MARIE

MEDITERRANEAN BUILDING
RETHINKING FOR ENERGY
EFFICIENCY IMPROVEMENT

WP4/ Task 4.1

Innovative Measures and Tools for Increasing Energy Efficiency in Buildings

Regional Benchmarking Analysis Of the Demand Side For Energy Efficiency in Buildings

APRIL 2012

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L'Europe en Méditerranée
Europe in the Mediterranean

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Acknowledgements

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- ANKO, Regional Development Agency of Western Macedonia (Greece) : Coordinator of the study
- LIMA Association, Low Impact Mediterranean Architecture (Catalonia, Spain)
- EPSA-COPV, Junta de Andalucia (Andalusia, Spain)
- PACA Region - Provence Alps Cote d'Azur (France)
- ARE Liguria, Regional Energy Agency of Liguria (Italy)
- PIEMONTE Region (Italy)
- BASILICATA Region (Italy)
- GOLEA, Goriska Local Energy Agency (Slovenia)
- LCA, Local Council Association of Malta (Malta)
- UNIVERSITY OF EVORA (Alendejo, Portugal)

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1. Introduction

The Regional Benchmarking Analysis of the demand side for energy efficiency in buildings is the first task that has been delivered within WP4 of the MARIE project. It is a very important task because it has identified the barriers that exist in the participating regions, based on the state-of-the-art in terms of energy efficiency demand in buildings. For this reason information and standardized data have been collected for:

- Building stock in the participating regions
- Energy consumption/ efficiency per type of building and corresponding indicators and trends
- Legislation (national/ regional) related to energy efficiency in buildings
- Financial schemes (national/regional) for energy efficiency in buildings
- Regional barriers to energy efficiency improvement

Furthermore, in order to have a common conceptual framework for building energy efficiency improvement between demand (WP4) and supply (WP5), there was an effort to structure information regarding legislation and financial schemes (see Annexes 1 and 2) according to the following areas of building energy efficiency improvement (see Annex 3 for definitions):

- Building envelope
- Building services
- Appliances/ equipment
- Occupants/ behaviour

Following the collection and analysis of this information, the corresponding barriers that prevent the fulfilment of energy efficiency targets have been identified, in order to identify and propose measures to overcome the existing barriers. For this reason, the information and data provided by all partners participating in the study were as standardized as possible in order to facilitate the analysis and the synthesis of the final Benchmarking Analysis Report.

Methodology for data collection and analysis

A Regional Benchmarking Analysis (RBA) template for the demand side on energy efficiency in buildings was designed and delivered to all the partners participating in the study in order to collect the information and data mentioned above for the benchmarking analysis and make the compilation of the final Benchmarking Analysis Report for the demand side. For this reason, and EXCEL file attached to the RBA template was provided to make the collection of standardised data easier, in particular data for building stock, corresponding energy consumption and efficiency. The data worksheet included all possible data needed for the analysis. However,

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some of the requested data were not available for all participating countries/ regions. In this case only available data were used for the analysis, even though all partners tried all suggested resources to complete as many requested data as possible. Separate templates were provided for presenting the corresponding legislation and financial measures or schemes in a standardised way, based on the corresponding templates provided by the MURE project.

Based on the collection of information and data, as requested, the analysis is presented in the following sections:

- Basic information on MED regions, providing a brief introduction to the socio, economic and environmental state-of-the-art of each participating region.
- Building stock and trends (national and regional) in construction in each participating region, with a final comparison of information based on best available data on common years.
- Energy consumption and efficiency in building stock (national and/or regional) in each participating region, with a final comparison of information based on best available data on common years.
- Legislation (national/ regional) in each participating region, related to energy efficiency in buildings, presented also for comparison in a standardised way in Annex 1.
- Financial schemes/ measures (national/ regional) for energy efficiency in buildings in each participating region, presented also for comparison in a standardised way in Annex 2.
- Main regional barriers on the demand side that prevent stakeholders from taking actions for improving energy efficiency in buildings.
- Conclusions summarising the main points of regional benchmarking analysis of the demand side for energy efficiency in buildings and providing a first proposal of a set of measures/ sub-measures to overcome the main identified barriers of the demand side.

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2. Basic information on MED regions

Basic information and data on socio-economic and environmental state-of-the-art of each region that participated in the study are provided below.

2.1. Catalonia (Spain)

Catalonia is located in the very East of the Iberian Peninsula.It comprises an area of 32,000 km^2 of which about 7% is urban area[1], with a very diverse geography: the Pyrenees Mountains in the north, the inland region and 580 km of Mediterranean coast. Its climate is equally diverse, with heating degree days (18/18) around 1000 in the coast, 1500 - 2000 in central Catalonia but up to 3000 in the Northern part of its territory, and cooling degree days (21/21) around 300 at the coast and interior and only 100 in the mountain area.[2] Rainfall is between 400 and 700mm/year.

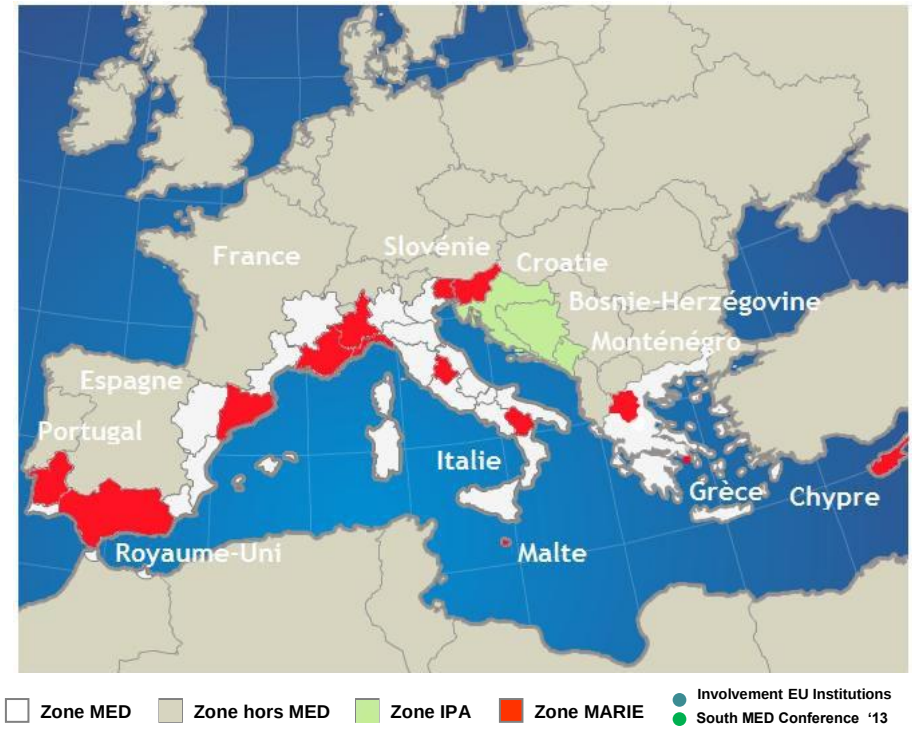

Figure 1: Catalonia in the Mediterranean Area

[1] Secretaria d´habitatge i millora urbana

[2] Els Graus-dia de calefacció i refrigeració de Catalunya, Estudis Monogràfics Num 14. January 2003

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Catalonia has a population of 7,505,000, with a population density of233 inhabitants/m[23] of which 82% live in urban areas with a population of more than 10,000 inhabitants[4].

Industry was the driver of the economy until the seventies, when the tertiary (service) sector started taking the lead as most important in terms of contribution to GDP and occupation, together with the construction sector, with 62.6% growth accumulated between 1998 and 2007, almost double that of GDP in general in that time.

As the whole of Spain, in 2007 Catalonia has entered into an economic and financial crisis which has lead to recession, with negative GDP growth in 2009 and 0.1% in 2010. Unemployment has soared, reaching 17.4% in 2010. The construction sector plays an important role in this crisis.[5] Its sharp decline in the years after 2007 has lead to massive job destruction, with 18% of unemployment being directly related to the construction sector in 2009.

Table 1: Macroeconomic Indicators Catalonia[6]

	2008	2009	2010	2011[7]
GDP (annual variation)	0.2%	-4.0%	0.1%	1.3%
Unemployment rate	9.0%	16.2%	17.4%	19,0%
Nr. of unemployed in the construction sector	65,355	101,571	96,735	100,521

As for the energy consumption of the economy, while the energy intensity of the economy has decreased in most European countries (especially the northern countries) over the last 20 years, the energy intensity of the Catalan economy increased during the last decade of the 20th Century, stayed at roughly the same level until 2004 and only then started to contract sharply (see Figure 2).

The current economic situation and high rate of unemployment has lead to a fall in household income, and lack of liquidity in the financial sector has lead to a decrease in loans, the combined effect of which is little saving and little investment capacity at both enterprise and household level. The general sensation is of an extremely uncertain future.

[3] Idescat, Figures Xifres de Catalunya 2010

[4] Secretaria d´habitatge i millora urbana

[5] Informe sobre el sector de l´habitatge a Catalunya 2009.

[6] Font: Departament d'Economia i Finances, Departament de Treball i Ministeri d'Economia.

[7] Data 2011 for the first trimester

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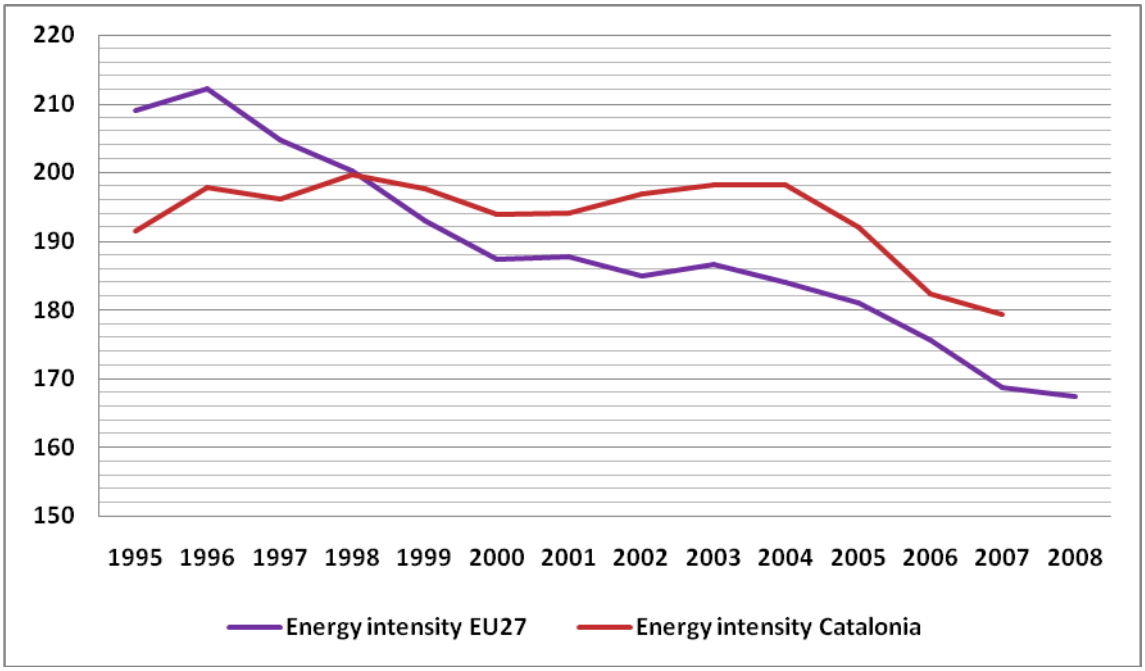

Figure 2: Energy Intensity (toe/GDP €1000) of the EU - 27 (Gross inland final energy consumption) and the Catalan (primary energy consumption) Economy.
Source: Eurostat and Icaen (Balanη energetic 1990-2007)

2.2. PACA (France)

The PACA region is characterized by wide disparities in population and socio-economic structures, between the territories and other highly urbanized, especially in mountain areas there is a low population density. Moreover, these territories are unequally served by the transportation system, not only in terms of infrastructure, but more generally, the supply of transport. The region is also characterized by the weight of the forest and plant space and agricultural land uncultivated. The natural occupation of the territory, that is to say neither agricultural nor urban, covers 70% of the regional area. Urbanized areas represent 1 588 km ² out of 31 752 km ².

They are denser along the coast, extending to the Middle Country to the margins of the mountains and valleys of the Rhône and Durance as a result of suburbanisation and metropolisation, often at the expense of agricultural space. 85% of the population is in urban centers and suburban municipalities of which 83% of the shoreline. The distribution of population in the territory is uneven, with a large range of urbanization from Avignon to Menton, which concentrates almost 90% of the population over 30% of the country.

The PACA region is a very attractive area with a population that will continue to growth in the coming years. It also has considerable pressure on the land with an

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important development and little control over its territory, which has many effects on the land and housing.

One can highlight the following issues:

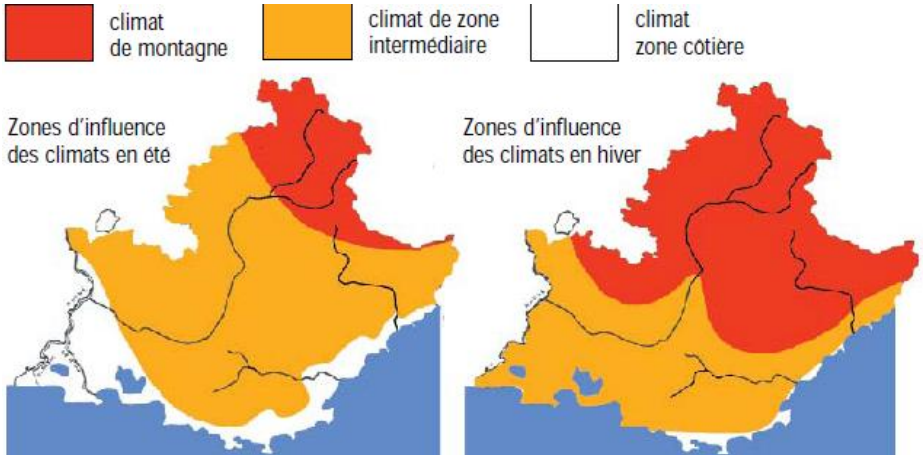
- An increasingly large and diverse housing needs,
- A lack of housing for the active people and a deficit of social rental housing (*55 social households / 1 000 inhabitant – less than 13% of the primary households*)
- A high proportion of second homes (18 %) plus 6% of unoccupied households
- An extension of land pressure in the medium-country
- The development of urban sprawl and sprawl, particularly in peri-urban, which consume a lot of natural spaces and destruct agriculture
- Conversion of agricultural land in natural space
- A continued need for land and infrastructure activities
- A coveted land, thus exacerbating conflicts of land use
- An increase in land and property values, which is very important
- A territory marked by tenuousness, with high economic and social disparities especially in housing.

Finally, one can say that the demand for land and housing is at a particularly high level in the PACA region, with an important speculative pressure.

Regarding climate characteristics, one has to keep in mind that the Mediterranean climate can be described fairly quickly by relatively mild winters, but especially by very hot summers.

The sun, wind, temperatures are used to define in Region PACA three homogeneous climate zones in which the geographical limits vary depending on the season. The three main groups are:

- Mountain area (*red area below*)
- The intermediate zone (*orange area below*)
- The coastal zone (*white area*)



The mountain area is not subject to excessive heat summer (the temperature rarely exceeds 27 ° C). The intermediate zone is where the summer discomfort is the more important.

- The sunshine: Exceptional, it is generally between 2500 and 2900 hours per year by geographical area.
- Temperatures: Higher in summer, they have large differences between day and night, night ventilation can harness the cool night air for the next day.
- Moisture: Except in the coastal strip, the air is generally hot and dry in summer for the entire region.
- Prevailing winds:
    - From land to the sea (*Mistral, Tramontana*) they often blow powerful gusts; cold in winter and cool in summer, they give off the sky and enhance sunshine.
    - From sea to land, they are often responsible for rain and softening temperature.
- The micro-climates: Site-specific, they sometimes modify these general climatic characteristics: strengthening of the winds in the Rhone valley, sea breeze in Nice, mild temperatures at mid-southern slopes of the hills, etc

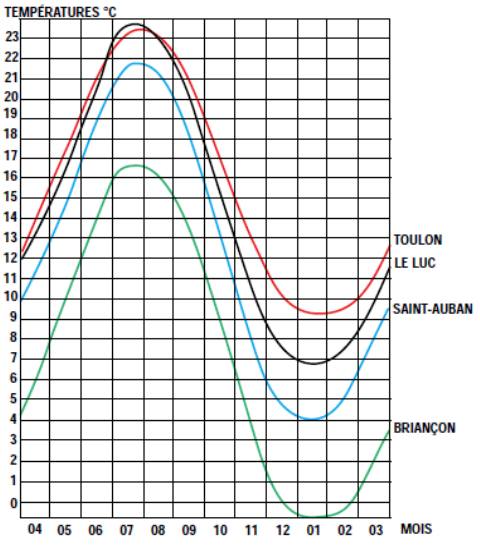


Figure 3 Temperature variations in PACA between areas and months.

Toulon, Le Luc : coastal zone
Saint Auban : intermediate area
Briançon : Mountain Area

2.3. Liguria (Italy)

Liguria had about 1,600,000 inhabitants in 2010. Its population had increased by 2.8% if compared to 2001. Such an increase is due to the regularization of foreigners that are living in Liguria and the growing number of family reunions. Birth rate is still very low and coupled with the ageing population and the longer life expectancy, Liguria is now the Italian Region characterised by the oldest population in Italy and Europe.

Liguria's territory is characterised by a very urbanised coastal area, rich in infrastructures, and densely populated, where many economic activities are situated; then, there's the area beyond the coast, which is connected to the former, and the hinterland. The average population density is 298 people per sq m, which is very high, if compared to the national and European average population density. 55.3% of the population lives in the Province of Genoa, whereas percentages decrease and people are uniformly distributed on the territory of the other three provinces (Savona: 17.5%, La Spezia and Imperia: 13.5%). The employment rate of Liguria is 61% and its unemployment rate is 5.8%. 76.30% of Liguria's workforce works in the services sector, 20.90% in the secondary sector and only 2.80% in the primary sector.

Liguria is characterised by a 350 km long coast and a territory of 5,422 sq km. It is the Italian Region where the coastal development is the most widespread if compared to the overall extension of the territory. This means that the coast is, and has always been, the most interesting and important area of the region, as well as its most difficult area from the social, economic and environmental points of view. As a matter of fact, in spite of the morphological and structural constraints, Liguria's position, which is of essential importance as for the movements of goods and people, encouraged the construction of many infrastructures along the coast, e.g. port infrastructures and the important railway system.

The most important towns and their road network are often overcrowded and traffic is at a standstill, this is not only due to the presence of port areas, but also to commuters, who use their private cars; this is why what is needed is strengthening the railway network.

Liguria is characterised by breathtaking landscapes and beautiful natural areas on both the coast and its hinterland, and by a very rich heritage: the built areas, the work of arts, the natural resources, the natural/historical/archaeological sites, landscapes and the heritage made of local values and traditions. As for the environmental values, Liguria is characterised by many areas belonging to the “Natura 2000 Network” and protected natural parks: 125 SCI (Sites of Community Interests) have been identified in Liguria, 26 of which are sea areas; 7 SPA (Special

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Protection areas) have been identified and they safeguard 75 habitats of Community interest. These areas comprise about 25% of the territory (in addition to the 7,000 hectares of sea areas belonging to Natura 2000 Network – sea areas).

The Liguria Region is characterised by: nine regional natural parks, three land nature reserves, four marine reserves. There are two very important botanical gardens that play a very important role as for nature and landscape. The total area of nature reserves is 49,131 ha, i.e. more than 9% of the regional territory.

The regional territory is characterised by a very high quality, however it is running many risks: the need of areas to be used for the construction of big buildings and infrastructures (mainly production areas and infrastructures) clashes with the features of the territory, where suitable areas are scarce, and characterised by elevated hydro-geological risks.

Liguria is strategically linked to Europe: this is true along the trans-boundary line of the Northern Mediterranean Sea and as for the integration/competition in the transport and port sectors, as well as the tourist, economic and knowledge systems and sectors. Liguria has a privileged position in the Mediterranean Sea, since three main world transport routes pass through it: two East – West routes, from the Balkan region and Eastern Europe to Western Europe and Spain and Portugal; then, the route going from the Far East to Western Europe, through the Suez Canal and the Mediterranean Sea; and the North – South route going from Northern Africa and the Near and Middle East to Southern and Central Europe.

Liguria is also involved in three of the six transnational strategic platforms that have been identified as areas that are used to connect Italy to the European system: the fifth corridor-West, the corridor of the two seas and the Ti-Bre axis (Tyrrhenian sea – Brenner Pass axis). The three infrastructural railway projects: “Terzo Valico” and “Pontremolese” (Tyrrhenian sea – Brenner Pass axis), as well as the infrastructures of Liguria's ports dedicated to the Motorways of the Sea, are included in the Community projects that want to develop the dynamics of the internal European market, improve the territorial cohesion, competition and the prospective growth of the EU.

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2.4. Piedmont (Italy)

Piedmont is one of the largest Italian regional economies. There are more than 410.000 firms and industrial employment rates are high (33%).

Piedmont spends 1.8 % of GDP in RTD, second in Italy and exceeding the national average which is around 1.1%, and also well positioned even compared with other European areas. In Italy, the region is also in first place for the percentage of expenditure on innovation in the manufacturing sector.

Piedmont, well-known for the size of its automotive industry, has increasingly pursued the diversification of productive system, investing more and more in sectors linked to the knowledge economy. Today, in addition to the automotive industry, which continues to be one of the region's driving sectors thank to its innovation intensive activities, there are several emerging strategic sectors such as robotics, ICT, renewable energies, environmental technologies, design, aerospace, life sciences, pharmaceuticals and health, logistics.

In particular, Piedmont Region strongly supports the energy efficiency field and reduction of energy consumption in buildings. It promotes the improvement of energy performance of existing buildings and new constructions through the application of the Regional Law n. 13/2007 (and subsequent implementation decrees) which takes into account the local climatic conditions, in order to facilitate the development, enhancement and integration of renewable sources and energy diversification, giving preference to technologies less environmental impact.

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2.5. Basilicata (Italy)

Basilicata is a small region of southern Italy, has a territorial surface of 9,992 square kilometers and a population of 587,517 inhabitants (January 1, 2011); its population density (59 inhabitants per sq km) is less than one third of the national average. From the administrative point of view the region consists of two provinces: Potenza, the regional capital, and Matera. The municipalities are 131, including 100 in the province of Potenza and 31 in the province of Matera.

The territory of the region is mostly mountainous, with only 8% of the territory is classified as "plain", while 47% is classified as a "mountain" with mountain range over 2,000 meters; 30% of the region's territorial surface is covered by forests. About 35% of the population lives in municipalities with a population less than 5,000 inhabitants.

In the year 2010 in Basilicata the GDP per capita amounted to € 18,012.5, below the national average (€ 25,607.3), but substantially in line with the rest of southern Italy regions (€ 17,466.4). In 2010, the economy has shown trends of Basilicata recession, according to some estimates, the GDP fell by over one percent, after the strong fall of 2009 (-6.7%). In the same year Southern Italy has recorded a growth of 0.2% and Italy as a whole an increase of 1 .3%. In total during the years between 2001 and 2010 Basilicata has recorded a GDP loss of 6.4%. The unemployment rate in Basilicata in 2010 was 13%, significantly higher than Italy (8.4%), but in line with the rest of southern Italy regions (13.4%).

Basilicata is the Italian region that produces the greatest amount of hydrocarbons. In fact, in 2010, Basilicata has produced 51% of domestic production of natural gas onshore and 78% of the total domestic production of crude oil. The area affected by the extraction of hydrocarbons amounted, at the end of 2010, to 37.1% of territorial area, amounting nearly three times the national rate. The production of electricity from renewable sources in Basilicata, in 2008, stood at 36.2% compared to the total electricity produced, as compared to the gross domestic electricity consumption amounted in the same year, to 17.2% and in 'year 2009 to 30.3%.

The average value of maximum temperature in 2009 ranged between 9.4 ° C in February and 30.5 ° C in August. In the same year the average values of minimum temperature ranged between 2.0 ° C in February and 16.3 ° C in August.

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2.6. Western Macedonia (Greece)

The region of Western Macedonia is situated in north-western Greece, bordering with the regions of Central Macedonia (east), Thessaly (south), Epirus (west), and bounded to the north at the international borders of Greece with F.Y.R.O.M. (Bitola region) and Albania (Korçë region). It was established in the 1987 administrative reform, comprising the prefectures of Kastoria, Grevena, Kozani and Florina. Although it covers a total surface of 9451 km2 (3649 sq mi) (7.2% of country's total), it has a total population of 302892 inhabitants (2.9% of the country's total), thus it is a low-density populated Region (32 per km², as compared to the country's 79.7 relevant figure). This is mainly due to the mountainous nature of the Region, as 82% of the total surface is mountainous and semi-mountainous area. This is also reflected in the population distribution, as the major part of the population (56%) lives in rural areas. Kozani is the capital city of the region with 47451 inhabitants.

Figure 4 : Map of Region of Western Macedonia
Source: Wikipedia

The secondary sector is very important for the regional economy, mainly due to the mining activities, the production of electric power (70% of country's total power is produced in the Region) and the fur-leather sector. Some of its more famous products are marbles, Saffron (krokos Kozanis), fruits, local wines (Kozani, Amyntaio), furs (Kastoria, Siatista) and specialized arts and crafts industry. However, "soft" structures have not followed the general improvement of heavy infrastructures, a situation that has to be remedied, in order to achieve an overall higher economic development of the Region. During the last years, tourism has been developed in the region, mainly winter tourism. It is the only Greek region without sea coast, but on the other hand there are a lot of lakes, mountains, graphic villages, two big facilities for skiing and one under construction.

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There is a commitment of the Regional Authority of Western Macedonia, the local authorities and other regional stakeholders to exploit the competitive advantages of the region and promote its historical and technological profile in the fields of Energy and Environment. Certain regional policies and actions have been promoted towards that direction. A Regional Innovation Pole of Western Macedonia has been created, following the collaborative approach of regional research, technology and business organisations to design and implement a corresponding programme promoting innovation in the field of energy, under the coordination of the Regional Authority of Western Macedonia. The Regional Innovation Pole of Western Macedonia aims at improving collaboration between research, innovation and production, technology transfer and new products and services in the field of energy as well as the creation of permanent mechanisms for technology and innovation development and promotion.

2.7. Primorsksa (Slovenia)

Slovenia is traditionally comprised of eight main regions: Gorenjska, Primorska, Notranjska, Dolenjska, Bela Krajina, Štajerska, Prekmurje, and Koroška, and the capital city, Ljubljana. There is a great variety and heterogeneity of lifestyles and culture. The regions differ in climate, dialects, architecture, agricultural produce, nutrition and cuisine, arts and crafts, tradition, and local custom. They have no political or administrative function.

Primorska region lies in the Western part of Slovenia. It shares borders with the eastern part of Italy. To the north are the Julian Alps next to the border with Austria. The southern part of Primorska contains the Adriatic Sea in the Gulf of Trieste and Istria. Primorska region also has many forested mountains with peaks rising to 750-1300m with beautiful valleys and clear rivers including Soca, Idrijca, Tolminka, Baca, Nadiza, Zadlascica, and Trebusica. The northern part of Primorska is predominantly a fine wine growing area and Goriska brda and Vipavska dolina are the most reputable vineyards producing excellent quality red and white wines. Due to its geographical position on the crossroads of the routes between Austria, Italy and Slovenia, where the Alpsdraw closest to the sea, here is a meeting point of different cultures and nations. The nearest airport is in Trieste (Italy).

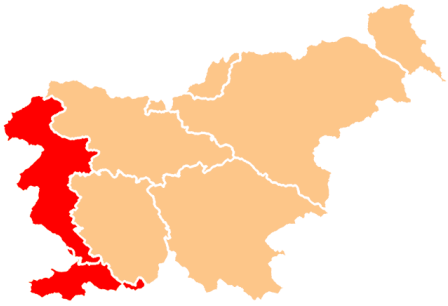

Figure 5: Primorska region

For statistical purposes Slovenia is divided in 12 statistical regions, Primorska comprises 3 statistical regions: Goriška, Obalno-kraška and Notranjsko- kraška.

Figure 6: Statistical regions of Slovenia

The Constitution of the Republic of Slovenia stipulates that people in Slovenia exercise their right to local self-government in municipalities and other local communities. Municipalities are defined as basic local self-government units. Slovenia is divided into 210 local municipalities (mostly small size). There are also 952 local communities that are part of a municipality. Moreover the Local Self-government Act stipulates that a local community may organize lower organizational forms: village, locality or quarter communities. In Slovenia there are 62 quarter communities and 256 village communities.

Northern Primorska which consists of the Gorišča statistical region is situated on the north-western part of Slovenia bordering Italy on a plain surrounded by viniferous hills and Karst plateau, between the Soča and Vipava Valleys and it covers 11.5% of the total Slovenian territory (2.325 km2, 119.742 inhabitants). It consists of 13

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municipalities. The municipality of Nova Gorica is the centre of Goriška Region. It is relatively rarely populated regarding that in average on a km2 lives only 51,5 inhabitants. The largest share of Goriška population is old between 50 and 54 years (8,1%) and the index of ageing (31.12.03) was 120, what was above the Slovene average.

Most of the region (northern part) has alpine landscape with hills and valleys; therefore it is less appropriate for intensive farming. On the other hand southern part of the Goriška has sub-Mediterranean climate and is used for intensive production of vegetables, fruit and grapes. The valley of Vipava and Goriška Brda are well known for wine production. 63% of the area is covered with forests of which 61.2% are in private property, 25.7% belong to the state and 13.2% to the municipalities. 28% of the entire area of Goriška statistical region area is used for farming. There are 83% of meadows, 11% of fields, 3% of orchards, and 3% of vineyards. The farms are mostly small; 72% of the range between 1 to 5 hectares of land, 17.3% of the range between 5.1 to 10 hectares and only 10.7% farms of range over 10 hectares. 47.1% of the region's landscape is a part of Natura 2000 Programme and National park Triglav.

The region contributes less than 6% to the total national GDP, it is ranked third in terms of GDP per capita and has the lowest rate of unemployment in Slovenia at only 6.7%.

The South Primorska region consists of the Obalno-kraška statistical region, to which the Municipality of Ilirska Bistrica is added.

The region is composed of three socio-geographic subregions: Slovenian Istra, Karst and Brkini-Ilirska Bistrica, which are geographically different from each other. The region consists of eight municipalities. The area is covered mainly in forests (67%) and agricultural land (28%). Built-up areas represent 2.8% and roads 1.3% of the territory. The share of protected areas is 3 %, the Natura 2000 areas occupy 48%, and according to this indicator, the region is ranked third in the country. The region is situated in the southwestern part of Slovenia, bordering with Italy on the west and Croatia on the east. The region is small and has a surface of 1,524 km2. It is the only Slovenian region lying by the sea and although only 46 km long, the coastal zone is of enormous national value and it is of great strategic importance from economic, natural and cultural points of view. An over-arching spatial plan is required because of the conflicting interests in such a small coastal stretch.

The population is 119.475 (2005), which is 5.97% of total population in Slovenia. The average density is 78 inhabitants per km2, which is below the national average. The coastal part of the region is populated more densely (213 inhabitants per km2), the Karst hinterland and the Municipality of Ilirska Bistrica have lower population density (33 inhabitants per km2 and 30 inhabitants per km2). The biggest municipality of the

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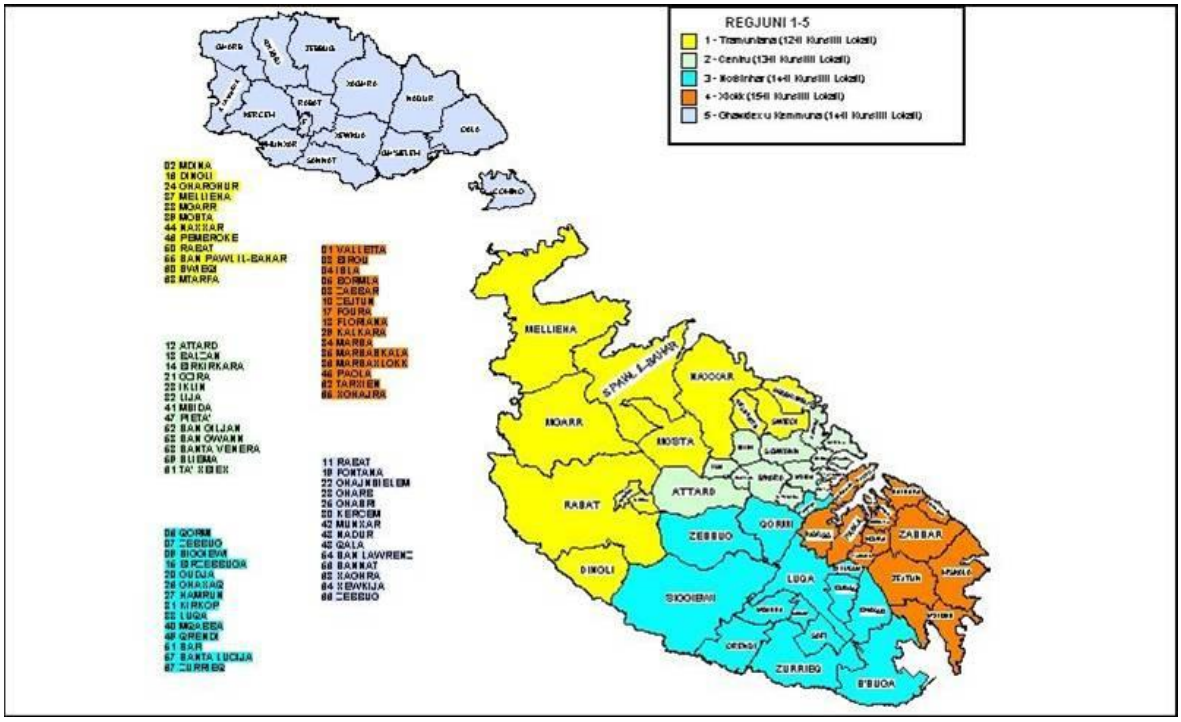
Slovenian Istra is Koper with 49,272 inhabitants. The ageing of the population is characteristic of all Slovenia; however, South Primorska has an even less favourable age structure. In this region, the ageing index is among the highest and it exceeds the Slovenian average by about 30%.

The coastal region with the submediterranean climate is the only one with an exit to the sea. Natural features enable the development of tourism, transport and special agricultural crops. Around three quarters of gross value added are created by services. In 2007 almost a fifth of gross value added was created by transport, activities in the Port of Koper representing the highest share. The shares of hotels and restaurants and of coastal and spa tourism in the total gross value added are higher than in other regions. Agricultural holdings in this region were among the smallest in Slovenia both in terms of utilised agricultural area and in terms of the number of livestock units. Almost a half of agricultural holdings grow permanent crops, which are the most important ones within utilised agricultural area compared to other regions in Slovenia. According to the changes in the use of agricultural area from 2003 to 2007 the role of agriculture is improving since the agricultural area increased by almost 50%. In 2008 the most intensive construction of dwellings took place in this region with more than 7 dwellings per 1,000 population, mainly new constructions.

2.8. Malta

In the case of Malta given the size of the island and the lack of data availability, the information given will be on a national basis rather than on a regional basis. Malta, with the introduction of the local councils was divided into five regions which include the Gozo region, the North region, the South East region, the South region and the Central region as shown below.



There are no regional energy policies in Malta but there is only a national energy policy which has been issued by the central Government. The Ministry for Resources and Rural Affairs has presented the National Strategy for Policy and Abatement Measures relating to the reduction of Greenhouse Gas emissions in September 2009.

The same national strategy underlines that a number of proposed actions require further study as it was not deemed possible or realistic that the published strategy document would be comprehensive in terms of the details and impacts of each policy or abatement measure considered.

Furthermore, it was emphasized that the proposed strategy is not absolute and immutable. As new challenges emerge and unforeseen opportunities arise, the

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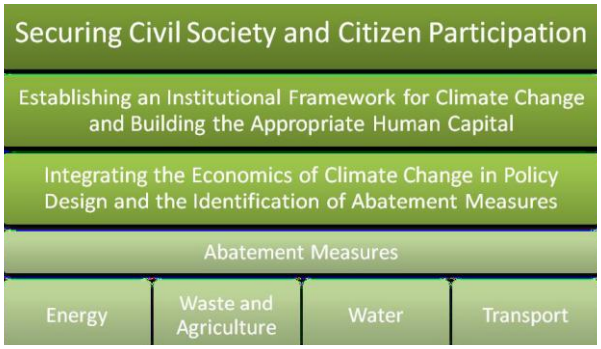
strategy should be reviewed and reconsidered. This strategy for policy and abatement measures relating to the reduction of Greenhouse Gas emissions was based on the following building blocks:



The table below from the National Census of Population and Housing, 2005 published by the National Statistics Office gives the main economic activities in main job of population.

Economic activity	Total
Total	**153,483**
Agriculture, hunting and forestry	2,249
Fishing	429
Mining and Quarrying	674
Manufacturing	26,201
Electricity, Gas and Water Supply	3,118
Construction	11,003
Wholesale and retail trade	24,474
Hotels and restaurants	12,724
Transport, storage and communications	11,953
Financial Intermediation	5,564
Real Estate, renting and business activities	10,406
Public admin. and defence; compulsory social security	13,101
Education	13,092
Health and Social Work	11,360
Other community, social and personal service activities	6,563
Private households with employed persons	163
Extra-territorial organisations and bodies	407

Again from the information published by the National Statistics Office through a news release on the 22nd May 2008 on the Energy Consumption in Malta between the period 2000 – 2007. This news release states that the Energy consumption in Malta is derived from a range of imported fossil fuels which are burnt for different

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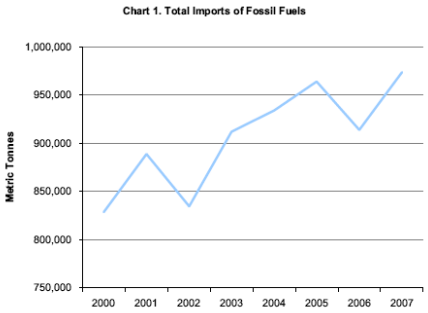
uses.The three major energy consumers are domestic transport, industry and power stations.

Transport includes all types of vehicles, sea craft and airplanes. All these moving units mainly consume leaded petrol, unleaded petrol and diesel fuels. Their consumption varies according to the type of unit and how much it is used. This reflects in a continuous change the demand of
fuels according to the travelling habits on the islands.

The tables presented in this news release give an overview of the energy consumption in Malta from 2000 to 2007 except for table 2 where data for financial year 2006/07 are unavailable. Energy statistical data for the Maltese Islands show that there is a continuous increasing demand for fossil fuel energy during the past eight years. This trend is graphically presented in Chart 1.



Such an increase during this period was of 17 per cent. Malta is totally dependent on fossil fuel imports and its fuel mix is becoming cleaner following measures such as the abolition of leaded petrol use in 2003 and the supply of low sulphur diesel. This is presented in Table 1 which shows the quantities of fuel imported in Malta.

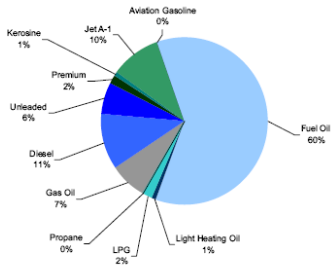
Table 1. Fossil fuel Imports - Metric Tonnes

	2000	2001	2002	2003	2004	2005	2006	2007
Gas Oil	170,721	45,619	53,420	71,672	22,228	67,731	43,631	53,704
Diesel (low sulphur)	-	111,767	56,617	109,550	137,851	97,710	91,826	99,188
Unleaded	27,220	29,172	43,577	70,186	58,012	68,028	75,982	63,866
Premium	42,692	37,501	31,113	-	-	-	-	-
Kerosine	9,677	9,992	12,386	14,719	15,640	3,000	1,878	1,413
Jet A-1	113,740	89,070	87,083	76,602	98,284	85,138	75,164	86,678
Aviation Gasoline	135	133	160	98	129	151	110	84
Fuel Oil	428,318	545,894	529,323	547,826	577,440	607,644	592,197	637,360
Light Heating Oil	0	3,000	3,098	3,783	7,274	15,789	12,862	11,147
LPG	16,135	16,383	17,369	16,997	16,816	18,177	19,597	19,759
Propane	224	131	123	318	195	421	336	228
Total	**828,569**	**888,662**	**834,269**	**911,753**	**933,869**	**963,789**	**913,584**	**973,427**

Source: Enemalta Corporation

The data indicate that fuel oil is the most imported commodity since it is used for the daily operations of the two installed power stations on the Island. The second most consumed fuel is the low sulphur diesel. This is followed by the unleaded fuel since this type of fuel is also used by the transport sector. Chart 2 presents the percentage share of the fossil fuel energy balance in Malta.

Chart 2. Energy Balance in Malta



It is evident that around 60 per cent of fuels (fuel oils) is used for electricity production while another 34 per cent of the total fuel share (Diesel, Gas oil, Unleaded, Jet fuel) is consumed by the public and private transportation.

Table 2 shows the pattern of the electricity consumption by sector for the years 2000 to 2006. is evident that between the year 2000 and 2006 Malta's gross energy consumption increased by 19 per cent with the domestic sector absorbing around 36 per cent of total electrical consumption. The commercial and industrial sectors are the next, with the commercial sector absorbing 32 per cent and the industrial sector 30 per cent. Such a distribution is mainly attributed to the accelerating energy demand from economic growth as shown in Chart 3.

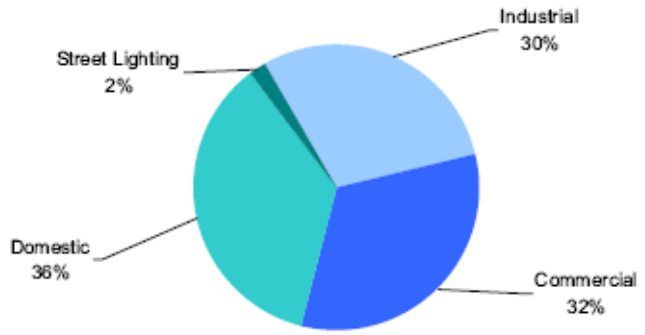
Table 2. Power generated and consumed in Malta

000' Kilowatt Hour

Year	Total Generated	Used in station	Industrial	Commercial	Domestic	Street Lighting	Lost in distribution and unaccounted for (Total Maltese Islands)
2000/01	1,943,350	117,661	482,908	503,660	540,265	42,733	256,123
2001/02	2,055,073	123,987	504,760	501,582	561,907	44,901	317,936
2002/03	2,208,015	125,093	499,230	553,804	623,679	35,220	370,989
2003/04	2,214,892	127,777	505,535	563,090	623,672	29,068	365,750
2004/05	2,263,145	131,005	518,147	577,544	669,467	29,192	337,790
2005/06	2,260,762	130,801	530,218	635,779	658,224	28,796	276,943

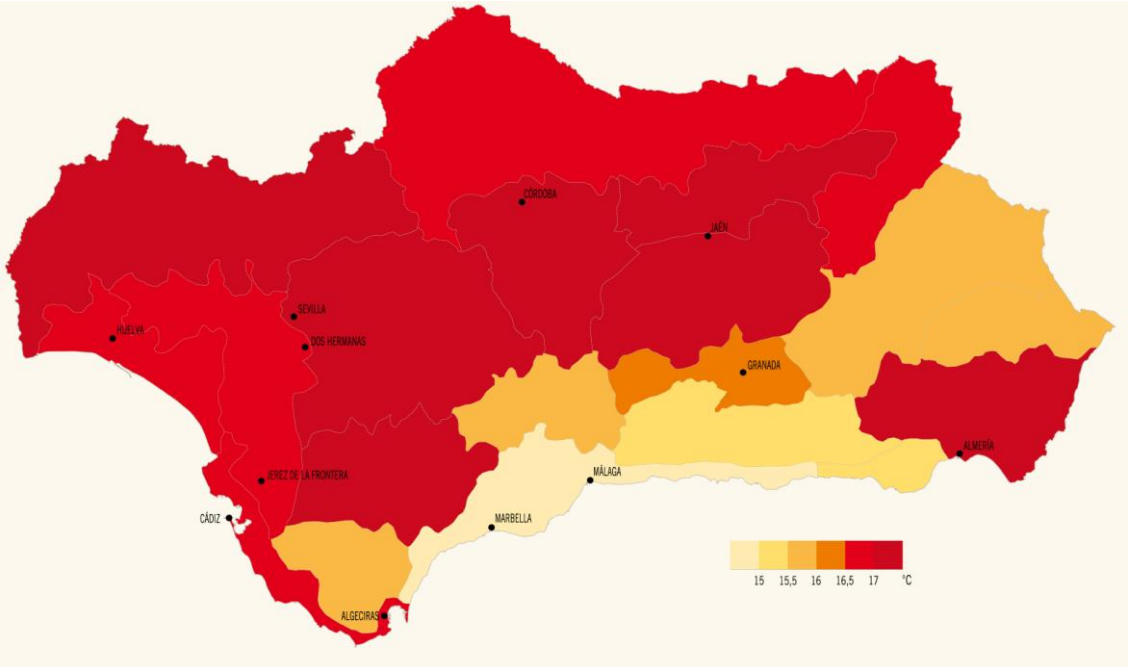
Source: Enemalta Corporation

Chart 3. Electrical consumption share in Malta



2.9. Andalusia (Spain)

Andalusia is the most southern region in Spain. The strait of Gibraltar separates Andalusia, and for instance, Spain, from Africa. It comprises an area of 87.597 Km2[8] in which urban areas represent the 3% of its surface, around 2.632,9 Km2. It is the second largest region in area among the Spanish regions and its sea border is limited by the Atlantic Ocean in the West coast and the Mediterranean Sea in the East coast. The Andalusian geography is very diverse, going from the extensive coastal plains along the Guadalquivir Valley, almost at sea level to the highest altitudes in the Iberian peninsula in Sierra Nevada. Additionally, so does happens with its clima, mostly Mediterranean, but with extreme spots, such as the dry Tabernas desert, the snowy Sierra Nevada, the subtropical coast of Granada or the rainy Sierra de Grazalema in Cádiz, where it rains the most in the Iberian Peninsula (4.346 mm/year). The average annual temperature is between 12ºC to 21ºC. However, it is important to highlight the extreme temperatures along the Valley of Guadalquivir River, where the highest temperature in Europe was recorded during some summer with 46.6ºC.



Moreover, the National Building Code establishes a series of climatic areas depending of the climatic harshness of winter, from lower to higher, A-B-C-D-E and for summer, 1-2-3-4. The combination of these divisions identifies the areas with a letter and a number according to the harshness in summer and winter, and as a

[8] Andalucia Datos Básicos 2010. Instituto de estadística de Andalucía.

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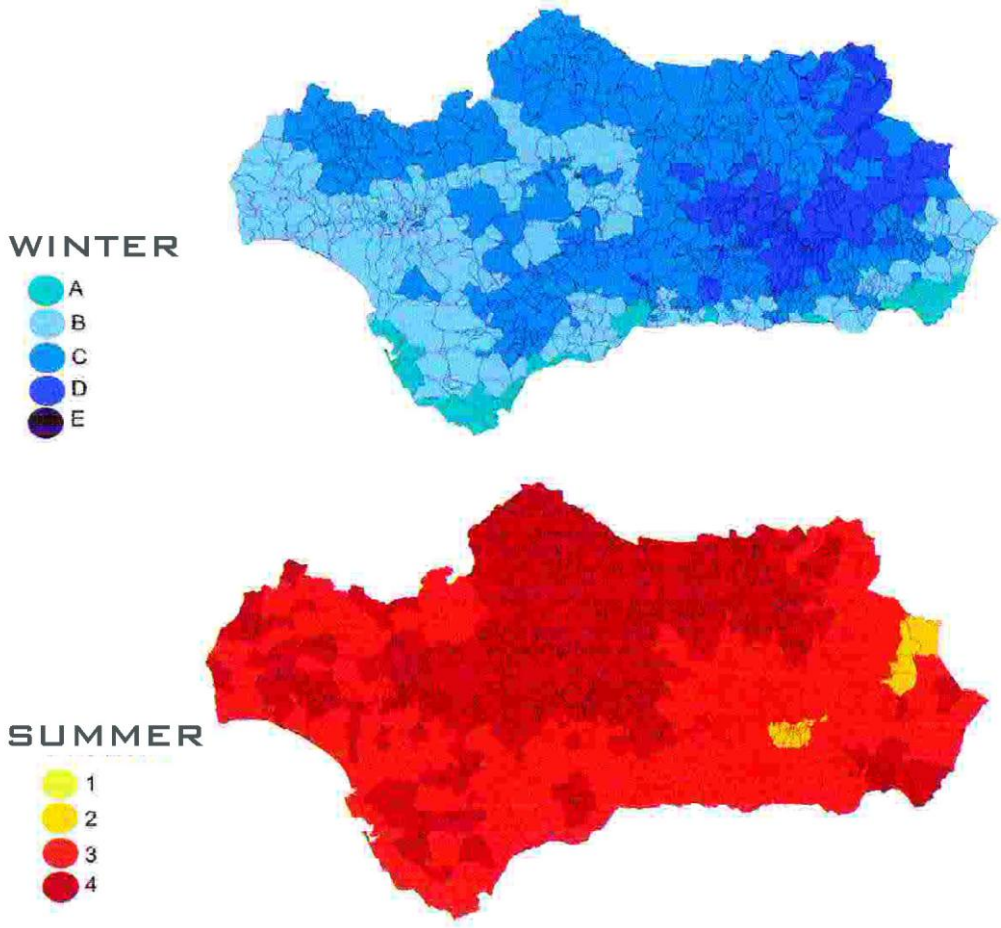
result, the climatic areas in Andalucia are 9, A3-A4-B3-B4-C3-C4-D1-D2-D3. With regard to this, it is remarkable, as it is shown in the maps below, that in its majority, the harshness in summer, reach the highest values represented by the numbers 3-4, while in winter, there is a wide distribution of B and C and some spots of A and D, but never the extreme winter harshness represented by E.



There is as well a variety on heating degree days (18-18º), around 500 degree-days in the coast areas up to 1000 in the central areas. The same fact happens with the cooling degree days (24-24º) with an average of 200-250 degree-days and extremes of 50 degree-days in the coast and 300 in the Central Guadalquivir Valley.

Andalusia has a population of 8.415.490[9] inhabitants over the 47.150.819 in Spain which means almost a 18% of the Spanish population. It is the region with highest population in Spain. It is interesting to highlight that the population nowadays is concentrated in big urban areas, such as the capitals of each province as well as all

[9] Instituto de Estadística y Cartografía de Andalucía (IECA) and Padrón Municipal de Habitantes INE- Indicadores Demográficos Básicos

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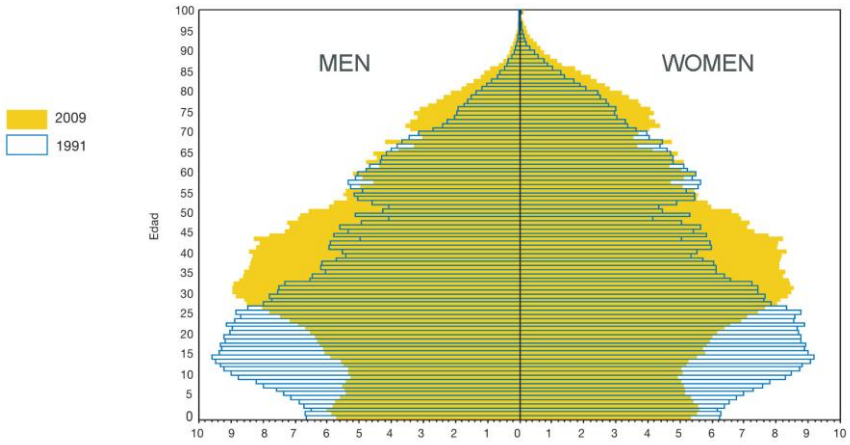
along the coast where the number of inhabitants is increasing opposite to the rural and country areas. There more than 81 municipalities with more than 20.000 inhabitants and 28 cities with more than 50.000 thousands.. The population density in Andalusia is 94.78 inhabitants/Km2.

The structure of population[10] in Andalusia:



Despite Andalusia is one of the poorer regions in Spain, the tertiary sector, services is above the average in Spain , specially due to the tourism which is the most important contribution to the GPD. However, the construction sector, hit hard by the 2009 recession, was also important to the region's economy. Nowadys and due the financial crisis the GPD has had a negative growth in 2010[11], -0.9% with a GPD per cápita of 17.405 Euros/inhabitant, second lower of the country, which supposes the 24.5% below the average GPD in Spain, 23.063 Euros/inhabitant and 28.9% of average European GPD, 24.486 Euros/inhab.

Following the last information published in the “Instituto de Estadística y Cartografía de Andalucía” the active population is 3.985,7 with an unemployement rate of 29.36%, over a million of unemployed.

Part of the main causes of the increase of this rate has been the huge fall of the construction activity, especially in the housing sector as it is shown in the graph below.

[10] Andalucia. Datos Básicos 2010
INE-IEA Censo de población 1991.
INE Revisión del padrón Municipal de Habitantes a 1 de Enero de 2009
[11] Instituto Nacional de Estadística. Notas de Prensa. 24 de Marzo de 2011

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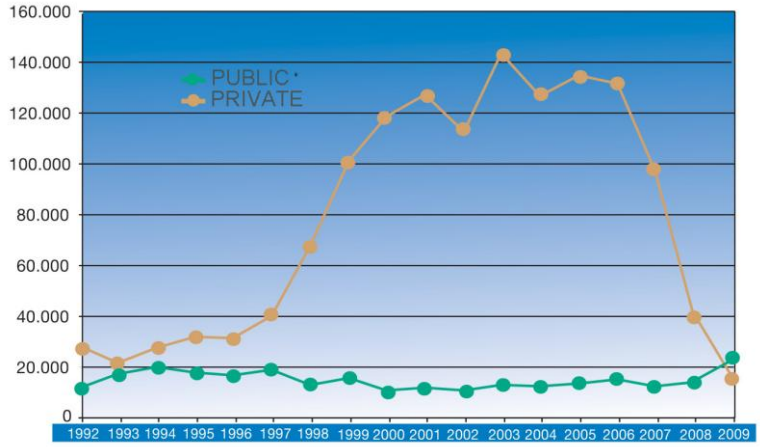
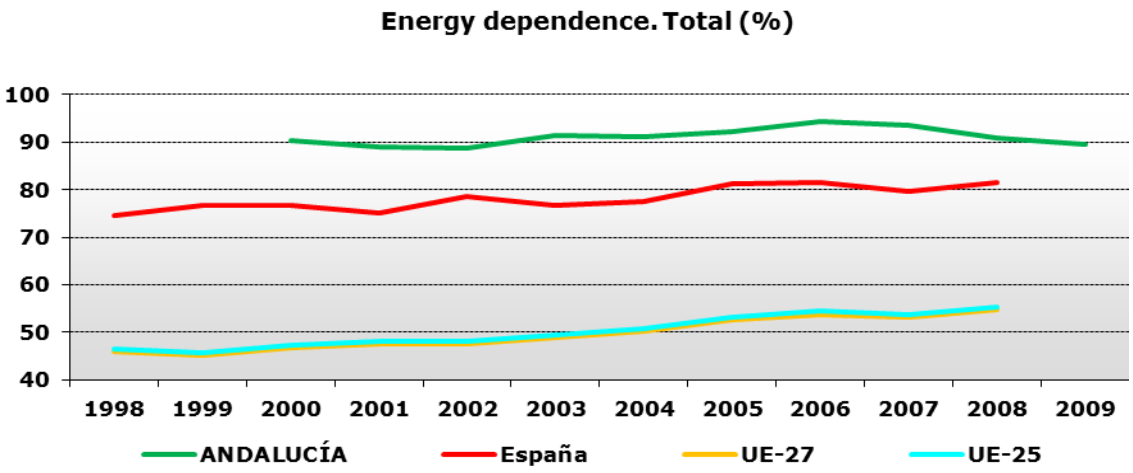


EVOLUTION OF NEW HOUSING CONSTRUCTION ACCORDING TO THE DIFFERENT REGIMES
Sources: Andalucia Datos Bαsicos 2010. Instituto de Estadvstica de Andalucva.
Consejerva de Obras Pïblicas y Vivienda.

The lack of high-quality fossil fuels in Andalusia has led to a strong dependency on petroleum imports. Still, Andalusia has a strong potential for the development of renewable energy, above all wind energy. The Photovoltaic Solar Plant, built by the Andalusian firm Abengoa in Sanlïcar la Mayor in the province of Seville, is the largest existing solar power facility in Europe. Smaller solar power stations, also recent, exist in other areas. The Plataforma Solar de Almerva (PSA) in the Tabernas Desert is an important center for the exploration of the solar energy.

The largest wind power firm in the region is the Sociedad Eólica de Andalucía, formed by the merger of Planta Eólica del Sur S.A. and Energía Eólica del Estrecho S.A.



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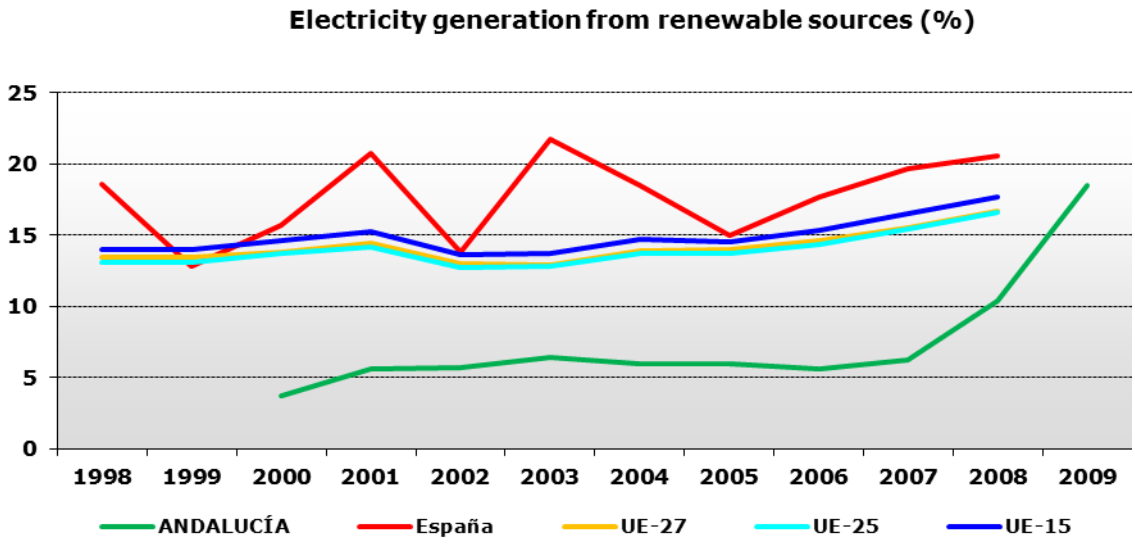

Source: Eurostat and Instituto de Estadística de Andalucia

2.10. Alendejo (Portugal)

Brief description of the socio-economic and environmental characteristics of the region is not available.

3. Definition of buildings in MED regions

The scope of this section is to estimate the building stock for residential and tertiary sector at regional level according to specific building typology. An overview is presented for each participating region, following the corresponding template provided and a comparison is made at the end of this section, based on best available common data on building stock.

3.1. Catalonia (Spain)

Data availability and limitations

Data collection in Spain is realised by national and some by regional authorities. Most data available for the Catalan building stock has its source almost exclusively in the 2001 national census of housing and population by the National Statistics Institute (INE), and data collected by the Catalan Statistics Institute (IDESCAT). This has two main consequences on the data availability relevant for this benchmark analysis: first, the census is conducted only every ten years, so that there is a discrepancy between the available statistical information and the current situation, almost a decade later, which has seen a strong expansion (and subsequent fall) of the construction sector; second, the most data available is on the housing sector. To mitigate the first and get an estimate of the current state of affairs, the census data is complemented in this report with annual data on completed new construction in the housing sector, which is available from the Secretary for housing and urban improvement (Secretaria d´habitatge i millora urbana) of the Government of Catalonia (Generalitat de Catalunya). In the case of the tertiary sector, which is very heterogeneous in its composition, complementing the available data is complex and in some cases, impossible, as there is very little information available. Consequently, most detailed information is given on the housing stock.

Additional data problems/limitations due to the absence of an integrated building stock data system are listed below:

- Refurbishment: the data on refurbishment used is data on public subsidies for refurbishment, which obviously excludes all refurbishment undertaken without subsidy.
- Social housing stock: the social (or protected) housing stock has public and private promoters in Catalonia. As data on holdings by developers, building societies / savings banks, or municipalities is not readily available, the data on social housing is that managed by the public housing agency (Agencia d´habitatge), property of the Government of Catalonia (Generalitat de

Catalunya, INCASOL – Institut Català del Sòl). This is not exhaustive, but represents the bulk of social housing.

- Building area: no integrated m2 data is available. The total useful area of single family and multifamily houses has been calculated with IDESCAT data for main residences. Tertiary sector useful building area data or total m 2 building sector data is not available.

Number of dwellings

The housing stock is determined by adding completed residential construction figures to the residential dwelling stock of the 2001 census, being 3,880,173 dwellings in 2010.

Use of dwellings

In 2001, of the then existing 3,314,155[12] dwellings, almost 70% were first residences (2,315,774 dwellings 2.782.300 in 2010), 15.5% were secondary/holiday residences, and 13.7% were vacant. [13]

Area of first residence stock

The useful area of residential dwellings (first residences) is 212,146,966 m^2 (estimated area in 2010: 276,030,851 m^2)[14]. Single family houses combine 54,326,848 m^2 of area, and multifamily houses and blocks of flats comprise 127,862,230 m^2.[15]

Age of residential building stock

The two decades with the highest construction activity in Catalonia were the 60s and 70s, when 38 % of the currently existing residential dwelling stock was built, before the first building regulations that introduced energy saving requirements came into force in 1979 (NBE-CT-79). Figure 7 depicts the age distribution of the housing stock up to 2010.

12

13 IDESCAT

14 Calculated by adding completed dwelling m2 to the 2001 first residences figure

15 Calculated by taking mean values of m^2, as m^2 information is available at IDESCAT in groups of $10m^2$

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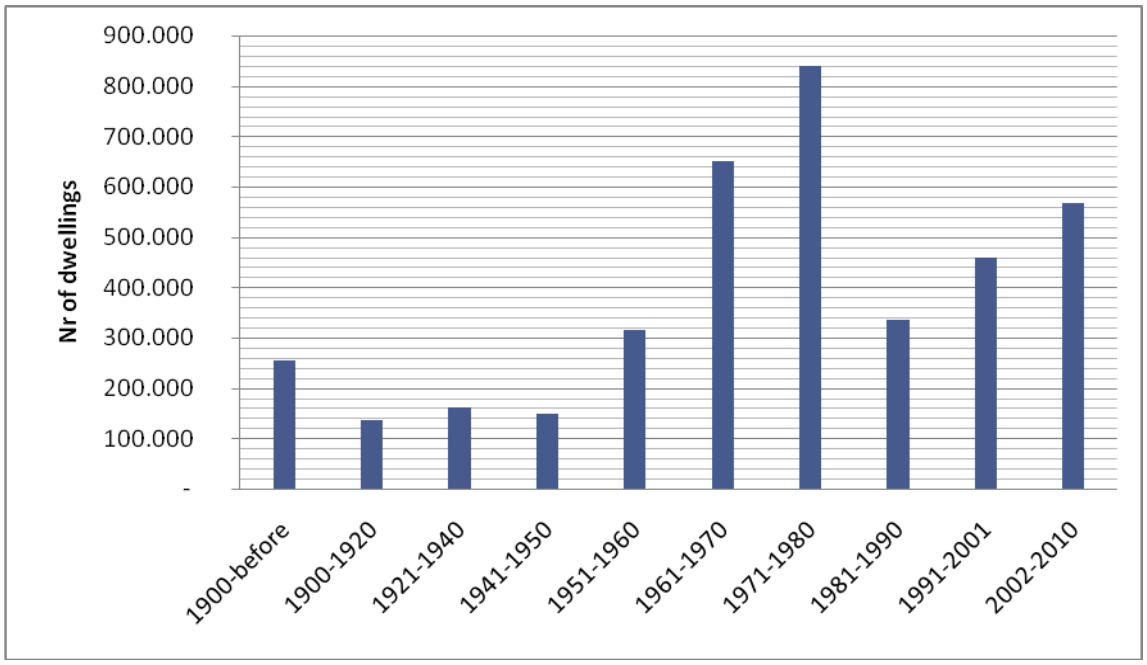

Figure 7: Period of construction of housing stock in Catalonia, number of dwellings.
Source: INE census 2001 and Secretaria d´habitatge i millora urbana (period 2002-2010)

Categories, types of buildings

The Catalan housing stock is made up of 66% single family houses, 8% of two-family houses and 18% of buildings with three or more dwellings[16] (see Figure 8)

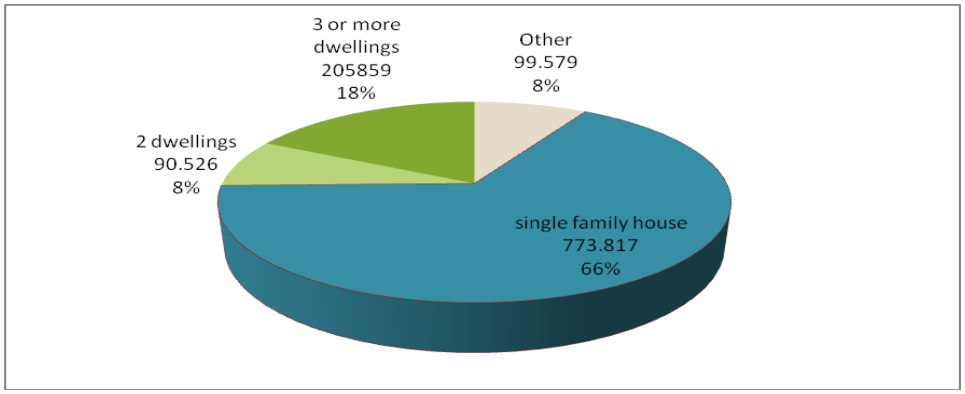

Figure 8: Buildings by number of dwellings per building.
Source: Idescat, 2001 census

16 (IDESCAT 2001)

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As for the distribution of dwellings, 74% of dwellings are located in multifamily buildings (2007, of 2,782,300 first residence dwellings) [17]

Figure 9 depicts in which period of construction, selected due to the change in construction type marked in every period, the different types of buildings were built. The criteria is: pre-war, between 1940 and 1980 (pre- NBE-CT-79), the 1980s (post NBE-CT-79), and the 1990s (when the building regulations were changed to include minimal standards in Catalonia with the NRE-AT-87 regulations) until 2001, year of the last census.

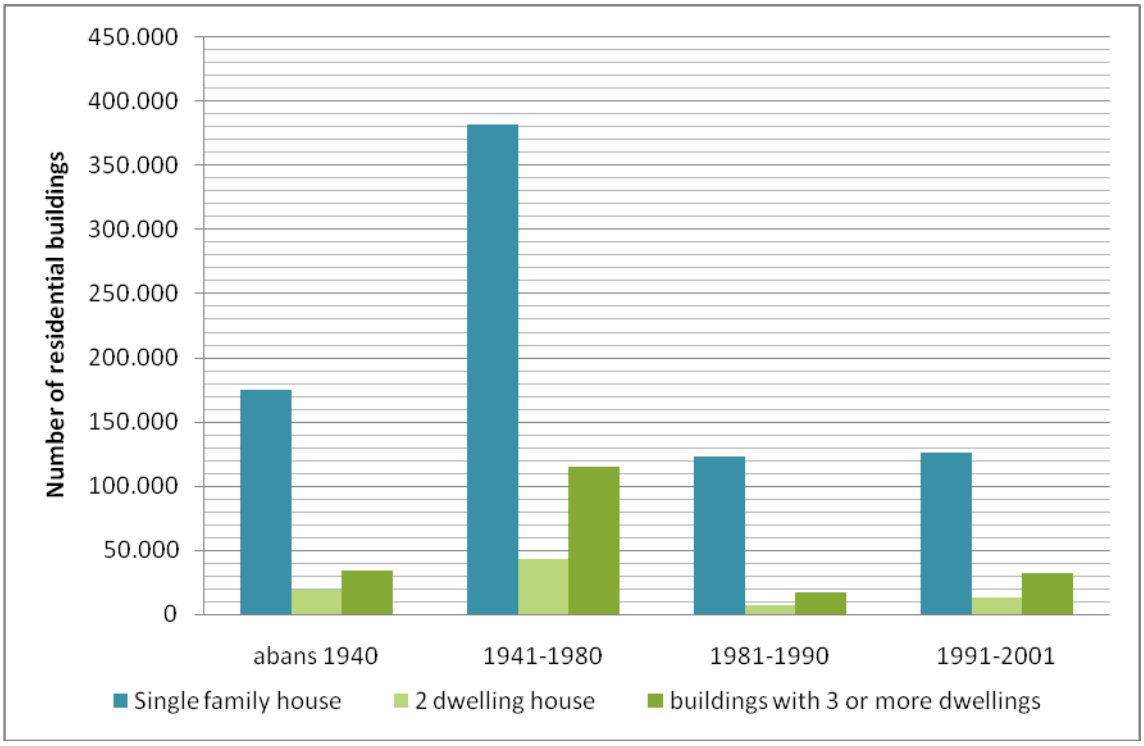

Figure 9: Period of construction of single family and multifamily houses in Catalonia.
Source: IDESCAT

The distribution of floor area constructed in the different periods is depicted in Figure 10. Most useful building area dates from the 1941-1980 period, and is situated in multifamily buildings (buildings with more than one dwelling).

[17] (idescat, enquesta demografica 2007)

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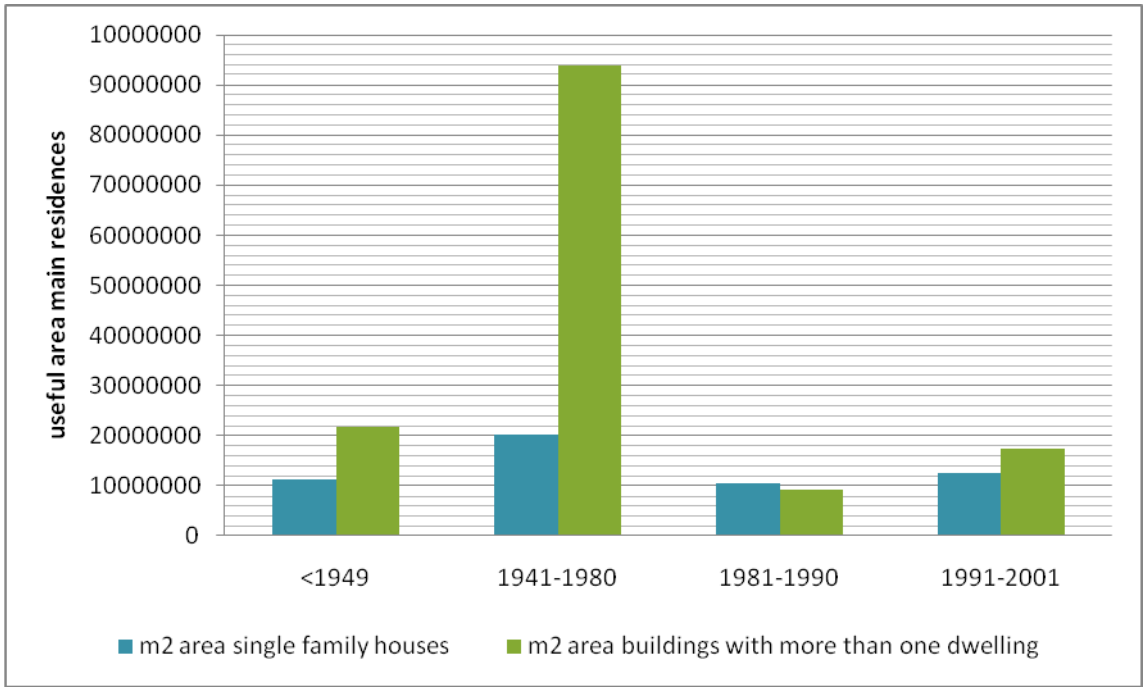

Figure 10: useful area (m2) of single family and multifamily buildings by period of construction, Catalonia.
Source: INE

Ownership structure of residential building stock

Private sector residential building stock

87% (925,944 buildings) of the residential building stock (total of 1,063,896 residential buildings; year 2001) is owned by private owners. Among this number are most single family and two-family houses.[18] The absence of big housing agencies is very characteristic for Catalonia. Around 60% of blocks of flats (118,323)[19] group together many individual apartment owners in so-called "communities of owners" (comunitat de propietaris). 70% of Catalans live in this type of "horizontal ownership" structure, obliging the apartment owners to manage common affairs in the building together (common services as lift or gardening, renovation issues, etc.). Nevertheless, there are multiple interlocutors for one building.

As for the ownership of dwellings by their occupants, 75.9% of first residences are owner-occupied (total of 2,728,345 dwellings) and 22% are rented homes (2007) [20].

18 (idescat, a pt cens poblacio I habitatge INE)

19 Idescat http://www.idescat.cat/territ/BasicTerr?TC=5&V0=3&V1=3&V3=244&V4=259&ALLINFO=TRUE&PARENT=25&CTX=B

20 IDESCAT, INE. Enquesta demográfica 2007

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Public sector residential building stock

This part of the stock has to be estimated with the social housing stock, as mentioned above. The social housing stock managed by the Housing Agency (Agencia d´habitatge) comprises of 88,660 dwellings.

Trends in new construction

After a phase of strong construction activity from the mid 90s until 2007 with residential construction peaking in 2006 with 127,117 building permits granted for construction of dwellings, and in 2007 with 79,580 completed new dwellings[21], the decline started in 2007 with the largest negative variation in 2009, where general construction decreased 42%, and the construction of residential dwellings 50%.[22] See Figure 11 (depicting commenced and completed construction) and Table 2:

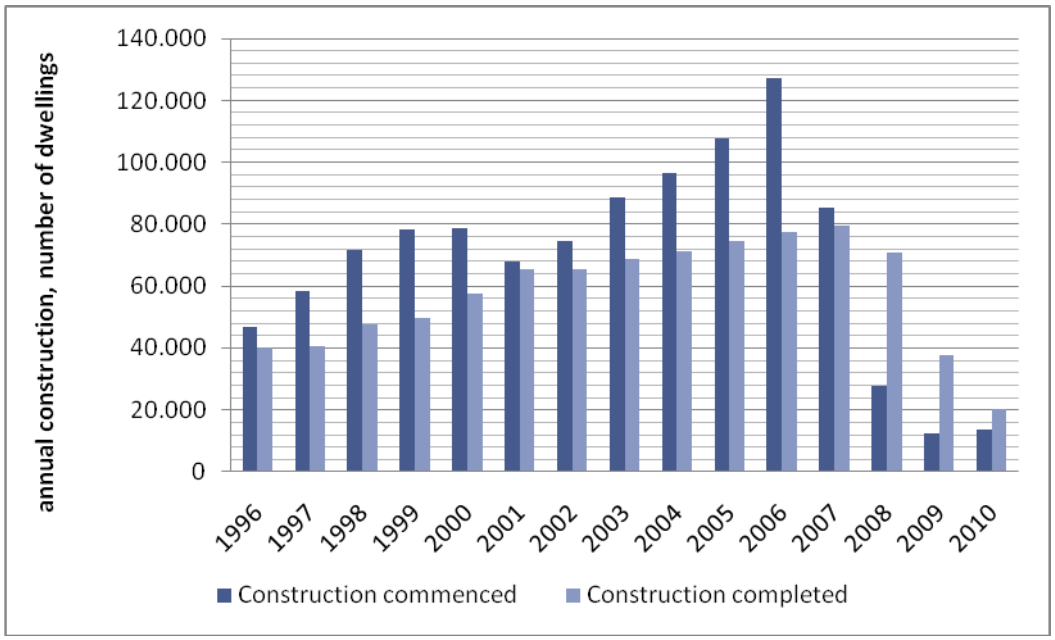

Figure 11 : Annual construction of residential dwellings in Catalonia.
Source: Secretaria d´Habitatge

[21] Secretaria d´habitatge (2011) *Informe sobre el sector de l´habitatge a Catalunya any 2010* Generalitat de Catalunya Departament de Medi Ambient i Habitatge

[22] Secretaria d´habitatge (2011) Informe Continu sobre el sector de l´habitatge, Maig 2011

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Table 2: Annual variation of production volume of the Construction Sector in Catalonia (%)

	2008	2009	2010 (1)	2011 (2)
Construction of new buildings	-23	-42	-22.8	-6.3
Construction of residential dwellings	-27	-50	-25	-0.5
Refurbishment	-2,5	-2	-0.7	-1.0
Total construction sector	-17	-23.7	-12.8	-10.5

Source: Informe continu d´habitatge, Maig 2011 (CCOC) (1) estimation (2) prediction

From the 20,292 dwellings completed in 2010 only 18% were single family and semi-detached houses while the rest 82% is located in multi-family building blocks (Figure 12). 37% of overall residential construction was dedicated to social housing, which can be explained by the fact that a high number of non social housing projects that are usually developed by private entities stopped activities quickly after the start of the economic crisis while public agencies finished the started projects.

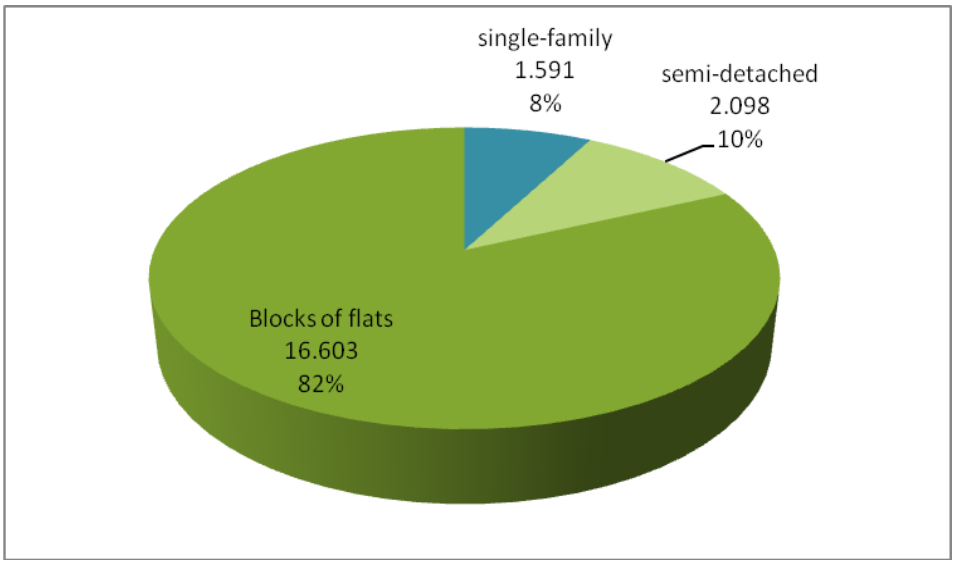

Figure 12 : Residential construction Catalonia 2010: dwellings in building categories.
Source: IDESCAT, DTES

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Trends in refurbishment

In 2001, 90% of occupants classified their homes to be in good condition. This data does not include information on thermal properties of the houses, but gives an indication of the perception the occupants have of their homes. [23]

According to data on public subsidies for general refurbishment, 226,238 dwellings were refurbished between 2001 and 2009, receiving a total of 302 million € in subsidies.[24] In 2010, 27,721 private dwellings received refurbishment subsidies of a total of 48.8 million € and 9,282 publicly owned dwellings received 72.3 million €, leading to a total of 37,003 refurbished dwellings. [25]. For the development of subsidised refurbishment, annual commenced and completed refurbishment (see Figure 13).

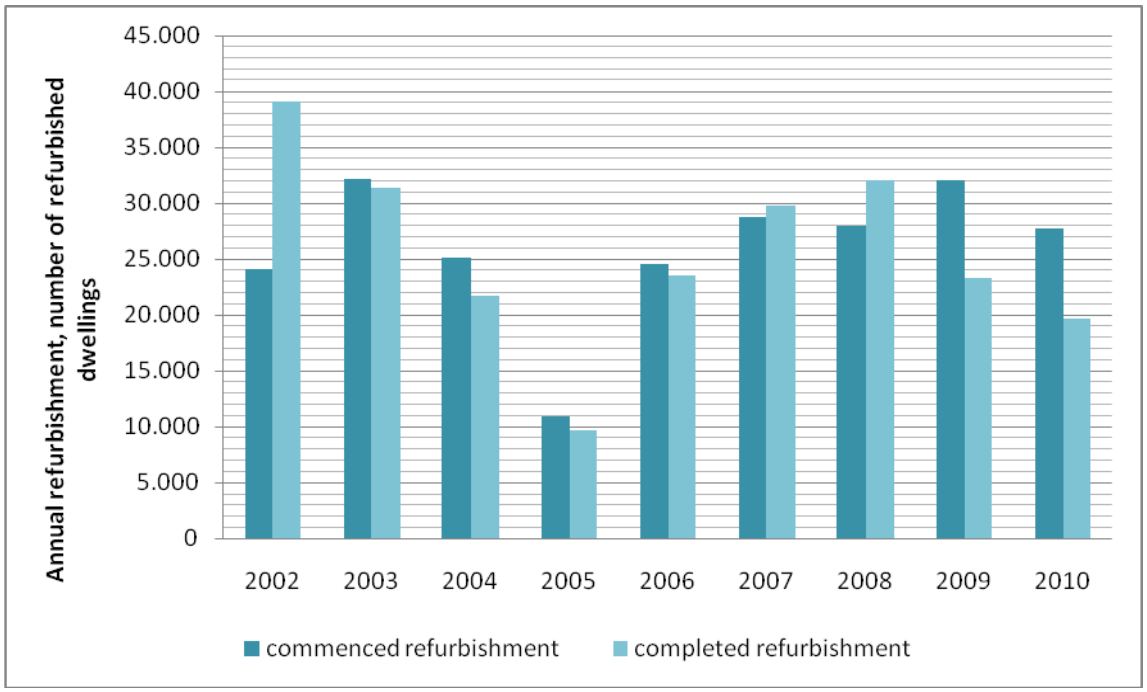

Figure 13: Subsidised commenced and completed refurbishment in Catalonia
Source: Secretaria d´habitatge, Informe d´habitatge de Catalunya 2005, 2009 and 2010

Figure 13 shows that even in the years after the onset of the crisis, the number of refurbishment actions commenced increased. It has to be taken into account, however, that these figures do not reflect the total amount of refurbishment undertaken in any given year, only the refurbishment that received subsidies, while the amount of total refurbishment is unknown. In 2009, only 8.4% of total subsidised

[23] IDESCAT
24¡Secretaria d´habitatge (¿?) *La evaluación de la sostenibilidad de las viviendas. El proyecto IRH-med: primeros resultados*
[25] ISecretaria d´Habitatge. nfrome continu sobre el sector de l´habitatge a Catalunya Maig 2011

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building refurbishment included sustainability criteria. 60% of interventions in the interior of dwellings included insulation upgrade.[26] (2010: 11.7% of subsidised refurbishment included energy efficiency improvement and acoustic insulation. 49% of interior refurbishment was insulation (thermal or acoustic) upgrade. (Informe 2010)

Between 2006 and 2009 the Government of Catalonia (Generalitat de Catalunya) in conjunction with the Spanish Institute for Energy Diversification and Savings (IDAE) subsidised refurbishment in 6,570 dwellings to improve energy efficiency, resulting in an estimated emissions reduction of 2,791.72 tonnes of CO_2 per year (see Table 3):

Table 3: Emissions saving in buildings refurbished with energy efficiency criteria

Year	Budget refurbishment €	Subsidy €	Nr. of dwellings	Energy saving MWh/yr	Energy saved Toe/a	Emissions avoided Tn CO_2/a
2006	12,916,899	3,842,986	1,214	2,525	217.2	884.5
2007	2,728,643	1,091,457	1,726	582	50.1	203.9
2008	7,504,797	3,001,918	1,558	2,320	199.5	812.6
2009	8,923,876	3,808,890	2,072	2,857	245.8	890.7
Total	**32,074,216**	**11,745,253**	**6,570**	**8,284**	**712.5**	**2,791.7**

Source: Secretaria d´habitatge I millora urbana (2011) La evaluación de la sostenibilidad de las viviendas. El proyecto IRH-med: primeros resultados

Structure of the tertiary building stock

The statistics on buildings in the 2001 census are grouped into residential buildings, buildings of "collective residence" (e.g. hotels, prisons, convents, etc), and buildings with "units" of non- residential spaces or venues for businesses or other uses, which include health, social activities, education and sports facilities, commercial and offices[27].

The collective residence and buildings with "units" have been used to identify the tertiary buildings stock, which, according to the 2001 census, comprises of 105.803 buildings[28], 9% of the total building stock. The characterisation of the tertiary buildings according to subsector is done by differentiating into establishments, which count 368,912 units or individual offices, some of which are situated in residential buildings (5,616 units). [29] The different uses of these individual spaces are depicted in Figure 14.

[26] Secretaria d´habitatge i millora urbana, Informe sobre el sector de l´Habitatge a Catalunya 2009

[27] definition from INE census.

[28] Building Census 2001 (IDESCAT, edificis locals i principalment locals amb habitatge

[29] IDESCAT, based on INE census 2001, numero total de locals

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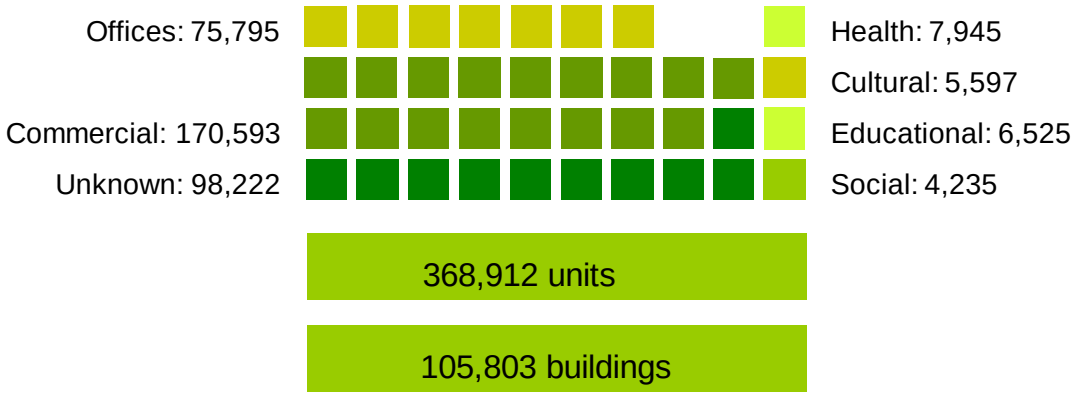

Figure 14: Nr of establishments by use in tertiary sector building stock:[30]

3.2. PACA (France)

Residential sector

The structure of the housing stock in the PACA region (Table 4) is characterized by a strong presence of second homes (16% of the park against 9% on average in France) and collective dwellings (59% against 43% in France).

Homeowners are less numerous in the PACA region (55% of principal residences against 58% in France) and live in two-thirds of the houses in the region (Figure 8). The park is mainly collective housing (Figure 14).

Table 4: Structure of residential buildings per type in PACA

Milliers de logements		Maisons	Appartements	Total	*Part du parc (%)*	*Part moyenne en France %)*
Résidences principales		884	1 175	**2 059**	**76,7%**	***84%***
Dont :	*Propriétaires occupants*	*708*	*418*	*1 126*	*54,7%*	*58%*
	Locataires (secteur privé)	*160*	*532*	*692*	*33,6%*	*27%*
	HLM	*16*	*225*	*241*	*11,7%*	*15%*
Résidences secondaires		165	274	**439**	**16,4%**	***9%***
Logements occasionnels		5	15	**21**	**0,8%**	***1%***
Logements vacants		50	115	**165**	**6,2%**	***6%***
Total		**1 104**	**1 580**	**2 684**	*100,0%*	*100%*
Part du parc%)		***41,1%***	***58,9%***	*100%*		
Part moyenne en France %)		***57%***	***43%***	*100%*		

[30] Idescat, based on INE CensusLocals per tipus, Catalunya 2001 (http://www.idescat.cat/territ/BasicTerr?TC=5&V0=3&V1=3&V3=1033&V4=759&ALLINFO=TRUE&PARENT=25&CTX=B)
Idescat, edificis segons el seu tipus
http://www.idescat.cat/territ/BasicTerr?TC=5&V0=3&V1=3&V3=183&V4=162&ALLINFO=TRUE&PARENT=25&CTX=B

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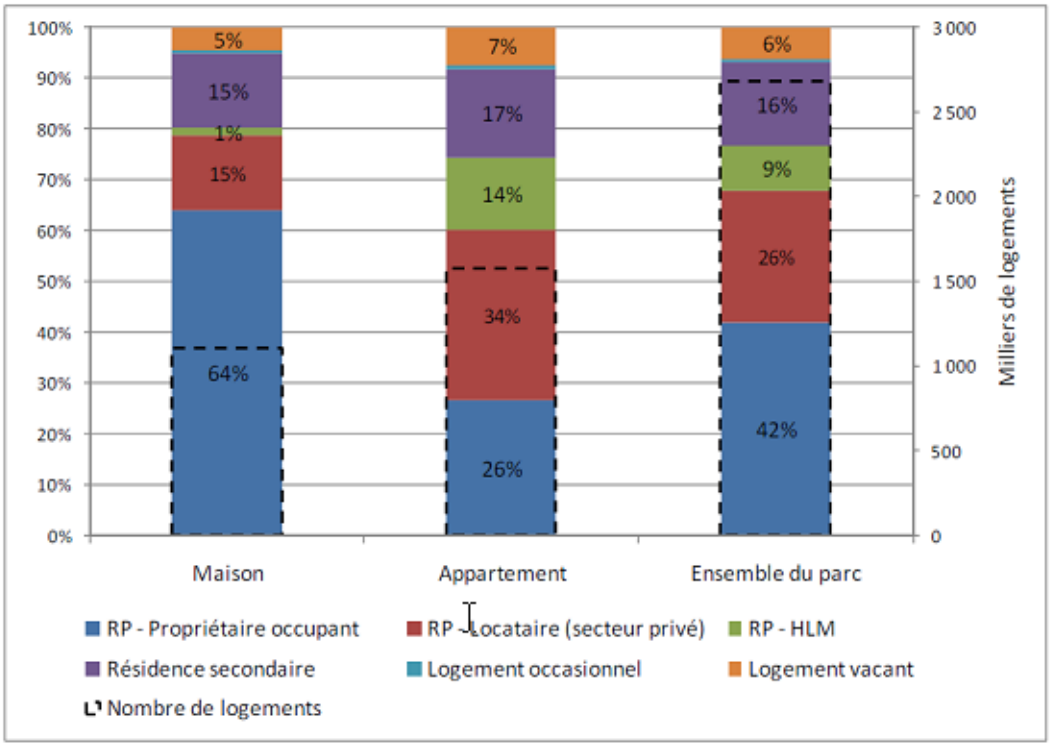

Figure 15: Categories of houses in PACA

The average size of houses and apartments are comparable to the average over the whole French fleet (Table 5), the lowest average size of dwellings in the PACA region - 81 m^2 against 88 m^2 in average in France - is explained by the differences in the structure of the housing (greater proportion of family housing and second homes in the PACA region).

Table 5

Surfaces moyennes des logements par catégorie

Type de logement		Maisons	Appartements	*Ensemble du parc*	*France*
Résidences principales		108	66	**84**	**91**
Dont :	*Propriétaires occupants*	*114*	*74*	*99*	*107*
	Locataires (secteur privé)	*86*	*57*	*64*	*67*
	HLM	*82*	*70*	*70*	*70*
Résidences secondaires		98	55	**71**	**76**
Logements occasionnels		80	54	**60**	**58**
Logements vacants		86	59	**68**	**71**
Ensemble du parc		**105**	**63**	**81**	**88**
France		**106**	**64**	**88**	

Housing built before 1975 account for 58% of the park, which is comparable to the average French (61%) - see Table 6. The distribution of park construction period detail is also similar to the average distribution in France. The construction period "massive" thirty glorious years (1949-1967 and 1967-1874 periods) is relatively more pronounced (34% of dwellings against 28% on average in France), which is linked to the presence of large cities.

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Table 6

Effectifs de logement par période de construction (Ensemble du parc)

Milliers de logements	Maison	Appartement	Total	Part du parc (%)	*Part moyenne en France (%)*
avant 1915	181	226	407	15%	*21%*
de 1916 à 1948	109	147	256	10%	*12%*
de 1949 à 1967	136	417	553	21%	*17%*
de 1968 à 1974	111	232	343	13%	*11%*
de 1975 à 1981	153	215	368	14%	*13%*
de 1982 à 1989	169	146	315	12%	*10%*
de 1990 à 2000	167	137	304	11%	*11%*
de 2001 à 2006	77	59	136	5%	*6%*
Ensemble du parc	1 104	1 580	2 684	100%	*21%*

Table 7

Répartition des logements individuels et collectifs par période de construction

Période de construction	Maison	Appartement	Ensemble du parc
avant 1949	26%	24%	25%
de 1949 à 1974	22%	41%	33%
de 1975 à 1989	29%	23%	25%
de 1990 à 2006	22%	12%	16%
Ensemble du parc	100%	100%	100%

Table 8

Répartition du parc par période de construction selon la catégorie de logements

Type de logement		avant 1949	de 1949 à 1974	de 1975 à 1989	de 1990 à 2006	Ensemble du parc
Résidence principale		24%	35%	25%	16%	100%
Dont :	*Propriétaire occupant*	21%	31%	29%	19%	100%
	Locataire (secteur privé)	36%	33%	17%	13%	100%
	HLM	5%	54%	25%	16%	100%
Résidence secondaire		20%	29%	33%	19%	100%
Logement occasionnel		34%	30%	22%	14%	100%
Logement vacant		43%	32%	15%	10%	100%
Ensemble du parc		25%	33%	25%	16%	100%

Tertiary Sector

The tertiary sector in the PACA region is dominated by branches Bureau-Administration, Education, Research and Trade, representing alone more than 60% of the area of the sector.

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Table 9

Surfaces tertiaires par branche d'activité

Milliers de mètres carrés	Région PACA	*Part du parc (%)*	*Part moyenne en France hors Ile de France*	*Part moyenne en France %)*
Bureau-Administration	15 238	**24,9%**	**20,3%**	**22,2%**
Dont Administration publique	*5 040*	*33,1%*	*38,6%*	*34,1%*
Cafés-Hôtel-Restaurant	6 624	**10,8%**	**6,7%**	**6,9%**
Commerce	9 682	**15,8%**	**21,5%**	**21,7%**
Enseignement-Recherche	12 025	**19,7%**	***21,1%***	***20,2%***
Habitat Communautaire	3 766	**6,2%**	***7,6%***	***6,6%***
Santé Social	7 723	**12,6%**	***12,2%***	***11,7%***
Sport Loisir Culture	4 355	**7,1%**	***7,7%***	***7,7%***
Transport	1 729	**2,8%**	***2,9%***	***3,0%***
Total	**61 143**	*100,0%*	*100,0%*	*100%*

Translation :

French	English
Milliers de mètres carrés	Thousands of square meters
Région PACA	PACA region
Part du parc (%)	Part of the park (%)
Part moyenne en France hors Ile de France	Average share in France outside Ile de France
Part moyenne en France (%)	Average share in France (%)
Bureau-Administration	Office-Administration
Dont Administration publique	Including public administration
Cafés-Hôtel-Restaurant	Coffee Hotel and Restaurant
Commerce	Trade
Enseignement-Recherche	Teaching-Research
Habitat Communautaire	Habitat Community
Santé Social	Social Health
Sport Loisir Culture	Sport Leisure Culture
Transport	Transport

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Regional TRENDS

Residential: 224,117 Mm^2 in 2010 (~ 2.7 Mhousehods)

- New household : 26 000 per year
- Demolition rate : 0.12% per year

Tertiary: 63, 78 Mm^2 in 2010

- New constructions: In constant diminution from 2006 to 2010: 1.14 Mm^2 per year in 2006 to 0.727 Mm^2 per year in 2010
- Demolition rate : 1. 9%

3.3. Liguria (Italy)

According to the 2001 census, the Liguria Region's real estate is made of more than 260,000 empty or unused buildings, 93% of which is to be used as houses.

Use	*Quantity*	*%*
Houses	247,712	93.4 %
House-sharing	580	0.2 %
Hotels	928	0.3 %
Offices	972	0.4 %
Trade, industries	5,751	2.2 %
Communications and transports	129	0.05%
Leisure time and sport activities	1,172	0.4 %
Schools	1,030	0.4 %
Hospitals	76	0.03%
Churches	1,673	0.6 %
More	5,168	1.9 %
TOTAL	**265,191**	**100.0%**

As far as the construction year is concerned, what can be observed is that, since 1946 up to these days, buildings used as houses have doubled: from 125,578 to 247,712 buildings are used as such.

Year	*Quantity*	*%*
Earlier than 1919	90,182	36%
1919 to 1945	35,396	14%
1946 to 1961	35,370	14%
1962 to 1971	37,915	15%
1972 to 1981	26,136	11%
1982 to 1991	13,491	5%
Later than 1991	9,222	4%
TOTAL	**247,712**	**100%**

ISTAT data state that in 2001 Liguria's houses were 991,892, 706,888 of which were used.

Examples of opaque buildings, and their transmittance, that have been identified at the national level, have been included in the UNITS 11300 Technical Regulation, part 1, Annexes A and B.

In Annex A, the thermal transmittance of the existing opaque buildings is indicated and subdivided according to its type:

- Opaque vertical walls;
- Rubbish bins;
- Opaque vertical walls looking onto internal areas;
- Flat layered covers;
- Attics and floors looking on to areas that are not heated or air-conditioned, open spaces;
- Insulated areas;

Transmittance related to insulated buildings or areas, is not only due to the thickness or size of the walls, but also to the climatic area where the buildings are located (C-D, E-F) and their construction year (1976-1985, 1986-1991).

According to what is envisaged by D.P.R. no. 412/93, art. 2, the Italian territory has been subdivided in 6 climatic areas: A (the warmest one) to F (the coldest one), that are characterized by the same climate, therefore it is possible to consider very similar external climatic conditions. In order to identify these climatic areas, this regulation created a fictitious unit of measurement, the "day-degree", i.e. the positive results between the day temperature of internal areas (set at 20° C) and the average external temperature: these figures are added up and, thus, the day-degree is obtained (in order to do this, the annual heating period is taken into consideration).

On the basis of the climatic area, what has been determined is the period during which the heating systems are due to work in winter.

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According to this study, Liguria is a very diversified territory, since it includes 4 different areas: C if a number of towns on the coast are considered, to F if a number of country areas or mountain villages are considered.

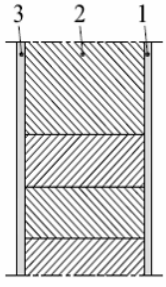
Climatic area	On	Off
A	1 December	15 March
B	1 December	31 March
C	15 November	31 March
D	1 November	15 April
E	15 October	15 April
F	5 October	22 April

Climatic areas

Transmittance related to insulated walls does change according to the construction year of the building. Since 1976, when Law no. 373/76 was passed, this law, "Regulations on the limitation of energy consumption for heating purposes in buildings", regulates a number of actions and activities that want to contain the energy consumption for heating purposes of buildings. The performance characteristics of the building components and materials are then verified, as well as installations and systems, the functioning and maintenance of heating systems, and the systems used for heating water for sanitary purposes that are based on solid, liquid or gas fuels and used in public or private buildings. Buildings used for Industrial or craft activities are not taken into consideration.

Annex B describes the wall structures that are used in Italy and specifies where they are used.

As for Liguria, two types of structures have been identified, which have been used for the construction of new buildings in the years between 1900 to 1955, and one more type that was used in the years between 1950 and 1980.

Wall section	Ref	Materials	Volume mass (kg/m^3)	Conductivity [W/(m x K)]
	1	Internal plaster (lime and plaster)	1400	0.7
	2	Bricks and stones	2000	0.90
	3	External plaster	1800	0.90
Thickness is from 15 cm and goes up				
In those buildings were many floors are present, thickness decreases when you reach the top floors				

Structure: Stone walls and bricks. Used from 1900 to 1955.

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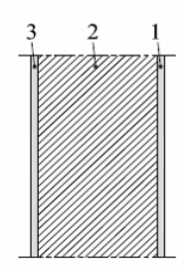
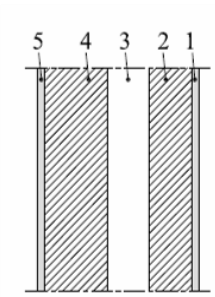
Wall section	Ref	Materials	Volume mass (kg/m^3)	Conductivity [W/(m x K)]
	1	Internal plaster (lime and plaster)	1400	0.70
	2	Bricks and stones	2000	0.90
	3	External plaster	1800	0.90

Structure: Mixed walls, stone and bricks. Used from 1900 to 1955.

Wall section	Ref	Materials	Volume mass (kg/m^3)	Wall section [cm]	Conductivity [W/(m x K)]
	1	Internal plaster (lime and plaster)	1400	2	0.70
	2	Perforated bricks	800	8	0.30
	3	Air space	-	6 - 12	
	4	Perforated bricks	1800	25	0.30
	5	External plaster	1800	2	0.90
Thickness varies from 43 cm to 49 cm (it depends on the air space)					

Structure: Hollow walls. Used from 1950 to 1980.

3.4. Piedmont (Italy)

In order to estimate the Building stock for residential and tertiary sector in Region Piedmont and to evaluate the energy efficiency according to specific building typology, we found data reference to Italian Census 2001 and Regional Statistical Yearbook 2007-2009.

Analyzing the regional building stock (number of total dwellings) divided by period of construction, we know that, in Region Piedmont, the total number of dwellings for household stock is 2.212.639 (census 2001). Unfortunately we haven't data for tertiary stock.

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Studying the scheme below, we note that intensive periods for construction are before 1919 (505775 dwellings) and between 1961-1970 (470377), during which Italy lived a great economic boom.

construction 1919-before	505775
construction 1920-1945	262230
construction 1946-1960	351688
construction 1961-1970	473077
construction 1971-1980	339650
construction 1981-1990	153044
construction 1991-1995	127175
construction 1996-after	
Total	2.212.639

In addiction, the Italian Census 2001 has data divided for residential building typology.

1.1.1.One dwelling house	377370
1.1.2.Two dwelling houses	283788
1.1.3.Three or more dwelling houses	1154629
1.1.4.Unknown residential buildings	
1.1.5.Non-residential buildings	
1.1.6.Unknown	396852
Total	2.212.639

We notice as in region Piedmont is more diffuse the three or more dwelling houses typology, due, probably, to the family composition. It's important to underline as a 18% of the total are unknown data.

We also dispose data for 2007-2008-2009 years but it's a number total of household dwellings. So, we can consider 2.665.696 the best updated data.

1.1.Total dwellings -Residential	2007	2008	2009
1.1.1.One dwelling house			
1.1.2.Two dwelling houses			
1.1.3.Three or more dwelling houses			
1.1.4.Unknown residential buildings			
1.1.5.Non-residential buildings			
1.1.6.Unknown			
Total	2.593.603	2.632.773	2.665.696

We notice that majority period of construction is between 2002 and 2008 during which 361. 6989 social housing dwellings were built with an average data of 51671 dwellings for year. These data are extracted to the "Observatory on the housing situation", institutional body of Region Piedmont.

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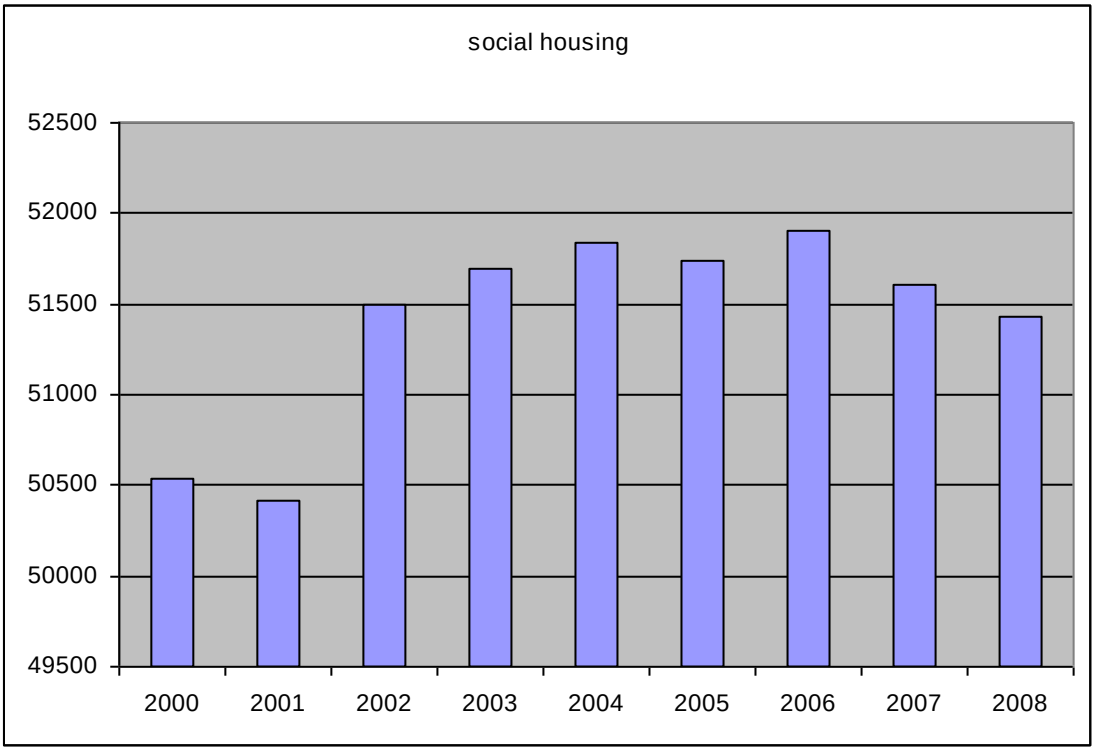
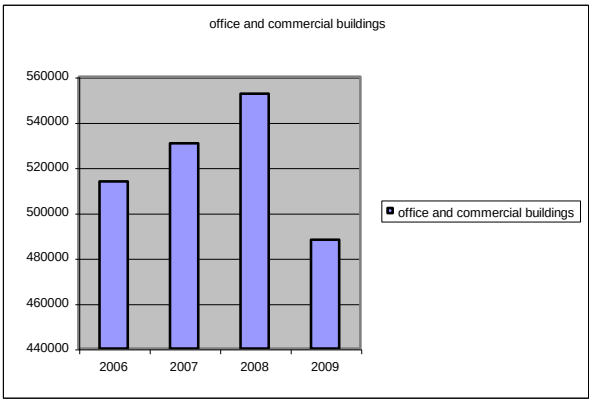
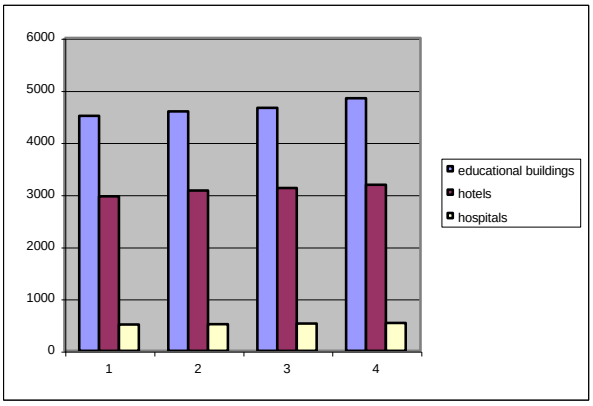


About the total number of dwellings for the tertiary sector, we have data extracted to the Italian Tax Office (Agenzia delle Entrate) and only for the period 2006-2009.

Analyzing the scheme below, we notice that the total number of dwellings is reduced in 2009 after a period of constant increase; this fact is due probably to the substantial reduction which involved the office and commercial sector (less than 13% compared to 2008). This trend is different for all the rest of categories. In fact for educational buildings, hotels and hospitals the annual constructions increase for all the period.

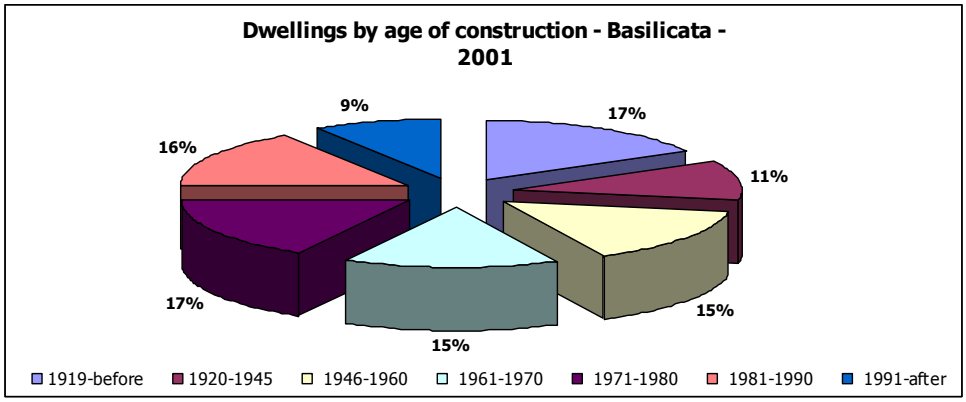
1.2.Total dwellings -Tertiary	2006	2007	2008	2009
1.2.1.office and commercial buildings	513755	530596	552571	488051
1.2.2.educational buildings	4506	4590	4662	4844
1.2.3.hotels	2965	3074	3124	3186
1.2.4.hospitals	507	512	522	536
1.2.5.other uses (i.e. airports, sports halls etc)				
Total	521733	538772	560879	496617

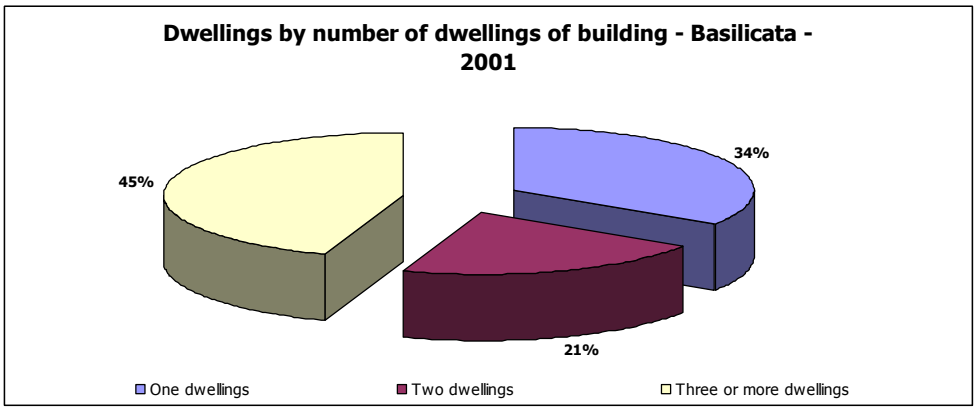




3.5. Basilicata (Italy)

In Italy the last comprehensive statistical on building stock is the National Census of Population and Housing 2001. According to these data, the number of dwellings in regional residential buildings was 283,329 units; among these 164,732 (58.1%) were built before 1970, and only 25,696 (9.1%) after 1991.





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3.6. Western Macedonia (Greece)

According to the data of the National Statistics Service in Greece, which are available only until the end of 2000, and the complementary data for Greece available in Eurostat from the 2001 census, the total number of buildings in the whole country was 3.990.970 and the total number of dwellings was 5.627.549, in the period 2000-2001. Similarly, in the region of Western Macedonia, the total number of buildings was 142.493 and the total number of dwellings was 146.782, in the period 2000-2001.

The distribution of the building stock according to use is shown in the following table and figures, for Greece and Western Macedonia respectively, based on the available data for the period 2000-2001. At national level, 57% of the buildings are one-dwelling houses and 23% of the buildings are non-residential buildings. Similarly, at regional level, 54% of the buildings are one-dwelling houses and 33% of the buildings are non-residential buildings. The distribution according to use in terms of dwellings and not buildings, based on EUROSTAT data for the year 2001, is slightly different and it is available only for the whole country, presented in section 2.9 where comparison of data from all participating MED countries/ regions is shown (Table 16).

Table 10: Building stock in Greece and Western Macedonia according to use
Source: National Statistics Service

BUILDING STOCK ACCORDING TO USE	GREECE (2000-2001)	WESTERN MACEDONIA (2000-2001)
Total number of dwellings	**5.627.549**	**146.782**
Total number of buildings	**3.990.970**	**142.493**
One-dwelling buildings	2.258.788	76.371
Two-dwelling buildings	441.882	11.471
Three or more dwelling buildings	371.280	7.594
Non-residential buildings	919.020	47.057

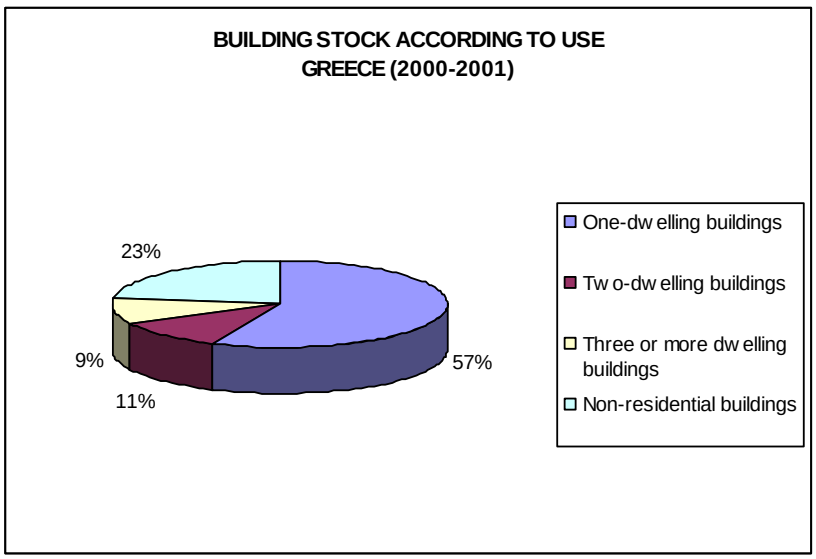

Figure 16: Distribution of building stock in Greece according to use (2000-2001)
Source: National Statistics Service

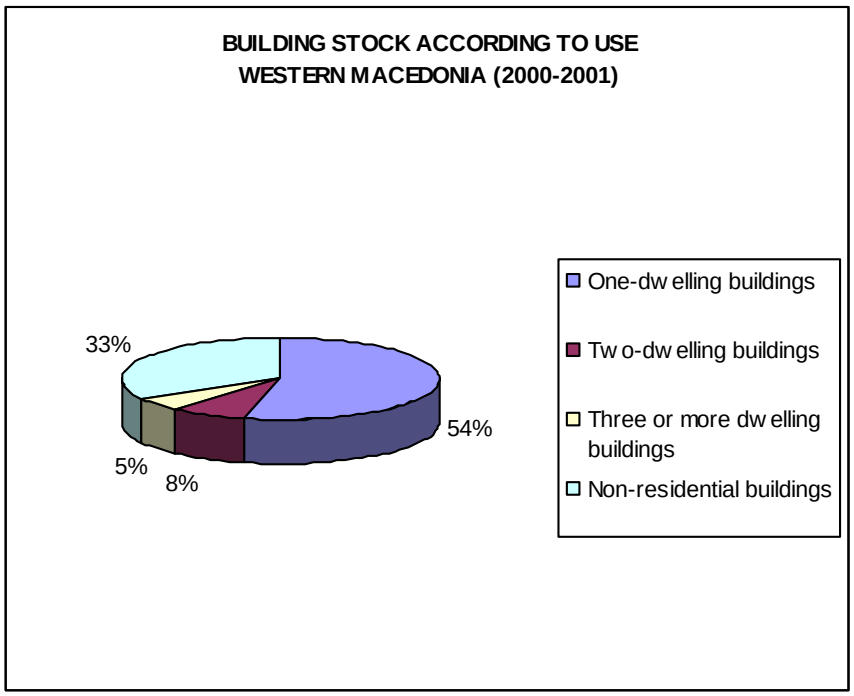

Figure 17: Distribution of building stock in Western Macedonia according to use (2000-2001)
Source: National Statistics Service

The distribution of non-residential buildings according to use is shown in the following table and figures, at both national and regional level, based on the available data for the period 2000-2001. In Greece, 16% of the non-residential

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buildings are office and commercial buildings, and 73% are for other uses that are not specified. Similarly, in Western Macedonia 8% of the non-residential buildings are office and commercial buildings, and 86% are for other uses that are not specified.

Table 11: Non-residential buildings in Greece and Western Macedonia according to use
Source: National Statistics Service

NON-RESIDENTIAL BUILDINGS	GREECE (2000-2001)	WESTERN MACEDONIA (2000-2001)
Office and commercial buildings	150.317	3.702
Educational buildings	18.223	935
Hotels	32.806	256
Hospitals	2.304	73
Churches/ monasteries	43.463	1.623
Other uses (not specified)	671.907	40.468
Total	**919.020**	**47.057**

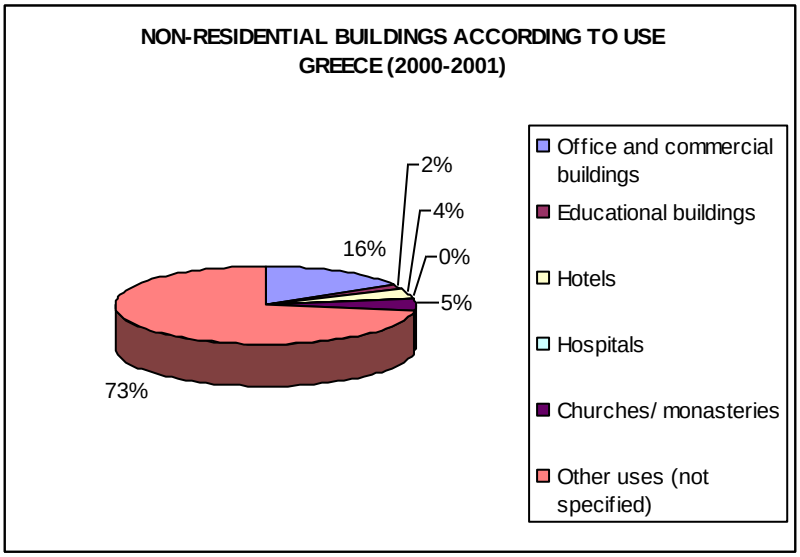

Figure 18: Distribution of non-residential buildings in Greece (200-2001) according to use
Source: National Statistics Service

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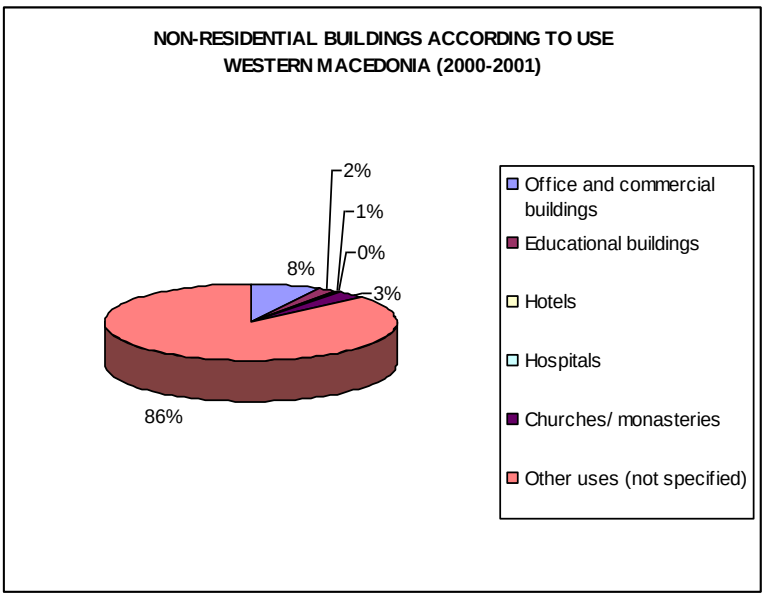

Figure 19: Distribution of non-residential buildings in Western Macedonia (200-2001) according to use
Source: National Statistics Service

The age of buildings and the trends in construction are shown in the following table and figures for Greece and Western Macedonia respectively, until the end of 2000, for which data are available. In Greece, 51% of the buildings by the end of 2000 were built before 1970. Similarly, in Western Macedonia, 49% of the buildings by the end of 2000 were built before 1970. The distribution per construction years in terms of dwellings and not buildings, based on EUROSTAT data, is slightly different and it is available only for the whole country, presented in section 2.9 where comparison of data from all participating MED countries/ regions is shown (Table 18).

Table 12: Building stock in Greece and Western Macedonia per year of construction
Source: National Statistics Service

BUILDING STOCK PER YEAR OF CONSTRUCTION	**GREECE (until the end of 2000)**	**WESTERN MACEDONIA (until the end of 2000)**
construction unknown	85.750	3.578
construction 1919-before	199.510	3.371
construction 1920-1945	406.633	13.197
construction 1946-1960	665.315	26.982
construction 1961-1970	761.182	26.605
construction 1971-1980	737.575	25.852
construction 1981-1990	701.651	21.303
construction 1991-1995	241.615	7.139
construction 1996-end of 2000	191.739	14.466
Total	**3.990.970**	**142.493**

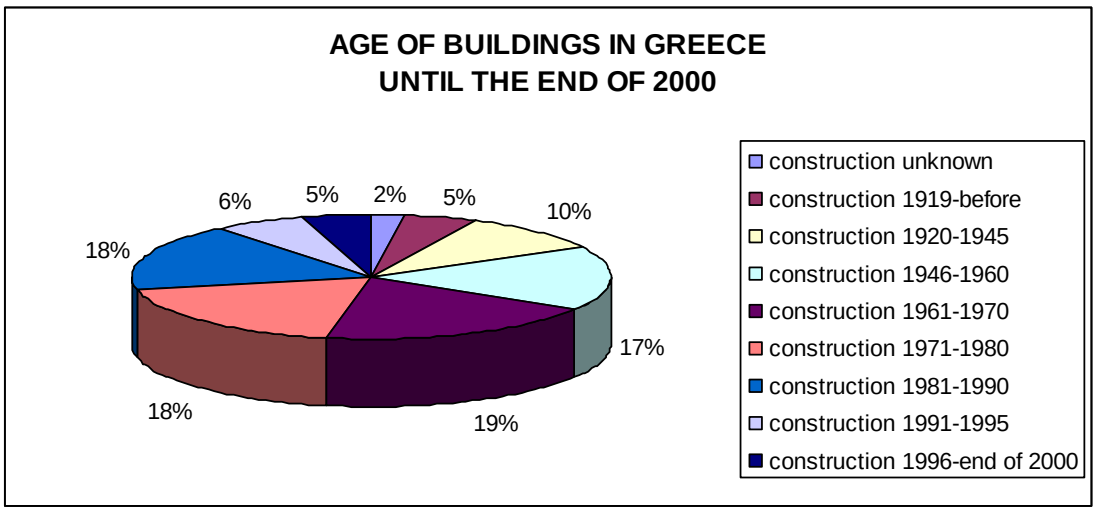

Figure 20: Age of buildings in Greece until the end of 2000
Source: National Statistics Service

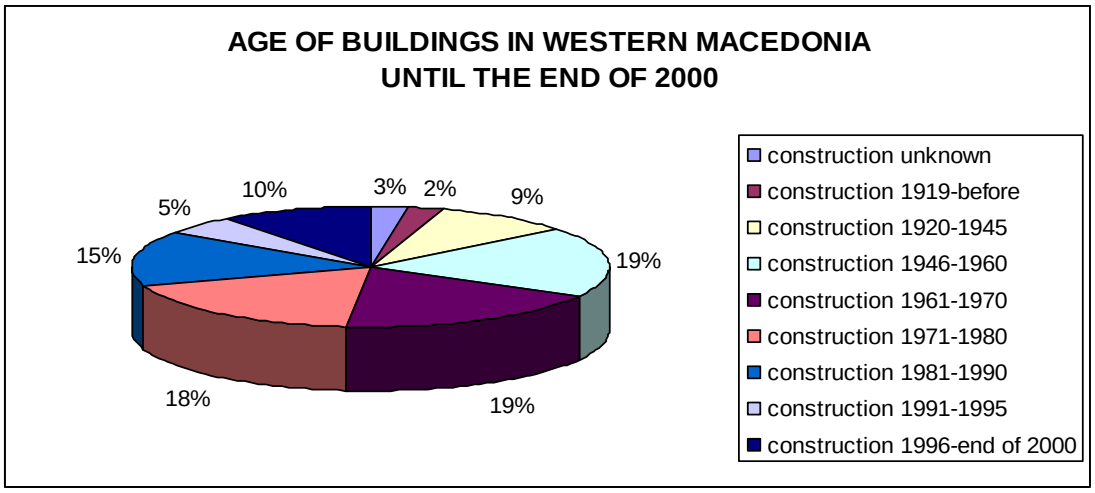

Figure 21: Age of buildings in Western Macedonia until the end of 2000
Source: National Statistics Service

3.7. Primorsksa (Slovenia)

There are 1.998.000 persons in Slovenia living in 777.772 dwellings with a total useable floor area of 58 million m2. The average floor area of a dwelling is 71,7 m2, the average floor area per person 25,7 m2 and the average number of persons in a dwelling is 2.8.

One family houses prevail in the existing dwelling stock. Approximately 68% (531.456 units) of dwellings are one family or one-family row houses and only 31% (242.011 units) are multi-family houses. According to the total floor area the share of dwellings in multi-family houses is 23% (13.492.000 m2) compared to 44.300.00 m2 in one family houses. About 50% of the total number of dwellings are built in urban settelments. 65% of the dwellings are equipped with central heating systems (73% in urban areras), 99,5% by electricity supply and 87% of the dwellings have a bathroom (National market analysis for CSTS, SOLARGE).

The potential for greater energy efficiency in the Slovenian housing sector is large since 70 percent of all housing stock is over 30 years old and 38 percent was built between 1960 and 1980 and is therefore in dire need for refurbishment. Only 10% of the buildings were built after 1990.

Only buildings built after 1985 can be expected to have some thermal insulation and only buildings fabricated after 1990 have good thermal insulation. Double glazed windows are common for almost the century.

After the country started its transition to a market economy in the 1990s the Slovenian housing stock has been marked by political and economic reforms which have caused some major changes to the housing system. After the privatisation of public rental housing stock pursuant to the Housing Act (1991) the tenure structure changed to an extremely high rate of homeownership. That is why more than 92% of dwellings in Slovenia are today private owned.

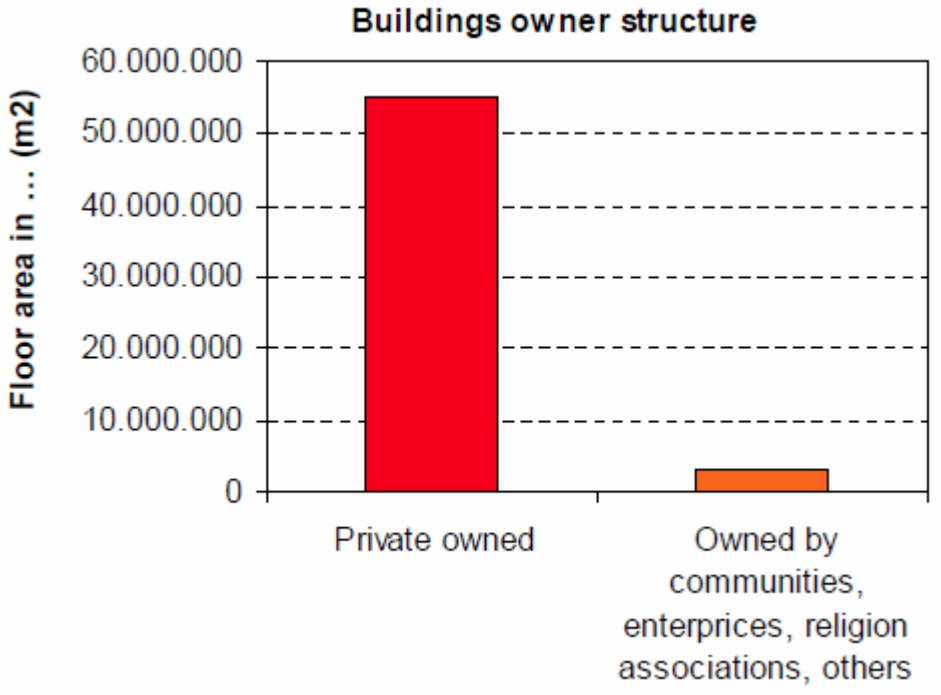

Figure 22: Buildings owner structure
(Statistical Yearbook Republic of Slovenia 2002)

The responsibility for housing management, maintenance and renewal has been transferred exclusively to the owners. In 2003, general regulations on housing management were introduced and were complemented in 2009 with detailed regulations on multi-dwelling housing.

New housing construction almost came to a halt in the 1990s compared to the 1980s and 1970s (Figure 4). This can be ascribed to the new regulations that abolished the previous system of financing new public housing in the form of financial contributions from the salaries of employees and enterprise profits. This lack of financing combined with high nominal interest rates (high inflation accompanied by high real interest rates in the banking sector), the lack of building land due to restitution as part of the changeover from the socialist system to the market economy and long and complicated building procedures affected construction activity quite severely and it did not pick up for almost a decade.

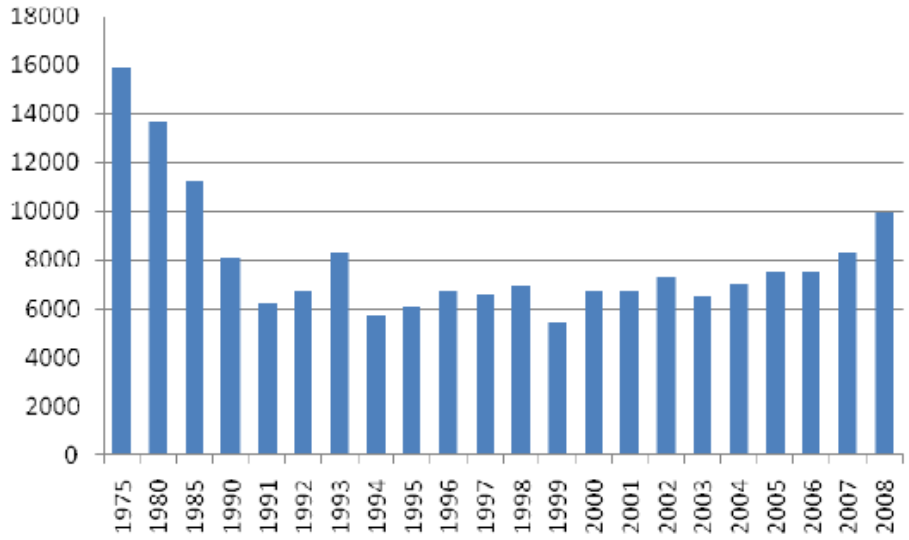

Figure 23: Dwellings completed in the 1975-2008 period
(Statistical office of the Republic of Slovenia 2010)

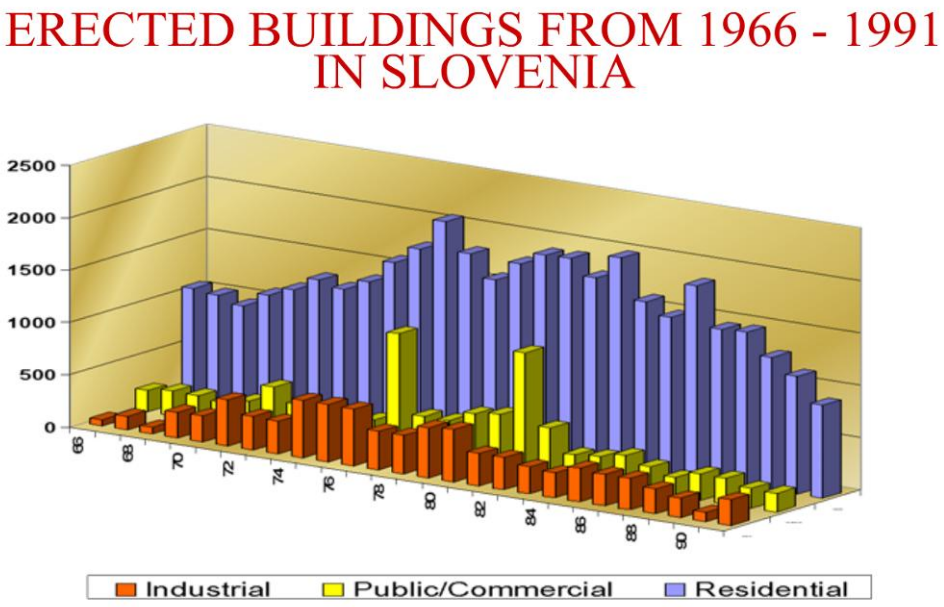

Figure 24: Erected buildings from 1966-1991 in Slovenia in Industrial, public/commercial and residential sector
(ZRMK)

In order to encourage the provision of housing, especially in the non-profit housing sector, the Housing Fund of the Republic of Slovenia, as well as Municipal Housing Funds and Non-profit Housing Associations were established. The Housing Fund of the Republic of Slovenia was established to finance the National Housing Programme and to promote housing construction along with the renovation and maintenance of

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apartments and residential houses. However, concerning the existing housing stock, neither a systematic strategy nor specific regulations on the renewal and refurbishment have been introduced yet. Further, there is a lack of statistics on buildings and renovation as well as on measurable indicators for quality assessment (Cirman A., Mandič S., Sitar M.: Energy Efficiency in Social Housing: The Case of Slovenia).

In the non-profit housing sector, the municipalities have retained the key responsibility for the construction, maintenance and redistribution of dwellings.

The ownership structure of the national housing sector is the following (year 2002) is shown below.

Table 13: The ownership structure of the national housing sector
(Statistical Yearbook Republic of Slovenia 2002)

	No. of dwellings	**% of total**	**Area (m2)**
Private owners (Condominium ownership)	718.964	92,5%	54.923.270
State, municipality, public funds (Non profit housing)	36.715	5,0%	1.924.225
Public enterprises, public institutions	11.801	1,5%	593.017
Private enterprises	6.472		339.816
Religion institutions, associations, trade unions, political parties	1.985		143.515
TOTAL	**777.772**		**58.031.187**

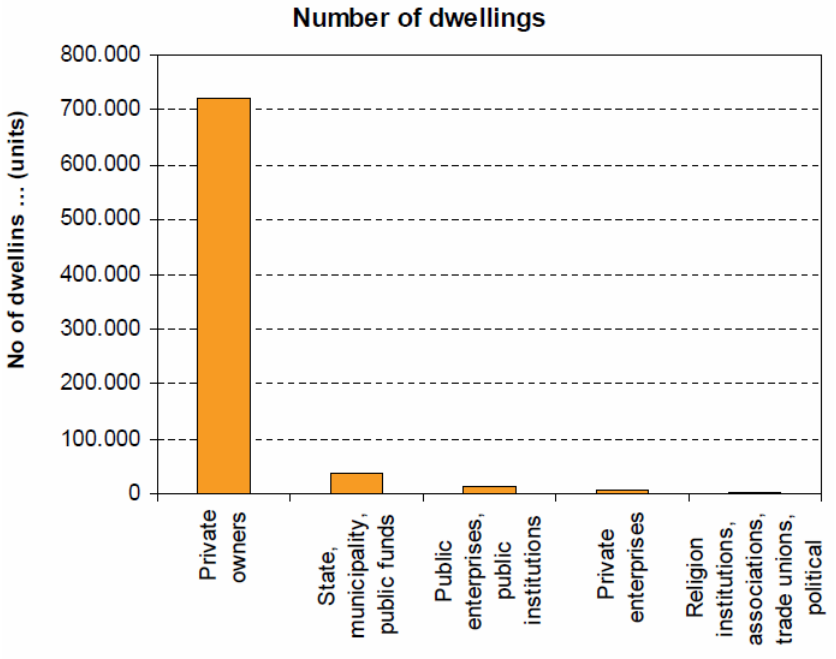

Figure 25: Ownership structure of dwellings in Slovenia
(Statistical Yearbook Republic of Slovenia 2002)

3.8. Malta

Total Dwellings (Household and Tertiary)

The figures were obtained from the document: 'Census of Population and Housing 2005' – Volume 2 (Dwellings). These data were compiled by the National Statistics Office of Malta in 2007.

Data are taken from Chapter 12 - Occupied dwellings by period of construction and age group of reference person. Data from the relative pages are reproduced below.

Table 14: Occupied dwellings by period of construction and age group of reference person

District and age group	Total	1918 or earlier	1919-1945	1946-1955	1956-1960
MALTA	139,178	16,955	13,962	10,182	5,885

1961-1965	1966-1970	1971-1980	1981-1990	1991-1995	1996-2000	2001-2005
6,079	8,631	22,478	26,629	13,998	9,635	4,744

The number of Tertiary buildings for the year 2005 was obtained from the list of Business Data also compiled by the National Statistics Office of Malta.

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This table lists all businesses according to type, number and location. A sample of this table is reproduced below, showing some figues for the Capital City of Valletta. The entire table was carefully scrutinized and listings irrelevant to tertiary buildings were removed. Thus, a total for the number of Tertiary buildings in 2005 was obtained. For example Agriculture and fishing businesses were removed as were market stalls and any other businesses not operating from fixed premises. The total of 40,989 Tertiary Buildings was therefore arrived at for the year 2005.

A	TownCod2	Town2	REL12NACE1	Nace Description
3	1	VALLETTA	Unknown	
5	1	VALLETTA	1.13	Growing of fruit, nuts, beverage and spice crops
7	1	VALLETTA	1.41	Agricultural service activities; landscape gardening
9	1	VALLETTA	5.01	Fishing
11	1	VALLETTA	5.02	Fish farming

In order to arrive at what percentage are Tertiary buildings to Households, it was assumed that all these buildings have gradually increased over the same period of years as the households, i.e. from pre-1919.

The total number of households constructed over this period of time is 139,178 as shown above and the total number of tertiary buildings amounts to 40,989. Therefore the number of Tertiary Buildings as at 2005 amounts to about 30% of the number of households.

The total for the number of tertiary buildings was arrived at by assuming that this ratio or percentage was constant throughout the years so that the value of tertiary buildings for 1919 and before amounts to about 30% of the number of households for that year. This was repeated for all the successive periods of time.

Total Dwellings Residential

The values for these dwellings for the year 2005 were obtained from 'Census of Population and Housing 2005' – Volume 2 (Dwellings). by the National Statistics Office of Malta. Data from the relative page sare is reproduced below.

Further data of building stock for Malta are presented in section 2.9, where comparison of data from all participating MED countries/ regions is shown.

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Table 15: Occupied dwellings by type and locality...

District and locality	Total	Terraced house	Semi-detached house	Fully-detached house
MALTA	139,178	54,714	6,105	3,534

Ground-floor tenement having its own airspace	Maisonette	Flat/Penthouse	Farmhouse	Suite of rooms forming part of a Housing Unit	Other
9,266	30,894	32,569	1,261	447	388

The values for one dwelling house were obtained from the addition of the values for terraced houses, semi-detached houses, fully-detached houses and farm houses. The value for two dwelling houses is that for maisonettes which consist of two overlying apartments. The value for three or more dwellings was taken to be the number of flats and penthouses. A suite of rooms is considered to be an unknown type of residential building and the number of others is the entry for unknown dwellings.

The total number of dwellings for the other years, i.e. 1990 to 2007 is taken from the MURE template, a section of which is reproduced below with the figures highlighted.

1990	1991	1992	1993	1994	1995	1996	1997
181860	186040	190220	194400	198400	202400	206600	210900
3526486	3537612	3548737	3559863	3568951	3579163	3590510	3602956
11283735	11406195	11528654	11651114	11771078	11892277	12014723	12138431
21772800	21981200	22189600	22398000	22632000	22857000	23071000	23350000
19735188	20039459	20343729	20648000	20684000	20822000	21450646	21642350
114304	115186	116069	116951	117834	118716	119598	120481
627499	632278	637057	641836	646615	651394	656173	660952

In order to arrive at the values for the different categories of housing for the years from 1990 to 2007, i.e. single, two dwelling etc., it was assumed that the same ratio or percentage of each of these categories to the total number of dwellings for 2005 remained the same throughout the years.

Hence, the percentage of one dwelling house is obtained from 65,614/139,178 = 0.4713. This was repeated for the other categories of dwellings. These factors or percentages were then multiplied by the totals for the other years to get the values of the different categories for the different years. Hence the number of single dwelling houses for 1990 is taken to be 0.4713 x 114,303, i,e, the total for that year.

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Total Dwellings Tertiary

The amount of tertiary buildings according to the required classification was obtained from the list of Business Data also compiled by the National Statistics Office of Malta. The values in the table were classified as required, i.e. Office and Commercial Buildings, Educational Buildings, Hotels, Hospitals and Others. As mentioned above, classes of business which require no fixed premises were discarded. The totals were then added up for the entire year.

Nace Description	Units	Office/Commercial	educational	hotels	hospitals	others
Supporting service activities for the government as a whole	8					8
Foreign affairs	1					1
Justice and judicial activities	2					2
Compulsory social security activities	1					1
Primary education	1		1			
General secondary education	1		1			
Driving school activities	6	6				
Adult and other education n.e.c.	26		26			
Hospital activities	1				1	
Medical practice activities	1				1	
Other human health activities	5	5				
Social work activities with accommodation	2	2				
Social work activities without accommodation	0					

Above is an example of part of the table and the way the totals were broken down and categorized.

Once again, the total for each category was worked out as a ratio or percentage of the total for the year 2005 so that for example, 1.2.1, Offices and commercial buildings account for 90.45% of the total tertiary buildings in 2005. These percentages were then assumed to be true for all the years being considered and extrapolated by being multiplied by the totals for the other years. For example the amount of offices and commercial buildings for 1990 was taken to be 90.45% of the total for that year, i.e. 114,304.

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3.9. Andalusia (Spain)

Most of the information included in this report about Andalusia has its main source in the publication "La vivienda en Andalucía. Estadísticas Históricas del siglo XX" (Housing in Andalucia. Historic Statistics of the XXth Century).

Concerning to the housing, researchers in this issue agree in establishing three phases in the evolution from the initial moment in 1860 to the present. The first period, goes from 1860 to beginnings of the 20th century under an unbalanced relation between a considerable amount of housing development and a scarce demand for them. The second phase, from the first decade of 1900 to 1940 sets a lower growth of the building stock than the population needs. For this reason, there is a quantitative and qualitative deficit becoming extreme after the War.

From 1940 to nowadays, there is a third phase, in which there is a more strict answer to the housing demand and where the building sector gets a boost without precedent. However, in this period there is a breaking point in 1975 with the political changes, becoming trascendental in the new housing policies, specially when the building sector is almost entirely left in hands of the private initiative. Even though, thet there were still a significant lack of social response.

Data from the two first periods is very scarce and mostly obtained from the "Anuarios Estadísticos" (Annual Statistics) and the "Censos de Población" (Population Census). In these periods there is not a knowledge about the housing sector, but after the Spanish Civil War, and with the reconstruction of the destroyed buildings, there is an attempt to register the housing interventions and its results. It is in 1945 when the INE "Instituto Nacional de Estadística" is established and together with the corresponding Ministries were providing periodical information completed with the contribution of Architectural Associations and other public entities that provide data from the building activity. Between 1940 and 1975, then is when the structure of the information is produced.

In 1989, the Andalusian Law of Statistics is approved (Law 4/1989) where the IEA "Instituto Andaluz de Estadística" (Andalusian Statistics Institute) is established and since the beginning the housing sector is included, offering not only census about buildings, housing and population, but through different sociodemographical studies. During the last decades, the National Housing Plans, or the Andalusian Housing Plan provide charts with the real situation, the real needs and the planning proposals.The Ministry of Housing and the Regional Ministry of Public Works and Housing provide as well information concerning to the housing construction in addition to those referring to the typologies that are available in the INE; IEA "Instituto Andaluz de Estadística" (Andalusian Stadistics Institute), Regional Public Entities, such as EPSA

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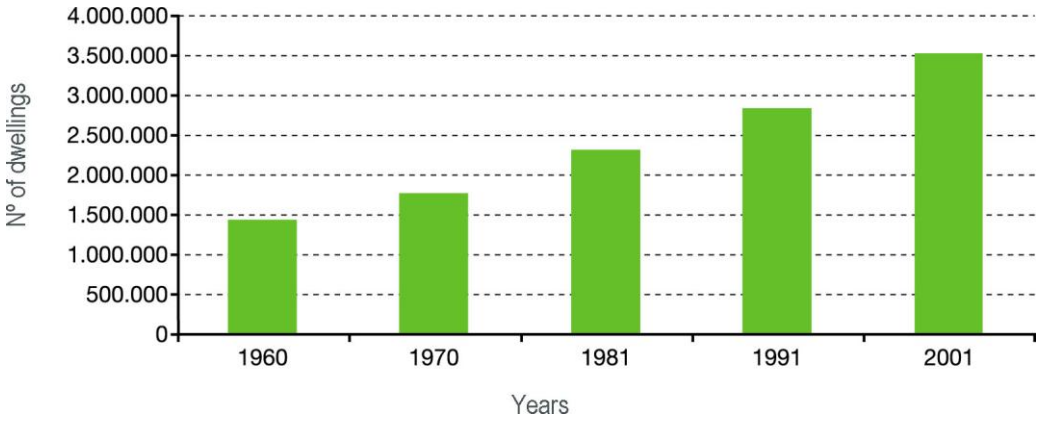
and/or local administrations. In fact is EPSA, since its establishment, the entity in charge of the information regarding with the Social Housing and even with the housing in Andalucia during the last decade of the XX century and the first of the XIst century.

Overview of Housing sector in Andalucia

In Andalucia, the housing development is along with the population growth, except during the historical events.

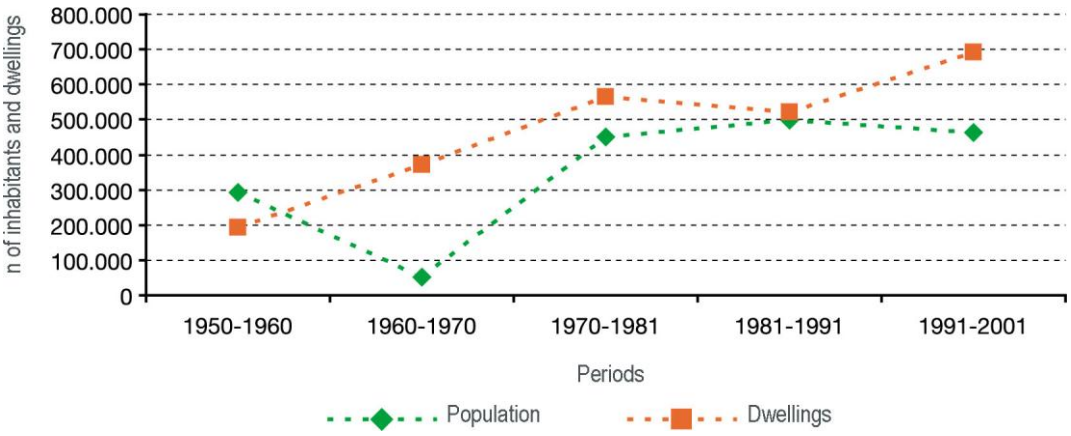
The population in Andalucia has been growing unconstantly and in some occasions, during some historical events, this has conditioned the building growth, and for instance, the housing. In fact, during the sixties and the seventies there was a population decrease due to the inmigration, and the building activity, as well as the building stock is affected, not only in the quantity but in the conditions of conservation and maintenance of the dwellings. This trend is inverted at some point and in the big cities the population is settled and the natural growth starts to raise and so does happen with the number of dwellings as it can be seen in the chart below.

Number of dwellings in Andalucia. Years 1960-2001



Source: "La vivienda en Andalucía. Estadísticas Históricas del siglo XX"

Population and Dwellings (family units) Growth in Andalucia. 1950-2001



Source: "La vivienda en Andalucía. Estadísticas Históricas del siglo XX"

In the chart below, there is a representation of the number of dwellings in Andalucia from 1991 to 2010 according to the data provided in the "INE Instituto Nacional de Estadística" (National Institute of Statistics) and the "Ministerio de Fomento" (Ministry of Public Works and Housing). It is remarkable that there is a linear progression in the building stock, being stronger during 2002 to 2008. However, we must highlight that, from this year on, this evolution has been almost static due to the financial crisis.

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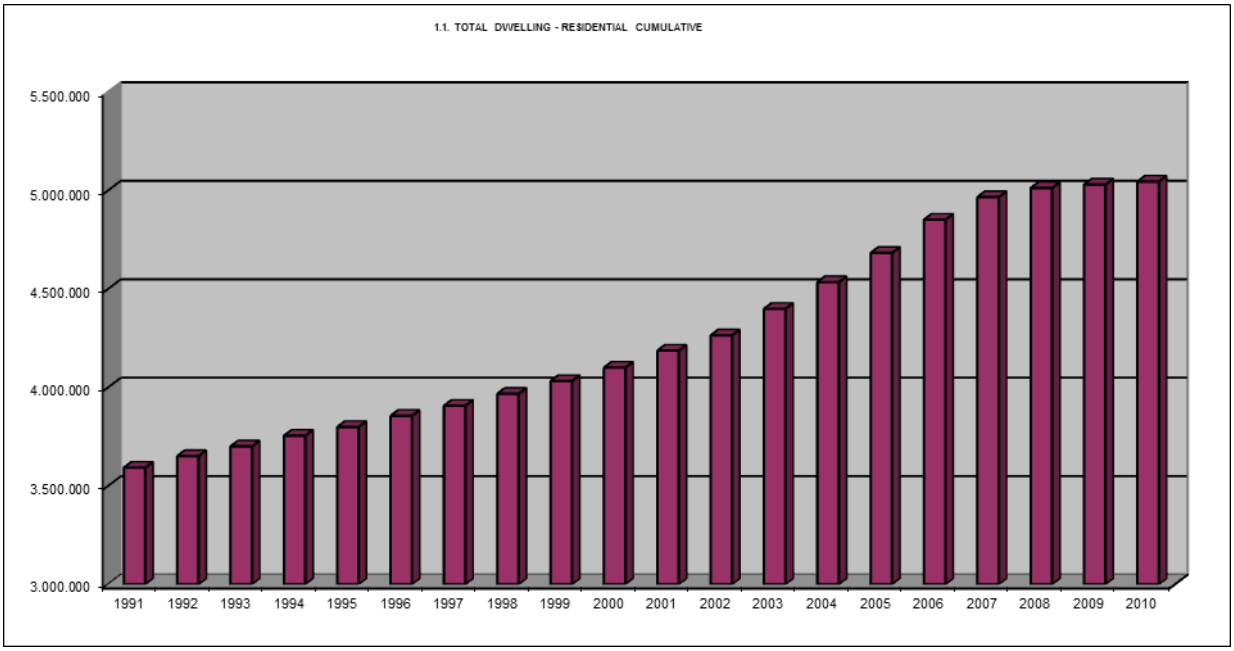
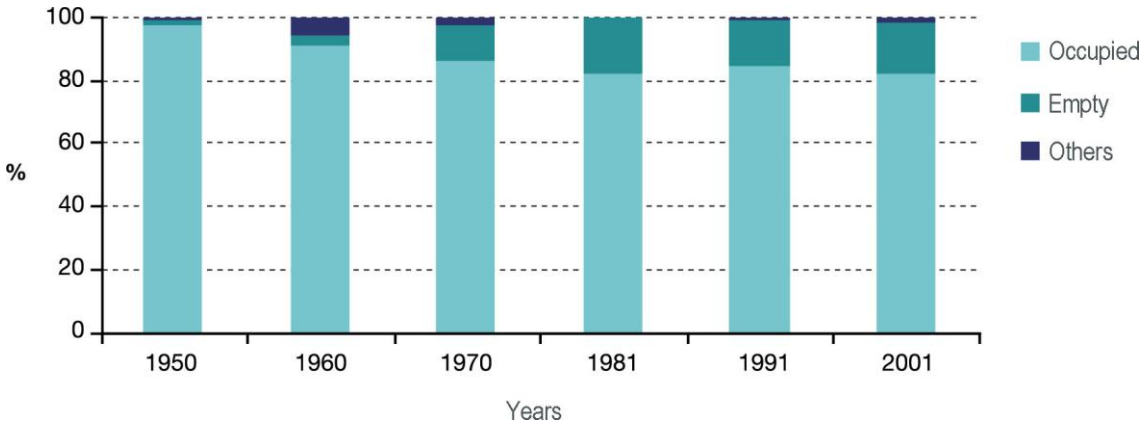
Total Dwellings per year 1991-2010



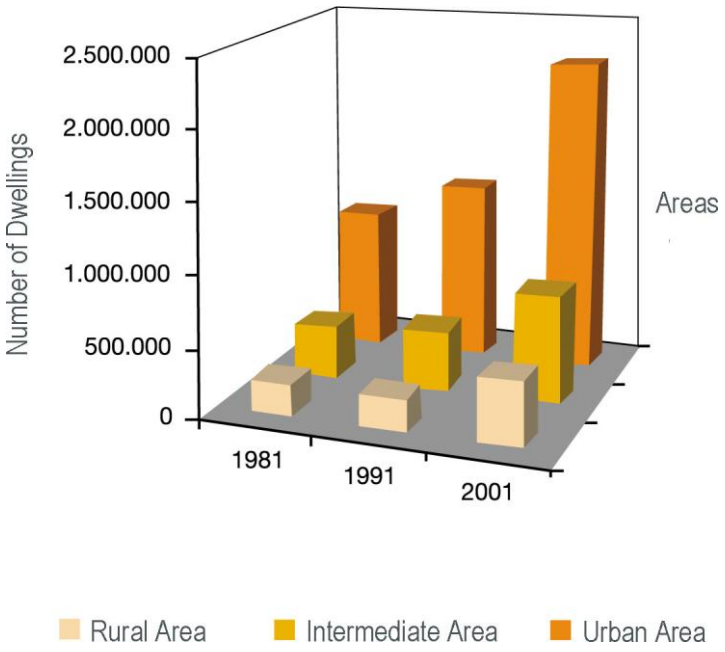
Number of dwelling based on occupation parameters

		OCCUPIED			EMPTY
	TOTAL DWELLINGS	TOTAL	MAIN RESIDENCES	SECOND RESIDENCES	
1950	1.185.280	1.152.400	1.110.810	41.590	22.970
1960	1.380.608	1.265.907			46.836
1970	1.773.835	1.517.080	1.399.066	117.827	191.989
1981	2.315.507	1.919.393	1.652.912	266.481	396.114
1991	2.837.548	2.414.621	1.950.289	464.332	408.319
2001	3.529.088	2.929.321	2.415.143	514.178	548.669



Source: "La vivienda en Andalucía. Estadísticas Históricas del siglo XX"

The evolution of the Andalusian dwellings aims towards the progression of the empty ones as it can be seen in the charts above. In 1950 and 1991 this number is lower than the second residences, while in the contrary, in the figures of 1970,1981 and 2001, the number of empty homes are bigger than the second residences maybe due as the urban circumstances of those years in which there was an urban expansion in the cities and the citiy centres were abandoned to move to the new areas. However, the occupied dwellings as second residences grow gradually together with the concept of economic investment and spare time.



Source: "La vivienda en Andalucía. Estadísticas Históricas del siglo XX"

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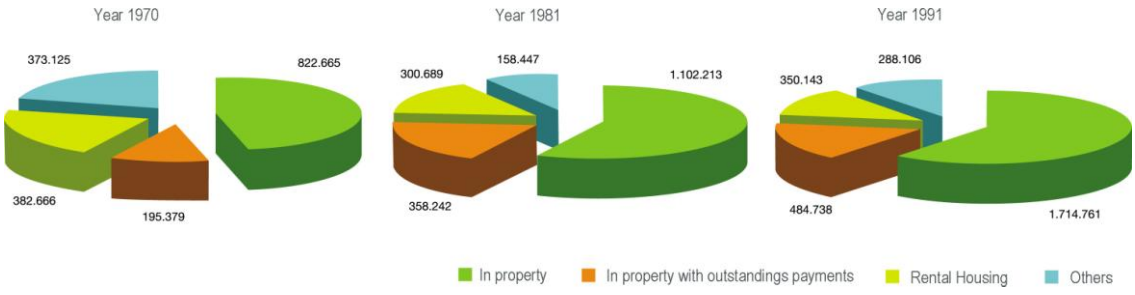
Classification of the dwelling based on the tenancy regime

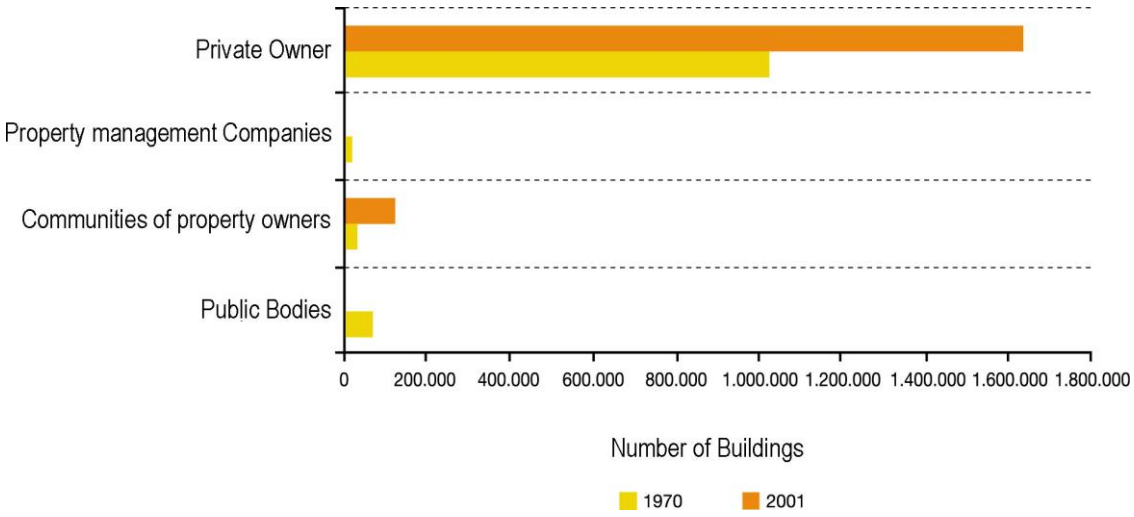
The property and the occupation of dwellings do not evolution in parallel ways. The information of tenancy regime has its origin in 1970 after the Census of Dwellings. The information provided since then, shows that unlikely other countries, in Spain, and more precisely in Andalucía, the trend is the home property opposite to renting. Moreover, in 2001, the tenancy of dwellings in property reached over 82%.



Source: "La vivienda en Andalucía. Estadísticas Históricas del siglo XX"

Building owner structure

The tenancy of the building property establishes the concept of property based on the type of tenant.



Source: "La vivienda en Andalucía. Estadísticas Históricas del siglo XX"

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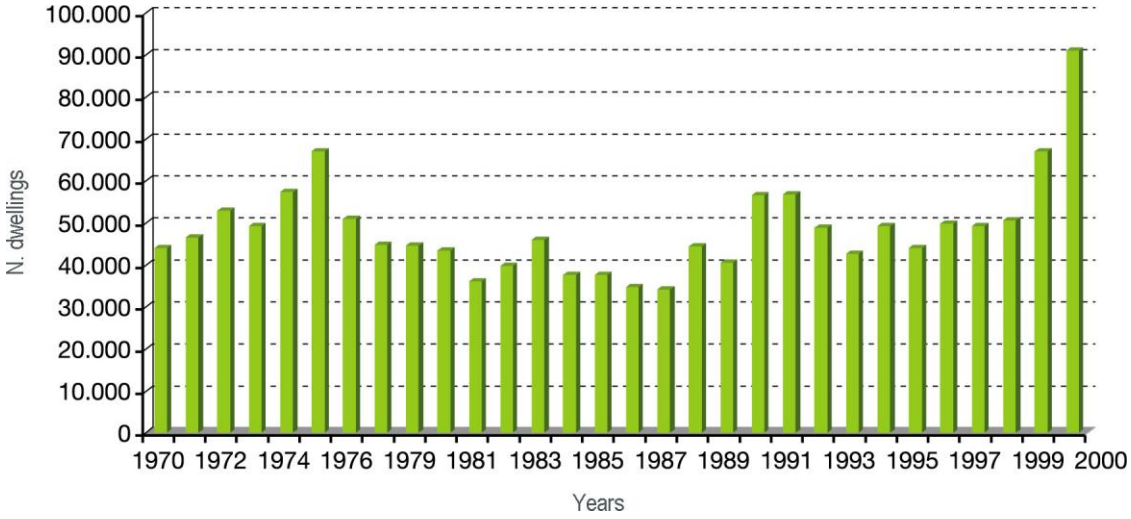
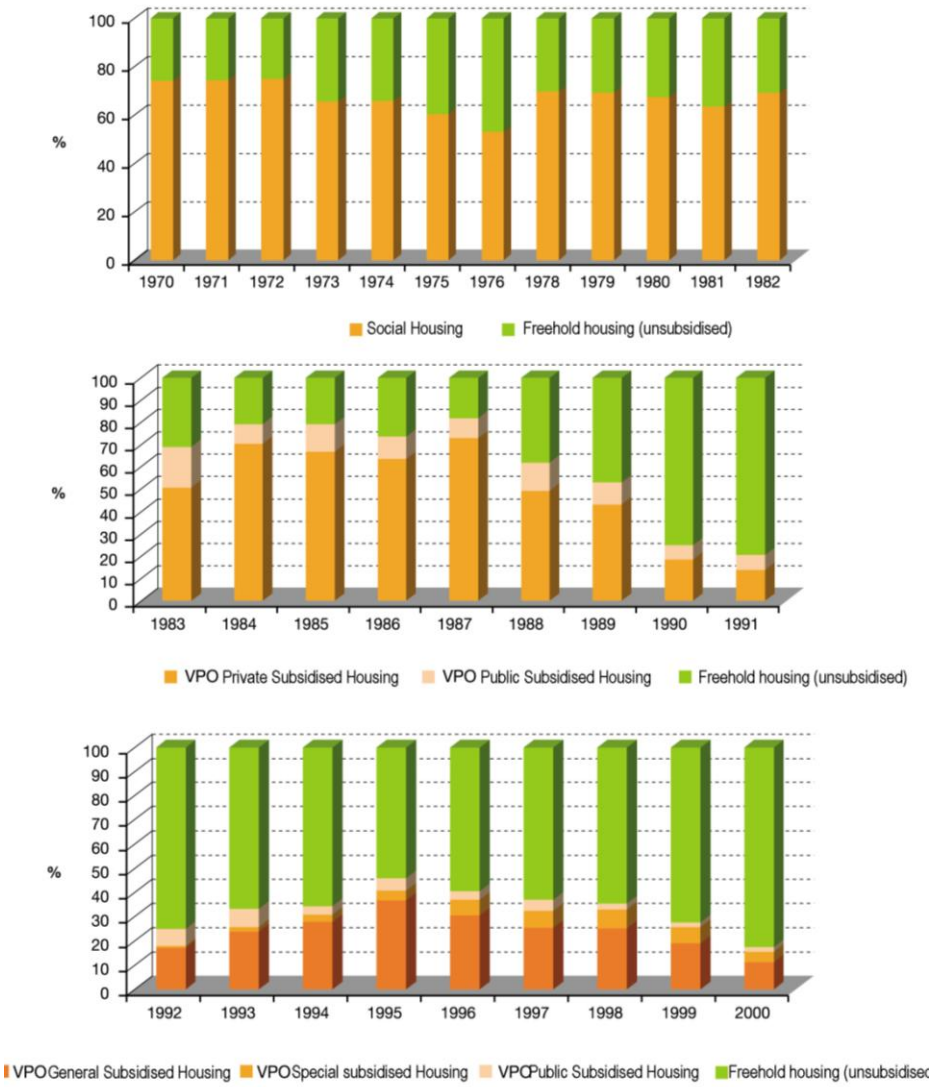
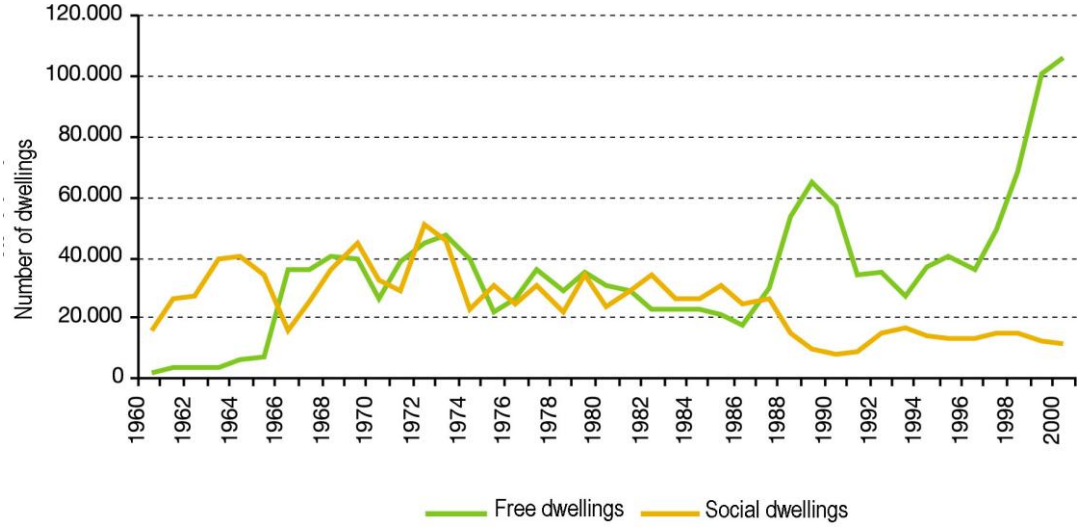
Construction of dwellings in Andalusia

There is not information available about the building of housing until the end of the sixties, when the Official Architects Association provide annual results about certified housing projects and in the same way, the Ministries and regional ministries concerning with housing matters have published the data about housing planning being this information.





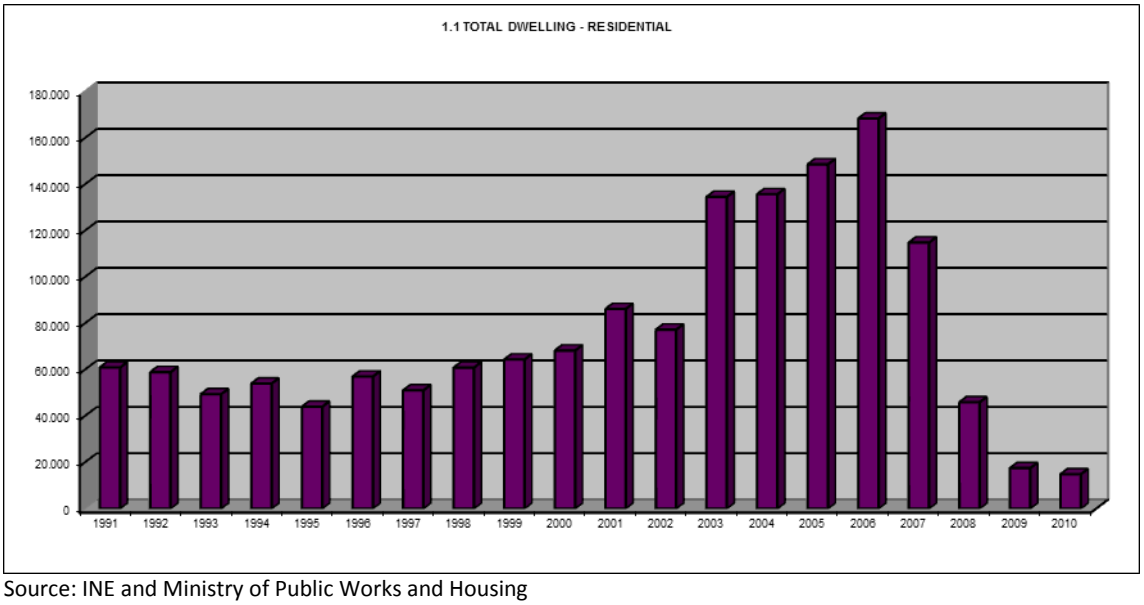
Source: “La vivienda en Andalucía. Estadísticas Históricas del siglo XX”



Source: "La vivienda en Andalucía. Estadísticas Históricas del siglo XX"

Trends in new construction

As it can be seen in the charts, after a significant construction activity during the beginnings of the XXIst century until 2007, achieving almost 170.000 new dwellings in his highest moment in 2006, from 2007 the activity started to decline in 2007 a 67%, reaching the lowest figure in 2010 a 9% of the 2006 peak.



Source: INE and Ministry of Public Works and Housing

It is important to distinguish both public and private construction activities in order to see the sectors that have been more influenced by the economy oscilations and above all for the construction speculation. In the chart below, this classification is shown.

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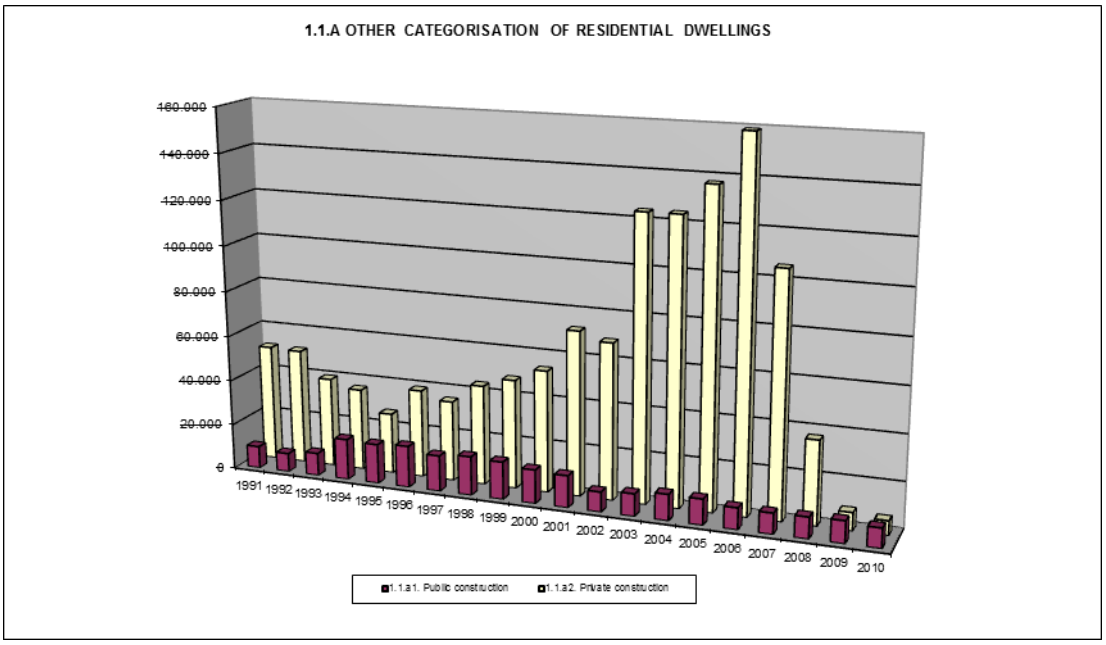
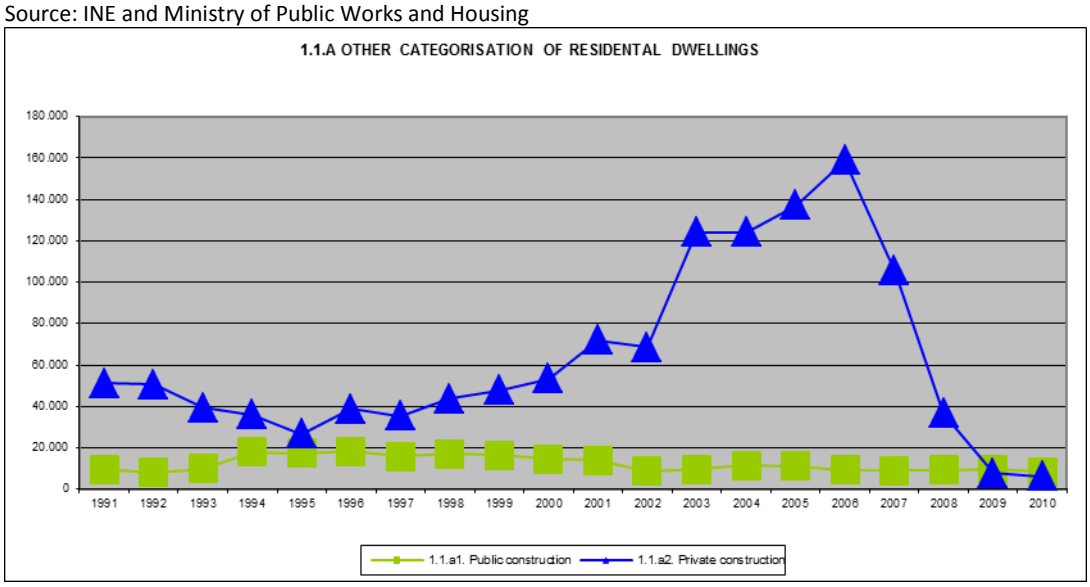


Source: INE and Ministry of Public Works and Housing



Source: INE and Ministry of Public Works and Housing

It is very significant that the rate of private construction increases steadily during the last decade of the XXth century, with a considerable increase from 2002 to 2007 when the economy had a very wealthy period in Spain and, especially to the Spanish property bubble. However, due to the financial crisis, this rate starts to decease until reach almost not construction. The public construction rate, however, remains almost steady during all the years with minimum oscilations.

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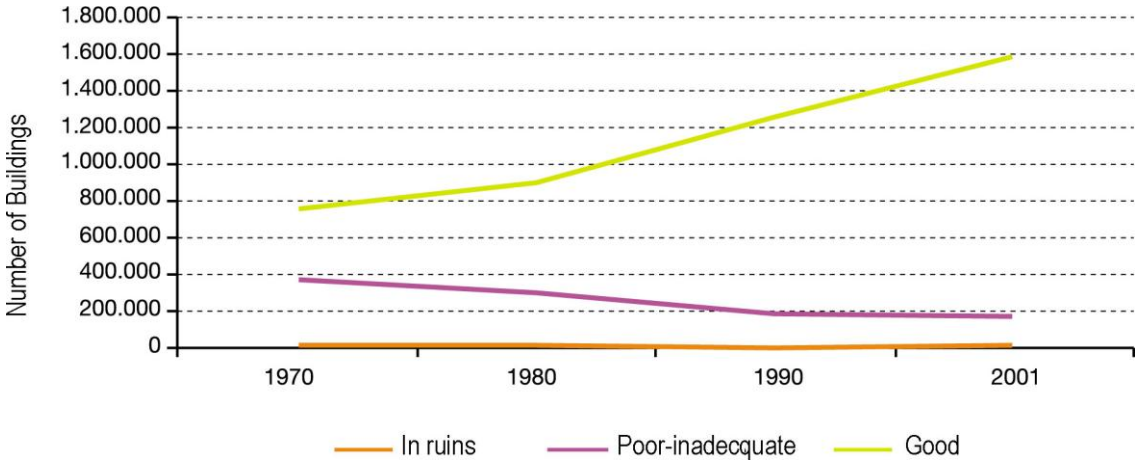
Trends in refurbishment

From the last decade of the XXth century, and specially, after the peck reached by the construction activity before the financial crisis and the Spanish property bubble and in order to avoid the urban speculation, there is a new intention to recover and regenerate the city centers and old buildings.

The graph below shows the conservation of the residential building stock. The detection of these dwellings conditions provides a realistic approach of the building stock. These data are obtained since 1970 from the Building Census in Spain. It is remarkable that there is a significant increase in the number of buildings in good conditions, maybe caused by the new boost to the housing sector. This is due to two main reasons, the first one is that there is a more exhaustive recount for buildings allocated to housing and the second and main reason is the policies implemented in Andalusia for the refurbishment of building, and more precisely for housing. With these guidelines on mind, the housing buildings in Andalusia have a profile in regeneration whose new building aim has nothing to do with the situation in the 60s and 70s. In this sense, the urban policies, the technical building inspection, the building codes and the building control support the retrofitting, renovation and regeneration of buildings.

Evolution of housing buildings in Andalusia. 1970-2001



Source: “La vivienda en Andalucía. Estadísticas Históricas del siglo XX”

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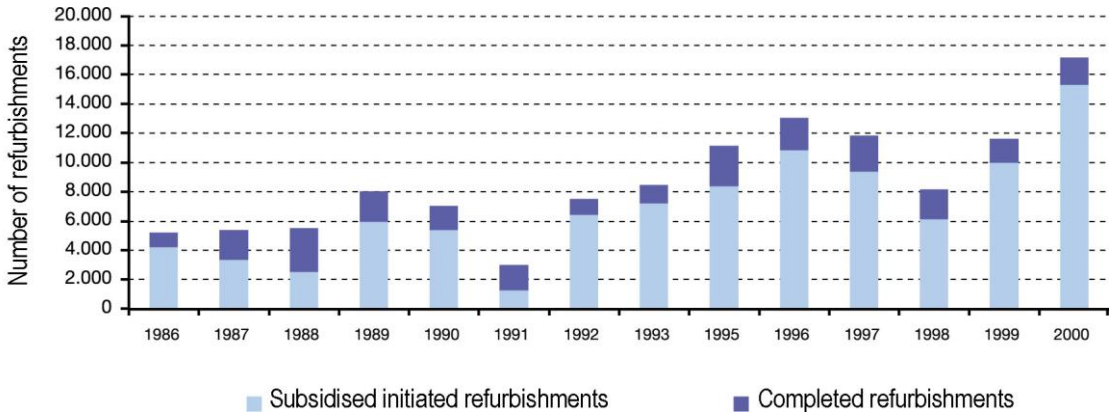
Retrofitting of the private patrimony in Andalusia. 1986-2000 (number of dwellings)



Source: "La vivienda en Andalucía. Estadísticas Históricas del siglo XX"

The retrofitting activity represents one of the three main action lines of the Plan Concertado de Vivienda y Suelo de Andalucia 2008-2012 (Housing and Land Agreed Plan 2008-2012) and its aim is not only the physical recovery of the buildings but **the improvement of the residents' living conditions. Moreover, there is an intention for the social integration and the recovery and maintenance of residents in urban decays.** This Plan establishes a series of programs for grants and subsidies based on different retrofitting actions.

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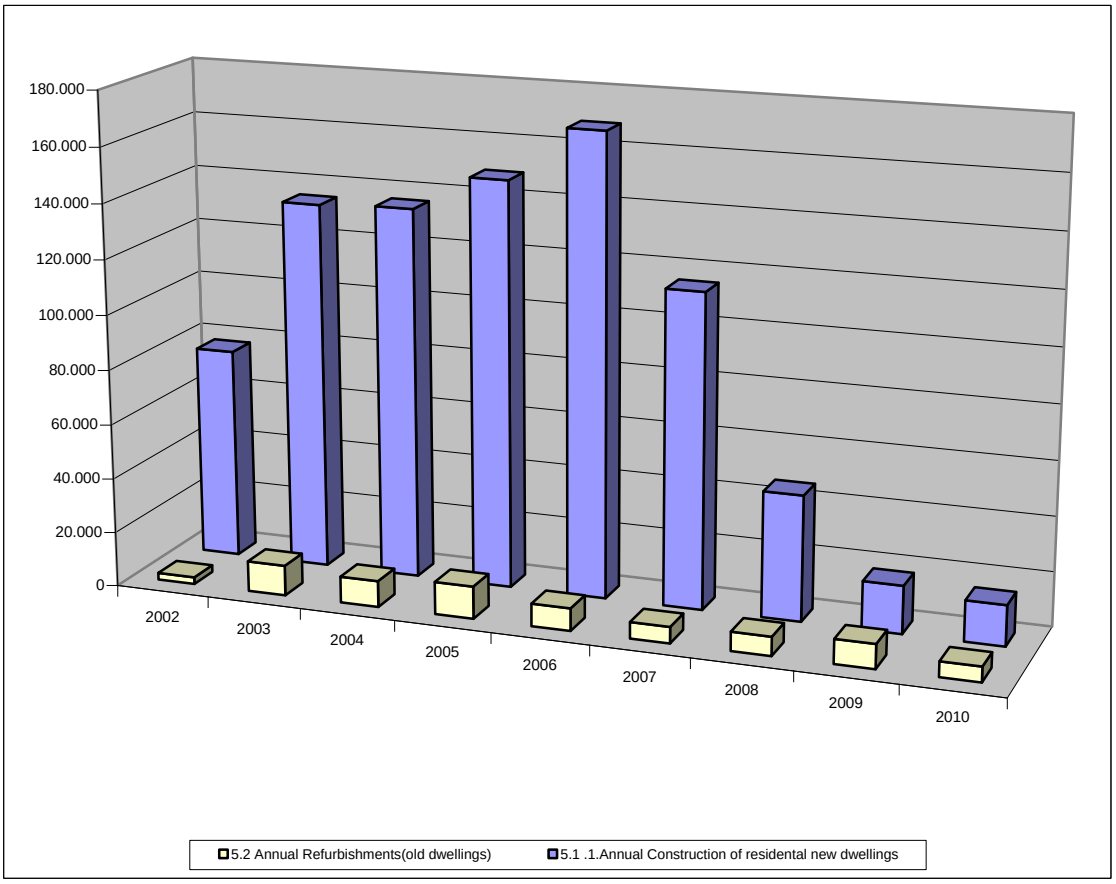
- **NUMBER OF DWELLING BUILT AND REFURBISHED**



Source: INE and Ministry of Public Works and Housing

3.10. Alendejo (Portugal)

Data on the building stock for residential and tertiary sector for Portugal and Alentejo have been provided and are included in the next section, which compares corresponding data of all participating regions.

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3.11. Comparison of building stock in MED regions

The following table and figure compare the dwelling distribution (residential) per type in the different MED countries/ regions that participated in the study. Most of the data are available for the year 2001, except Malta that has data for 2005, PACA region (France) that has data for 2006 and Portugal/ Alendejo region that have data for 2006.

Table 16: Number of dwellings per type (residential) in MED countries/ regions

Country/ region	One-dwelling	Two-dwellings	Three or more dwellings	Unknown	Total
Italy (2001)	6.500.623	4.554.640	16.213.617	51.142	**27.320.022**
Piedmont (2001)	377.370	283.788	1.154.629	396.852	**2.212.639**
Liguria (2001)	117.790	98.549	774.187	1.366	**991.892**
Basilicata (2001)	97.102	59.144	127.083	1.138	**284.467**
Catalonia (2001)	504.022	135.556	1.676.195	998.382	**3.314.155**
Andalusia (2001)	1.454.554	47.392	2.026.236	2.943	**3.531.125**
PACA (2006)	1.104.000	0	1.580.000	0	**2.684.000**
Slovenia (2001)	360.661	142.446	265.843	10.016	**778.966**
Greece (2001)	2.238.693	986.422	2.217.036	34.011	**5.476.162**
Western Macedonia (2001)	71.886	25.893	39.642	726	**138.147**
Malta (2005)	65.614	30.894	32.569	10.101	**139.178**
Portugal (2006)	447.348	1.293.446	2.292.599	1.442.276	**5.475.669**
Alentejo (2006)	39.190	102.599	172.985	131.459	**446.233**

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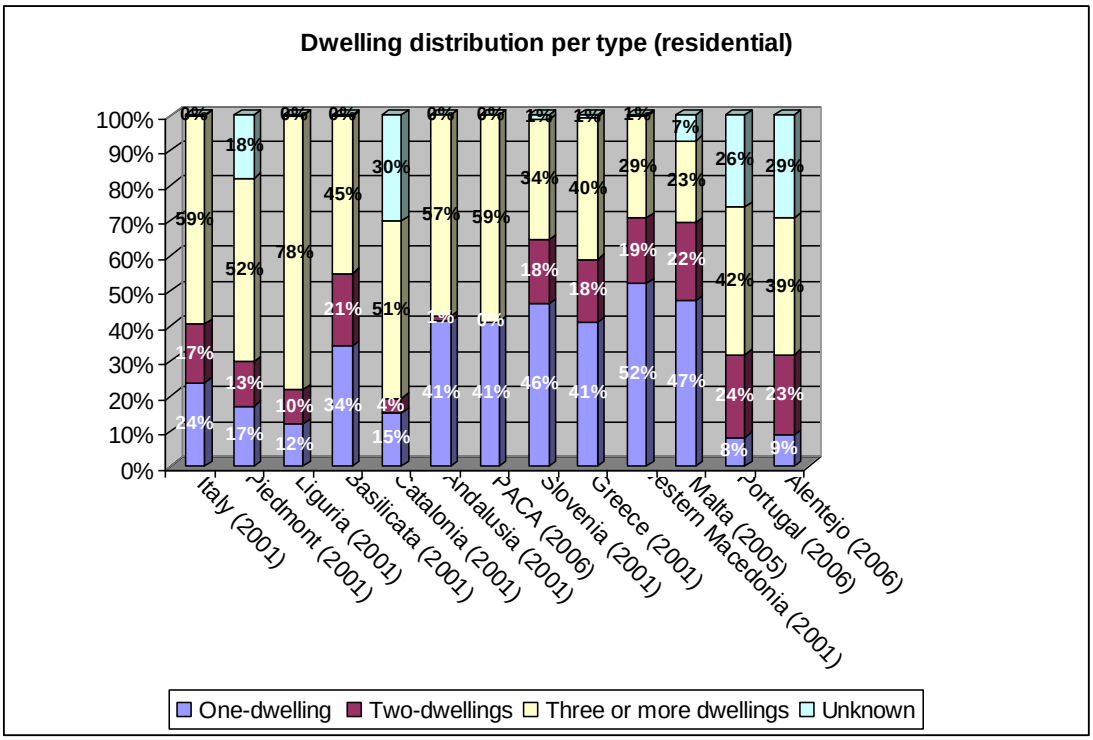

Figure 26: Dwelling distribution per type (residential) in MED countries/ regions

It can be seen that in Italian regions more than half of the dwellings are located in buildings with three or more dwellings, in particular the dwellings in Liguria (78%) and Piedmont (52%) regions. The same applies to PACA region in France (59%) and Andalusia (57%) and Catalonia regions of Spain (51%). In Basilicata region of Italy, the number of dwellings being located in one-dwelling and two-dwelling buildings is higher (55%). Similarly, most of the dwellings are located in one-dwelling or two-dwelling buildings in Slovenia (64%), Malta (69%) and Western Macedonia region of Greece (71%). In Alentejo region and even at national level in Portugal there are a large number of dwellings of unknown type, but again most of the dwellings are located in three or more dwelling buildings (59% in Alentejo, 42% in Portugal at national level). In general, it can be seen that in MED regions most of the dwellings are located in large buildings of three or more dwellings.

The following table and figure compare the tertiary building unit distribution per use in the different MED countries/ regions that participated in the RBA study. Data in numbers of tertiary units are not available for Slovenia, Andalusia region of Spain, PACA region of France and Basilicata Region of Italy. In case of PACA region data for tertiary are only available in m^2 but it's not possible to compare them with the data from most of the other countries/ regions because they were not available in m^2. In case of Alentejo and Portugal data are only available for educational, hotel and

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hospital building units. Most of the data are available for the year 2001, except Malta that has data for 2005 and Piedmont (Italy) that has data for 2009.

Table 17: Number of tertiary building units per use in MED countries/ regions

Country/ region	**Office and commercial units**	**Educational units**	**Hotel units**	**Hospital units**	**Other uses (i.e. airports, sports halls etc)**	**Total tertiary units**
Piedmont (2009)	488.051	4.844	3.186	536		**496.617**
Liguria (2001)	972	1.030	928	76	14.473	**17.479**
Basilicata	n/a	n/a	n/a	n/a	n/a	**n/a**
Catalonia (2001)	75.795	6.525			323.031	**405.351**
Andalusia	n/a	n/a	n/a	n/a	n/a	**n/a**
PACA	n/a	n/a	n/a	n/a	n/a	**n/a**
Slovenia	n/a	n/a	n/a	n/a	n/a	**n/a**
Greece (2001)	150.317	18.223	32.806	2.304	715.370	**919.020**
Western Macedonia (2001)	3.702	935	256	73	42.091	**47.057**
Malta (2005)	37.075	965	201	11	2.737	**40.989**
Portugal (2001)	n/a	19.984	1.781	217	n/a	**n/a**
Alentejo (2001)	n/a	1.228	104	10	n/a	**n/a**

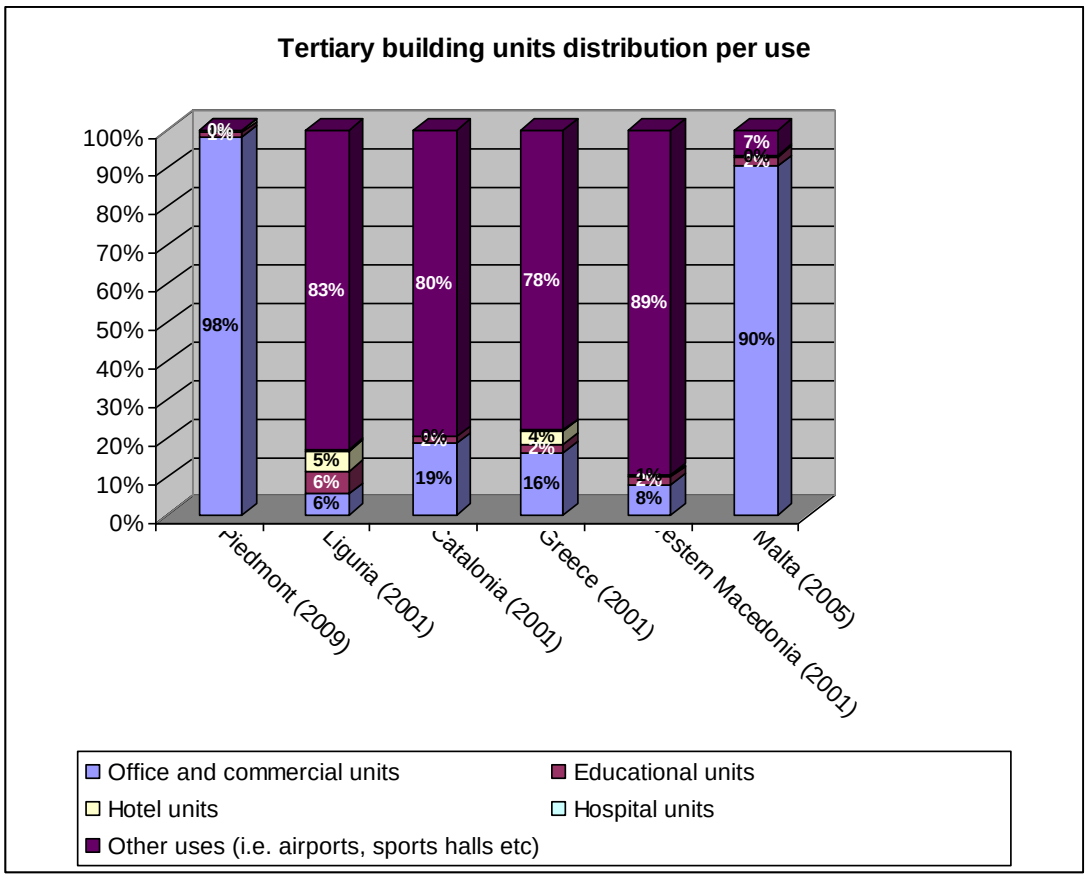

Figure 27: Distribution of tertiary building units per use in MED countries/ regions

It can be seen that most of the tertiary building units have been registered as office and commercial units in Piedmont (98%) and Malta (90%). However, most of the tertiary building units are for other non-specified uses in Liguria (83%), Catalonia (80%) and Western Macedonia (89%) and a smaller percentage is for office and commercial use, namely 6% in Liguria, 19% in Catalonia and 8% in Western Macedonia.

Educational building, hotel and hospital units are small in numbers compared to the rest of the building units and are therefore compared separately in the following figure. It can be seen that more than half of the building units of these three categories are educational, mostly in Catalonia (100%), Alentejo (92%), Malta (82%) and Western Macedonia (74%), whereas there is an increased number of hotel units in Piedmont (57%) and Liguria (46%).

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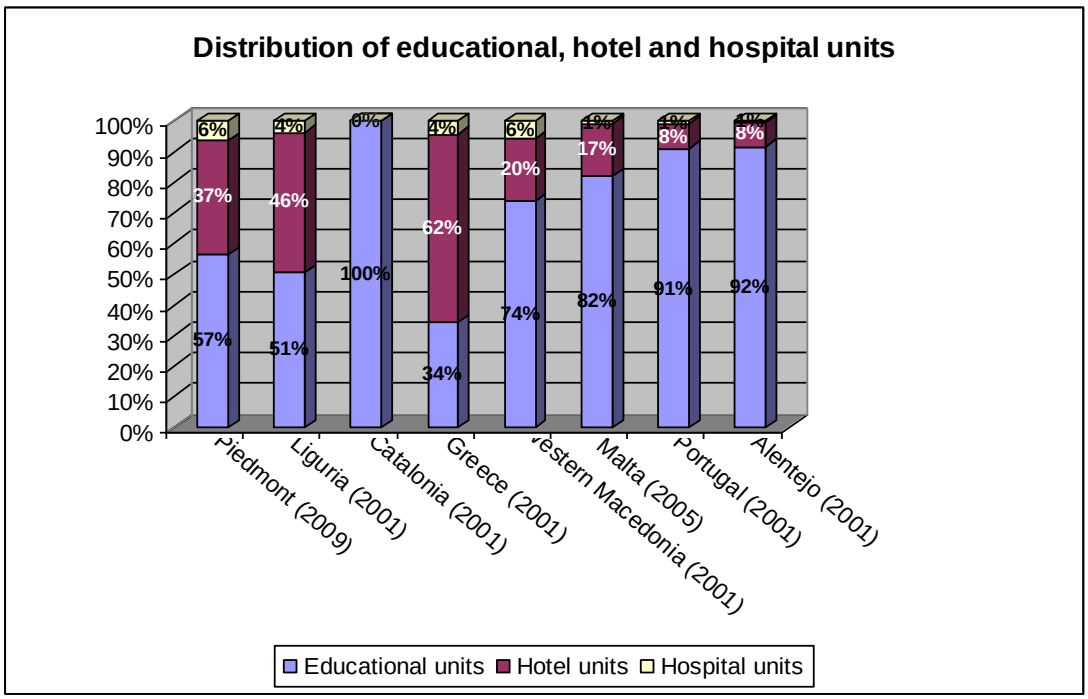

Figure 28: Distribution of educational, hotel and hospital units in MED countries/ regions

The following table and figure show the year of construction of dwellings (residential) in the MED countries/ regions that participated in the study. Most of the data are available until 2001 except data for Malta that are available until 2005. Also, data of residential dwellings are not available for Western Macedonia, and therefore only available data for Greece are compared.

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Table 18: Number of dwellings (residential) per year of construction in MED countries/ regions

Country/ region	construction unknown	construction 1919-before	construction 1920-1945	construction 1946-1960	construction 1961-1970	construction 1971-1980	construction 1981-1990	construction 1991-	Total
Italy (2001)	51.142	3.893.567	2.704.969	4.333.882	5.707.383	5.142.940	3.324.794	2.161.345	**27.320.022**
Piedmont (2001)		505.775	262.230	351.688	473.077	339.650	153.044	127.175	**2.212.639**
Liguria (2001)	1.366	228.141	130.822	202.616	240.909	114.255	49.791	23.992	**991.892**
Basilicata (2001)	1.138	48.075	30.278	42.605	43.774	47.679	45.222	25.696	**284.467**
Catalonia (2001)	14.602	390.224	161.257	465.210	649.522	838.433	335.789	459.118	**3.314.155**
Andalusia (2001)	15.791	237.278	186.775	362.320	569.930	896.920	606.682	655.430	**3.531.125**
PACA (2001)		407.000	256.000	553.000	343.000	368.000	315.000	304.000	**2.546.000**
Slovenia (2001)	144	120.460	62.132	88.334	132.657	185.380	127.514	61.151	**777.772**
Greece (2001)	10.995	167.482	398.454	667.429	1.068.880	1.339.979	1.043.444	779.499	**5.476.162**
Malta (2005)		16.955	13.962	16.067	14.710	22.478	26.629	28.377	**139.178**
Portugal (2001)		253.880	344.936	357.042	395.262	553.349	648.930	606644	**3.160.043**
Alentejo (2001)		43.429	54.282	45.000	39.775	47.440	57.182	62838	**349.946**

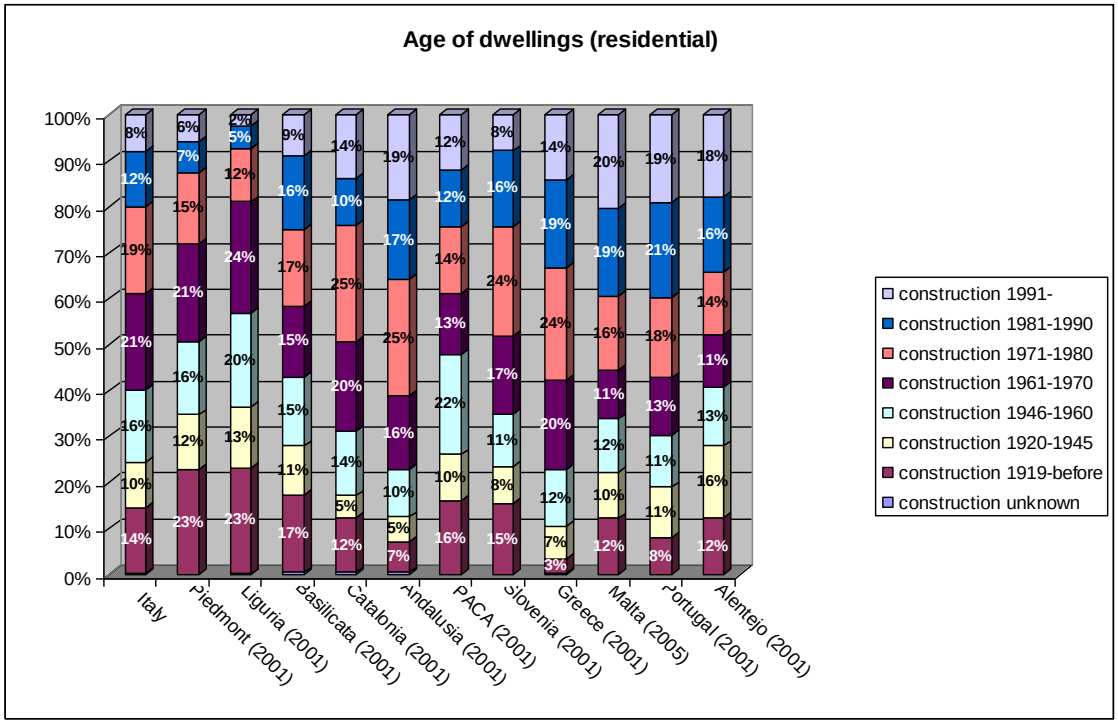

Figure 29: Age of dwellings (residential) in MED countries/ regions

It can be seen that a great number of dwellings in the MED regions until the year 2001 were built before 1970, mostly in Liguria (81%) and Piedmont (72%), followed by PACA (61%), Basilicata (58%), Slovenia (52%), Alentejo (52%), Catalonia (51%), Malta (44%), Greece (42%) and Andalusia (39%). The results show that in general most of the dwellings in MED countries/ regions are quite old.

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4. Energy consumption and energy efficiency of buildings in MED regions

The scope of this section is to estimate the energy consumption and efficiency of buildings of the residential and tertiary sector at regional level. An overview is presented for each participating region, following the corresponding template provided and a comparison is made at the end of this section, based on best available common data on building stock.

4.1. Catalonia (Spain)

Data availability

The data used and its sources (and shortcomings) are listed below:

- Data on domestic energy consumption are retrieved from the Catalan Energy Institute (ICAEN), where the classification into consumption per end uses was done in 1997 and 2007.
- No data are available on tertiary sector subsector consumption, or distribution by different end uses. The data used for this purpose are derived from different studies conducted by the Catalan Energy Institute (ICAEN) [31]; they have to be treated with care, as they are not official statistics.
- Data on energy consumption for different building types from different construction periods are gathered from reports elaborated for the Housing Agency (Agència de l'Habitatge) by Institut Cerdà, a private consulting firm[32]

Total primary and final energy consumption

Total primary energy consumption in Catalonia was 26,840.3 ktoe in 2007 and final energy consumption 16,458.3 ktoe . Both grew with an annual rate of around 4% in the first part of the latest period of economic growth (1995-2003) and displayed a moderation in growth in the period 2003-2007 (mean rate of 1% and 1.8% respectively).

[31] **ICAEN (2004): Dades de consums i comportament energètic per a diferents sectors consumidors Projecte Ciutat Sostenible. Fòrum Barcelona 2.004**

[32] Institut Cerdà (2006) La *contribució de l'habitatge de Catalunya a la reducció d'emissions de gasos amb efecte d'hivernacle.* Generalitat de Catalunya, Departament de Medi Ambient i Habitatge

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Per capita energy consumption in Catalonia, as shown in Figure 30, has been rising steadily over the last two decades, and levelled out in the last few years before the economic crisis.

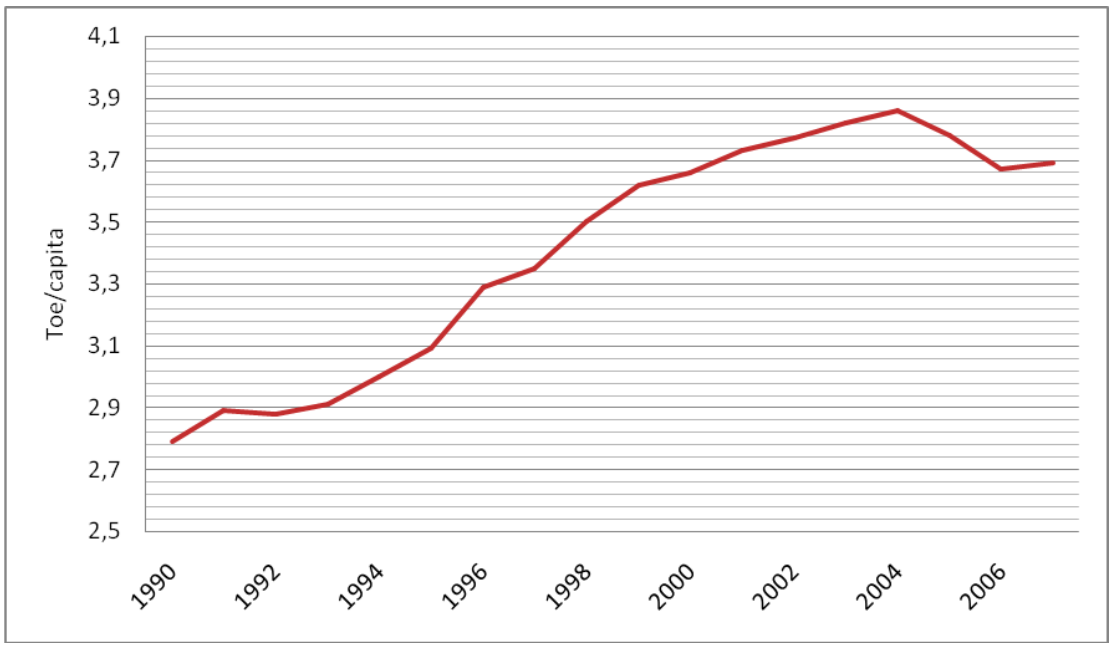

Figure 30 : Per capita primary energy consumption Catalonia.
Source: ICAEN, Balanç energètic 1990-2007

Energy Sources

Final energy consumption is mainly divided between three sources: oil (petroleum products) (51%), natural gas (22%) and electricity (25%), see Figure 31. [33]

[33] ICAEN (2007) Balanç energètic de Catalunya

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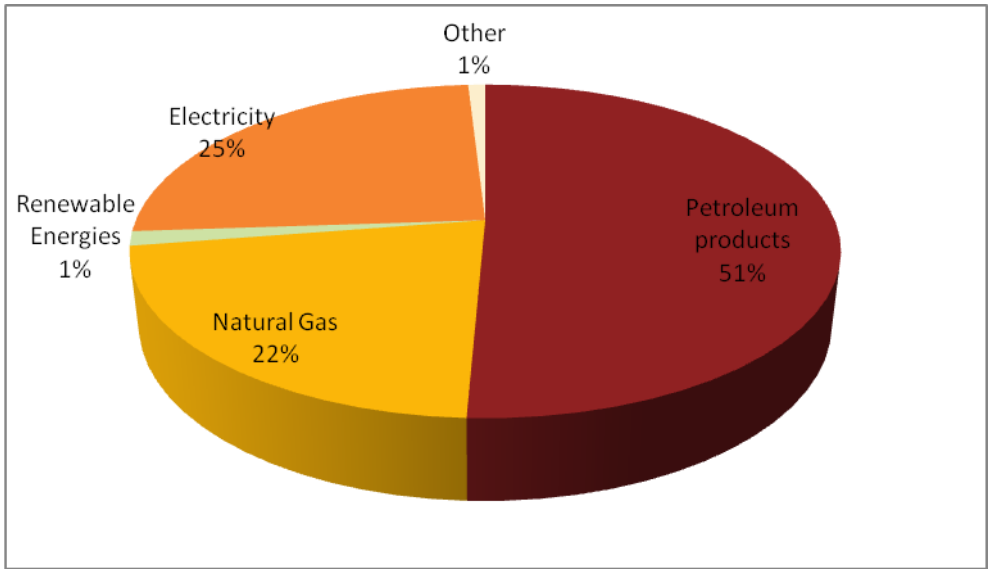

Figure 31: Total Final energy consumption Catalonia 2007.
Source: Icaen, Balanç energetic 2007

The primary energy source for electricity is primarily nuclear energy (47%), with gas fired combined cycle and cogeneration plants and hydro power jointly providing another 45%[34] . The non-conventional renewable energy contribution to electricity generation is with 1.2% still very low, consisting mainly of wind power and some solar photovoltaics, Figure 32. This high level of nuclear power in electricity generation leads to a low CO_2 emission conversion factor for electricity in Catalonia of 0.196 $kgCO_2/kWh$[35], approximately half of the emissions associated to electricity generation in Spain, and equivalent to the emission impact of gas[36] (0.201 $kgCO_2/kWh$), not taking into account the high environmental impact and threat of nuclear technology itself.

[34] ICAEN web,
http://www20.gencat.cat/portal/site/icaen/menuitem.71a2158dbba416fdc644968bb0c0e1a0/?vgnextoid=e0f046768abad110VgnVCM1000008d0c1e0aRCRD&vgnextchannel=e0f046768abad110VgnVCM1000008d0c1e0aRCRD&vgnextfmt=default
http://www20.gencat.cat/portal/site/icaen/menuitem.71a2158dbba416fdc644968bb0c0e1a0/?vgnextoid=e0f046768abad110VgnVCM1000008d0c1e0aRCRD&vgnextchannel=e0f046768abad110VgnVCM1000008d0c1e0aRCRD&vgnextfmt=default

[35] Mix oficial elèctric Catalunya 2007 (most recent data)

[36] http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html (volum 2: Energy, capítol 1, pàgina 23)

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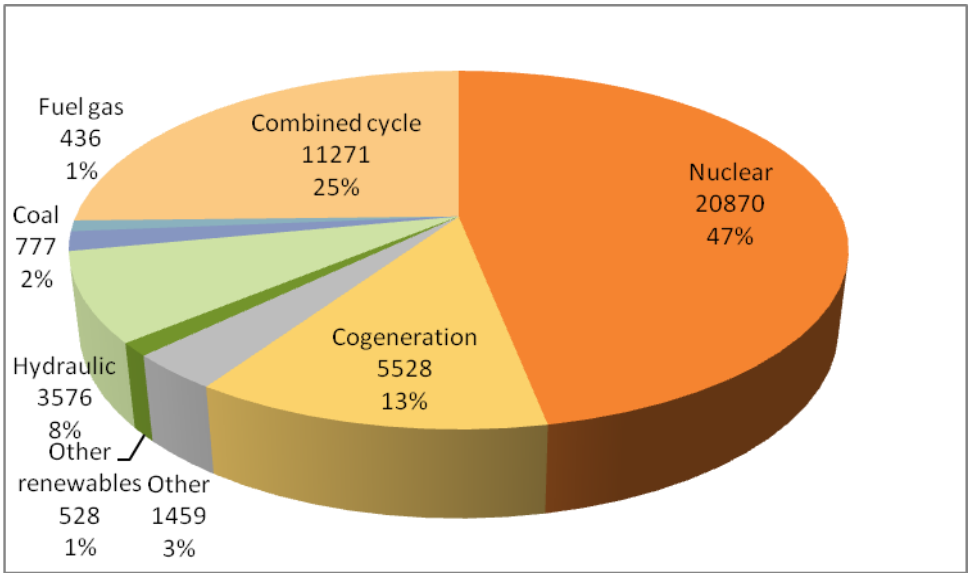

Figure 32: Fuel sources for gross electricity production; Catalonia 2007.
Source: Icaen[37]

Distribution of energy consumption per sector

In Catalonia, the residential sector share of final energy consumption is 14% and the service sector's 11%, thus the two sectors combined amount to a quarter of final energy consumption[38] as depicted in Figure 33. While the building's energy performance plays an important role in determining the level of domestic energy consumption, with to a certain extent standardised energy end uses, the tertiary sector is less homogeneous and uses part of the energy for sector specific activities such as hotel kitchens or hospital laundry facilities.[39]

Consequently, a lot more data is available for domestic energy consumption. The most recent data available is for 2007.

37

http://www20.gencat.cat/portal/site/icaen/menuitem.71a2158dbba416fdc644968bb0c0e1a0/?vgnextoid=e0f046768abad110VgnVCM1000008d0c1e0aRCRD&vgnextchannel=e0f046768abad110VgnVCM1000008d0c1e0aRCRD&vgnextfmt=default

38ICAEN
webhttp://www20.gencat.cat/portal/site/icaen/menuitem.71a2158dbba416fdc644968bb0c0e1a0/?vgnextoid=e0f046768abad110VgnVCM1000008d0c1e0aRCRD&vgnextchannel=e0f046768abad110VgnVCM1000008d0c1e0aRCRD&vgnextfmt=default

39 Pla de l´energia a Catalunya 2006-2015, p. 322

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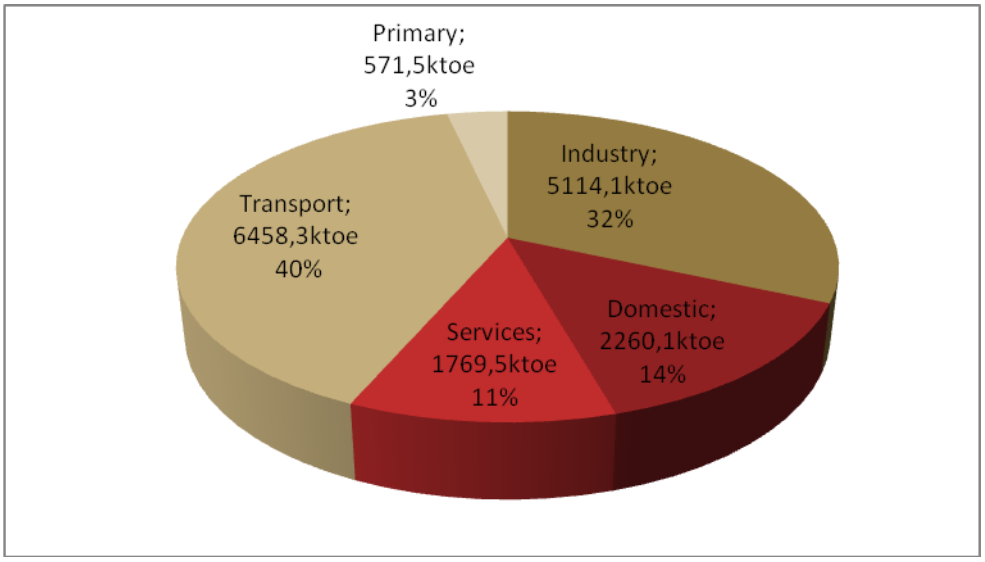

Figure 33: Final energy consumption distribution per sector Catalonia 2007.
Source: ICAEN[40]

40

ICAENhttp://www20.gencat.cat/portal/site/icaen/menuitem.71a2158dbba416fdc644968bb0c0e1a0/?vgnextoid=e0f046768abad110VgnVCM1000008d0c1e0aRCRD&vgnextchannel=e0f046768abad110VgnVCM1000008d0c1e0aRCRD&vgnextfmt=default

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Energy consumption/types of building

Almost half of the housing stock has been built in the 1940-1980 period, in times of very limited economic resources, high demographic pressure and not existing energetic or environmental legislation, and therefore with particularly deficient buildings' envelopes (thermal insulation, air-tightness, etc,) compared to current minimum standards.

Therefore it is not surprising that most building energy consumption stems from this part of the building stock. [41] (Figure 34).

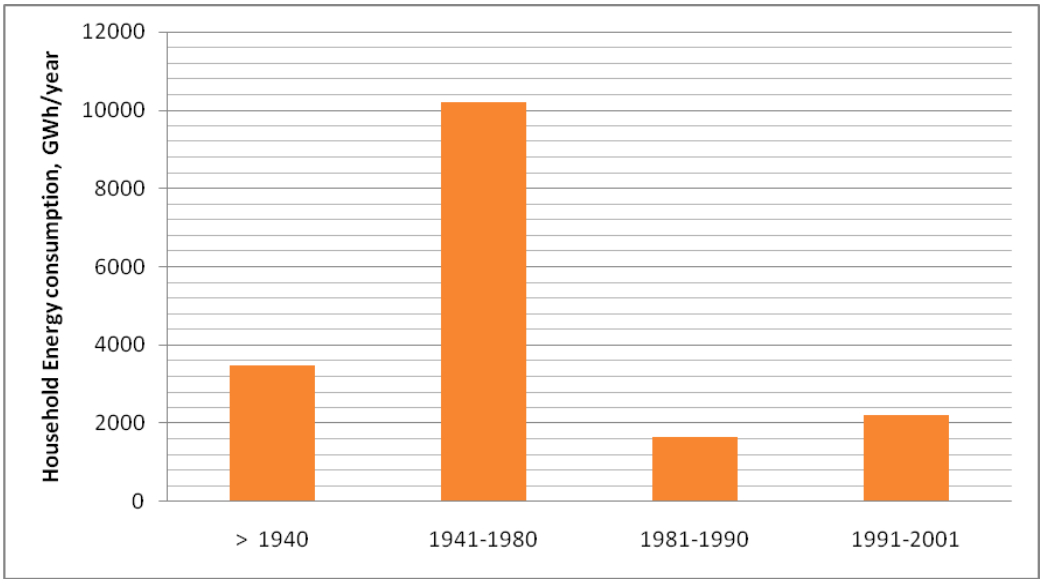

Figure 34: Household final energy consumption by construction period, Catalonia.
Source: Institut Cerdà (2006)

Divided into consumption by single family and multifamily buildings, multifamily buildings built between 1940 and 1980 consume the most energy in total numbers (Figure 35).

41 41 Institut Cerdà (2006) La *contribució de l'habitatge de Catalunya a la reducció d'emissions de gasos amb efecte d'hivernacle.* Generalitat de Catalunya, Departament de Medi Ambient i Habitatge

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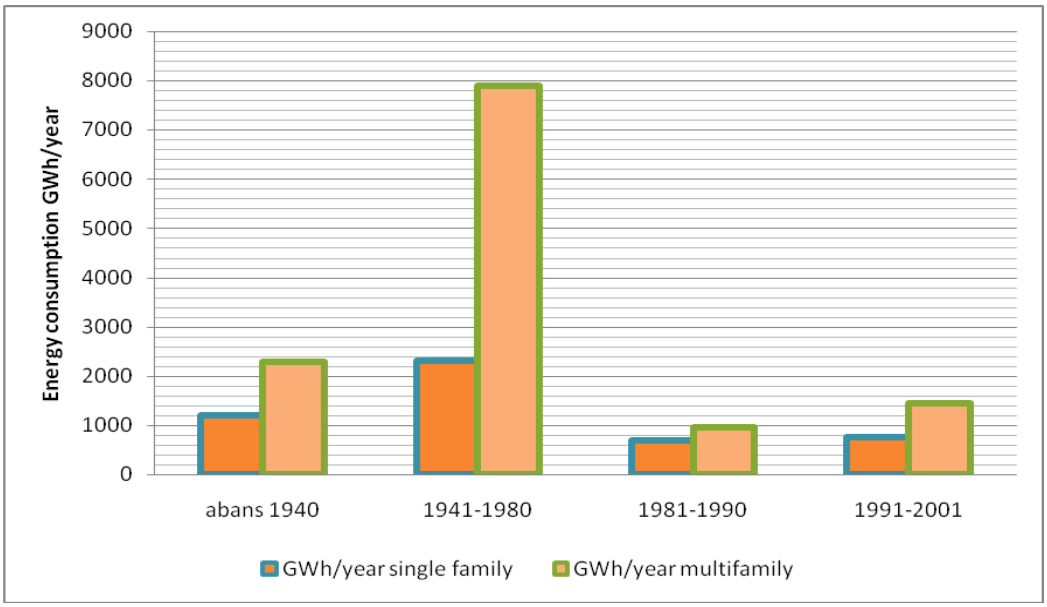

Figure 35: Total dwelling final energy consumption by type of building and construction period.
Source: Cerdà (2006)

Mean annual residential building heating energy demand per square meter is depicted in Figure 36, weighted by climate zones and building typologies as calculated by Garrido (2010). Square meter demand is generally higher in single family buildings as they present a higher surface to volume ratio than multifamily buildings, at equal building regulations (except after 1991), and decreases with improving energy building regulations.

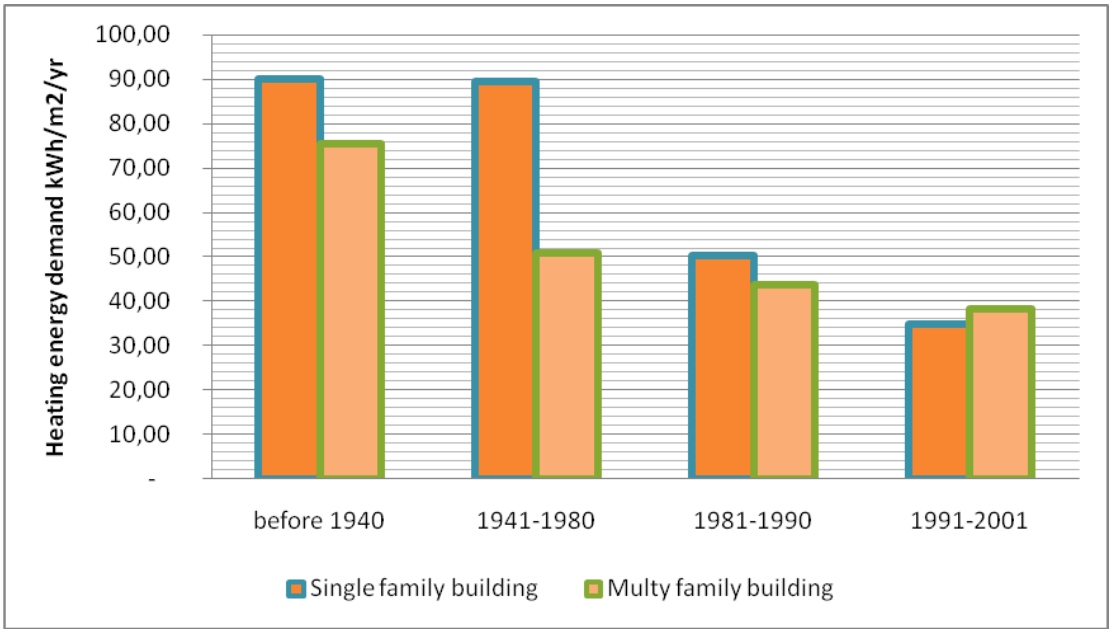

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Figure 36: Annual heating demand, weighted average of climate zones and building typologies.
Source: Garrido (2010), calculated with LIDER program

Domestic energy consumption distribution by end use

Figure 37 depicts the distribution of domestic energy consumption per end use in Catalonia in the year 2007. It reveals that heating takes up the largest part of domestic energy consumption (41%), followed by household appliances (22%) and hot water (17%) while still very little energy is spent on cooling.

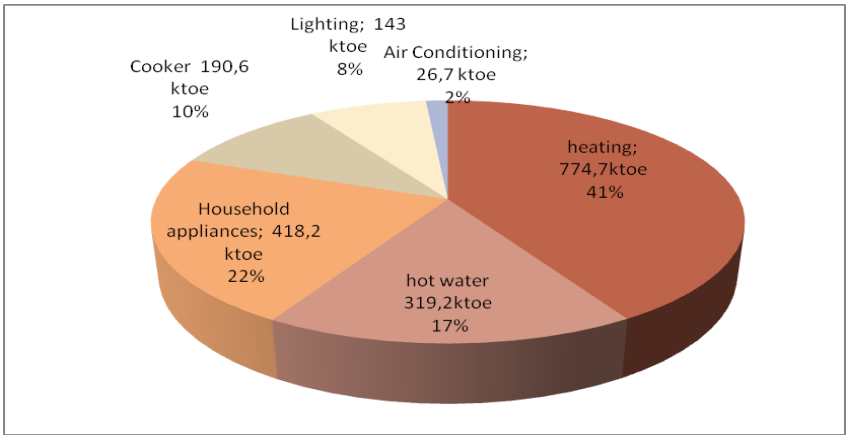

Figure 37: Domestic energy consumption distribution by uses, Catalonia 2007.
Source: ICAEN (2007)

In the residential sector, an approximate m^2 energy consumption has been calculated to be 83 kWh/m^2 total final energy consumption in first residences. Heating energy consumption is 34.3 kWh/m^2, appliances 18.5 kWh/m^2 and lighting 6.4 kWh/m^2 (Table 19). These figures have been calculated using the above values for domestic energy consumption for 2007, and a calculated m^2 value based on IDESCAT data. Square meter cooling energy is 1.2 kWh/m^2, with the same credibility problem as the cooling energy above.

Table 19. Household energy consumption

Domestic energy consumption/m^2 of first residences 2007	Household energy consumption	heating	appliances	lighting	Cooling
kWh/m^2	83.0	34.3	18.5	6.4	1.2

Source: IDESCAT and ICAEN

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Distribution of heating types/fuel

Considering the relative importance heating energy consumption has in total domestic energy consumption, the distribution of the different types of heating and their fuel sources in Catalonia are detailed in Figure 38.

Over the last decades, gas fired dwelling central heating systems have increasingly substituted small mobile gas or electric heaters, leading to an increase in energy demand for heating, despite the fact that the systems are more efficient, as this means being able to achieve higher comfort levels and heat the whole dwelling.[42] In 2001, 94.4% of first residences had some type of heating.[43]

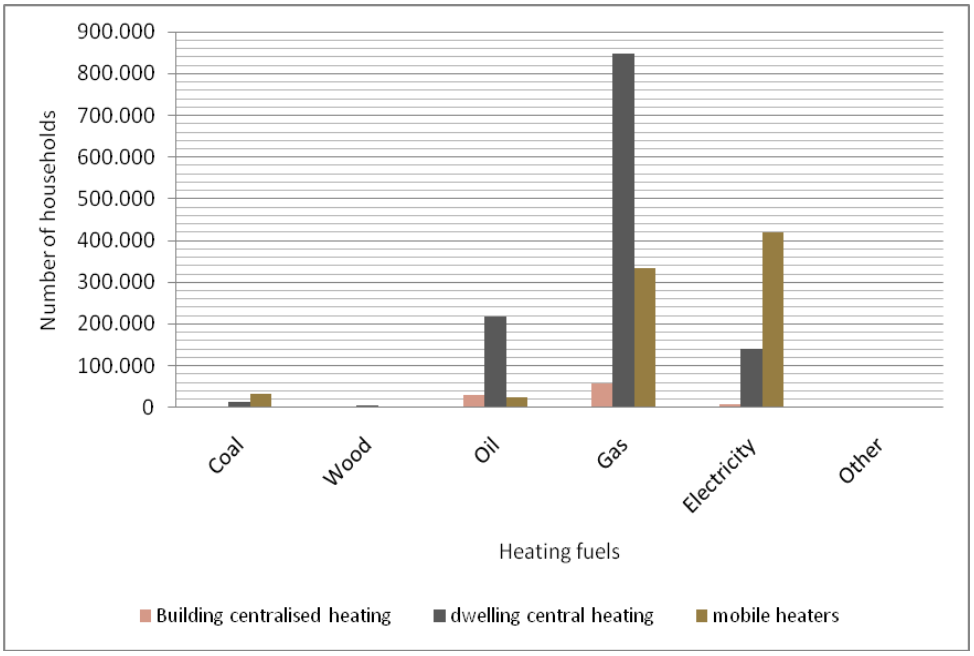

Figure 38: Domestic heating systems and their fuel sources, Catalonia 2001.
Source: Idescat, population census INE2001

Tertiary sector energy consumption / uses and sub sectors

There are large differences in tertiary sector consumer sizes. Large single consumers in the service sector are the Government of Catalonia (Generalitat de Catalunya), as a whole, which is one of the largest consumers of energy in Catalonia, with an estimated annual energy consumption of 1000GWh[44] including public buildings as well as many small consumers, like primary healthcare centres, schools or offices.

[42] Energy Efficiency strategy (Estratègia eficiència energètica 2006-2015, p. 337)
[43] (ICAEN 2007)
[44] El Govern aprova el Pla d'estalvi i eficiència energética als edificis i equipaments de la Generalitat de Catalunya 2011-2014

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Other main consumers are large companies, and large single consumers include airports and train stations, large commercial centres, office blocks, public lighting.[45]

Sub sectors analysed: tourism, health care, education, offices.

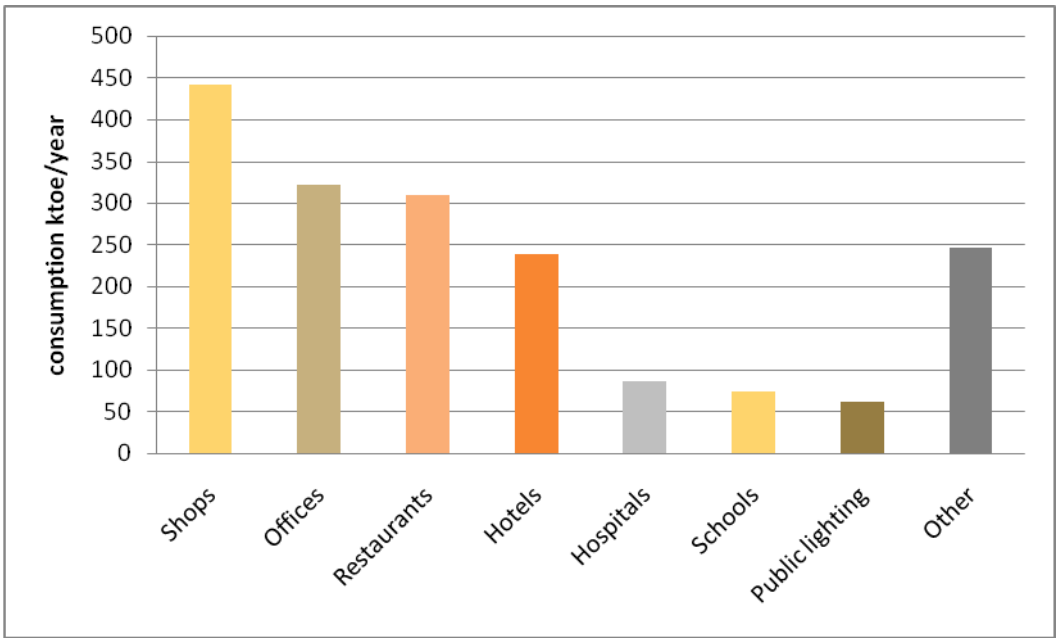

Figure 39: Service sector subsector energy consumption.
Source: Estrategia i estalvi i eficiencia energètica 2006-2015 ICAEN

The relative share of the sub sectors in tertiary sector energy consumption can be seen in Figure 39. Shops and commerce, offices, hotels and restaurants are the largest consumers.

The distribution of energy consumption between the different end uses is different for the sub sectors in the residential and tertiary sector. However, most sectors use most energy for heating, followed by hot water. Only hotels and offices use an elevated part of energy consumption for cooling, and offices use a high proportion of energy in lighting, as can be seen in Table 20 and Graphs 40-43. As mentioned above, these are not official statistics, but they can reveal a trend or the relative impact of different parts of the sector. They are also very useful for illustrating the heterogeneity of the tertiary sector.

[45] Estrategia eficiencia energetica 2006-2015, p. 324

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Table 20: Distribution of final energy consumption between different end uses for tertiary sub sectors (in % of total use in sub sector)

	Heating	Cooling	Hot water	Lighting
Residential (2007)	41%	2%	17%	8%
Hotels (2004)	25%	23%	13%	7%
Hospitals (2004)	56%		21%	-
Schools(2004)	81%	-	6%	6%
Offices(2004)	23%	35%	7,8%	16%

Source: ICAEN 2004[46]

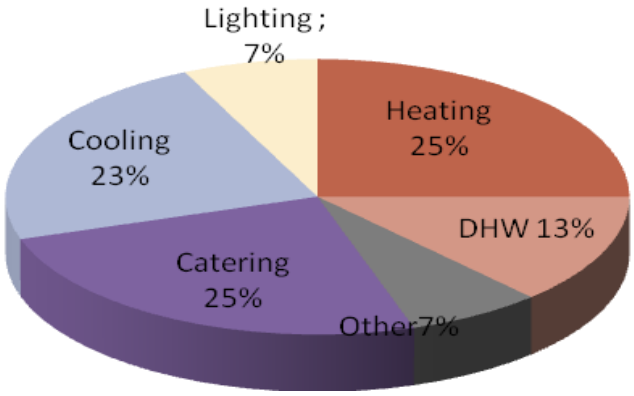

Figure 40: Distribution of Hotel energy consumption 2004

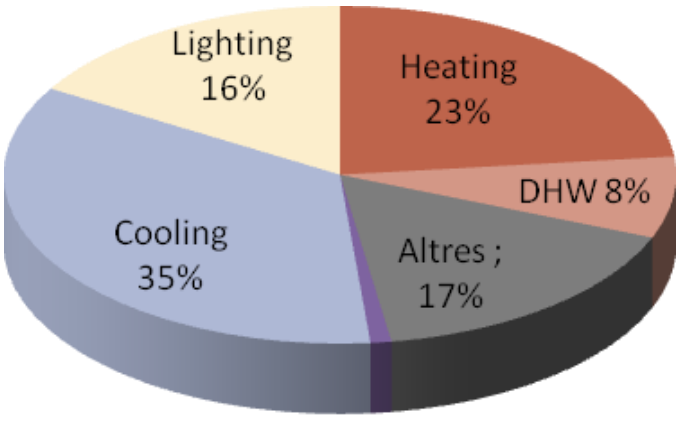

Figure 41: Distribution of Office energy consumption 2004

46 ICAEN (2004): Dades de consums i comportament energètic per a diferents sectors consumidors Projecte Ciutat Sostenible. Fòrum Barcelona 2.004

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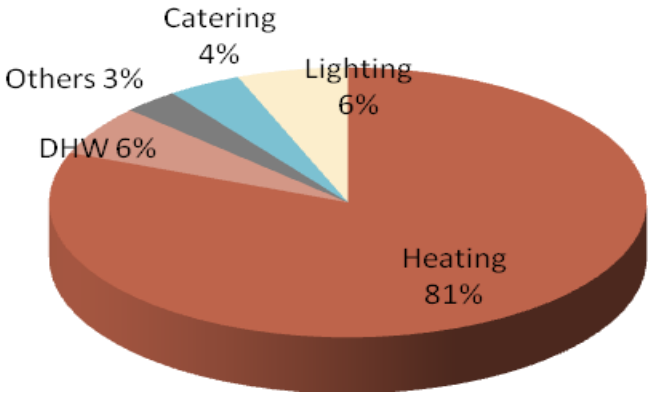

Figure 42: Distribution of School energy consumption 2004

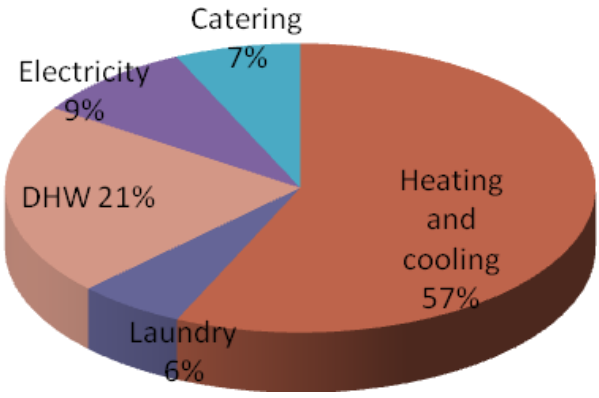

Figure 43: Distribution of Hospital energy consumption 2004[47]

47 ICAEN (2004): Dades de consums i comportament energètic per a diferents sectors consumidors Projecte Ciutat Sostenible. Fòrum Barcelona 2.004

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4.2. PACA (France)

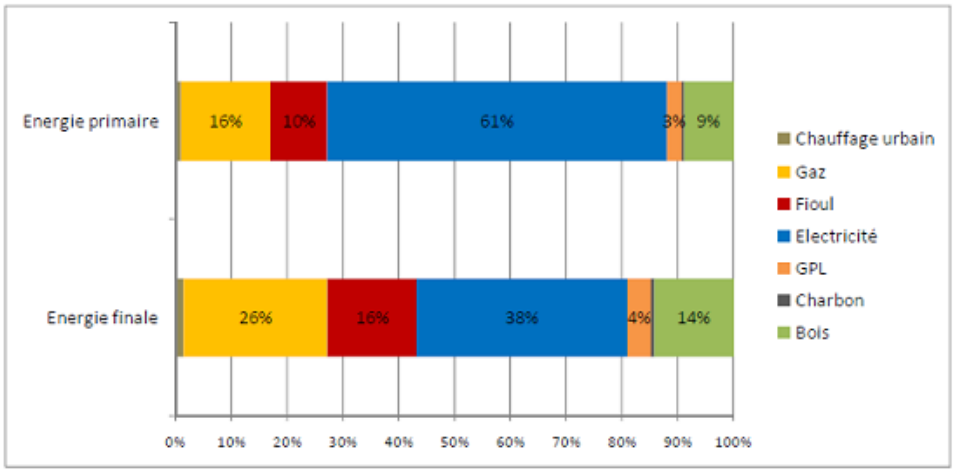
Residential sector

The table below describes the energy consumption of residential building stock in the PACA region from the model ENERTER ®. We find the specificities of the PACA region identified in the study of the structure of the housing stock: electricity is the primary source energy use with 38% of final energy consumption and 61% of consumption primary energy (Figure 44 and Figure 46). Follow the gas (26% of energy consumption final) and fuel oil and wood almost equally (16% and 14%). The share of heating consumption is 65% against 71% in France (Figure 45), including due to the climate, warmer in the PACA region.

Table 21

. Bilan des consommations d'énergie finale du parc bâti résidentiel (GWh EF) - *Ensemble du parc*

Energie	Chauffage	ECS[6]	Cuisson	Electricité spécifique	Total	*Part des consommations*
Chauffage urbain	339	139			478	1%
Gaz	6 381	1 158	876		8 415	26%
Fioul	4 709	520			5 229	16%
Electricité	4 225	1 725	855	5 486	12 291	38%
GPL	684	151	505		1 341	4%
Charbon	225				225	1%
Bois	4 523	46			4 569	14%
Solaire		40			40	0%
Total	21 087	3 780	2 236	5 486	32 589	100%
Part des consommations	*65%*	*12%*	*7%*	*17%*	*100%*	



Répartition des consommations d'énergie finale et d'énergie primaire par énergie - *Ensemble du parc*

Figure 44

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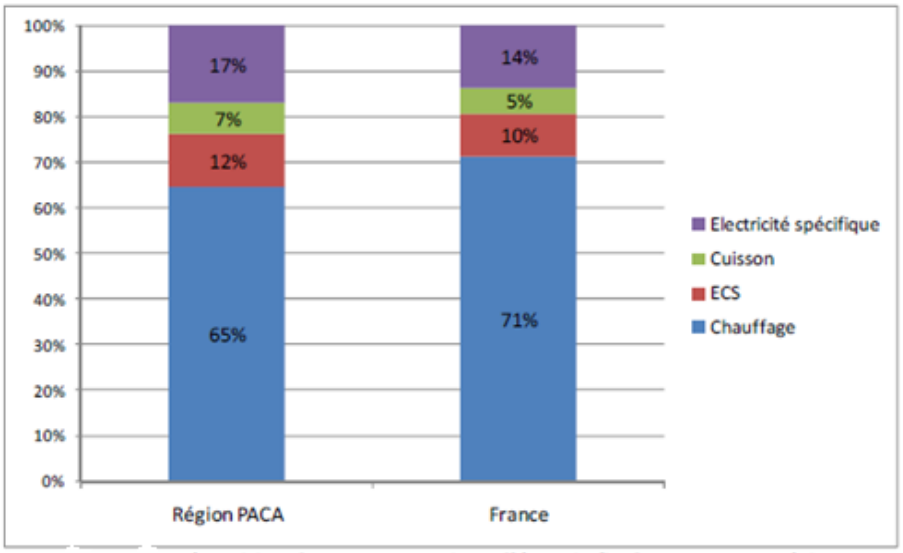
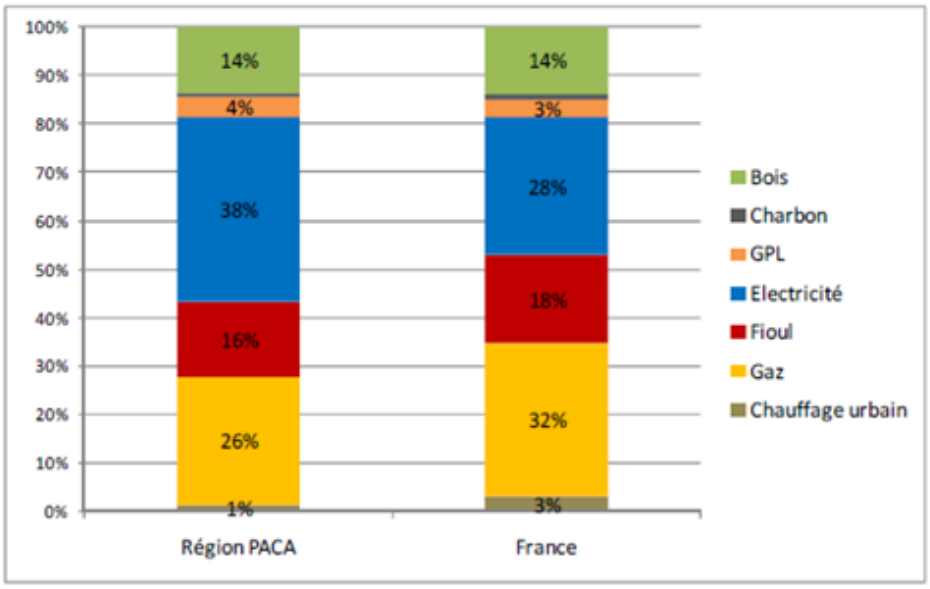


Répartition des consommations d'énergie finale par usage - Région PACA et France métropolitaine

Figure 45: Please note that the specific electricity includes the cooling consumption



Répartition des consommations d'énergie finale par énergie - Région PACA et France métropolitaine

Figure 46

The distribution of consumption by category of accommodation is a reflection of the structure of the housing stock (Table 22): the proportion of family housing is almost half of energy consumption against 30% in France. Second homes, after modulation occupancy assumptions (*For more details, one has to see the entire study*) are

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responsible for 2 to 7% of the total residential consumption (3*% in the table 22 considering a 30% occupancy rate*).

Table 22

. Bilan des consommations d'énergie finale par type de logement et d'occupant (GWh)

Consommations d'énergie finale (GWh EF)		Maisons	Appartements	*Total*	Part des consomma-tions (%)	Répartition moyenne en France (%)
Résidences principales		17 563	13 796	**31 359**	**96%**	96%
Dont :	*Propriétaires occupants*	*14 151*	*5 096*	*19 247*	*59%*	64%
	Locataires (secteur privé)	*3 130*	*5 737*	*8 866*	*27%*	20%
	HLM	*282*	*2 963*	*3 246*	*10%*	12%
Résidences secondaires		568	453	**1 021**	**3%**	3%
Logements occasionnels		16	27	**43**	**0,1%**	0,2%
Logements vacants		76	89	**165**	**0,5%**	0,6%
Total		**18 223**	**14 366**	**32 589**	**100%**	100,0%
Part des consommations (%)		**56%**	**44%**	100%		
Répartition moyenne en France (%)		70%	30%	100%		

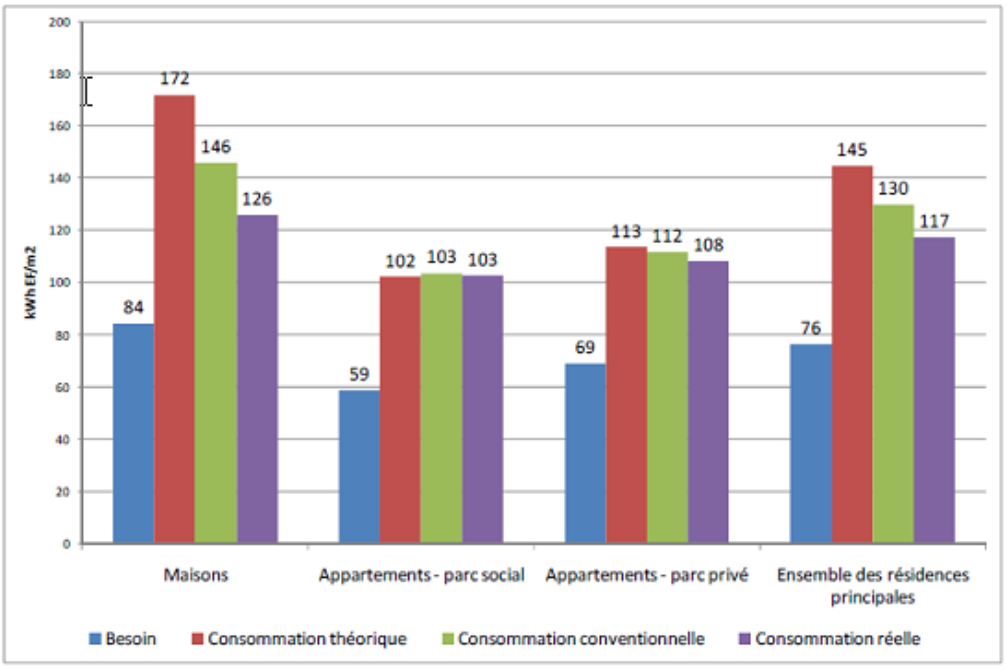

Figure 47: consumption of final energy related to heating method estimation and category of accommodation - Main residences only

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Table 23

Consommations unitaires d'énergie finale liées au chauffage par méthode d'estimation et catégorie de logement - Résidences principales uniquement

Consommations unitaires kWh EF/m² Résidences principales	Besoin	Consommation théorique	Consommation conventionnelle	Consommation réelle
Maisons - Ensemble	84	172	146	126
Appartements - parc social	59	102	103	103
Appartements - parc privé	69	113	112	108
Appartements - Ensemble	67	111	110	107
Ensemble des résidences principales	76	145	130	117

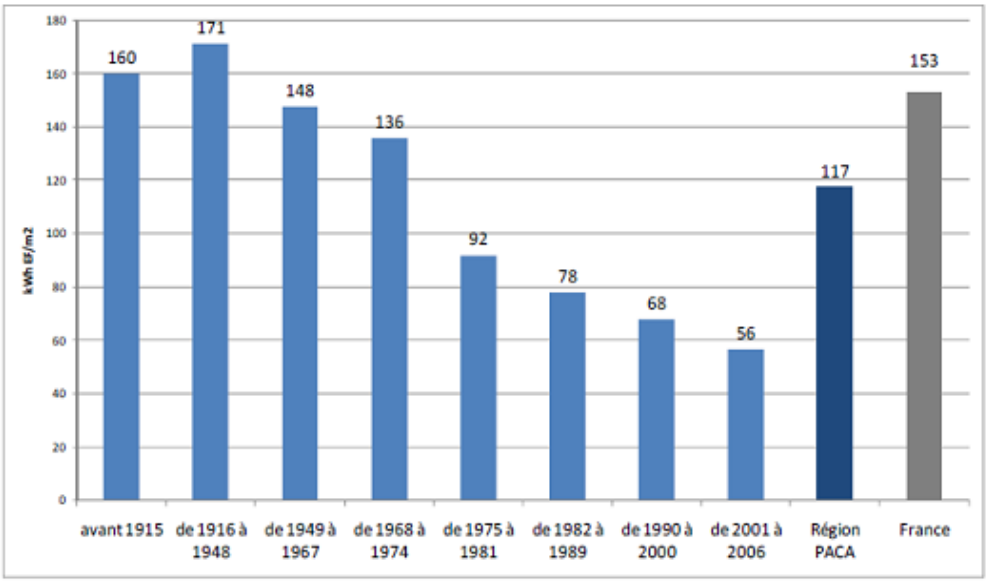

Figure 48: Surface consumption of final energy related to the construction period - Main residences only

The unit consumption is also determined significantly by the age of the housing (Figure 48). The thermal performance of buildings increases as we approach the recent period. The establishment of the first thermal regulation in 1975 results in a significant improvement in unit consumption.

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Table 24 : Unit consumption of final energy-related to heating per construction period, construction, type and category of housing

Consommations liées au chauffage (kWh EF/m²) Résidences principales	avant 1949	de 1949 à 1974	de 1975 à 1989	de 1990 à 2006	Ensemble des résidences principales PACA	Ensemble des résidences principales France
Maison - Propriétaire occupant	180	162	97	71	**121**	156
Maison - Locataire (secteur privé)	200	186	113	80	**155**	183
Moyenne maisons - secteur privé	**184**	**166**	**99**	**72**	**126**	159
Appartement - Propriétaire occupant	139	127	55	30	**103**	134
Appartement - Locataire (secteur privé)	140	133	62	40	**113**	140
Moyenne appartements - secteur privé	**139**	**130**	**58**	**36**	**108**	138
Parc social - Maison	241	211	116	104	**127**	168
Parc social - Appartement	148	127	65	53	**103**	137
Moyenne parc social	**157**	**128**	**70**	**64**	**104**	142
Ensemble des résidences principales - PACA	**164**	**143**	**85**	**64**	**117**	
Ensemble des résidences principales - France	196	188	114	82		153

Tertiary sector

Note : The following data are from the CERC PACA study: year 2006

	Energy consumption in GWh final energy					
	Heating	Cooling	Specific electricity	Hot Water	Others	**Total**
Bureau-administration (**Office, administration**)	1 819	568	1 270	116	39	3 812
Café-Hôtel-Restaurant (**Hotels, Café, Restaurants**)	819	215	362	310	469	2 175
Commerce (**Trade**)	763	356	819	163	308	2 409
Enseignement -recherche (**Education -research**)	791	19	191	168	80	1 249
Habitat Communautaire (**Community Housing**)	391	52	118	137	54	752
Santé-Social (**Health, Social**)	950	358	273	288	56	1 925
Sport-Loisir-Culture (**Sports, leisure, Culture**)	431	no data	325	190	13	959
Transport (**Transport**)	177	no data	183	31	17	408
TOTAL	6 141	1 568	3 541	1 403	1 036	**13 689**

Others: cooking and other uses of non-electrical process

Specific electricity : heating auxiliary, lighting and ventilation

They specify electricity accounts for 26% and heating for 45 % of the total tertiary energy consumption.

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Energy consumption by type of energy in GWh final energy		
	Heating only	**Total**
Wood	350	350
Coal	1	1
Electricity	1 121	7 077
Fuel	1 908	2 479
Gaz	2 716	3 687
District heating	47	47
Others	-	50
Total	6 141	**13 689**

The heating is mainly covered with gas (44%) and fuel (31%)

Energy efficiency indicators for residential sector

Average number of people in France				
1975	1982	1990	1999	2005
2,88	2,7	2,57	2,4	2,31

The average number of people in France per household is decreasing by 20% from 1975 to 2005 (no data found for PACA).

	Dwelling area single family m2	Dwelling area multi family m2	Share old dwellings	share single family	share old single family	Total construction of dwelling	Share of construction single family dwelling	demolition rate	litres_hh_day	GWh of electricity
	m2	m2	%	%	%	thousand	%	%	lt/hh-day	
France	105,93	79,36	0,606	0,564	0,343	330	0,57	0,0045	60	145 755
FR-PACA	106,00	64,00	0,58	0,420	0,400	26	0,46	0,12%	79	16 288

In Region PACA, the average area of the collective household is 20% less than the average in France

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PACA	Final energy consumption (kWh-EF/m²)				
	2 006	2 007	2 008	2 009	2 010
Heating	98	96	94	92	91
Hot water (excluding solar energy)	17	17	17	17	17
cooking	10	10	10	10	10
Specific électricity (including cooling)	25	26	26	26	26
Total	151	149	147	146	144

	Final energy consumption in TOE per dwelling				
PACA	2 006	2 007	2 008	2 009	2 010
Total	1,043	1,032	1,021	1,010	1,000
Heating only	0,676	0,664	0,652	0,641	0,630

Regarding the CERC study from 'Energie Demain', in the following years, the specific electricity is going to grow in percentage compared to the others energy consumption, as the total final energy consumption is decreasing.

Energy efficiency indicators for tertiary sector

Year 2006	Energy consumption in kWh final energy per m2					
	Heating	Cooling	Specific electricity	Hot Water	Others	**Total**
Bureau-administration (**Office, administration**)	29,8	9,3	20,8	1,9	0,6	62
Café-Hôtel-Restaurant (**Hotels, Café, Restaurants**)	13,4	3,5	5,9	5,1	7,7	36
Commerce (**Trade**)	12,5	5,8	13,4	2,7	5,0	39
Enseignement -recherche (**Education -research**)	12,9	0,3	3,1	2,7	1,3	20
Habitat Communautaire (**Community Housing**)	6,4	0,9	1,9	2,2	0,9	12
Santé-Social (**Health, Social**)	15,5	5,9	4,5	4,7	0,9	31
Sport-Loisir-Culture (**Sports, leisure, Culture**)	7,0	no data	5,3	3,1	0,2	16
Transport (**Transport**)	2,9	no data	3,0	0,5	0,3	7
TOTAL	100	26	58	23	17	**224**

Others: cooking and other uses of non-electrical process

Specific electricity : heating auxiliary, lighting and ventilation

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	Final energy consumption (kWh-EF/m²)				
	2 006	2 007	2 008	2 009	2 010
Heating	100	98	96	95	93
Hot water	23	23	22	22	22
Cooking	11	11	11	11	11
Cooling	26	26	26	26	25
Specific electricity	58	58	58	57	57
Others	6	6	6	6	6
Total	**224**	**221**	**219**	**216**	**214**

	Final energy consumption in TOE per employee				
PACA	2 006	2 007	2 008	2 009	2 010
Total	0,788	0,773	0,722	nd	nd

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4.3. Liguria (Italy)

Annual consumption in the Liguria Region is derived from the ENEA (Italian Agency for new technologies, energy and economic sustainable development) national balances related to the years 1990 to 2004, whereas, as for 2005, the regional consumption is based on SIRA (Liguria's Regional Environmental Information System). In order to draw up such a balance, data were gathered on the territory and the bottom-up system is used.

The general trend is above 3000 ktep, and only in 1999, values are below that value. In 2000, energy consumption was at its peak and reached more that 3500 ktep. If individual sectors are studied, what is apparent is that consumption in the housing sector and Service sector keeps increasing (except for 2005), whereas in the industrial sector, energy consumption has been stable for a few years, after decreasing steadily for a time.

Table 25: Final consumption values concerning the different sectors, Liguria Region [ktep]
Source: ENEA and SIRA

Sectors [ktep]	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
Housing	855	965	941	974	928	923	984	921
Agriculture and fisheries	58	59	77	78	69	74	81	76
Industries	919	858	921	1.032	1.026	1.020	924	1.037
Service sector	289	272	275	290	299	299	316	308
Transports	1.007	918	965	931	874	890	792	789
TOTAL	**3,127**	**3,073**	**3,179**	**3,305**	**3,196**	**3,205**	**3,097**	**3,131**
Sectors [ktep]	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005***
Housing	958	1.033	939	946	884	936	966	881
Agriculture and fisheries	84	91	86	86	91	45	35	56
Industries	1.211	755	968	872	1.063	815	811	847
Service sector	332	375	417	382	383	463	478	537
Transports	765	740	1.092	1.118	1.041	1.000	1.003	1.022
TOTAL	**3,349**	**2,995**	**3,502**	**3,404**	**3,462**	**3,259**	**3,293**	**3,342**

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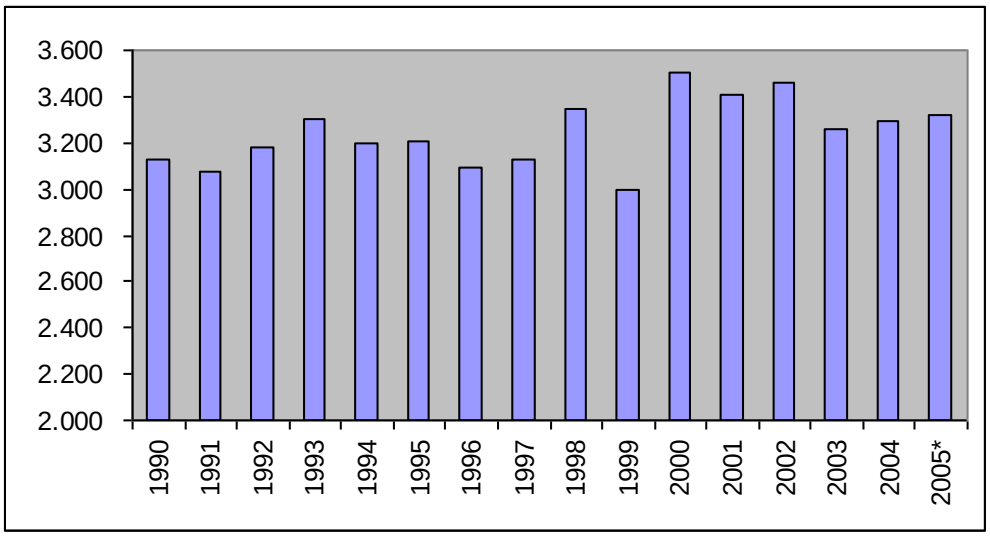

Figure 49: Final total consumption values, Liguria Region [ktep]
Source: ENEA and SIRA

As for 2005, the impact of the various sectors that have been identified by SIRA is as follows.

Table 26: Final consumption values subdivided by sector, year 2005
Source: SIRA

Sectors 2005	ktep	%
Agriculture and fisheries	56	1.7%
Housing	881	26.4%
Public Administration	45	1.4%
Service sector	469	14.0%
Industries	847	25.3%
Other public sectors	22	0.7%
Railways transport	1,002	30%
Railways transport	20	0.6%
TOTAL	**3,342**	**100%**

In 2005, the sector which used the largest amount of energy was the transport sector, followed by the housing sector, 26.4 %, and the industrial sector, 25.3 %. The Service sector's consumption (both public and private services) is 15.4 %. Therefore, the sector including housing, public administration and services uses an amount of energy equal to 41.8 %, if compared to the overall balance of the Liguria Region.

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Table 27: Final consumption of the housing and service sectors, Liguria Region [ktep]
Source: ENEA and SIRA

Sectors [ktep]	1990	1991	1992	1993	1994	1995	1996	1997
Housing	855	965	941	974	928	923	984	921
Services	289	272	275	290	299	299	316	308
TOTAL	**1,144**	**1,238**	**1,216**	**1,264**	**1,227**	**1,222**	**1,300**	**1,229**
Sectors [ktep]	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005***
Housing	958	1.033	939	946	884	936	966	881
Services	332	375	417	382	383	463	478	537
TOTAL	**1,290**	**1,409**	**1,356**	**1,328**	**1,267**	**1,399**	**1,444**	**1,417**

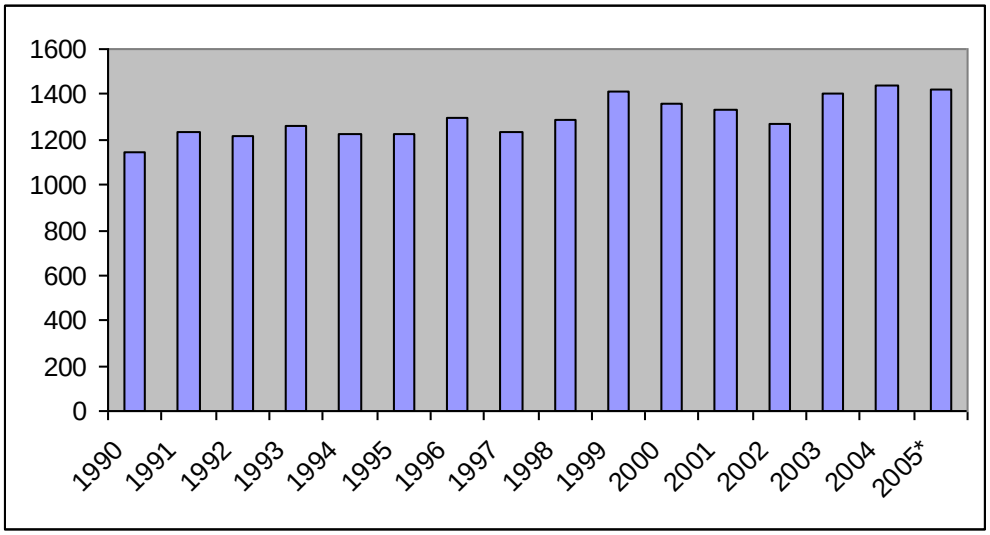

Figure 50: Final consumption values related to the housing and service sectors, Liguria Region [ktep]
Source: ENEA and SIRA

If the sector including housing, public administration and services is taken into consideration, what can be observed is an increase in consumption over the years. A peak in consumption was reached in 2004.

In the following table, different kinds of fuel, and their percentages of use, are listed. Natural gas is the most used fuel, followed by electricity.

Table 28 : Fuel consumption related to the housing and service sectors in 2005 – Source: SIRA

Fuels 2005	ktep	%
Vegetable fuels	6	0.4%
Gas oil	106	7.6%
LPG	47	3.4%
Natural gas	867	62.2%
Electricity	333	23.9%
Solar energy	1	0.04%
Fuel oil	35	2.5%
TOTALE	**1,395**	**100%**

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4.4. Piedmont (Italy)

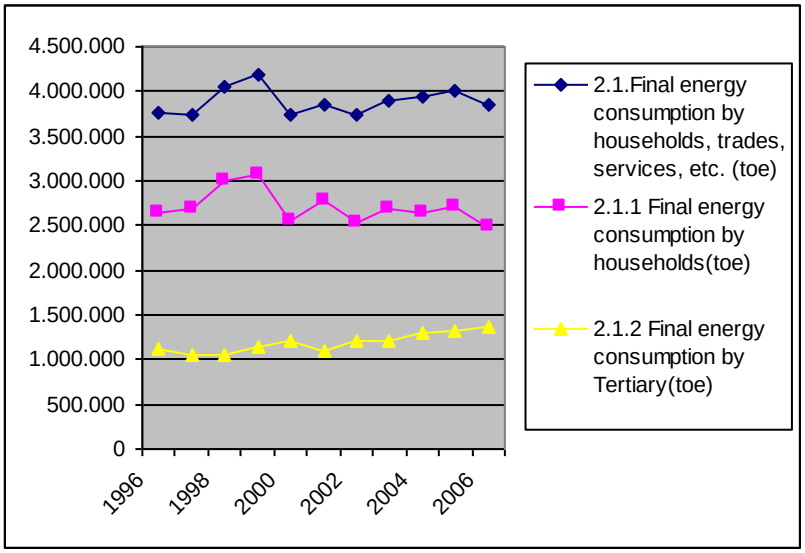
In order to estimate the energy performance of buildings, we need some data about the following indicators:

- Final energy consumption by households, trades, services, etc.
- Final energy consumption by households
- Final energy consumption by Tertiary

- Consumption of heating – Households
- Consumption of heating – Tertiary

These data are extracted from ENEA database. ENEA is the Italian National agency for new technologies, Energy and sustainable economic development and is responsible to collect data from each region. Unfortunately we have a limited collection of data and focused on the period 1996-2006.

In the following graph data about final energy consumption (toe) in region Piedmont are represented. We can notice that, for the tertiary, the growth is almost linear for the period 2002-2006. For household dwellings the trend is fragmented and has a peak value around 1999. Unfortunately we haven't the possibility to compare data between energy consumption and building construction trend.



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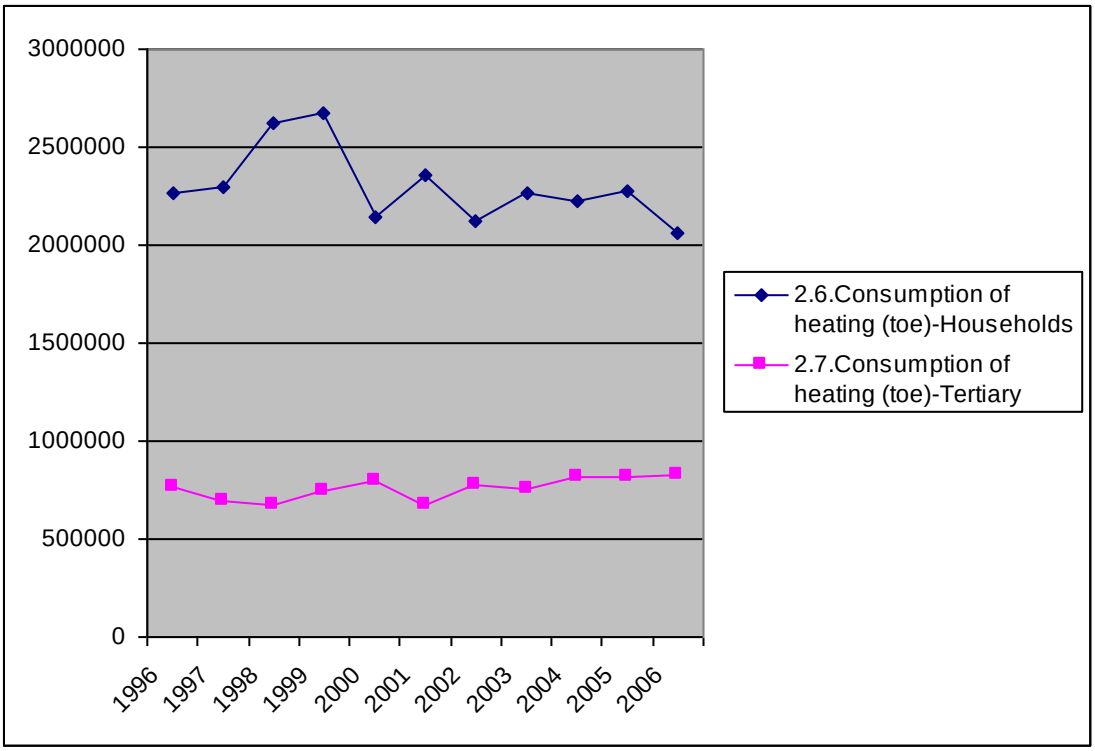
Another indicator able to estimate the energy performance of buildings is the consumption data for Households and tertiary. These data are also extracted from ENEA database and are referred to the period 1996-2006. Analyzing the graph below, we can see that, if for the tertiary the trend follows a Gaussian line, for the household field is different. In fact, in this case, the trend is not linear and knows a peak around 1999, the same year in which most energy consumption occurred.



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Other data are collected in order to improve the Regional Benchmarking Analysis. Starting from census data, it's possible to evaluate the total area for households.
In fact using an average value of area extracted to census 2001, it's possible to obtain the total area multiplying for the number of dwellings.

In conclusion the total area of households in region Piedmont is 159.952.677 mq (census 2001).

3.Others	Area floor	Area type	Units	2001
3.2.total area of households(m2)		**net floor**		159.952.677
3.2.1 total area of households(m2)-case 1.1.1.		net floor	mq	33.242.523
3.2.2. total area of households(m2)-case 1.1.2+1.1.3.		net floor	mq	126.710.154

For the tertiary, we have data extracted from the national tax office (Agenzia delle Entrata) updated to the period 2006-2009 and referred to three different typologies:

- office and commercial buildings
- educational buildings
- hospitals

As shown in the graph below, we notice that the trend for hospitals doesn't undergo substantial changes between 2006-2009, maybe due to the great financial investment that they require.

For educational buildings the growth is linear as opposed to office and commercial buildings, after a growth in 2006-2008 period the trend is decreasing

3.Others	2006	2007	2008	2009
3.3.total area of tertiary(m2)				
3.3.1.total area of tertiary(m2) case 1.2.1.	34.677.282	35.836.880	37.121.992	36.380.281
3.3.2.total area of tertiary(m2) case 1.2.2.	27.356.795	28.076.336	28.298.917	29.854.963
3.3.3.total area of tertiary(m2) case 1.2.3.				
3.3.4.total area of tertiary(m2) case 1.2.4.	10.247.002	10.718.796	10.909.447	11.128.568
3.3.5.total area of tertiary(m2) case 1.2.5.				
3.4.total area of space heating (m2)-households				
3.5.total area of space heating (m2)-tertiary				
3.6. Total area of space cooling (m2)-households				
3.7. Totak area of space cooling(m2)-tertiary				
3.8.number of employees -Tertiary				

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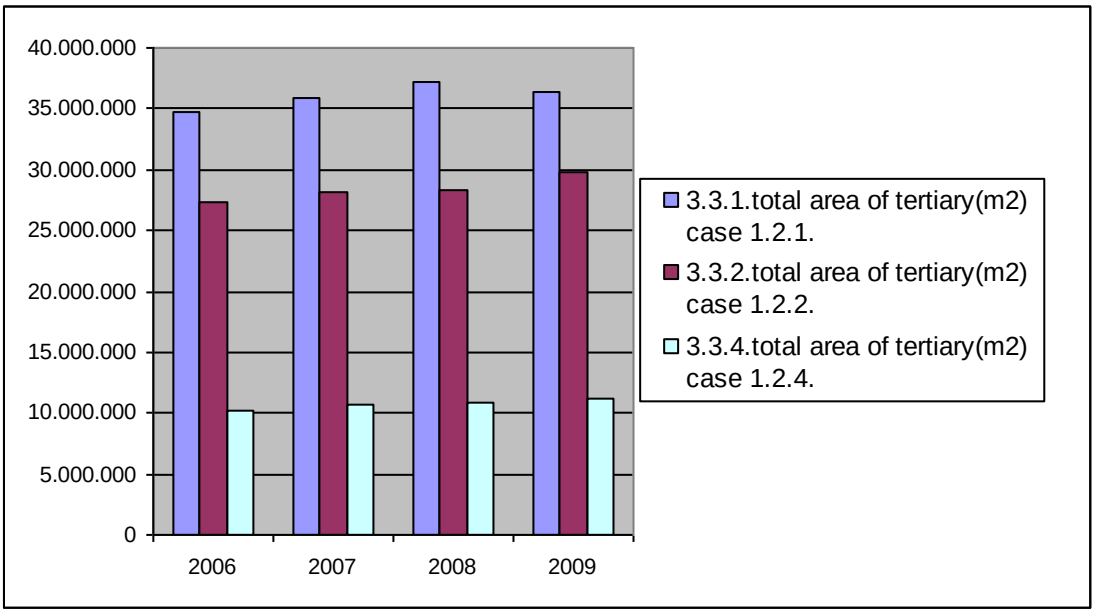

To analyze energy Efficiency indicators, we have data only for heating consumption extracted to Regional Action Plans 2009, an official document about regional energy balance (resolution of the regional council n. 30-12221 of 28-09-2009). The value of heating consumption is 151.5 kWh/mq until 2008. It's important to underline that this value is an average between 180 e 140 kWh/mq, values deducted from studies/ literature and not from a real monitoring on site.

Considering the application of regional legislation it's possible to hypothesize a reduction of 15% before 2020. So, in order to fill heating consumption data in excel worksheet for each year, we obtained an annual reduction of –1.2%.

4.Energy Efficiency Indicators **4.1.Residential**	2006	2007	2008	2009	2010
4.1.1.Consumption per dwelling					
4.1.1.1Consumption per dwelling -case1.1.1.					
4.1.1.2Consumption per dwelling -case1.1.2.+1.1.3.					
4.1.2.Cons. per dwelling for elec. Appliances					
4.1.2.1.Cons. per dwelling for elec. Appliances-case 1.1.1.					
4.1.2.2.Cons. per dwelling for elec. Appliances-case 1.1.2.+1.1.3.					
4.1.3.Cons. per dwelling for lighting					
4.1.3.1.Cons. per dwelling for lighting-case 1.1.1.					
4.1.3.2.Cons. per dwelling for lighting -case 1.1.2.+1.1.3.					
4.1.4.Cons. per m² for lighting					
4.1.4.1.Cons. per m² for lighting-case 1.1.1.					
4.1.4.2.Cons.per m² for lighting -case 1.1.2.+1.1.3.					
4.1.5.Consumption per dwelling for heating					
4.1.5.1.Consumption per dwelling for heating-case 1.1.1					
4.1.5.2.Consumption per dwelling for heating-case 1.1.2.+1.1.3.					
4.1.6.Consumption of per m² for heating	151,5	151,5	149,7	147,9	146,1
4.1.6.1.Consumption of per m² for heating-case 1.1.1.					
4.1.6.2.Consumption of per m² for heating-case 1.1.2.+1.1.3					
4.1.7. Consumption per dwelling for cooling					
4.1.7.1. Consumption per dwelling for cooling - case 1.1.1					
4.1.7.2. Consumption per dwelling for cooling - case 1.1.2 + 1.1.3					
4.1.8. Consumption of per m² for cooling					
4.1.8.1. Consumption of per m² for cooling - case 1.1.1					
4.1.8.2. Consumption of per m² for cooling - case 1.1.2 + 1.1.3					

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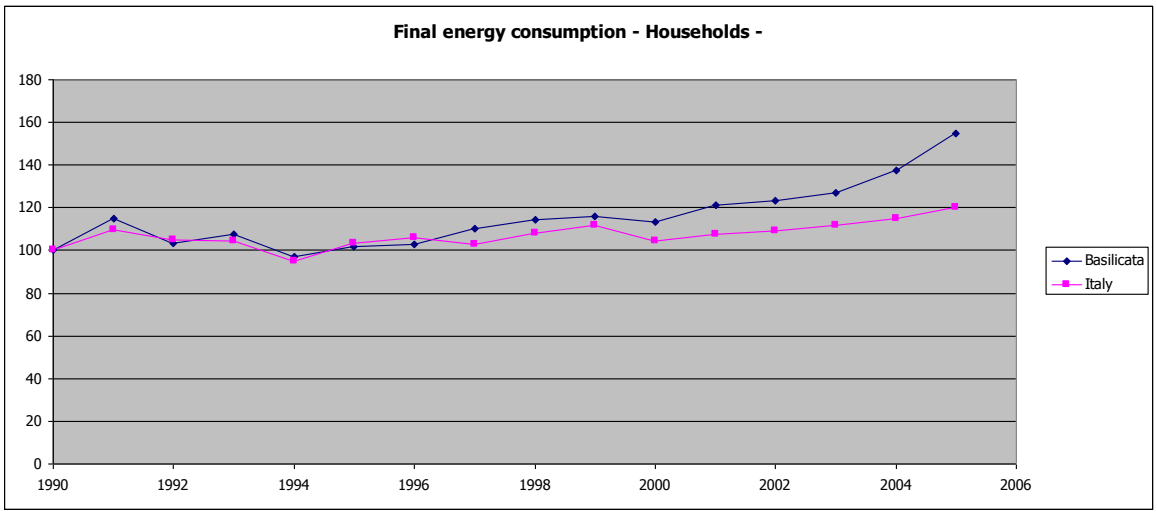
4.5. Basilicata (Italy)

In Basilicata, the residential sector represents 16% (186 ktoe) of final energy consumption in the region, but only 0.6% of the Italian residential consumption. From 1990 to 2005 the sector showed a growth in consumption by 38% from 135 ktoe to 186, compared to national development in which the residential consumption for the same period have increased by 23% (from 25,117 to 30,835 ktoe). The following figure shows the growth, in percentage, of the energy consumption of sector at regional and national levels.

The mix of primary and secondary energy sources used in this field shows a fairly constant trend, with the exception of natural gas which has absorbed the growth of energy demand in the sector rising from 92 ktoe in 1999 to 120 ktoe in 2005 (+30%). In particular, in 2005, natural gas has satisfied the residential sector consumption for 64%, electricity for 24%, oil products by 8% and 4% for renewables. A mix very similar to the national and differs from it for a lower weight percentage of fuel oil and a more weight percentage of electricity.

Also interesting is the trend of electricity consumption in the residential sector (+9%) and their distribution within the province. In particular, from 1999 to 2005 the electricity consumption of households increased by almost 8% in the province of Potenza (from 308 to 342 GWh) and almost 11% (from 164 to 182 GWh) in the province of Matera. In addition, it is clear the prevalent electricity consumption attributable to the province of Potenza (65%) than the province of Matera (35%).



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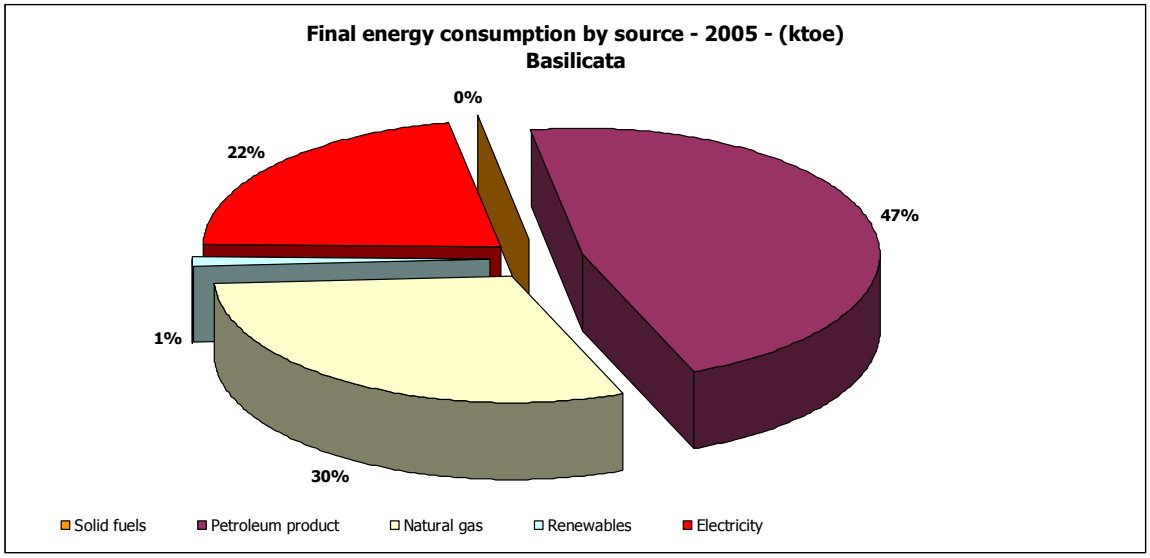

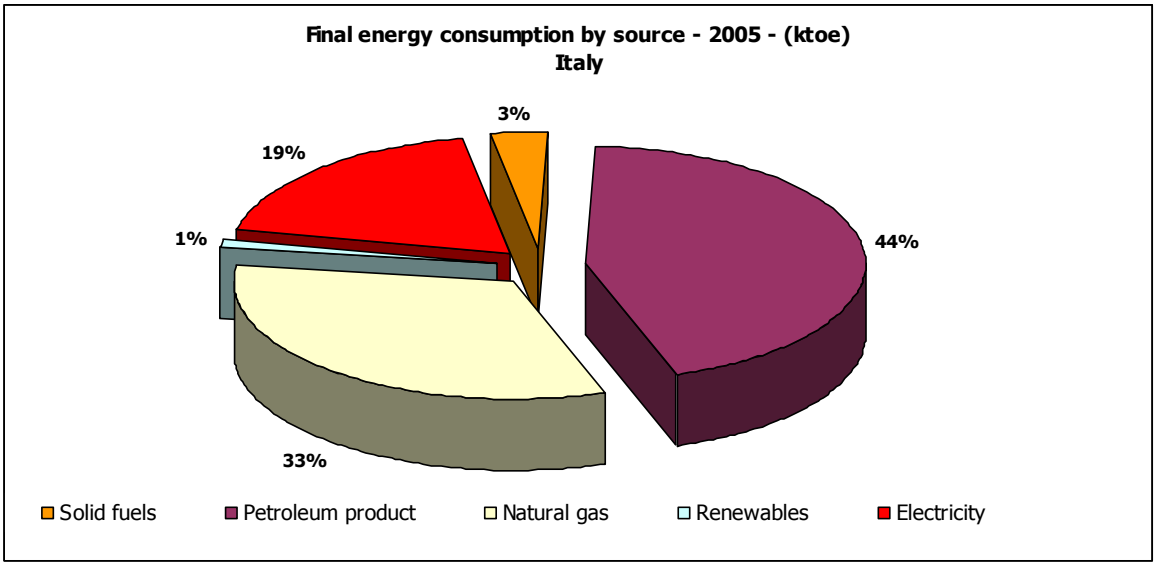

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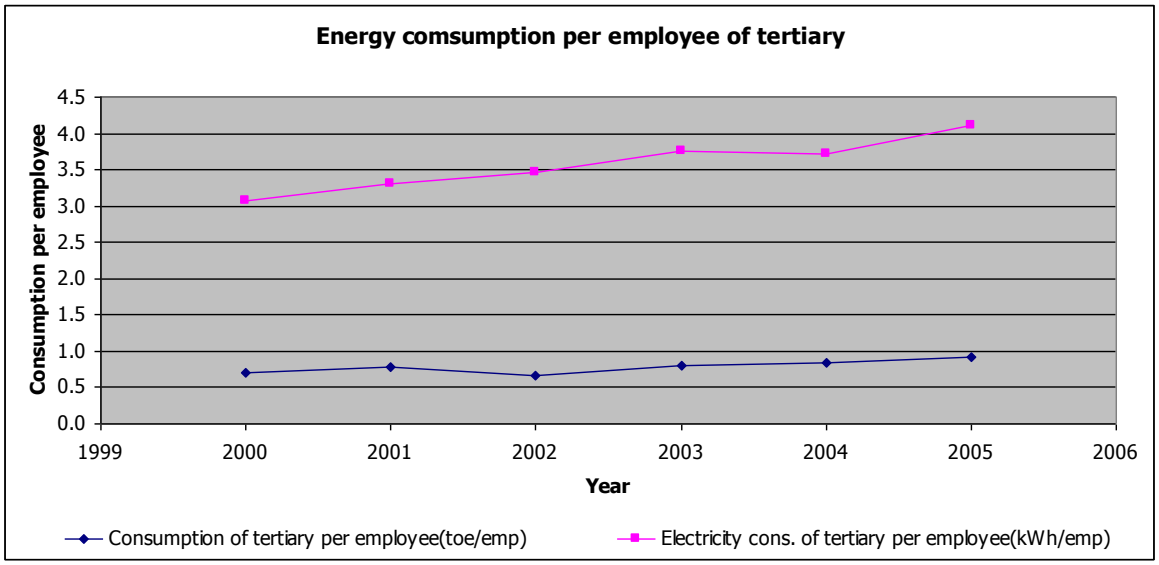

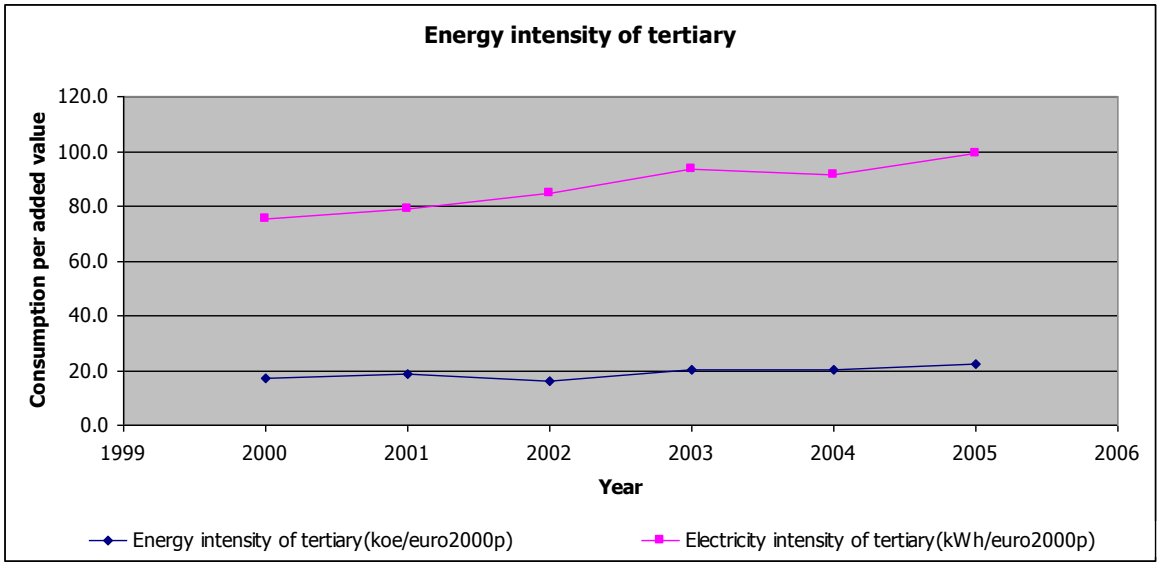

Table with relevant indicators

Regional dwellings indicators						
	Basilicata			Italy		
	2008	**2009**	**Var 2008 - 2009**	**2008**	**2009**	**Var 2008 - 2009**
Total area of dwellings (millions of square meters)	33.6	34.4	2.33%	3 714.3	3 781.8	1.78%
Average area of dwellings (square meters/dwelling)	101.0	101.5	0.49%	114.0	114.4	0.35%
Average area by inhabitants of dwellings (square meters/inhabitant)	57.0	58.4	2.40%	62.0	62.7	1.12%

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Final energy consumption - Households - (ktoe)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Basilicata	135	156	140	146	132	138	140	150	155	157	154	164	167	172	186	210
Italia	24 680	27 105	25 843	25 825	23 405	25 466	26 108	25 430	26 660	27 525	25 711	26 613	26 943	27 560	28 411	29 680

Final consumption of electric energy - Households - (ktoe)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Basilicata	35	36	37	37	38	38	38	39	39	41	41	41	42	44	44	44
Italy	4 535	4 702	4 794	4 851	4 904	4 921	4 986	5 029	5 098	5 222	5 256	5 294	5 414	5 581	5 727	5 756

Final energy consumption by source - 2005 - (ktoe)

	Solid fuels	Petroleum product	Natural gas	Renewables	Electricity	Total
Basilicata	0	467	300	13	218	**999**
Italy	4 527	58 520	43 403	1 341	25 279	**133 069**

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4.6. Western Macedonia (Greece)

Energy consumption data are only available at national level, and can be found in EUROSTAT and in the ODYSSEE national report for Greece, published by CRES in September 2009. The following table and figure show the energy consumption trends in households and the tertiary sector at national level, based on the EUROSTAT data.

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Table 29: Energy consumption trends in households and the tertiary sector in Greece
Source: EUROSTAT

Energy Consumption	Data available	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Final energy consumption (total) (ktoe)	normal climate	14597	14910	14990	15030	15337	15712	16812	17288	18178	18116	18563	19166	19517	20546	20328	20821	21425	21937	21256	20544
Final energy consumption in households, trades, services, etc. (ktoe)	normal climate									6491	6549	6904	7282	7596	8400	8281	8577	8737	8608	8522	7865
Final energy consumption by households (ktoe)	normal climate	3049	3137	3166	3149	3199	3324	3938	4077	4214	4233	4486	4702	4898	5488	5399	5497	5490	5377	5212	4848
Final energy consumption by Tertiary (ktoe)	normal climate	651	732	770	812	880	937	1020	1095	1195	1236	1310	1470	1541	1666	1778	1939	2075	2134	2216	2143

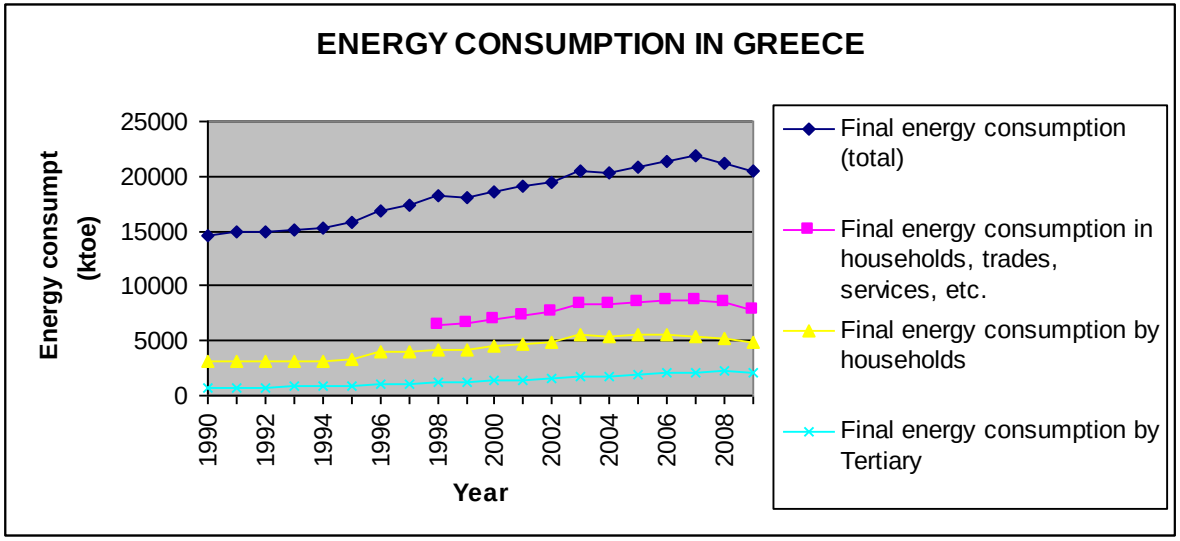

Figure 51: Energy consumption trends in households and the tertiary sector in Greece
Source: EUROSTAT

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According to the Energy Outlook of Greece report of the Ministry of Development (February 2009) the final energy consumption in Greece increased by 50% between 1990 and 2006 and this is due to the good state of the Greek economy during this period. From 1995 onwards, the Greek economy showed a significant improvement in various economic development indicators. Thus between 1995 and 2006, the development of the GDP was about 3.9% per year. The demand for electricity in Greece increased at a fast rate from 1990 onwards. The main increase is in the domestic and tertiary sector. Specifically, in 2006, the tertiary sector was the biggest consumer of electricity in Greece with a yearly consumption of 17.7 TWh. This is a percentage increase of about 21.6% compared to 1990 levels, when consumption by the tertiary sector was just 5.6 TWh.

According to the National Energy Efficiency Action Plan (NEEAP) of Greece (June 2008), the residential sector accounted for 32% of the average final energy consumption in Greece during the years 2001-2005, having the highest energy consumption after the transport sector. Also, the tertiary sector accounted for 11% of the average final energy consumption in Greece during the years 2001-2005.

According to the ODYSSEE report, since 1990, the final energy consumption in households in Greece has increased by 72% from 3.1 Mtoe in 1990 to 5.3 Mtoe in 2007, leading to a 42% total growth in household energy consumption and a 3.1% increase of households' energy share. Nevertheless, as opposed to industry and agriculture, the energy consumption of which remains almost constant and near 1990 levels, **the most rapidly growing sector in terms of energy consumption has been the tertiary sector**. The energy consumption of the tertiary sector has almost tripled from 0.7 Mtoe in 1990 to 2.1 Mtoe in 2007, following an average growing trend of 6.7% per year. As a result, the energy share of the tertiary sector was 9.7% in 2007 against 4.4 % in 1990.

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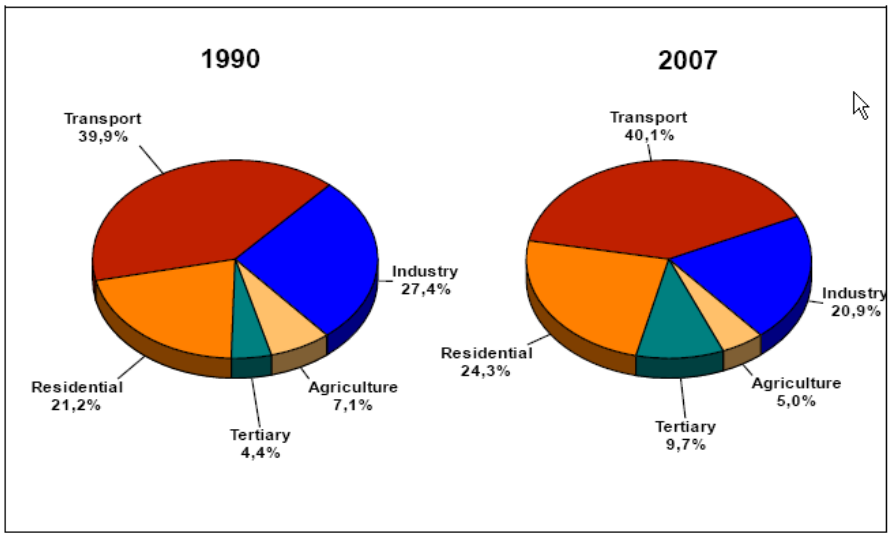

Figure 52: Share of Final Energy Consumption by Sector in Greece (1990 vs 2007)
Source: Monitoring of Energy Efficiency in EU 27, Norway and Croatia (ODYSSEE-MURE)

The above growing trends are mainly related to the following:

- Increase in oil consumption by 74.9% of households (1.5 Mtoe in 1990 to 2.6 Mtoe in 2007)
- A major increase in electricity consumption of households; electricity consumption of households almost doubled since 1990 (0.78 Mtoe in 1990 to 1.5 Mtoe in 2007)
- A major increase in oil consumption of the tertiary sector (0.21 Mtoe in 1990 to 1.6 Mtoe in 2007)
- Increase in electricity consumption of the tertiary sector (0.48 Mtoe in 1990 to 1.6 Mtoe in 2007)
- Since 1998, with the introduction of natural gas in the energy mix, the final consumption in natural gas of both households and the tertiary sector has rapidly increased and this rapidly growing trend is expected to be sustained in the near future.

The development of market shares in energy consumption sectors in Greece is typical for an economy in post industrial development which is oriented towards a service economy where industry is significantly reduced and the residential along with the tertiary sector gradually develop their corresponding shares. The contribution of these sectors to the GDP confirms this increase while correspondingly tourism is the main profitable activity of the country[48].

[48] The contribution of industry to the GDP of Greece is 12% and that of the tertiary sector is around 66%

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According to the ODYSSEE report, the largest part of final energy consumption in households is for space heating. Households in 2007 consumed 3.7 Mtoe for space heating against 2.2 Mtoe in 1990; namely a 63% total growth in energy consumption for space heating. The amount of energy consumed by electric appliances and lighting has almost tripled since 1990 and the energy share has been increased by 7.7%. The energy consumption for cooking remains almost constant and near 1990 levels, therefore the energy share has decreased by 4.1%. Since 1990, the specific energy consumption of most large appliances has decreased, due to sensitivity of consumers in energy efficiency issues. The biggest reduction in specific consumption is shown in washing machines (23.6% reduction since 1990). On the contrary, the amount of energy consumed by TV sets has increased from 228 ktoe in 1990 to 286 ktoe in 2007 and the energy share has been increased by 4.3%.

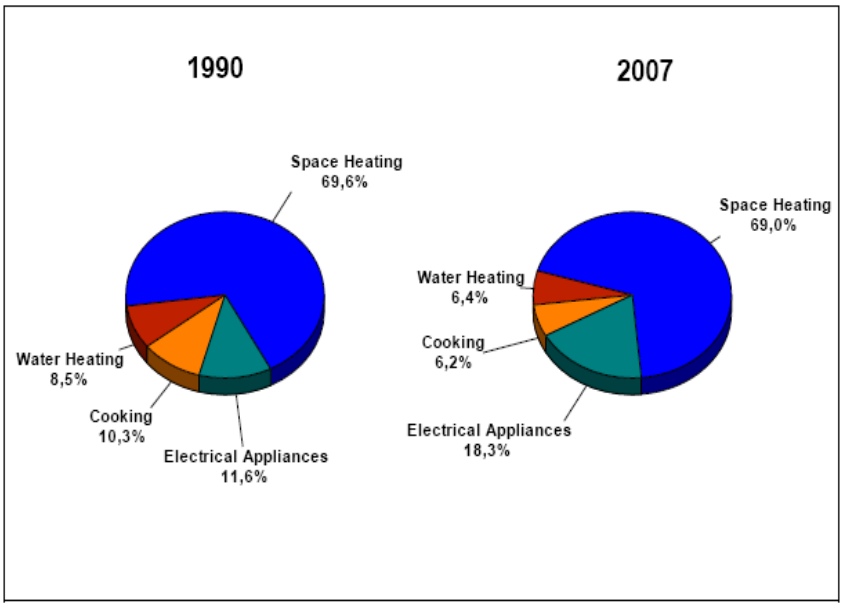

Figure 53: Share of Final Energy Consumption by Energy Use in Households in Greece (1990 vs 2007)

Source: Monitoring of Energy Efficiency in EU 27, Norway and Croatia (ODYSSEE-MURE)

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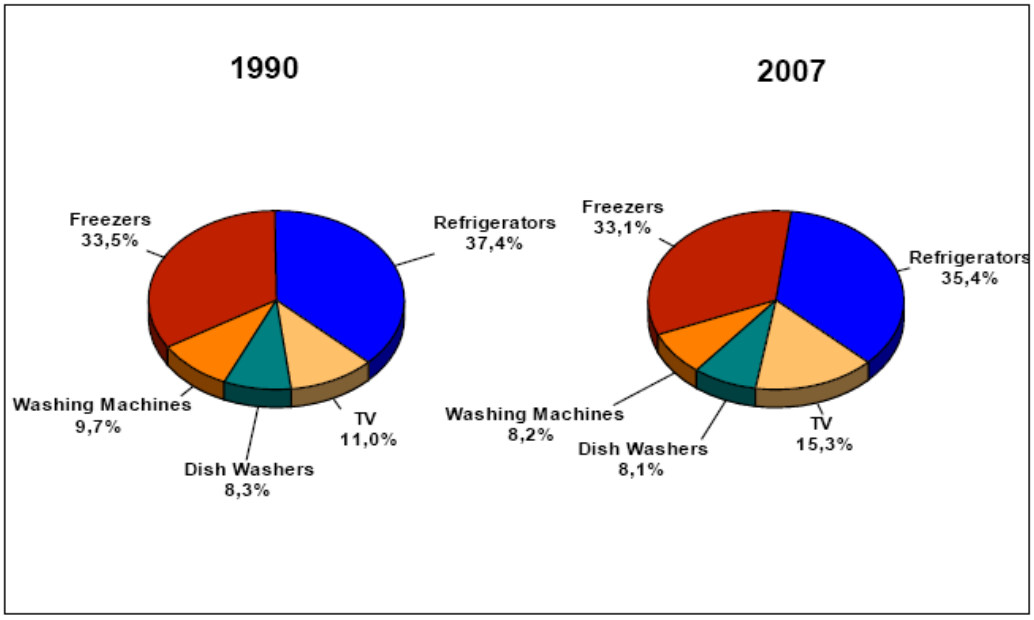

Figure 54: Share of Specific Consumption of Large Appliances in Greece (1990 vs 2007)

Source: Monitoring of Energy Efficiency in EU 27, Norway and Croatia (ODYSSEE-MURE)

The typical characteristic for the tertiary sector in Greece during the period 1990-1998 was the continuously increasing of energy and electricity intensity. In the tertiary sector, the unit energy and electricity consumption per employee has almost doubled since 1990, following an average increase of 3.7% and 4.1% respectively, as shown in the following figures.

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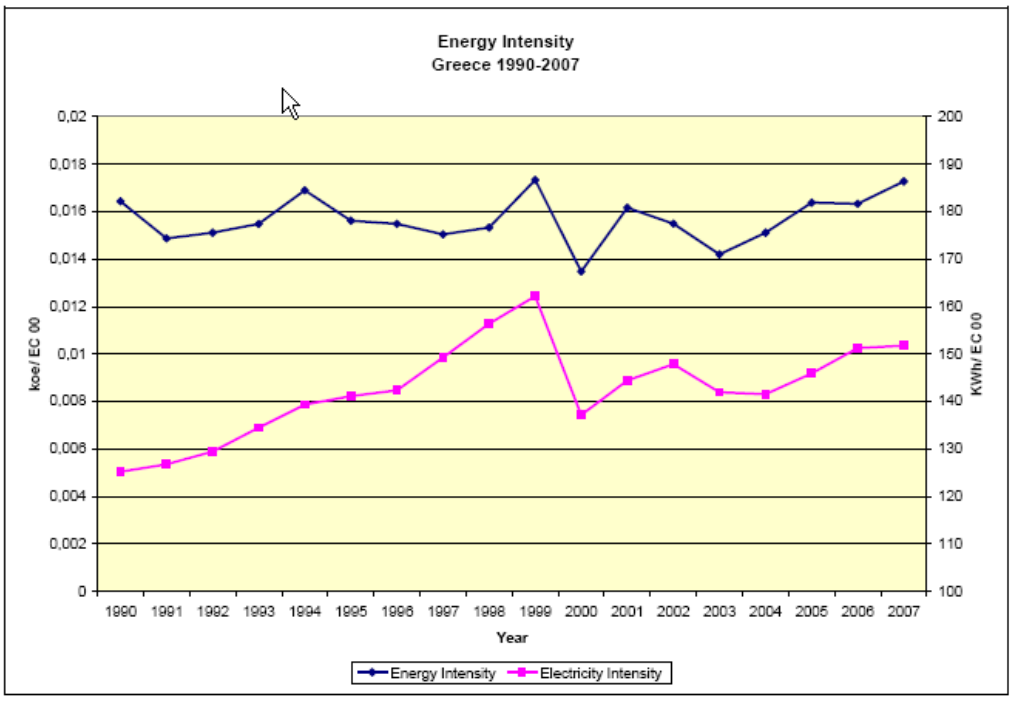

Figure 55: Energy Intensity in Tertiary Sector in Greece (1990-2007)
Source: Monitoring of Energy Efficiency in EU 27, Norway and Croatia (ODYSSEE-MURE)

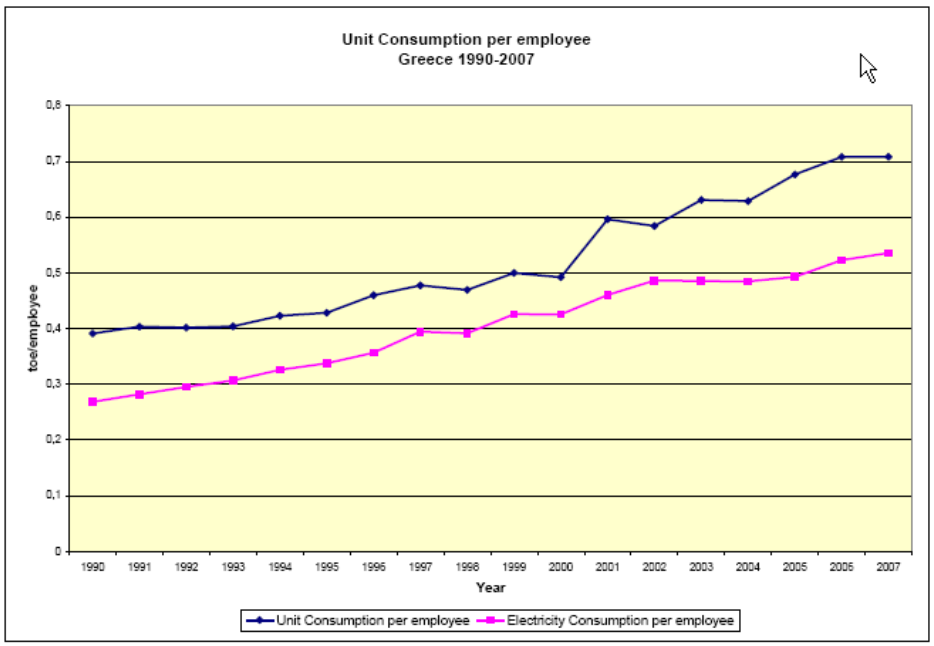

Figure 56: Unit Consumption per employee of Tertiary Sector in Greece (1990-2007)
Source: Monitoring of Energy Efficiency in EU 27, Norway and Croatia (ODYSSEE-MURE)

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A special feature of the Greek electricity system is the type of peak load which occurs in the middle of the day in the summer months, especially in the month of July. The transfer of the peak load from the winter to the summer months began in 1992 and is due to the increased use of air conditioners, which is related to the increase in the average income of consumers and the change of the climatic conditions in urban areas.

The following Table presents the national target for energy saving in the residential and tertiary sector, calculated according to the methodology of the Directive 2006/32/EC and presented in the first National Energy Efficiency Action Plan (NEEAP) of Greece (June 2008).

Table 30: Energy consumption reference and saving targets
Source: National Energy Efficiency Action Plan (NEEAP) of Greece (June 2008)

Sector	Average 2001-2005			Saving target 2010 (GWh)	Saving target 2016 (GWh)
	Conventional fuels and RES (TWh)	Electricity (TWh)	Total (TWh)		
Residential	42.9	16.1	59.0	1679	5533
Tertiary	4.6	14.9	19.5	1529	5715

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Data for energy efficiency indicators are available for Greece by ODYSSEE, and are presented in the following table and figures. The assumption is made that the same energy efficiency indicators apply in average also for the Region of Western Macedonia.

Table 31: Energy Efficiency Indicators for Greece (1990 – 2008)
Source: ODYSSEE

Residential													
Energy Efficiency Indicators	**Units**	**Data available**	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008
Consumption per dwelling	toe/ dw	normal climate	0,98	0,98	1,18	1,24	1,32	1,33	1,39	1,35	1,31	1,38	1,36
Cons. per dwelling for elec. appliances including lighting	kwh/ dw	normal climate	1230	1607	2318	2363	2523	2688	2771	2820	2926	2960	2992
Consumption per dwelling for space heating	toe/ dw	normal climate	0,76	0,66	0,82	0,86	0,94	0,92	0,97	0,95	0,9	0,94	0,93
Consumption of per m² for space heating	koe/ m2	normal climate	8916	7714	9628	10166	11043	10825	11464	11147	10536	11082	10914
Tertiary													
Energy Efficiency Indicators	**Units**	**Data available**	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008
Consumption of tertiary per employee	toe/ emp	normal climate	0,41	0,44	0,47	0,58	0,58	0,57	0,61	0,63	0,65	0,7	0,74
Electricity consumption of tertiary per employee	kWh/ emp	normal climate	3122	3925	4947	5352	5655	5645	5635	5731	6080	6230	6458
Energy intensity of tertiary	koe/ euro2005p	climate corrected	0,014	0,013	0,011	0,013	0,012	0,011	0,012	0,012	0,012	0,012	0,012
Electricity intensity of tertiary	kWh/ euro2005p	climate corrected	118	123	111	119	119	101	104	99	98	103	104

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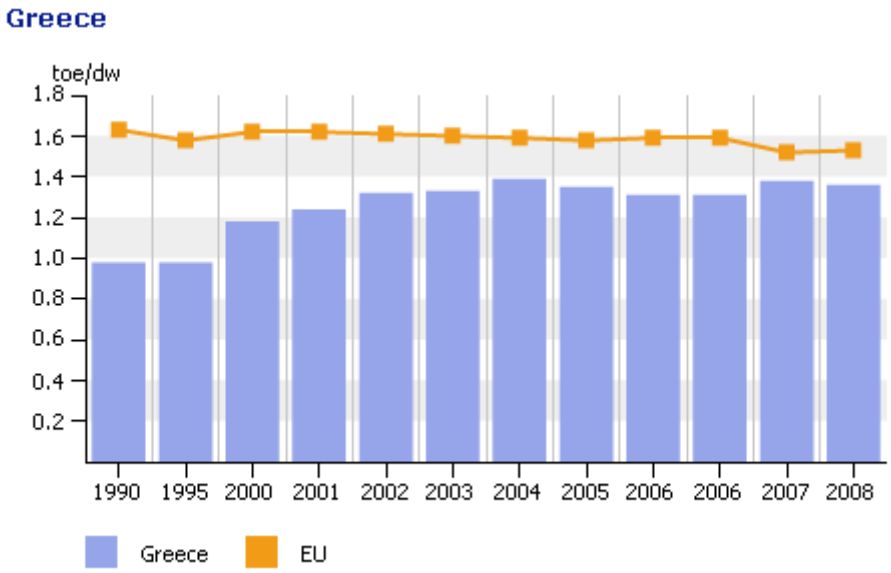

Figure 57: Energy consumption of households per permanently occupied dwellings in Greece, calculated at normal climate
Source: ODYSSEE

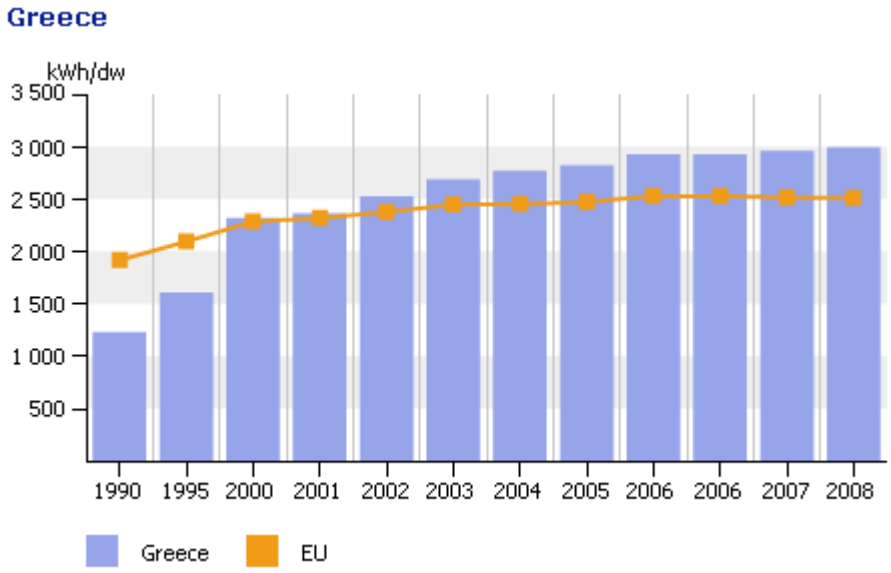

Figure 58: Consumption for electrical appliances and lighting per permanently occupied dwellings in Greece (apart from space heating, water heating and cooking)
Source: ODYSSEE

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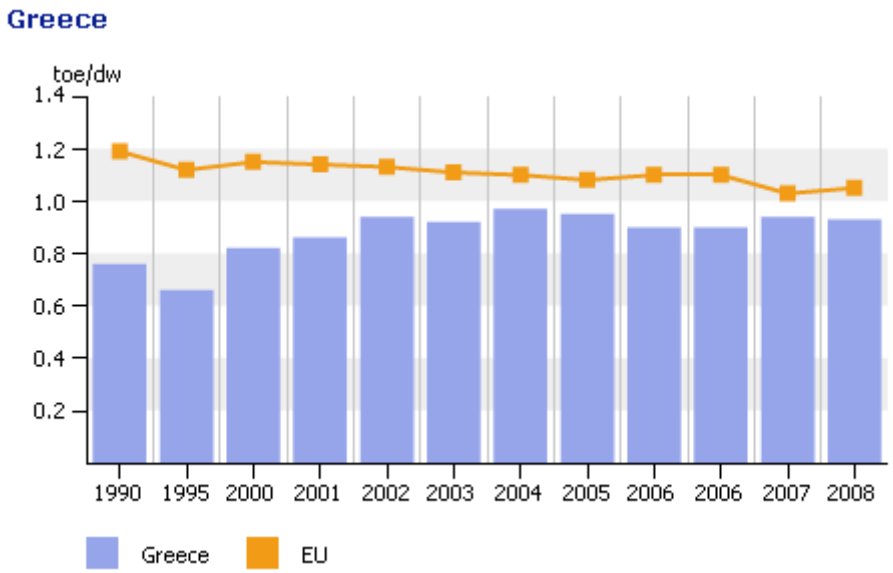

Figure 59: Energy consumption of households for space heating at normal climate per permanently occupied dwellings in Greece
Source: ODYSSEE

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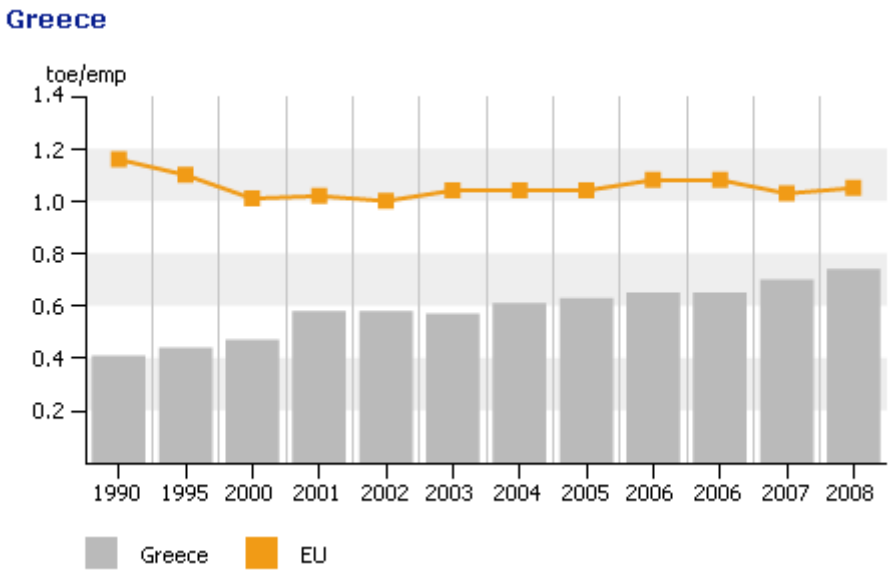

Figure 60: Final energy consumption of tertiary sector per employee in Greece
Source: ODYSSEE

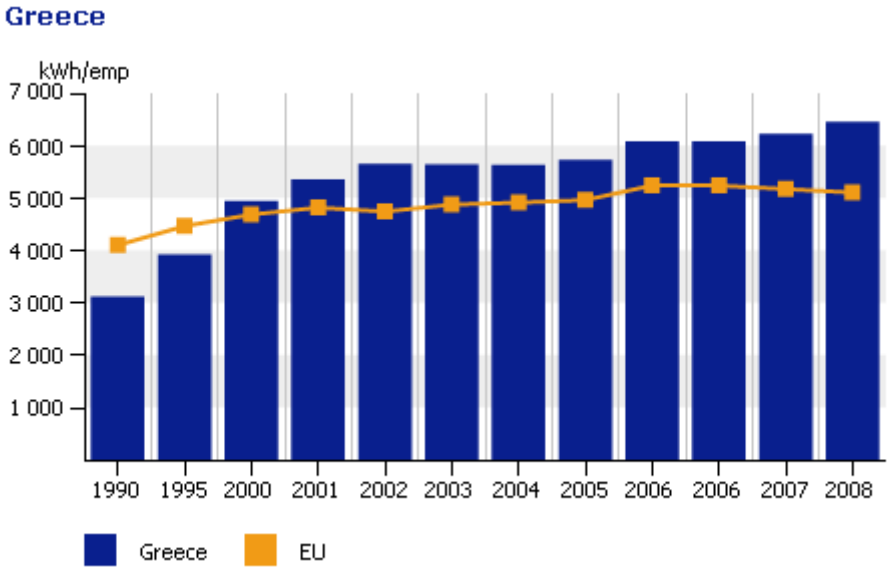

Figure 61: Electricity consumption of tertiary sector per employee in Greece
Source: ODYSSEE

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4.7. Primorsksa (Slovenia)

In final energy consumption of Slovenia in 2005, manufacturing and construction accounted for 35%, transport for 31%, and other sectors, together with the residential sector, for 34%. The share taken by industry and transport is rising at the expense of other sectors.

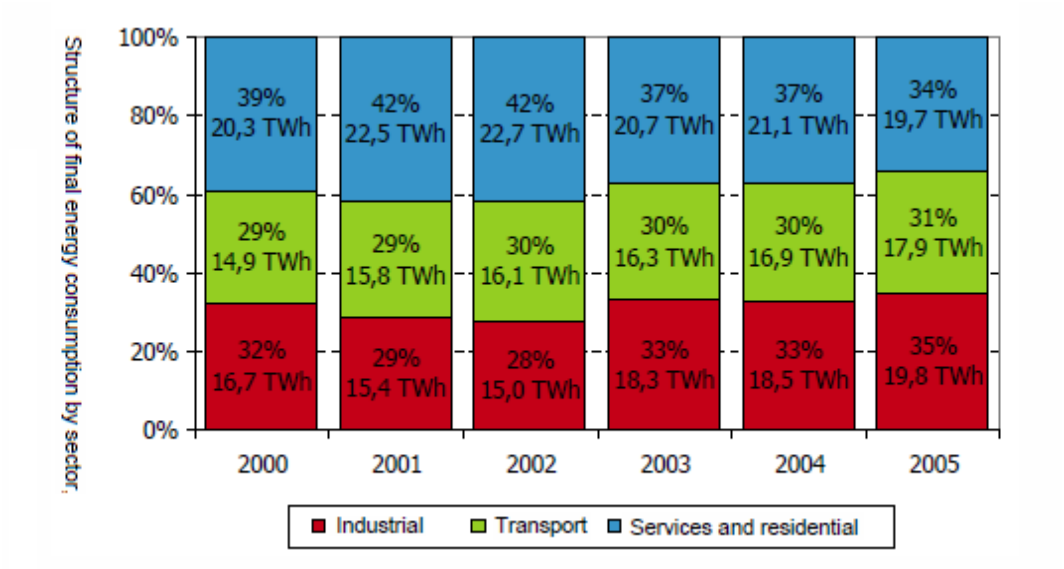

Figure 62: Structure of final energy consumption by industrial, transport and services and residential sector
(National energy efficiency action plan 2008–2016)

Slovenian households consume around 20% of final energy, including the processing activities and construction, just over a half. Apart from electricity generation and transportation, they are estimated as being the biggest consumers of primary energy.

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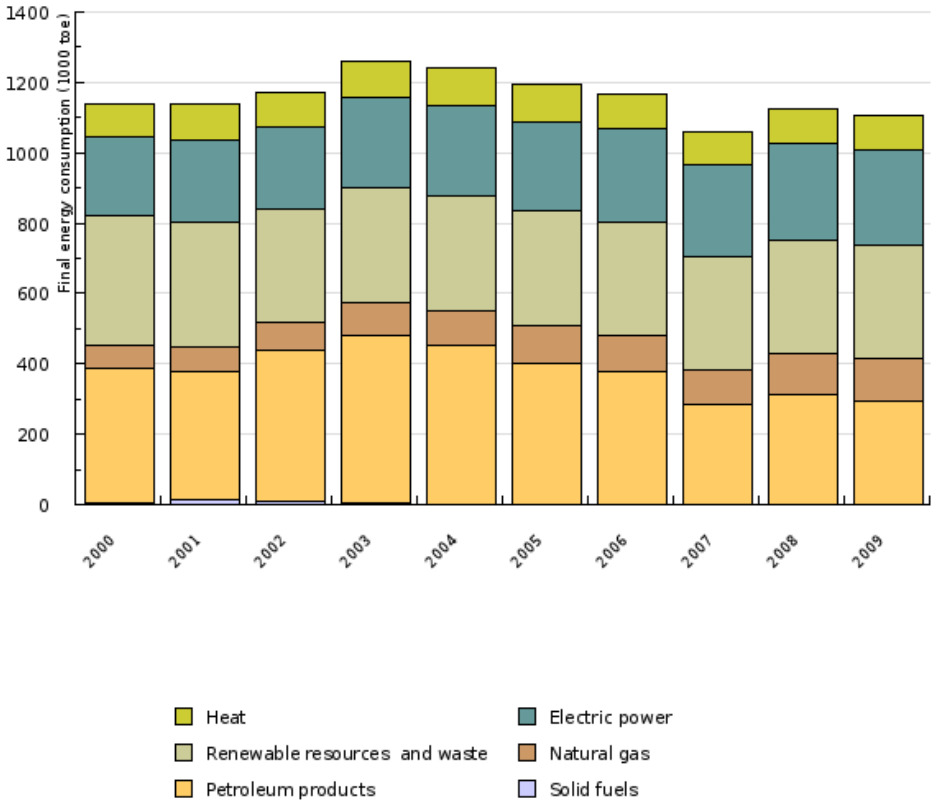

Figure 63: Structure of final energy and fuel use in households

The growth of final energy consumption in households was in the period from 1997 to 2003. Final energy consumption in households has been decreasing since 2003, mainly on account of petroleum products, consumption of which fell by 40% in 2007 compared to 2003, when consumption was the highest. Reduced use of light fuel oil in 2007 was most likely a consequence of the growing prices and consequently postponed purchase of fuel. After 2003, consumption of other types of energy has been more or less the same. In this period, some fluctuations were noted only with regard to natural gas and heat. In 2007, a million toe (ton of oil equivalent) of energy from various energy sources were consumed for the supply of households, 31% of which were from renewable sources (including hydroelectric power plants) and waste, 27% from petroleum products, 25% from electric energy, and 9% from natural gas and heat with the same share.

According to the latest data available (SURS 2002), Slovenian households consume most of the final energy for space heating (53%), cooking (25%), and water heating (13%).

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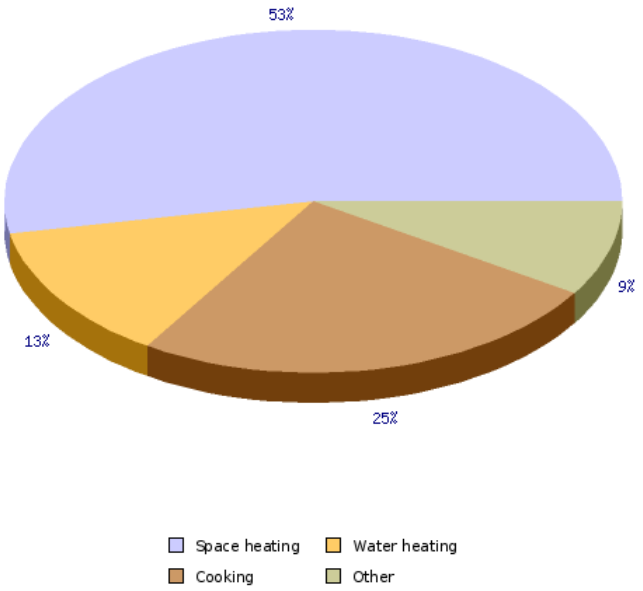

Figure 64: Structure of final energy and fuel use in households

The main increase in household's appliances happened in the period from 1997 to 2007 by 12% of refrigerators, 7% of independent freezers, 11% of washing machines, 140% of dishwashers and 12% of TV sets.

58% of the dwellings use centralized heating system, while 20% benefit from district heating networks. Space heating is prevailing in energy consumption in households (27.4 PJ/year), followed by electricity consumption (10 PJ/year) and DWH (6.7 PJ/year).

The main energy sources for district heating are coal (63.5%) and natural gas (32.7%). In the commercial sector, there is less biomass and more district heating systems, while in office buildings, heating is often combined with cooling by using fan coil units.

The share of air-conditioned dwellings in 2002 was 3%, but this amount was quickly increasing, reaching about 14% (more than 100,000 dwellings) in 2006. The annual electricity consumption in residential buildings is 48 kWh/ m2 and has been quite constant in the last years. New commercial office buildings are mainly equipped with centralised fan coil water cooling systems, while compact split systems are often used for the commercial building stock (Market Report for Small and Medium-Sized Solar Air-Conditioning Appliances Analysis of Market Potential, SOLAIR)

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On the basis of our experience, studies and analysis which GOLEA carried out, it results that public buildings are a big consumers of energy as major part of these structures were built in the period when legislation and construction standards were not so well-defined as they are nowadays. In Slovenia the average energy consumption of public buildings owned by municipalities is very high between 150 and 200 kWh/m2, in some cases even higher.

Most of these buildings are equipped with expensive heating systems on fossil fuels, primarily heating oil or Liquified Petroleum Gas. The interest for the refurbishment of these buildings is low as there is a lack of municipal financial sources, financial funding sources and knowledge on benefits of refurbishment actions.

The average energy consumption of Slovenia dwellings built within the period from 1915 to 2001:

Year	**1918**	**1919-1945**	**1946-1960**	**1961-1970**	**1971-1980**	**1981-1990**	**1996-2000**	**2001**
Energy number	200	200	200	150	140	120	80	70

The average overall specific energy consumption in dwellings is 237 kWh/m2, among that 175 kWh/m2 for heating, 32 kWh/m2 year for hot water heating and 11 kWh/m2/year for cooking.

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4.8. Malta

The values for Final energy consumption by households, trades, services, etc. (toe) were obtained from the data provided by Eurostat, part of the table reproduced below. The values for Malta are highlighted.

Final energy consumption by households, trades, services, etc. 1000 toe geo\time	**1998**	**1999**	**2000**
European Union (27 countries)	457767	453816	449373
Euro area (EA11-2000, EA12-2006, EA13-2007, EA15-2008, EA16-2010, EA17)	291898	289140	287846
Euro area (17 countries)	307140	304452	303251
Euro area (16 countries)	305757	303162	301976
Belgium	14673	14101	13638
Bulgaria	3320	3167	3124
Czech Republic	9929	10142	10185
Denmark	7311	7172	6966
Germany (including former GDR from 1991)	102354	96866	95595
Estonia	1383	1290	1274
Ireland	3885	4015	4174
Greece	6491	6549	6904
Spain	18709	20061	21150
France	65135	66033	66637
Italy	42044	43695	42490
Cyprus	304	316	341
Latvia	2182	2060	1921
Lithuania	2156	2048	1911
Luxembourg	744	751	846
Hungary	9269	9467	9299
Malta	115	127	122

The final energy consumption for households and tertiary premises for 2005 were obtained from local SEAP (Sustainable Energy Action Plan) reports drawn up by a consultancy firm for a number of local councils. In these studies, it was concluded that energy consumption by households in Malta is consists of the use of electricity and Liquified Petroleum Gas (LPG). The use of other fossil fuels, mainly for heating is negligible.

Local electricity provider, Enemalta, in 2005 provided households with 658,224MWh of electricity and the equivalent of 194,349 MWh of energy from the supply of LPG. Thus, the total energy consumption by households for this year was taken to be the sum of these two values or 852,573MWh of energy.

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As regards Tertiary buildings, the total for 2005 was obtained from the same SEAP's as follows. It has been established that Enemalta produces a total of 2,260,762MW/h of electricity. If the amount used by households is deducted from this, the rest may be assumed to be used by the Tertiary sector. Therefore this amounts to 1,602,538MWh. The amount of LPG consumed by the tertiary sector amounts to 47,060MWh. On a national level, the amount of other fuels used amounts to 152,386MWh. The total consumption for the tertiary sector for 2005 therefore amounts to 1,801,984MWh.

In order to extrapolate these results to the other years in the table, the total for each year was taken as a ratio of the total for 2005. Therefore the total for 2006, or 138,000 was taken to be 0.92 that of 2005 or 150,000. The values for 2005 which are known to be accurate were then multiplied by the factors obtained for each of the different years according to their total, which as stated above, was obtained from Eurostat.

4.9. Andalusia (Spain)

In the next points both residential and services sectors buildings energy efficiency and consumption in Andalucía will be analyzed.

For Spain and Andalucía in 2010, official conversion factor from final electrical energy (1MWh = 0.086 toe) in buildings consumption to toe= 1MWh primary electrical energy = 11,72 Toe

Conversion factors for CO_2 emissions, final and primary energy for 2010 in Spain. Source: IDAE.

	Final energy		Primary Energy in consumtion point	Emissions in consumption point
Electrical Energy. Low tension (Building sector)	1 MWh	0,086 toe	**0,19** toe/ MWh final	**0,27** tCO2/ MWh final
			2,21 MWhpri/ MWh final	**3,09** tCO2/ toe final

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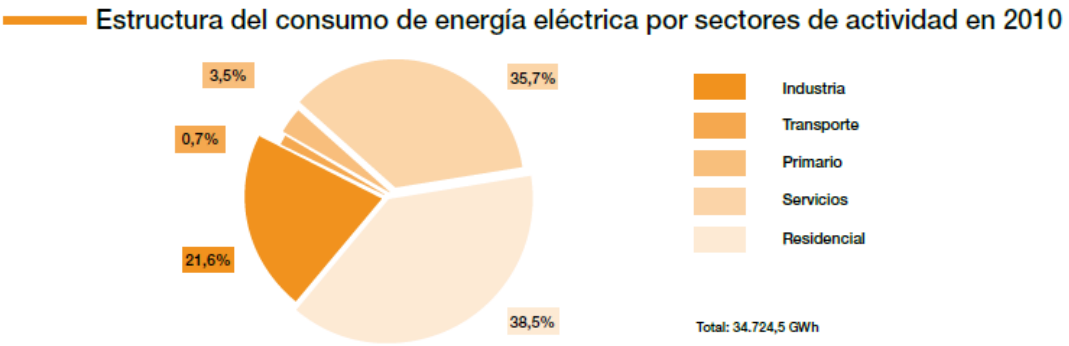
Sector analysis[49]

Tertiary (Services)

Unidad: GWh	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Industria	8.656,9	8.731,4	8.763,9	9.734,1	9.943,5	10.092,7	9.310,1	10.028,9	9.169,0	7.176,4	7.501,2
Transporte	339,0	268,8	251,2	368,1	374,7	360,9	392,4	380,4	232,9	223,0	248,6
Primario	1.161,7	1.182,1	1.277,1	1.331,9	1.364,9	1.758,5	1.455,3	1.504,3	1.466,3	1.320,1	1.208,5
Servicios	7.779,3	8.329,4	8.835,1	9.792,9	10.296,0	11.159,7	11.806,4	12.233,0	12.541,6	11.511,9	12.401,0
Residencial	7.541,4	8.120,2	8.642,7	9.648,0	10.494,3	11.410,7	12.320,3	12.411,9	13.030,4	13.932,6	13.365,2



Andalucía: Evolution and energy (electricity) consumption framework by sectors in 2010

In 2010, the services sector consumption has registered a positive variation of 5.7% (67.5 ktoe), reaching 1242.4 ktoe. Increases its share by 0.6 percentage points in the final structure of consumption, which stood at 9.1%.

[49] Figures and graphs from Agencia Andaluza de la Energía: "Datos energéticos de Andalucía 2010".

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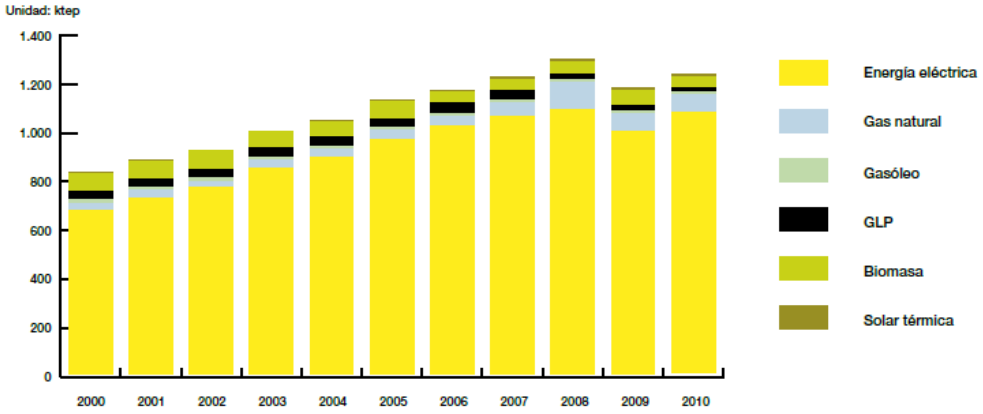
Evolución del consumo final del sector servicios por fuentes



Unidad: ktep	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Energía eléctrica	669,0	716,3	759,8	842,2	885,5	959,7	1.015,4	1.052,0	1.078,6	990,0	1.066,5
Gas natural	34,4	39,6	33,3	38,8	40,2	42,1	44,0	61,7	122,5	80,3	89,6
Gasóleo	13,5	13,7	13,0	13,4	13,1	11,8	10,4	11,6	11,4	10,1	9,7
GLP	36,0	35,6	35,6	35,1	36,0	36,8	43,3	41,8	22,5	21,5	20,8
Biomasa	73,9	72,9	76,9	66,9	63,8	70,6	46,0	46,0	46,5	62,0	42,9
Solar térmica	2,5	3,1	3,8	4,4	5,0	5,6	6,8	8,1	9,8	11,0	13,0
TOTAL	**829,4**	**881,2**	**922,5**	**1.000,7**	**1.043,5**	**1.126,5**	**1.165,8**	**1.221,2**	**1.291,2**	**1.174,9**	**1.242,4**

By energy sources, natural gas increased by 11.5% (9.3 ktoe) and represents 7.2% of the consumption sector. The electrical energy continues to grow its weight within the consumption matrix with 85.8% (1066.5 ktoe) and recovers from the downturn in 2009 with an increase of 7.7% (76.5 ktoe).

Consumption from renewable sources fell by 23.4% (17.1 ktoe) caused by lower demand for biomass whose consumption is more than three-fourths of the renewable supply. Oil products with 30.4 ktoe, 3.6% less than last year, occupies the last place with 2.4% of the sector consumption in 2010.

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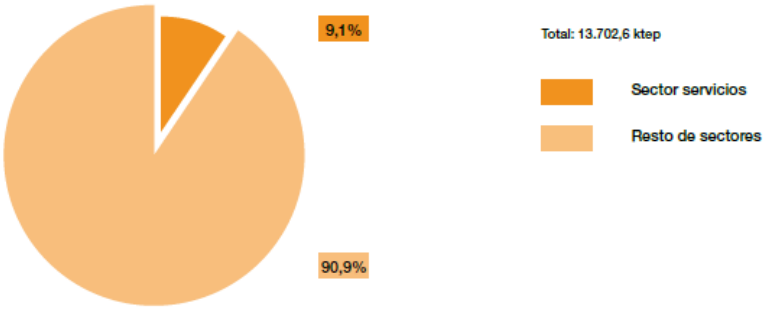
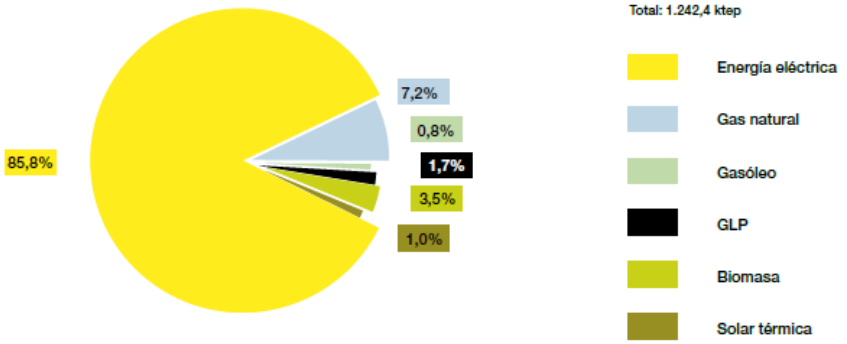
Cuota del sector servicios dentro del consumo final en 2010



Distribución del consumo del sector servicios por fuentes en 2010



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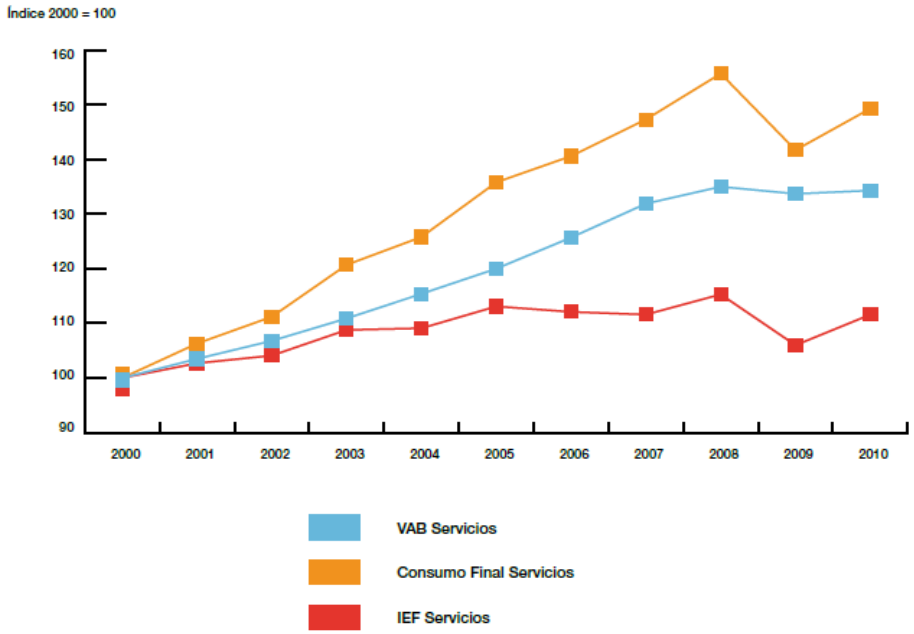
Evolución de la intensidad energética en el sector servicios



Unidad: tep/M€ cte. de 2000	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Intensidad energética sector servicios	15,5	15,9	16,1	16,8	16,9	17,5	17,3	17,3	17,8	16,4	17,3

Fuente: Instituto de Estadística y Cartografía de Andalucía y elaboración propia

Evolution of Energy intensity of services sector[50]

[50] VAB Servicios= Services GVA, Gross Value Added.

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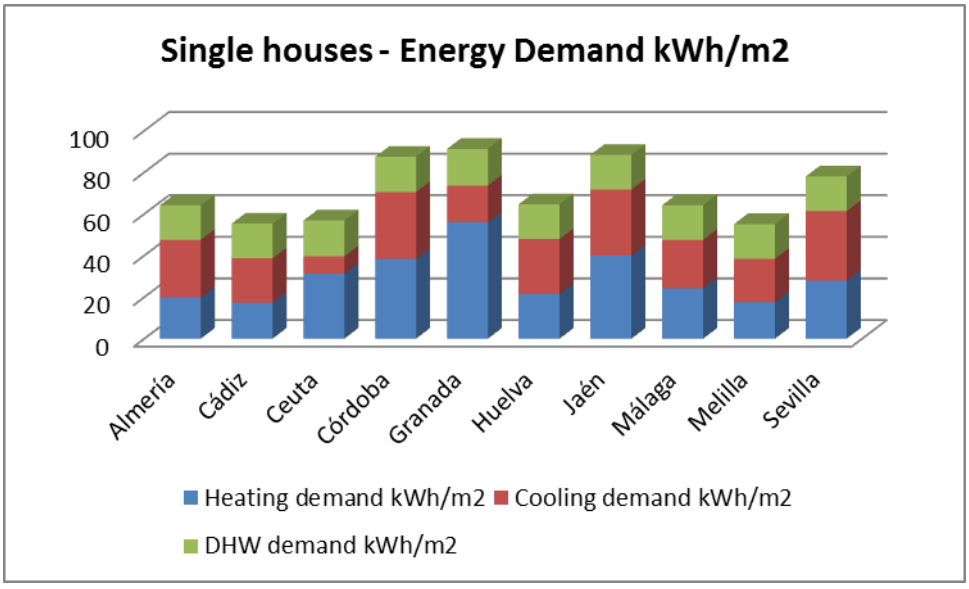
Residential sector Energy Demand

Energy Performance indicators for individual houses in Andalucía[51].

Location	Heating demand kWh/m^2	Cooling demand kWh/m^2	DHW demand kWh/m^2	Heating emis-sions kgCO_2/m^2	Cooling emis-sions gCO_2/m^2	Heating Pri. Energy comsumption kWh/m^2	Cooling Pri. Energy comsumption kWh/m^2
Almería	19,8	27,7	16,6	6,3	6,9	28,7	28,3
Cádiz	17,2	21,4	16,7	5,5	5,4	24,9	21,8
Ceuta	31,2	8,4	17,2	11,9	3,2	48,4	11
Córdoba	38,3	32,2	16,9	12,3	8,1	55,5	32,8
Granada	55,9	17,7	17,6	17,9	4,4	81,1	18,1
Huelva	21,5	26,4	16,7	6,9	6,6	31,2	26,9
Jaén	39,9	31,8	16,7	12,8	8	57,9	32,4
Málaga	24,2	23,3	16,7	7,7	5,8	35,1	23,8
Melilla	17,5	20,9	16,7	6,7	7,9	27,1	27,4
Sevilla	27,9	33,4	16,7	8,9	8,4	40,5	34,1



[51] Source: "Escala de calificación energética: Edificios de nueva construcción". IDAE. Spain 2009

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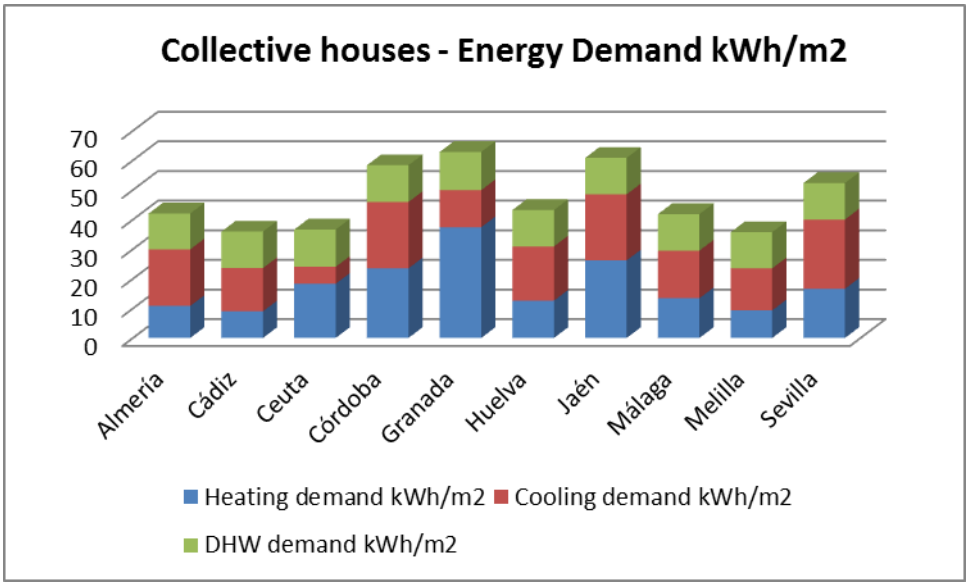
Energy Performance indicators for collective residential buildings in Andalucía.

Location	Heating demand kWh/m^2	Cooling demand kWh/m^2	DHW demand kWh/m^2	Heating emis-sions kgCO_2/m^2	Cooling emis-sions gCO_2/m^2	Heating Pri. Energy comsumption kWh/m^2	Cooling Pri. Energy comsumption kWh/m^2
Almería	10,8	19,1	12,1	3,5	4,8	15,7	19,5
Cádiz	9	14,6	12,3	2,9	3,7	13,1	14,9
Ceuta	18,3	5,7	12,6	7	2,2	28,4	7,5
Córdoba	23,5	22,4	12,4	7,5	5,6	34,1	22,8
Granada	37,4	12,5	12,9	12	3,1	54,2	12,8
Huelva	12,6	18,3	12,3	4	4,6	18,3	18,7
Jaén	26,2	22,3	12,3	8,4	5,6	38	22,7
Málaga	13,4	16,1	12,3	4,3	4	19,4	16,4
Melilla	9,3	14,2	12,2	3,5	5,4	14,4	18,6
Sevilla	16,6	23,4	12,3	5,3	5,9	24,1	23,9



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Comfort conditions and operational schedule in dwellings for energy demand calculation

The ability of standardization and comparison of the energy efficiency rates within the MARIE regions involved must be supported by a common measure. For the calculation of the energy demand rates for air conditioning and its associated final energy and carbon emissions in the residential sector its been adopted, at national level, an specific operational protocol for energy efficiency certification purposes (National implementation of the 2002/91/CE Directive).

That protocol includes, for summer and winter seasons, a week schedule for the next hourly items involved in the definition of thermal loads:

- Highest temp. Set point (°C) Cooling startup
- Lowest temp. Set point (°C) Heating startup
- Sensible heat load (W/m2)
- Latent heat load (W/m2)
- Lighting load (W/m2)
- Devices and appliances load (W/m2)
- Summer Ventilation (air changes per hour)
- Winter Ventilation (air changes per hour)
- Domestic Hot Water, DHW (% of maximum demand)

The next table includes all year values for the factors considered.

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Item	HOUR																							
Higest temp. Setpoint (°C) Cooling startup	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
January	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
February	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
March	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
April	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
May	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
June	27	27	27	27	27	27	27	–	–	–	–	–	–	–	–	25	25	25	25	25	25	25	25	27
July	27	27	27	27	27	27	27	–	–	–	–	–	–	–	–	25	25	25	25	25	25	25	25	27
August	27	27	27	27	27	27	27	–	–	–	–	–	–	–	–	25	25	25	25	25	25	25	25	27
September	27	27	27	27	27	27	27	–	–	–	–	–	–	–	–	25	25	25	25	25	25	25	25	27
October	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
November	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Dicember	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Lowest temp. Setpoint (°C) Heating startup	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
January	17	17	17	17	17	17	17	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	17
February	17	17	17	17	17	17	17	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	17
March	17	17	17	17	17	17	17	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	17
April	17	17	17	17	17	17	17	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	17
May	17	17	17	17	17	17	17	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	17
June	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
July	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
August	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
September	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
October	17	17	17	17	17	17	17	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	17
November	17	17	17	17	17	17	17	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	17
Dicember	17	17	17	17	17	17	17	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	17
sensible heat load	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
weekday	2.15	2.15	2.15	2.15	2.15	2.15	2.15	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	2.15
Saturday	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15
Sunday and holyday	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15	2.15
latent heat load	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
weekday	1.36	1.36	1.36	1.36	1.36	1.36	1.36	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.68	0.68	0.68	0.68	0.68	0.68	0.68	0.68	1.36
Saturday	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36
Sunday and holyday	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36
Ligting load (W/m2)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
all days	0.44	0.44	0.44	0.44	0.44	0.44	0.44	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	2.20	4.40	4.40	4.40	4.40	2.20
Devices and appliances load (W/m2)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
weekday, Saturday and	0.44	0.44	0.44	0.44	0.44	0.44	0.44	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	2.20	4.40	4.40	4.40	4.40	2.20
Summer Ventilation (2)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
all days	4	4	4	4	4	4	4	4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Winter Ventilation (3)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
all days	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Domestic Hot	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Day profile (% of max)	12	5	4	2	2	6	27	100	70	75	62	56	48	48	41	33	39	38	52	70	57	63	48	52

(2) In summer regime during the period between 1 and 8 hours,inclusive, it is assumed that the living spaces of residential buildings have infiltration caused by opening windows of 4 air changes per hour. The rest of the time, indicated by * in the table, the number of renewals hours will be constant and equal to 1 air change per hour.

(3) The number of renewal hours, indicated by * in the table, will be constant and equal 1 air change per hour.

Operational conditions schedule for energy demand calculation in dwellings in Spain. Source: "Condiciones de aceptación de procedimientos alternativos a LIDER y CALENER. Anexos" Ministerio de Vivienda + IDAE. 2009

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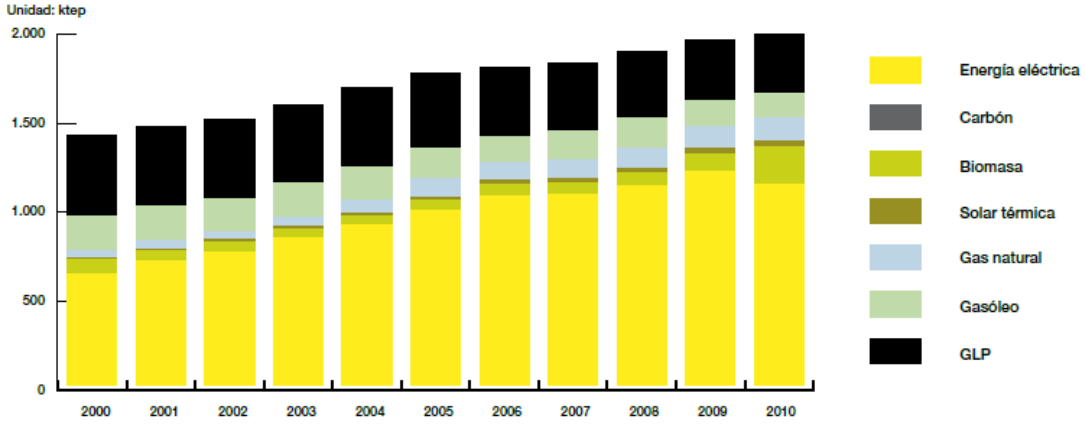
Residential Energy Consumption . 2010.

In the residential sector energy consumption has increased to a lesser extent than in previous years, 1.6% (32.1 ktoe) and stood at 1995.2 ktoe. This is mainly due to lower demand of electricity, by 3.4 percentage points lower weight in the final structure of consumption in the sector stood at 57.6% (1149.4 ktoe).

Households have consumed 4.1% (48.8 ktoe) less electricity than in 2009 and 3.9% (19.2 ktoe) less than petroleum products (diesel and LPG). Highlights the growing contribution of renewable sources, 58.4% (91.2ktoe), contributing to the matrix 247.4 ktoe supply sector, 12.4% of total consumption. Natural gas is also an increase of 7.6% (9 ktoe), although the source has less weight in the total, 6.3%.

Evolución del consumo final del sector residencial por fuentes



Unidad: ktep	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Energía eléctrica	648,6	698,3	743,3	829,7	902,5	981,3	1.059,5	1.067,4	1.120,6	1.198,2	1.149,4
Carbón	3,7	2,8	2,4	1,2	1,2	1,2	0,0	0,0	0,0	0,0	0,0
Biomasa	79,4	78,3	82,7	71,9	68,6	75,9	92,0	92,1	93,1	123,1	208,3
Solar térmica	7,6	9,4	11,5	13,1	14,9	16,8	20,3	24,3	29,3	33,1	39,1
Gas natural	41,1	47,3	44,1	47,4	75,3	104,9	97,2	101,1	112,0	117,4	126,4
Gasóleo	194,1	197,0	187,2	192,7	188,5	169,7	149,3	167,4	164,4	146,0	139,4
GLP	447,7	441,8	441,8	441,3	442,4	425,6	391,9	382,2	375,9	345,2	332,6
TOTAL	**1.422,2**	**1.475,0**	**1.513,0**	**1.597,4**	**1.693,4**	**1.775,6**	**1.810,2**	**1.834,5**	**1.895,2**	**1.963,1**	**1.995,2**

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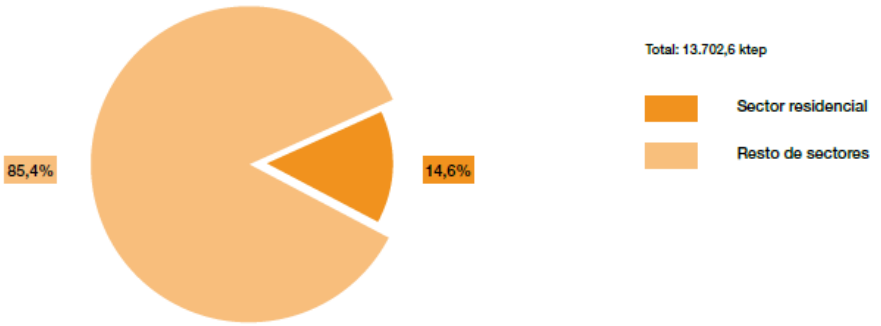
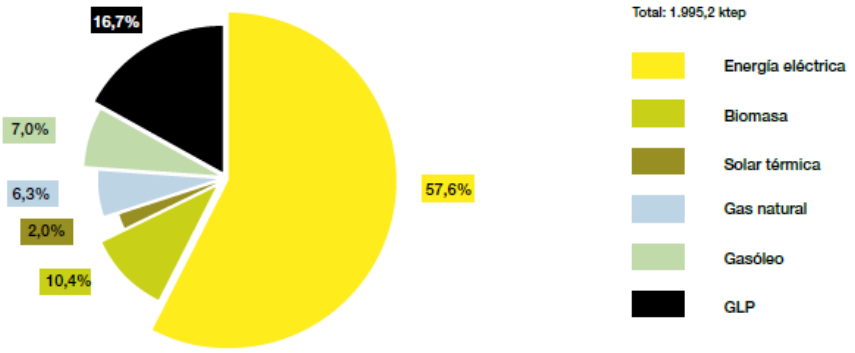
Cuota del sector residencial dentro del consumo final en 2010



Distribución del consumo del sector residencial por fuentes en 2010



Considering both residential 14,6 % , services 9,1 %, building stock sector contributes to a 23,7% of the global final energy consumption in Andalucía in 2010.

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4.10. Alendejo (Portugal)

Data on energy consumption and energy efficiency of residential and tertiary building units for Portugal and Alentejo have been provided and are included in the next section, which compares corresponding data of all participating regions.

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4.11. Comparison of energy consumption in buildings of MED regions

The following tables and figure compare the final energy consumption between 1999 and 2005 in buildings of the residential and tertiary sectors in the different MED countries/ regions that participated in the study. The 1999 and 2005 years were chosen for comparison because data were available for those years for all MED countries/ regions under study. It has been argued that correct comparison can only be made using climate corrected values for energy consumption. However, it should be noted that only normal climate values were available for comparison. Furthermore, a lot of data sources and studies used have done comparisons of energy consumption values and energy efficiency indicators based on normal climate values. It is therefore proposed, taking into consideration the corresponding comments of the MARIE Advisory Group, that the missing data on climate corrected values for energy consumption, having in mind annual values of degree-days (heating and cooling) for each specific country or region, should be made available in the future. These data are very important for the correct comparison of energy consumption on a yearly basis and between countries or regions and the successful follow-up of proposed energy efficiency programs within the Mediterranean region.

Table 32: Final energy consumption by households, trades, services, etc. (ktoe) in MED countries/ regions (normal climate)

Country/ region	**1999**	**2005**
Italy	40.692	46.535
Piedmont	4.192	4.017
Liguria	1.409	1.395
Basilicata	241	329
Catalonia	2.945	4.032
Andalusia	2.252	2.902
PACA	4.224	4.514
Slovenia	4.394	4.872
Greece	6.549	8.577
Malta	193	228
Portugal	9.792	11.078

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Table 33: Final energy consumption by households (ktoe) in MED countries/ regions (normal climate)

Country/ region	1999	2005
Italy	27.804	30.382
Piedmont	3.061	2.700
Liguria	1.033	881
Basilicata	n/a	n/a
Catalonia	1.718	2.316
Andalusia	1.422	1.776
PACA	2.796	2.900
Slovenia	1.049	1.186
Greece	4.233	5.497
Malta	62	73
Portugal	2.854	3.231

Table 34: Final energy consumption by tertiary (ktoe) in MED countries/ regions (normal climate)

Country/ region	1999	2005
Italy	12.888	16.153
Piedmont	1.131	1.317
Liguria	375	515
Basilicata	n/a	n/a
Catalonia	1.227	1.716
Andalusia	829	1.127
PACA	1.428	1.613
Slovenia	822	474
Greece	1.236	1.939
Malta	131	155
Portugal	6.938	7.847

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Table 35: Change in final energy consumption (1999 - 2005) in MED countries/ regions (normal climate)

Country/ region	Households, trades, services	Households	Tertiary
Italy	14,36%	9,27%	25,34%
Piedmont	-4,17%	-11,79%	16,44%
Liguria	-0,96%	-14,79%	37,14%
Basilicata	36,77%	n/a	n/a
Catalonia	36,91%	34,79%	39,87%
Andalusia	28,89%	24,85%	35,82%
PACA	6,87%	3,72%	12,96%
Slovenia	10,88%	13,06%	-42,34%
Greece	30,97%	29,86%	56,88%
Malta	18,08%	18,11%	18,06%
Portugal	13,13%	13,22%	13,09%

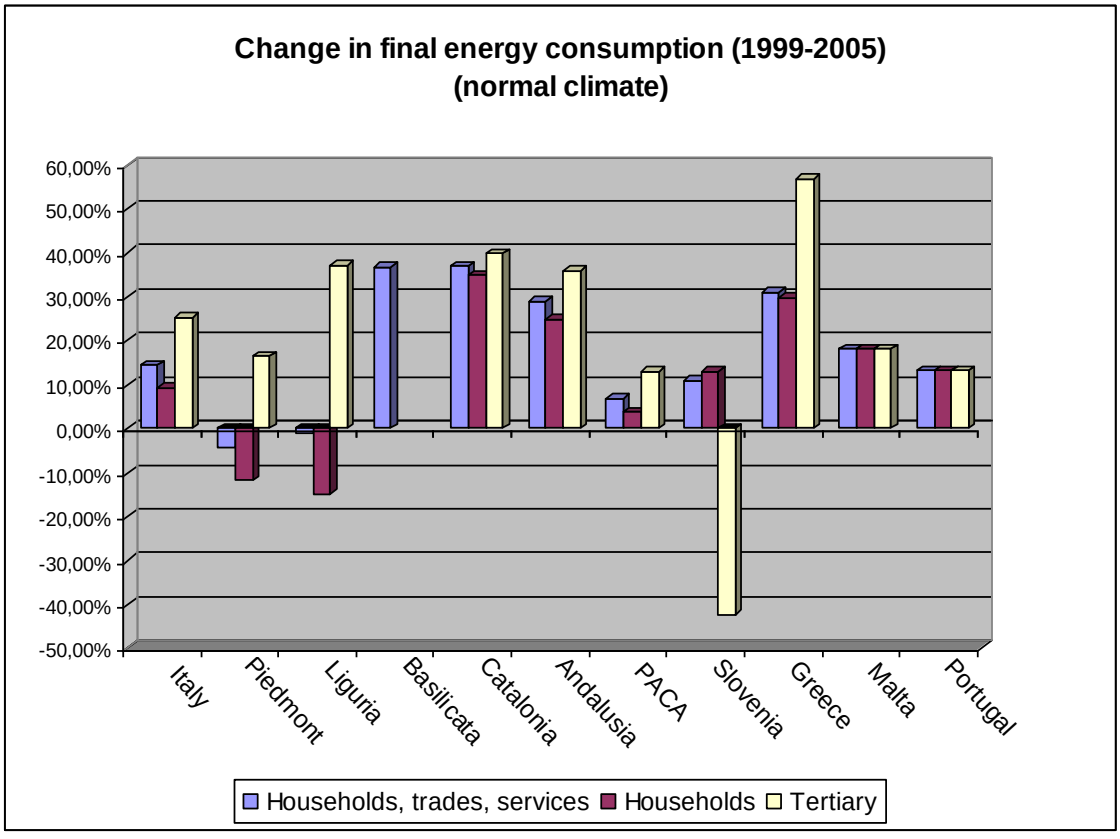

Figure 65: Change in final energy consumption (1999 - 2005) in MED countries/ regions (normal climate)

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The highest increase in final energy consumption in households, trades and services between the years 1999 and 2005 is seen in Catalonia (36,91%), Basilicata (36,77%), Greece (30,97%) and Andalusia (28,89%). This was due to increase in final energy consumption of both residential and tertiary sectors. In particular, in Greece the highest increase was in the tertiary sector (56,88%). In Liguria and Piedmont, there was a decrease in final energy consumption of the residential sector (14,79% and 11,79% respectively) as opposed to an increase in final energy consumption of the tertiary sector (37,14 and 16,44% respectively). On the contrary, in Slovenia there was a small increase in the final energy consumption of the residential sector (13,06%) as opposed to a substantial decrease in the final energy consumption of the tertiary sector (42,34%). In Malta, Portugal and PACA the increase in final energy consumption in both sectors was smaller (18,08%, 13,13% and 6,87% respectively).

4.12. Comparison of Energy Efficiency Indicators in buildings of MED regions

The following figures compare the energy efficiency indicators of 2001 and 2007 in building units of the residential and tertiary sectors in the different MED countries/ regions that participated in the study. Energy Efficiency Indicators for building units of 2001 and 2007 were chosen for comparison because data were available for those years for most MED countries/ regions under study.

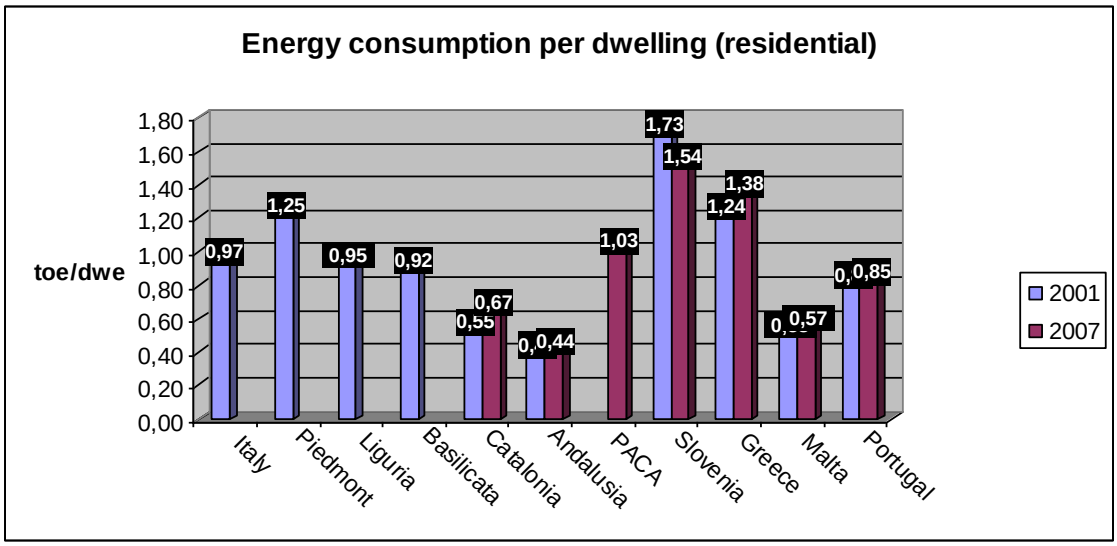

Figure 66: Energy consumption per dwelling (residential) in MED countries/ regions

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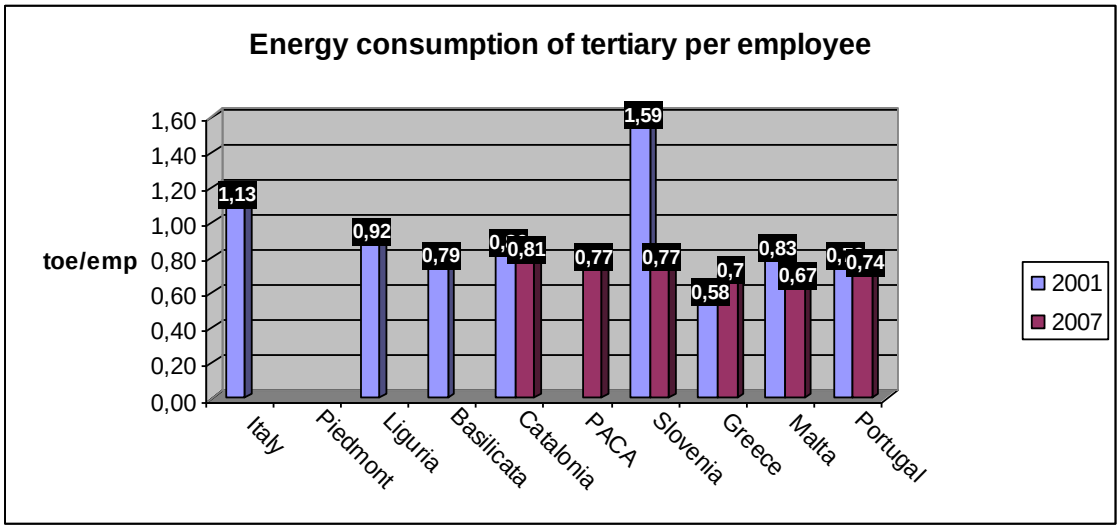

Figure 67: Energy consumption of tertiary per employee in MED countries/ regions

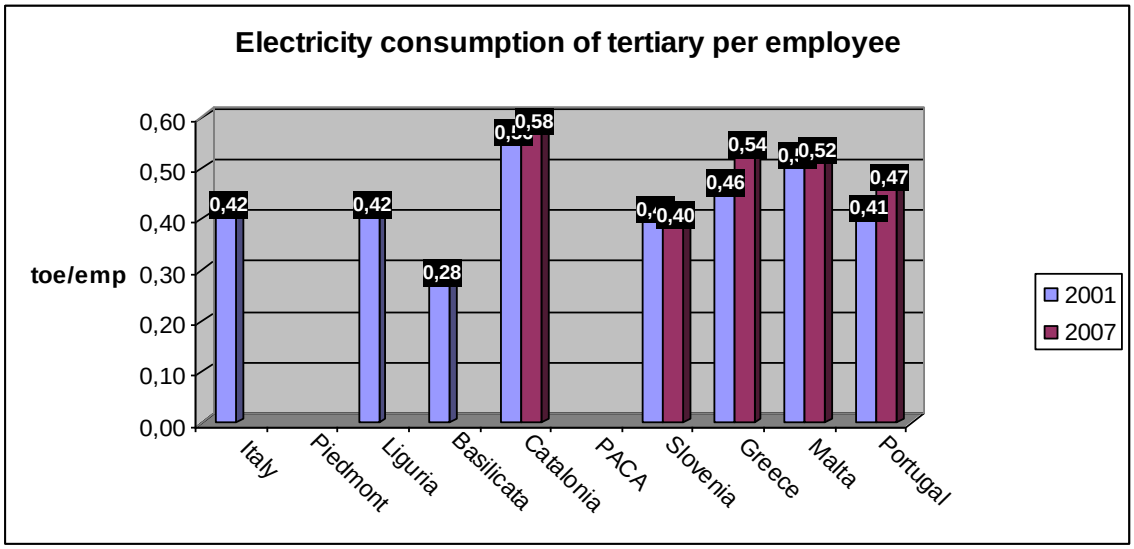

Figure 68: Electricity consumption of tertiary per employee in MED countries/ regions

Slovenia, Greece and Piedmont had the highest energy consumption per dwelling, followed by PACA, Liguria, Basilicata, Portugal, Catalonia, Malta and Andalusia. Slovenia had the highest energy consumption per employee in the tertiary sector in 2001 which had substantially decreased in 2007, followed by Liguria, Catalonia, Basilicata, PACA, Portugal, Greece and Malta. In terms of electricity consumption per employee in the tertiary sector, Catalonia, Greece and Malta had the highest consumption, followed by Portugal, Liguria, Slovenia and Basilicata. Data for energy consumption per employee in the tertiary sector of Piedmont and Andalusia were

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not available. Data for electricity consumption per employee in the tertiary sector of Piedmont, PACA and Andalusia were not available.

Additional indicators on energy consumption per square meter, both for households and tertiary sector, could give better comparison in terms of size of the dwelling or tertiary unit. However, as mentioned before, the size of dwellings and tertiary units were not available for most countries and regions that participated in the study. Taking into consideration the corresponding comments of the MARIE Advisory Group, it is therefore proposed that together with climate corrected values of energy consumption the missing data on size of dwellings and tertiary units in m^2 should be made available in the future. These data are considered necessary for the successful follow-up of proposed energy efficiency programs within the Mediterranean region.

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5. Legislation related to energy efficiency in buildings of MED regions

The scope of this section is to summarise the main legislation at national and /or regional level (if any), issued for energy efficiency in buildings (residential & tertiary sector) in each participating country/ region. An overview is presented for each participating region, complemented by a standardised presentation in Annex 1 of the corresponding legislation for residential and tertiary buildings in relation to the four areas of the conceptual framework of building energy efficiency improvement (Annex 3), based on the corresponding template provided.

5.1. Catalonia (Spain)

In Spain, the competences in energy policy and legislation lie with the regional Governments, but nevertheless Spanish Royal Decrees are of mandatory compliance. This leads to a dualism in law and ordinances in the building sector that have to be respected and fulfilled, a part from local authorities rules and particular by-laws. As for building energy efficiency legislation, Energy requirements were minimal and ruled by regulations dating from 1987, until in 2006 the EU directive was applied in the Technical Building Code.

Strategies for Energy Renovation in Buildings at State Level

National housing and refurbishment Plan 2009-2012

(Plan Nacional de Vivienda y Rehabilitación)
This plan defines different areas of refurbishment: Integrated refurbishment areas, areas of urban renovation and refurbishment, and "Renove" support for low income families.[52] As housing is competence of the autonomous regions, bilateral agreements between Autonomies and Central Government have been developed. Its objective is to reach 1 million households and multiply refurbishment (including the "renove" program for energy efficiency, and access improvement) by 3.5. The budget is €10.19billion, a 49% increase over the previous plan. [53]

Spanish Energy Efficiency and Saving Strategy 2008-2012 (4E)

(Estrategia de Ahorro y Eficiencia Energética en España 2008-2012 E4)

[52] Informe sobre la situación del sector vivienda en España (2010)
[53] http://www.lamoncloa.gob.es/ConsejodeMinistros/Referencias/_2008/refc20081212.htm#PlanViviendahttp://www.lamoncloa.gob.es/ConsejodeMinistros/Referencias/_2008/refc20081212.htm#PlanVivienda

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This strategy specifies measures in seven sectors. Overall objective: 11% energy saving for 2012 (compared to the base scenario considered in the 2006/32/EC Directive, surpassing its 9% goal for 2016). The following strategies have implications for the refurbishment and energy efficiency sector:

- Energy efficiency programme for buildings of the public national administration (plan de activación de la eficiencia energética en los edificios de la Administración General del Estado 2010)
- Plan to encourage contracting of energy service companies (ESCOs)[54]

Action Plan for 2008-2012

(Plan de Acción 2008-2012)
Objective: Primary energy saving of 87.9 Mtoe, 59.45Mtoe reduction in final energy consumption, total CO_2 emissions reduction of 238 Mt. The objective for the building sector is a reduction in final energy consumption of 7,936 ktoe. [55] Four building energy measures: building envelope refurbishment, improvement of thermal (heating, DHW) and lighting installations, and replacement of household appliances.

Energy Saving and Efficiency Action Plan 2011-2020[56]

(Plan de Acción de Ahorro Y Eficiencia Energética 2011-2020)
Objective: reduce energy consumption by 20% by 2020, in line with EU guidelines.
Savings resulting from the 2004-2012 Energy efficiency Strategy (corresponding Action Plan 2005-2007) and the 2008-2012 Energy Saving and Efficiency Strategy (and 2008-2012 Action Plan): Overall, by 2010, 71,5% of the energy savings objective for 2012 has been reached. The building sector energy savings are calculated by IDAE to have been 2,232.5 ktoe between 2004-2010, 67% of which derive from improvements in thermal building envelope performance and heating and domestic hot water installations, and 33% from lighting improvement (low energy light bulbs), in the domestic and tertiary sector.[57]

Legislation at State level – overview

In Spain, the 2002/91/EC Energy Efficiency in Buildings Directive was translated into national legislation through three main legislative measures, treating the area of energy efficiency in buildings in a much more profound way than before:

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54 Fundación Cande del Valle de Salazar (2010) *la generación de empleo en la rehabilitación y modernización energética de edificios y viviendas.* CCOO, Instituto Sindical de Trabajo, Ambiente y Salud.

55 http://www.idae.es/index.php/mod.documentos/mem.descarga?file=/documentos_Resumen_Ejecutivo_Plan_de_Accion_2008-2012___17-07-2007_con_TABLA_PDF_ACC_362e698f.pdf

56 http://www.idae.es/index.php/mod.documentos/mem.descarga?file=/documentos_RES_EJECUTIVO_PA_2011-2020_Definitivo_4ec17865.pdf-

57 IDEA (2011) Plan de Acción de Ahorro y Eficiencia Energética 2011-2020. Ministerio de Industria, Turismo y Comercio, Gobierno de España

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- The technical building code (Royal Decree 314/2006)
- The regulation on Heating/Ventilating/Air-Conditioning Systems (Royal Decree 1027/2007)
- The energy certification of buildings process (Royal Decree 47/2007)

Unfortunately, they all came into effect at the very late stage of the construction boom so that only the few recently approved new building and refurbishment projects and of course all future ones fulfil the strengthened requirements.

Other legislation transposes different European Directives, as concerning domestic appliances certification.

Technical Building Code (CTE)

The technical building code (CTE, Código Técnico de la Edificación; Royal Decree 314/2006) came into effect the 29.09.2006, including the Basic Energy Saving Document (DB HE), referring to energy saving in five areas. Its main aim is to achieve rational energy use in buildings, part of which generated by renewable energies.

HE-1 Quality of the building's envelope (energy demand reduction)
HE-2 Thermal installation performance (Royal Decree 1027/2007)
HE-3 Indoor lighting performance
HE-4 Minimum solar contribution to domestic water heating
HE-5 Minimum solar contribution to electricity generation

Regulation for Thermal Installations in Buildings

The Regulation on Heating/Ventilating/Air-Conditioning Systems (RITE) (Royal Decree 1027/2007) came into effect the 1. March 2008 and "lays down the conditions that must be met by systems intended to provide thermal comfort and hygiene by providing heating, air-conditioning, and hot water, so as to achieve a rational use of energy". Its main objective is a rational energy use by building systems. **"**The more stringent energy efficiency requirements laid down in RITE are specifically [58]:

- Improved energy performance from heating and cooling equipment
- Improved temperature monitoring of air conditioned spaces
- Employment of renewable energy sources (solar thermal and biomass), heat recovery systems

Building Energy Certification

The basic procedure for the energy certification of newly constructed buildings (Royal Decree 47/2007) became mandatory after 1.November 2007, and creates the basic energy efficiency qualification methodology which precedes certification,

[58] IDAE http://www.idae.es/index.php/mod.pags/mem.detalle/relcategoria.1030/id.27/relmenu.53

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taking into account the factors which most influence energy efficiency in new buildings or those undergoing major refurbishment, as well as the technical and administrative certification procedures for projects and completed buildings. Energy certification for the existing stock is in process[59]
Content: buyers or users (in case of change of tenant) of buildings have to be provided with an Energy Efficiency Certificate, with classes A to G on the energy efficiency label.[60]

Strategies for Energy Renovation in Buildings at Regional Level

A number of Catalan energy plans with its respective action plans and climate change mitigation plans shape the energy and environmental policy in Catalonia. Their basic objective as detailed in the 2009 Revision of the Catalan Energy Plan 2006-2015 is to reduce final energy consumption by 14,1% by the year 2015, a total of 2.484 ktoe/yr in the year 2015, 422,3ktoe of which in the domestic sector, as detailed in the energy efficiency strategy. Public expenditure for energy efficiency measures 2009-2015: 716.1M€.

The Future Energy and Climate Change Plan of Catalonia 2012-2020 is currently under development, which aims to integrate the energy efficiency and climate change strategy, and develops strategies in the building sector (domestic and tertiary):

- Public policies to incentivate and regulate ESCOs
- Refurbishment of buildings and dwellings to impulse economic activity and improve energy efficiency
- Framework of legislative standards to promote construction solutions and technologies to reduce energy consumption

The energy plans, strategies and action plans are listed below:

- Energy Plan of Catalonia 2006-2015 (Revised in 2009) (Pla d'Energia de Catalunya 2006-2015 (PEC))
- Energy Saving and Efficiency Strategy (Estratègia d'Estalvi i Eficiència Energètica (PEC))
- Action Plan 2006-2010 (Pla d´acció 2006-2010)
- Climate change mitigation framework plan 2008-2012 (Pla marc de mitigació del canvi climàtic a Catalunya 2008-2012)

[59] Secretaria d´habitatge (2010) Guia de la renovació renovació enerètica d´edificis d´habitatges. Envolupament térmica i instal·lacions
[60] IDAE http://www.idae.es/index.php/id.25/mod.pags/mem.detalle

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- Future Energy and Climate change mitigation plan of Catalonia 2012-2020 (El futur pla de l'energia i del canvi climàtic de Catalunya 2012-2020 / PECAC 2020), Juliol 2011
- Government Agreement on energy saving and energy efficiency in the Generalitat de Catalunya (GOV/104/2007
- Energy saving and Efficiency Plan for the Catalan Government buildings 2011-2014. (Pla d´estalvi i eficiencia energética als edificis i equipaments de la Generalitat de Catalunya 2011-2014)

Legislation at Regional level (Catalonia)

Eco-efficiency in buildings

(Decret d´ecoeficiencia en edificis - Decree 21/2006)
The most important regional law concerning energy efficiency in the building sector is the Eco efficiency Decree that regulates environmental criteria in the areas of energy efficiency, water use, renewable energy use, materials and waste management. As the CTE at State level, this legislation is mandatory for new construction and major refurbishment projects. In some particular aspects and for specific climate zones within Catalonia it goes further than the CTE (e.g. thermal insulation requirements, minimum solar thermal contribution for domestic water heating) and it provides a range of measures to comply with a score system concerning energy and environmental aspects.

Environmental quality labelling for products and services

(Decret 316/1994 and 296/1998 Garantia de qualitat ambiental)
Label to promote products and services that are respectful with the environment. The Resolution MAH/1899/2007, of 27th of April, establishes the criteria for the environmental quality certificate in the products of acoustic and thermal insulating with recycled materials, and The Resolution MAH/2405/2009, of 29th of April, for boilers and domestic gas heaters.[61]

[61] –Agencia d´habitatge de Catalunya (2011) **Innovative Residential Housing for the Mediterranean INTEGRATED TRANSNATIONAL BENCHMARK STUDY (ITBS)**

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5.2. PACA (France)

National Measures

National Developments under the EU Energy Efficiency Directive and the 20% Energy Efficiency: Target of the EU

The National Energy Efficiency Action Plan is essentially based on the environment round table (Grenelle de l'environnement) realised in 2007:

- The "Energy efficiency and carbon" programme :

- Programme to promote renewable energy > hydraulic, wind, biomass, geothermal, photovoltaic cells and solar energy.
- Consumption of 30% to 50% renewable energy in the French overseas departments and territories by 2020.
- Research into second-generation biofuels.
- R&D programme for geological capture and storage of CO2.
- Plan for very energy-efficient low-input farming.
- Carbon balance assessments of administrative departments and a 20% improvement in their energy efficiency.
- Inclusion of environmental clauses in the public procurement code.
- Study of the introduction of a climate-energy tax.

- The "Modernising buildings and cities" programme

- Building new energy-efficient housing from 2010, widespread use of Green Buildings by 2012, and passive or positive-energy buildings from 2020.
- Building office space, buildings and public facilities that comply with low-consumption or positive energy standards from 2010.
- Ban on incandescent light bulbs and single glazing from 2010.
- Thermal renovation of public buildings within the next 5 years.
- Financial incentives for thermal renovation of privately-owned buildings.
- Carbon balance and energy-efficient assessments of all organisations of more than 50 people.

- The "Urban planning and national/regional governance" programme

- Revitalising city centres in decline.
- Developing "eco-quarters".

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- Widespread implementation of national/regional climate-energy plans by the end of 2012 in built-up and urban communities, complying with the objective of a 20% reduction in greenhouse gas emissions by 2020.
- Fighting urban sprawl and the destruction of the countryside.
- Environmental impact study for new urban development zones, integrating transport and the use of agricultural and natural land, with a view to protection.

***Source: Mure/Odyssey**: Energy Efficiency trends, Policies & Measures in FRANCE*

Selected Energy Efficiency Measures

Sectors	Title of Measure	Since	Evaluation Impacts
Households	Building insulation standards of 2005 : RT 2005	2005	15% of energy savings compared to 2000
Households	Tax credit for energy efficiency works and RES	1978	1 billion Euro in 2005, up to 50% aid
Households	Energy performance audits	2006	
Households, tertiary	Audits subsidies in buildings	1980	1.94 tCo2 saved per audited building
Transport	Grants for electric and natural gas vehicles	1985	C02 savings : 13 tCo2 for electric vehicles; 63 ktCo2 for LPG vehicles
Transport	Car labelling	2006	
Transport	Ecological Bonus	2008	In six month, the average of C02 emissions of the new cars decreased by 149 to 140gCO_2/km.
Industry	Quota Allocation plan	2002	
Industry	Energy audits and subsidies	1999	16.5 tCo2 saved per company
Tertiary	"High environmental quality" in buildings (HQE)	2001	
All	White certificate scheme	2006	Excluding energy intensive industries, 54 TWh cumulated
All	Local energy information centres	1990	187 centres; 1000 000 contacts between 2004 and 2006; 317 ktoe/year and 592 ktC02/year

ADEME

Households, Services

The thermal building code was reinforced as of July 2005 for both households and the service sectors. This should bring on average energy savings of 15%, compared to 2000 standards. For the existing stock, the tax credit scheme, which was very successful, has been reinforced in 2005 and can reach 50%. In 2010, 1600 buildings have been audited for a total of 5185 buildings since 2008. This measure is completed by demonstration projects and by OPATB program (energy efficiency of residential and tertiary building). The total subsidies dedicated to these measures reached €37 millions in 2010.

The implementation of local energy information centres has been reinforced: in 2009, there were 230 centres with 400 advisers, which resulted in savings estimated at 95ktoe/year and 160kt CO2/year in 2009.

In 2009, 84.5 TWh Cumac of energy savings were certified, mainly in the household and service sectors (corresponding approximately to 7.77 TWh per year) in the **white certificate scheme.**

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Since 2006-2007, the energy performance audit of the household or a building was a legal obligation for the sale, for the hiring and for construction.

A zero interest green loan was created in December 2008. In 2010, around 150 000 loans have been granted versus an objective of 200 000. The objectives for the next years are 240 000 more in 2011, 320 000 more in 2012 and 400 000 more each year as of 2013.

Energy prices and taxes

There is no environment or CO2 tax in France. However in all consuming sectors, the energy prices at the consumer level continue to raise.

Budgets

The budget of ADEME allocated for energy efficiency and renewable in 2009 was €446.5 million. The most important budget for the government is for the tax credit €2.6 billion.

Regional measures (source : IRH benchmarking)

In structural terms, the Paca Region contributes to measures favouring sustainable building, providing its support to inter-professional measures and organisations:

- Discussions with energy groups as part of the consultation: Codebaque (sustainable building), Codesol (solar energy), Codebois (wood-energy)
- A resources centre: Envirobat-Med
- The Sustainable Mediterranean Buildings Association.

General context – AGIR programme

In the French context, regions do not have any regulatory powers in the field of construction. Rules in most construction fields are fixed at a national level (thermal regulation, energy performance diagnoses, material regulations, professional training frames of reference, etc.).

The PACA region policy regarding energy matters and sustainable development has been developed as part of a general programme called AGIR (Action Globale Innovante pour la Région – Innovative Global Regional Actions), which has existed since December 2006. A fund of €63 million provided support for over 600 projects between 2007 and 2010. The monitoring and assessment of these projects will be expanded as part of the next programme.

With the administration's new term in office, this global measure has now been extended with an AGIR + programme, taking into account feedback from the previous programme. It has an overall budget of €15 million per year for the 2011-

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2014 period (to date, it is impossible to determine a breakdown of the sums specifically aimed at sustainable building).

This programme is, above all, a programme focused on operational actions in cooperation with other regional echelons (European, state, local authorities, etc.) and with professionals. In particular, the search for convergence of aid and regulations is stated as a founding principle of the AGIR+ programme.

Since measures implemented at a European and State level (Grenelle II, SNDD – National Sustainable Development Strategy, TR (2012 thermal regulation), etc.) constantly modify the regulatory and financial context, the AGIR + measure should encourage experimentation over the medium and long term, with the main objective being structural actions.

The main lines of the PACA Region's policy – 2010-2014

On 23 October 2010, deliberations held in the plenary session of the Paca Regional Council established the main lines of the government's programme pertaining to sustainable building and energy efficiency issues.

§ Development of public information, using technical tools such as improved Energy Performance Diagnoses, taking into account specific Mediterranean climate requirements, as well as energy audits for co-ownerships. This has been reviewed and instead of this measures, development of new financing tools are under progress.

§ Continued structural actions in the field of construction aimed at sustainability, and in particular, improved training actions in this field.

§ Help with exemplary operations:
A call for projects aimed mainly at those related to the renovation of public buildings pursuant to the BBC-Effinergie level (40% below regulations), depending on the assessment made of the previous invitation to tender. To receive aid, new public buildings must thus aim for the BEPOS (positive energy building) level. Regional aid would also be contingent upon the fact that projects rely on the support process of the Sustainable Mediterranean Building Initiative.
Experiments may be carried out into the ambitious energy renovation of houses or small building complexes (primarily those built before 1975) in cooperation with Infor Energy Spaces and other professionals.

§ The progressive implementation of eco-conditionality criteria related to all policies for buildings receiving regional aid.

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The energy challenges related to the constant increase of consumption in buildings, the economic challenges related to the qualification of professionals over the long term, the structural actions taken in the region, the mobilisation of professionals, the state's focus on the building sector, with a toughening of thermal regulations, will all contribute to the definition of the first "eco-condition" which will have a bearing on all applications for new projects made to the regional government. This complies with the "Sustainable Mediterranean Buildings" Initiative led by the eponymous PRIDES.

As a result, regional aid under common law will be made progressively more conditional, as follows:

- For new construction, when reaching a level of energy performance level that is higher than the regulations in force ("Low Consumption Building – Effinergie") and by recourse to the support process provided under the "Sustainable Mediterranean Buildings Initiative".
- For existing buildings to be renovated, the work to be carried out must contribute to reaching at least a level "B" on the EPD (energy performance diagnosis) and by recourse to the "Sustainable Mediterranean Buildings" Initiative. The level referred to as "C+ (120 kWhep/m^2/hab./year for housing)" of the energy performance diagnosis could constitute an accepted target, as long as the energy audit justifies the lack of financial or technical feasibility for reaching of level "B" mentioned above.
- Once the 2012 Thermal Regulations enter into force in 2011, making "Low Consumption Building" mandatory for new constructions, these criteria will be modified to meet new legal requirements. For renovation, the performance level to be reached following work may be reviewed in coming years in accordance with changes in techniques and regulations. Part of regional aid may be paid depending on effective results.

It should be noted that the regional government already applies a frame of reference to its own buildings and schools. This policy regarding "Sustainable Development and the Environmental Quality of Buildings" was approved in July 2009.

The progressive implementation of these measures pertaining to building finance applications will be developed on the basis of an assessment of the level of financial acceptability of the expansion of these eco-conditionality criteria.

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5.3. Liguria (Italy)

Rules and regulations in force

The Liguria Region applies the compliance clause and accepted the 2002/91/EC directive and the Legislative Decree no. 311/06 on energy efficiency and certification of buildings by means of the Regional Law no. 22, of May 29th, 2007, and subsequent amendments and integrations; and the Regional Regulation no. 1, of January 29th, 2009, by preceding the implementation of national laws and regulations that have been passed at a later date.

At the regional level, the regulatory instruments that may be used to increase energy efficiency are:

1. The **Regional Law no. 22/2007,** which states the following:
   - the minimum requirements for new and existing buildings that need to be fully or partially renovated;
   - the implementation methods of the above mentioned minimum requirements, according to the different type of activity;
   - the method applied to Energy Certification that allowed the process to be launched at the regional level before the publication of the national Guidelines.

2. The **Regional Regulation no. 1/2009,** which identifies specific criteria and rules to be applied to new buildings and the existing real estate. Minimum requirements are listed in Annex 1 to this document, and can be summarized as follows:

   - new buildings must abide by the rules concerning minimum requirements that are mentioned in the Regional Regulation, and deal with heat consumption due to house heating and heating of water for sanitary purposes (annual energy needs per sq m), the thermal insulation capability of the structure (thermal transmittance) and the global performance of the installation;

   - existing buildings: should extraordinary maintenance of buildings that are not subjected to landscape and cultural constraints (Lgs. Decree no. 42/04) be needed, the energy efficiency works on the buildings and installations must be carried out in such a way that their energy consumption and characteristics are in line with the restrictions envisaged by the laws in force.

***Remark**: it may often be difficult to be in line with such minimum requirements, and this is especially true when existing building structures need to be renovated and adapted to the new rules. For example, if you need to apply a "thermal cover" by means of insulating panels that are mounted onto the external surface of a building, what you need are 8cm thick insulating panels – and they must be no thinner than that – in order to be in line with the values envisaged by the Regulation. However, such thickness may not be applied because of external shutters, windowsills, façade decorations, etc.*

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5.4. Piedmont (Italy)

Regional Law n. 13/2007

The Piedmont Region, implementing Directive 2002/91/EC of the European Parliament and the Council of 16 December 2002 on the energy performance of buildings and respecting the fundamental principles laid down in Legislative Decree 19 August 2005, No 192(Implementation of Directive 2002/91/EC on the energy performance of buildings), as amended by legislative decree of 29December 2006, no 311, promotes the improvement of energy performance of existing buildings and new construction through the application of the regional law n. 13/2007 (and subsequent implementation decrees) which takes into account the local climatic conditions, in order to facilitate the development, enhancement and integration of renewable sources and energy diversification, giving preference to technologies less environmental impact.

The law regulates:

a) the methodology for calculating the integrated energy performance of buildings;
b) the application of minimum requirements and specific requirements on energy performance of new buildings;
c) the application of minimum requirements and specific requirements on the energy performance of existing buildings undergoing renovation;
d) criteria and characteristics of the energy certification of buildings;
e) regular inspection of heating and air conditioning systems;
f) the professional qualifications and criteria for accreditation of persons authorized to issue the energy certification of buildings and the conduct of inspections of heating and air conditioning systems;
g) promoting the rational use of energy through information and awareness of end users, training and retraining of professionals;
h) forms of economic incentives for citizens.

Scope:

- new buildings
- buildings subject to building renovation,
- extensions or elevations of existing buildings;
- buildings subject to extraordinary maintenance;
- installation of new heating plants in existing buildings;
- renovation of heating plants;
- replacement of the heat generator

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Main measures:

<table>
<tr><td>BUILDING ENVELOPE</td><td>In order to improve the energy efficiency of building it's fixed minimum levels of performance for new and existing building subject to building renovation.
These minimum levels are:

<table>
<tr><th>Thermal transmittance of opaque vertical structures</th><th>Thermal transmittance of horizontal or opaque structures</th><th>Thermal transmittance of transparent closures (average glass /frame)</th></tr>
<tr><td>0,33 W/mqK</td><td>0,30 W/mqK</td><td>2,0 W/mqK</td></tr>
</table></td></tr>
<tr><td>BUILDING ENVELOPE</td><td>The new residential buildings, excluding colleges, convents, prisons and the existing buildings with a usable floor area over 1000 m2 subjects to a building renovation must respect the limits of energy needs for heating (Qh)
<table>
<tr><th>GG</th><th>V ≤ 500 (m³)</th><th>V = 1000 (m³)</th><th>V = 2000 (m³)</th><th>V = 4000 (m³)</th><th>V = 6000 (m³)</th><th>V = 8000 (m³)</th><th>V ≥10000 (m³)</th></tr>
<tr><td>≤3000</td><td>70</td><td>65</td><td>60</td><td>50</td><td>45</td><td>40</td><td>35</td></tr>
<tr><td>≥5000</td><td>130</td><td>120</td><td>115</td><td>100</td><td>90</td><td>85</td><td>75</td></tr>
</table>
For all other types of buildings
<table>
<tr><th>GG</th><th>V ≤ 500 (m³)</th><th>V = 1000 (m³)</th><th>V = 2000 (m³)</th><th>V = 4000 (m³)</th><th>V = 6000 (m³)</th><th>V = 8000 (m³)</th><th>V ≥10000 (m³)</th></tr>
<tr><td>≤3000</td><td>23</td><td>21.5</td><td>20</td><td>16.5</td><td>15</td><td>13.5</td><td>11.5</td></tr>
<tr><td>≥5000</td><td>43</td><td>40</td><td>38</td><td>33</td><td>30</td><td>28</td><td>25</td></tr>
</table></td></tr>
<tr><td>BUILDING ENVELOPE</td><td>determine the energy performance of the building for summer cooling:

<table>
<tr><th>Residential building</th><th>Other typology of building</th></tr>
<tr><td><30 kWh/mq year</td><td><10 kWh/mq year</td></tr>
</table></td></tr>
<tr><td>BUILDING ENVELOPE</td><td></td></tr>
<tr><td>BUILDING ENVELOPE</td><td>In order to reduce the energy demand for summer air conditioning, in case of new buildings or building renovation, all transparent elements which receive direct solar radiation, should have appropriate external fixed or mobile sunscreens that reduce by 70% the maximum summer solar radiation.</td></tr>
<tr><td>BUILDING ENVELOPE</td><td>Solar greenhouses are excluded from the calculation of volumes. In fact use of passive solar technologies include direct and indirect solar gain for space heating (greenhouses)</td></tr>
<tr><td>BUILDING ENVELOPE</td><td>The thickness of external walls, cladding or massive walls, exceeding of 30 cm in new buildings and the greater thickness of the floors necessary to thermal insulation are not considered in the calculations for determining the volumes, surfaces and coverage ratios</td></tr>
</table>

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	for the part exceeding of 30 cm (and up to a maximum of 25 cm) for vertical walls and 15 cm for the horizontal floors.
BUILDING SERVICES	renewable energy. **Solar energy**. Install solar thermal systems in order to cover 60% of annual need
BUILDING SERVICES	renewable energy. **Solar energy**. In case of new buildings or building renovation is obligatory installation of **photovoltaic systems** for the production of electricity
BUILDING SERVICES	For all categories of buildings, in the case of: - installation of heating systems in new buildings; - installation of new heating systems in existing buildings; - replace of heating system is obligatory to calculate the **seasonal average efficiency** of the heating plant.
BUILDING SERVICES	Heat generators installed in new buildings or existing buildings must ensure, performance not less than $\eta_g = (93+2\text{Log } Pn)$ and emissions of nitrogen oxides (NOx) below to 80 mg / kWht.
BUILDING SERVICES	The heating systems installed in buildings with a number of residential units above 4 either centralized, should be with the thermoregulation and heat metering systems for each unit.
BUILDING ENVELOPE AND SERVICES	Each new building, subject to renovation project, must be have the energy performance certificate. In the cases of sale of an entire building or individual units, the energy performance certificate is attached to the contract. Some building typologies are exempt from the obligations inherent energy performance certificate: -box; -garages; -multi-storey car parks; -depots; -structures for sports; -temporary structures -buildings or other structures similar to those listed. The energy performance certificate will include the following indicators: a)a global energy performance indicator (EPG_L); b)a energy consumption c)a energy performance indicator for the air conditioning

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	in summer; d)a energy performance indicator for the production of hot water; e) a energy performance indicator for the production of artificial lighting; f) total average efficiency of the heating season g) value of the energy performance of heat pump; h) global index of energy performance expressed in annual emissions of CO2; For the classification of buildings we use the EPG_L: Classe A+: $EP_{L\ To} < 27$ kWh/m² Classe A: 27 kWh/m² ≤ $EP_{L\ To} < 44$ kWh/m² Classe B: 44 kWh/m² ≤ $EP_{L\ To} < 82$ kWh/m² --- Classe C: 82 kWh/m² ≤ $EP_{L\ To} < 143$ kWh/m² Classe D: 143 kWh/m² ≤ $EP_{L\ To} < 201$ kWh/m² Classe E: 201 kWh/m² ≤ $EP_{L\ To} < 249$ kWh/m² Classe F: 249 kWh/m² ≤ $EP_{L\ To} < 300$ kWh/m² Classe G: 300 kWh/m² ≤ $EP_{L\ To} \leq 435$ kWh/m² NC: >435 kWh/m² Altri edifici Classe A+: $EP_{L\ To} < 9$ kWh/m³ Classe A: 9 kWh/m³ ≤ $EP_{L\ To} < 14$ kWh/m³ Classe B: 14 kWh/m³ ≤ $EP_{L\ To} < 27$ kWh/m³ --- Classe C: 27 kWh/m³ ≤ $EP_{L\ To} < 46$ kWh/m³ Classe D: 46 kWh/m³ ≤ $EP_{L\ To} < 64$ kWh/m³ Classe E: 64 kWh/m³ ≤ $EP_{L\ To} < 79$ kWh/m³ Classe F: 79 kWh/m³ ≤ $EP_{L\ To} < 95$ kWh/m³ Classe G: 95 kWh/m³ ≤ $EP_{L\ To} < 137$ kWh/m³ NC: >137 kWh/ m³

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5.5. Basilicata (Italy)

In Italy energy policy is partially delegated to the Regions and autonomous Provinces, leaving the drafting of the general framework to the central government; in particular the regulation on energy efficiency of buildings is in charge of the Ministry of Economic Development, in collaboration with the Ministry of Environment and the Ministry of Infrastructures, with agreement of the Committee of Regions, through the State-Regions Conference.

On August 19, 2005 the Council of Ministers approved **a Legislative Decree (D. Lgs. n. 192/2005, published in the Official Gazette n. 222 of the 23 September 2005) producing a general framework for the transposition of the 91/2002/EC Directive in the national legislation,** except article 9 (inspection of air conditioners) where a three year delay was requested. Later the Council of Ministers modified and integrated the D.Lgs. 192/2005 by the **Legislative Decree 29 December 2006 n. 311 (Official Gazette n. 26 of the 1 February 2007).** This decree sets criteria, conditions and ways to improve the energy performance of buildings in order to facilitate the development, enhancement and integration of renewable sources and energy diversification, and to promote the competitiveness of the sectors through the most advanced technological development.

The **Legislative Decree 30 May 2008 n.** 311 (Official Gazette n. 154 of the 3 July 2008) implementing the 32/2006/EC Directive on energy end-use efficiency and energy services. This decree establishes a framework of measures to improve energy end-use efficiency to improving security of energy supply and environmental protection by reducing emissions of greenhouse gases. Therefore it defines indicative targets, mechanisms, incentives and identifies institutional, financial and legal framework to eliminate existing barriers and market imperfections that impede the efficient end-use energy. It also aims to create the conditions for the development and promotion of a market for energy services.

The Decree of the President of the Republic April 2, 2009, n. 59 (Official Gazette n. 132 of 10 June 2009) implement, in execution of Legislative Decree no. 192/2005, the general criteria, methods of calculation and the minimum requirements for energy performance of buildings and systems for space heating and sanitary water heating.

On June 26, 2009 the Ministry of Economic Development has approved a **Ministerial Decree (Official Gazette n. 158 of 10 July 2009 - effective from July 07, 2009) adopting National Guidelines on Energy Certification of Buildings.** The guidelines specify the procedures, the performance classes and the basic elements for certification, which have legal value in all the Regions that have not yet produced

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their own legislation, or until the date of issue of new regional Laws. The Regions that have already enforced regulations on building energy certification are required to adopt certain measures when their requirements are less strict or some aspect has been neglected, so that they gradually adapt their instruments to the national guidelines.

The implementation of the Energy Certification of Buildings was graduated in various building categories; from the July 1, 2009, all the required buildings were included in the certification system: new buildings, major renovations, public buildings and all buildings when sold.

The Energy Performance Certificate assigns an energy performance label to residential and non-residential buildings or building units, and it lists measures for improving their energy performance, sorted by cost-effectiveness. The energy label classifies the energy performance (EP) of buildings on an efficiency scale ranging from A+ (high energy efficiency building, with low environmental impact) to G (very low energy efficiency building).

Some Italian regions and autonomous Provinces have adopted their own schemes on energy certification of buildings; the most relevant are the voluntary label named “CASACLIMA”, implemented by the Bolzano Province, and the regional guidelines and the accreditation system for the building certification, named “CENED”, which Lombardia Region has endorsed.

Other regions and autonomous Provinces which produced local legislation on the energy performance of buildings are: Valle d’Aosta, Piemonte, Liguria, Trento Province, Emilia Romagna, Toscana, Puglia, Friuli Venezia Giulia.

Basilicata Region, with the decision of the Regional government May 15, 2006, No 724, adopted the synthetic ITACA Protocol as a technical directive to a correct approach to sustainable construction and reference tool for the implementation of actions on public house buildings. ITACA Protocol, approved in 2004 by the Conference of Presidents of Italian Regions, is a environmental quality assessment system for residential buildings.

ITACA Protocol is an instrument for measuring the level of environmental compatibility of buildings through the use of a system of principles and performance requirements, aiming to further reduce consumption of resources to below a predefined threshold. It can allow the government to make appropriate choices to encourage more respectful of environment solutions, in the collective best interest.
The Protocol was created by the working group on green building of ITACA (Federal Association of the Italian Regions) and is based on the international method named

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Green Building Challenge (GBC) formed by a network comprising 25 countries around the world.

5.6. Western Macedonia (Greece)

In Greece the relative legislation and corresponding action plans are designed and implemented at national level. There are no regional regulations or strategic development actions on energy policy issues.

In the past decades, the energy-saving efforts in Greece did not have a concrete planning and a specific quantitative target. The measures taken occasionally for energy efficiency improvement were fragmented and temporary with very little contribution to the reduction of the final energy consumption.

In the last years however, the energy policies and measures for energy efficiency improvement have appeared to change with the mandatory implementation of the following European Directives:

- **"Energy Performance of Buildings" Directive (EPBD - 2002/91/EC)**
- **"Energy Service Directive" in the final consumption (2006/32/EC)**
- **Co-generation of Heat and Power and Renewable Sources**

The **Law 3661/2008 on "Energy Performance of Buildings" transposed the EPBD directive to the Greek legislation in May 2008**. It provides the framework of measures and procedures for energy conservation in buildings, especially in the areas of:

- Energy certification for new and existing buildings
- Energy audits for new and existing buildings
- Regular inspection of boilers and air conditioning

For the implementation of these measures, it was necessary to issue regulations and specifications regarding the energy certification scheme and model, the energy efficiency standards for new buildings, the determination of the new elements and calculations required for the energy study of new buildings, the requirements for energy auditors:

- The **Joint Ministerial Decision (5825/30-03-2010) on the "Regulation for Energy Performance of Buildings" (KENAK),** establishing minimum energy standards for new and renovated buildings, energy audits and energy labelling of buildings, which has been implemented since 2010.
- The **Presidential Decree (100/30-09-2010) on "Energy auditors of buildings, boiler, heating and air conditioning systems"**, establishing qualification requirements for energy auditors and a Registered Body of qualified energy auditors.

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The above regulation and specifications provide the framework of main principles and specify the terms and conditions for improving the energy efficiency of buildings. The purpose of this is to reduce consumption of conventional energy for heating, cooling, air conditioning, lighting and hot water while ensuring comfortable indoors conditions in buildings. This purpose is achieved through energy efficient design of the shell, use of energy-efficient building materials and installation, renewable energy sources (RES) and co-generation of heat and power (CHP).

The above regulation and specifications specify the method of calculating the energy performance of buildings, the minimum requirements for energy performance, the type and content of the study of energy efficiency in buildings, the responsible persons for its realisation, the process and schedule of energy audits in buildings, boilers, heating and air conditioning systems, the type and content of energy performance certificate.

In addition to the above legislation, the following legislation also relates to energy efficiency in buildings, even though it addresses energy issues that are cross-cutting.

The **Law 3855/2010 on "Measures for Energy Performance in the final consumption and Energy Services"** transposed the "Energy Service Directive" in the final consumption to the Greek legislation in June 2010. It sets national targets for energy saving, establishes the necessary institutional and legal framework and provides corresponding financial means to achieve these objectives, provides appropriate incentives and the necessary mechanisms for the efficient removal of barriers and market deficiencies that impede the efficient final use of energy:

- For the period until the end of 2016, it establishes the national indicative target for energy saving at 9% of annual final energy consumption of reference
- It defines the methodology for calculating the national indicative energy saving target
- It provides Energy Efficiency Action Plans and incentives and other means to improve energy efficiency
- It introduces measures to improve and sets minimum energy efficiency requirements for public procurement of public authorities and institutions of the broader public sector

Furthermore, it creates conditions for the development and promotion of energy services and other measures to improve energy efficiency in the final consumption:

- Obligations of energy distributors, managers of energy distribution systems, and energy retailers
- Registration and Code of Conduct for Energy Service Companies (ESCOs)
- Voluntary Agreements

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- Availability of information
- Setting tariffs and other obligations to promote energy efficiency
- Measurement and detailed account of energy consumption
- Energy Performance Contracts
- Green Public Procurement

In accordance with the requirements of the Directive 2006/32/EC, **the first National Energy Efficiency Action Plan (NEEAP)** was established and submitted to the European Commission. The Second National Energy Efficiency Action Plan is about to be submitted to the EU Commission. The measures were selected on the basis of immediate applicability, with particular emphasis on the overall cost of investment in relation to the anticipated annual energy saving, with the aim of meeting the 9% target for 2010, and furthermore the 20% target for 2020. The transport sector is estimated to have the greatest potential for energy savings, identified to be about 36%. In terms of importance, the tertiary and residential sectors follow, having a percentage in the total energy savings of 30% and 29% respectively. A summary of all the measures proposed for the tertiary and residential sectors, for achieving the energy saving targets of the National Energy Efficiency Action Plan, is presented in the section about corresponding financial schemes/ measures.

The **Law 3851/2010 refers to "Accelerating the development of Renewable Energy Sources to address climate change and other provisions relating to the Ministry of Environment, Energy and Climate Change"**. It specifies the following targets until the year 2020:

- Contribution of energy produced from RES in final energy consumption by 20%
- Contribution of electricity produced from RES in final electricity consumption by at least 40%
- Contribution of energy produced from RES in final energy consumption for heating and cooling by at least 20%
- Contribution of energy produced from RES in final energy consumption for transport by at least 10%

In what concerns use of energy produced from RES in buildings, the above legislation refers to the following:

- For new buildings, there is a need for a feasibility study for the installation of at least one alternative energy supply system, such as decentralized energy supply system based on RES, etc
- For energy refurbishment of existing buildings, upgrading of energy efficiency should meet the minimum energy efficiency requirements
- During boiler inspection, alternative solutions should be recommended if there is a need for replacement

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5.7. Primorsksa (Slovenia)

The issue of the sustainability of buildings, housing and urban development has without doubt recently become a core topic addressed by academics and practitioners. Corresponding principles concerning environmental, ecological and energy-saving guidelines and measures have been introduced in a number of EU documents. At the national level, the recommendations on promoting environmentally based activities are reflected in the Integrated **Environmental Management Programme (2002)**, which is primarily addressed to local authorities. The need for the refurbishment and renovation of buildings is presented, among others, as a responsibility of the Ministry of Environment and Spatial Planning, but no comprehensive legislation framework of this topic has been delivered yet. Later on, the content of the renewal and refurbishment of the existing housing stock was incorporated in strategic guidelines for spatial development in the **Spatial Development Strategy of Slovenia (2003)**. It provides sustainable principles for the planning of energy infrastructure and introduces new documents, socalled energy concepts for regions, cities and local communities in order to promote energy saving and the integration of renewable energy sources. Further, the **Spatial Planning Act (2003)** establishes a definition of comprehensive renovation and introduces the spatial information system which has become of vital importance for future efforts to improve the quality of the existing housing stock. On the other hand, the **Building Act (2002, 2004)** sets the building and construction standards for new constructions, but no adequate requirements for refurbishment and renewal are incorporated.

The sustainable renovation and refurbishment of the existing housing stock aims to reduce environmental burdening in terms of energy efficient construction, which is one of the key goals of European development. In this area, Slovenian legislation in the energy sector has established a new legislation framework that introduces several documents such as, for example, the **Resolution on the National Energy Programme** and the **National Programme for Encouraging Efficient Use of Energy and Renewable Energy Sources**. Further a comprehensive national document called **Slovenia's Development Strategy (2005)** introduces the principle of sustainable development as a priority, and positions the environmental criteria within sectoral policies so as to encourage energy saving, material intensity and the re-use of materials and structures. The terms energy efficiency and renewable energy sources are applied to public buildings, in particular. Also, some new instruments like environmental tax reform issues and the concept of “green” procurement are established.

In Slovenia the **EFBD** has been transported into national legislation by the **Building Construction Act**, the **Environmental Protection Act** and by the amended **Energy Act** (17th of November 2006). The secondary regulation on new minimum requirements,

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calculation methodology, feasibility studies and regular inspection of A/C systems was promulgated in 2008, while the regulation on energy performance certification was accepetd in 2009. The training and licens for indipendent experts working on building energy certification and inspection of A/C systems as well as the protocols related to the registry of certificates, were defined in the 2010 regulation.

In accordance with the Energy Performance of Building Directive ("EPBD"), the main requirements were set by the **National Action Plan on Energy Efficiency 2008–2016**, which falls within the responsibility of the Ministry of the Economy, promoting energy efficient building refurbishment with a very clear emphasis on thermal insulation and building techniques.

The National Energy Efficiency Action Plan was drawn up in accordance with the requirements of Directive 2006/32/EC concerning preparation of Member States' first energy efficiency action plan and with the instructions given by the Commission.

The Action Plan determines:

- the calculation of baseline final energy consumption
- the savings target for final energy consumption for the entire 2008–2016 period, and the interim target for 2008–2010
- sectoral energy efficiency improvement instruments
- multi-sectoral and horizontal instruments
- public sector instruments
- financing of the Action Plan
- implementation of the Action Plan.

In order to bring the requirements of the EPBD into engineering practice, a new regulation on efficient energy use in buildings was introduced in 2008, replacing the old one from 2002 (Energy Efficiency in Social Housing: The Case of Slovenia).

In order to demonstrate compliance with the minimum requirements, the calculation of the energy performance of buildings was updated in July 2010 (replacing the 2008 regulation), through the promulgation of a new version of the **Regulation on efficient use of energy in buildings (PURES-2 2010)** and obligatory **technical guidelines for construction TSG-1-004:2010** Efficient use of energy. PURES-2 2010 has already covered some elements of the EFBD Recast transposition, i.e. the implementation of CEN EFBD standards in the calculation methodology and the setting of minimum requirements for very low energy new buildings and public buildings, respectively. The calculation methodology is based on SIST ISO 13790 and the respective set of CEN EFBD standards, with some national adjustments.
At the same time, Slovenia started the process of establishing and improving the **certification process** (Implementation of the EPBD in Slovenia).

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To support the projects and actions for energy saving and environmental improvement in general the Eco Fund was established with the main task to promote financial incentives in the form of subsidies and affordable loans for investments in energy efficient buildings and environmentally-friendly energy production. Finally, sustainable energy principles were introduced in the **National Operational Programme of Environmental and Transport Infrastructure Development 2007–2013** (Cirman A., Mandič S., Sitar M.: Energy Efficiency in Social Housing: The Case of Slovenia).

5.8. Malta

Information on legislation related to energy efficiency in buildings of Malta is included in standardized template in Annex 1.

5.9. Andalusia (Spain)

Among the initiatives launched in Spain, we can include the establishment of a regulatory framework designed to establish the progressive liberalization of electricity and gas markets. Thus, since January 1, 2003, all consumers can choose their supplier, ahead of the European calendar establishing a deadline of July 2007. Moreover, Spain has committed to limit the growth of greenhouse gases emissions by 15% above those for the year 1990 emissions in 2012 under the Kyoto Protocol framework through the National Allocation Plans approved to date for the period 2005-2007 and 2008-2012. In February 2007 the Strategy for the Spanish Climate Change was presented, which sets out a series of policies and measures that mitigate the effects of climate change and facilitate the compliance with the international commitments undertaken by Spain.

Due that the Catalonia report contains all the information concerning to the National legislation, we will focus on the Regional Legislation. However we'll give just an overview about the National Strategies and Legislation as an introduction.

The national energy policy has taken on the priority objectives set by the European Union, such as, the Renewable Energy Plan 2005-2010 in Spain or the 2005-2007 Action Plan and the Energy Efficiency and Energy Savings Strategy in Spain 2004-2012.

The EPBD 2002/91/EC has implied a reorganisation of all the legislation in Spain, and has significantly increased the number of requirements that buildings in Spain must meet. The last step is the publication of the Royal Decree regulating the energy performance certification in 2011.

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The transposition of the EPBD in Spain has been basically made through the following Royal Decrees:

- Royal Decree 314/2006, of the 17th of March, approving the Technical Building Code (CTE)
  of Mº de Vivienda.
- Royal Decree 47/2007, of the 19th of January, approving the basic procedure for the energy certification of new build
- Royal Decree 1027/2007, of the 20th of July, approving the Thermal Building Regulations (RITE)

A fourth decree will be further added to these, to legislate the energy certification of existing buildings, and which will complete the transposition of the EPDB to the Spanish legal system. Once this has been published the next step would be to combine the subsidies of the Energy Saving and Efficiency Plan to the improvement of the building energy rating.

The minimum qualification that a new building can achieve is now E.

With the enforcement of the Technical Building Code in 2006, the building energy efficiency received a large boost. This basic standard consists of a Basic Document, made up in time by 5 documents with a specific objective each.

CTE DB HE1- Limitation of energy demand
CTE DB HE2- Performance of Thermal Installations (RITE)
CTE DB HE3- Energy Efficiency in lighting installations
CTE DB HE4- Minimum solar contribution for hot sanitary water
CTE DB HE5- Minimum photovoltaic contribution for electric power

The Document CTE DB HE1- Limitation of energy demand considerably toughens the requirements demanded for the building envelope.

For the first time, the use of renewable energies becomes mandatory in the whole Spanish territory to meet part of the energy needs of buildings, either to produce sanitary hot water (CTE DB HE4) or the use of renewable energies to produce electric power in tertiary buildings (CTE DB HE5).

Concerning to the building certification, the number of registered buildings with a certificate in the Autonomous Communities where a certification scheme exists is still very low, basically because this regulation is at this moment only applicable to new buildings and due to the crisis in the building sector in Spain. However there is some data available of some regions.

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The Spanish normative will be tightened gradually in order to achieve the "nearly zero-energy building" (NZEB) objective by 2020.

The energy policy of the Andalusian Region has been formulated together following the principles and criteria of European and national policies, aiming for the diversification of secure energy sources and low carbon emissions, decentralized energy generation and more energy efficiency.

The Andalusian Energy Plan (PLEAN) 2003-2006 was the first step toward that change of energetic model with the adoption by the Government Council of ambitious targets on renewable energy and energy conservation and efficiency. It is based on a solid foundation consisting of a legal framework in line with the changes to be and urges the government of Andalusia to increasing clean and renewable energies, carrying out policies that promote sustainable use of energy resources, energy sufficiency and savings in order to prevent climate change.

Framed in the Autonomous Strategy on Climate Change adopted in 2002, the Andalusian Plan for Climate Action 2007-2012: Mitigation Program, includes among its areas two structural lines of the energy policy of the Junta de Andalucia: promotion of savings and energy performance and promotion of renewable energy sources.

The Sustainable Energy Plan Andaluz de 2007-2013 (PASENER 2007-2013), includes the need to develop a new energy plan on the basis commitments of resources acquired in the Kyoto Protocol, incorporating changes in the principles of energy policy, improves the PLEAN 2003-2006 and increases the scope of the objectives of energy policy aiming at an energy model that promotes structural changes in the system and the consolidation of a new energy culture imbued with a collective conscience to consider the energy as scarce and valuable asset. This Andalusian energy system should look for the best use of energy resources in the region and the global definition of an energy model fully adapted to the climatic cultural and economic conditions of Andalucía. Moreover, the Andalusian Government has gone a step further defining and establishing the Climatic Areas for each municipality. This gives the particular local conditions and facilitates the optimal implementation of measures.

The approval of the Technical Building Code by the Royal Decree 314/2006, the new compensation framework for renewable energy provisions of the Royal Decree 661/2007, the Law 2 / 2007 of Renewable Energy Development and Efficiency and Savings Energy in Andalusia, the recent Decree 169/2011 for the support of the renewable energies and energy savings and efficiency in Andalusia and the

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consolidation of the Andalusian Energy Agency as a tool to achieve the goal of optimizing, in economic and environmental, energy supply of Andalusia, make up a robust framework on which to base the main pillars of the Andalusian Energy policy in the coming years.

Andalusia is also going a step further requiring now in new buildings a minimun qualification of "D".

Building Envelope

AT NATIONAL LEVEL:

• Royal Decree 314/2006, of the 17th of March, APPROVING THE TECHNICAL BUILDING CODE (CTE)
del Mº de Vivienda. BOE 28.03.2006. BOE 23.04.09** - CTE DB HE1- Limitation of energy demand

• Royal Decree 47/2007, of the 19th of January, APPROVING THE BASIC PROCEDURE FOR THE ENERGY CERTIFICATION OF NEW BUILD

- NATIONAL HOUSING AND REFURBISHMENT PLAN 2009-2012 (SUBSIDIES FOR DWELLINGS WITH ENERGY RATING A, B,C)

AT REGIONAL LEVEL- ANDALUCÍA

- Law 2/2007, of 27 March, for the support of the Renewable Energy Development and Energy Efficiency and Savings in Andalusia.

- Orden de 25 June 2008. BOJA 22.7.08. Digital registration of the energy efficiency certificates for new buildings.

- Decree 169/2011 for the support of the renewable energies and energy savings and efficiency in Andalusia

Building Services

AT NATIONAL LEVEL

- Royal Decree 1027/2007, of the 20th of July, APPROVING THE THERMAL BUILDING REGULATIONS (RITE)

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• Royal Decree 314/2006, of the 17th of March, APPROVING THE TECHNICAL BUILDING CODE (CTE)
del Mº de Vivienda. BOE 28.03.2006. BOE 23.04.09**
CTE DB HE2- Performance of Thermal Installations (RITE)
CTE DB HE3- Energy Efficiency in lighting installations
CTE DB HE4- Minimun solar contribution for hot sanitary water
CTE DB HE5- Minimun photovoltaic contribution for electric power.

- Plan for the support and foster of ESCOs

- Rules and supplementary instructions for the approval of solar panels.

Orden de 28 de julio de 1980, del Mº de Industria y Energía. BOE nº 198, de 18.08.80, BOE nº 23, de 26.01.07*. BOE 26.01.07**.

- Specifications of technical requirements to be accomplished by solar hot water and air conditioning systems.

B.O.E. 99; 25.04.81 Orden de 9 de abril de 1981, del Mº de Industria y Energía.
B.O.E. 55; 05.03.82 Prórroga de plazo.

- Connection of photovoltaic installations to the low voltage network.

R.D. 1663/2000, de 29 de septiembre, del Mº de Economía. BOE nº 235, de 30/09/2000.

- Transport, distribution, marketing and supply activities and authorization procedures for electric power facilities .

R.D. 1955/2000, de 1 de diciembre, del Mº de Economía. BOE nº 310, de 27/12/2000; BOE nº 62, de 13/03/2001*. BOE 4.03.08**

- Templates for the contract and bill for solar photovoltaic installations connected to low voltage network.

Resolución de 31.05.01, de la Dirección General de Política Energética y Minas. BOE nº148, de 21.06.2001.

- Regulation of measurement points for the electric power system

Real Decreto 1110/2007, de 24 de agosto. BOE 18.09.07

- Regulation of the electric production activity in special regime

RD 661/2007, of 25th may. BOE 26.05.07. BOE 25.07.07*. BOE 29.09.07**. BOE 18.03.08**. BOE 28.06.08**. BOE 27.09.08**.

AT REGIONAL LEVEL

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- Law 2/2007, of 27 March, for the support of the Renewable Energy Development and Energy Efficiency and Savings in Andalusia.

- Decree 169/2011, of the 31st of May, for the support of the renewable energies and energy savings and efficiency in Andalucía.

- Decree 279/2007 Andalusian Plan Of Energy Sustainability 2007-2013. (Plan Andaluz De Sostenibilidad Energética- Pasener)

- Order of the 4th of February 2009 (BOJA 30 of February the13th) modified by the Order of the 7th of December 2010 (BOJA 244 of December the16th) establishing the rules and regulations for an Incentives Program for the Sustainable Energy Development in Andalusia 2009-2014.

Concerning to the Solar Thermal appliances:

- Order of the 30th March 1991 establishing the technical specifications for the design and implementation of solar thermal installations for the hot water production.

- Agreement of the 9th of September 2003 of the Regional Ministry of Employment and Technological Development for the obligatory incorporation of active low temperature solar energy for the hot water production in buildings belonging to the Andalusian regional government.

Related to the Photovoltaic appliances:

- Decree 50/2008, of 19 February, for the regulation of the administrative procedures related to the photovoltaic solar energy appliances implemented in Andalusia.

- Order of the 26th March 2007 approving the technical specifications of the Andalusian photovoltaic appliances.

- Resolution of the 23th February 2005 of the General Directorate of Industry, Energy and Mines for the Complementary Rules for the connection of photovoltaic generators under 100 KW, included in the Royal Decree 436/2004 of 12th March, and able to be connected to the low voltage power supply net.

- Instruction of the 12th May 2006 establishing the procedure for the implementation of photovoltaic appliances plugged in to the distribution power supply net.

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Appliances/ equipment

AT REGIONAL LEVEL

- Order of the 14th of November 2008 (BOJA 238 of December the1st) establishing the rules and regulations for the Renove Plan for electric appliances in Andalucia.

Some of the legislation has been already mentioned above.

Occupants/ Behaviour

AT REGIONAL LEVEL

- Order of the 25th June 2008 establishing the Electronic registration of Energy Performance of new buildings.

- Andalusian Program for Adaptation to Climate Change. (Programa Andaluz de Adaptación al Cambio Climático)

- Order of the 4th of February 2009 (BOJA 30 of February the13th) modified by the Order of the 7th of December 2010 (BOJA 244 of December the16th) establishing the rules and regulations for an Incentives Program for the Sustainable Energy Development in Andalusia 2009-2014- **"ANDALUCIA A+".** It contains five main action lines:
  1) Energy savings and Energy Efficiency;
  2) Energy Renewable systems;
  3) Energy exploitation and energy recovery;
  4) Energy studies, audits and consulting and dissemination actions;
  5) Energy Infrastructure.

- Within the innovations introduced by the Order of the 7th of December 2010, there are 5 specific programs:
  1) PROSOL Program;
  2) Program for Efficient Vehicles;
  3) Windows renovation Plan for citizens in Andalusia;
  4) Efficient Lighting Program in Andalusia;
  5) Program for the Efficient Air Conditioning.

- Order of 22 December 2010, of he General Secretariat of Industrial and Energy Development, announces the membership of authorized companies and collaborating in the management of certain specific programs on a regular basis

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for the promotion of savings and energy efficiency in buildings and facilities.

This resolution seeks to convene the accession of authorized companies and partners, in order to establish the necessary conditions for the next publication of the resolution that opens the application period of the grant under the following specific programs

1. Window Renewal Plan in Andalusia.

2. Efficient Lighting Program in Andalusia.

3. Efficient air conditioning Program in Andalusia

- Resolution of March 24, 2011, of the General Secretariat of Industrial Development and Energy, establishing the calls for grants under certain specific programs for the promotion of energy saving and energy efficiency in buildings and facilities.

  This resolution convenes the awards of the grants under the following specific programs as provided in Article 12 of the Order of February 4, 2009:

  1. Window Renewal Plan in Andalusia.

  2. Efficient Lighting Program in Andalusia.

  3. Efficient air conditioning Program in Andalusia

- Order of the 7th July 2009 publishing the integral text of the Housing and Land Agreed Plan 2008-2012, approved by the Decree 395/2008, of the 24th of June, with the modifications introduced by the Decree 266/2009 of 9th June.

- Order of the 10th November 2008 for the development and procedures of housing and land actions of the Housing and Land Agreed Plan 2008-2012

- Order of the 26th January 2010, for the development and procedures of housing and land actions of the Housing and Land Agreed Plan 2008-2012

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5.10. Alendejo (Portugal)

The Portuguese legislation on buildings energy efficiency derives directly from the implementation of Directive 2002/91/EC and comprises three mains laws, published in the Official Journal on 4th of April 2006:

- The SCE (Law-Decree nº 78/2006), which defines the certifications system for energy and indoor air quality in buildings;
- The RSECE (Law-Decree nº 79/2006), which is the regulation for HVAC systems in buildings;
- The RCCTE (Law-Decree nº 80/2006), which regulates the characteristics of buildings thermal performance of buildings and hot water production.

The aim of the SCE is to promote energy efficiency in buildings through the certification of the building energetic performance and indoor-air quality and the identification of energy efficiency improvement measures. The system full implementation occurred only in 2009, when it's application by qualified experts become mandatory for all types of buildings: new buildings, major refurbishments, public buildings and all existing buildings when sold or rented.

In summary, the SCE consists in a certificate which rates the energy performance of buildings from A++ (high energy efficiency) to G (poor energy efficiency) according to the results obtained from the application of the calculation methods presented in the RCCTE and RSECE, and it may contain a list of energy efficiency improvement measures.

RCCTE and RSECE are applicable according to the building type. While RCCTE is applicable to Residential buildings and small non-residential buildings (<1000 m^2), RSECE is applicable to non residential buildings with more than 1000 m^2 of useful area. Both regulations aim to improve building energy efficiency by setting standard calculation procedures to estimate energy demands (and loads for large non-residential buildings) and by establishing mandatory requirements according to the type of building (dwellings, office-buildings, schools, sports centres, etc). Such requirements can be summarised according to the four areas of the WP4 conceptual framework in the following manner:

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Requirements for new buildings and major renovations

Building envelop
Maximum Heating and Cooling demands per m^2 of useful floor area, according to location (residential and small non-residential buildings only)
Maximum U-Value, depending on location (walls: 1,45 to 1,80 W/m^2K ; roofs: 1.25 to 0.9 W/m^2K)
Minimum shading requirements for all windows
Minimum requirements for thermal bridges
Maximum primary energy consumption per m^2 of floor area, according to location
Building services
Maximum consumption for production of domestic hot water, including mandatory installation of collectors for solar hot water (all residential buildings as well as large non-residential buildings with significant hot water use, e.g., hotels, hospitals, etc.)
Minimum efficiency and quality requirements for heating and cooling systems components (non-residential buildings)
Mandatory maintenance plans (large non-residential buildings only)
Appliances / equipment
Appliances have their own energy efficiency labelling system imposed by law-decree nº214/98 However their classification does not contribute to the buildings energy efficiency ranking.
Occupants / Behaviour
No known applicable legislation

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Requirements for existing non-residential buildings larger than 1000 m2

RSECE regulation establishes that all existing non-residential buildings with more than 1000 m2 must be subject to energy surveys every six years, based on actual fuel bills covering all types of energy. If the primary energy consumption of such buildings exceeds a certain level, an energy efficiency plan must be developed by a certified expert, and all the measures with simple payback periods shorter than eight years became of mandatory implementation in a three year period. This threshold level corresponds to the currently 40% worst performers of their typology, as determined by extensive building energy consumption surveys ordered by the national government in preparation of the new regulations, and should be regularly lowered over the years, to include an increasing number of buildings

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5.11. General overview of legislation for building energy efficiency in MED regions

Most of the information provided about the main legislation for building energy efficiency in the MED countries/ regions participating in the study relates to national legislation, regulation and standards, which lead to national and/or regional strategic and action plans for the implementation of the corresponding legislation. The following tables present a general overview of the corresponding legislation and strategic plans, mentioning the MED countries and regions that provided the corresponding standardized information (see Annex 1).

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Table 36: Legislation for building energy efficiency in MED regions

Conceptual framework/ areas of application					**Legislation**	**Countries/ regions**
General	***Building Envelope***	***Building Services***	***Appliances/ Equipment***	***Occupants/ Behaviour***		
✓					Fiscal incentives for energy efficiency improvement in buildings (loans, tax reduction etc)	France, Italy, Malta
✓					Accelerating the development of RES	Greece
	✓	✓	✓		Energy Performance of Buildings (Directive 2002/91/EC) and corresponding regulations and standards	Italy, Spain Greece, Slovenia Malta, Portugal
	✓	✓	✓		Environmental and eco-efficiency criteria for buildings	Spain/ Catalonia, Andalusia
	✓	✓			Building code for renovation of existing constructions	France
	✓	✓	✓	✓	Energy performance in the final consumption and energy services	Greece, Malta
		✓	✓		Installation, working and maintenance of thermal plants in buildings	Italy, Andalusia
		✓			Efficient lighting and control systems	Italy, Malta
				✓	Environmental Quality Label	Spain/ Catalonia
	✓	✓	✓		Renewable Energy Development and Energy Efficiency and savings	Andalusia

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Table 37: Strategic and action plans for building energy efficiency in MED regions

Strategic plans	**Countries/ regions**
Energy Efficiency action plans	Catalonia, Andalusia Greece Slovenia Italy France
Future energy and climate change plans	Catalonia, Andalusia
Energy saving and energy efficiency in buildings	Catalonia, Andalusia
Regional Energy Improvement in housing	France/ PACA

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6. Financial schemes/ measures for energy efficiency in buildings of MED regions

The scope of this section is to summarise the main financial schemes/ measures at national and /or regional level (if any) for energy efficiency in buildings (residential & tertiary sector) in each participating country/ region. An overview is presented for each participating region, complemented by a standardised presentation in Annex 2 of the corresponding financial schemes/ measures in relation to the four areas of the conceptual framework of building energy efficiency improvement (Annex 3), based on the corresponding template provided.

6.1. Catalonia (Spain)

At national level, the most important financial measures for energy efficiency in buildings include:

- several decrees and orders in charge of financing the National housing and refurbishment Plan 2009-2012 (real decreto 2066/2008, Orden VIV/2680/2009),
- Resolution from IDAE (Spanish Institute for energy saving and diversification) and the State Secretary for Energy (January 2010): Energy efficiency programme for buildings of the national public administration. (September 2010): incentives and economic support for energy service companies to participate in the energy efficiency programme for buildings of the national public administration
- Royal decree (6/2010) for economic and employment stimulation measures: Plan to support ESCO contracts (Plan 2000 ESE's) (improve energy efficiency in 2000 public buildings)
- Government agreement 04.03.2011: Energy Efficiency Intensification Plan 2011. 20 urgent measures with total investment of 1,151 million €. Measures in building sector: establishment of credit line for ESCOs (ICO-ESE), and promotion of biomass boilers in public buildings financed in part by ESCOs..
- Royal decree (5/2011) for measures for the regulation and control of employment and promotion of housing refurbishment (included in this decree is a fiscal deduction for housing refurbishment)[62]
- July 2011: agreement between the European Investment Bank and the Spanish IDAE, to create a fund for JESSICA (Joint European Support for Sustainable Investment in City Areas) projects focused on financing energy efficiency and

[62] http://portaljuridico.lexnova.es/articulo/JURIDICO/62916/principales-aspectos-del-real-decreto-ley-5-2011-sobre-el-empleo-sumergido

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renewable energy projects, in what is a new way of using European structural funds. (FIDAE – Energy saving and diversification investment fund).
- Plan E (government plan for public construction to stimulate employment)
  - Resources invested in refurbishment in 2009: €110 million, some of which went to energy efficiency criteria, leading to 43.724 home refurbishments, and generating up to 26.949 jobs. Catalonia received over €19 million from the refurbishment fund.

Financial schemes/ measures at Regional level (Catalonia)

There are mainly two public entities in the Catalan Government directly involved in the definition and management of financial support measures in form of subsidies for energy efficiency improvement in the building sector. While the Department for Housing and Environment (current Department for Territory and Sustainability) is exclusively dedicated to the residential sector, the Catalan Energy Institute (ICAEN – Institut Català d'Energia) provides subsidies to both, domestic and tertiary sector.

The actions deriving from the 2006-2015 Energy Plan of Catalonia are financed by a collaboration of the Spanish IDAE and the Catalan Energy Institute (ICAEN), signed 17. April 2008.

General energy efficiency measures:
- subsidies for residential building refurbishment **(**MAH/177/2010, applying the Decree 13/2010 Plan for the Right to Housing 2009-2012)
- Subsidies for energy saving and energy efficiency of the action Plan deriving from the energy efficiency and energy saving strategy (2009 and 2010) (ECF/462/2010)
- Subsidies for the neighbourhood and urban areas development fund created with the Law of 2/2004 for urban area improvement (PTO/430/2010)

Specific energy efficiency measures, applied to different areas of building energy consumption:

Building Envelope

The Refurbishment Plan (Pla de Rehabilitació) is the basis for an annual financial subsidy programme managed by the former Department of Housing and Environment for residential buildings built before the first Catalan Regional Law on Thermal Insulation In buildings (NRE-AT-87) came into effect. Some subsidies refer to energy efficiency improvement of the building's envelope, such as improvement of

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insulation in opaque and transparent parts; others refer to the installation of solar assisted DHW.[63]

Subsidies for the substitution of windows ("Renove" plan 2010 and 2011) (Plan Renove Finestres ECF/124/2010)

Building Services

Subsidies for substitution of boilers and air conditioning devices ("Renove" plan 2010) (ECF/362/480/2010)

Appliances / Equipment

Subsidies for substitution of electrical appliances ("Renove" plan 2010) (ECF/362/480/2010)

First results of financial schemes/ measures

With regard to the joint financial programmes of the State and Regions, first results are available. Table 6 shows the results of the economic impact evaluation for the four main categories of public subsidy given in the frame of the joint IDAE and autonomous community programme during the years 2005-2010 at State level.

The relation of public subsidy to energy savings considers the total energy savings over the estimated lifetime of the specific measures. It has to be stressed that the financial values only reflect the amount of public subsidy, not the total investment to implement the energy efficiency measure. The relation of public subsidy to primary energy saving works out to be less than 1cent€ subsidy/avoided kWh.

Table 38: Summary of bottom-up results for 2010 (2004 base) of the joint IDEA and autonomous community program, 2005-2010.
Source: IDEA Plan de Acción 2011--2020

Energy efficient renovation	Public subsidy	Final energy savings	Primary energy savings	Avoided emissions
	M€	ktep	ktep	$ktCO_2$
Building envelope	111,5	22	42	89
Building services	145,5	61	116	244
Lighting equipment	22,5	30	74	150

63 63 Institut Cerdà (2006) La *contribució de l'habitatge de Catalunya a la reducció d'emissions de gasos amb efecte d'hivernacle.* Generalitat de Catalunya, Departament de Medi Ambient i Habitatge

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Appliances	282,3	81	204	412

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Table 39: Relation of public subsidy to energy savings and avoided emissions
Source: own calculations

Energy efficient renovation	Estimated lifetime of measure	Public subsidy / primary energy saving	Public subsidy / avoided emissions	Avoided emissions / public subsidy
	a	€/kWh	€/kgCO_2	kgCO_2/€
Building envelope	30	0,01	0,04	23,95
Building services	15	0,01	0,04	25,15
Lighting equipment	6	0,00	0,03	40,00
Appliances	10	0,01	0,07	14,59

6.2. PACA (France)

National measures

Extract from the MURE database:

Household France

Code	Title	Status	Type	Starting Year	Ending Year	Semiquantitative Impact	NEEAP Measure
FRA1	High environmental quality of buildings	Ongoing	Information/Education	1990		Low	Yes
FRA2	Labels on electrical households appliances	Ongoing	Legislative/Informative	1995		Medium	No
FRA3	Minimum efficiency standards for hot water boilers	Ongoing	Legislative/Normative	1994		Low	No
FRA4	Demonstration projets in buildings	Ongoing	Financial	1980		Low	No
FRA5	VAT Reduction on energy efficiency investments	Ongoing	Fiscal/Tariffs	1999		High	Yes
FRA6	Subsidies for dwellings retrofitting OPAH	Ongoing	Financial	1978		Low	No
FRA7	Tax credit for works on energy efficiency	Ongoing	Fiscal/Tariffs	1990	2012	High	Yes
FRA8	Building codes "RT 1974"	Completed	Legislative/Normative	1974	1982	High	No
FRA9	Building codes "RT 1982"	Completed	Legislative/Normative	1982	1989	Medium	No
FRA10	Subsidies for wood equipment	Completed	Financial	1999	2006	Low	No
FRA11	Subsidies for solar equipment	Completed	Financial	2000	2005	Low	No
FRA12	Limit to the internal temperature of houses or dwellings (19°C)	Ongoing	Legislative/Normative	1974		Medium	No
FRA13	Audits subsidies in buildings	Ongoing	Financial	1980		Medium	No
FRA14	Minimum efficiency standards for refrigerators and freezers	Completed	Legislative/Normative	1999	2007	Medium	No
FRA15	Building codes	Completed	Legislative/Normative	2001	2005	Medium	No

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Household France

Code	Title	Status	Type	Starting Year	Ending Year	Semiquantitative Impact	NEEAP Measure
FRA16	Local energy information centres	Ongoing	Information/Education	2001		Medium	Yes
FRA18	Building codes "RT 1989"	Completed	Legislative/Normative	1989	2001	Medium	No
FRA22	Information and advertising campaign “Faisons vite ça chauffe	Completed	Information/Education	2004	2006	High	No
FRA23	Tax credit for energy efficiency materials and renewable energies	Ongoing	Fiscal/Tariffs	2005		High	Yes
FRA28	Sustainable building training scheme	Ongoing	Unknown	2008		Low	Yes
FRA31	0% green loans	Ongoing	Financial	2009	2012	Medium	Yes
FRA32	The sustainable development account	Ongoing	Financial	2007		Unknown	Yes
FRA33	Building codes "RT 2005"	Ongoing	Legislative/Normative	2006		High	Yes
FRA34	EU-related: Energy Performance of Buildings (Directive 2002/91/EC) - Energy performance audits	Ongoing	Legislative/Informative	2006		High	No
FRA35	High performance label dwellings	Ongoing	Information/Education	2007		Low	No
FRA37	CO2-credits for “household” projects	Ongoing	Financial	2007		Low	No
FRA38	Periodic mandatory inspection of boilers	Ongoing	Legislative/Informative, Legislative/Normative	1998		Low	Yes
FRA39	Periodic mandatory inspection of Heating/Ventilation/AC (HVAC)	Ongoing	Legislative/Normative	2002		Low	No
FRA40	“Modernising buildings and cities” programme	Ongoing	Unknown	2008		Unknown	Yes
FRA42	Tax credit for BBC building	Ongoing	Financial	2009	2020	Low	No
FRA43	Green loan for social housing	Ongoing	Financial	2009	2020	Unknown	No
FRA44	Subsidies for dwellings retrofitting PALULOS	Ongoing	Financial	1979		Medium	No
FRA45	Energy savings certificates	Ongoing	Financial	2006	2013	High	Yes
FRA46	Information and advertising campaign "why wait" (pourquoi attendre)	Completed	Information/Education	2004		High	No
FRA47	Carbon tax	Proposed(medium/long-term)	Cross-cutting with sector-specific characteristics			Unknown	No
FRA48	EU-related: Energy Performance of Buildings EPBD Recast (Directive 2010/31/EU) - RT 2012	Ongoing	Legislative/Normative	2013		High	Yes

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Tertiary France

Code	Title	Status	Type	Starting Year	Ending Year	Semiquantitative Impact	NEEAP Measure
FRA1	Audits subsidies in buildings	Ongoing	Financial	2000		Medium	No
FRA2	Energy efficiency of residential and tertiary buildings - Program OPATB	Ongoing	Co-operative Measures, Financial, Information/Education/Training	2003		Medium	No
FRA3	Building codes "RT 2000"	Completed	Legislative/Normative	2001	2005	High	No
FRA4	High environnmental quality of buildings	Ongoing	Information/Education/Training	1990		Low	Yes
FRA5	Minimum efficiency standards for fluorescent lamp ballasts	Ongoing	Legislative/Normative	2001		Medium	No
FRA7	Building codes "RT 2005"	Ongoing	Legislative/Normative	2006		High	Yes
FRA8	Energy performance audits	Ongoing	Legislative/Informative	2006		High	Yes
FRA9	Minimum efficiency standards for boilers	Ongoing	Legislative/Normative	1992		Low	No
FRA10	Periodic mandatory inspection of boilers	Ongoing	Legislative/Normative	1998		Low	Yes
FRA11	Periodic mandatory inspection of Heating/Ventilation/AC (HVAC)	Ongoing	Legislative/Normative	2002		Low	No
FRA12	High energy performance label	Ongoing	Information/Education/Training	2007		Low	Yes
FRA13	Limit to internal temperature	Ongoing	Legislative/Normative	1974		Medium	No
FRA14	Building codes RT1989	Completed	Legislative/Normative	1990		Medium	No
FRA15	"Moderning building and cities" programme	Ongoing	Financial, Legislative/Informative	2008		High	Yes
FRA16	Energy savings certificates	Ongoing	Financial	2006	2013	High	Yes
FRA17	Energy advisors for local authorities	Ongoing	Unknown	2009		Low	No

From a regulatory perspective, France is a centralised country. Regulations relating to sustainable building are therefore largely dictated at a national level. Under the framework of the "Grenelle I" law, which is currently undergoing review and extension with "Grenelle II", numerous provisions apply to the management of sustainable building (see the detailed analysis in Appendix 3). In particular, the “Grenelle Building Plan” has a strong focus on energy efficiency.

Focus on thermal regulation

More specifically, with regard to thermal regulations, France applies the European energy directive **at a national level.**

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Some key dates:

- **2000:** Reduction of new-build consumption to around 120/140 kWhEP/m^2 net surface area (see Appendix 1 for explanations of this calculation)
- **2005:** Reduction of new-build consumption to around 100/120 kWhEP/m^2. net surface area
- **2006:** Setting up of the Energy Performance Diagnosis and the energy label for new-build and then older houses (see Appendix 2) for sale in 2006 and for lease in 2007; As of 2008, display of the EPD in certain public buildings. With the enactment of the Grenelle II law, the inclusion of the EPD in real estate adverts (sales and rentals) will be made obligatory.
- **2007:** Setting up of the "Grenelle" framework environmental act: air conditioning temperature (26°C) and energy regulation of existing equipment (mandatory thermal calculation for renovations > 1000 m^2 of net surface area)
- **As of 2011:** reduction of new-build consumption to 50 kWhEP/m^2. net surface area (RT 2012); setting up of the BEPAS (building with passive energy - 2015), then BEPOS (buildings with positive energy) labels.

To date, the systematic submission of evidence that regulatory thermal calculations have been properly carried out is not mandatory when filing the building (or renovation). With the Grenelle II law, this measure is mandatory.

Energy performance labels

Beyond regulatory thermal thresholds are higher performance levels, the thresholds of which may be recognised by labels[64] (according to the ruling of 8 May 2007), the most demanding of which is the BBC-Effinergie label (50 kwh/m^2/year) which serves as a reference for the BDM Initiative.

These levels of recognition are required for access to financial and fiscal benefits (e.g. zero rate loans), in particular for housing (including social housing). The government's aim was to create favourable market conditions (boosting demand) so as to prepare the entire profession for the strengthening of thermal regulations (RT 2012, taking effect in 2011 for certain buildings). In fact, the energy performance level which will be required under RT 2012 is that of the BBC level of the 2005 RT. BBC-Effinergie, an entity originally founded by the French regions, therefore plays an important pole in French government regulations.

At the level of France as a whole, the number of BBC-certified housing units has evolved extremely rapidly:

- 2007: 853

[64] HPE, THPE, HPE EnR, THPE EnR, BBC, Positive energy building

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- 2008: 2582
- 2009: 20000

Regional and local adaptations

BBC-Effinergie certification is also a tool enabling local communities to supplement their own regulatory systems and incentives. The law gives them the option of agreeing to a land tax exemption, and to exceed the 20% land occupancy coefficient (soon to be 30%) in the case of improved energy performance. In 2009, the Paca region represented only 6% of BBC certification applications, although this figure is increasing for new constructions.

The Grenelle II law will also allow regional authorities to reserve development zones for buildings meeting stricter energy and environmental rules.

Focus on Grenelle I and Grenelle II for sustainable development

Grenelle II goes far beyond energy alone, even though, curiously enough, it begins with this aspect. It then moves on to planning, only to return to energy and then move on to other topics. A detailed analysis is provided in Appendix 3.

Ultimately, several policies can be distinguished:

- **An overall voluntary development and planning policy:** Articles 7 to 17, then 25 to 31, and above all Grenelle II
- **A voluntary policy for thermal renovation, in particular for housing: A**rticles 1 to 6 and 18 to 20
- **A more objective policy relating to materials, health, environment, food, biodiversity: A**rticles 21 to 25 and 32 to 47
- **A policy to be "grasped" on the importance of key players: regions (excluding development) and the government**: Articles 48 to 57; with regard to this point, the French state will be incapable, financially and technically speaking, of implementing this entire programme alone; it will require the collaboration of professionals, local people and regional authorities.
  Local authorities must work hard to fulfil their responsibilities, but they must also demonstrate volition. For the moment, we are therefore faced with two types of actions:
  - **Bottom up:** The Grenelle committee entrusted by the ministry with application of the law lacks resources, and already relies on local authorities, associations and clusters.
  - **Top down:** some institutions on a national level (France GNC, the BEEP network, for example) rely on powers of prohibition to dictate conduct in terms of sustainable development to the "provinces".

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However, the changes that are underway with the reform of regional authorities will modify the administrative pyramid, the scope of responsibility of regional authorities, and the budgetary resources they have access to, making the prospective difficult over the medium term.

Grenelle I has 57 articles, while Grenelle II of 12 July 2010 — entrusted more specifically with the operational set-up – has 257. An additional 201 implementing decrees are currently being prepared and ordinances are intended to catch up with the transposition of European environmental protection laws.

A very careful reading of these two framework laws might disappoint some. This would take several months, as not all decrees have yet been set out; this should take place between now and the end of 2011/beginning of 2012.
Nevertheless, the ministerial reshuffling of 13 November 2010, 18 months before the presidential elections, risks slowing down the rate of ecological reforms, as all governments since 1974 have consistently dedicated less efforts in this area at the end of their terms of office.

Strategic plans for HSA in France

Regarding the specific question of the energy performance of housing, France's current ambitions may be confused with those of Grenelle I and Grenelle II.

More specifically, we can expect:

§ More BBC buildings in 2012, and more buildings with positive energy in 2020, thanks to regulatory changes (cf. the previous chapter): that is to say, in less than four years to divide by a factor of 2 to 4, depending on the energy in question, greenhouse gas emissions from new builds.
§ Reduced extra costs linked to the construction of BBC buildings through experimentation, exemplariness, the dissemination of innovations (soft and hard) and economies of scale: excess costs of around 5 to 10% are envisaged for 2012, with a ROI in 10 to 15 years.
§ The "greening" of financial and fiscal instruments that should be reserved for investment in BBC-categorised housing
§ A significant focus on existing housing (reducing energy consumption by 38% between now and 2020):

- Zero rate Ecoprêt environmental loans and other support schemes, contingent upon "work packages" for individuals (occupants or lessees)
- Social housing: the goal is to renovate between now and 2020 a total of 800,000 homes with energy consumption levels that fall within the EFG categories of the energy performance diagnosis (incentive

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financing mechanisms)

- Greater flexibility of rent increase rules in the event of significant energy renovations
- Apartment blocks: individualised accounting of heating costs in buildings with collective heating systems; modification of decision-making rules in jointly owned buildings for work linked to energy efficiency

6.3. Liguria (Italy)

The Regional Energy Plan (PEAR) developed by the Liguria Region, identified a number of actions to promote Energy efficiency on the regional territory thank to the implementation of the buildings' energy certification process and the publication of a number of calls for bids to foster the use of renewable sources and the renovation of buildings.

The Energy certification process concerning buildings was launched when the Law no. 22/07 and the Implementation Technical Regulation were passed, and the 2002/91/EC directive was recognized into the Italian Law. The former was then launched before the development of the national Guidelines.

In the years that have gone by since 2007, the Liguria Region, in collaboration with ARE Liguria, has developed calculation methods, started the first course for energy certifiers, created the regional list of energy certifiers and established the technical assistance department for professionals that need to use the Celeste software, which has been developed and is now available to certify buildings according to Liguria's procedures.

At the moment, there are about 4,900 professional energy certifiers at the regional level and the energy certifications that have already been sent to Liguria Region are more than 50,000 (these data were updated in August 2011). The start of the energy certification process made professionals aware of energy efficiency and encouraged them to use the most up-to-date technologies aimed at saving energy when designing buildings ad their installations and systems. The energy certification must be drawn up upon selling or renting out a place and it is used to increase people's awareness concerning the energy performance of their places; in the future, the energy class of buildings may steer the market towards more energy efficient buildings.

The Liguria Region entrusted ARE with reviewing and amending Law no. 22, May 29th, 2007 "Regulations concerning energy", in order to recognize the 2010/31/EU directive on energy performance of buildings. The 2010/31/EU directive envisages

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stricter criteria if compared to the criteria already in force, what is necessary then is amending the regulations concerning energy efficiency and certification of buildings by Member States. The updating of the law is carried out by paying specific attention to the better implementation of the directive provisions, and, at the same time, what we are trying to do is being in line with the updating of the national regulation that is being performed by the Ministry of Economic Development.

The Liguria Region and ARE Liguria are thus taking part into the following initiatives at the national and European levels:

- Concerted Action III, this project is financed by the European Commission and aims at encouraging Member States to recognize the 2010/31/UE directive. Experts from the 27 Member States do take part into the project;
- Inter-regional work-groups. Representatives of the Ministry of Economic Development and the CTI (Comitato Termotecnica Italiano) do take part into these work-groups in order to compare their expertise and harmonize the certification process on the national territory; the CTI work-group aims at updating the UNI/TS technical regulations intended for calculating the primary energy needs of buildings.

The three calls for funding to improve energy efficiency and the use of renewable sources that have been published by the Liguria Region were intended for general companies, tourist companies and public administrations. This project started at the end of 2009 and will come to an end at the end of 2012. Allocated funds are equal to 8.5M€ for general companies, 0.75M€ for tourist companies and 5.4M€ for public administrations.

About 80% of the performed actions were focused on the installation of solar photovoltaic panels, whereas 20% - which amounted to an overall funding of about 3M€ - was focused on energy renovation projects of heating and air-conditioning systems, as well as systems for heating water for sanitary purposes, house lighting and a few more works performed on the building structure.

The most important initiative, from both technical and financial points of view, has been implemented at the public administration level. It was the renovation of the systems of a very important building, having a surface of more than 10,000m2. The existing heating and air-conditioning systems – based on traditional methane boilers and air-conditioning systems - have been substituted by a trigeneration plant that operates with a heat pump system equipped with geothermal probe. The system is remote managed and controlled. The overall cost of these plants is about 2.5M€, whereas the allocated funds amounted to about 1M€.

The works on the building structure were not extensive, since they were very complex and expensive, because it was extraordinary maintenance and renovation

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of vintage buildings that make up most of Liguria's building heritage. Most of the works that have been performed were focused on substituting traditional boilers with condensing boilers or heat pumps (either air heat pumps or equipped with geothermal probes), solar panels for heating water for sanitary purposes and wood boilers instead of fossil fuel boilers. Moreover, what has also been done, is the installation of a heat pump to be used for house heating and heating water, that operates with solar panels, whose role is increasing the temperature of cold sources, thus it increases the overall performance of the system. This project was developed by the University of Genoa that has been working on such a system for years.

Many applications for funding to support the installation of systems for the production of energy from renewable resources (photovoltaic systems especially) have been placed, whereas there are fewer applications for supporting energy renovation actions. This means that support to production – if it is useful to encourage the use of new technologies - may discourage more beneficial, and more complex, activities, such as renovation of building structures. What is needed is funding to be gradually reduced as these new technologies are more and more present on the market. The moment these technologies are fully developed, they ought to be made compulsory at the town planning level and funding ought to be allocated to different actions and works that the market is not yet interested in, even if they are clearly beneficial.

6.4. Piedmont (Italy)

The Piedmont Region supports measures for the energy efficiency of buildings through the supply of grants for two different measures:

1- **Demonstration and strategic projects** (regional law n. 23/2002).
Demonstration projects in the field of energy efficiency are directed to the realization of plants that have innovative features for technical and /or management, such as pilot interventions. Strategic projects are directed to the use of renewable and efficient energy leading to annual savings of CO2 equivalent. In support of these initiatives were intended funds for an amount of EUR 13.500.000.

2- **The Regional Operational Programme (POR) 2007/2013** is the instrument that regulates the European Regional Development Fund in Piedmont for the period 2007/2013. The general objective of the Programme is to develop the ability to adapt to sudden changes in the regional system of economic systems and strengthen the capacity for innovation and facilitating the attachment to the European areas with a higher living standards. The Programme is based on 3 strategic priorities. These priorities are divided into 4 specific objectives that identify the areas in which

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focuses the action of the ERDF in order to increase the levels of competitiveness and attractiveness of the regional system.

Axis 1 - improve the competitiveness of the regional system through the development of research, innovation and new technologies;
Axis 2 - Promote eco-sustainability by pursuing a more efficient use of natural resources;
Axis 3 - Promoting the environmental heritage – historical - cultural and regeneration of urban areas;
Axis 4 - Developing a service for the administrative and technical structure of the Region in order to ensure an improvement in the implementation of the Programme.

The programme has developed activities related to energy efficiency of buildings increasing energy production from renewable sources and promoting efficiency in production and consumption of energy (axis 2).

3- **Constructing or strengthening of district heating** using revolving funds system. Beneficiaries may be private companies, public or mixed associations...
Eligible expenses: which are strictly necessary for the construction or upgrading of the plant. It does not include expenses incurred in the construction of generation plant (except in the case of biomass power plants).

4- PROGRAMMA CASA – 10.000 ALLOGGI ENTRO IL 2012
It's a funding program of the Region Piedmont (Direction of strategic planning, housing and regional policies) for the construction of social buildings. The program, which provides a total financial of 748.850.000 euros is divided into three-year periods.
The actions that characterize the program can be summarized as:

- to build housing with rent-controlled lease;
- Encourage the opportunity to enter into lease contracts with negotiated rents;
- Encourage the restoration of existing buildings in order to reduce the tendency to occupy new spaces (compromising the territory);
- Constrain the design and implementation of interventions aim to reduce consumption of energy and environmental resources, to promote the use of renewable energy sources and eco-friendly materials.

All buildings financed with this program must be designed, built and operated according to the criteria contained in the environmental assessment system known as "PROTOCOLLO ITACA" (D.G.R. 25 Maggio 2009, n. 10-11465)

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This tool allows to estimate the level of environmental quality by measuring performance of the building in relation to "resource consumption" and "environmental load".
In fact, the PROTOCOLLO ITACA allows to consider:

- The evaluation of the use of material derived from renewable sources and recycled;
- The evaluation of the use of drinking water
- The evaluation of the use of the performance of the building (as required by law)
- The evaluation of energy consumption for winter heating
- Assessing the level of control of solar radiation.

The compilation of the sheets included in the "PROTOCOLLO ITACA" allows to assign a score between –1 and 5 for each criteria. The score of 0 matches to the benchmark, and corresponds to the current construction practice.

6.5. Basilicata (Italy)

At national level, the Budget law 2007, 2008 (covering the years 2009-2010) and 2011 have introduced set of fiscal incentives and facilitating measures direct to improve energy efficiency in existing building. The access to the incentives is limited to those buildings provided with energy certification. It is established a 55% tax credit, to be spread over a maximum of ten fiscal years, for works carried out before the 01/2012 and directed to improve existing buildings performances. The implementing Decrees (2007, 2009, 2010) set the values and the parameters to be respected for each type of work financed. In particular are financed the improvements of:

1. The renewal the improvement of the efficiency of the heating system (fiscal deduction of up to € 30.000) with installation of electric, absorption cycle ad geothermal heat pumps and condensing boilers. Furthermore, it is established a fiscal deduction up to € 60.000 to support the installation of solar thermal applications.
2. Retrofitting of building envelop elements (fiscal deduction up to € 60.000). The works have to satisfied stricter values updated specifically by the Decree of the Ministry of Economic Development in 2010.
3. Small building renovations, with building performance of less than 20% less respect the values set by law. (fiscal deduction of up to € 100.000).

The following diagrams show a summary of the results obtained in 2009.

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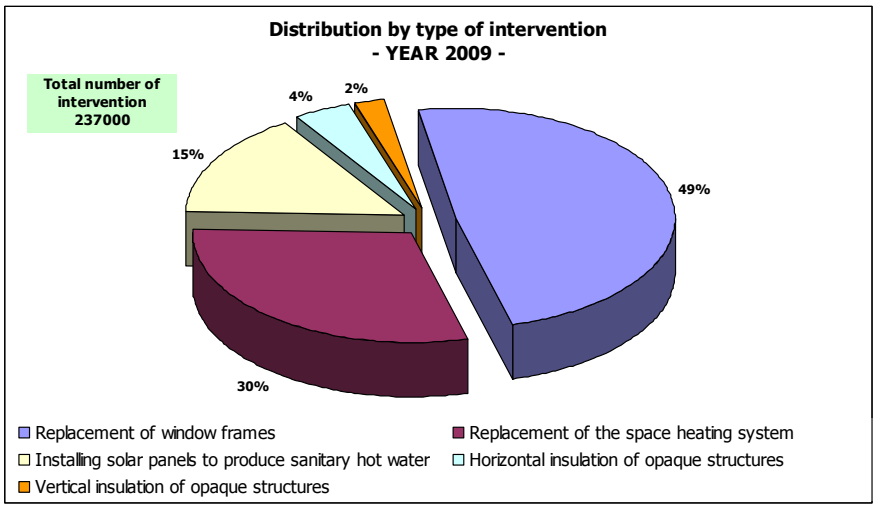

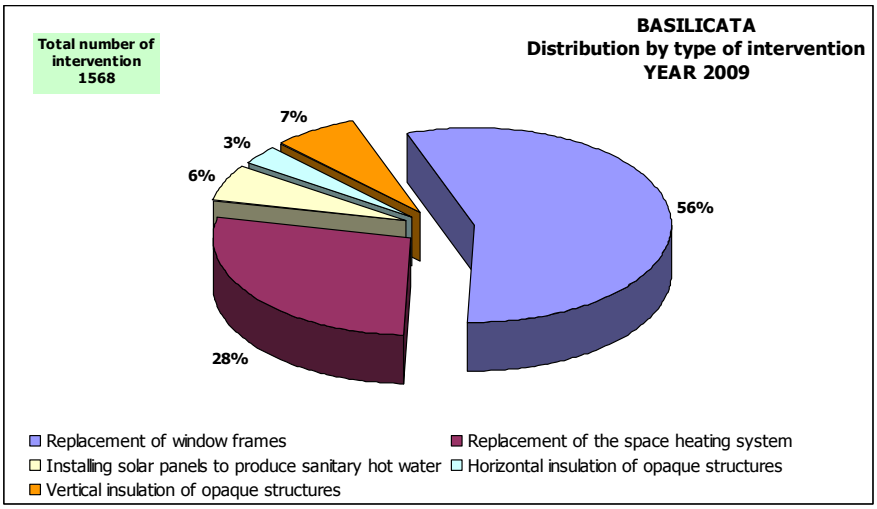

Basilicata Region, with no decision of the Regional government n. 1449 on October 2, 2006, issued the "Call of proposal for the grant of aid to support technological innovation and reducing energy consumption in buildings". This call of proposal allowed capital contributions aimed to encourage the use of materials, systems and innovative technologies in the energy sector by reducing energy consumption, improving energy efficiency and the use of renewable energy in buildings used for civil, commercial, tourist and sports.

The contributions concerned the following types of intervention:

1. Integrated control and accounting of the consumption systems of heat and sanitary hot water,
2. Combined production of electricity and heat,
3. High performance lighting systems,
4. Solar collectors for space heating,
5. Solar collectors for heating domestic sanitary hot water,
6. Combustion systems of vegetable residues,

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7. Pellet stoves
8. Radiant systems combined with condensing boiler and solar collectors.
9. Integrated interventions in buildings (insulation, improvement of windows transmittance and replacement of boilers with high efficiency generators),
10. Improving insulation in buildings,
11. Improvement of windows transmittance in buildings,
12. Installation of boilers with high efficiency,
13. Small wind systems for the production of electricity for buildings used for commercial, tourist, sporting and productive,
14. Heat pump for space heating.

Under this call of proposal, 1568 actions are financed for a total cost of € 8,424 251.00; the subsidies provided amounted to € 3 000 000.00.
The interventions supported have produced an overall energy savings of 7,604 toe per year and a decrease of 18,133 ton equivalent per year ofCO2.

	Interventions	Cost of interventions	Funding granted	Energy saving (toe/year)	Reduction of CO2 emissions (ton CO2 equivalent/year)
Integrated control and accounting of the consumption systems of heat and sanitary hot water,	0	€ 0	€ 0	0	0
Heat pump for space heating.	0	€ 0	€ 0	0	0
Radiant systems combined with condensing boiler and solar collectors	0	€ 0	€ 0	7	16
Solar collectors for heating domestic sanitary hot water,	1	€ 1 733	€ 606	75	178
Solar collectors for space heating	1	€ 143 000	€ 57 200	46	111
Small wind systems for the production of electricity for buildings used for commercial, tourist, sporting and productive,	1	€ 126 000	€ 50 400	36	87
Combined production of electricity and heat	2	€ 269 700	€ 101 895	0	0
Installation of boilers with high efficiency	7	€ 22 026	€ 7 708	81	193
Integrated interventions in buildings	7	€ 416 348	€ 131 819	238	568
High performance lighting systems	12	€ 1 673 449	€ 628 113	974	2 323
Improving insulation in buildings	27	€ 470 681	€ 159 320	380	907
Improvement of windows transmittance in buildings	52	€ 654 283	€ 238 218	520	1 239
Combustion systems of vegetable residues	504	€ 1 848 446	€ 646 005	1 789	4 265
Pellet stoves	954	€ 2 798 584	€ 978 716	3 458	8 246
Total	**1 568**	**€ 8 424 251**	**€ 3 000 000**	**7 604**	**18 133**

High performance lighting systems	12	€ 1 673 449	€ 628 113	974	2 323
Improving insulation in buildings	27	€ 470 681	€ 159 320	380	907
Improvement of windows transmittance in buildings	52	€ 654 283	€ 238 218	520	1 239
Combustion systems of vegetable residues	504	€ 1 848 446	€ 646 005	1 789	4 265
Pellet stoves	954	€ 2 798 584	€ 978 716	3 458	8 246
Other	19	€ 978 807	€ 349 628	483	1 153
Total	**1 568**	**€ 8 424 251**	**€ 3 000 000**	**7 604**	**18 133**

The graphs below show the distribution of actions and their cost over the provided category.

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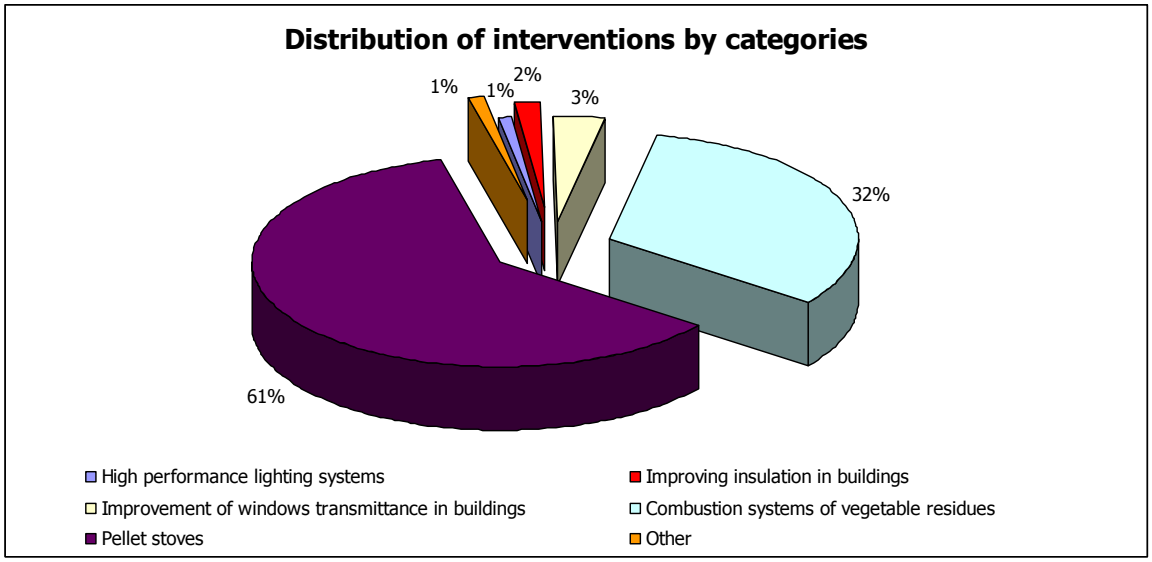

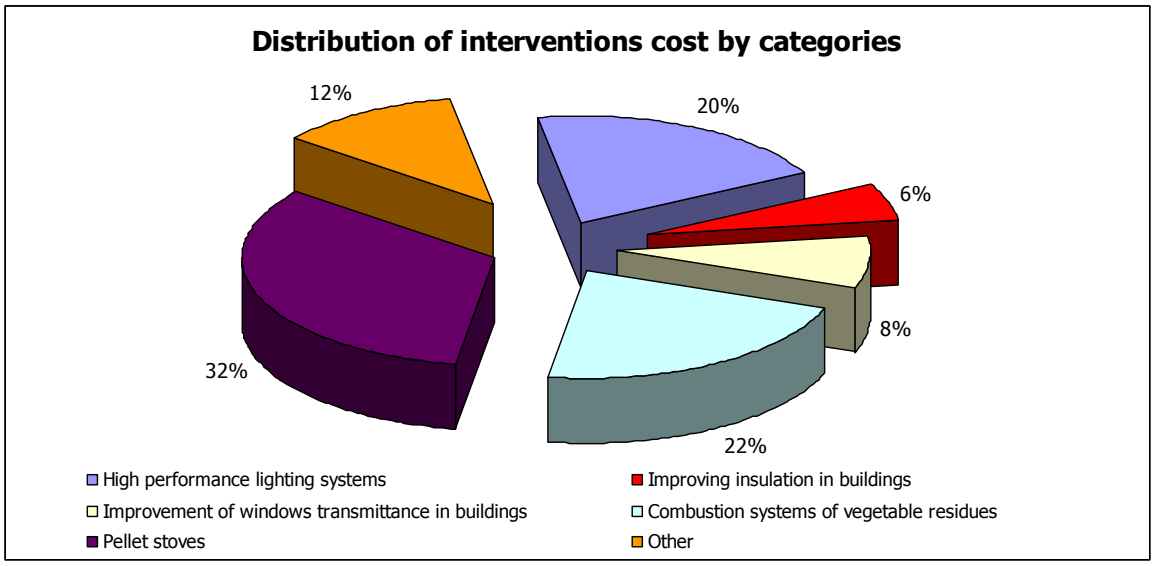

Basilicata Region, with decision of the Regional government n. 1298 on September 13, 2011, issued the "*Call of proposal for the planning and implementation of measures for reducing energy consumption of public buildings and public lighting systems*". This call of proposal aims, in consistency with the targets set at EU and national levels, as well as the provisions contained in the Regional Environmental Energy Plan, to promote:

- the use of installations, equipment, materials and innovative technologies to save energy and improve energy efficiency of public building,
- the reduction of energy consumption associated with public lighting;

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The budget for this call is approximately 8 million euros; at this time the procedures are taking place for the evaluation of financing proposals.

6.6. Western Macedonia (Greece)

As already mentioned, the energy efficiency schemes in Greece are developed at national level only. The following table presents a summary of all the measures proposed for the tertiary and residential sectors, for achieving the energy saving targets of the National Energy Efficiency Action Plan of Greece.

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Table 40: Summary table of proposed measures in Greece for energy efficiency in buildings
Source: Source: National Energy Efficiency Action Plan (NEEAP) of Greece (June 2008)

MEASURES	Targeted action	Duration	Annual energy saving 2010 (GWh)	Annual energy saving 2016 (GWh)	Investment cost (€)
Measures for all sectors					
Energy efficiency of buildings	Legislative framework for harmonisation with directive 2002/91/EC. Mandatory energy specifications for all new social housing buildings and building block of public organisations.	2009-2016	Residential: 200 Tertiary: 375 Public: 27	Residential: 850 Tertiary: 1125 Public: 81	
Further promotion of the use of Natural Gas and Liquefied Petroleum Gas (LPG)	Mandatory use of natural gas. Information on alternative ways of financing. Incentives for low income households. Information to consumers on LPG use and applications. Public subsidy for fuel substitution with Natural Gas or LPG.	2008-2016	230	Residential: 360	
Energy labelling of appliances and requirements for	Further information to consumers on highest energy efficiency classes of	Until 2016	995	Residential appliances:	Residential: 380 million

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MEASURES	Targeted action	Duration	Annual energy saving 2010 (GWh)	Annual energy saving 2016 (GWh)	Investment cost (€)
minimum energy efficiency	appliances. Requirements for minimum energy efficiency of energy equipment in tertiary private and public sector.			600 Residential lighting: 500 Tertiary appliances: 760 Tertiary lighting: 866	Tertiary: 1.2 billion
Energy Management Systems in the tertiary and public sector	Issue of standard procedures for Energy Management Systems. Mandatory implementation in the public and borader public sectors. Subsidies. Loans (low interest and/or subsidized).	Until 2016	150	1000	Study is required
Energy upgrading of existing buildings through third party financing (TPF), energy performance contracts (EPC) and public private partnerships (PPP)	Regulatory framework for energy performance contracting and ESCOs. System for certification of ESCOs. Procedure for energy performance contracting. Tax relief regulations. Subsidies for the benefit of the final	2008-2016	Depending on the size/ cost of energy interventions	Depending on the size/ cost of energy interventions	

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MEASURES	Targeted action	Duration	Annual energy saving 2010 (GWh)	Annual energy saving 2016 (GWh)	Investment cost (€)
	consumer though ESCOs for energy interventions.				
Installation of electronic and smart meters for consumers of electricity and natural gas	Installation of electronic and/or smart meters and detailed accounts from energy providers to all new buildings and gradual implementation to existing buildings. Targeted information campaigns to consumers through detailed accounts.	2008-2016	80	800	
Promotion of Co-generation of Heat and Power (CHP) systems and district heating	Legislation for harmonisation with directive 2004/08/EC and identification of requirements. Targeted information actions. Incentives.	2000-2016	180	Residential district heating: 823	240 million

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MEASURES	Targeted action	Duration	Annual energy saving 2010 (GWh)	Annual energy saving 2016 (GWh)	Investment cost (€)
Measures for residential sector					
Energy upgrade of the building envelope of houses	Public subsidies during procedure for issuing building permit. Loans (low interest and/or subsidized). Tax relief. One stop-shop procedures.	2009-2016	200	2000	1.7 billion
Financial support for upgrading systems of boilers / burners for heating in existing buildings	Tax relief. Loans (low interest and/or subsidized). Information campaign.	2009-2016	300	900	800 million
Obligatory installation of central solar thermal systems in new residential buildings and financial incentives for further penetration of small-scale solar thermal systems in residential buildings	Relevant legislation. Quality control and performance control of installation by accredited body. Public subsidies. Loans (low interest and/or subsidized).	2009 until covering 80% of existing buildings	180	540	450 million
Energy upgrading of social	Relevant legislation.	2012:	Integrated	Integrated	Integrated

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MEASURES	Targeted action	Duration	Annual energy saving 2010 (GWh)	Annual energy saving 2016 (GWh)	Investment cost (€)
housing buildings	Public subsidies. Loans (low interest and/or subsidized).	upgrading 10% of buildings	study is required	study is required	study is required
Measures for tertiary sector					
Private sector					
Obligatory installation of central solar thermal systems in buildings of the tertiary sector which are over 1000m^2	Relevant legislation. Quality control and performance control by accredited body. Public subsidies. Loans (low interest and/or subsidized).	2009-2016	10	250	400 million
Promotion of voluntary agreements for interventions of energy upgrading in buildings of the tertiary sector	Development of voluntary agreements programme based on European programmes (Greenbuilding, Greenlight, etc). Establishment of management body or bodies for determining, monitoring and controlling targets. Implementation of voluntary agreements for energy saving in air-conditioning, lighting, boilers/ burners, office equipment, etc.	2009-2016	Depending on number of voluntary agreements	Depending on number of voluntary agreements Estimated reduction in energy consumption of 20% - 40%	

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MEASURES	Targeted action	Duration	Annual energy saving 2010 (GWh)	Annual energy saving 2016 (GWh)	Investment cost (€)
	Implementation of voluntary agreements in reduction of electricity load during peak hours and development of incentives for building larger than 3500 sq. meters.				
Public sector					
Obligatory installation of central solar thermal systems for hot water use	Relative legislation for hospitals, sport centres, social services, etc. Quality control and performance control by accredited body.	2009-2016	2	50	100 million
Obligatory procurement procedures for energy-efficient technologies and RES - green procurement - in public buildings	Definition of products (materials and equipment) contributing directly or indirectly in energy savings. Action plan for replacement of existing energy consuming products. Economically and technically acceptable procurement based on mature technologies and RES.	2009-2016	Study is required	Study is required	
Integrated energy planning in municipalities	Energy office and energy responsible in municipalities. Energy audit and energy planning of	2008-2016	Study is required	Study is required	

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MEASURES	Targeted action	Duration	Annual energy saving 2010 (GWh)	Annual energy saving 2016 (GWh)	Investment cost (€)
	municipalities. Implementation, monitoring and evaluation of actions. Targeted studies for energy consumption and behaviour of residential sector. "Energy identity" of municipalities. Awareness and information of general public. Training of staff in energy behaviour issues. Annual auditing/ reviewing of energy interventions and redefining the "energy identity" of the municipalities,				
Obligatory replacement of all luminaires with low energy efficiency in the public and broader public sectors	Energy audit. Mandatory replacement. Annual auditing/ reviewing of energy interventions for lighting and redefining targets.	2008-2016	98	298	98 million

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The implementation of corresponding financial measures follows the National Strategic Reference Framework 2007-2013 (NSRF), which constitutes the reference document for the programming of European Union funds at national level for the 2007-2013 period. The country's strategic planning is being implemented through Sector Operational Programmes, Regional Operational Programmes and European Territorial Cooperation Programmes.

The main measures related to energy efficiency in buildings, which have been implemented and/or under implementation, are presented below in more detail.

Energy Efficiency of Household Buildings

The "Energy Efficiency of Household Buildings" Programme (http://exoikonomisi.ypeka.gr/) provides grant aid for energy efficiency interventions to old, legally constructed buildings throughout the country. It's a co-financed programme concerning owners whose household buildings were constructed before 31 December 1989 in areas valued at a maximum of 2100 euros/ sq.m., are used as a primary or first secondary residence and whose owners meet certain income-related criteria. The programme offers citizens incentives to carry out important interventions, aimed at improving their houses' energy efficiency, while at the same time contributes to the achievement of Greece's energy and environmental targets; once completed, the Programme will help save energy up to 1 billion kWh annually.

The programme implementation is based on the application of the legal framework recently established through the Buildings' Energy Efficiency Regulation (KENAK, Δ6/B/5825/30.03.2010, Official Journal of the Hellenic Republic B' 407) and Presidential Decree 100/30.09.2010 (Official Jounal of the Hellenic Republic 177/A) concerning energy inspectors.

The purpose of the programme is to determine the buildings' energy requirements, as well as the necessary interventions that will maximize energy conservation. The eligible categories of interventions to improve energy efficiency are: the replacement of windows/ doors (frames/ glazing) and the fitting of shading systems, insulation of the building envelope, and the upgrading of the heating and the hot-water supply systems. The combined application of the programme and the above-mentioned legal framework establishes an integrated framework for the implementation of energy efficiency actions.

The programme is implemented through a Holding Fund entitled "Energy Efficiency at Household Buildings Fund" (DECISION no. 31654/1415/20.07.2010, Official Journal of the Hellenic Republic B/ 1262). The budget of the Programme is EUR 396 million; the programme is implemented throughout Greece, with an indicative regional allocation to the 13 Regions. The programme started on 1 February 2011 and is still ongoing. To

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date, around 10000 applications have been submitted and around 3500 applications are now at the approval stage.

The "Change Your Air-Conditioning" action

The "Change Your Air-Conditioning" action provided financial support for the replacement and recycling of old, inefficient domestic air-conditioning systems. The grant amounted to 35% of the retail sale price of each new device, with a maximum grant of 500 euros. A total of 141323 old air-conditioning systems were replaced and recycled under this measure. This figure is three times the original target of 4 000. Similarly, the budget for the action amounted to 46900000 euros, compared to the original budget of 15 million euros, due to increased demand and the strong consumer response. This measure was completed for consumers on 22 August 2009, with energy savings of 52.53 GWh/year and a decrease in CO_2 emissions of 46.22 kt/year.

Integrated municipal energy planning -"Let's save Energy" programme

The "Let's save energy" programme concerns the implementation of measures and proven best practices to reduce energy consumption in the urban environment, focussing first on the building sector (public buildings) and the upgrading of public areas, and secondly on the public and private transport sector and energy-intensive community facilities through the provision of technical intervention and actions to raise awareness and mobilise citizens, local government, businesses and organisations. The programme is in the evaluation phase for the proposals submitted. In particular Priority Axis 1 of the programme refers to interventions on existing public buildings and concerns the improvement of energy efficiency in existing public buildings and especially an overall reduction in consumption by 30%, i.e. 11.14 GWh (958 toe) per year, of which 7.8 GWh is heat energy and 3.34 GWh is electrical. The annual CO2 savings amounts to 4.97 kt.

Programmes for improving the energy efficiency of public buildings *under Priority Axis 1 "Protection of the Atmospheric Environment & Urban Transport – Tackling Climate Change – Renewable Energy Sources" of the Operational Programme "Environment and Sustainable Development"*

In particular, the following funding actions have already been promoted:

- Installation of high-efficiency CHP units in conjunction with natural gas cooling systems in hospitals, with a budget of 15000000. This action is ongoing and so far three applications have been filed;
- Demonstration projects for the use of renewable energy sources and energy-saving measures in existing public primary and secondary school buildings, with a budget of 40000000. This action is ongoing and so far ten applications have been filed;

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- Standard demonstration projects for the use of renewable energy sources and energy saving in public buildings, with a budget of 40000000. For this action, 63 applications have been submitted with a budget of 120000000 euros, and are currently in the evaluation phase;
- Demonstration project entitled "Green Neighbourhood", with a budget of 7000000 euros. It involves an energy upgrade of four residential apartment blocks in buildings with almost zero energy consumption, and the optimisation of the local micro-climate. The project is in the implementation phase and it is estimated that the works will be completed by the end of 2012, involving the incorporation of modern energy-saving technology and renewable resources to achieve maximum possible benefit at minimum cost. It is important that a large number of Greek industries and commercial companies participate and contribute by donating entire sections of the project, in accordance with the voluntary agreements which they have signed.

"Building the Future" Programme

The "Building the Future" programme is a comprehensive programme to improve the energy efficiency of the building stock of Greece and it is now in the planning stage. It is a partnership between the public sector, the manufacturing industry and citizens and includes a total of twelve interventions on residential and commercial buildings (replacement of frames with high-standard equivalents, replacement of single-glazing with low-energy double-glazing, installation of solar-powered central heating systems, installation of cool roofs, rooftop insulation, façade insulation, replacement of conventional heating and cooling systems by high efficiency systems, replacement of artificial lighting, replacement or installation of advanced energy control systems). The programme does not foresee financial incentives but is based on voluntary agreements between the public and private sectors, under which the parties responsible for interventions (manufacturers and suppliers of products, installers, service providers) are obliged to offer special substantial discounts for citizens. The programme foresees the refurbishment of 154000 buildings in total, until the end of 2014. The expected savings are estimated to be 14% of the energy consumption of the buildings that will participate in the programme.

Obligatory installation of central solar thermal systems in buildings

This programme concerns the obligatory installation of central solar thermal systems in new residential buildings, in new buildings of the private tertiary sector and in all buildings of the public sector. In the public sector the installation of central solar thermal systems for hot water production is obligatory in both new and existing buildings. In the residential sector and the private tertiary sector, legislative regulation will render the installation of central solar thermal systems in new buildings as obligatory, including the quality control of system performance. The implementation of

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this measure in residential sector and the private tertiary sector is estimate to cover the annual load for hot water production of 55% - 70% depending on the climate zones that the system is installed. These actions, in combination with promotion campaigns for further penetration of solar thermal systems for hot water production and heating/ cooling production are estimated to lead to the replacement of conventional fuels and electricity for hot water production in percentage of 50% - 100%, depending on the climate conditions of the climate zone, the thermal load that has to be covered and the placement of the building.

Tax relief

In accordance with the Income Tax Code (as amended by Act 3943/2011 – Government Gazette Series I, No 66 of 2011), provision is made for the deduction of expenses from taxable income of 20% of expenditure for amounts of up to 3000 euros and of 10% of expenditure for amounts of between 3001 and 6 000 euros, for energy-upgrading interventions which are included in projects under the Operational Programme "Environment – Sustainable Development" in the framework of the NRSF or for energy-upgrading interventions on property, which may be required following an energy inspection.

6.7. Primorsksa (Slovenia)

Various programmes are in place in Slovenia, through which non-returnable funds are available to promote energy efficiency in buildings and installation of renewables. All the schemes and measures are adopted at national level. In Slovenia regions are not introduced yet, the Constitution of the Republic of Slovenia stipulates that people in Slovenia exercise their right to local self-government in municipalities and other local communities. Municipalities are defined as basic local self-government units.

The financial incentives currently available are defined in the Operational Programme for Developing Environmental and Transport Infrastructure. The main areas for allocation of financial support are:

- energy refurbishment of existing buildings and sustainable new buildings in the public sector (low energy, passive buildings, energy efficient HVAC, decentralised RES based energy supply),
- efficient use of electricity in the industrial, public and tertiary sectors
- innovative systems for local energy supply, large and medium district heating based on RES and CHP,
- demonstration projects, information, energy advisory service

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Cohesion Fund financing is being used for the above priorities, in the form of non-returnable subsidies to promote district heating systems operating on wood biomass (solar collectors are also included as an eligible cost), as well as large wood biomass boilers in industry. Additional subsidies for the energy restoration of buildings and low energy new buildings, facilitating the EPBD Recast targets on RES and RUE in buildings were prepared – targeting public buildings: secondary school buildings, hospitals, social houses and homes for elderly people.

Eco fund (Slovenian environmental public fund) gives subsidies and soft loans also for energy renovation of existing residential buildings and construction of very low new residential buildings. Most of the subsidies are given for building components and systems based on the technical data in the required EPCs. In 2101, the subsidies from the state budget were increased with financial contributions from energy distributors. Based on the ESD directive, utilities are obliged to allocate part of their income to financial instruments for improving energy efficiency.

In 2011, subsidies for various new investments in RES and RUE in **family houses and apartment buildings** are available (budget of 12 Mio EUR in the current call) – i. e. measures like solar systems for DHW, biomass heating system, heat pump for DHW and/or space heating, installation of central heating, if energy refurbished building is connected to RES based district heating, replacement of windows (wooden frames), thermal insulation of walls and roof, installation of mechanical ventilation with heat recovery, thermostatic valves and hydraulic balance, heat metering and billing, construction of purchase of a low energy and /Or passive house, buying of a flat in an apartment building built or retrofitted in passive house technology. The indicative level of the subsidy is 25% of eligible cost

Energy advice network for residents -**ENSVET** is the main programme launched by the Ministry of the Environment and Spatial Planning (European Affairs and Investments Directorate-Department of Efficient Energy Use and Use of Renewable Energy Sources) for advising, informing and assisting the citizens (local residents) in the implementation of energy efficiency measures in households.

For the public sector the Government approved the Action Plan for **Green Public Procurement for the period 2009–2012**, which seeks to decrease the negative effects of the public sector on the environment, encourage the development of products and services which are easier on the environment, ensure more efficient use of public finances, and provide a good model to the business sector and consumers. The primary aim of the action plan is to speed up the implementation of green public procurement in Slovenia by introducing fourteen measures. Concrete goals refer to eight proposed priority groups of products and services (vehicles, electronic office equipment, construction and buildings, paper, cleaning agents and services, furniture, electricity and

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food. The overall goal is that on average 50 per cent of all public procurement will result in the purchase of a more environmentally sustainable product or service by 2012.

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6.8. Malta

Information on financial schemes/ measures for energy efficiency in buildings of Malta is included in standardised template in Annex 2.

6.9. Andalusia (Spain)

The Andalusian Energy Agency, attached to the Ministry of Economy, Innovation and Science, manages the grants for the Sustainable Energy Development of Andalusia. This grant program "Andalusia A +", is co-financed by the European Regional Development Fund and included in the ERDF Operational Programme for Andalusia 2007-2013, and by funds from the Ministry of Industry, Tourism and Trade through the agreements signed between the Andalusian Energy Agency and the Institute for Energy Diversification and Saving of Energy (IDAE).

They are specific programs whose aim are, within others, the promotion of Energy savings through social and energetic high impact actions.

Incentives Program "Saving at Home" ("Ahorrar en Casa") and "Sustainable SMEs" ("PYME" sostenible")

Among the innovations incorporated by the Order of December 7, 2010, there is the incorporation of specific programs, in order to boost the performances of renewable energy use, energy conservation or improve energy infrastructures.

It includes five specific programs: Program PROSOL, Efficient Vehicle Program, Window Renewal Plan in Andalusia, Efficient Lighting Program and Efficient Air Conditioning Program in Andalusia

In all these applications there are processed programs through partner companies, providers of subsidized goods or services, thereby facilitating access of citizens and SMEs subsidies and contributing to the creation of a specialized business network.

- Order of the 4th of February 2009 (BOJA 30 of February the13th) modified by the Order of the 7th of December 2010 (BOJA 244 of December the16th) establishing the rules and regulations for an Incentives Program for the Sustainable Energy Development in Andalucia 2009-2014- **"ANDALUCIA A+".** It contains five main action lines:
  6) Energy savings and Energy Efficiency;
  7) Energy Renewable systems;

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8) Energy exploitation and energy recovery;
9) Energy studies, audits and consulting and dissemination actions;
10) Energy Infrastructure.

- Within the innovations introduced by the Order of the 7th of December 2010, there are 5 specific programs:
  6) PROSOL Program;
  7) Program for Efficient Vehicles;
  8) Windows renovation Plan for citizens in Andalusia;
  9) Efficient Lighting Program in Andalusia;
  10) Program for the Efficient Air Conditioning.

- Order of 22 December 2010, of the General Secretariat of Industrial and Energy Development, announces the membership of authorized companies and collaborating in the management of certain specific programs on a regular basis for the promotion of savings and energy efficiency in buildings and facilities.

  This resolution seeks to convene the accession of authorized companies and partners, in order to establish the necessary conditions for the next publication of the resolution that opens the application period of the grant under the following specific programs

  1. Window Renewal Plan in Andalusia.

  2. Efficient Lighting Program in Andalusia.

  3. Efficient air conditioning Program in Andalusia

- Resolution of March 24, 2011, of the General Secretariat of Industrial Development and Energy, establishing the calls for grants under certain specific programs for the promotion of energy saving and energy efficiency in buildings and facilities.

  This resolution convenes the awards of the grants under the following specific programs as provided in Article 12 of the Order of February 4, 2009:

  1. Window Renewal Plan in Andalusia.

  2. Efficient Lighting Program in Andalusia.

  3. Efficient air conditioning Program in Andalusia

On the other hand, the Regional Ministry of Public Works and Housing, includes in the Housing and Land Agreed Plan 2008-2012, “Plan Concertado de Vivienda y Suelo 2008-

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2012", in its **Chapter VIII** Energy Efficiency Improvement for Housing and Buildings an Incentive Program for existing housing and buildings through which, the subsidies from the National Housing and Refurbishment Plan RENOVE are processed. Its objective is to foster the use of renewable energies, the improvement of energy efficiency, the Environmental hygiene, health and protection and the accessibility the building stock. These incentives are aimed to persons promoting the retrofitting of their homes or housing buildings.

- Several decrees and orders in charge of financing the National Housing and refurbishment plan 2009-2012 (RD 2066/2008, ORDEN VIV/2680/2009)

- Order of the 7th July 2009 publishing the integral text of the Housing and Land Agreed Plan 2008-2012, approved by the Decree 395/2008, of the 24th of June, with the modifications introduced by the Decree 266/2009 of 9th June.

- Order of the 10th November 2008 for the development and procedures of housing and land actions of the Housing and Land Agreed Plan 2008-2012

- Order of the 26th January 2010, for the development and procedures of housing and land actions of the Housing and Land Agreed Plan 2008-2012

Building Envelope

- **Incentives Program "Saving at Home" ("Ahorrar en Casa") WINDOWS RENOVATION PLAN FOR CITIZENS**

These grants are aimed for citizens and residents (owners and tenants) of homes in Andalucia. The aim of this grant program is to contribute to the replacement of old external windows by new ones with higher thermal isolation levels in order to preserve the energy savings.

The grants are intended to be for the purchase and implementation of thermal efficient windows as well as the removal of the old ones being always the cost between 1.000 and 10.000 euro. The quantity of the grant depends on the windows size and the kind of window frames covering from 90 to 400 euro per window. However, never the grants will be more than 25% of the total cost.

Building Services

- **Incentives Program "Sustainable SME" (" PYME sostenible") Efficient Lighting Program in Andalusia;**

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Grants aimed to SMEs whose activity is Retailing and food-industry. The aim of this grant program is the energy efficiency improvement of the lighting systems through the renovation of the old ones in shops, bars and restaurants. The purchase and implementation of efficient indoor lighting system is granted, as well as its removal when the cost is between 1.000 and 10.000 euros. The grant depends on the kind of elements to be installed, being between 10 and 50 euros and , never the grants will be more than 30% of the total cost.

- **Incentives Program " Saving at Home" ("Ahorrar en Casa") Program for the Efficient Air Conditioning.**

Grants for citizens, owners and tenants of homes in Andalucva as well as for SMEs. The aim of this grant program is the energy efficiency improvement of the air conditioning systems through the renovation of the old ones and the implementation of zoning system in centralised air conditioning. The purchase and implementation of efficient system is granted, as well as its removal when the cost is between 2.000 and 30.000 euro. There are 4 types of renovation.

The Andalusian Energy Agency offer grants whose amounts go from 800 to 7.000 euro, depending on the type, when changing the old air conditioning systems by others improving the energy efficiency. The maximum grant is 25% of the total cost.

- **Incentives Program for the energy sustainable development "Sustainable SME" (" PYME sostenible") PROSOL**

The aim of this specific program is the promotion of the renewable energies exploitation for the generation of hot water and/or air conditioning through solar thermal energy or biomass in SMEs

Small installations, whose investment is less than 12.000 eurosand consist of the acquisition of:

- Installation of prefabricated solar thermal systems.
- Solar thermal installations with a solar collector area less than 7 m².
- Pellets equipment installations

Larger installations, consisting of the acquisition of:

- Installation of solar thermal systems for hot water production wih a solar collector area greater than 7 m².
- Installations of biomass boilers, with less than 300 kW power.
- Mixed solar - biomass Facilities

The grant amount depends on the renewable energy facility to be installed and the same conditions, knowing a priori the subsidies granted to small installations.

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- **Regional Funds for the promotion of energy efficiency and renewable energies.**

VOLUME: 70 millions Euros
ORIGIN: 100% ANDALUSIAN REGIONAL GOVERNMENT
INVESTMENT PERIOD: 3 years
MAXIMUM FUNDINGS: 70% total project: min 20.000- max.2.000.000 Euros
TARGET GROUP
• Capital Expenditures only (not current)
• Any legal form (incl. constitution Societies)
• registered office or operating in Andalusia (now or future)
• Compliance with tax and Social Security
• Public Companies or with more than a 25% of public participation are excluded.
• Preferably SMEs

FINANCIABLE PROJECTS
• investment only
• Improved energy efficiency in production processes or equipment.
• Reducing energy consumption in buildings and facilities.
• Energy saving in fleets of passenger or freight transport.
• The generation and thermal energy use through renewable energy facilities.
• trigeneracióny cogeneration systems and facilities for the use of residual heat.
• production systems and air conditioning hot water by RES.
• the projects presented by energy service companies

Appliances/ equipment

- Order of the 14th of November 2008 (BOJA 238 of December the1st) establishing the rules and regulations for the Renovate Plan for electric appliances in Andalucia. **COMPLETED**

Incentives for the replacement of appliances in the andalusian homes by high efficiency ones, class A or higher.

Occupants/ Behaviour

- Incentives Program “Saving at Home” (“Ahorrar en Casa”) Program for Efficient vehicles

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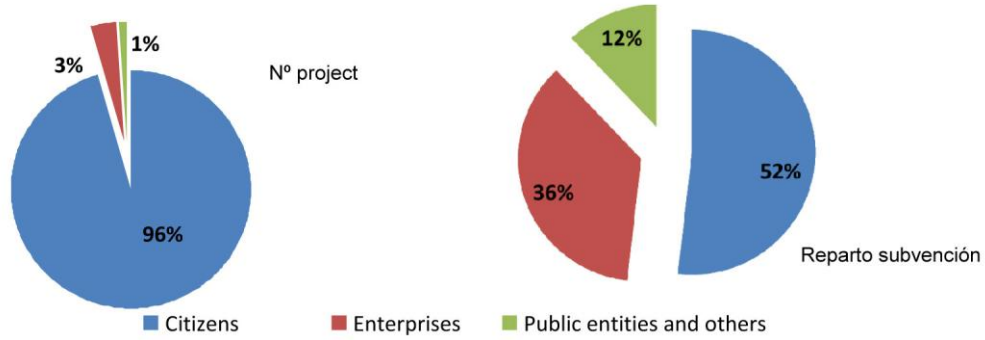
ORDER 4 FEB2009: RESULTS YEAR 2009-2010 (Source: Andalusian Energy Agence)

Subsidied projects: **35.122 projects**

Induced investment: **745 millions euros**

Funding Granted : **91 millions euros**

For type of beneficiary:



FOR TYPE OF PROJECT: (Source: Andalusian Energy Agence)

Type	Granted proj.	Induced investment (€)	Grants (€)
Energy Efficiency & Savings	1.723	87.710.578	15.663.091
Renewable Energies	33.022	597.323.388	64.037.197
Energy exploitation appliances	16	21.077.002	3.144.042
Energy Studies and diffusion	208	7.942.675	2.743.929
Improvement of the Energy infrastructures	153	30.600.743	5.454.635
Total:	35.122	744.654.386	91.042.894

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ENERGY RESULTS: (Source: Andalusian Energy Agency)

Technology or action granted	
Expected Energy Savings	43.470 tep/year
New Solar Thermal Area	68.967 m^2
New Thermal Biomass Power	365 MW
Isolated Installed PV Power	822 kWp
New Efficient Vehicles	1.319
Audits and Energy Studies	208

6.10. Alentejo (Portugal)

Information on financial schemes/ measures for energy efficiency in buildings of Portugal is not available.

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6.11. General overview of financial schemes/ measures for building energy efficiency in MED regions

Most of the information provided about the main financial schemes/ measures for building energy efficiency in the MED countries/ regions participating in the study relates to the national and/or regional strategic and action plans for the implementation of the corresponding legislation, listed in the previous chapter. The following table presents a general overview of the corresponding financial schemes/ measures, mentioning the MED countries and regions that provided the corresponding standardized information (see Annex 2).

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Table 41: Financial schemes/ measure for building energy efficiency in MED regions

Conceptual framework/ areas of application					**Schemes/ measures**	**Countries/ regions**
General	***Building Envelope***	***Building Services***	***Appliances/ Equipment***	***Occupants/ Behaviour***		
	✓	✓	✓		Subsidies and/ or fiscal incentives for energy saving and energy efficiency	Spain/ Catalonia, Andalusia Italy, Slovenia, Malta
	✓		✓		Energy efficiency of household buildings	Greece
	✓	✓			Energy requalification of buildings owned by territorial agencies of the house	Piedmont (Italy)
	✓	✓			Rationalisation of energy consumption in the public buildings	Piedmont (Italy)
	✓	✓			Demonstrative and strategic actions in the energy sector	Piedmont (Italy)
	✓	✓			Grants for the construction of near-zero energy buildings	Piedmont (Italy)
	✓	✓			Rehabilitation of residential buildings	Piedmont (Italy)
	✓	✓	✓	✓	Integrate municipal energy planning – “Let’s save Energy” programme	Greece
	✓	✓	✓	✓	Programmes for improving the energy efficiency of public buildings	Greece

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Conceptual framework/ areas of application					**Schemes/ measures**	**Countries/ regions**
General	***Building Envelope***	***Building Services***	***Appliances/ Equipment***	***Occupants/ Behaviour***		
	✓	✓	✓	✓	"Building the Future" programme	Greece
	✓	✓	✓		Energy advice network for advising, informing and assisting the citizens in the implementation of energy efficiency measures in households	Slovenia
	✓	✓	✓	✓	Energy renovation of public buildings in the form of non-returnable funds	Slovenia
	✓	✓			Call for projets « Thermal refurbishment of social housing » (Appel à Projet "Réhabilitation thermique des logements sociaux")	France/ PACA
	✓			✓	RHEA Programme : Region Living Energy Improvement (RHEA Région Habitat Energie Amélioration) : low income building	France/ PACA
	✓	✓			Energy Rehabilitation	France/ PACA
	✓	✓	✓	✓	Incentives Programs "Saving at Home" and "Sustainable SMEs"	Andalusia (Spain)
		✓			Subsidies for urban area improvement	Spain/ Catalonia
		✓			Constructing/ strengthening district heating	Piedmont (Italy)
			✓		Subsidies for substitution of electrical appliances, boilers and air conditioning devices	Spain/ Catalonia

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Conceptual framework/ areas of application					Schemes/ measures	Countries/ regions
General	*Building Envelope*	*Building Services*	*Appliances/ Equipment*	*Occupants/ Behaviour*		
			✓		"Change your air-conditioning" action	Greece
			✓		Obligatory installation of central solar thermal systems in buildings of public sector and in new buildings of household and tertiary private sectors	Greece
			✓		Grant on the purchase of household appliances for domestic use certified as being efficient in the use and consumption of energy	Malta
			✓		Promotion of Renewable energy sources in the domestic sector	Malta
				✓	Education and training for advice experts, information and promotion material, financing or services	Slovenia

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7. Barriers to energy efficiency improvement in buildings

The scope of this section is to identify the main regional barriers on the demand side that prevent stakeholders from taking actions for improving energy efficiency in buildings. Bibliographical search was made in order to identify and review corresponding studies or reports by competent organisations. An effort was made to structure the analysis of barriers according to the four areas of the conceptual framework for building energy efficiency improvement (Annex 3).

7.1. Introduction to the "Efficiency Gap"

The Intergovernmental Panel on Climate Change (IPCC) found that cost-effective energy efficiency improvements could contribute to half the potential emission reductions by 2012 (IPCC, 2001). More recently, the IEA World Energy Outlook 2007 (IEA, 2007a) and the IPCC 2007 Working Group III identify energy efficiency's significant potential to reduce greenhouse gas emissions over the next 20 to 30 years. A range of technologies and options contributes to this potential. For example, if all conventional incandescent lamps worldwide were replaced by Compact Fluorescent Lamps (CFLs) roughly 2 880 PJ and 470 MtCO2 emissions in 2010 could be saved, rising to 4 320 PJ and 700 MtCO2 in 2030. Cumulatively this would reduce global net lighting costs by USD 1.3 trillion from 2008 to 2030, and avoid 6.4 Gt CO2 emissions at negative abatement cost of USD -205 per tonne (IEA, 2007a). The potential cost-effective savings from improvements in heating, cooling, ventilation and hot water in the building sector, which accounts for approximately 40% of all energy use, is at least 20 EJ per year by 2030 (IEA, 2007b).

Yet evidence suggests that a significant proportion of energy efficiency improvement potential is not realised. The difference between the actual level of energy efficiency and the higher level that would be cost-effective from the individual's or firm's point of view is often referred to as the 'efficiency gap'. The existence of the energy efficiency gap is often explained by the presence of "market failures" and "market barriers" to energy efficiency (IEA, 2007b).

In general, the main market barriers and failures include:

- **Low priority of energy issues**: In many instances, energy efficiency is not a major concern for consumers or firms because energy costs are low relative to the cost of many other factors (such as labour costs). Consequently, there is little incentive to invest in energy efficiency improvements.

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- **Information failure:** information failure stands amongst the most important barriers to the deployment of energy efficient technologies. There are different forms of information obstacles: its asymmetric access, the mere lack of available information and its highly technical aspect which makes it difficult for non-experts to understand.
- **Access to capital – initial cost:** the initial cost barrier refers to the fact that energy-efficient products tend to be more expensive than their less efficient counterparts. Although energy-efficient technologies make sense on a life-cycle cost standpoint, their higher initial cost often represents an insurmountable barrier for customers.

The following sections specify in more detail the barriers identified in the countries/ regions participating in this study.

7.2. Barriers in Catalonia (Spain)

In a first step, residential and service sector demand side barriers for energy efficiency improvement in buildings have been identified as in official and academic publications:

- Economic/ financial barriers
- Information barriers
- Structural barriers
- Technological / technical barriers
- Opportunity barriers

The identification of barriers for energy efficiency improvement in buildings in Catalonia is mainly based on the barriers discussed in the Energy saving and energy efficiency strategy 2006-2015, and backed up by Spanish and international sources:

- Estrategia d´eficiencia energètica, Pla d´energia de Catalunya 2006-2015
- Deloitte (2010) Estudio sobre el mercado de la eficiencia energética en España. A3E, IDEA
- Linares, P. (2009) Eficiencia energética y medio ambiente. Información Comercial Española, 847: 75-92, 2009
- Sweatman, p. et al (2010) Financiación de mejoras energéticas en edificios. Climate Strategy&Partners
- Alcantara et al (2010)Structural analysis of electricity consumption by productive sectors. The Spanish case, 2010, Energy 35 (2010) 2088-2098
- Fundación Cande del Valle de Salazar (2010) La generación de empleo en la rehabilitación y modernización energética de edificios y viviendas. CCOO, Instituto Sindical de Trabajo, Ambiente y Salud

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- UN environment Programme, Buildings and climate change. Summary for decision makers, 2009

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Table 42: Type of barrier to energy efficiency improvement in buildings (published)

Economic/ financial (domestic, tertiary and public demand)	**Information** (domestic and tertiary demand)	**Structural** (domestic, tertiary and public demand)	**Technological/ technical** (domestic, tertiary and public demand)	**Opportunity** (domestic and tertiary demand)
environmental cost externalities investment barriers	lack of information incomplete or asymmetric information) bounded rationality	-political -budget rigidities in the public sector horizontal building ownership in the residential sector	-lack of local structures	- principal-agent problem - public-private dilemma

Economic/ financial barriers

- Environmental cost externalities
  The current energy price does not reflect the real (environmental and social) cost of energy and therefore renders energy efficiency less profitable
- Investment barriers
  Usually large investments are needed, and they are often higher than expected (transaction costs, hidden costs). Risk perception is high due to uncertainties such as future energy prices, development of technology, professionalism of planners/installers, and the fact that the investments are irreversible (cannot be recovered in case they result not to be profitable).
  Furthermore, the access to financing is more difficult for end consumers and SMEs compared to large enterprises.

Information barriers

- Information problems

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Incomplete or asymmetric information on the best technologies and options available, uneven spread of information between different agents (consumers and small and medium companies compared to large enterprises)

- Bounded rationality
  Even with full information, the consumer might not be willing or able to take the right decision on the most efficient measure, or to prioritise energy efficiency

Structural barriers

- Horizontal building ownership
  The absence of big housing agencies is very characteristic for Catalonia. Most blocks of flats group together many different home owners, and consequently there are multiple interlocutors for one building. The coordinating body is the ”community president” who the owners take turns in interpreting. Decisions have to be adopted by all with 1/3 of the owners in favour of a specific measure. Owners with more properties have more voting power. 70% of Catalan people live in so-called communities of owners.
- Political barriers
  Lack of interest, legislation is not restrictive enough
- Budget rigidities (public): even if the same public agent, budget lines often are different, so that an additional investment in energy efficiency in the construction or renovation phase cannot be recovered by a decrease in exploitation costs.

Technological/technical barriers

- Lack of local technological and technical structures
  Most technology and know-how has been arriving from other countries, which have started investing in energy efficiency processes earlier than Spain and Catalonia, resulting in a lack of local R&D, physical infrastructures (industrial, production) but also a scarcity of training and education (engineering, training etc).

  In this sense, the lack of training in energy efficiency related areas, as well as the lack of local innovation and R&D structures, which a priori constitutes a supply barrier, can be a demand barrier as well, as it deteriorates confidence in quality of service received, especially in a sector with quite large investment sums required. Similarly, the lack of access to local technical support, maintenance and engineering due to predominantly foreign technology can dissuade investment as it is imperative for effective use of efficient technologies.

Opportunity barriers

- Principal-agent problem
  This barrier describes the circumstance that often the entity/person doing the investment is not the one receiving the benefits. A typical example of this is investment in building envelope insulation in rented homes, where the owner has to

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make the investment but the tenant receives the benefits of reduced heating and cooling energy bills.

- Private-public dilemma
  The policy makers might have different interests to private home owners or businesses in terms of what energy efficiency measures are preferable.

Table 43: Type of barrier to energy efficiency improvement in buildings (additional)

Economic/ financial (domestic, tertiary and public demand)	**Information** (domestic and tertiary demand)	**Structural** (domestic, tertiary and public demand)	**Technological/ technical** (domestic, tertiary and public demand)	**Opportunity** (domestic and tertiary demand)
lack of public investment capacity	lack of user information on energy consumption	lack of administrative coordination complex administrative procedures		

Additional barriers were identified and with particular relevance for the Catalan project implementation in the context of MARIE:

Economic/ financial barriers

- Lack of public investment capacity
  The current economic crisis has brought the public investment capacity, especially in the Mediterranean European regions, to a limit, up to the extreme, that not even the publicly owned building stock maintenance and renovation can be guaranteed.

Information barriers

- Lack of user information on energy consumption
  One specific kind of information gap is identified in the information that is available to the end user. As he is not aware of his own consumption, apart from monthly global energy bills, and even less of the energy uses that cause the consumption, no corrective measures in case of energy mismanagement are taken.

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Structural barriers

- Lack of inter-administrative coordination
  Easily four different legislative and administrative levels are involved in building renovation: The European Union, the State, the region and the local level (might be municipality or confederation of municipalities). Often, these four levels do not follow the same strategy in obtaining energy efficiency improvement and consequently do not promote the same measures.
- Lack of intra-administrative coordination
  Within the public administration, even if on the same decision making level (region / local), communication is not sufficiently developed to put coordinated action into practise, as main targets might be different (environmental / energy / social / economic / etc.). This also happens within different departments of one single entity.
- Complex administrative procedures
  Building permissions for renovation, compulsory energy labelling in case of change of uses or major renovation, sustainability certification and other administrative procedures are complex and managed by various authorities, and in this sense might weaken the owner´s will to renovate when becoming aware of the situation.

The barriers identified above- according to official and academic publications and own research - are now categorized according to the different areas that influence energy efficiency in buildings agreed as conceptual framework throughout this document: the building envelope, building services, building appliances and the occupants. It is furthermore indicated, which agent is usually affected by the barrier, and – if of relevance – the main related sector is indicated, residential or tertiary.

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Table 44: Type of barrier to energy efficiency improvement in buildings

	Economic / financial	**Information**	**Structural**	**Technological / technical**	**Opportunity**
All categories (user / owner)	- environmental cost externalities - lack of public investment capacity	- lack of - bounded rationality	- political		
Appliances (user)		- lack of user information on energy consumption			
Building envelope (owner)	- investment barriers (		- budget rigidities in the public sector - horizontal ownership in the residential sector - lack of administrative coordination	- lack of local structures	- principal-agent problem - public-private dilemma
Building services (user / owner)	- investment barriers	- lack of user information on energy consumption	- budget rigidities in the public sector - horizontal ownership in the residential sector - lack of administrative coordination	- lack of local structures ¡	- principal-agent problem - public-private dilemma
Occupant / behaviour (user)		- lack of user information on energy consumption	Lack of maintenance – culture		- principal-agent problem - public-private dilemma

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7.3. Barriers in PACA (France)

Regional Barriers to energy efficiency improvements were mainly extracted from the study “What rehabilitation in the built before 1975?” done for the Regional Energy Observatory, by Viviane Hamon Conseil/ Domene.

Knowledge barriers

The renovation whether it is light or heavy (rehabilitation) is usually part of logic of autonomy, the project management being mainly attributable to the owner, including the landlord. With regard to the overall design of renovation projects, the absence of architects for the households of individuals is clearly noticed. On the other hand, the study didn’t reveal an intermediate kind of enterprise playing this part.

It appears that renovation is a process in which the owners are targeting different companies depending on their needs and their means. The owners often speak of an "obstacle course", be it for seemingly simple questions (solve a specific problem) or highly complex (complete renovation) ones. If even owners can sometimes become over-informed (see experts), they are usually rather lost and request for information. They are rarely the ability to think things systemically and work instead, in logic of "piecemeal”, which is a rather negative factor knowing that some decisions ahead may eventually thwart the implementation of future work, especially with regard to insulation. The study point out that we are not dealing with a offer's market (where the market is driven by the manufacturers, traders and artisans), but with a demand market. (Need to increase the level of knowledge and requirements of end-customers).

Nevertheless, there is a need to increase the level of knowledge and requirements of the end-customers. For their renovation projects, they are driven by four principal motivations: self-fulfilment, pleasure, an undeniable financial constraint, and finding an enterprise to trust. The difficulty in finding reliable SME, in a timely manner, so we may call it ‘obligation’ rather than ‘motivation’. This leads often to the «getting by" or "system D". It is also essential to communicate in a positive way, because the issue of energy savings from renovation put people in tension: economy versus pleasure, morality versus hedonism.

Communication barriers

<u>a-The information sources used by the owners:</u>
The press (primarily decorative and feminine) is ultimately a relatively minor source of information, even if it may be noted his involvement on the heat issue. Interpersonal and Internet sources are proving essential.

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b- Rule of word-of-mouth:

The first source of information and principal owner is the word-of-mouth. The first form of word-of-mouth is to be understood literally: the close network of relationships in the family, from friends or colleagues. A second form of word-of-mouth tends visibly to grow, these are the various internet forums. These can be general or activists. The importance of word-of-mouth reinforces the need for ambitious and clear public information since there is no guarantee that the discourse of opinion leaders is always fully informed and relevant.

c- Internet:

Beyond the few forums, the Internet has become a key source used by most homeowners met. They visit shopping sites: hardware stores, manufacturers, suppliers . A systematic reciprocal links between sites whose contents are approved would be to search for. Cooperative work with the sites for improvement to better take into account the thermal aspects would be to find.

d- The professionals

The information is often too complex. If owners fail at the end of information it is also because they do not initially know the right questions to ask and the ones to ask to the professionals they consult. At one extreme we can find a general hyper-nebula that affects a wide audience (potentially the whole society). At the other extreme, there are hyper-specialists players most often rooted in the public interest, and for many involved in the activist realm (including among the players merchants), who are responsible for transmitting data from highly specialized qualitative point of view.

Between these two extremes it is clear large gaps, if not a gap in terms of intermediate levels of education, mediation and counseling. However, mediators exist ... in a virtual state. For practice, the transmission of information lacks seriously because these mediators (estate agents, window installer, artisans ...) are:

- Misidentified or unrecognized
- poorly, nor trained
- either they think they are competent, but unfortunately wrong.
- isolated

The economical key

One can say 'The more higher the energy price, the better it is for the market of renovation'. However, the study shows that the 'acting out' always falls in a hierarchy of future projects and that the renovation project is reflected as a purchase based on a 'nest egg'. The use of credit is relatively minority because this cost is ultimately not considered as a priority and, once engaged, it is not renegotiable.

To borrow, it is not just a cost in its budget but also a commitment to the future, even if interest rates very low. Finally, lack of awareness of existing financial devices, the complexity of putting together an application, be accountable to his banker, be required to provide quotes, having to resort to an enterprise, are inhibiting further. On the other hand, the 'return on investment is quite inoperative. In fact, even if the people met

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during the study are sensitive to their heating bills, none refers to a calculation of return on investment really informed, objective and take into account, the cost of work versus the expected energy savings or the cost the cost of credit versus the reward of their savings versus the expected energy savings.

Three complementary levers

Three additional levers must not be forgotten when thinking about possible actions: acoustics, sensory and thermography. The discourse on the thermal insulation must not forget to greatly enhance its contribution to sound insulation which is an evil an evil contemporary, especially in urban center. Thermography can be a powerful tool of communication but it must not act on its own. It must be accompanied and followed by proposed solutions to implement. The Communication on retrofitting should also rely on marketing sensory: touch, smell and feel, see.

Some additional levers

a- The Energy Performance Diagnosis which must be considered as a tool for mass awareness. However, at term, the whole market housing, the EPD is one of the few choke points where you can recognize the energy problem and try to act.
b- Financial supports: an undeniable announcement effect, a nuanced reality
It appears that the publicity surrounding the existing aid is a powerful lever to bring efforts to find information, however the aid's inventory is always provisional. As for professionals in particular, it highlights the difficulty to track and aid their development, the obsolescence of information that the aid is likely to change, or to simply disappear. Even more at the regional level, the spatial variability of aid poses an additional problem to relay information. Moreover, the eligibility requirements are challenged.
c- Self-realization excluded
All of financial supports are conditioned to the use of an enterprise, which is quite contrary to the general dynamics of the market for rehabilitation where self-realization of work is common, especially for insulation.

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7.4. Barriers in Liguria (Italy)

Those obstacles that prevent us from fully exploiting the possibilities of energy efficiency are different in nature, even if they are interconnected and are related to cultural, financial, professional and technical and regulatory aspects.

- **The cultural obstacle:** this is due to the lack of information, the final users are not aware of the existence of technologies or materials that may improve the energy efficiency of the buildings. Therefore, the little interest and knowledge of technical actions that might be performed on the buildings, cause people to underestimated their importance and think of them as ineffective and expensive.

- **The financial obstacle:** first, it is due to the lack of willingness or reluctance of banks to finance improvement works on the existing buildings. Banks are ready to finance the installation of photovoltaic panel systems, since they think this is a safe investment and with no risks. Second, funding allocated by the government by means of tax allowance, is limited. Such concessions have been renovated, on an annual basis, since 2007; however they are not sufficient for users to make important investments, since they never know if the concessions are renovated.

- **The professional-technical obstacle:** it deals with the difficulties of implementing improvement projects aimed at energy savings, and involving buildings that were mainly built (before 1976) without taking into consideration (or very little consideration) the energy issues. What it is often needed, is a very invasive action and a full renovation of the building, which is not easily applicable since it is extremely expensive. In addition to that, professionals are not very aware of energy saving issues: most of the time, systems are not correctly sized and they are not really persuaded of using innovative technologies.

- **The regulatory obstacle:** professionals must face many problems as far as laws and legislation is concerned. Laws on these issues keep changing and the time interval needed for the laws to be recognized by the relevant bodies, does not allow professionals to rely on a clear legislative framework.

As far as the experiences in Liguria are concerned, thanks to the work of our technical call centre that helps energy certifiers, and the activities related to the “management of calls for funding”, what we understood is that energy efficiency is hindered mainly by cultural and financial obstacles. If people are not aware of the energy problems, they do not accept innovative methods that might be expensive. Moreover, banks do not encourage funding dedicated to energy renovation of buildings, since they think it is not financially beneficial.

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7.5. Barriers in Piedmont (Italy)

The main barriers arisen for energy efficiency improvement in buildings are:

- **Institutional barriers**
    - Administrative hurdle - the application of legislation on energy efficiency is not uniform across the region because municipalities have the ability to integrate the law with additional criteria in Municipal Building Regulations
    - No training on energy savings for municipal technicians
    - legislation is laboured and not easy to understand
    - no integration between the national and regional legislation
- **Financial barriers**, i.e.
    - Limited access to capital
    - Risk exposure, uncertainty, etc
- **Technical barriers**, i.e.
    - Lack of technical know-how
    - no specialist training about bureaucratic and administrative aspects;
    - no training about technical - economic aspects: price analysis, technical specification, evaluation of technological solutions based on the economic benefits
- **Stakeholder barriers**, i.e.
    - Low priority for energy issues
    - Information failure, etc

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7.6. Barriers in Basilicata (Italy)

Technical barriers

- ***Old and energy-intensive buildings:*** in Italy about 75% of the buildings were built before 1976, when it was introduced for the first time a regulation prescribing energy efficiency standards in buildings. For this reason most of the existing buildings were built in Italy in a period when they were absent prescriptive requirements on energy efficiency in buildings, and only a few buildings have been made after a careful evaluation of energy consumption. According to an ADICONSUM's study (Association of Consumers and Environment Defense) in 2005, about 250,000 of 400000 condominiums have centralized heating plants over 15 years former and therefore obsolete, inefficient and requiring requalification to improve the energy efficiency and save fuel. It is estimated that each year these buildings consume 4 million toe and emit about 15 million tons of carbon dioxide (CO2).

- ***Lack of training of technicians:*** technicians who design heating systems often have a good background in systems and facilities management and their safety, but are not enough qualified on the economic and organizational aspects and therefore are not able to propose measures able to accomplish, in a concrete way, the potential savings.

- ***Professional inaction of technicians:*** the lack of training sometimes adds the professional inertia. Technicians can be considered a technological innovation not yet directly tested as a possible source of complications, malfunctions or safety hazards for the plants, so do not promote innovation.

Institutional barriers

- ***Delays in the introduction of regulations*** for the minimum requirements for energy efficiency.

- ***Incorrect application of regulatory instruments***

Italian legislation provides a specific set of tools as the energy certification, the energy service contract, the White Certificates, the feed-in tariff for photovoltaic systems, the energy saving companies (ESCO) - designed to promote improvements in energy efficiency of apartment buildings. Unfortunately, the inappropriate use of these tools, or their slow realization, obstacles the full implementation of interventions that are slowed or entirely hindered.

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Financial barriers

- ***Split incentives*:** one financial obstacle is the so-called "split incentives" that is the situation where the owners could make investments in energy efficiency but without obtaining any direct benefit, while tenants could benefit from cost savings but have no interest in investing in a building they are not proprietary and that could leave after a few years before returning on their investment.

- ***Limited access to capital***

- ***Overstate the premium charges*:** in the building sector experts tend to overstate the premium charges of measures which aim to reduce energy consumption. In this way, even before assessing the real costs and benefits, some measures are excluded from being realized.

Stakeholder barriers

- ***Low priority*** for energy issues

- ***Information failure***

7.7. Barriers in Western Macedonia (Greece)

According to official information provided by the Hellenic Ministry of Environment, Energy and Climate Change (http://www.ypeka.gr/) the buildings and transportation are the most energy-consuming sectors in Greece. Buildings in Greece account for approximately 36% of the total energy consumption, while, during the years 2000-2005, relevant energy consumption increased by approximately 24%, one of the highest increases in Europe.

One of the main reasons why Greek buildings consume so much energy is that they are old and have no built-in state-of-the art technology, due to the lack of relevant legislation over the last 30 years.

Most of these buildings were built before 1990 and have problems relating to:

- partial or total lack of heat insulation;
- outdated technology windows/doors (frames/single glazing);
- lack of sun protection on southern and western sides;
- inadequate use of Greece's high solar potential;
- inadequate maintenance of heating / air conditioning systems, resulting in poor performance.

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Another important factor affecting building's energy performance is tenant behaviour. Users-tenants, who lack information about the rational use and management of energy, often tend to waste energy, e.g. by installing individual air conditioning systems without a relevant study, using low efficiency appliances, not performing maintenance of heating systems, etc.

The obstacles to investments cannot be ignored either. The current economic crisis can limit investment possibilities due to the lack of available capital.

Within this context, the Hellenic Ministry of the Environment, Energy and Climate Change (YPEKA), having completed the legal framework on buildings' energy efficiency, has developed a set of financial incentives, with co-financing from the European Union, for the implementation of energy efficiency upgrading interventions in residential buildings, via the "Energy Efficiency at Household Buildings" Program described above (http://exoikonomisi.ypeka.gr/).

The following table summarizes the main barriers to energy efficiency improvement in buildings identified above, structured according to the four areas of the conceptual framework for building energy efficiency improvement (see Annex 3 for definitions of the conceptual framework).

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Table 45: Main barriers to energy efficiency improvement in Greek buildings
Source: Hellenic Ministry of the Environment, Energy and Climate Change http://exoikonomisi.ypeka.gr/

Conceptual framework/ areas of application	**Main barriers**
Building envelope	***Legislative*** Old buildings with no built-in state-of-the art technology, due to lack of relevant legislation over the last 30 years (relevant legislation has been recently introduced). ***Financial*** Limited investment possibilities due to lack of available capital.
Building services	***Legislative*** Inadequate maintenance of heating / air conditioning systems, resulting in poor performance, due to lack of relevant legislation over the last 30 years (relevant legislation has been recently introduced).
Appliances/ equipment	***Legislative*** Inadequate use of Greece's high solar potential, due to lack of relevant legislation. ***Financial*** Limited investment possibilities due to lack of available capital.
Occupants/ behaviour	***Informative*** Lack of information about the rational use and management of energy.

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7.8. Barriers in Primorsksa (Slovenia)

State interventions in the areas of efficient energy use and RES are required because of the inefficient workings of the market, which cannot by itself guarantee that the necessary changes will occur with sufficient speed. The purpose of such intervention is the removal of a large number of barriers; these barriers are of an institutional, legislative, administrative, economic, financial, personnel nature, and also relate to awareness and information provision, etc. The main barriers, as presented in the National Energy Efficiency Action Plan 2008-2016, are the following:

Systemic and institutional barriers

- The areas of efficient energy use and RES do not have suitable priority attached to them in accordance with European and national development and environmental policy.
- The same body is responsible for long-term planning, the drafting of action plans and regulations, and the implementation of promotional programmes (i.e. it has planning, supervisory and implementational functions), which contributes to inefficiency in terms of organisation and time taken.
- There is no strong national institution for the implementation of programmes to promote efficient energy use and RES. There is no institution for the implementation of efficient energy use and RES programmes for the public sector that could serve as an exemplar to other sectors. The area is understaffed.
- There is weak coordination between the various ministries (of the environment, the economy, transport, agriculture and forestry, finance, education, science and technology, and regional development) in the planning and promotion of efficient energy use and RES. There are insufficient links between government policies in the fields of efficient energy use and RES
- There are too few links between national and local institutions.
- There is a lack of control over the quality of devices and appliances on the market, which leads to the presence of inefficient products on the market.
- Research and development for energy and other technologies and services in the areas of efficient energy use and RES is too limited in scope and volume.

Legal and administrative barriers

- There is a limited range of economic instruments for promoting efficient energy use and RES.
- There have been delays in adopting regulations concerning the energy performance of buildings.
- There is a lack of regulations concerning the minimum energy efficiency of energy-consuming products.

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- Energy performance contracting and energy supply have still not been fully addressed in regulations.
- The compulsory division and calculation of heating costs in multi-dwelling buildings according to actual energy used is not prescribed in law.
- The unanimous agreement of all floor owners in a multi-dwelling building is required before common areas can be rehabilitated.
- Aspects of efficient energy use and RES are not included in the selection criteria for public contracts.
- The process of acquiring construction and other documentation is complex and protracted (e.g. heat pumps, systems using wood biomass with a power of over 50 kW, lack of clarity of legislation in the issuing of construction permits).
- Complex and protracted procedure from the submission of a grant application to its approval, especially for households.

Economic barriers

- There is an inappropriate relationship of price between certain types of energy because of the failure to factor in all the costs, including the external costs of damage caused by energy to the environment, human health, etc.
- There is an inadequate tariff system which fails to encourage users to save energy (the fixed part of energy costs is too high).
- The level of discount used when assessing the profitability of investments within companies is too high. Therefore the profitability of a large number of energy saving measures does not satisfy the high economic criteria of company owners. Investments in production technology take precedence over investments in efficient energy use measures.
- The share of energy costs in the overall costs of companies, institutions and households is frequently disproportionately high. This means that investments in efficient energy use and RES are not seen as priorities. Investments in certain measures, e.g. the energy rehabilitation of buildings and RES, have a long investment-return period and are therefore not attractive.
- The payers of invoices for investment and energy consumed are separate, which reduces interest in investing in efficient energy use and RES (e.g. primary schools, renting of buildings or flats).
- The costs associated with drawing up small-scale projects are high.
- There is greater risk attached to the introduction of new technologies, which have not yet found their way to Slovenia.

Barriers relating to financial resources

- Central government funding for financial incentives is to low and lags a considerable way behind the volume planned in the ReNEP. There has, up to now, been no stable, long-term financial mechanism for supporting efficient

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energy use and RES projects. Support has been dependent on the adoption of annual budgets.

- There is a low level of availability of own funds. The poor financial standing, primarily of private individuals, prevents them from obtaining loans for otherwise economically viable projects, as does the poor financial standing of owners and potential buyers (e.g. when building a house and investing in energy installations).
- Financial incentives are oriented solely towards the purchase of established technologies; there are no incentives for technological and economic development in this area (e.g. the production of pellet boilers, etc.), which could, in the future, reduce potential positive economic benefits.
- The transaction costs associated with the allocation of financial incentives, especially in the residential sector, are too high.
- The market for alternative financing models is poorly developed (energy performance contracting or energy supply) and financial institutions have a lack of knowledge and experience of these models.
- A tax on air pollution caused by CO2 emissions should become an instrument for promoting efficient energy use and RES, with revenues being used specifically for financing technologies that reduce CO2 emissions.

Human-resource barriers: availability, knowledge, qualifications

- There is a lack of efficient energy use and RES experts on the labour market.
- Providers of energy and other services are poorly qualified (architects, planners, building contractors, including installers of heating equipment such as solar collectors, PV, heat pumps, and other construction specialists.
- There is a lack of qualified staff among energy users, particularly in small and medium-sized companies and in the public sector, able to manage and implement efficient energy use, RES and energy management projects.
- Administrative workers are not sufficiently qualified to review documentation for acquiring a construction permit (new buildings, building reconstructions).
- There are too few professionals qualified to promote and support activities relating to efficient energy use and RES measures.
- Efficient energy use and RES are insufficiently integrated into education and study programmes.

Barriers relating to awareness and information

- The level of information provided on energy costs, possible efficient energy use measures and modern technologies is too low.
- The population are insufficiently aware that excessive and inefficient energy use also damages the environment (CO2, hole in the ozone layer, SO2)

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- There are too few activities being carried out to increase energy efficiency in the public sector, which should be fulfilling an exemplary role.
- There is a lack of trust in innovative energy technologies and too few high quality pilot and model projects, especially in public buildings and for new technologies.
- There is a lack of knowledge and interest among company managers concerning energy supply and consumption.

Barriers, structured according to the four areas of the conceptual framework for building energy efficiency improvement

Building Envelope

High cost of investment, a low level of availability of own funds for investment in energy efficiency, low level of available state financial incentives, lack of knowledge and interest in possible earnings in long term through investment in energy efficiency, delays in adopting regulations concerning the energy performance of buildings

Building Services

Very demanding documentation to be filled in order to present the applications for getting the financial support**,** over-segmentation of financial incentives between different programmes, the process of acquiring construction and other documentation is complex and protracted (e.g. heat pumps, systems using wood biomass with a power of over 50 kW, lack of clarity of legislation in the issuing of construction permits), monthly fluctuations of energy prices (the investitor is not certain if the decision is right in long term), lack of knowledge and interest in possible earnings in long term through investment in energy efficiency, The population are insufficiently aware that excessive and inefficient energy use also damages the environment, There is a lack of trust in innovative energy technologies and too few high quality pilot and model projects, especially in public buildings and for new technologies, there are too few activities being carried out to increase energy efficiency in the public sector, a low level of availability of own funds, a lack of qualified staff among energy users, particularly in small and medium-sized companies and in the public sector, able to manage and implement efficient energy use, RES and energy management projects

Appliances/equipment

High investment costs in equipment, lack of knowledge and interest in possible earnings in long term through investment in energy efficient appliances/equipment, low level of available state financial incentives, a low level of availability of own funds

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Occupants/Behaviour

The lack of attention to energy efficiency, lack of motivation in the organisation and the operating personnel, lack of interest in energy efficiency improvements, lack of energy efficiency behaviour education, lack of energy accounting within the institutions and enterprises, consumerism.

Conceptual framework/areas of application	**Main barriers**
Building Envelope	**Legal and administrative barriers** (delays in adopting regulations concerning the energy performance of buildings, a limited range of economic instruments for promoting efficient energy use) **Barriers relating to financial resources (**Central government funding for financial incentives is to low, there is a low level of availability of own funds, the market for alternative financing models is poorly developed)
Building Services	**Barriers relating to financial resources (**Central government funding for financial incentives is to low, there is a low level of availability of own funds) **Economic barrier** (the costs associated with drawing up small-scale projects are high, investments in efficient energy use and RES are not seen as priorities) **Financial barrier (**limited range of economic instruments for promoting efficient energy use, uncertainty) **Legal and administrative barrier (**Complex and protracted procedure from the submission of a grant application to its approval) **Barrier relating to awareness and information (**There are too few activities being carried out to increase energy efficiency in the public sector, which should be fulfilling an exemplary role)
Appliances/equipment	**Economic barrier** (investments in efficient energy use and RES are not seen as priorities) **Financial barrier** (limited range of economic instruments for promoting efficient energy use, there is a low level of availability of own funds
Occupants/Behaviour	**Barrier relating to awareness and information (**the level of information provided on energy costs, possible efficient energy use measures and modern technologies is too low, efficient energy use and RES are insufficiently

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Conceptual framework/areas of application	Main barriers
	integrated into education and study programmes) **Systemic and institutional barriers (**There is no strong national institution for the implementation of programmes to promote efficient energy use, Research and development for energy and other technologies and services in the areas of efficient energy use and RES is too limited in scope and volume)

7.9. Barriers in Malta

Conceptual framework/ areas of application	Main barriers
Building envelope	Most of the buildings in Malta due to the materials used have a high u-value Lack of adequate financial schemes from the private sector Lack of enforcement of existing legislation
Building services	Lack of standardised technical procedures
Appliances/ equipment	Although there are several financial schemes these may not be sufficient The energy labelling and standard product information legislation has been updated only this year and is not sufficiently enforced. Lack of investment from the private sector Lack of energy efficiency culture
Occupants/ behaviour	Low priority for energy issues (cultural) Lack of adequate and continuous information campaigns amongst the public

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7.10. Barriers in Andalusia (Spain)

In general, we must say that one of the main barriers for the implementation of energy efficiency measures in building is the lack of awareness and knowledge among all the stakeholders. People are not aware about the sustainability issue and make themselves questions such as *"What do I get of this? I have more concerns at this moment than reducing carbon emissions"*. It would be necessary for the users to realize that there is a real and current problem that will also affect him/her particularly.

A good practice should be that users could know how much energy they expend and for instance, how much money they could save and so on, undertake measures. In the specific case of EPSA, there must be highlighted that a considerable amount of housing promoted by the company is a multiple private ownership, a fact that makes the management and the willingness to make investments to improve energy efficiency measures more difficult.

However, without a doubt, the "big issue" is the lack of enough finance and funding schemes. There is a difficulty to access to funds and doubts about the return of investments, especially nowadays with the financial crisis.

In addition, there is a wrong approach when considering the initial costs that suppose the implementation of energy efficiency measures compared with the initial cost of the buildings following the traditional way since there is not a life cycle approach. Private investors want a "quick-profit". In the private sector, investors and residents need to see the financial benefits of environmental improvements in order to invest in refurbishing their homes.

At national level, from the point of view of the dwellings building company there must be highlighted a barrier in relation with the lack of direct payback of the energy efficiency promotion investments. Along the life cycle of buildings home users will recover the economical benefit from the energy savings, although the investment in energy efficiency improvement was done in the beginning by the companies. That makes these investment less attractive and feasible because most of the time (even in rental housing) energy bills do not affect the initial cost for building.

Moreover, there is a need to establish specific comfort standards appropriate to the site and users conditions. For new building there is an established comfort criteria at national level (see table nº3 – Operational conditions) . When dealing with social housing retrofitting, comfort parameters should be also adapted to the residents

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specific economic conditions as an improvement in that should also cause a consumption raise.

The measures for the energy efficiency improvement in buildings should be considered since the beginning of the process. The matter of sustainability shouldn't be considered once the building is finished but during the construction process as well.

Additionally, the lack of a good design or even a bad performance of the building is sometimes fulfilled by the implementation of active systems which causes big and, for instance, unnecessary energy expenses.

The extremely high temperatures during summer are not really considered in the building regulations while the cold temperatures are. This fact does not make mandatory the implementation of air conditioning systems in Andalucía. Only space heating for social housing in Granada and Jaén is mandatory. However, residents buy the necessary devises which, most of the time are the cheapest and also the less energy efficient.

Regarding the building regulations, there are weak and not clear buildings regulations for the retrofitting works in matters of energy efficiency. For instance, at the moment, Spain still has not approved the energy efficiency certification for existing buildings procedure established in the 2002/91/CE Directive.

Building Envelope

- **Technical and Stakeholder barriers**

Among the barriers related to the building envelope, we can highlight the lack of training about new technologies and systems that can be implemented over the building envelope in order to improve its U value, and for instance, the energy performance of the building.

In retrofitting, there are some questions such as the urban protection of some façades, preventing the use of external solutions for the building envelope or the small size of the homes that avoid the use of insulation solutions in the inside of façades.

There is also a need to consider the own specific characteristics of the building, site, users etc in order to choose the solutions.

- **Institutional and Technical barriers**

There should have been more investment in research and dissemination about techniques, materials and systems.

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Building Services

- **Technical, Financial and Stakeholder barriers**

In this section, there is a need to highlight the fact of the rejection to all "the new", systems, materials, technologies that have better energy efficiency rates due to the lack of knowledge, suspicion and, generally the higher prices.

Concerning to the energy sources, residents trust more in conventional sources than in the renewable ones since the immediate results are not clear enough, specially, the cost effectiveness.

In addition, there is in many cases, a need of space available in the homes and in the buildings that makes difficult its implementation and so happens with the maintenance, requiring specialized keepers.

The general use of heating/cooling systems is individual. It is not very common in Andalusia to find buildings with centralised systems. This makes the performance less effective since there is not any possibility to reach the optimum and there are not synergies among them. There are some parts of Andalusia, where traditionally the heating has been implemented in the buildings, being now mandatory, with this kind of centralised systems. Nevertheless, this doesn't happen with the cooling systems. With regard to the heating systems, in Andalusia, the most widely used devises are individual radiant electrical heaters (Joule-Kelvin effect) which have been demonstrated to be the less effective even though the energy expense is one of highest. When space conditioning in dwellings it is usual to warm up or refrigerate little spaces with fast devices instead of using zone systems to heat and maintain at a minimum level the whole living area of the house.

The cooling systems are as well individual and generally split with air source heat pumps that in majority are the cheapest in the market.

If the control of the air ventilation is manual, this can't be done properly since the homes are not occupied during the working hours and therefore the ventilation is not enough.

Generally speaking, it must be said that there is not a holistic approach when considering the implementation of systems in buildings and the results can not be optimal.

Appliances/ equipment

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- **Technical, Financial and Stakeholder barriers**

There is not awareness and, in some cases, knowledge about how to make an efficient use of household appliances.

The use of some appliances has been already mentioned in the area above.

There is a general lack of information about self final energy consumption rates, what becomes in lack the real feedback for the energy efficiency strategies considered.

Occupants/ Behaviour

- **Technical and Stakeholder barriers**

Despite there are facts that have been already mentioned above, it is remarkable that the main barriers are the lack of awareness among users and the need to change some resident habits.

7.11. Barriers in Alentejo (Portugal)

In order to identify and analyse Portugal, and its region Alentejo, main barriers to building energy efficiency, one has first to realise the current characteristics of the national/regional building stock.

In the last decades Portuguese population has suffered a significant displacement from rural areas to the largest cities, especially Lisbon and Porto. Since the Portuguese weather is fairly moderate in most of the country and until 1990 there wasn't any legislation on building energy performance, this demographical movement resulted in two very dense urban areas, where the large majority of the Portuguese population lives and works, in multi-storage buildings, which in most cases have very poor envelop thermal characteristics, with scarce or no insulation at all, and therefore very poor energy efficiency.

In contrast to Lisbon and Porto, Alentejo, the largest Portuguese region, is still very rural and has one of the country's lowest population densities. With just a few small cities and several disperse villages, the buildings stock in the Alentejo region is somewhat diverse, with old buildings of town centres contrasting with the more recent buildings of the outskirts. However, older buildings with high thermal (from large structural walls made from stone and earth) tend to respond better to the hot summer weather that

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characterises this particular region than the buildings constructed in the last decades, with thinner walls made of cored bricks, and thus less thermal mass.

In recent years, especially after the publication of the buildings energy performance regulations in 2006, energy efficiency in new buildings has increased considerably. Good insulation levels and solar thermal panels for hot water heating became mandatory for every new building and major refurbishment. However, due to the surplus of buildings nationwide that resulted from the 80's and 90´s construction eagerness, and poor urban planning, the rate of the building stock renovation has been low. In the past few years, because of the financial crisis and limited access to capital, this already low rate has declined even more, and future perspectives foresee even lower numbers of new buildings. On the up-side, the appliances efficiency has improved generally.

Regarding energy efficiency refurbishment measures, the numbers have also failed to impress, mostly due to extremely long payback periods, in many cases, several decades. The reason for this is a favourable climate, which results in relatively low heating and cooling demands, and rather low comfort levels regarding internal building temperatures that lead to small costs with acclimatization and consequently very large payback periods.

Another barrier can also be pointed out. In Portugal, until very recently, building energy consumption was far from being a priority for general public and building technicians, and building design early stage decisions (e.g. orientation, shape, openings, shadings) have still a lot to improve.

In summary, the main barriers for building energy efficiency improvement in Portugal are:

- Low building stock renovation rate, mainly due to limited access to capital and poor urban planning.
- Extremely large payback periods of energy efficiency refurbishment measures, especially regarding the building envelop, due to low heating and cooling demands derived from a favourable climate and the general acceptance of relatively low levels of comfort.

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Main barriers to energy efficiency improvement in buildings of Portugal

Conceptual framework/ areas of application	Main barriers	Quantitative results if available
Building envelope	Stakeholders barriers: Architect's low priority for energy efficiency and lack of knowledge Financial barriers: Low access to capital which results in low rates of new buildings construction and existing buildings refurbishment Very high payback periods for energy efficient refurbishment measures	Several decades
Building services	Financial barriers: Low access to capital which results in low rates of new buildings construction and existing buildings refurbishment Very high payback periods for energy efficient refurbishment measures Technical barriers: Lack of technical know-how	
Appliances/ equipment		
Occupants/ behaviour	Stakeholder barriers: Lack of building energy management Low awareness of general public for energy efficiency habits	

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7.12. Compilation of main barriers

Comparison shows that all regions face similar barriers of the demand side to energy efficiency in buildings, focused mainly on the following categories and issues:

- ***Structural/ institutional barriers***
  - Unclear, unstable and short-term oriented operational legislative framework for both offer and demand
  - Poor integration of European, national, regional and local policies on energy efficiency and renewable energy supply, and of the related administrative bodies
  - Gap between political objectives (3*20 especially) and operational regulations: level, delays, control
  - Complexity of (1) regulations, (2) implementation and (3) enforcement and verification of compliance
  - Complex administrative procedures for implementing energy efficiency refurbishments
  - No connection between energy efficiency regulations or public incentive schemes from social and behaviour issues (and too much linked with technical/ academic/ financial issues)
  - Complex decision making for owners renting buildings and not profiting of energy efficiency benefits (private renting and social housing)
  - Complex decision making for multi-owner buildings
  - Renovation projects are usually conceived as renovation of individual buildings, while better solutions may arise at "neighbourhood" scale

- ***Economic/ financial barriers***
  - Limited profit margin for ESCOs in small energy refurbishment projects
  - Bad integration of the real (economical, environmental and social) cost of energy in current energy prices, rendering energy efficiency less profitable
  - Requirement for large investments for energy efficiency refurbishment projects
  - Lack of public investment and funding capacity
  - Incapacity of conventional financial instruments to make energy efficiency renovations feasible and lack of new/alternative financial models
  - Lack of private investment capacity

- ***Technical/ technological barriers***
  - Lack of generic skills and organized leadership to address the refurbishment process

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- ***Knowledge barriers***
  - Difficult access and analysis capacity by users to real-time, detailed information on their energy use
  - Incomplete, unshared, unstable, spread or asymmetric information on EE issues, the best methodology and solutions, providers of available services
  - Lack of awareness among users on the benefits of energy efficiency investments in the long run
  - Lack of accurate knowledge within politicians, administrative and civil servants
  - Lack of detailed information on the characteristics of the building stock at regional level
  - Misconception of the main climate and comfort challenges that the Med area buildings face

- ***Behavioural barriers***
  - Lack of motivation for energy efficiency in users. The issues of aesthetics, bigger space, fashion and updating, well-being, reducing noise are the most important motivations for refurbishment. As a consequence, there is a distortion between public policies (energy efficiency focus only) and consumer behaviour
  - Reluctance of users to accept refurbishment works as they are perceived as intrusive, complex and annoying
  - Distortion between behaviour requirements for use of refurbished building and MED usual way of life (open windows, mobile sun protections, use of control technologies etc)

The following table summarises the identified barriers of the demand side, structured according to the target groups of stakeholders. The target groups of stakeholders are categorised as follows:

- ***Target group A***: National, regional and local authorities as policy makers
- ***Target group B***: Public and private owners, with centralised decision making:
  - Public administrations (tertiary)
  - Social housing operators (housing)
  - Private owners (tertiary)
- ***Target Group C***: Private owners, with collective decision-making (condominium)
- ***Target Group D***: Private owners, with centralized decision making
  - Apartment/ House, Occupying/ Renting
- ***Target Group E***: Users (and not owners) of buildings:
  - Education (body and students in schools, college/ university)

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  - Tenants in social housing
  - Tenants in dwelling of private renting owners

- ***Target Group F***: Public and private financial services organizations
- ***Target Group G***: Professionals as suppliers of products or services:
  - Suppliers of building materials and systems (skin/equipments)
  - Suppliers of services (global refurbishment services, energy management, building companies related with building energy efficiency, architects, engineers and experts, ESCOs)
  - Suppliers of services for SMEs (i.e. clusters)
  - Other professionals (i.e. real estate agencies)
- ***Target Group H***: Others (universities, institutions and technology centres, NGO, social organizations)

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Table 46: Compilation of demand side barriers to energy efficiency improvement in buildings in relation to target groups of stakeholders

Type of barriers	Target group / Barrier	A. National, regional and local authorities as policy makers	B. Public and private owners, with centralised decision making	C. Private owners, with collective decision-making	D. Private owners, with centralized decision making	E. Users (and no owners) of buildings	F. Public and private financial services organizations	G. Professionals as suppliers of products or services	H. Others
Structural/ institutional barriers	Unclear, unstable and short-term oriented operational legislative framework for both offer and demand	✓							
	Poor integration of European, national, regional and local policies on energy efficiency and renewable energy supply, and of the related administrative bodies	✓							
	Gap between political objectives (3*20 especially) and operational regulations: level, delays, control	✓							
	Complexity of (1) regulations, (2) implementation and (3) enforcement and verification of compliance	✓							

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Type of barriers	Target group / Barrier	A. National, regional and local authorities as policy makers	B. Public and private owners, with centralised decision making	C. Private owners, with collective decision-making	D. Private owners, with centralized decision making	E. Users (and no owners) of buildings	F. Public and private financial services organizations	G. Professionals as suppliers of products or services	H. Others
	Complex administrative procedures for implementing energy efficiency refurbishments	✓							
	No connection between energy efficiency regulations or public incentive schemes from social and behaviour issues (and too much linked with technical/ academic/ financial issues)	✓							
	Complex decision making for owners renting buildings and not profiting of energy efficiency benefits (private renting and social housing)	✓	✓		✓	✓			
	Complex decision making for multi-owner buildings	✓		✓					
	Renovation projects are usually conceived as renovation of individual buildings, while better solutions may arise at	✓							

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Type of barriers	Target group / Barrier	A. National, regional and local authorities as policy makers	B. Public and private owners, with centralised decision making	C. Private owners, with collective decision-making	D. Private owners, with centralized decision making	E. Users (and no owners) of buildings	F. Public and private financial services organizations	G. Professionals as suppliers of products or services	H. Others
	"neighbourhood" scale								
Economic/ financial barriers	Bad integration of the real (economical, environmental and social) cost of energy in current energy prices , rendering energy efficiency less profitable		✓	✓	✓		✓		
	Requirement for large investments for energy efficiency refurbishment projects		✓	✓	✓				
	Lack of public investment and funding capacity	✓	✓						
	Incapacity of conventional financial instruments to make energy efficiency renovations feasible and lack of new/alternative financial models	✓					✓		
	Limited profit margin for ESCOs in small energy refurbishment projects							✓	
Technical/	Lack of generic skills and		✓	✓	✓		✓	✓	

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Type of barriers	Target group / Barrier	A. National, regional and local authorities as policy makers	B. Public and private owners, with centralised decision making	C. Private owners, with collective decision-making	D. Private owners, with centralized decision making	E. Users (and no owners) of buildings	F. Public and private financial services organizations	G. Professionals as suppliers of products or services	H. Others
technological barriers	organized leadership to address the refurbishment process								
Knowledge barriers	Difficult access and analysis capacity by users to real-time, detailed information on their energy use		✓	✓	✓	✓			
	Incomplete, unshared, unstable, spread or asymmetric information on EE issues, the best methodology and solutions, providers of available services	✓	✓	✓	✓	✓	✓	✓	
	Lack of awareness among users on the benefits of energy efficiency investments in the long run		✓	✓	✓	✓			
	Lack of accurate knowledge within politicians, administrative and civil servants	✓							

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Type of barriers	Target group / Barrier	A. National, regional and local authorities as policy makers	B. Public and private owners, with centralised decision making	C. Private owners, with collective decision-making	D. Private owners, with centralized decision making	E. Users (and no owners) of buildings	F. Public and private financial services organizations	G. Professionals as suppliers of products or services	H. Others
	Lack of detailed information on the characteristics of the building stock at regional level	✓							
	Misconception of the main climate and comfort challenges that the Med area buildings face		✓	✓	✓	✓			
Behavioural barriers	Lack of motivation for energy efficiency in users.		✓	✓	✓	✓			
	Reluctance of users to accept refurbishment works as they are perceived as intrusive, complex and annoying					✓			
	Distortion between behaviour requirements for use of refurbished building and MED usual way of life (open windows, mobile sun protections, use of control technologies etc)					✓			

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8. Main Conclusions

Catalonia - Spain

Catalonia as the rest of Spain is living a severe economic crisis, particularly accentuated in the building sector after more than a decade of booming construction activity encouraged by demographic growth. The fall of economy and consequent reduced households' income together with the banks' lack of liquidity and reduced lending capacity has lead to a paralysis of the construction sector in the last two years. Only the publicly subsidised building renovation activity (around 30,000 dwellings/year; 1% of the overall dwelling stock) was not affected by this reduction until 2010.

As for number of buildings and dwellings / units, the residential sector accounts for more than 90% of the total stock. This relation might be different if construction area is chosen as indicator, but no figures are available on the tertiary sector's area.

A particularity in the residential building stock can be seen in the fact that 30% of the dwellings are 2nd residences, and that more than ¾ of the 1st residences dwellings are property of the occupant. Only 19% of the residential buildings are apartment blocks, owned in "horizontal property" that means that by individual apartment owners.

While construction of new built homes has plummeted, subsidised refurbishment has slightly increased. In 2008 the number of refurbishments commenced exceeded the number of residential building sites initiated that year for the first time.

The building stock's energy performance can be roughly characterized in three main standards: before 1940 (solid traditional construction with important thermal inertia), 1941-1980 (post-war construction with little resources under high demographic pressure) and after 1981 (with first legislation considering minimal thermal comfort and energy efficiency). The national transposition of the EPBD 2002/91/EC brought an important improvement concerning energy efficient construction, but has to be strengthened quickly to meet the new requirements of energy efficiency to meet the goals of the EPBD 2010/31/EC.

In terms of energy consumption, the tertiary sector consumes almost the same amount of energy as the domestic sector (relation 44% to 56%). Due to the lack of tertiary building surface data, kWh/m^2 consumption relations between domestic and tertiary sector cannot be established or respective energy efficiencies evaluated.

Concerning the relation of energy consumption to interlocutors, the tertiary sector, with little number of buildings and units (1/10 compared to residential), but responsible for nearly half of the energy consumption seems the first target to be tackled, as a larger share could be addressed per interlocutor, independently of energy consumption per square meter ratios.

Within the tertiary sector buildings, there is a clear importance to tackle cooling energy consumption, as this at least in hotels and office buildings comes up for between 25-35% of total final energy consumption, being significantly more important on primary energy level, and being responsible for critical electric power peaks in summer.

Concerning the residential sector, most buildings are single family or two family houses (74%), but more useful building area is located with multifamily buildings (60% of the total). Specific energy consumption is higher in single family houses (around 35% higher than in multifamily houses in the construction period 1941-1980) and therefore seem to have to be tackled first, but on the other hand due to higher surface/volume relation, especially measures on the building envelope, might result much costlier here than in multifamily houses and therefore be economically less efficient. More detailed studies are needed to define the input-impact ratio, especially on Regional level.

An interesting target for energy efficiency improvement within the residential sector is the important post-war building stock (46% of total building stock) built between 1941 and 1980. The blocks of flats built in those decades reveal very low construction standards concerning the building's envelope as well as services as the usually do not count on centralised heating systems, so that the occupants – in a good part low – income – do not heat the overall dwelling but only selected rooms with decentralised movable heating devices, leading to a significant lack of comfort.

In the residential sector, specific energy consumption has been calculated to be 86 kWh/m^2 total final energy consumption in first residences. Heating energy consumption is 36 kWh/m^2, appliances 19 kWh/m^2 and lighting 6.6 kWh/m^2.

On legislative level, the EPBD 2002/91/EC transposition in form of the CTE (Cσdigo Tιcnico de la Edificacισn) as well as Regional laws already set minimum requirements in case of new construction and major renovations, but mechanisms like a compulsory energy certification also for existing buildings are needed to penetrate the market.

On economic-financial level, several public subsidy schemes promote energy efficient renovation, from appliances to services and building envelope, achieving important energy savings and CO_2 emissions reduction at negative abatement costs (less than 1cent€ public subsidy/avoided kWh taken over the whole lifecycle of the measure), revealed in an impact study of the Spanish 2005-207 and 2008-2012 (?) Action Plans elaborated by IDAE for the period 2005-2010.

The main energy efficiency renovation demand barriers are identified to be on economic-financial, information and structural level. Specific measures to overcome the identified barriers in the frame of MARIE are going to be defined in the second part of WP4.1, but we encourage conceiving far-reaching measures, attacking especially structural and economic issues, for example:

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- internalize the environmental cost of energy into the energy price, taking into account social aspects;
- allow the investor to benefit from the energy savings achieved by the investment over the lifetime of the energy efficiency improvement measure;
- provide solutions for the specific characteristic of "horizontal property" in the Catalan residential building stock, where the huge number of apartment owners within a single building might hinder the implementation of common measures on building envelope and centralised services;
- provide detailed information on energy consumption to the occupant to increase awareness and provide information on economic and environmental benefits of energy efficiency improvement measures to all stakeholders (occupants, facility manager, owners);
- provide training to stakeholders at all levels: design, production, installation, operation and maintenance and management in order to improve reliability of energy efficiency measures and equipment.

Finally, the impact of the difficulties to obtain recent data on the building stock and especially on energy consumption, particularly for the tertiary sector, has to be accounted for. Neither total building surface figures were found nor disaggregated energy consumption data are available for the tertiary sector. This lack of relevant data reduces the possibility of obtaining clear results in some cases and of course of detailed energy planning in general.

PACA - France

The region PACA is a specific Region with:

- 3 climatic zones
- more than 20% of secondary homes (or vacancy homes)
- 60% of collective households with a majority built before 1975
- a majority of owners,
- More than 90% of the population is living in an urban area, mainly along the coastal strip. Moreover the region will see an increase of 15% of its population which will reach 5.5 millions in 2040, thus exacerbating land constraints
- The average disposable income of families in the PACA region is below the national average
- The percentage of people living below the poverty line is more important than the national average PACA
- The percentage of single parent families in the PACA region is higher than the national average
- Trend of rising energy prices and national levels
- increasing development electricity consumption in PACA
- a risk of electric supply in the East of the Region
- the level of water consumption in PACA is rather important

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- Household and tertiary consumption accounts for 1/3 of the total energy consumption
- Households accounts for 70% of the consumption into the total households / tertiary consumption.

Three major issues for improving the energy efficiency in the existing buildings:

1 - Providing appropriate information :
This is the major issue, without which nothing else will (correctly). Information must meet three essential conditions:

a-Speak in a simple way and not add to the complexity room.

b-Remove the messianic attitudes, scare and guilt.

c-The global approach to retrofitting in the individual household must not become sterile: it must be translated into standard solutions easy to understand and to implement

2 - Providing relevant financial assistance :
The existence of financial support is an excellent vehicle for awareness and information retrieval. This can also be a source of frustration: complicated cases, conditions for granting offset relative to the characteristics and experiences of potential entitlement.
One needs to have some long term perspective for being eligible to the financial support. The access to it must be easy to understand. New financial supports are to be invented.

3 - Use of coercion
Although the regional actions are largely constrained by the national regulatory frameworks or European ones, it is important that the coercion is positioned in a proactive manner.

The study '*What renovation in the built before 1975* 'shows that different approaches could be conducted depending of the types of the inhabitants which are:

- homeowners,
- landlords,
- collective housing,
- social housing,
- social guardianship

Notes :
In the Region PACA, the use of coercion is under way : financial support only for global environmental project seeking highly energy performances. A broad program for social housing and refurbishment seeking high energy performance has begun this year. In parallel, the Region PACA is working on new financial support such as guarantee fund,

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preferential loans, or the birth of a regional operator helping renewable energy and energy efficiency local projects.

Liguria – Italy

The Liguria Region has implemented the European Directive 2002/91/EC on the energy efficiency of buildings in 2007 and has anticipated the publication of the National Guidelines for the certification of buildings.

The RBA analysis has allowed the Region to point out new measures/ actions aiming at renewal energy of new and exiting buildings in order to improve and guarantee the quality of the process (certification, planning)

In particular it will be necessary to:
- Improve the technical training of professionals involved in the energy certification process;
- Raise awareness about energy efficiency in buildings;
- Enlarge the database dedicated to the residential building;
- Create a database dedicated to the tertiary sector.

Piedmont - Italy

The Piedmont Region has implemented an integrated approach to the issue of energy efficiency in buildings through obligatory measures (laws, regulations, requirements) and by financing the improvement of public building stocks.

The RBA analysis shows the need to continue through this way even if corrective measures should be put in place in order to improve the effectiveness of what has been done.

In this regard, we note that it's important to:

- involve traders placed on the territory;

- streamline the existing legislation, avoiding the red tape;

- enhance the technical and administrative training for staff involved in operations of energy efficiency in buildings

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Basilicata - Italy

In Basilicata, there is no system for the direct collection of data and information relating to building stock. At national level the only systematic measurements of such information are included in the General Census of Population and Household, which have every ten years. This circumstance makes very difficult to perform an accurate analysis of the energy performance of existing buildings.

The Basilicata Region, however, is committed to the promotion and dissemination of policies for sustainability in the building sector. In recent years, in fact, the Basilicata Region:

- adopted the ITACA Protocol as a technical directive to a correct approach to sustainable construction and reference tool for the implementation of actions on public house buildings. ITACA Protocol, approved in 2004 by the Conference of Presidents of Italian Regions, is a environmental quality assessment system for residential buildings;
- issued the “Call of proposal for the grant of aid to support technological innovation and reducing energy consumption in buildings". This call of proposal allowed capital contributions aimed to encourage the use of materials, systems and innovative technologies in the energy sector by reducing energy consumption, improving energy efficiency and the use of renewable energy in buildings used for civil, commercial, tourist and sports;
- issued the “Call of proposal for the grant of aid to support technological innovation and reducing energy consumption in buildings". This call of proposal allowed capital contributions aimed to encourage the use of materials, systems and innovative technologies in the energy sector by reducing energy consumption, improving energy efficiency and the use of renewable energy in buildings used for civil, commercial, tourist and sports
- issued the “Call of proposal for the planning and implementation of measures for reducing energy consumption of public buildings and public lighting systems”. This call of proposal aims, in consistency with the targets set at EU and national levels, as well as the provisions contained in the Regional Environmental Energy Plan, to promote :
    - the use of installations, equipment, materials and innovative technologies to save energy and improve energy efficiency of public building
    - the reduction of energy consumption associated with public lighting;

In the near future, the Basilicata Region aims, as a priority, to implement the procedures for the regional energy certification of buildings, which will also provide a system for the systematic measurement of the energy performance of existing building stock.

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Western Macedonia - Greece

The buildings and transportation are the most energy-consuming sectors in Greece. Buildings in Greece account for approximately 36% of the total energy consumption, while, during the years 2000-2005, relevant energy consumption increased by approximately 24%, one of the highest increases in Europe. In particular, the residential sector accounted for 32% of the average final energy consumption in Greece during the years 2001-2005, having the highest energy consumption after the transport sector. Also, the tertiary sector accounted for 11% of the average final energy consumption in Greece during the years 2001-2005. The development of market shares in energy consumption sectors in Greece is typical for an economy in post industrial development which is oriented towards a service economy where industry is significantly reduced and the residential along with the tertiary sector gradually develop their corresponding shares.

One of the main reasons why buildings in Greece consume so much energy is that they are old and have no built-in state-of-the art technology, due to the lack of relevant legislation over the last 30 years. Most of the buildings were built before 1990 and have problems relating to:

- partial or total lack of heat insulation;
- outdated technology windows/doors (frames/single glazing);
- lack of sun protection on southern and western sides;
- inadequate use of Greece's high solar potential;
- inadequate maintenance of heating / air conditioning systems, resulting in poor performance.

Greece adopted the Directive 2002/91/EC (Law 3661/2008) for the reduction of energy consumption in buildings in 2008. The main articles of the law concern building codes and minimum requirements for Energy Efficiency in new and existing buildings, focusing on buildings energy performance certificate in all existing buildings, energy auditing, inspection of boilers and air condition systems. For the implementation of these measures, regulations and specifications were issued regarding the energy certification scheme and model, the energy efficiency standards for new buildings, the determination of the new elements and calculations required for the energy study of new buildings, the requirements for energy auditors.

In accordance with the requirements of the Directive 2006/32/EC, the first National Energy Efficiency Action Plan was established and submitted to the European commission. The Second National Energy Efficiency Action Plan is about to be submitted to the EU Commission. The measures were selected on the basis of immediate applicability, with particular emphasis on the overall cost of investment in relation to the anticipated annual energy saving, with the aim of meeting the 9% target for 2010,

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and furthermore the 20% target for 2020. The transport sector is estimated to have the greatest potential for energy savings, identified to be about 36%. In terms of importance, the tertiary and residential sectors follow, having a percentage in the total energy savings of 30% and 29% respectively.

Two major programs give economic incentives for improving energy efficiency in the residential sector:

- The programme "Change Your Air-Conditioning" for the replacement of old split air condition units ran in summer 2009 and led to the replacement of 140.000 units all over the country.
- The programme "Energy Efficiency of Household Buildings" for the insulation refurbishment of walls, roofs, windows and the replacement of heating and water heating equipment in residential buildings constructed before 1990 is under implementation.

Similarly, a number of measures for improving energy efficiency in the public tertiary sector are under implementation:

- The programme "Let's Save Energy" for technical interventions to improve the energy efficiency of existing municipal buildings and targeted information campaigns to raise awareness and mobilize citizens, local government, businesses and organisations.
- Programmes for improving the energy efficiency of public buildings, including hospitals, schools, other public buildings and demonstration project in four residential housing blocks (Green Neighbourhood).

Finally, a number of measures for improving energy efficiency in buildings of both residential and tertiary sector are in the planning and/or initial stage of implementation, with emphasis on the following programmes:

- The programme "Building the Future" for the promotion of energy saving in residential and commercial buildings, based on voluntary agreements for reduced prices, between the supply chain and the final consumers.
- Obligatory installation of central solar thermal systems in all buildings of the public sector and in new buildings of the residential sector and the private tertiary sector.

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Primorska – Slovenia

Since 1995 Slovenia has carried out a large number of promotional programmes aimed at removing the barriers preventing an increase in energy efficiency and greater use of renewable energy sources. In addition, numerous regulations have been adopted primarily in relation to the energy performance of buildings and to household appliances and other products.

The main areas covered by the promotional programmes are:

- informing, raising the awareness of and training energy consumers, investors and other target groups;
- providing energy advice to the public;
- promoting the implementation of advisory services;
- promoting investment in efficient energy use and RES.

A recent survey shows that energy-inefficient buildings prevail in Slovenia, the major part of apartment buildings in the country lack sufficient insulation and only a low percentage of Slovenian households have energy-efficient windows.

Drastic changes are anticipated in the development of buildings, along with more stringent regulations on the energy efficiency of buildings, and even greater savings can only be achieved by removing obstacles to building renovation at all levels. The majority of instruments have already been pledged.

The contractual reduction in energy costs (so-called 'third party financing'), which was introduced in 2003 and is suitable primarily for the public sector. A number of projects have already been carried out using this instrument.

As seen in the upper text state interventions in the areas of efficient energy use and RES are required and necessary in order to remove a large number of existing barriers; these barriers are of an institutional, legislative, administrative, economic, financial, personnel nature, and also relate to awareness and information provision, etc.

State interventions in the areas of efficient energy use are required because of the inefficient workings of the market, which cannot by itself guarantee that the necessary changes will occur with sufficient speed.

Along with the higher number of state financial incentives there is a lack of financial mechanisms, like ESCO. Energy service contracting is a comprehensive, yet modular tool to implement energy efficiency investments. Despite the fact, that Energy performance contracting is recognized as an economically viable instrument to achieve energy

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savings through improved energy efficiency and despite some efforts to promote its development lately, the instrument has been rarely used in Slovenia and should become a model of effective measure for energy efficient improvement.

In Slovenia the energy performance certification of the buildings has not started yet. The introduction of the certification is useful to achieve two important results: to foster demand and supply of increasingly efficient buildings, by providing consumers with independent and third-party reliable information and to encourage energy efficiency improvement interventions on already existing buildings, by giving assistance on energy certification and performance of buildings.

Moreover, there is a lack in national legislative in order to accelerate the efficient use of energy as the Regulation on energy accounting and monitoring of the target energy use in public facilities was not adopted yet.

Malta

The National Strategy for Policy and Abatement Measures Relating to the Reduction of Greenhouse Gas Emissions issued by the Ministry for Resources and Rural Affairs contains various actions which when implemented will eventually reduce the greenhouse gas emissions and improve our daily lives. But it is very important that all stakeholders in Malta are involved in order to ensure a comprehensive plan and in order to ensure the successful implementation of these policies / plans.

As can be seen the list of the energy efficiency legislation, particularly that in the residential sector is substantial which indicates the commitment which Malta has to ensure that the goal of 20% CO2 reduction and 10% of the total energy generated in Malta comes from renewable sources by 2020 is achieved. Moreover even the grants which started in the year 2006 and the frequency of which is increasing each year, have attracted many stakeholders and encouraged the public to invest more in the energy efficiency sector.

The introduction of the Minimum Requirement on the Energy Performance in Building Regulations in 2006 by means of the publication of the Technical Guidance Document F – Conservation of Fuel, Energy and Natural Resources and the Energy Performance Certification of Buildings Regulations in 2008 shall have a long term effect to reduce energy requirements of buildings.

Andalusia - Spain

Concluding remarks summarising main points are not available.

Alendejo - Portugal

Concluding remarks summarising main points are not available.

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Final Conclusion

The scope of MARIE project is to identify, test and conclude on the necessary measures to overcome the identified barriers. The following table summarises the initial proposal of demand – side measures and sub-measures for overcoming the most important barriers of the demand side (main structural and financial barriers and specific knowledge barrier) and the relevant pilot activities that will test and evaluate the proposed measures/ sub-measures. Each general measure refers to a broader area of necessary interventions whereas the sub-measures refer to more specific interventions which will be tested and evaluated by MARIE project.

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Table 47: Proposed measures/ sub-measures for the demand side to overcome identified barriers

Measure	Barriers	Sub-measure	Pilot Activity
LEGISLATION & REGULATIONS Adaptation of legal framework to facilitate Energy Renovation of Buildings	• Unclear, unstable and short-term oriented operational legislative framework for both offer and demand. • Poor integration of European, national, regional and local policies on EE and renewable energy supply, and of the related administrative bodies. • Gap between political objectives (3*20 especially) and operational regulations: level, delays, control. • Complexity of (1) regulations, (2) implementation and (3) enforcement and verification of compliance. • Complex administrative procedures for implementing energy efficiency refurbishments.	Innovation in Legislation: Energy Certification, project procedures, works management and monitoring impact	PA 1.1. Update, adapt, structure and innovate regional and local regulations and specifications in order to facilitate the EU Directive (2010/31/EU) and the energy renovation of buildings.
PLANNING Identification and use of urban planning model to organize and promote Energy Renovation of Buildings	• Lack of detailed information on the characteristics of the building stock at regional level.	Designing and determining information infrastructure to register the physical and energy data from buildings in urban areas	PA 1.2. Design and Implementation of Urban Plans for Energy Efficiency Improvement in existing buildings (building catalogue)
	• Renovation projects are usually conceived as renovation of individual buildings, while better solutions may arise at “neighbourhood" scale.	Designing and determining diagnostic and proposal tools for planning Energy	PA 1.2. Design and Implementation of Urban Plans for Energy Efficiency Improvement in existing

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Measure	Barriers	Sub-measure	Pilot Activity
		Renovation in Buildings at urban scale	buildings (diagnostic and proposal model)
FINANCIAL Design and implementation of new integrated financial schemes for Energy Renovation of Buildings	• Incapacity of conventional financial instruments to make energy efficiency renovations feasible and lack of new/ alternative financial models. • Requirement for large investments for energy efficiency refurbishment projects. • Lack of public investment and funding capacity. • Lack of private investment capacity. • Limited profit margin for ESCOs in small energy refurbishment projects.	Stimulating access to finance through private investment mechanisms at building scale	PA 2.1. Third Party Financing (TPF) mechanisms.
	• Incapacity of conventional financial instruments to make energy efficiency renovations feasible and lack of new/ alternative financial models. • Requirement for large investments for energy efficiency refurbishment projects. • Lack of public investment and funding capacity.	Developing regional investment plans for Energy Building Renovation based on Public-Private partnership mechanisms	PA 2.2. Public Private Partnership (PPP) mechanisms.

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Information sources are not available.

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Annex 0. Definitions

Number of dwellings: number of places of residence/ homes. Number of two-dwellings refers to number of dwellings located in two-dwelling buildings. Number of three or more dwellings refers to number of dwellings located in buildings with three or more dwellings. In case of tertiary sector, the equivalent of dwelling is the building unit.

Final energy consumption (Ktoe): energy supplied to the final consumer for all energy uses in thousand tonnes of oil equivalent.

Degree-day: a unit of measure used to estimate the fuel and power requirements in heating and cooling a building; it is equal to a difference of 1 degree between the outdoor daily average temperature (the mean of the maximum and minimum daily dry-bulb temperatures) and a reference temperature. Degree-days are an indicator of how far the average temperature departs from a human comfort level called the base.

Climate-corrected energy consumption: calculated by scaling the energy consumption to the average climate on the basis of a relative number of degree days (for comparison between years and countries/ regions).

Energy consumption per dwelling (toe/dw): Final energy consumption of households per permanently occupied dwellings in tonnes of oil equivalent per dwelling.

Energy consumption of tertiary per employee (toe/emp): Final energy consumption of services per employee in tonnes of oil equivalent per employee.

Electricity consumption of tertiary per employee (toe/emp): Electricity consumption of services per employee in tonnes of oil equivalent per employee (originally given in Kilowatt hour per employee but converted to tonnes of oil equivalent per employee for better comparison).

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