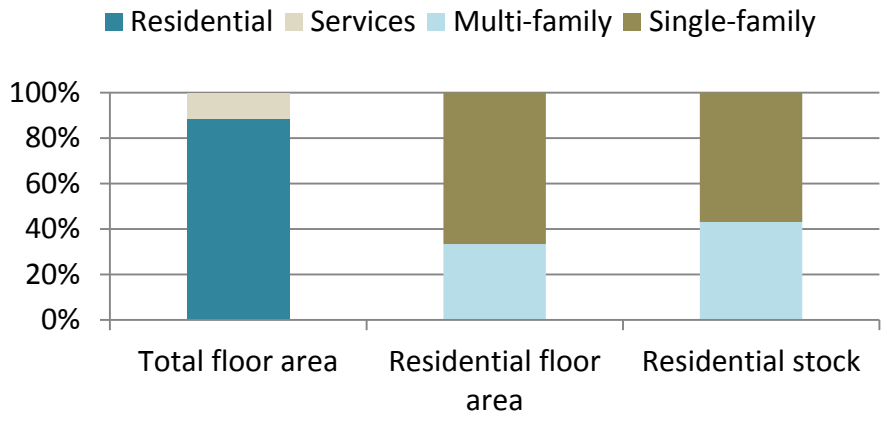
Figure 1: Decomposition of buildings by type (2008[2])



Source: Odyssee, BPIE survey

Table 1: Decomposition of buildings by type (stock and floor area, 2008)

	Stock (k)	Surface area (Mm2)
Total Residential	7362	456.5
Multi-family	3173	152.4
Single-family	4189	304
Service		59.4

Source: Odyssee, BPIE

Erreur ! Référence non valide pour un signet. represents the distribution of the total number of floor area according to the status of occupation. Romania is among the countries with the highest ratios of private ownership and owner occupancy in the residential sector in Europe. A share of 86% of all Romanian buildings is occupied by their owners for residential purposes, while rented dwellings account for up to 2,5% and mainly for apartment dwellings. In Romania, non-residential buildings represent around 11,6% of the building stock.

[2] The reference year chosen for this report is 2008, in order to get as much as possible available data among European countries.

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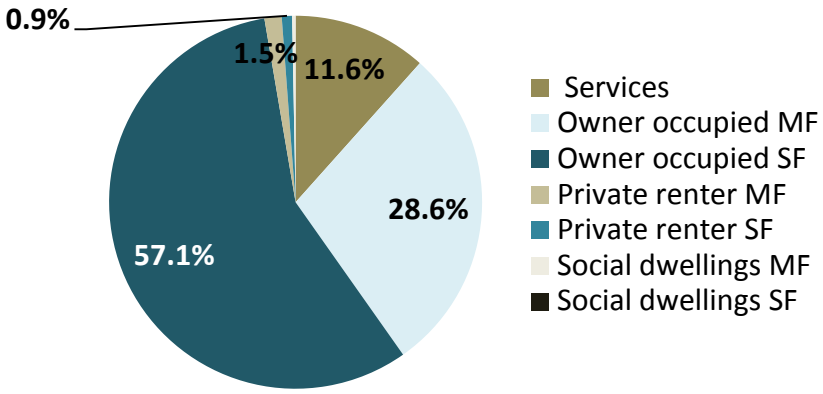
Figure 2: Breakdown of floor area by ownership structure (2008)



Source: Housing Statistics, Odysee, BPIE survey

The sectors with the highest new-build rates are the retail market (especially shopping centres and retail parks, with most dynamic being the food and Do-It-Yourself markets), industrial parks (including logistic parks) and offices[3].

In a 6-year period between 2000 and 2005, 173 thousand of residential dwellings have been constructed, i.e. 29 000 dwellings per year on average. In 2008, dwellings built after 2000 represented around 8% of residential floor area (However, due to the economic crisis the construction rates slowed down over the last two years.

Figure 3). While construction rates almost tripled between 2000 and 2008, a decline in 2009 due to the global crisis is observed. The ratio of new single-family to new multi-family dwellings has been around 7:5 and has been roughly kept constant during the last decade.[4]

No consistent data is available for the construction rates in the service sector of Romania. However, high construction rates for the services sector were obtained over the last decade, with certain sub-types even well above 10% per year. Based on market research, the commercial office floor area is shown to be doubled from 2005 to 2010 (However, due to the economic crisis the construction rates slowed down over the last two years.

Figure 3)[5].

[3] BPIE (2012). "Implementing nearly zero-energy Buildings (nZEB) in romania – Towards a definition and roadmap", 2012. Available at www.bpie.eu

[4] Based on Odyssee data

[5] BPIE Report "Implementing nearly zero-energy Buildings (nZEB) in romania – Towards a definition and roadmap", 2012. Available at www.bpie.eu

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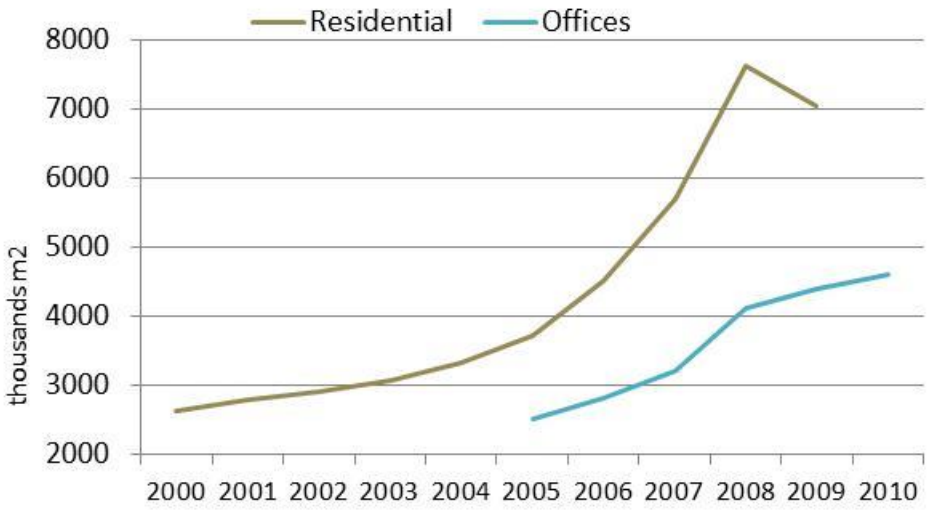
However, due to the economic crisis the construction rates slowed down over the last two years.

Figure 3: Dynamics of building construction



Source: Odysee, BPIE (2012)

1.2 Residential sector

The average age of buildings and the share of new buildings in the total stock represent an indicator of the quality and standards of construction. The higher the share of recent dwellings, i.e. built with more efficient standards, the higher the energy performance of the stock: in Romania, 42% of the dwelling stock existing in 2008 was built before 1970 and 64% before 1980 (Figure 4). Another good indicator for the existing building stock in Romania is the high rate of construction registered between 1961 and 1990, when quantity prevails to quality. The big earthquake from 1977 when many old buildings were destroyed (mainly in Bucharest city) and the reorganisation of cities structures from the '80s (i.e. demolitions of old buildings, significant concentration of population from small towns in multi-family buildings, new administrative buildings etc.) are other important milestones defining the situation of the existing building stock.

It should be noted that no performance-based requirements exist to date in Romania (i.e. maximum values for the energy consumption) for new or existing/renovated buildings. However, following the Energy Performance of Buildings implementation, new minimum requirements for thermal resistance values were established in 2005 and upgraded in 2010.

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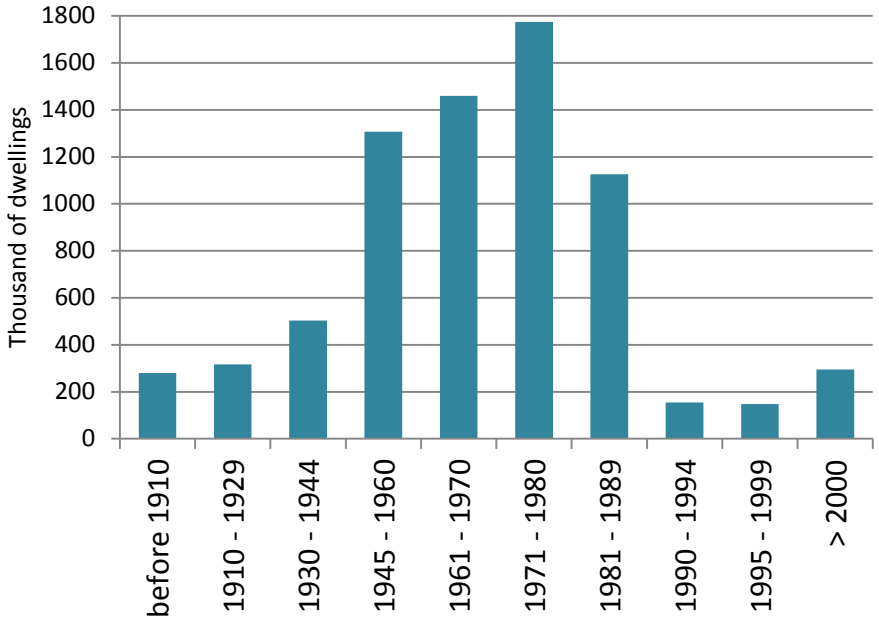
Figure 4: Residential dwellings according to construction date (2008)[6]



Source: Odysee, BPIE survey

Owner occupants are very dominant in residential buildings, representing 96% of all dwellings. This is explained by the fact that dwellings which were mainly state property until 1989 were either sold by the state to the inhabitants or, by retrocession, returned to the pre-communist property owners[7].

[6] The age categories correspond the revision of building standards (i.e. 1975, 1982, 1989, 2001 and 2005). Available at www.bpie.eu

[7] BPIE (2012). "Implementing nearly zero-energy Buildings (nZEB) in Romania – Towards a definition and roadmap", 2012. Available at www.bpie.eu

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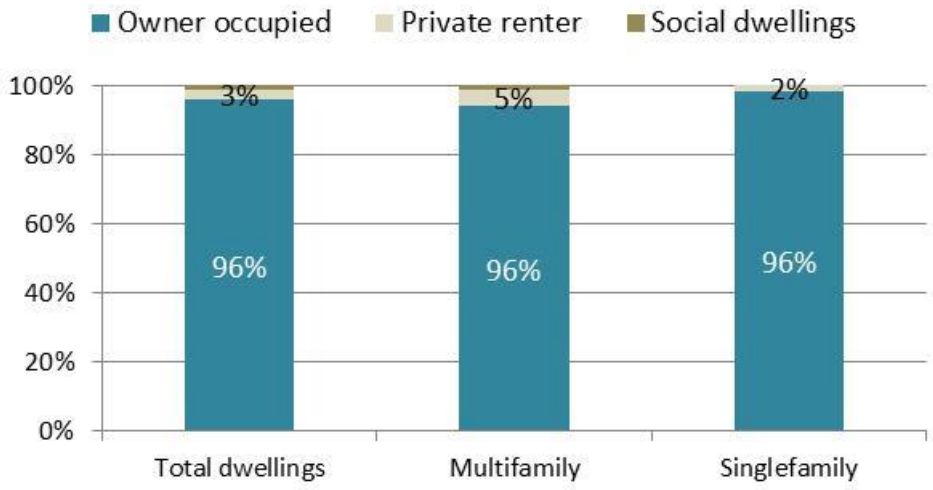
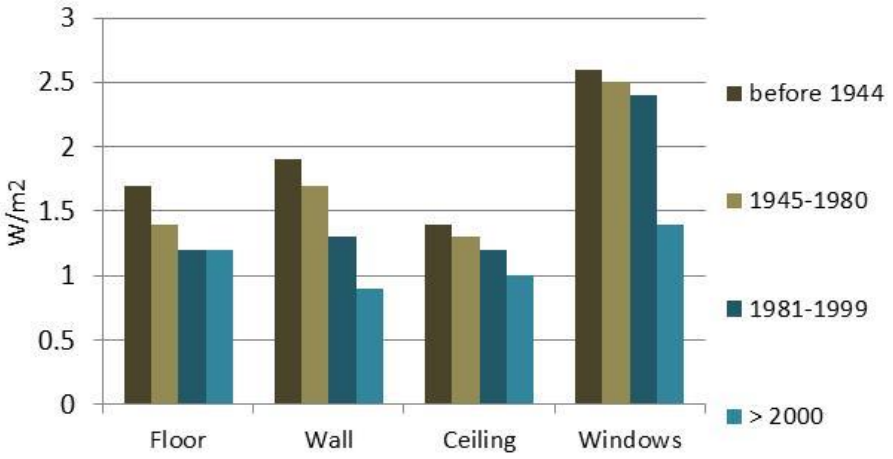
Figure 5: Breakdown of ownership & tenure (2008)



Source: Odyssee, BPIE survey

U-values that measure heat loss in building elements, i.e. how well the exterior walls of a building are insulated. **Erreur ! Référence non valide pour un signet.** shows how the wall insulation of the residential building stock has improved over the last 100 years. However, the values presented in the figure are estimated averages, the renovation activities are not considered and the situation may vary largely from case to case. Overall in Romania, U-values have decreased, and thus insulation improved, by around 50% in 40 years.

Figure 6: U-values of dwellings by construction period



A) U-values for multi-family buildings

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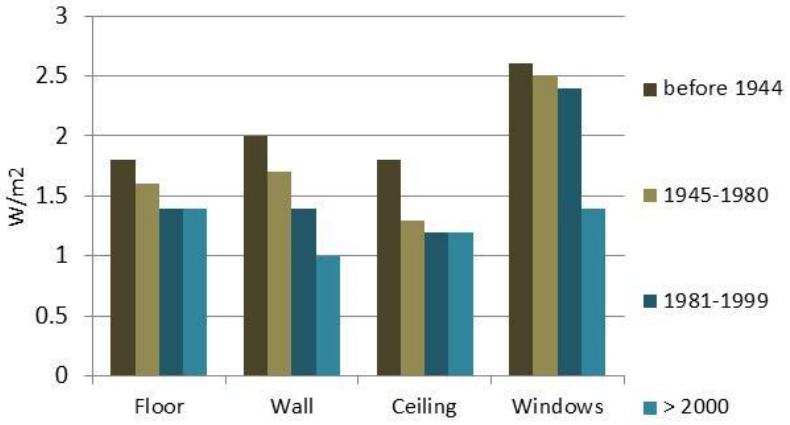


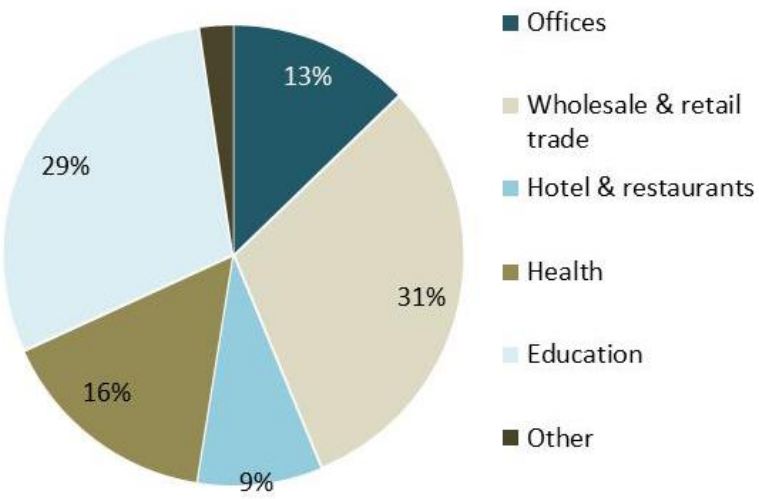
B) U-values for single-family buildings

Source: BPIE survey

1.3 Service sector

Wholesale and retail trade represent the highest share of total service sector floor area (31%). It is followed by educational buildings (29%), health (16%), offices (13%) and hotels and restaurants (9%). A percentage of 2% accounts for buildings in the "other" category, which include logistics, industry buildings, etc. Public offices represent around 40% of the total office floor area in Romania.

Figure 7: Decomposition of service building areas by type



Source: BPIE (2012)[8]

[8] BPIE(2012). Implementing nearly Zero-Energy Buildings in Romania. Towards a definition and roadmap, ISBN: 9789491143045, Brussels 2012. Available at www.bpie.eu

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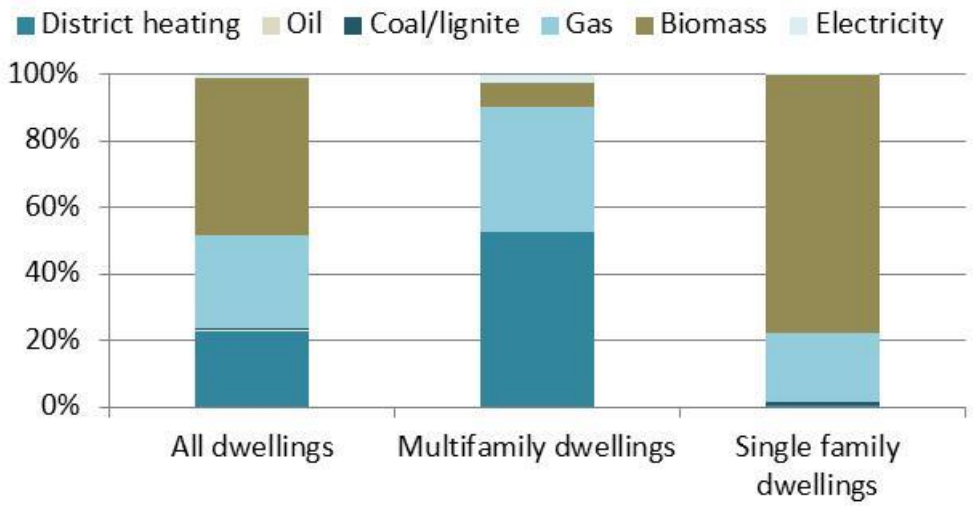
2. Space heating and cooling systems

Biomass is the main source of energy for household space heating: 47% of residential dwellings are heated with biomass (largely wood), 28% with gas, 23% with district heating, around 1,2% electric heating; other energy sources are marginal such as oil and coal heating (around 0,5% together). While biomass is important in single family dwellings (78% of single-family dwellings) and especially in rural areas, district heating is dominant in urban multifamily dwellings (53% of multi-family dwellings).

Figure 8: Dwelling stock according to space heating systems by energy (2008)



Source: Odyssee, BPIE survey

Figure 9 shows the penetration of heating systems. In Romania, around 1,6 million of dwellings are heated by district heating, where 92% of energy supplied by district heating came from recycled heat[9] in CHPs. The DH connected dwellings are almost only apartments in block of flats and largely in urban areas. It is worth to note that over the last decade was a continuous trend of disconnections from DH and shifting to individual apartment heating systems on gas. The main problem with district heating systems in Romania is that are not efficient (with 30% improvement potential), are carbon intensive and the prices continue to rise challenging people's affordability (also due to an on-going process of reducing heating subsidies)[10].

[9] Euroheat and Power Statistics http://www.euroheat.org

[10] PWC Romania: Provocari si Oportunitati pentru sistemul de furnizare centralizata a energiei termice din Romania, June 2011, available at: http://www.pwc.com/ro/en/publications/assets/assets_2011/Provocari_Oportunitati_Energie_Termica.pdf

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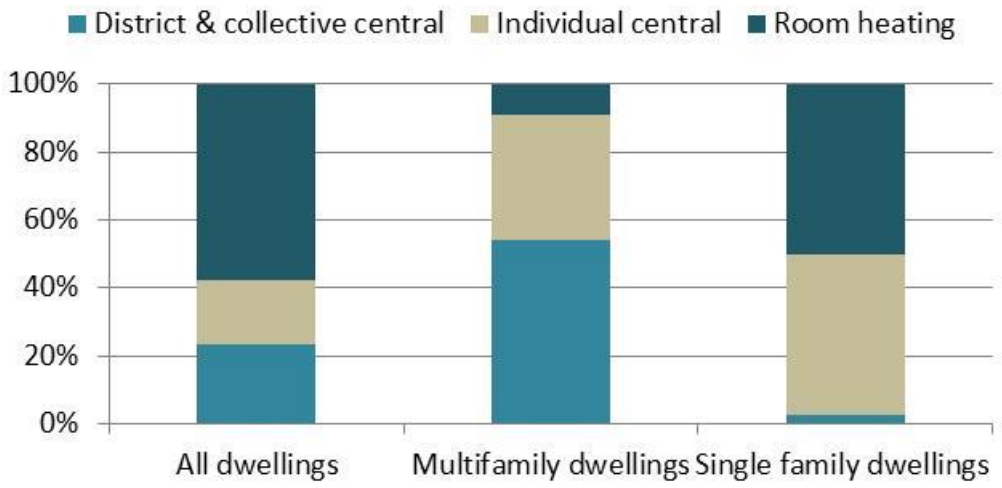
Biomass (mainly wood) is the main source for heating in single family homes and especially in rural areas. Room heating, mainly by wood burned in stoves, is still largely used in rural areas where the access to the gas pipes is not yet available.

Figure 9: Dwellings according to centralisation of heat supply (2008)



Source: Odyssee, BPIE survey

The diffusion of efficient and renewable heating and hot water systems, such as solar collectors and heat pumps are supported mainly by the CASA VERDE (Green Home) program launched in 2008. The most emerging renewable technologies currently used in Romanian buildings are solar thermal systems. According to EurObserv'ER renewable energy barometer[11], the total installed solar-thermal collectors area in 2010 in Romania was at around 144 thousands m2 (38,4% growth from 2009) with a thermal capacity of around 101MWhth. Most of this solar-thermal capacity is installed in buildings, both residential but mainly commercial (including hotels). However, there are no public data available concerning the actual sales and installed solar-thermal power in Romanian buildings.

No data on sales of energy efficient and renewable systems is publicly available. As cooling needs increase with years, information of penetration of air conditioning systems in the market is also important. Diffusion of air conditioning has been steadily increasing in the residential sector: the share of dwellings with air conditioning increased from 0.4% in 2000 to 5% in 2010 (Figure 10).

[11] EurObserv'ER (2011): The state of renewable energy in Europe. 11th EurObserv'ER Report, available at: http://www.energies-renouvelables.org/observer/stat_baro/barobilan/barobilan11.pdf

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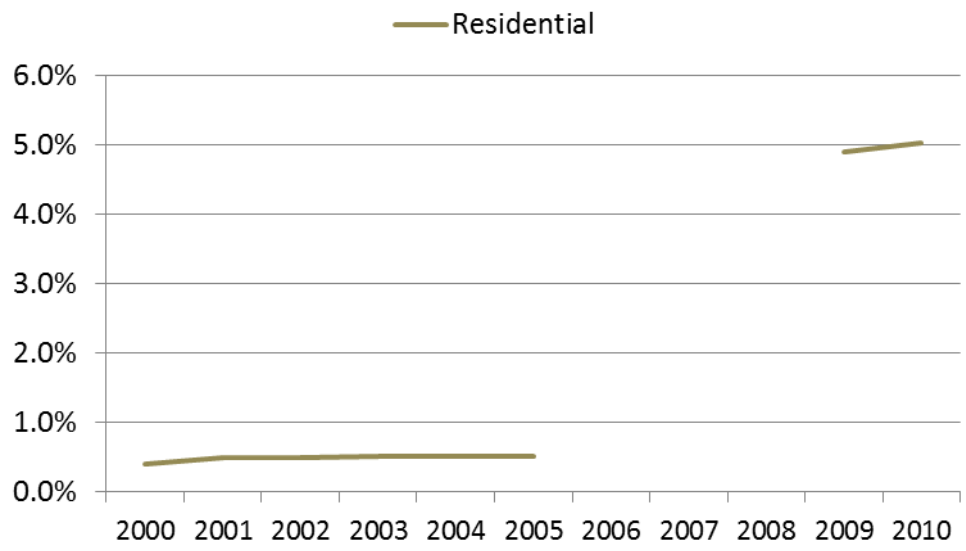
The penetration of air conditioning is even more important in the service sector; however no data is available.

Figure 10: Penetration of air conditioning (% of residential dwellings)



Source: Odysse

3. Energy consumption

Biomass and natural gas are the dominant sources of energy in Romanian buildings with 42% and 27% of the total market, respectively (Figure 11). While biomass is used mainly in mainly single-family dwellings from rural areas, gas is more important in multi-family buildings and non-residential sector. District heating represents 15% while oil 4% in the total building stock.

In the service sector, gas is the dominant source of energy with 48%, followed by electricity with 33%. In the residential sector, biomass, gas and district heating are the main sources of energy.

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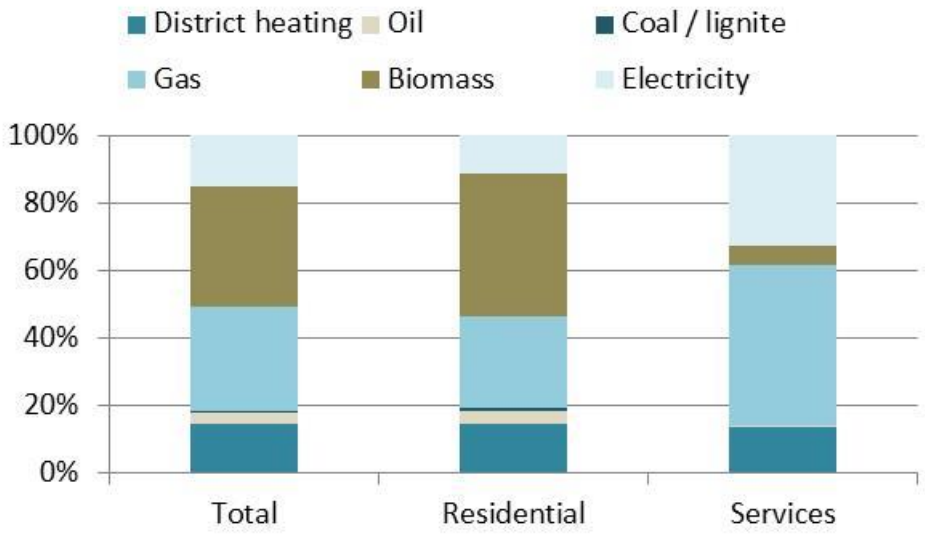
Figure 11: Total energy consumption of the building sector (2008)



Source: Odyssee, BPIE survey

Space heating (58%) and domestic hot water (up to 23%) represents the largest share of household energy use, cumulating together 80% of the overall consumption. Lighting makes up 5% of household consumption. Air conditioning still represents a marginal share of residential consumption with only 1,2% but the tendency is to grow significantly due warmer and longer summer seasons registered over the last decade.

In the service sector, space heating (55%) and water heating (10%) represent 65% in total energy consumption. Lighting (9%) and air conditioning (6%) are more significant than in the residential sector.

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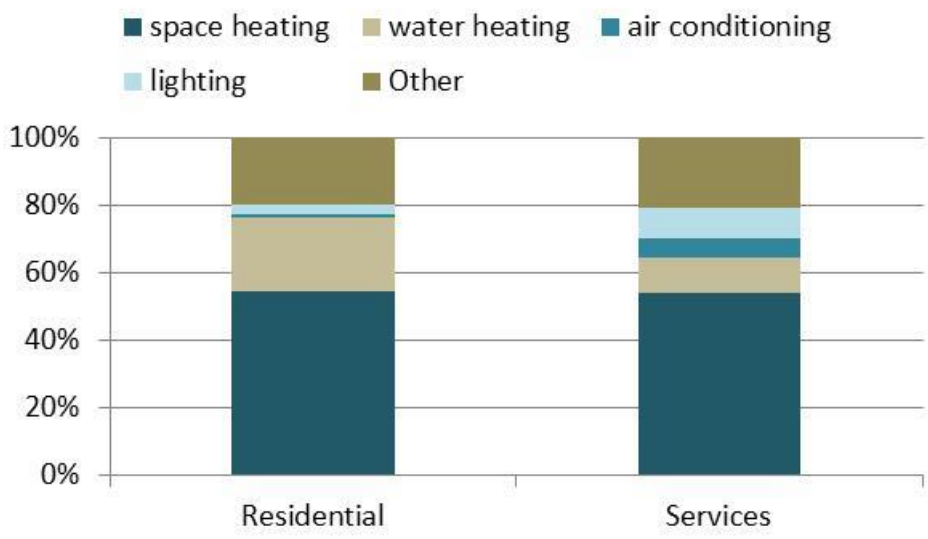
Figure 12: Total energy consumption by end-use (2008)



Source: Odyssee, BPIE survey

4. Conclusions

Residential buildings represent 88,5% of total floor area and the main stakeholders in Romania are owner occupants, accounting for 96% of the total number of dwellings. Between 2000 and 2005, 173 thousand of residential dwellings have been constructed, i.e. 29 000 dwellings per year on average. More than ¾ of Romania's residential dwelling stock was built before the 1980s, and wall U-values have decreased by roughly 50% since the 1960s.

Space heating represents the largest share of household energy use: it corresponds on average to almost 58% of total energy consumption. Water heating consumption equals 13% of total energy consumption.

Biomass is the main source of energy for household space heating: 47% of residential dwellings are heated with biomass (largely wood), 28% with gas, 23% with district heating, around 1,2% electric heating; other energy sources are marginal such as oil and coal heating (around 0,5% together). While biomass is important in single family dwellings (77% of single-family dwellings) and especially in rural areas, district heating is dominant in urban multifamily dwellings (53% of multi-family dwellings)

In the service sector, space heating (55%) and water heating (10%) represent 65% in total energy consumption. Lighting (9%) and air conditioning (6%) are more significant than in the residential sector, with a growing need for air-conditioning due to warmer and longer summer periods.

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