The challenges, dynamics and activities in the building sector and its energy demand in the Republic of Bulgaria

D2.1 of WP2 from Entranze Project

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The ENTRANZE project

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Project consortium:

	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 RenewableEnergyCentre
	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 Bulgaria 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 residential stock, we consider only permanently occupied dwellings.

Floor area: The floor areas do not take into account the gross floor area in the average surface per dwelling, i.e. it does not consider 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 measure energy indicators trends that are independent on the year-to-year variations in the winter severity. 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, implies that all the rooms are well heated, as opposed to room heating, where generally a stove provides heat to the main room only.
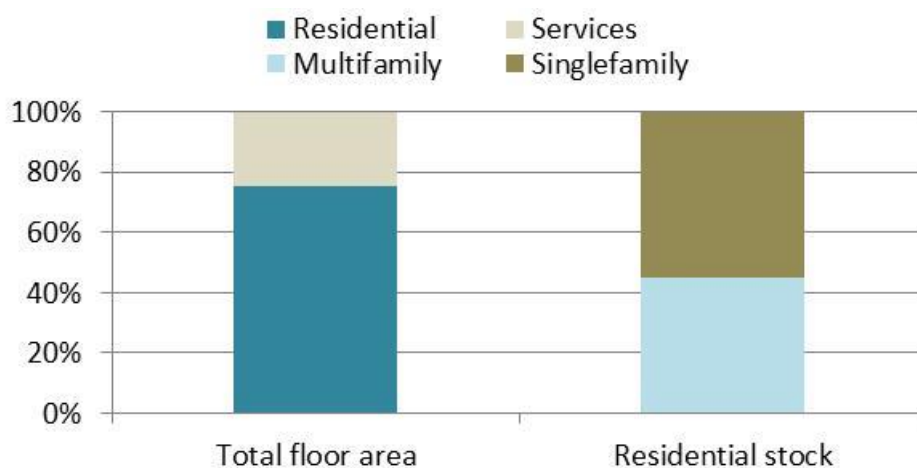
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1. Building characteristics

1.1 Building sector

The total building stock area in the Republic of Bulgaria is about 261 Mm^2 from which 75% is related to residential building stock and the rest relates to service sector (see Figure 1 and Table 1). In total there are about 3 million dwellings, from which about 45% are in multi family buildings and 55% in single family houses. In terms of residential floor area, multi family buildings have about 55% and remaining 45% comes to single family ones (BPIE). In the case of single family houses, detached houses are most typical (about 98%), semi-detached houses (1%) and row houses (1%) are not typical for the country.

About 0.7 million dwellings (around 23% of the stock) are situated in panel buildings (pre-cast concrete structure) constructed after 1958. The number of the dwellings are distributed approximately 2/3 in the towns and1/3 in the villages.

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

Source: Odyssee and National Statistical Institute

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[1]The reference year chosen for this report is 2008, in order to get as much as possible available data among European countries.
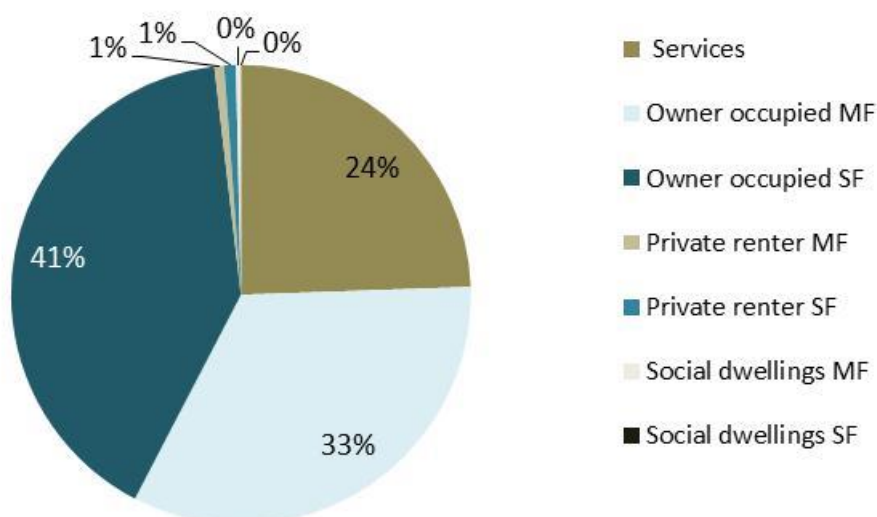
Table 1: Decomposition of dwellings by type (stock and floor area, 2008)

	Stock (k)	Floor area (km2)
Total Residential	**3082**	**197248**
Multi-family	**1385**	**89303**
Single-family	**1697**	**107945**
Service		**63843**

Source: National Statistical Institute and expert estimates

Figure 2 represents the distribution of the total building floor area according to the status of occupation. Before services (about 24%), the main building stakeholders in the Republic of Bulgaria are owner occupants of single-family houses, with 41% of the total floor area and owner occupants of multi-family buildings with about 33%. Social rental housing is not common in the country and stays at last position (about 1% in total). Social housing is provided by some municipalities for citizens with low income and without possessing real estate. Private rental apartments make up 1% of total floor space. Rented single-family dwellings make up 1% as well.

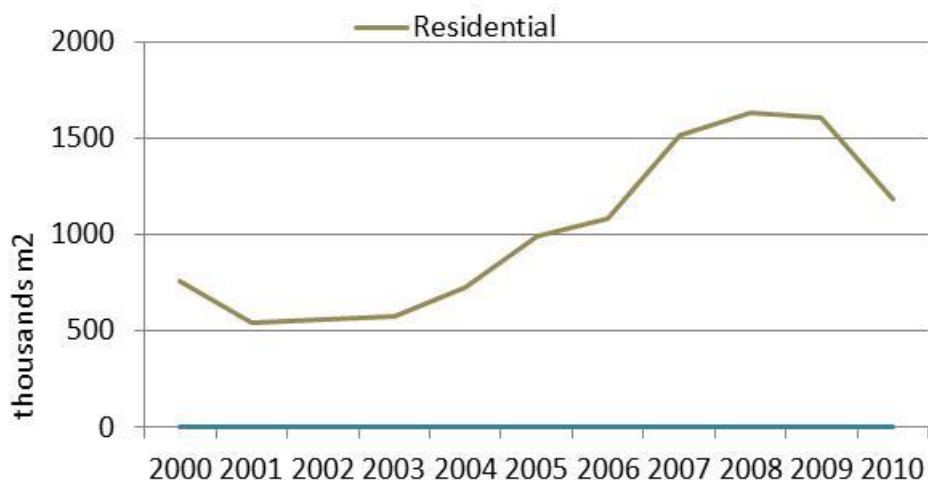**Figure 2: Breakdown of floor area by ownership structure (2008)[2]**

Source: Eurostat, Odyssee,National Statistical Institute, estimations of SOFENA´s experts

Between 2000 and 2010, 104 000 of newresidentialbuildings have been constructed, accounting 11.2 Mm^2 of floor area.In the years 2007 – 2009 there was huge boom in the construction sector (increase with more than 50%). After that, because of the global economic crisis, the statistical data show recession in construction sector(Figure 3) and in 2010 the number of newly constructed buildings dropped back to the levels of 2006.Data for service sector are not available.

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[2]explanation for the figure MF: Multi-family dwellings ; SF: single family dwellings.

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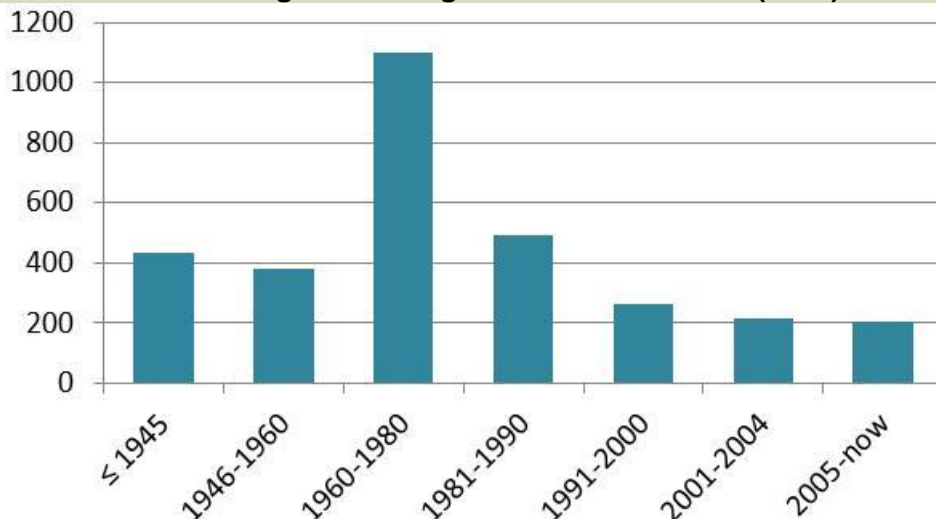**Figure 3: Dynamics of building construction**

Source: ODYSSEE, National Statistical Institute

1.2   Residential sector

The average age of buildings and the share of new buildingsin the total stock represent a good indicator of the quality and standards of construction. 36% of the buildings were constructed in the period 1960-1980. The first normative requirements for thermal insulation in Bulgaria were applied from 1961.The main requirement is the achievement of minimal value of the total thermal resistance of heat transfer in order not to cause condensation of water vapors on the internal surface of the building shell during the coldest winter day, which is a hygienic requirement. After the oil crises in the end of 1970s the energy performance characteristics of panel buildings were improved. In 1987 new normative requirements were applied and the thermal requirements were increased with about 35-40%.

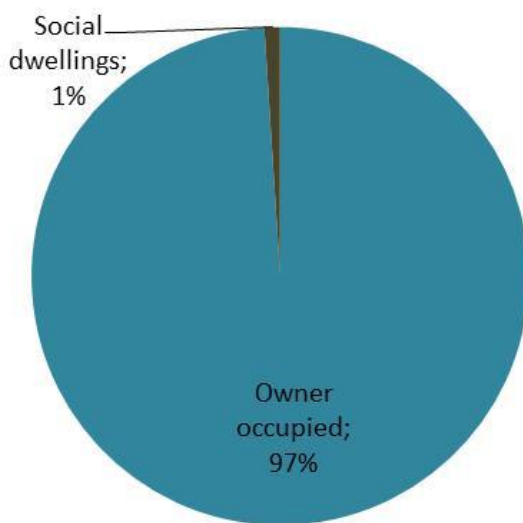The distribution of the residential dwellings per construction period is presented inFigure 4.

Figure 4: Residential dwellings according to construction date (2008)[3]

Source: National Statistical Institute, SOFENA's experts estimates

Owner occupants areabsolutely dominant in residential buildings, accounting97% of the total dwellings (**Erreur ! Source du renvoi introuvable.**).
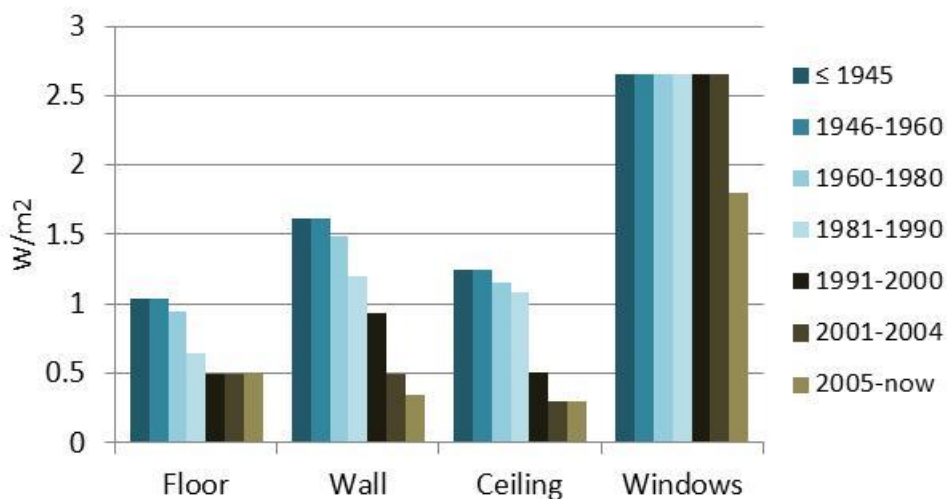
Figure 5: Breakdown of ownership & tenure (2008)

Source: National Statistical Institute

Erreur ! Source du renvoi introuvable. shows the U-values thatmeasure heat loss in building elements: wall, floor, windows or roof, i.e. how well the buildings components are insulated. In the Republic of Bulgaria, U-values have decreased in several periods but most significantly after 1999 when Ordinance 1 for design of heat insulation of buildings were adopted. After that the requirements were strengthened in 2004 and 2009.

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[3]The age categories correspond to typical construction eras in the Czech Republic

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Figure 6: U-values by construction period (multifamily and single family, 2008)
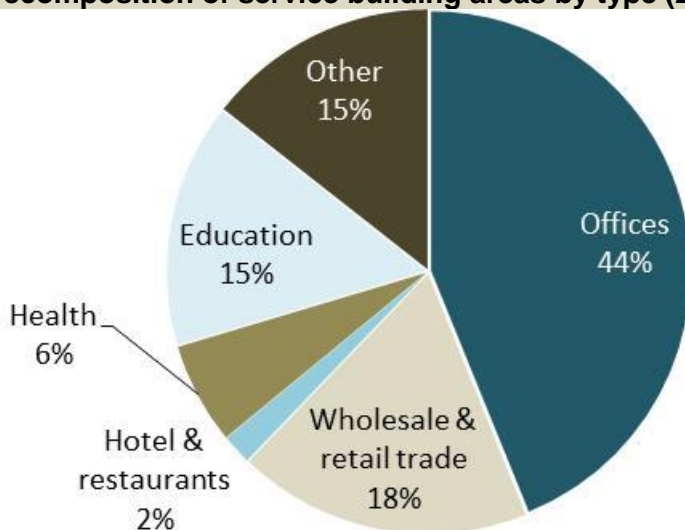

Source: BPIE, SOFENA's expert estimations

1.3   Service sector

Offices (about 44%) and wholesale and retail trade (about 18%) represent the highest share of total service sector floor area in 2008.Education buildings (15%) and health (6%) follow. Other types of buildings have about 17% share.

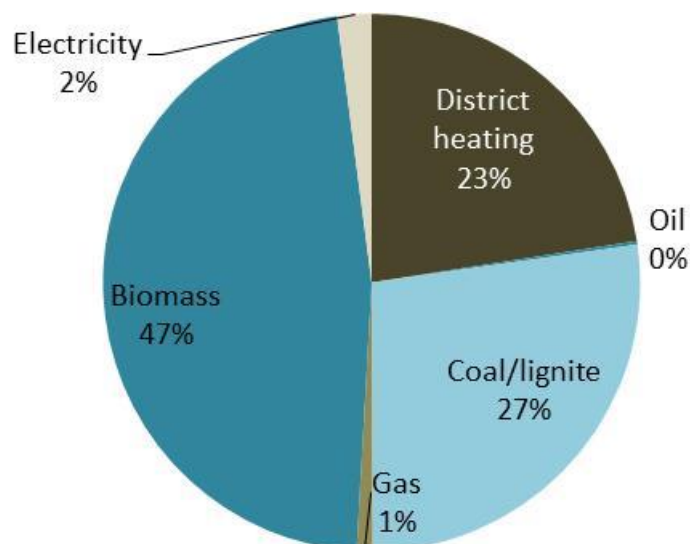**Figure 7: Decomposition of service building areas by type (2008)**

Source: Odyssee, BPIE

2. Space heating and cooling systems

Dominating energy source for space heating (especially for single family houses) is biomass (mainly fire woods). District heating covers densely populated urban area and has 23% share. Coals are cheap and still used mainly in single family houses and rarely for public buildings. Gas network for residential building is not well developed and has lowest share together with oil.
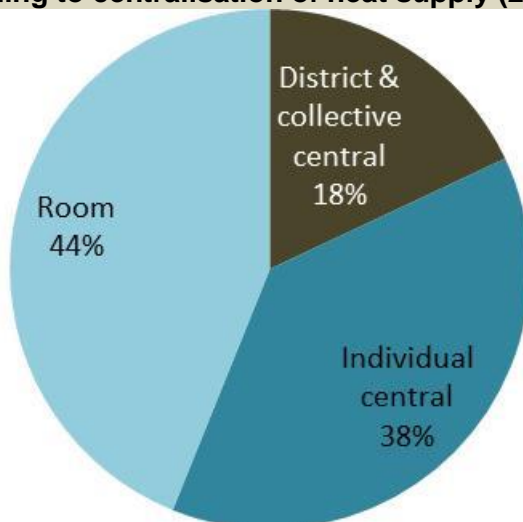
Figure 8: Dwelling stock according to space heating systems by energy (2008)

Source: SOFENA's expert estimations based on energy balance of Bulgaria – National Statistical Institute

Erreur ! Source du renvoi introuvable. shows the penetration of heating systems. In the Republic of Bulgaria room heating has relatively high share (44%) as due to the fuel poverty it is common that not all rooms in the dwellings are heated. This is valid both for single family houses in rural areas and for the apartment buildings.
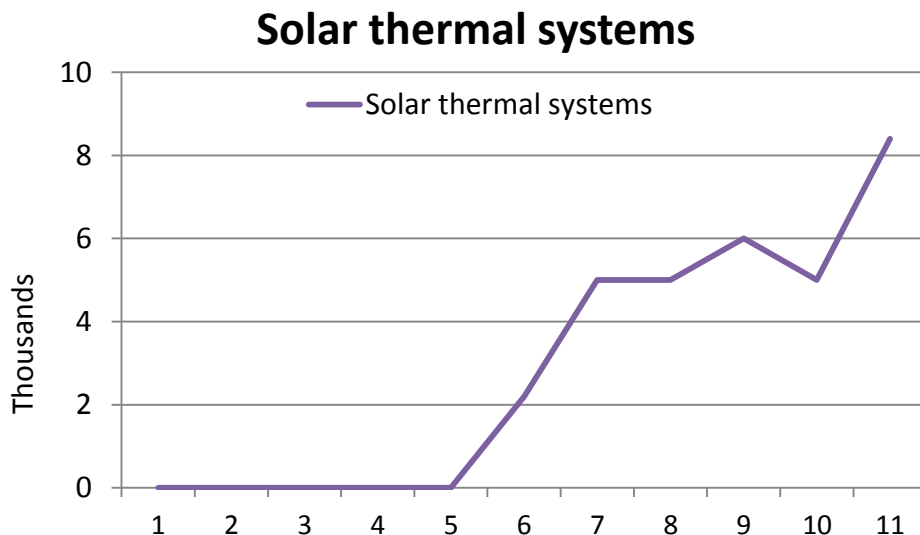
Figure 9: Dwellings according to centralisation of heat supply (2008)

Source: Odyssee, SOFENA'sexperts estimations and calculations based on experience

There is no statistical information for the diffusion of efficient and renewable heating systems, such as condensing boilers, biomass boilers and heat pumps.Estimates for the solar thermal systems market is presented in Figure 10.
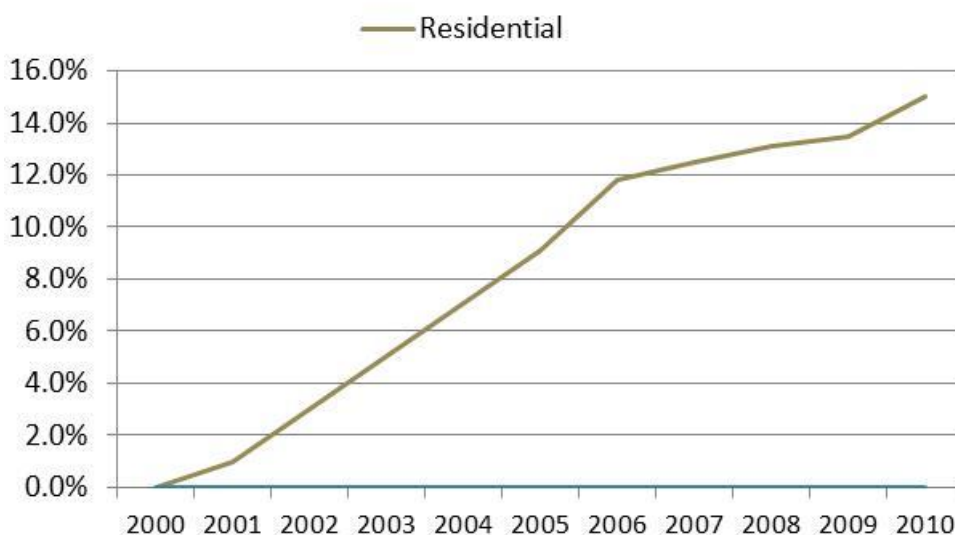
Figure 10: Sales of solar thermal systems

Solar thermal systems

Source: Observ'ER

Diffusion of air conditioning is steadily increasing due to improving comfort in public and residential buildings. Air conditioners are used both for heating in winter and cooling in summer. Detailed statistics are not available, the data are based on experts estimations (Figure 11).

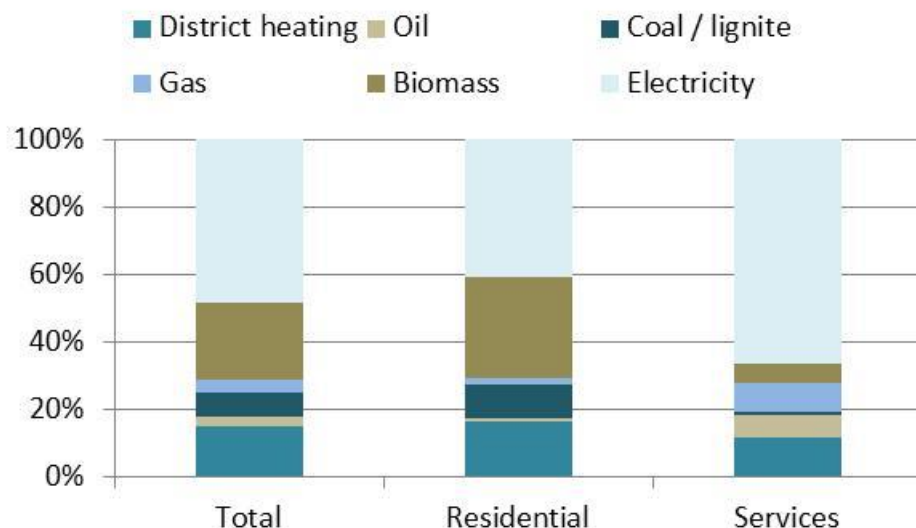**Figure 11: Penetration of air conditioning**

Source: ODYSSEE

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3. Energy consumption

Electricity has the highest share in the energy consumption in buildings (48.3%). The other sources are biomass (23%), district heating (15%), coal, natural gas and oil, which have smaller share (**Erreur ! Source du renvoi introuvable.**). In service sector use of energy from oil exceeds the use of biomass.
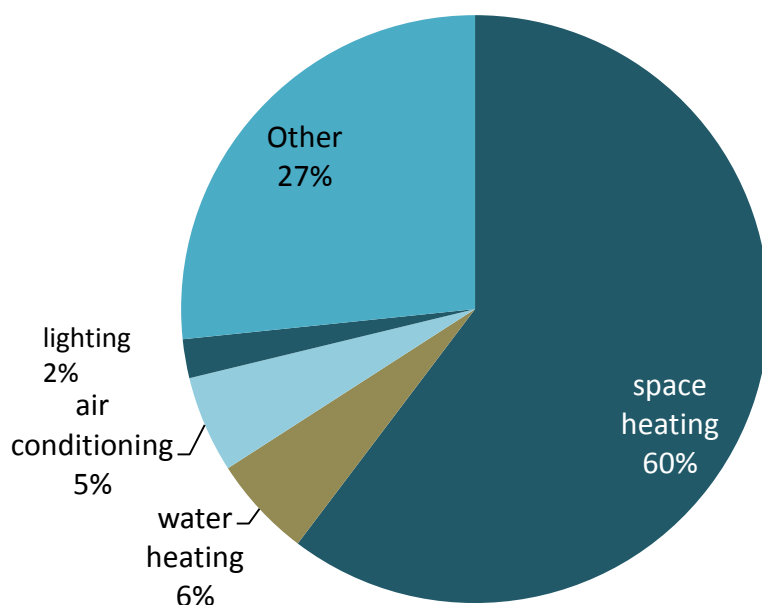
Figure 12: Total energy consumption of the building sector(2008)

Source: National Statistical Institute and estimation of SOFENA's

Space heating represents the largest share of household energy use. It corresponds on average to almost 60% of total energy consumption. Water heating consumption equals to almost 6%of theresidential buildings consumption. Air conditioning consumes about 5% in the housing stock.

Figure 13: Total energy consumption by end-use (2008, real climate)

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Source: ODYSSEE

4. Conclusions

Bulgaria has 7.5 million inhabitants living in about 3 million dwellings. Residential buildings represent75% of total floor area of buildings, the rest are service buildings. 36% of the residential buildings were constructed in the period 1960-1980. In the period 2000-2010 about 104 000 new buildings (i.e. around 3.5% of total stock, 5.6% of the total floor area) were constructed in compliance with the new normative requirements for heat retention and energy saving in buildings (Ordinance 1 from 1999 and 7 from 2004, amended in 2009). Bulgarian building norms require maximum U-values for the building elements: wall, floor, ceiling (roof), windows.

Energy efficiency act (2008) and the Low on energy from renewable sources (2011) stipulate requirements for energy auditing and certification and inspections of heating and air-conditioning installations. In case of major renovation or new construction it is obligatory to analyze the possibility of using renewable energy sources. However there is no statistical data on the number of systems on solar energy, modern biomass and heat pumps.

Biomass has the highest share for heating in the housing stock with 47% share followed by coal (27%) and district heating (23%). Room heating is applied in 44% from the dwellings due to the fuel poverty.

Heating represents 60% from the total energy consumption per end use as the share of air-conditioning (cooling) is also increasing in the last decade. The share of other end uses is also significant for office equipment and appliances but lighting is marginal.

5. References

Bertoli, P. and Atanasiu, B.: Electricity Consumption and Efficiency Trends in the Enlarged European Union – Status Report 2006. European Commission: DG Joint Research Centre 2007.

BPIE, Data Hub for the energy performance of buildings, http://www.buildingsdata.eu/results

Eurostat, Population and social conditions, distribution of population by tenure status, type of household and income group (Source SILC) (ilc_lvho02) http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ilc_lvho02&lang=en ,

ODYSSEE, database http://www.odyssee-indicators.org/

TABULA, Typology Approach for Building Stock Energy Assessment, http://www.building-typology.eu/country.html

National Statistical Institute of Bulgaria, Energy Balances, Results from the Census 2011