



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

D2.1 of WP2 from 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 ISI	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

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 France 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.

1. Building characteristics

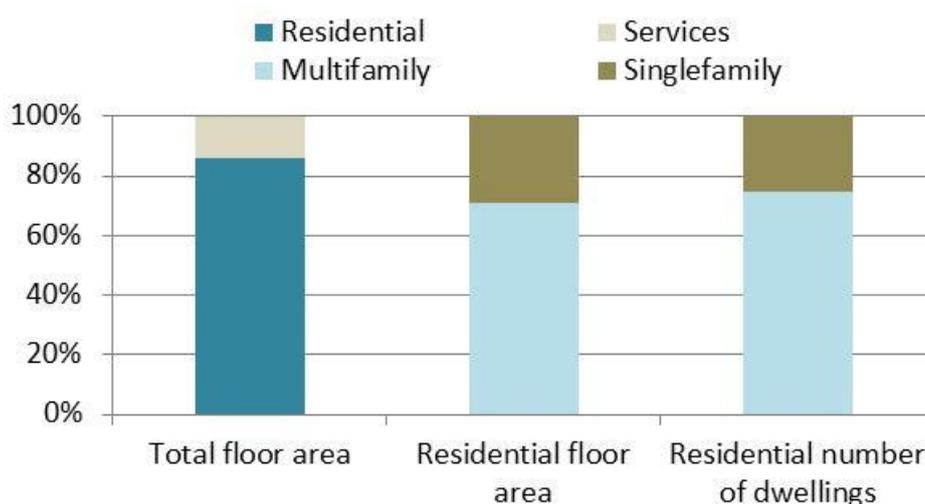
1.1 Building sector

The total Italian building area is around 3 000 Mm²: it is composed for about 86% by residential dwellings and the rest by services buildings (14%) (Figure 1 and Table1).

74% of the residential stock is composed by multi-family buildings with an average size of 91 m², while the single-family dwellings (26% of the total residential stock) have an average size of 110 m². As a consequence, the share of multi-family buildings is dominant in the total floor area, with 70%.

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): for Italy, we estimate that the stock of individual dwellings is composed by 35% of semi-detached houses while detached houses are dominant with 65%.

Figure 1: Decomposition of buildings by type (2008¹)



Sources: Odyssee, Tabula, ISTAT, CRESME

¹ The reference year chosen for this report is 2008, in order to get as much as possible available data among European countries.

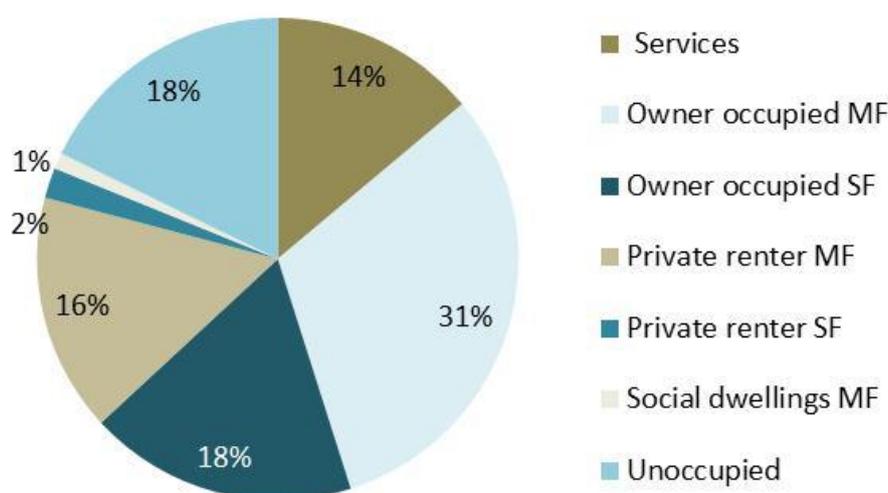
Table 1: Decomposition of buildings by type (stock and floor area, 2008)

	Stock (k)	Floor area (Mm2)
Total Residential	26 944	2 577
Multi-family	20 045	1 820
Single-family	6 899	757
Service		415

Source: Odyssee, Tabula, CRESME updating of data ISTAT 2001

Figure 2 illustrates the distribution of the total building floor area according to the status of occupation. Before owner occupied single-family dwellings (18%) and private renter of apartments (16%), the main building stakeholders in Italy are owner occupant of dwellings in multi-family buildings, with 31% of the total floor area. Service sector arrives in fourth position (14%), while rented single-family and social dwellings represent a small part (3%) of the total floor area.

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



Source: Odyssee, Tabula, Housing Statistics

Between 2000 and 2010, 1.74 M of residential dwellings have been constructed, i.e. 174 000 per year on average, but in 2008, dwellings built after 2000 still represents a small part of total stock. While construction increased on average by 6.5% per year

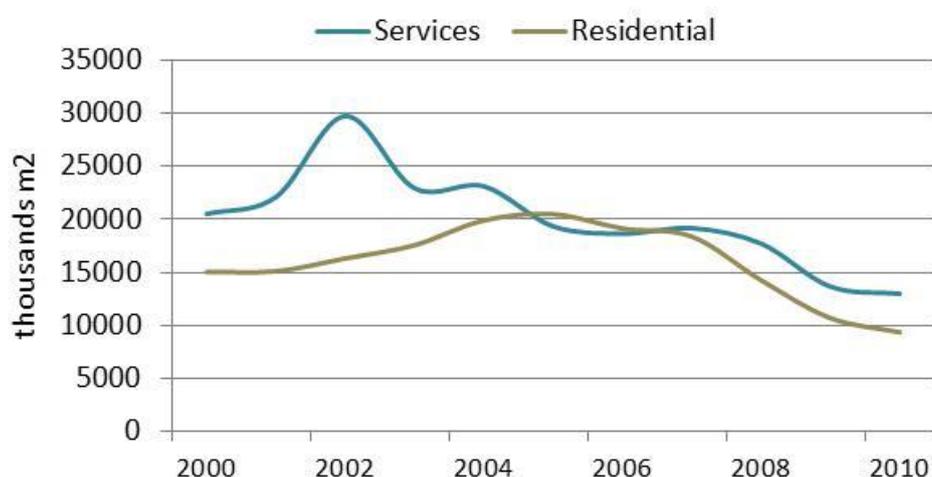
² MF: multi-family dwellings ; SF: single family dwellings.

between 2000 and 2005, it has been significantly affected by the global crisis in subsequent years.

During this last decade, the share of multi-family dwellings in annual construction became even more important: they represent the 91% of new realizations.

Over the period 2000-2010, the service sector (with about 220 Mm²) has been an important driver for the building companies. In 2002 we observe the peak of service construction: 30 Mm², almost double the new residential area in the same year. Despite the decrease recorded in the following years, this implies that the service buildings constructed between 2000 and 2008 represent 46% of total floor area of service sector buildings in 2008 stock.

Figure 3: Dynamics of building construction

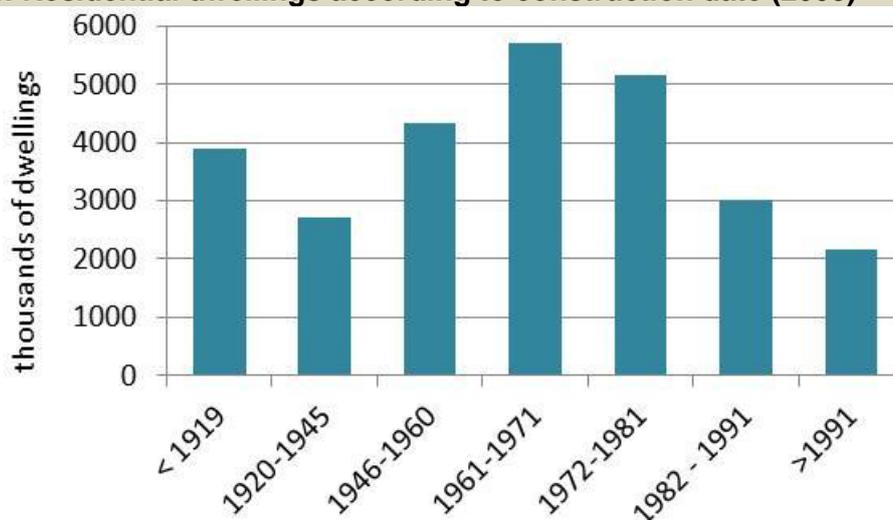


Source: ISTAT 2011 (building permits)

1.2 Residential sector

The average age of buildings and the share of new buildings in the total stock represent a good indicator of the quality and standards of construction. The higher the share of recent dwelling, i.e. built with more efficient standards, the higher the energy performance of the stock: in Italy, about 72% of the dwelling stock existing in 2008 was built after 1976, the year the first thermal regulation came into force (Figure 4).

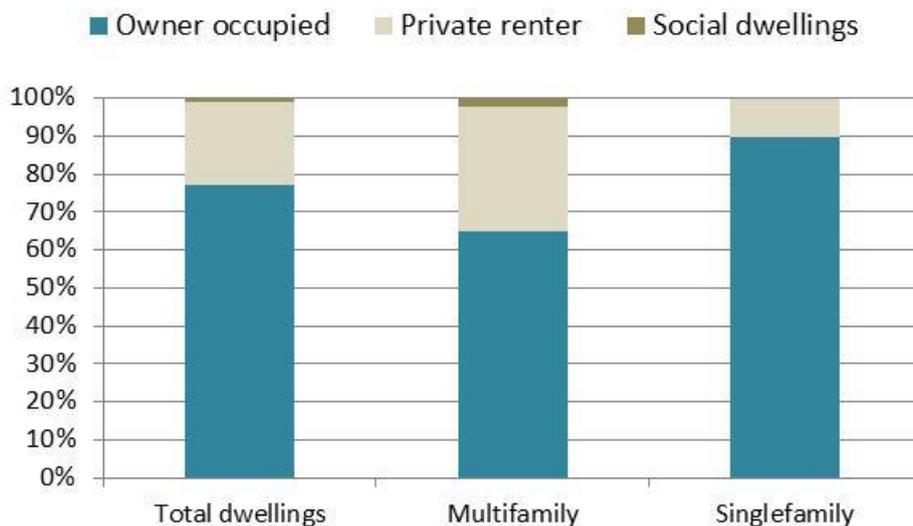
Figure 4: Residential dwellings according to construction date (2008)³



Source: Tabula

In buildings occupied by residents, owner occupants are dominant: 77% of total stock and about 90% in single-family dwellings. In multi-family dwellings we observe: 65% of owner occupant, 32% of private renter and 3% of social dwellings (Figure 5).

Figure 5: Breakdown of ownership & tenure (2008)

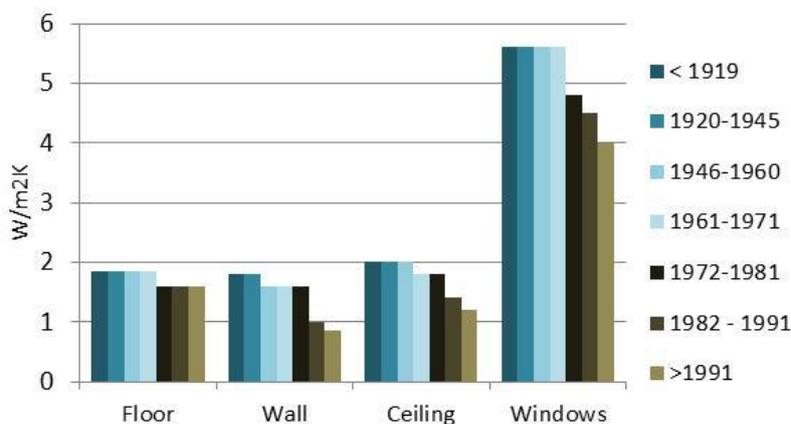


Source: ISTAT

³ The age categories refer to the ISTAT classification.

Figure 6 shows the U-values that represent the heat loss in building elements, such as wall, floor or roof, i.e. how well the buildings components are insulated. In Italy, U-values have decreased, and thus insulation improved, on average by 30% in 40 years. Biggest improvements occur for wall and ceiling insulation.

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

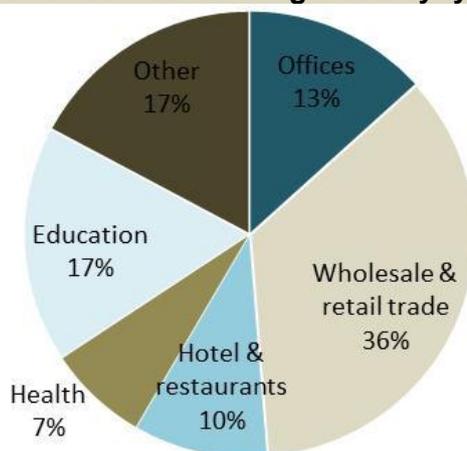


Source: Tabula

1.3 Service sector

Wholesale and retail trade represent the highest share of total service sector floor area in 2008 (36%). It is followed by education buildings (17%), offices (13%), hotels and restaurants (10%) and health (7%).

Figure 7: Decomposition of service building areas by type (2008⁴)



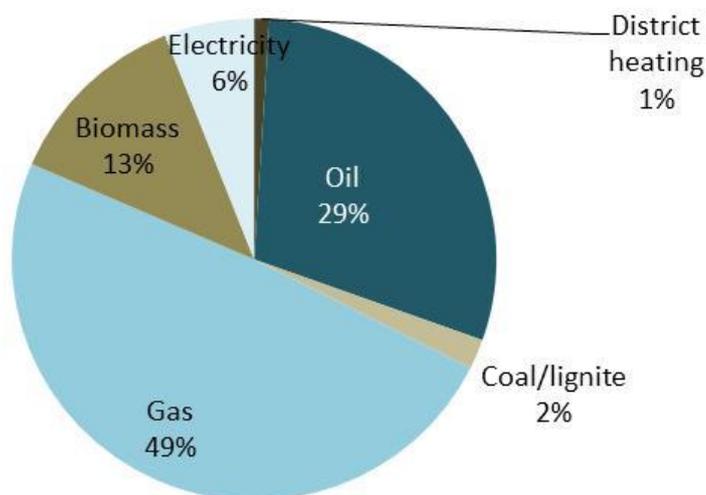
Source: BPIE, ENEA

⁴ Official data provide only total offices, i.e. without distinction between private and public sector. Public offices stock has been estimated by CEREN and French government data. Private sector has been calculated by difference.

2. Space heating and cooling systems

Natural gas is the main source of energy for household space heating: 49% of residential dwelling are heated with gas, 29% with oil and 13% with biomass; other energy sources are marginal such as electricity (6%), coal (2%) and district heating (1%).

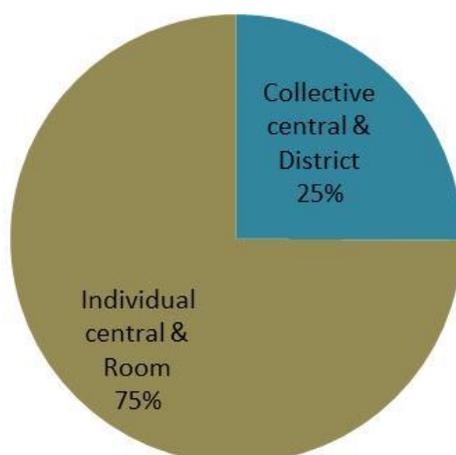
Figure 8: Dwelling stock according to space heating systems by energy (2008)



Source: ISTAT, CRESME

Figure 9 shows the penetration of heating systems. In Italy the majority of the housing stock (75%) is heated by individual heating systems, including room heating that has almost disappeared, except in single family dwellings of southern rural areas.

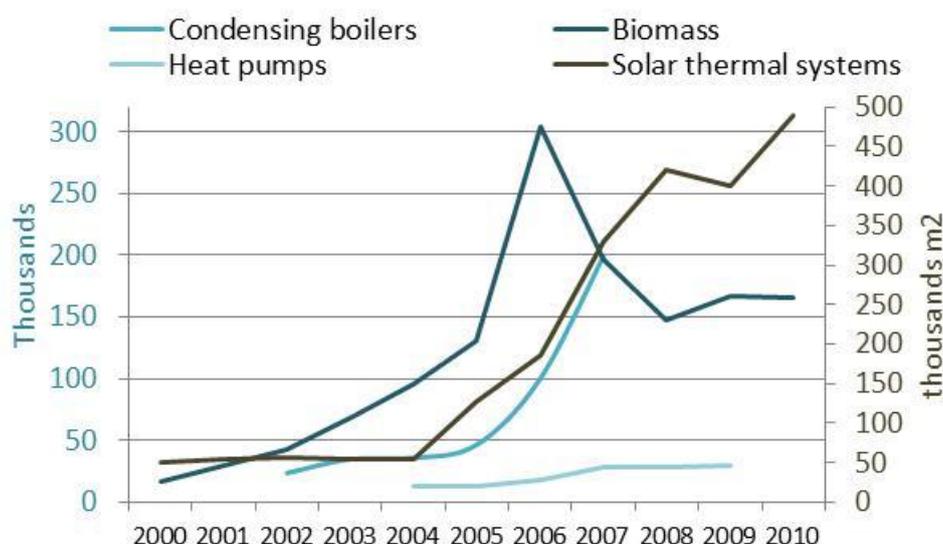
Figure 9: Dwellings according to centralisation of heat supply (2008)



Source: ISTAT, CRESME

The diffusion of efficient and renewable heating systems, such as condensing boilers and heat pumps, promoted by several subsidies or tax credits, significantly improve the average heating energy efficiency. The sales of condensing boilers and heat pumps are increasing over time. About biomass boiler we observed a high initial diffusion and a changing trend from 2006. However only a small part of dwellings are equipped in 2008, thus it has a limited impact on energy performance. Geothermal⁵ heat pumps represent around 15% of total heat pumps sales. Because of the obligations introduced in 2005 (for new buildings and major renovations) and the incentives available (for existing residential buildings) from 2007, the installation of solar thermal systems is constantly growing.

Figure 10: Sales of energy efficient and renewable systems in recent years



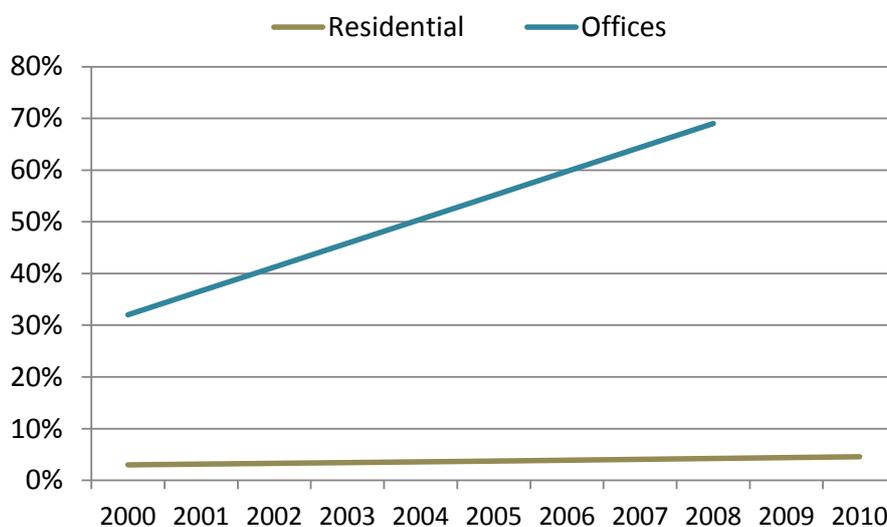
Source: Odyssee, ASSOTERMICA, ASSOPELLET

Diffusion of air conditioning is steadily increasing in the Italian residential sector: we observed a turnover increase of 64% from 1994 to 1995 and even 85% if we refer to 1993. After a period of stable market between 1996 and 1998, there has been a veritable explosion of the market in 1999, with a doubling of the appliances sold the year before. The following year, 2000, saw a further increase of 30% and from 2001 sales have increased steadily by 3% (Figure 11).

The penetration of air conditioning is even more important in the service sector; it is around 70% of office buildings, providing a better working environment.

⁵ Geothermal heat pumps include water/water, ground/ground and ground/water heat pumps. Generally the latter ones are dominant.

Figure 11: Penetration of air conditioning (% of floor area)



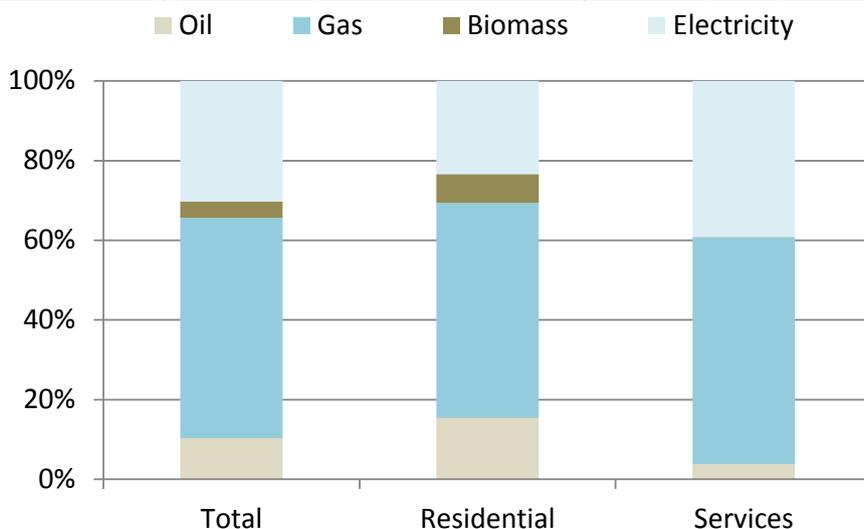
Source: eERG estimation starting from Odyssee and EECCAC data

3. Energy consumption

Natural gas (55%) and electricity (30%) are the dominant source of energy in Italian total buildings stock (Figure 12). Oil is slowly being phased out but still represents around 16% in residential and 4% in service stock.

In the service sector, electricity is more relevant with 39% and its share has increased in the last years due to the greater use of electricity especially for information/communication technologies and air conditioning. Gas represents 57% of total service sector energy consumption.

Figure 12: Total energy consumption of the building sector (2008)

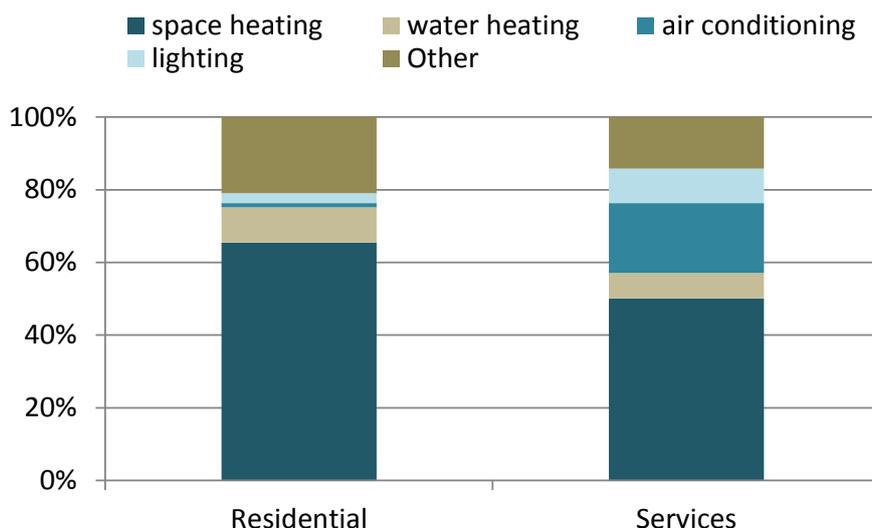


Source: Odyssee

Space heating represents the largest share of household energy use: it corresponds on average to almost 65% of total energy consumption. Water heating consumption equals 10% of the consumption. Lighting makes up 2.7% of household consumption. Air conditioning still represents a marginal share of residential consumption.

In the service sector, space heating and water heating represent 50 and 7% respectively of total consumption. Air conditioning and lighting are more significant than in the residential sector: they reached 19% and 9% respectively of total consumptions.

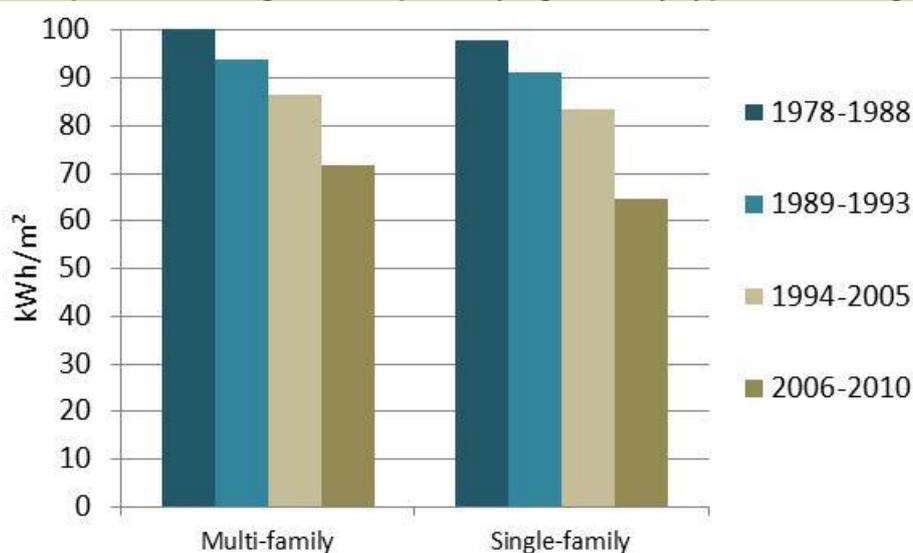
Figure 13: Total energy consumption by end-use (2008, real climate)



Source: Odyssee

Energy efficiency standards enforced on new dwellings have an impact on the space heating energy performance. However, the magnitude of this impact depends on the frequency of thermal regulations updates and on their severity. These standards require theoretical maximum heating unit consumption for new buildings, as shown in Figure 14. In Italy, three main thermal regulations were implemented since the 70's (1976, 1991 and 2005). The last thermal regulation implies a specific heating consumption 30% lower than the thermal regulation implemented in the mid 70's and 65% lower than the buildings of the first half of the twentieth century. The theoretical maximum consumption of new dwellings is equal to around 65-70 kWh/m²/year.

Figure 14: Specific heating consumption by age and by type of dwellings



Source: Odyssee

4. Conclusions

Despite its favourable climatic conditions, Italy is one of the European Country with the largest energy losses in the building stock. Residential buildings represent 86% of total floor area and the main stakeholders in Italy are owner occupants of apartments in multi-family buildings.

Being the last energy regulation (2005) only applied to new buildings and major refurbishment, it will not achieve the main aim of improving overall building efficiency if not accompanied by effective renovation plans. Through the establishment of national incentive programmes, we observed in the last years an important increase of the renovation works in the residential sector: in the period 2000-2010 more than 4 millions of buildings (around 36% of the total residential stock), with a mean yearly growth of 6.5%.

In Italy the larger part of housing stock is heated by individual central systems and half is heated with gas. Space heating represents the largest share of household energy use (65% of total consumptions) and air conditioning is steadily increasing. The sales of condensing boilers are increasing rapidly in recent years over time.

The Italian service sector consists mainly of trade, educational and office buildings. Natural gas and electricity are the dominant sources; space heating and air conditioning cover largest part of total energy consumptions.

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