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COLEOPTER

European Regional Development Fund

TYPOLOGY OF RURAL CONTEXTS IN THE SUDOE AREA

CHARACTERISATION OF RURAL TERRITORIES IN THE SUDOE AREA

MARCH 2020

RURENER

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UPC UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH

Comunidade Intermunicipal do Ave

Ayuntamiento Cartagena

PÓVOA DE LANHOSO Município

EST-CREUSE développement

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COLEOPTER PROJECT

The COLEOPTER (*COncertation LocalE pour l'Optimisation des Politiques Territoriales pour l'Energie Rurale*) project develops an integrated approach to the energy efficiency of public buildings that links technical, social and economic challenges. COLEOPTER addresses two energy efficiency challenges in buildings: difficulties for rural municipalities to act and carry out work despite the positive local impact (i.e., energy savings and local employment) and a lack of awareness of building challenges, which leads to irrational use of energy and low renovation rates.

The COLEOPTER approach has three components:

1. Territorial dialogue with local actors to co-construct work plans of public buildings.
2. Use of Building Information Modelling (BIM) as a collaborative tool to support the dialogue.
3. Consideration of water efficiency issues along with energy challenges to better consider usage.

The approach will be tested on four public buildings, three to be renovated (in Póvoa do Lanhoso, Portugal; Cartagena, Spain; and Creuse, France) and one new building (in Creuse, France). It will be replicated in Escaldes-Engordany (Andorra) to validate its transferability.

The main contributions of the project, namely the COLEOPTER approach and the work conducted on the test sites, will benefit municipalities, citizens and small and medium-sized enterprises (SMEs), leading to better planning of energy efficiency policies and increased public and private renovation rates.

The COLEOPTER project (SOE3/P3/F0951) is financed by the Interreg Sudoe Programme that supports regional development in Southern Europe, financing transnational projects through the European Regional Development Fund. The Programme promotes transnational cooperation to solve common problems in Southern Europe, such as low investment in research and development, weak competitiveness of small and medium-sized enterprises and exposure to climate change and environmental risks.

Project leader	Céline Seince – contact@rurener.eu
Axis 3	Low-carbon economy
Objective 4C1	Improving energy efficiency policies and the use of renewable energy sources in public buildings and housing through the implementation of networks and joint experimentation
Total eligible cost	1 454 944.07 €
ERDF Grant	1 091 208.06 €
Duration	36 months (01/10/2019–30/09/2022)

Partners

RURENER
*Agência para a Energía (*ADENE)
*Asociación Empresarial Centro Tecnológico de la Energía y del Medio Ambiente de la Región de Murcia (*CETENMA)
Universitat Politècnica de Catalunya (UPC)
Comunidade intermunicipal do Ave
Ayuntamiento de Cartagena
Município da Póvoa de Lanhoso
Syndicat Mixte Ferme est Creuse

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1. INTRODUCTION

The COLEOPTER project examines four case studies in the following Sudoe eligible regions: two in Nouvelle-Aquitaine (France), one in Norte (Portugal) and one in Murcia (Spain). Additionally, the methodology will be replicated in Escaldes-Engordany (Andorra) to validate its transferability.

Figure 1 shows the buildings to be renovated in Póvoa do Lanhoso (Norte, Portugal), Tallante (Murcia, Spain), Chénérailles (Nouvelle-Aquitaine, France) and the new building in Chambon-sur-Voueize (Nouvelle-Aquitaine, France).

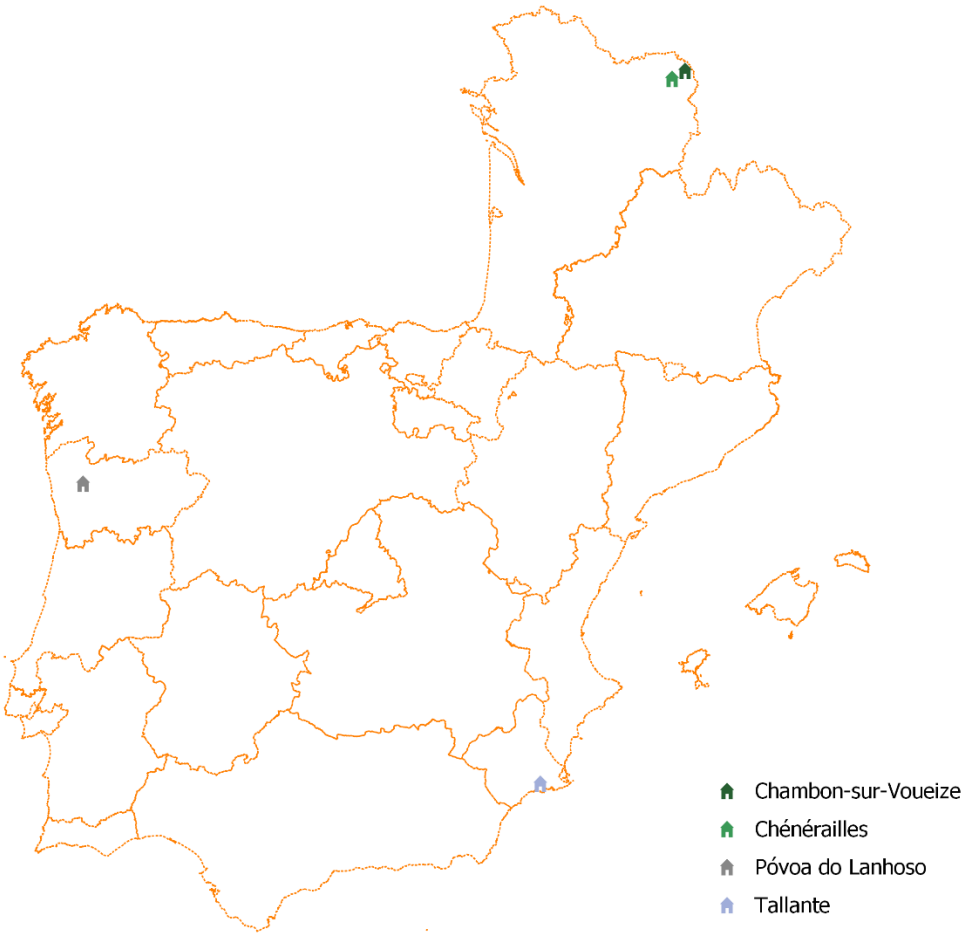

Figure 1. Location of case studies in the COLEOPTER project

This report contains a comparative analysis of the local contexts of the case studies. The diversity of the regions' contexts (territorial division, geography, climate and demographics) and resources (economy and energy system characteristics) are analysed in this report as the first step to design a solution for the project challenges. This characterisation will increase the transferability of the COLEOPTER approach, since it considers the diversity of rural territories in the Sudoe area.

The context of each case study is described in detail in the following sections.

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2. CASE STUDIES: TYPOLOGY AND CONTEXTS

2.1 PÓVOA DO LANHOSO (PORTUGAL)

Portugal is a transcontinental country in southwestern Europe. It is mainly on the Iberian Peninsula but also includes the autonomous archipelagos of the Azores and Madeira. The Portuguese territory is the westernmost in Europe, bordered by Spain to the north and east and by the Atlantic Ocean to the south and west. It is divided into the territorial units defined below.

The main administrative divisions of the Portuguese territory are the eighteen continental districts (*distritos* in Portuguese), and its two independent regions (Azores and Madeira). Each district is composed of various municipalities (*concelhos* in Portuguese), and each municipality is divided into parishes (*freguesias* in Portuguese) that are the basic level of the Portuguese local government. Today, Portugal has 308 municipalities and 4 260 parishes. In addition to this territorial division, in Portugal it is common to talk about regions and intermunicipal communities (*comunidade intermunicipal* in Portuguese) as these are territorial levels used for statistical purposes at European Union (EU) level (i.e., in Eurostat). Intermunicipal communities are territorial associations composed of several municipalities that are not necessarily contiguous and have their own management bodies, independent of the participating municipalities.

The COLEOPTER case study in Portugal is located in the parish of Póvoa do Lanhoso. It is in the northern region of continental Portugal, in Braga district and in the municipality that also bears the name Póvoa do Lanhoso. This municipality belongs to the Comunidade Intermunicipal do Ave (CIM do Ave). Figure 2 shows the location of the case study in the Portuguese territory.

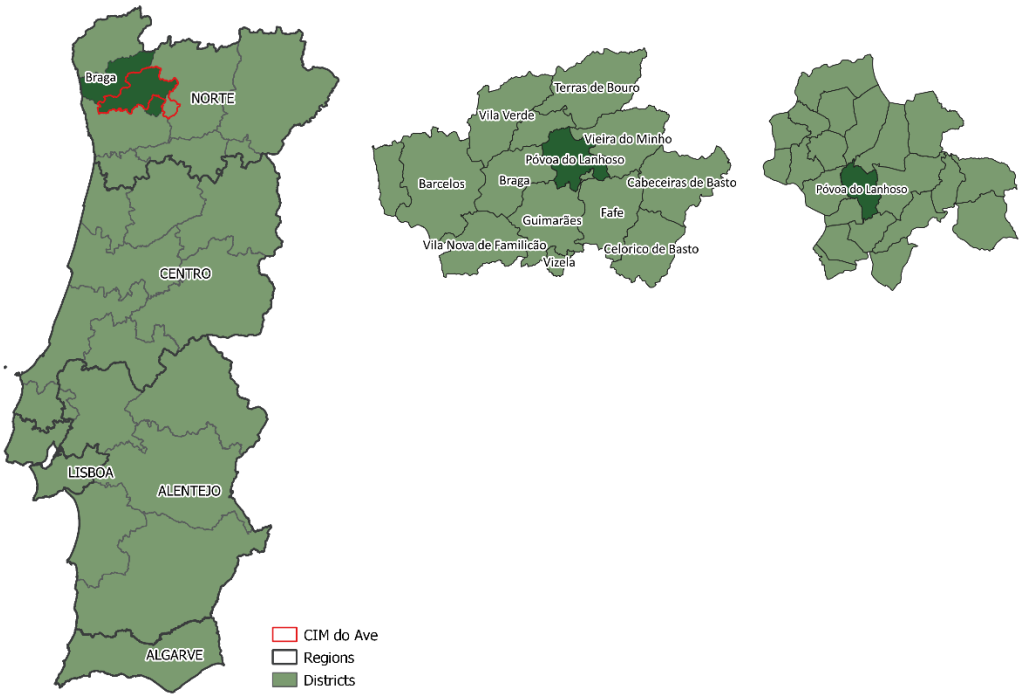

Figure 2. Location of the case study in the Portuguese territory

The main characteristics of Braga district, and particularly of Póvoa do Lanhoso, are addressed in the next sections.

2.1.1 Geography and climate

Located in the northwest of the Portuguese territory, Braga district covers an area of 2 708 km^2. Topographically, the district has quite rugged territory dominated by high altitudes in the east, close to the Spanish border and the limits of the Vila Real district, that drop down to the western coast. The relief is crossed by the valleys of several rivers that flow from east-northeast to west-southwest. The orography and settlement model have formed a diverse landscape throughout this territory. Southern municipalities (Guimarães, Vila Nova de Famalicão and Vizela) have a humanised rural landscape of dispersed settlement, in which the rural and urban are interconnected. This contrasts with the dominant landscape in the northern municipalities (Fafe, Póvoa de Lanhoso and Vieira do Minho) in which concentrated settlements predominate as well as an agricultural and forestry economy marked by the Cabreira, Gerês and Montelongo mountain ranges (see Figure 3). Braga district contains part of the only Portuguese national park, the Peneda-Geres National Park.

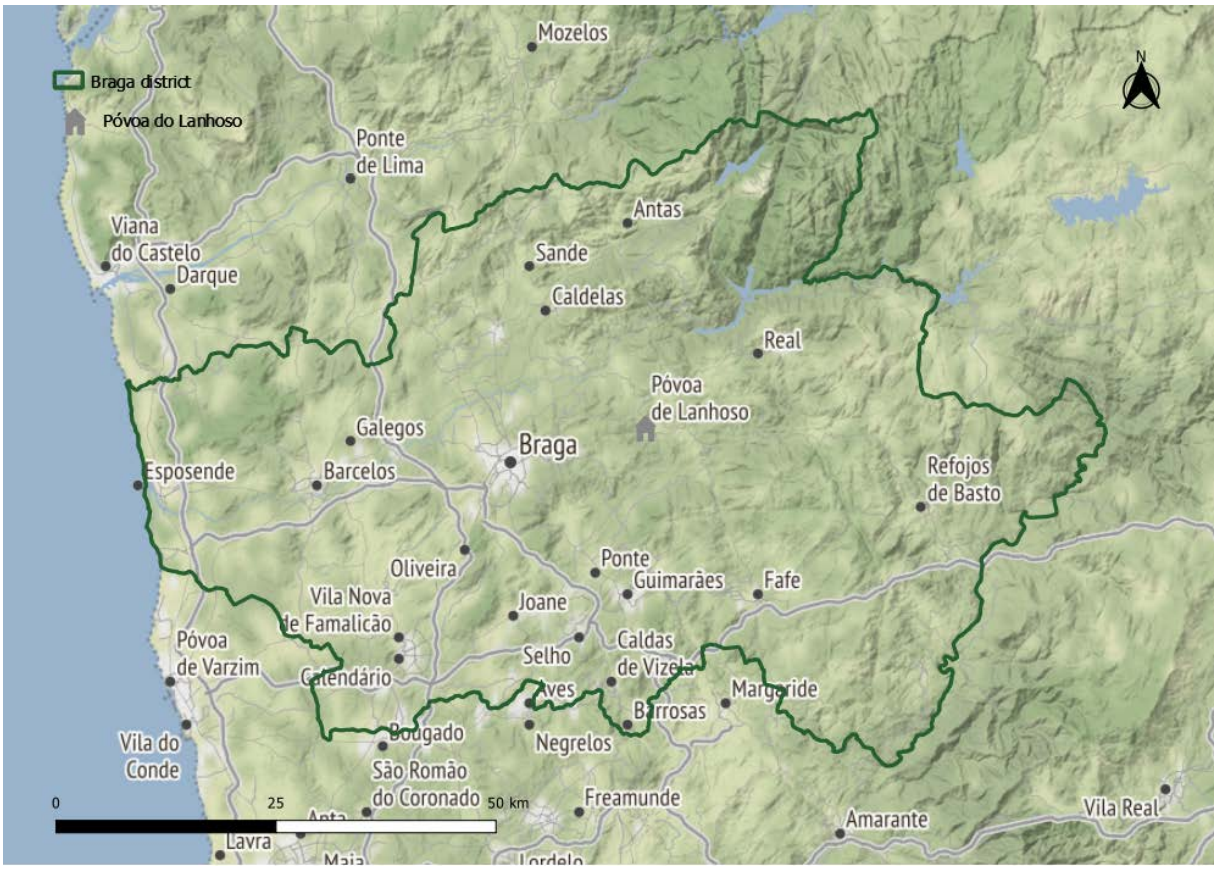

Figure 3. Topography of Braga district

Braga has an important water network that can be seen in the high number of reservoirs evenly distributed throughout the territory, including the Ermal and Andorinhas reservoirs. This territory extends through the river Cávado basins on the border with the municipalities of Póvoa de Lanhoso and Vieira do Minho, and the river Ave that crosses the remaining municipalities. The Cávado river basin is the most important feature related to the hydrographic network, crossing the district completely and dividing its mountains into two areas.

Braga is a district with Mediterranean climate characteristics but a strong Atlantic influence. As a result of its proximity to the Atlantic Ocean and the shape and layout of the main mountain ranges, its climate has mild temperatures, small thermal ranges and strong average rainfall. The average annual

temperature is around 14ºC and the annual temperature range is 12ºC. The most striking climatic characteristic of the Portuguese northwest is unquestionably the high rainfall, with annual average precipitation values exceeding 1 400 mm due to the frequent passage of frontal systems combined with the effect of the mountains, which are very close to the coast. Precipitation is highly irregular, as topography and distance from the sea strongly influence precipitation levels. In fact, the average values for precipitations range from 1 400 mm to about 3 000 mm annually depending on the municipality, with very abundant rainfall during winter months and almost non-existent rainfall during July and August. Considering the meteorological information collected at the Braga-Porto Agrário climate station for the period 1951 to 1980, the annual amount of precipitation exceeds 1 500 mm, with 130.4 days of precipitation.

2.1.2 Demographics

With a population of 828 650 inhabitants in 2018 (Pordata, 2020c), Braga is the third most populated district in Portugal after Lisbon and Porto, with 23% of the northern region's population. The population is distributed unevenly in the district for natural and economic reasons linked to work opportunities. There is a clear difference between the more rural inland municipalities (Terras do Bouro, Vieira do Minho, Celorico de Basto and Póvoa do Lanhoso), which have declining population dynamics, and the more urban municipalities (Barcelos, Braga, Guimarães and Vila Nova de Famalicão). Vila Nova de Famalicão has a total population of 582 980 inhabitants, which is approximately 70% of the district's resident population.

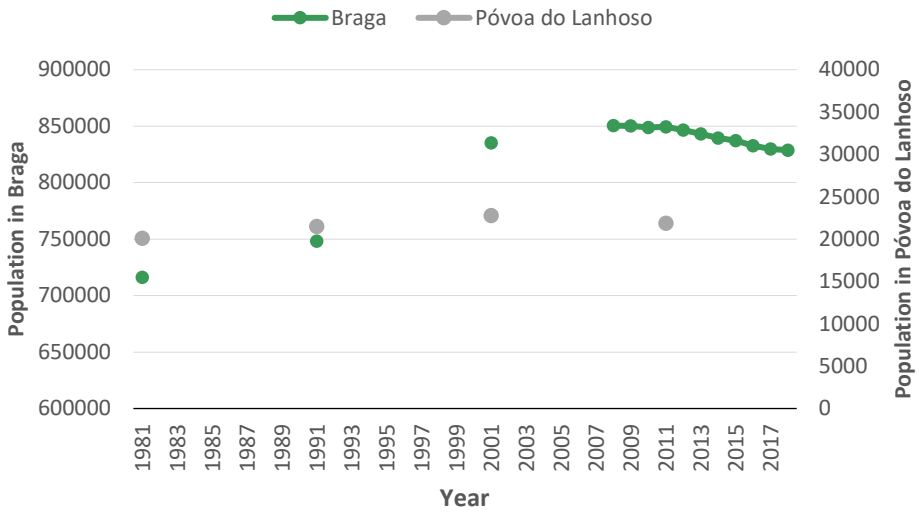

Figure 4. Demographic evolution in Braga district. Source: Pordata (2020b)

Figure 4 shows a constant increase of population in Braga in the period 1981–2008, followed by a slowdown and decrease until 2018. Although Braga district has a negative migration and natural balance and lost 1 246 inhabitants in 2018, this is not the case for all municipalities in the district. In fact, the more urban regions have a positive migration and natural balance (i.e., Braga municipality), in contrast to the more rural inland areas, where the balance is negative. Emigration is still a marked phenomenon in Braga district, although on a much smaller scale than in the 1960s and 1970s (Amorim, 2005). In more rural parishes, there is a strong trend towards emigration and rural exodus, which leads to population ageing. The main reasons for moving to urban or peri-urban centres are absence or insufficiency of employment opportunities and restricted access to certain goods and services.

With an ageing index[1] of 1.13, the lowest in Portugal, the northern region of the country has the highest percentage of young people and the lowest percentage of elderly people. Taking up the problem of the rural-urban dichotomy in the district territory, in the more rural municipalities there is a higher proportion of the age group "65 and over" and lower numbers of the working age group (see Figure 5). Although population ageing is now a feature of Portuguese demography, it is most pronounced in what are known as "receding" areas (i.e., the countryside, especially the areas furthest from urban centres).

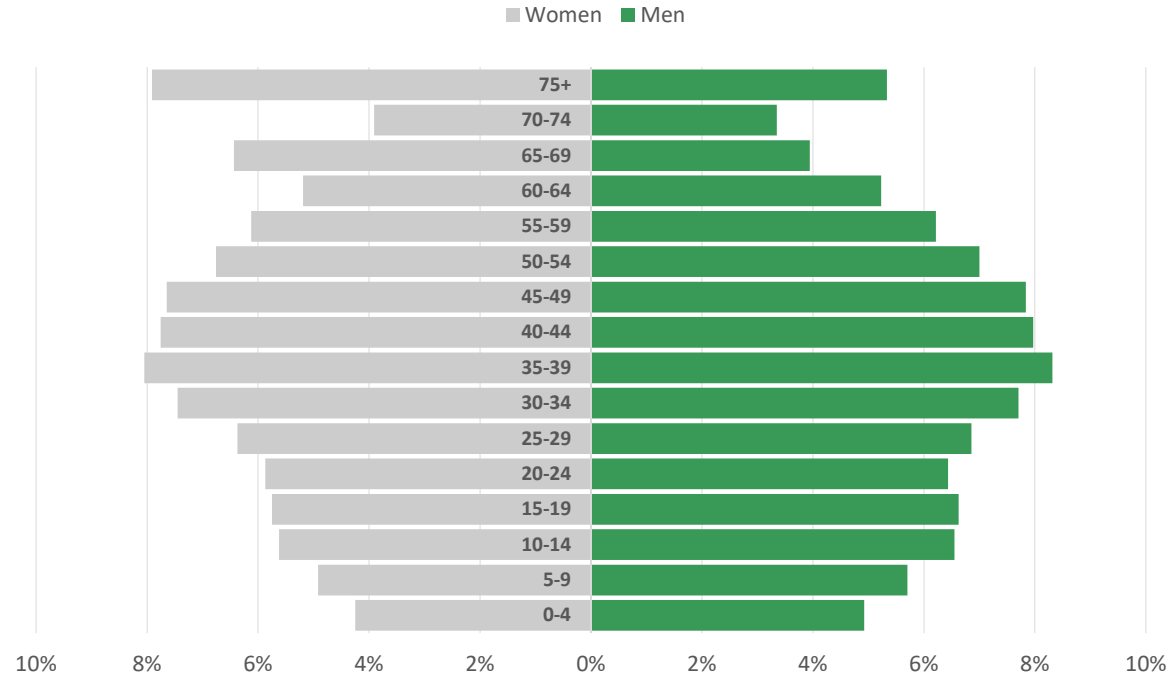

Figure 5. Population pyramid in Braga district in 2011. Source: Pordata (2020b)

2.1.3 Economy

Historically, the economy of Braga district, particularly inland municipalities like Póvoa do Lanhoso, was based on the primary sector. However, the most recent data from the Instituto Nacional de Estatística (Pordata, 2020b) show that this is not the case today. Figure 6 indicates that the sector with the highest number of employees in Braga district is the tertiary sector with 53% of the total, followed by the secondary sector (45% of employees), which includes extractive and processing industries. This value is considerably higher than the figure of 36% for the northern region, and even higher than the national value of 27%. Finally, the primary sector accounts for only 2% of employees.

[1] Ratio of the population aged 65 or over to the population under 15.

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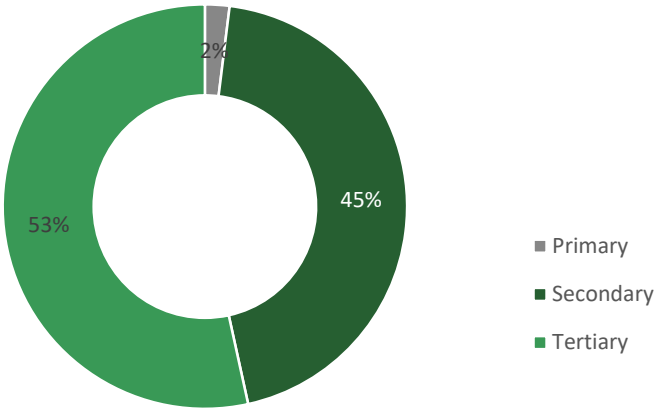

Figure 6. Employees by sector of activity in Braga in 2011. Source:

An analysis of changes in the number of companies and the staff employed in the municipality of Póvoa de Lanhoso shows that the secondary sector (extractive and manufacturing industries) has the largest percentage of employees (51.8%) followed by construction (23.4%) and the tertiary sector, including commerce, accommodation and catering (16.8%). Figure 7 shows one of the textile factories in Vale do Ave.

Figure 7. Interior of one of the textile factories in Vale do Ave. Source: Ehsan Namavar/freeimages.com

Unemployment is one of the main problems in the district and has increased in recent years, particularly in the industrial sector. On the date of the census (2011), the unemployment rate in CIM do Ave (14.6%) was virtually identical to the average for the northern region (14.5%) and about one and a half percentage points higher than the national average (13.2%). Póvoa de Lanhoso avoided this pattern and had the lowest unemployment rate in CIM do Ave (13.2%). Long-term unemployment predominates. In 2011, most of the registered unemployed people had been in this situation for less than 1 year (57.6%). However, this trend began to change in 2012 with high growth in the number of long-term unemployed. Long-term unemployed represented 54% of the total in 2013 (IEFP, 2020).

2.1.4 Energy system characteristics

In 2017, the final energy use in Portugal was 15 613 ktep, 1.5% more than in 2016 (Observatório da energia et al., 2019). Figure 8 shows that the main energy consumer is the transportation sector (37.2%) closely followed by the industrial sector (31.3%). At considerably lower percentages, the residential and service sectors account for 16.4% and 12.2% respectively. Finally, the agricultural sector consumes a 2.9% share.

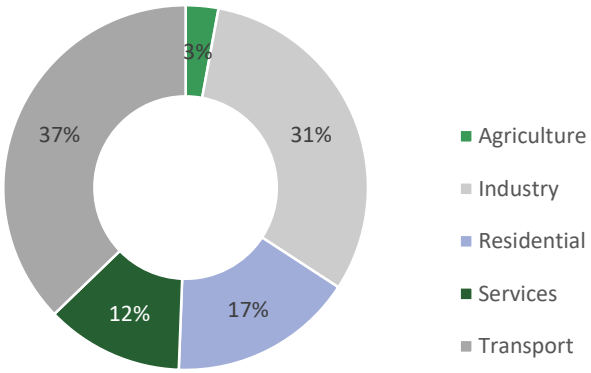

Figure 8. Final energy use by sector in Portugal in 2017. Source: Observatório da Energia et al. (2019)

Figure 9 shows that energy in Portugal is mainly supplied by fossil fuels, in the form of petroleum products and natural gas (60%) and electricity (26%). The remainder is supplied by heat (7%) and renewables (7%).

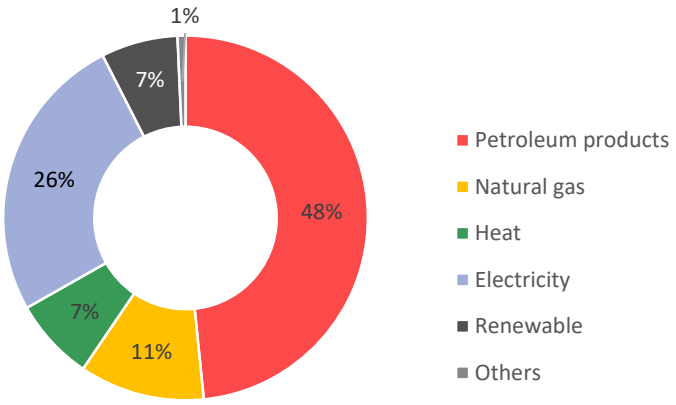

Figure 9. Final energy use by fuel in Portugal in 2017. Source: Observatório da Energia et al. (2019)

According to Pordata (2020a), the northern region of Portugal is the region with the highest electricity consumption (39%) and the second highest natural gas consumption (29.4%). Braga district accounts for 23% of the electricity and 17% of the natural gas consumed in the north region. The highest percentages of electricity and gas consumption are found in the more urban municipalities of Braga district (Guimaraes, Vila Nova de Famalicao, Barcelos and Braga).

The percentage of electricity production in thermal power plants in the last ten years ranged from 44% to 71% of the total (Figure 10 presents 2017 values). This variation is strongly influenced by the

availability of hydroelectricity. In 2016 and 2017, electricity production was higher than national consumption and the balance of electricity imports was reversed.

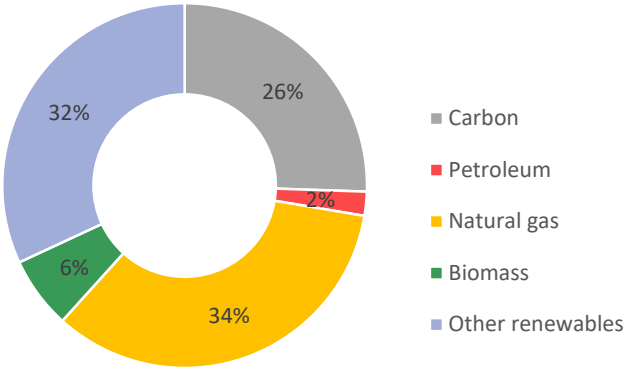

Figure 10. Electricity generation in Portugal in 2017. Source: Observatório da Energia et al. (2019)

Heat production from cogeneration uses biomass as the main form of primary energy, which contributes around 60%. In recent years, less than 6% of cogeneration energy has come from oil, partly because oil has been replaced by natural gas, which contributes around 34%.

In 2017, the main endogenous source of local energy production in Portugal was biomass, which amounted to 54% of the total production. Electricity was the second endogenous source at 35%. In recent years, biofuels have accounted for about 6% of local production. Electricity production is mostly from hydro and wind, which constitute about 95% of the total. The production of solar electricity has been increasing significantly and represented about 5% of the total in 2017.

Portugal has been moving towards increasing levels of incorporation of renewable sources in several sectors. It has reached a total share above the European average that has continued to increase in recent years (+8.9 percentage points [pp] compared to 2005). Portugal's development is also relevant in the electricity sector. Currently, it is the EU country with the third highest level of incorporation of renewables (+26.8 pp compared to 2005). As a result of this evolution, Portugal has managed to reduce its energy dependence from abroad (-9.1 pp compared to 2005), increase domestic energy production and reduce primary energy consumption (-17% compared to 2005), thus also ensuring higher security of supply.

Portugal has a prominent position internationally in the areas of greenhouse gas (GHG) emission reduction and investment in renewable energy sources. It has achieved very positive results in recent years. In 2017, GHG emissions dropped 17.5% compared to records for 2005. In 2016, Portugal committed to the goal of achieving carbon neutrality by 2050 at the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC). It has developed a Roadmap for Carbon Neutrality 2050 (RNC2050) that establishes the vision, trajectories and guidelines for policies and measures to be implemented in this time horizon. The RNC2050, published in the Resolution of the Council of Ministers No. 107/2019, is the long-term development strategy with low GHG emissions submitted to UNFCCC on 20 September 2019.

2.2 TALLANTE (SPAIN)

Spain is a transcontinental country in southwestern Europe. It occupies almost the entire Iberian Peninsula and two coastal cities in the north of Africa. The Spanish territory is divided into numerous territorial units, as defined below.

Spain is formally a unitary country that functions as a decentralised federation comprised of autonomous communities (*Comunidad autónoma* in Spanish) with varying levels of self-government. Currently, Spain has seventeen autonomous communities and two autonomous cities: Ceuta and Melilla. Each autonomous community is composed of provinces (*província* in Spanish), except for the seven single-province autonomous communities. Each province is comprised of regions (*comarca* in Spanish), which are divided into municipalities (*municipios* in Spanish); the basic level of Spanish local government. In 2020, Spain has 50 provinces and 8 131 municipalities. In some autonomous communities such as the Región de Murcia, municipalities are divided into councils (*diputaciones* in Spanish). These are organised into various localities and scattered villages administered under the figure of the *Diputación*. They are governed by neighbourhood councils (*Juntas Vecinales* in Spanish), which are forums for deciding on municipal actions in the area of influence (Wikipedia, 2019).

Figure 11 shows the location of Tallante village, the Spanish case study in the COLEOPTER project. Tallante is in the autonomous single-province community of the Región de Murcia, in Cartagena municipality at the northwest of the Campo de Cartagena-Mar Menor region.[2] Tallante is part of the council of Campo Nubla.

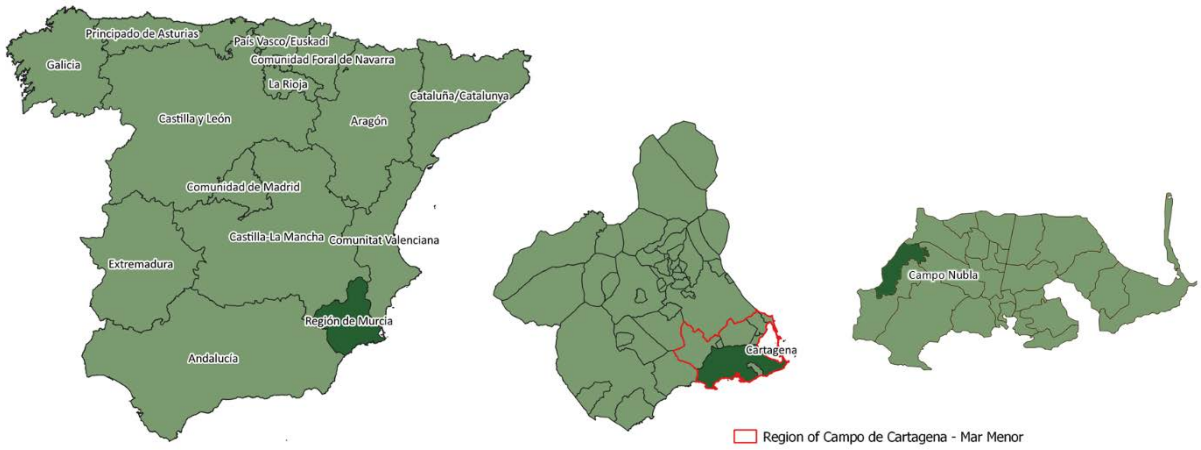

Figure 11. Location of the case study in the Spanish territory

The main characteristics of Cartagena municipality, and particularly of the Campo Nubla council are addressed in the next sections.

2.2.1 Geography and climate

Located in the southeast of the Iberian Peninsula, Cartagena municipality covers an area of 558.08 km^2. Topographically, the territory of this municipality constitutes a sloping plain from northwest to southeast, bounded on the north by the Rambla de El Albujón, on the south and east by the Mediterranean Sea and on the west by Cabezos del Pericón and the Sierra de los Victorias (see Figure

[2] Territorial division proposed by the *Atlas Global de la Región de Murcia (*https://www.atlasdemurcia.com/)

12). Several sectors with completely different characteristics can be identified in the relief of this municipality: the plain, the coastal mountains, and the area around the Mar Menor.

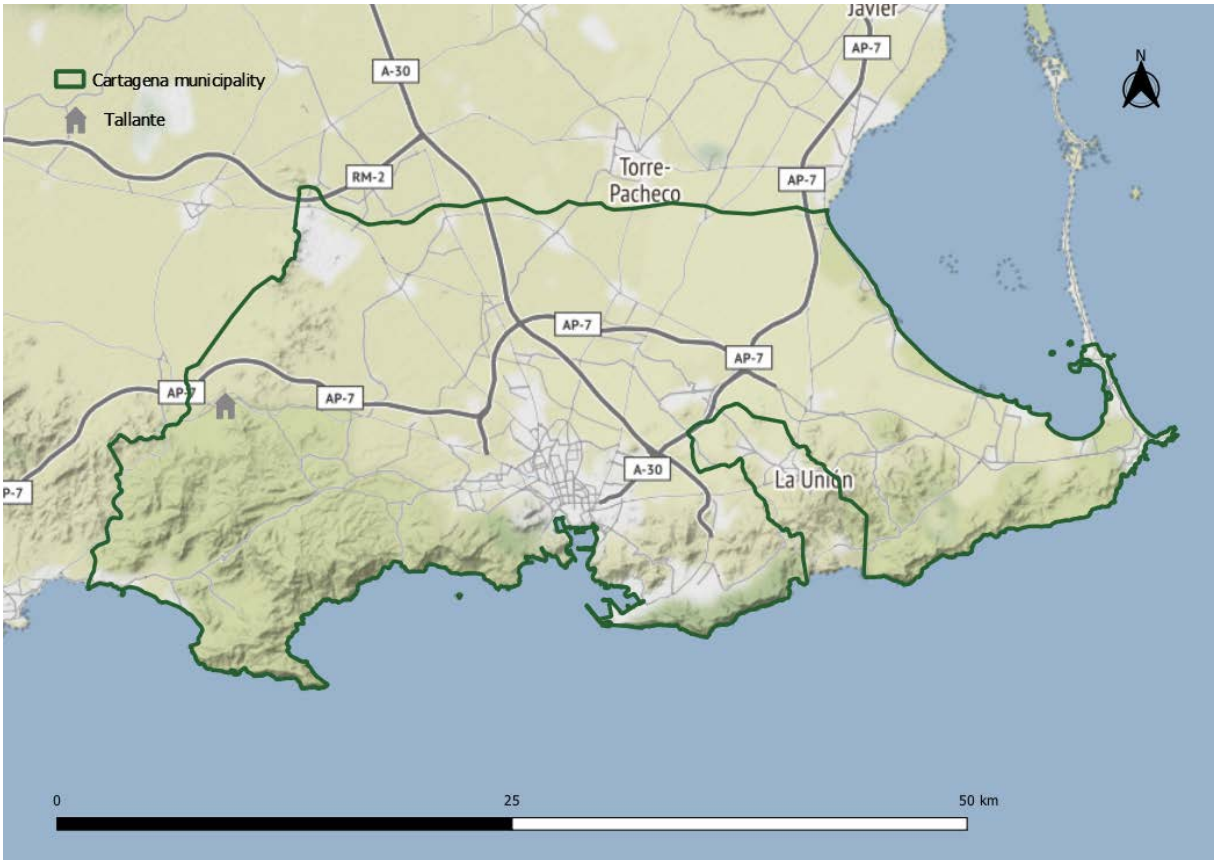

Figure 12. Topography of Cartagena municipality

At the western edge of this municipality, bordering the municipality of Fuente Álamo, the council of Campo Nubla is in the lowland area of Cartagena. This council has irregular topography and volcanic orography. Indeed, the landscape is dominated by small hills and geographical features that reach less than 400 m.a.s.l, such as the Cabezo Negro, the Rambla del Cañar or the Panadera. The variety of landscapes is notable, with a strong presence of Mediterranean flora, as well as dry farming of crops such as almond, olive, carob and fig (see Figure 13). The typical tree species of Campo Nubla are conifers such as cypress and pine, although there are other less abundant species including elm or oleander, which appear mainly at the edges of dry river courses or near aquifers.

Figure 13. Campo Nubla landscape. Source: Emilio.F.F

Surface water is scarce in the region due to the low elevation, the extreme aridity of its climate and the absence of surface water courses. The water network is limited to a few water courses that are continuously dry, except during the few rainy days. Until the construction of the Tajo-Segura water transfer, the main source of water was underground. In fact, the water transfer has profoundly transformed the municipality's agricultural possibilities. It has helped to alleviate water scarcity in the entire municipality and prevent overexploitation of aquifers.

The climate is dry Mediterranean with warm winters and very dry summers. The municipality's proximity to the sea reduces the average annual temperature to around 20ºC (Atlas Global de la Región de Múrcia, 2020). The wind is one of the main climatic factors in Cartagena municipality. The predominant wind directions throughout the year are those of the first quadrant, in a northeast direction, and those of the third quadrant, in a southwest direction. In addition, the barrier effect of the municipality's coastal ranges and the wind channelled in the bay that constitutes Cartagena and the coastal saltwater lagoon Mar Menor favour changes in wind direction to the southwest.

Cartagena is one of the least rainy areas of the Iberian Peninsula. Rainfall does not exceed 300 mm per year over much of the territory. The average rainfall gradually increases towards the east, to reach 332 mm per year in the Mar Menor area and a maximum of 364 mm per year in Cabo de Palos, which is part of the foothills of the Béticas range.

2.2.2 Demographics

Cartagena municipality has an irregular population distribution. There is a clear difference between rural or industrial areas (Escombreras, Los Médicos and Campo Nubla), which have a low population density, and the more urban areas (Cartagena, San Antonio Abad and El Plan) whose total population is 137 753 inhabitants; 64.4% of the total resident population of the municipality.

The municipality of Cartagena has a natural and positive migratory balance. Records for 2018 show 150 more births than deaths and 582 more inhabitants. An important aspect of this municipality is its significant immigration. The highest percentage of the foreign population is located in the most rural councils of the municipality, such as Campo Nubla or Llentiscar, which house over 30% of the foreign population. Figure 14 illustrates that the increase in resident population at municipal scale is not in line with that at council scale (Campo Nubla).

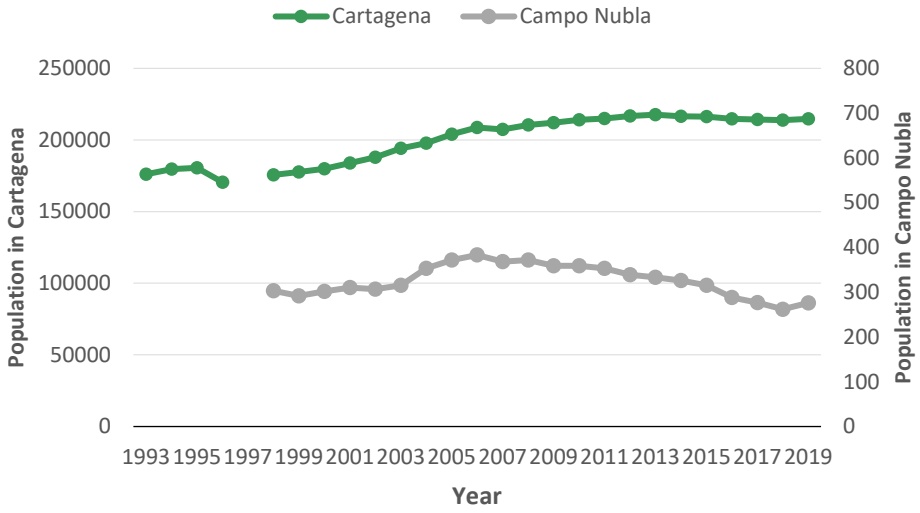

Figure 14. Demographic evolution in Cartagena municipality and Campo Nubla council. Source: Ayuntamiento de Cartagena (2020) and CREM (2020)

With an ageing index[3] of 0.89, which is considerably lower than the Spanish national index of 1.2, the population of Cartagena municipality has one of the lowest indices of Spanish municipalities[4] (INE, 2020). Figure 15 shows the age distribution of the population in Cartagena in 2019.

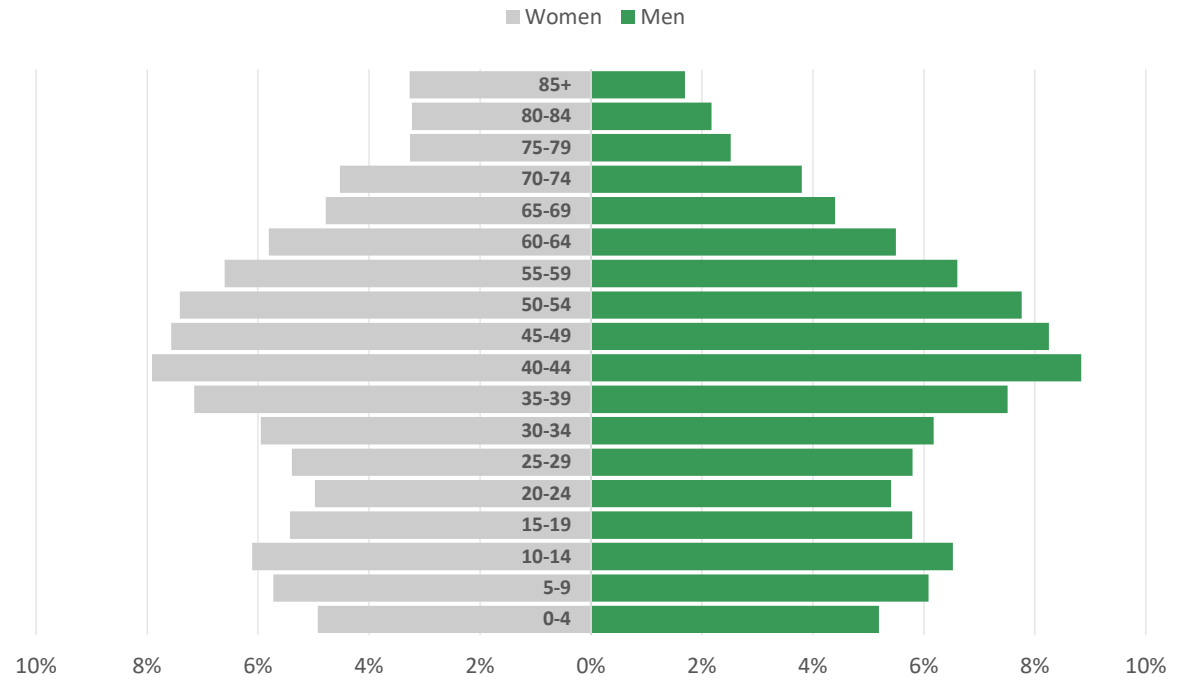

Figure 15. Population pyramid of Cartagena municipality in 2019. Source: CREM (2020)

As with the population distribution, the aging factor differs significantly among councils in the municipality with values ranging from 0.42 to 5.82 (CREM, 2020). Campo Nubla council, where the case

[3] Ratio of the population aged 65 or over to the population under 15

[4] Considering municipalities with more than 50 000 inhabitants

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study is located, stands out. Children aged under fifteen represent 6.23%, the lowest percentage in the municipality, and those over sixty-five represent 33.3%, the highest percentage in the municipality. Therefore, this council is the most aged in the entire municipality.

2.2.3 Economy

The economic activity of the municipality of Cartagena varies widely throughout the territory. Industry and maritime trade are located in the south of the municipality, mainly in the city of Cartagena, while tourism is concentrated around the Mar Menor and agriculture extends to the northern area. According to the latest data of the Regional Centre for Statistics in Murcia (CREM, 2020), the activities with the highest number of establishments in the municipality are services and commerce, at 55.6% and 29%, respectively. These activities are strongly linked to the tourism sector and are mainly concentrated near the city of Cartagena in areas such as San Antonio Abad or El Plan and urban areas of the Mar Menor. The construction sector, which is closely linked to significant urbanisation due to tourism development, represents 9.7% of the establishments in the municipality followed by the industrial and energy sector at 4.9% and the agricultural sector at only 0.7%. [5]

Although tourism is most important around the Mar Menor, regional tourism has contributed to the transformation of the economic, social and territorial situation in Cartagena. On the western shore of the Mar Menor, holidaymakers have traditionally occupied coastal towns such as Los Alcázares. In 1963, La Manga del Mar Menor started operation with a view to attracting international tourism with a high number of hotels and apartment blocks and capacity to accommodate over 100 000 tourists. It is now one of the main tourist complexes in Spain (see Figure 16).

Figure 16. Tourist complexes in La Manga del Mar Menor (Cartagena)

The peacefulness and beauty of the rural environment has also encouraged tourism as an economic resource in inland areas of the municipality. Many foreigners have established themselves in towns in municipalities such as Campo Nubla, which has added a tourist value to rural residences in the area. In recent years, the tertiary sector has developed considerably, mainly in association with tourism.

In close connection with the traditional mining activity in the region during 1830 and 1919, in 1949 Cartagena municipality became more industrialised with the creation of the Escombreras refinery. The

[5] This ratio refers to establishments, not the number of employees.

industry, which underwent a major process of industrial restructuring in the 1980s, began to take off again at the end of the 1990s with the installation of new industries in the Escombreras valley and in the Fuente Álamo technology park.

The arrival in the 1980s of water from the Tagus-Segura transfer transformed a considerable part of dry farming into irrigation. Water from the Tagus-Segura transfer combined with the mild climate and the productive, technological and business transformations turned the agriculture of the Campo de Cartagena into one of the most productive and profitable in Europe. Agricultural products from Campo de Cartagena are exported all over the world, especially to European Union countries (Wikipedia, 2020a).

2.2.4 Energy system characteristics

The availability of data on total energy use at province scale is limited. Figure 17 presents the final energy use by fuel in the city of Cartagena compiled in the context of the Covenant of Mayors for Climate & Energy (Ayuntamiento de Cartagena, 2017).

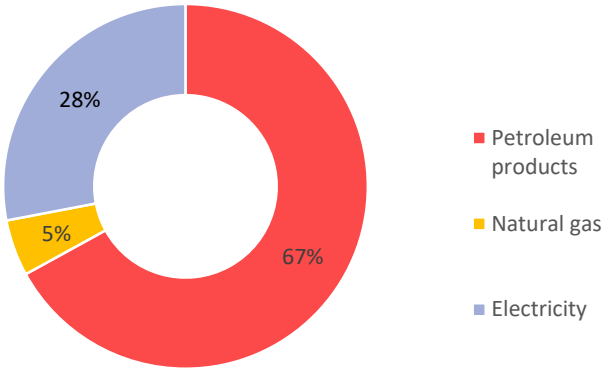

Figure 17. Final energy use by fuel in the city of Cartagena in 2017. Source: Ayuntamiento de Cartagena (2017)

The Autonomous Community of the Región de Murcia produced 52% of the electricity demand in 2016 (CREM, 2020). Electricity in the province has traditionally been generated in the thermal power plants of Puerto de Escombreras in Cartagena municipality.

As shown in Figure 18, the tertiary, residential and industry sectors are the main consumers of electricity in the Región de Murcia with 29%, 27% and 24% of the total electricity use, respectively (CREM, 2020).

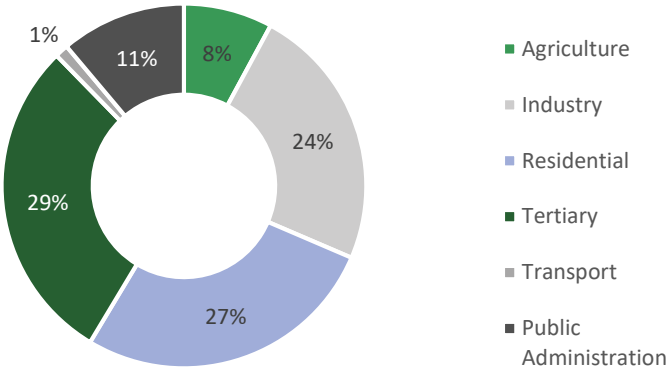

Figure 18. Electricity use by sector in the Región de Murcia in 2016. Source: CREM (2020)

In recent years, the increase in electricity production has been enriched by the contribution of renewable energies and cogeneration plants. The first combined heat and power (CHP) plants started up in the early 1990s and use fuels derived from oil, while those opened in recent years operate with natural gas.

Figure 19 shows that solar energy contributes to 19% of the electricity generation, with a combination of solar PV and thermal solar energy. Other renewables such as wind, hydropower and thermal power contribute to 14% of the electricity generation in the province.

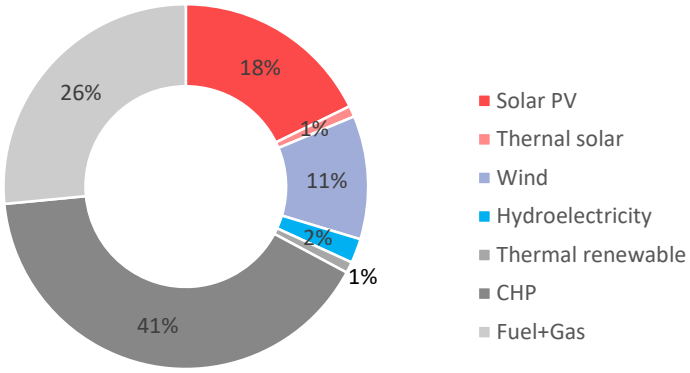

Figure 19. Electricity generation in the Región de Murcia in 2016. Source: CREM (2020)

Nationally, the contribution of renewable energy sources to total gross electricity generation in Spain in 2016 was 38.1%, of which wind generation produced 46.7% and hydroelectric sources 34.6% (81.3% altogether). Electricity generation from other sources in 2016 came from nuclear (21.3%), natural gas (19.2%), coal (13.6%), oil products (6.2%) and other technologies (1.6%) (UNFCC, 2018).

Renewable energy is promoted in Spain through the Renewable Energy Action Plan 2011–2020, which is a package of over 80 sectoral and cross-sectoral measures, designed to achieve a share of 20 per cent of renewable energy sources in the gross energy consumed in the country by 2020, including renewable energy use for electricity generation, transport, heating and cooling. The measures in the plan cover the promotion of wind, solar and hydroelectric generation.

Energy efficiency is promoted in Spain through the National Energy Efficiency Action Plan 2014–2020, which was updated in 2017 to the National Energy Efficiency Action Plan 2017–2020. Measures include the efficient vehicle incentive and efficient driving programmes, and the energy efficiency programme for small and medium-sized industries. The plan established a national objective for primary energy consumption of 122.6 Mtoe by 2020, which represents a 24.7% reduction in comparison with the baseline scenario. The target for the plan is a cumulative reduction in energy consumption by 15 979 ktoe in the period 2014–2020.

2.3 CHAMBON-SUR-VOUEIZE AND CHÉNÉRAILLES (FRANCE)

France is a transcontinental country in Western Europe that has several overseas regions, making it the largest country in the European Union. The French territory is composed of eighteen regions (*régions* in French) of which thirteen are in mainland France (including the island of Corsica), and the remaining five in overseas France. Although regions are the main division of the country, they do not have legislative or executive autonomy. They receive a consistent share of national taxes that they can distribute according to their needs (Wikipedia, 2020b).

Except overseas, all regions are made up of at least two departments (*départements* in French). Departments are the main territorial entities into which France is administratively divided. There are 101 departments in total, five of which are in overseas France. The departments are also divided into arrondissements (*arrondissements* in French), which in turn are divided into cantons (*canton* in French). The arrondissements are smaller divisions headed by a subprefect to support the prefects. Since the 2014 reform, cantons have been electoral districts, to allow the election of departmental councillors. Today, France has 329 arrondissements and 3 879 cantons.

Finally, the smallest divisions are the communes (*commune* in French) which are headed by a mayor. In addition to this territorial division, it is common to use the term intercommunities (*intercommunalités* in French) to refer to groupings of communes into legal organisations to exercise shared powers, mainly in fiscal or economic areas, and to promote public works and cooperation.

Two of the four case studies of the COLEOPTER project are in French territory, specifically in the communes of Chénérailles and Chambon-sur-Voueize. Both are in the region of Nouvelle-Aquitaine, in the department of Creuse and the arrondissement of Aubusson. Despite being two very close towns, they are in different communes. Chénérailles is in the intercommunity of Marche et Combraille en Aquitaine and Chambon-sur-Voueize is in the intercommunity of Creuse Confluence. Both intercommunities delegated their energy competence to the Syndicat mixte Est Creuse (former Pays de Combraille en Marche). Figure 20 shows the location of the two case studies in the French territory.

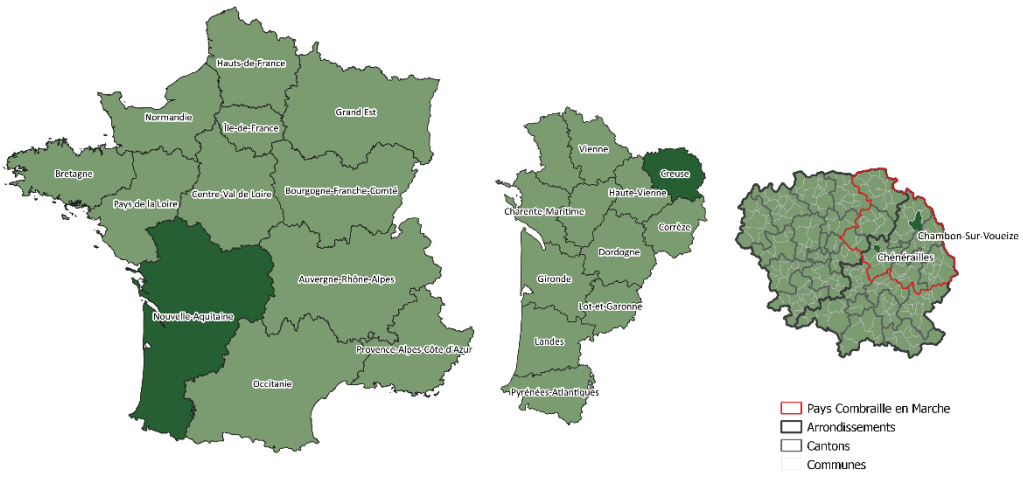

Figure 20. Location of case studies in the French territory

Despite being two separate study areas, in this report they are described in the same chapter due to their proximity. The main characteristics of La Creuse department, and specifically of Chénérailles and Chambon-sur-Voueize communes, are addressed in the next sections. The main information is based on the report *La Creuse à grands traits* (Mallemanche, 2016).

2.3.1 Geography and climate

Located in the northwest end of the Massif Central, the department of La Creuse covers 5 565 km^2 (see Figure 21). Topographically, the territory of La Creuse forms an inclined plane which rises gradually from the west and north, near the plains to the south of the Indre and Allier departments, to the Millevaches plateau in the southeast of the department. The altitude above sea level increases from north to south, reaching a maximum of 932 metres in the Chateauvert forest.

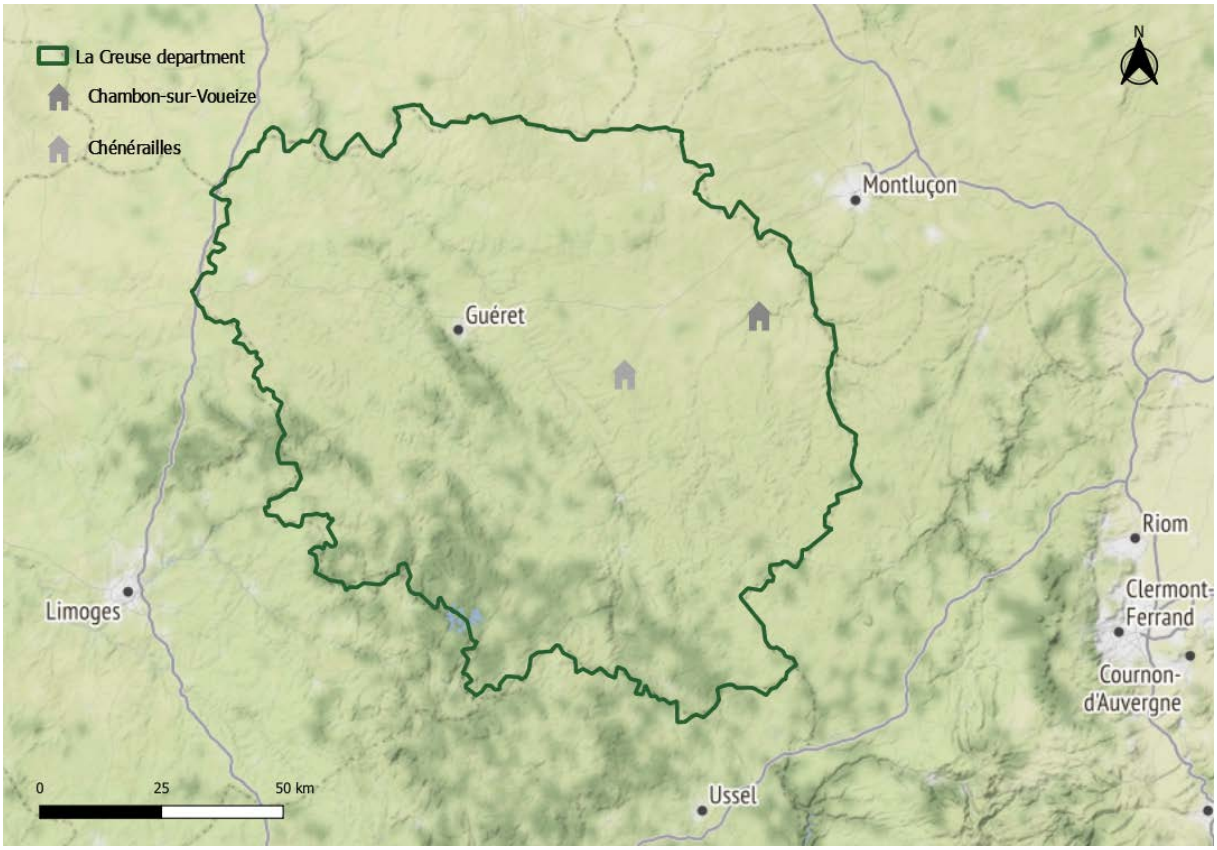

Figure 21. Topography of La Creuse department

The department of La Creuse has approximately 160 000 ha of forest, covering almost 30% of its area and mainly occupying the southern and eastern parts of the territory. The forest massif constitutes a very important ecological resource for the department and its exploitation allows economic development in the region, especially relating to wood use. Figure 22 shows a representative sample of the La Creuse landscape.

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Figure 22. Aerial view of La Creuse landscape. Source: Reflectim [6]

The department's relief is guided by water, in the form of rivers or lakes such as the National Natural Reserve of the Etang de Landes. The hydrographic network is directly linked to the Loire basin. The Creuse, Thaurion and Gartempe rivers stand out, as well as the Vassivière lake, located in the southwest of the department. The latter is the largest water body in Limousin covering a total of 1 000 ha.

The climate is Atlantic with the same general characteristics as the climate of the Massif Central: humid, cold and very variable. Summers are short, unlike winters, which are generally long and harsh, especially in the south of the department where snow is abundant and often persists for several weeks of the year. In contrast, the climate in the north of the department is milder. Overall, the northern region has mild temperatures and lower rainfall. The central region has very variable temperatures and rainfall fluctuates significantly according to altitude and exposure. The southern region is the most continental area with high rainfall, at over 1 000 mm, lower temperatures than the rest of the department and more intense snowfall. The dominant winds are from the southwest, and generally loaded with rain. On average, in the department of La Creuse it rains about 1 000 mm per year in the southern part of the department, and about 600 mm in the northern part.

2.3.2 Demographics

In the department of La Creuse, the population peaked at 287 000 inhabitants in the mid-nineteenth century. Demographic decline, which began with a massive rural exodus, has continued since then. Today, La Creuse has approximately 120 000 inhabitants and is the second least populated department in France after Lozère, with only 2% of the population of the Nouvelle-Aquitaine region. The population density is less than 22 inhabitants per km^2, three times less than the average for the region which is 77 inhabitants per km^2.

La Creuse is registering a decrease of 650 inhabitants per year or a 0.5% annual population contraction (see Figure 23). This is the most unfavourable demographic development in the Nouvelle-Aquitaine region.

[6] http://reflectim.fr/la-creuse/

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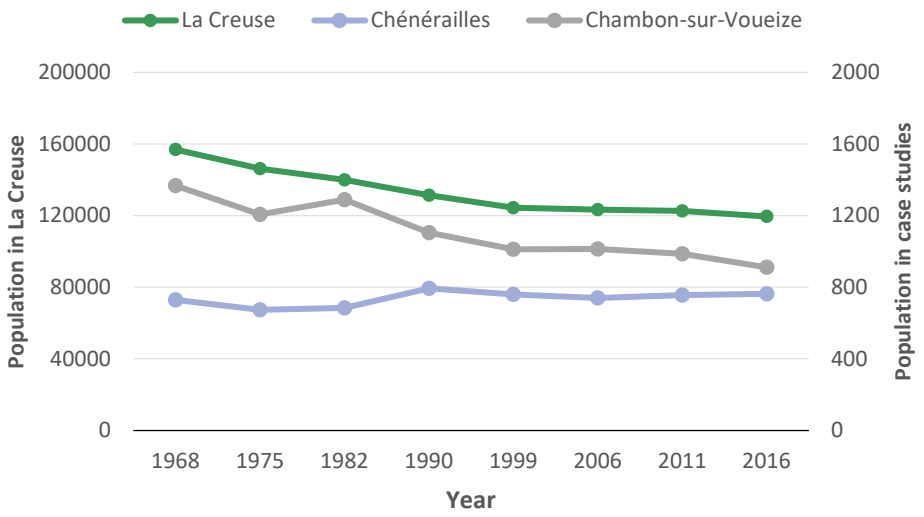

Figure 23. Demographic evolution in La Creuse department and case study communes. Source: Insee (2020)

The demographic development of the department has had a negative natural balance[7] and an increasing migration balance[8] since the end of the 1990s. According to data from the National Institute of Statistics and Economic Studies (INSEE), the natural balance of the department of La Creuse is -0.8%, with around 1 000 more deaths than births recorded every year. The migration balance is 0.3%, with an average increase of 350 inhabitants per year. Although the positive migration balance helps to attenuate the decline in the department's population, the sharp demographic decline resulting from the massive rural exodus especially between the 1960s and 1990s has left La Creuse heavily affected and with an old population. This situation is further accentuated by the fact that young people often leave to continue their studies outside the department, sometimes even for secondary school, in neighbouring towns such as Limoges, Montluçon or Clermont-Ferrand. These young people do not always return.

The demographic decline has slowed down in the department especially due to the attraction of main cities such as Guéret and Montluçon. Figure 23 shows that in recent years some isolated towns such as Chénérailles have benefitted from people searching for rural areas to live in (i.e., retirees and high-ranking executives).

Figure 24 presents the distribution of the population in La Creuse by age. With an average of 47.5 years, the inhabitants of La Creuse are the oldest in the entire region of Nouvelle-Aquitaine, where the average age is 42.8 years. Children under 20 represent 18.7% of the population, the lowest rate in a region with an average of 22.2%. The ageing index[9] is 1.49 compared to 0.94 in the region.

[7] Difference between number of deaths and number of births
[8] Difference between the number of emigrants and the number of immigrants
[9] Ratio of the population aged 65 or over to the population under 15

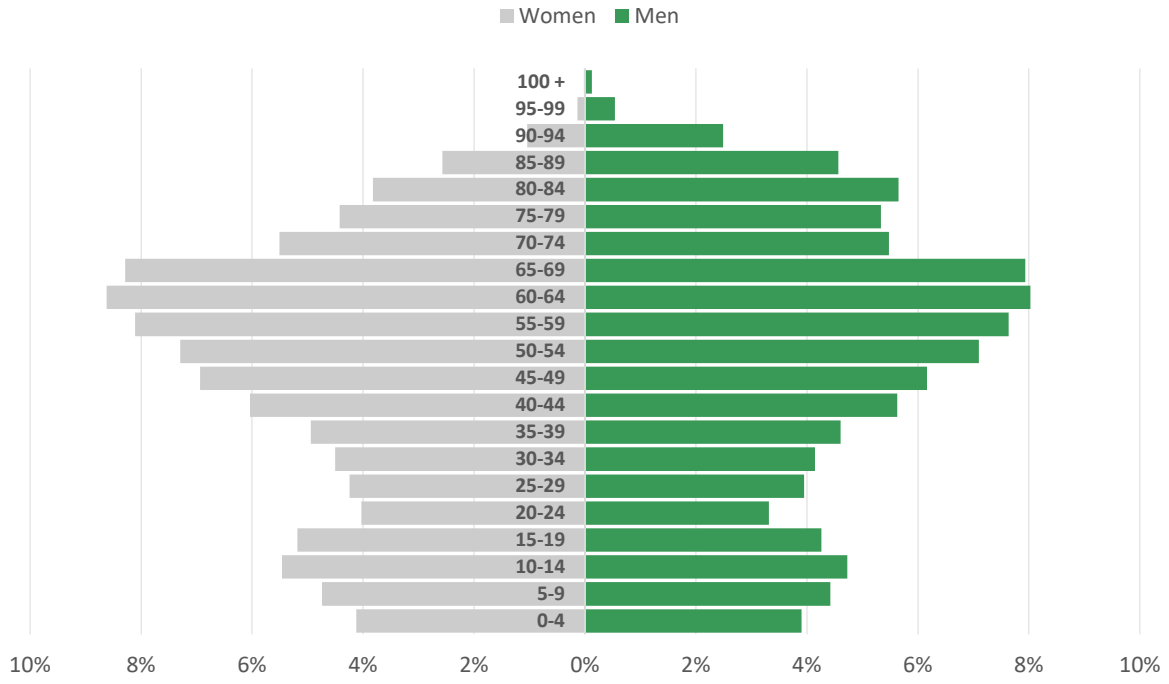

Figure 24. Population pyramid of La Creuse department in 2016. Source: Insee (2020)

2.3.3 Economy

In 2016, the number of employees in the department was estimated at around 43 500, which is 1.8% of the total for the region of Nouvelle-Aquitaine. Historically, the economy of La Creuse department was based on the livestock and crafts sectors, but this is no longer the case. Figure 25 shows that, according to the most recent data (Insee, 2020), the sector with the highest number of employees is the civil service (i.e., public administration, education, health, etc.), with 41% of the total, followed by the tertiary sector with 31%. The commercial tertiary sector is underrepresented, with 31.7% of total employment. This is the lowest proportion in the region, where the average percentage of commercial tertiary sector employment is 42.9%. Agriculture and industry have more modest percentages of 11.4% and 9.8% of employees respectively. Finally, the construction sector accounts for 6.6% of the total.

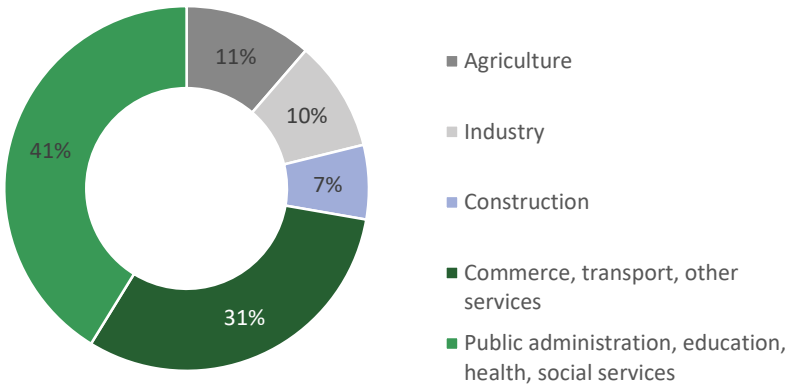

Figure 25. Employees by sector of activity in La Creuse in 2016. Source: Insee (2020)

Nearly 25% of the workforce in 2016 was self-employed, which is the highest proportion in the region. This is partly explained by the weight of the agricultural sector, which is mainly composed of self-employed workers.

The pervasiveness of poverty and unemployment in the department is also noteworthy. Indeed, one person in five is in a situation of poverty, which places the department of La Creuse two points above the region of Nouvelle-Aquitaine, where one person in seven is in this situation. The average income is 17 300 €, 11% less than the regional average. Fortunately, the relatively low cost of housing in the department mitigates this finding. The unemployment rate is 9.6% of the working population, which is average for the region. A total of 47.2% of jobseekers have been unemployed for a year or more. This is the highest proportion in the region's departments and reflects the difficulties faced by the inhabitants of La Creuse in finding work, particularly for young people under 25.

2.3.4 Energy system characteristics

The energy demand in the region of Nouvelle-Aquitaine represents approximately 10% of the final energy use in mainland France (AREC, 2019). As shown in Figure 26 (inner chart), the main energy consumer is the transportation sector (36%) followed by the residential sector and the tertiary sector. The combined energy use in the residential and tertiary sectors, mainly by buildings, accounts for 40% of the final consumption. According to data from 2016, the energy demand by sector in Pays de Combraille en Marche is similar to that of the entire region (see Figure 26 outer chart). Values are only higher for transportation, the residential sector and the agriculture sector in particular.

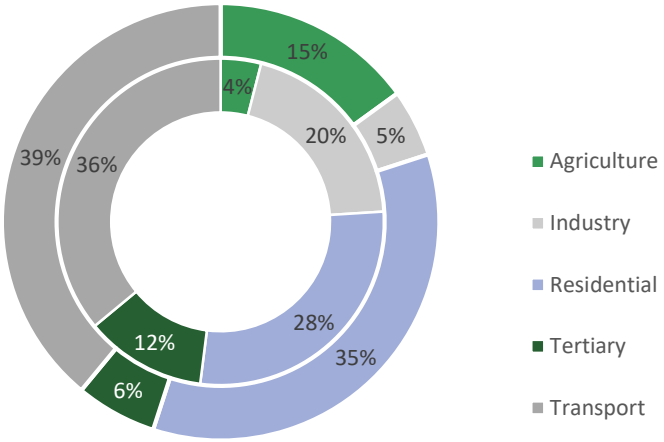

Figure 26. Final energy use by sector in Nouvelle-Aquitaine (inner chart, 2018) and Pays de Combraille en Marche (outer chart, 2016). Source: AREC (2020) and Axenne (2018)

Figure 27 shows that energy demand in Nouvelle-Aquitaine is supplied mainly by fossil fuels (petroleum products, natural gas and coal) at 57% and electricity at 22%. A total of 18% is supplied by thermal renewable energy (wood and other biomass, thermal solar, geothermal and biofuels) and waste. The remaining 3% is supplied in the form of heat (urban district heating and steam for the industrial sector). In this case, the main difference between Nouvelle-Aquitaine and Pays de Combraille en Marche is the greater dependence on petroleum products (see Figure 27, outer chart).

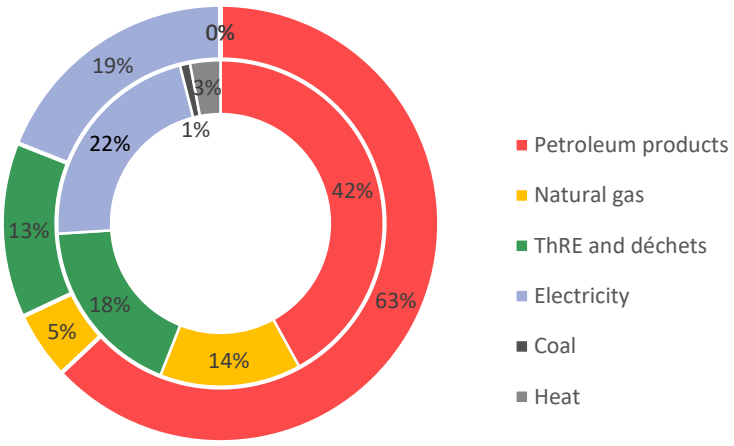

Figure 27. Final energy use by fuel in Nouvelle-Aquitaine (inner chart, 2018) and Pays de Combraille en Marche (outer chart, 2016). Source: AREC (2020) and Axenne (2018)

According to Axenne (2018), 27% of the total energy used in Pays de Combraille en Marche is supplied by renewable energy in the form of heat (56%) and electricity (44%). Figure 28 shows that most of the heat is produced in individual biomass heating systems (i.e., wood and pellets). Renewable energy, wind and solar photovoltaic (PV) represent 96% of the total electricity generation. According to Axenne (2018), the use of wind energy is close to its theoretical potential, while other technologies such as solar (thermal and PV), hydroelectricity or geothermal have great growth potential.

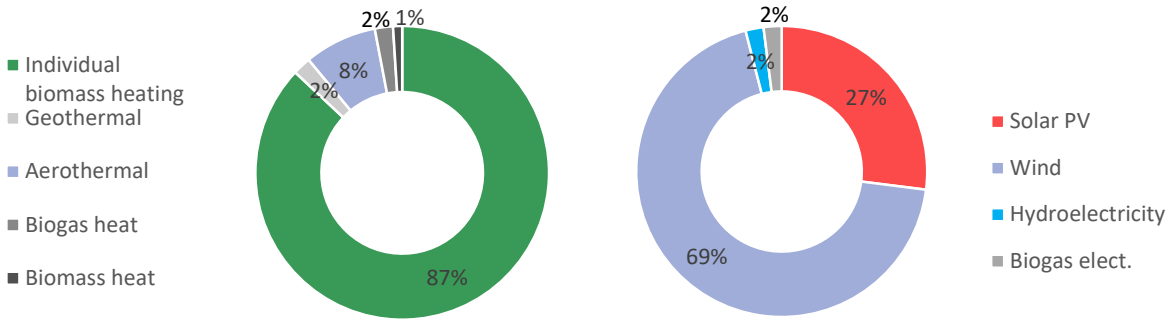

Figure 28. Heat (left) and electricity (right) generation in Pays de Combraille en Marche in 2016. Source: Axenne (2018)

The final energy use decreased by 4.4% in Nouvelle-Aquitaine in the period 2010–2017 due to reductions in the residential and tertiary sectors (AREC, 2019). Energy use increased in other sectors such as transport and agriculture. The decrease in final energy use must be consolidated to meet the *Schéma Régional d'Aménagement de Développement Durable et d'Égalité des Territoires*[10] (SRADDET) reduction target of 30% in 2030.

[10] More information: https://www.grandest.fr/politiques-publiques/sraddet/

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2.4 SUMMARY OF THE COLEOPTER TERRITORIES

	Póvoa do Lanhoso (Portugal)	Tallante (Spain)	Chénérailles Chambon-sur-Voueize (France)
Territorial division			
From country to local scale	Region District Intermunicipal Community Municipality Parish	Autonomous Community Province Region Municipality Council	Region Arrondissement Canton Intercommunity Commune
Geography and Climate			
Territory	Rugged territory	Almost flat	Almost flat
Hydrography	Extensive surface water network	Severe water surface scarcity	Extensive surface water network
Climate	Mediterranean, Atlantic influence	Dry Mediterranean	Atlantic
Temperature (a. a.)	14ºC	20ºC	10.2ºC
Wind	-	High	-
Rainfall (mm/year)	1 400–3 000	Less than 300	600–1 000
Demography [11]			
Population	849 311 (21 886)	214 802 (276)	119 502 (763–911)
Natural balance	-84 (-66)	+150	-1 000
Migration balance	-1246 (+48)	+582	+350
Ageing index	0.93 (1.07)	0.88 (5.82)	1.49
Economy [12]			
Employees by sector		[13]	
Primary	2%	0.7%	11%
Secondary	45%	14.6%	17%
Tertiary	53%	84.6%	72%
Unemployment	14.6%	-	9.6%
Energy system [14]			
Energy use by sector		[15]	
Agriculture	3%	8%	15%
Industry	31%	24%	5%
Residential	17%	27%	35%
Services - Tertiary	12%	40%	6%
Transport	37%	1%	39%
Energy use by fuel		[16]	
Petroleum products	48%	67%	63%
Natural gas	11%	5%	5%
Electricity	26%	28%	19%
Others	15%	-	13%

Table 1. Summary of the main characteristics of the COLEOPTER rural territories

[11] The data in brackets relate to the case study area, otherwise district, municipality or department scale
[12] Portuguese data relate to district scale, Spanish to municipality scale and French to department scale
[13] The data relate to the number of establishments in the municipality of Cartagena
[14] Portuguese data relate to country scale, Spanish to autonomous community scale and French to region scale
[15] The data on electricity use only relate to autonomous community scale
[16] The data are for Cartagena municipality only

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