Case study 2

Castilla y León

Institute for European Environmental Policy

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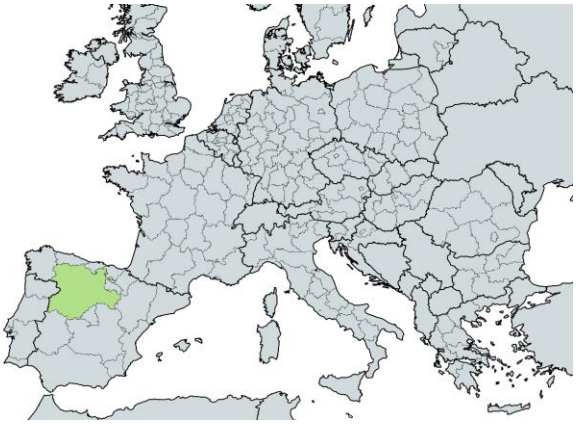
Photo by Héctor J. Rivas on Unsplash

Castile and León (Castilla y León), Spain



GDP per capita	€24,261 (2020)
Population	2,394,918 (2020)
Population density	26.1/km^2
Unemployment rate	11.82% (2020)
People at risk of poverty or social exclusion	16,7%
Share of renewable energy (% of gross final energy consumption)	N/A
Total installed RES capacity	11,606 (MW) out of 12,197 (MW) (2020)
Employment in RES	1% direct (2020 est)

1. A BRIEF OVERVIEW OF THE SPANISH CONTEXT

1.1 National socio-economic development

The economy of Spain is the fourth biggest in the EU with an estimated size of €1,244,772 million[1] and a real GDP per capita of €25,200[2] in 2019. Despite being a high-income country and showing a remarkable convergence[3] with the EU since its accession in 1986, the country suffers from comparatively high levels of structural unemployment and slightly above average income inequalities with respect to similar countries in the EU.

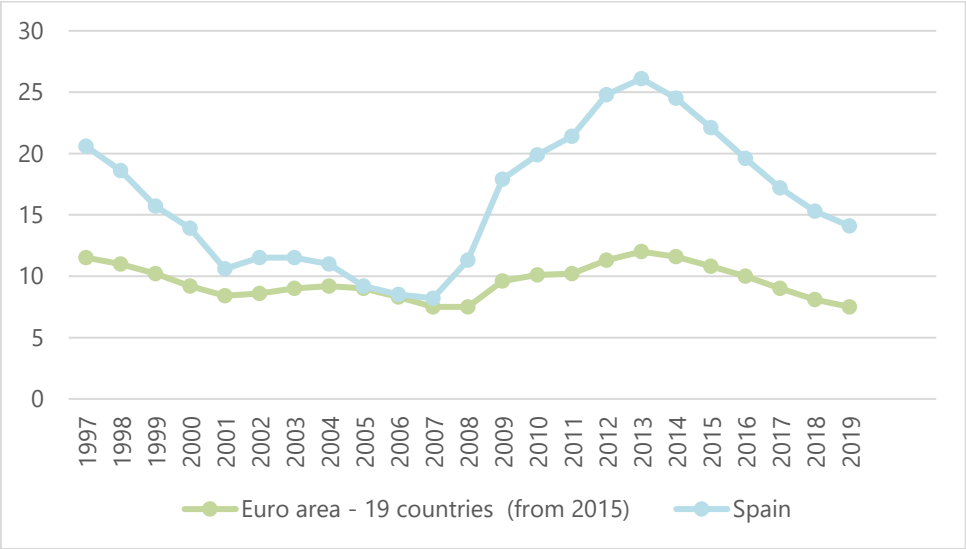
Concerning unemployment, the Spanish economy suffers from high levels of unemployment compared to the Euro area (Figure 1). This is mainly due to the nature of the Spanish economic growth model, based on tourism and construction activities. This has led to the existence of high numbers of short-term contracts and persistent mismatches between supply and demand.

[1] Eurostat (2021) *Gross domestic product at market prices.* Retrieved from https://ec.europa.eu/eurostat/databrowser/view/tec00001/default/table?lang=en

[2] Eurostat (2021) *Real GDP per capita.* Retrieved from https://ec.europa.eu/eurostat/databrowser/view/sdg_08_10/default/table?lang=en

[3] Luis de Guindos (06/09/2018). *Remarks by Luis de Guindos, Vice-President of the European Central Bank, at an event in honour of the 40th anniversary of the Spanish constitution*. Retrieved from https://www.ecb.europa.eu/press/key/date/2018/html/ecb.sp181218.en.html

Figure 1: Unemployment levels in % (1997-2019)

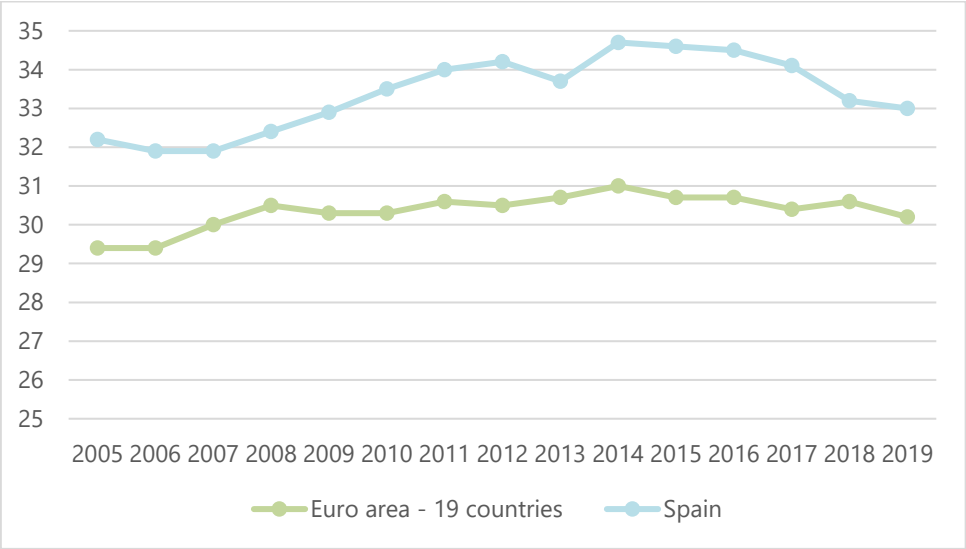


Source: Own elaboration from selected Eurostat[4] figures

Regarding income inequalities, Figure 2 illustrates the Gini coefficient of Spain and comparable countries. Spain performs worse than the EU15 countries consistently, although it converged until 2004. Figure 3 also illustrates the interterritorial inequalities present among different Spanish regions and autonomous cities in terms of GDP per capita to illustrate intra-national inequalities,

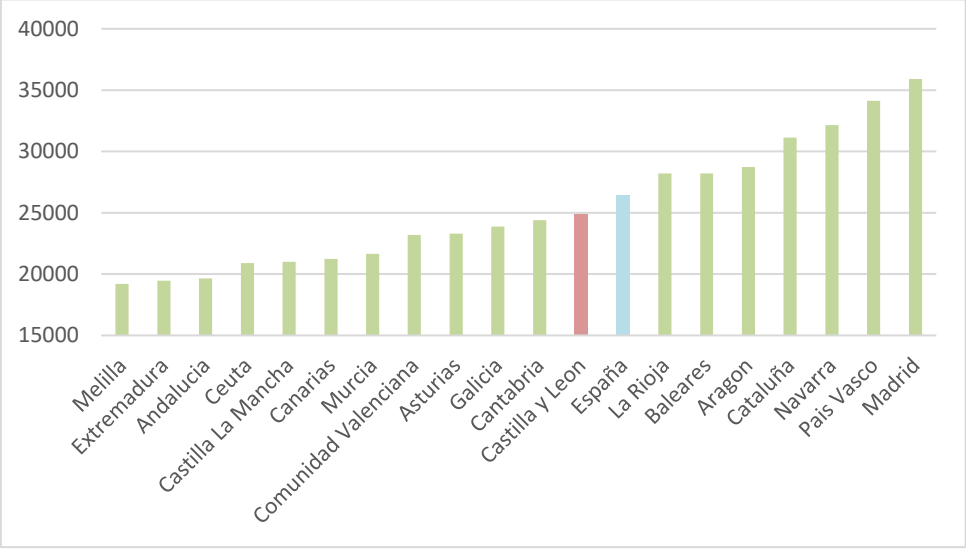
[4] Eurostat (2021) *Unemployment by sex and age.* Retrieved from https://ec.europa.eu/eurostat/data-browser/view/une_rt_m/default/table?lang=en

Figure 2: Gini coefficient of equivalised disposable income EU-SILC survey



Source: Own elaboration from selected Eurostat[5] figures

Figure 3: Regional GDP per capita (2019)



Source: Own elaboration from selected INE[6] figures

[5] Eurostat (2021) *Gini coefficient of equivalised disposable income – EU-SILC survey*. Retrieved from https://ec.europa.eu/eurostat/web/products-datasets/-/ilc_di12

[6] Instituto Nacional de Estadística (2021) *GDP per capita*. Retrieved from https://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736167628&menu=ultiDatos&idp=1254735576581

1.1.1 Population trends

Spain is the fourth most populated country in the EU with 47,351,567 million inhabitants in 2020.[7] However, the country is expected to have weak population growth, in line with other European countries, due to low levels of fertility and ageing population.

The most important demographic trend in Spain is the fact that the population is aging at a considerable rate. In 2019, the percentage of the population above 65 years was 19.5%. This figure is expected to reach 32.7% in 2050.[8] This is partially explained by the above-mentioned low fertility rates and the level of life expectancy at birth: Spanish life expectancy in 2018 was the second highest worldwide at 83 years old, second only to Japan and Switzerland (84)[9], partly due to the existence of strong welfare policies.

Another relevant trend is the population shifts towards the main Spanish cities and coastal areas. For instance, Madrid has grown 73% since 1975 while the province of Soria in Castilla y León has lost 23% of its population. The regions more affected by depopulation are rural areas of the interior and north-west of the Iberian Peninsula, namely Castilla y León, Castilla la Mancha, Asturias, Extremadura and Galicia.[10]

1.1.2 Political dynamics

Spain has not remained isolated from political trends taking place in Europe and elsewhere, although with its own idiosyncrasy. From democratic restoration in 1975 until 2015, Spanish politics were rather bipartisan and stable. The main center-right (PP) and center-left (PSOE) parties reached often solid absolute majorities to form government or simple majorities supported by regional and nationalist parties.

However, the effects of the 2007 financial crisis and a series of corruption scandals contributed to the fragmentation of the political landscape and the surge of some

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[7] Instituto Nacional de Estadística (2021) *Population living in Spain.* Retrieved from https://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736176951&menu=ultiDatos&idp=1254735572981

[8] European Commission (2020) *The 2021 Ageing Report*. Retrieved from: https://ec.europa.eu/info/sites/info/files/economy-finance/ip142_en.pdf

[9] World Bank (2021). *Life expectancy at birth*. Retrieved from https://data.worldbank.org/indicator/SP.DYN.LE00.IN?locations=OE&most_recent_value_desc=false

[10] Epdata (2021) *La España vacía: despoblación en España, datos y estadísticas*. Retrieved from https://www.epdata.es/datos/despoblacion-espana-datos-estadisticas/282#:~:text=Datos%20actualizados%20el%2025%20de,todas%20las%20zonas%20por%20igual.

political parties on the fringe of populism across the whole political spectrum, as well as regional nationalists and independence movements. This has caused an unprecedented parliamentary fragmentation that has forced political parties to engage in governmental coalitions with the associated dynamics in a country with limited culture of political compromise among parties.

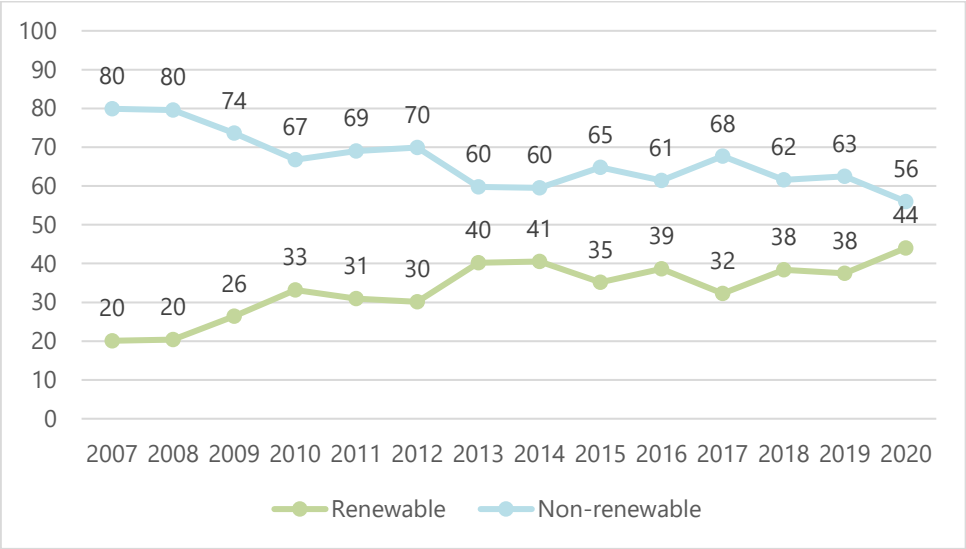
1.2 Renewable energy deployment at the national level

Spain has virtually no domestic production of fossil fuel resources, with the exception of limited coal reserves, and it imports almost all the natural gas and oil needed to meet its energy demand. However, despite some progress in greening national generation, non-renewable sources (including fossil fuels and nuclear energy) still held the largest share of generation at 56%, while power from renewable sources accounted for 44% of gross electricity generation in 2020 (Figure 4). Wind generation represented 21.9% and solar PV reached a historic 6.1% of total generation in 2020.[11] Concerning the power generation from renewable energy sources, wind accounted for 55.4% of generation, followed by hydropower (Figure 5). In 2019, Spain also reached 18.4% of renewable energy sources in gross final energy consumption.[12]

[11] Red Eléctrica de España (2019) *El sistema eléctrico español (Avance 2020)*. Retrieved from https://www.ree.es/sites/default/files/publication/2021/03/downloadable/Avance_ISE_2020_1.pdf

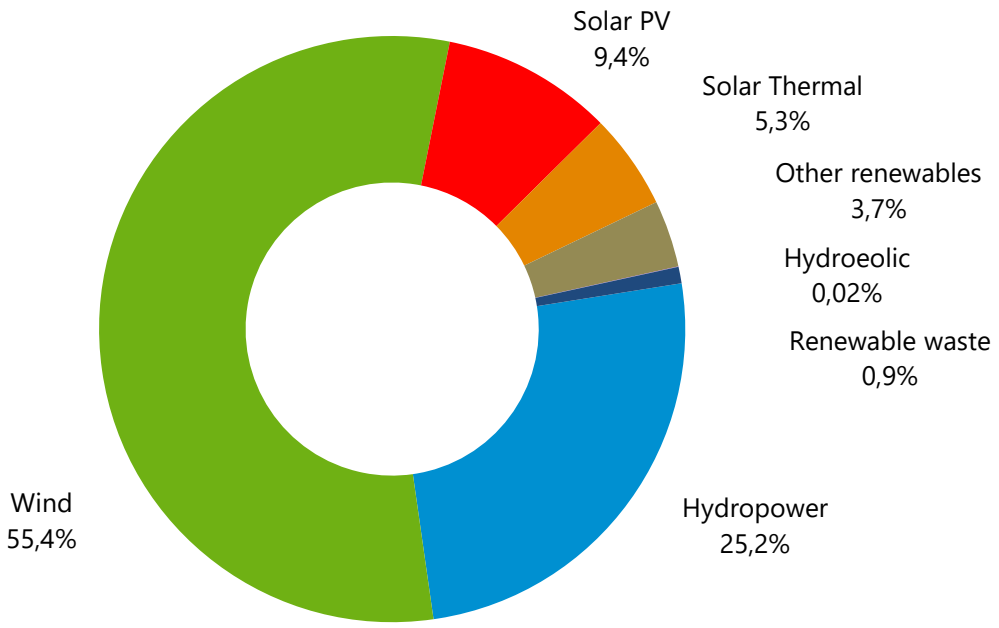
[12] Eurostat (2021) *Renewable energy statistics*. Retrieved from https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Renewable_energy_statistics

Figure 4: Evolution of national power generation in Spain (2007-2020 in %)



Source: own elaboration from selected REE13 data

Figure 5: Renewable energy power generation structure (2019)



Source: REE[14]

[13] Red Eléctrica de España (2021) *Evolución de la generación renovable y no renovable nacional*. Retrieved from: https://www.ree.es/es/datos/generacion

[14] Red Eléctrica de España (2019) *Las energías renovables en el sistema eléctrico espanol*. Retrieved from https://www.ree.es/es/datos/publicaciones/informe-de-energias-renovables/informe-2019

The need to reduce energy dependence from third countries, the potential for renewable energy production and the efforts needed to comply with international climate mitigation agreements and European law, have led the central government to deliver several strategies concerning the promotion of renewable energy.

1.2.1 Central Government programmes

In the year 2000 the central government approved the 'Plan for the Promotion of Renewable Energy in Spain'[15] with the final objective of achieving at least 12% of primary energy consumption by 2010, based on the European Commission's 1998 White Paper on renewable energy[16] . In 2005, the new government considered that such a plan was not going to deliver its own stated objectives. Hence, the previous plan was replaced by the 'Renewable Energy Plan 2005-2010'[17]. The new plan maintained the 12% objective for the year 2010 but with additional regulatory and financial provisions. Thanks to this legislative framework, renewable energy primary energy consumption grew from 6.3% in 2004 to 13.2% in 2010.

In 2011, a new 'Renewable Energy Programme'[18] was approved with the objective of reaching 20% of final energy consumption from renewable sources by 2020. The plan aimed to fulfill the requirements laid out in the 2009 Renewable Energy Directive[19] in the context of the 2020 Energy and Climate Pack objectives[20].

Upon expiry of the 2011 plan, the central government approved in 2019 the 'National Integrated Energy and Climate Plan'[21] (NECP) for the period 2021-2030. The new plan was designed to fulfill the legal obligations derived from the legislation

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[15] Gobierno de España. Ministry for Science and Technology (1999) *Plan de Fomento de las energías renovables en España*. Retrieved from https://www.idae.es/uploads/documentos/documentos_4044_PFER2000-10_1999_1cd4b316.pdf

[16] Communication from the Commission – Energy for the future: renewable sources of energy – White Paper for a Community strategy and action plan (1999) COM/97/0599

[17] Gobierno de España. Ministry for Industry, Tourism and Trade (2005) *Plan de energías renovables en España*. Retrieved from https://energia.gob.es/desarrollo/EnergiaRenovable/Plan/Documents/ResumenPlanEnergiasRenov.pdf

[18] Instituto para la diversificación y Ahorro de la energía (2011) *Plan de energias renovables (2011 – 2020)*. Retrieved from https://www.idae.es/sites/default/files/documentos/publicaciones_idae/documentos_11227_per_2011-2020_def_93c624ab.pdf

[19] 'Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC' (2009) *Official Journal L140/6*

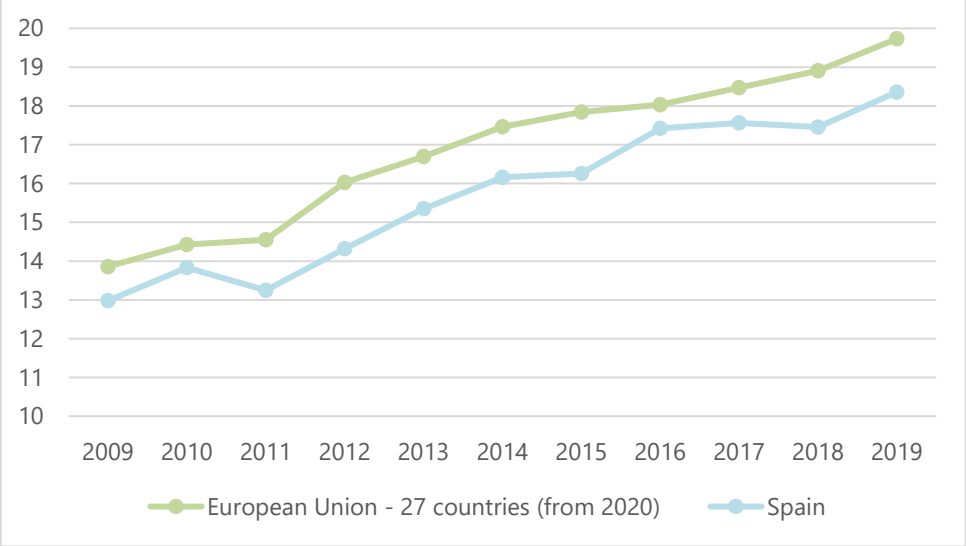
[20] European Commission (2021) *2020 climate & energy package*. Retrieved from https://ec.europa.eu/clima/policies/strategies/2020_en

[21] Gobierno de España (2020) *Plan Nacional Integrado de energía y Clima*. Retrieved from https://ec.europa.eu/energy/sites/ener/files/documents/es_final_necp_main_es.pdf

agreed in the context of the 2016 'Clean Energy for All Europeans'[22] package. The 2019 Spanish plan goes beyond the EU 2030 objectives and aims to reach 42% of final energy consumption from renewable sources and 74% of renewable energy generation by 2030.

Figure 6 illustrates the results of the mentioned above policies and compares it with the EU.

Figure 6: Share of energy from renewable sources (%)



Source: own elaboration from selected Eurostat[23] data

[22] European Commission (2016) *Clean energy for all Europeans package*. Retrieved from https://ec.europa.eu/energy/topics/energy-strategy/clean-energy-all-europeans_en

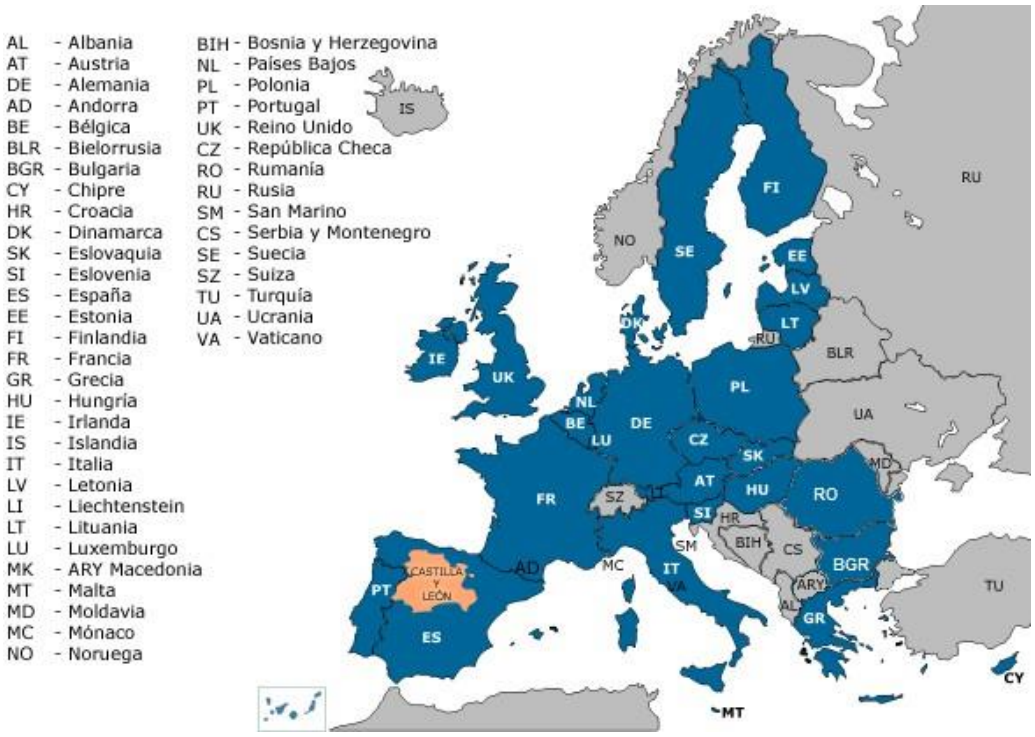
[23] Eurostat (2021) *Share of energy from renewable sources*. Retrieved from https://ec.europa.eu/eurostat/databrowser/view/NRG_IND_REN__custom_874796/default/table?lang=en

2. DETAILED OVERVIEW OF CASTILLA Y LEÓN

2.1 Geography and potential for renewable energy

Castilla y León is one of the 17 regions that form Spain, situated in the northeast of the Iberian Peninsula. With a surface area of 94,225 km^2, it is the biggest Spanish region and the third biggest region of the EU. The region is made up of 9 provinces (Ávila, Burgos, León, Palencia, Salamanca, Segovia, Soria, Valladolid y Zamora) and its capital is Valladolid. It shares border with 9 other Spanish regions and with Portugal, hence it is positioned as a nexus between different regions.[24]

Figure7: Castilla y Leon in the EU



Source: Junta de Castilla y León

The predominant climate in the region is continental Mediterranean climate, characterized by cold winters and hot summers with short spring and autumn periods, although some areas fall within the continental and mountain climates.[25]

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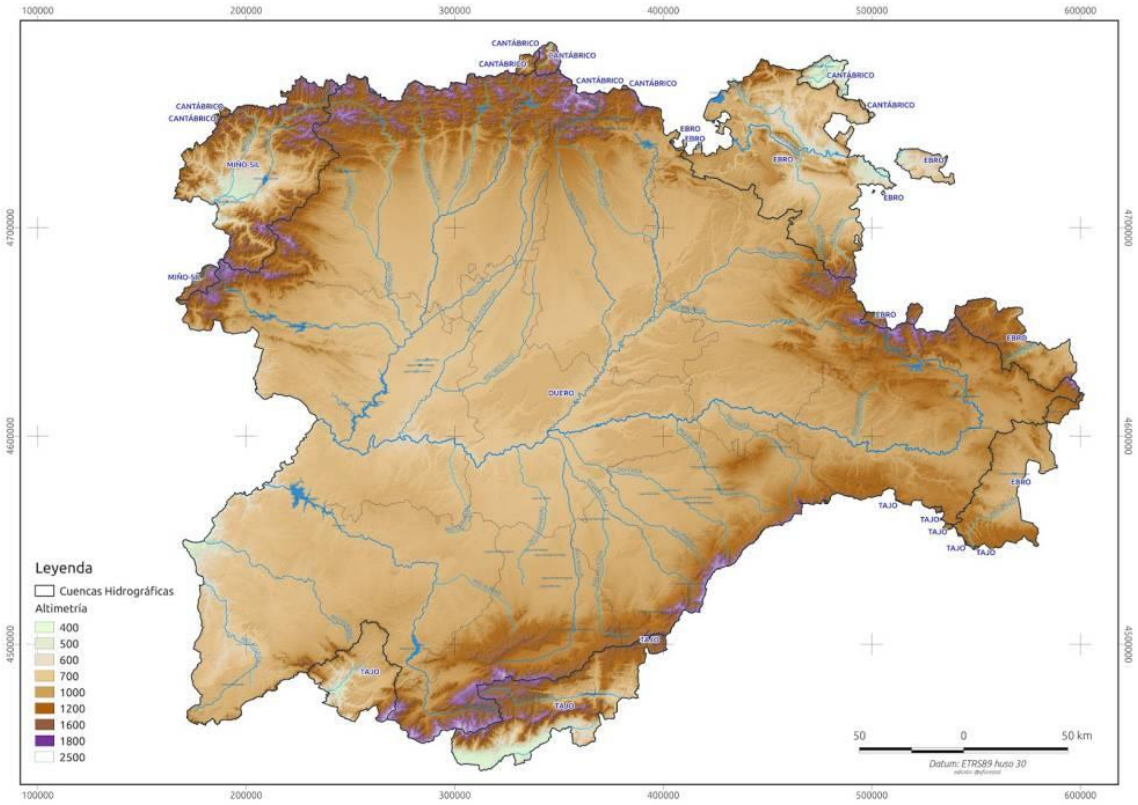
[24] Junta de Castilla y León (2021) *Geography*. Retrieved from: https://conocecastillayleon.jcyl.es/web/es/geografia-poblacion/geografia.html

[25] Junta de Castilla y León (2021) *Climate*. Retrieved from: https://conocecastillayleon.jcyl.es/web/es/geografia-poblacion/clima.html

Castilla y León has a rather limited rainfall, with an annual average precipitation of 413 mm. Hence, the importance of dams in the region to rationalise the use of water resources, both for supplying the population and for generating hydroelectric power or for agricultural use. Spain is in fact the first country in the EU and the fifth worldwide on number of dams and reservoirs.[26] Castilla y León's orography consists of a vast plain surrounded by mountain ranges with an average altitude of the region of 830 meters above sea level. The highest point is Torrecerredo mountain, with 2,648 meters high.[27]

Figure 8: Physical map of Castilla y León with altimetry and main rivers



Source: El Pais[28]

Castilla y León has a lot of potential for the deployment of renewable energy due to its geographical conditions. A study from the Joint Research Center (JRC) of

[26] Morales, F. (2018, September 23) España es el país de la UE que tiene mayor número de embalses. *Diario expansión* https://www.expansion.com/sociedad/2018/09/23/5ba7dedbe2704e51b08b464d.html

[27] Junta de Castilla y León (2021) *Orography*. Retrieved from: https://conocecastillayleon.jcyl.es/web/es/geografia-poblacion/orografia.html

[28] Martin Barbero, I. (2019, September 4) Mapas de Espana para descargar e imprimir completamente actualizados. *Cinco Días* https://cincodias.elpais.com/cincodias/2019/09/04/lifestyle/1567613643_630278.html

the European Commission compared 41 regions across the EU and concluded that Castilla y León has the highest onshore wind potential (228 GW) and the highest potential for ground-mounted solar PV systems (~80 GW) (Figure 9). The region also scores with the highest bioenergy potential from crop residues and from livestock methane (730 MW and 110 MW, respectively) due to its relatively big primary sector. Finally, the region also has the highest sustainable potential for geothermal energy (500 MW).[29] Indeed, the region is currently far from reaching its highest RE potential as described in the JRC report:

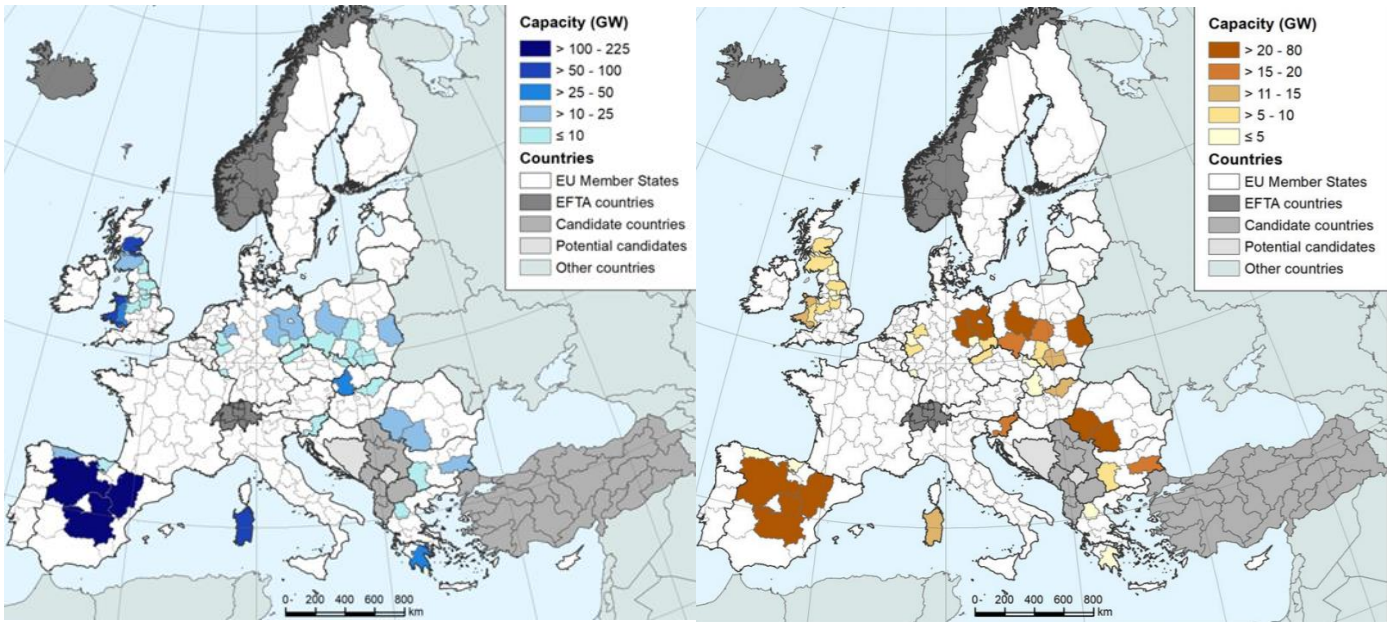
Table 1: Current installation vs potential installation gap (GW)

	2020 installed capacity	Potential (JRC)
Wind	4,39	228
Solar	0,84	80
Bioenergy	0,096	0,84

Source: Own elaboration from JRC and REE data

[29] Kapetaki, Z., Ruiz Castello, P., Armani, R., Bodis, K., Fahl, F., Gonzalez Aparicio, I., Jaeger-Waldau, A., Lebedeva, N., Pinedo Pascua, I., Scarlat, N., Taylor, N., Telsnig, T., Uihlein, A., Vazquez Hernandez, C. and Zangheri, P. (2020) *Clean energy technologies in coal regions*. EUR 29895 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-10356-1, doi:10.2760/384605, JRC117938.

Figure 9: Onshore wind and grounded-solar PV potential in selected EU regions



Source: JRC

2.2 Socio-economic development

Out of the 17 autonomous regions and the 2 autonomous cities, Castilla y León is the 7th biggest regional economy in Spain with a total GDP of €59,794,929 million in 2019. In terms of GDP per capita, the region ranks 8th with a value of €24,886[30] per person, below the national average of €25,200 and the EU average of €27,970 per person.[31] There are also remarkable differences in income by province.

Table 2: GDP per capita of Castilla y León by provinces (EUR)

Burgos	29,571
Palencia	27,346
Valladolid	26,901

[30] Instituto Nacional de Estadística (2021) *GDP per capita by regions*. Retrieved from https://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736167628&menu=resultados&idp=1254735576581

[31] Eurostat (2021) *Real GDP per capita*. Retrieved from https://ec.europa.eu/eurostat/data-browser/view/sdg_08_10/default/table?lang=en

Soria	26,626
Average	24,261
Segovia	22,212
León	21,579
Salamanca	21,187
Ávila	20,423
Zamora	19,813

Source: INE[32]

The economic structure of the region is one of a developed, service-oriented economy. However, as it can be seen on Table 3, the weight of the primary sector on GDP is twice the size with respect to the rest of Spain and almost 4 times higher than the EU average. The industrial sector of the region is mainly composed of agri-food, car production and construction activities. The region has been a net exporter with a positive trade balance over the past 15 years.

[32] Instituto Nacional de Estadística (2021) *GDP per capita by provinces*. Retrieved from https://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736167628&menu=resultados&idp=1254735576581

Table 3: GDP composition by sectors (%, 2019)[33]

	Castilla y León	Spain*	EU
Services	68,4	74,2	71
Primary sector	6,6	2,6	1,6
Industry	26	23,2	25,1

Source: JCyL[34] and CIA[35] - *data from 2017

2.2.1 Demographics

Castilla y León had 2,394,918 habitants in 2020 (5.5% over the national census), with a 5.89% of foreign population[36] (compared to an 11.5%[37] average in Spain). The region has one of the lowest population densities in the EU: the region has an average of 26.1 people per km², in contrast with the Spanish average (92 people per km²) and the EU average (177 people per per km²). Additionally, 44% of the population lives in urban areas,[38] in contrast with the EU average of people living in rural areas (29.1%).[39]

As mentioned in the section above, Castilla y León is one of the Spanish regions most affected by depopulation. Almost 88% of the region's municipalities had less population in 2018 than they had in 1998 and for the period 2000-2018, 6 out of the 9 provinces of Castilla y León lost population. Most emigrants, given its geographical proximity and importance, go to Madrid, followed by the Basque

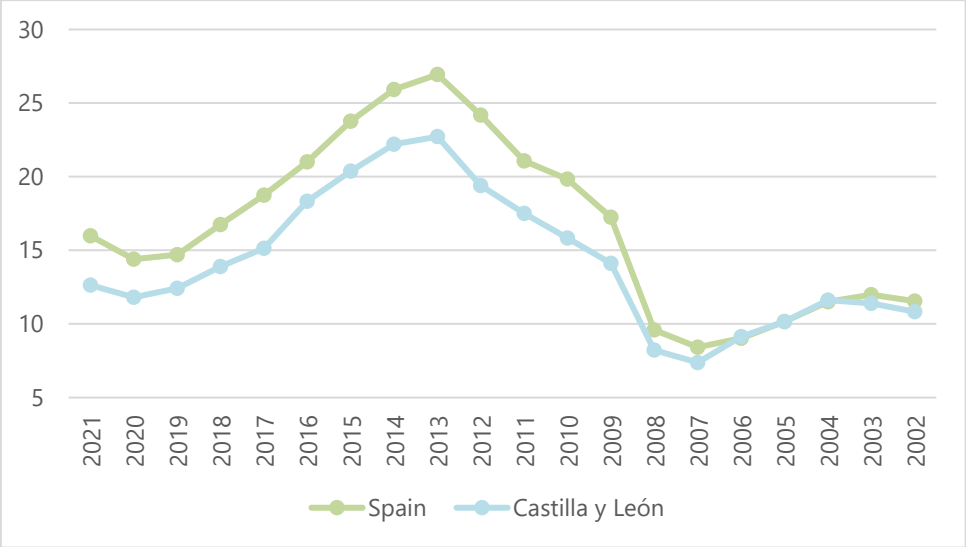
[33] Data for Castilla y León is dated from 2019 according to the regional government, while data for the EU and Spain comes from the CIA's database from 2017. The sum of percentages for Castilla y León sums up to 101, while the one for the EU sums 97.7. Both sums should account for 100, as it is expressed in percentage. This is probably due to typos and/or statistical mistakes. However, it gives an overview of the weight of the primary sector in the region with respect to the Spain and the EU.
[34] Junta de Castilla y León (2021) *Información socioeconómica – Mercado laboral*. Retrieved from https://estadistica.jcyl.es/web/es/estadisticas-temas/informacion-socioeconomica.html
[35] CIA (2021) *The World Factbook*. Retrieved from https://www.cia.gov/the-world-factbook/
[36] Junta de Castilla y León (2021) *Estadística – demográficas*. Retrieved from https://estadistica.jcyl.es/web/es/estadisticas-temas/demograficas.html
[37] Instituto Nacional de Estadística (2021) *Foreign population by nationality, provincces, sex and year*. Retrieved from https://www.ine.es/jaxi/Tabla.htm?path=/t20/e245/p08/l0/&file=03005.px&L=0
[38] Epdata op. cit.
[39] European Commission (2021) *Urban and rural living in the EU*. Retrieved from https://ec.europa.eu/eurostat/web/products-eurostat-news/-/EDN-20200207-1

Country.[40] Overall, the region has been losing population since the 1980's.[41] In addition, the region has an aging population: in 2019, the average age in the region was 47.1 years[42] due to the high life expectancy rate and the emigration of young people. The median age in Spain is 44.9 and the EU average is 43.[43]

2.2.2 Labor dynamics

Concerning employment, the region performs better than Spain in terms of unemployment (Figure 10), although still well above the EU average:

Figure 10: Unemployment rate Spain - Castilla y León in % (2002-2021 at the end of Q1)



Source: INE[44]

[40] Epdata op. cit.

[41] Gobierno de España. Ministry for the Ecological Transition and the demographic challenge (2020) The demographic challenge and depopulation in numbers Retrieved from https://www.lamoncloa.gob.es/presidente/actividades/Documents/2020/280220-despoblacion-en-cifras.pdf

[42] Junta de Castilla y León (2019) *Demographic indicators*. Retrieved from https://estadistica.jcyl.es/web/es/estadisticas-temas/indicadores-demograficos.html

[43] Eurostat (2019) *Median age over 43 years in the EU*. Retrieved from https://ec.europa.eu/eurostat/web/products-eurostat-news/-/DDN-20191105-1#:~:text=In%202018%2C%20the%20median%20age,was%20recorded%20(37.3%20years).

[44] Instituto Nacional de Estadística (2021) Unemployment rate by age, gender and regions. Retrieved from https://www.ine.es/jaxiT3/Tabla.htm?t=4247

These are some of the key characteristics of the current labor market in Castilla y León[45]:

- According to the Central Business Directory[46], in 2018 there were 161,986 companies in Castilla y León, of which 83.47% had fewer than three employees. Only 57 had more than 500 employees. This is in line with the business structure of Spain, where most businesses are SMEs.

- The total workforce of the region amounted to 1,131,500 people in 2019. There were 1,005,000 employed and 126,500 unemployed. By economic sectors, 6.8 % of the employed worked in agriculture, 17.3 % in industry, 6.4 % in construction and 69.5 % in the service sector. In addition, foreign workers accounted for 7.15 % of the total. Out of these, there were 37,700 employed persons from EU countries and 34,100 from third countries.

- In 2019, 85.5 % of those employed had a full-time contract and 14.5 % had a part-time contract. In addition, 73.54% had a permanent contract and 26.46% had a temporary contract.

- The largest companies located in Castilla y León are: Renault Spain, Grupo Antolin, Michelin Spain Portugal, Iveco Spain, Campofrio Alimentación, Calidad Pascual and Grupo Europac.

- The main trade union of the region (and in Spain) is the Union General de Trabajadores (UGT) with over 65,000 affiliates. The second most relevant trade union is Comisiones Obreras (CCOO). The main business organization is the Confederación de Organizaciones Empresariales de Castilla y León (CECALE).[47] The Estatuto de Autonomia recognizes and encourages what is known as 'social dialogue' between trade unions, business organizations and the public administration. Hence, social dialogue is institutionalized.[48]

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[45] EURES (2021) *Information about the labor market of Castilla y León*. Retrieved from https://ec.europa.eu/eures/main.jsp?countryId=ES&acro=lmi&showRegion=true&lang=es&mode=text&regionId=ES4&nuts2Code=%20&nuts3Code=null&catId=440

[46] Instituto Nacional de Estadística (2020) *Companies by regions*. Retrieved from https://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736160707&menu=ultiDatos&idp=1254735576550

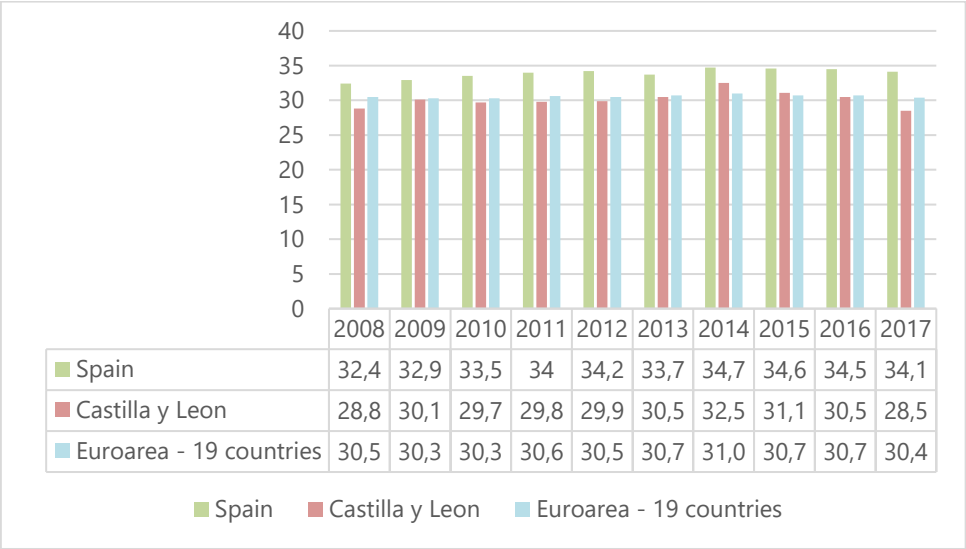
[47] Junta de Castilla y León (2021) *Most relevant labor unions and business organizations in Castilla y León*. Retrieved from https://fafecyl.jcyl.es/web/es/enlaces-interes/organizaciones-empresariales-sindicales-representativas.html

[48] Consejo Económico y Social de Castilla y León (2018) *Annual report – Social dialogue in Castilla y León*. Retrieved from https://www.cescyl.es/es/publicaciones/bases-datos-excel-informe-

2.2.3 Social inequalities, poverty and rent distribution

The Gini coefficient (Figure 11) has been consistently lower in Castilla y León than in the rest of Spain, indicating a more egalitarian income distribution structure. It can also be observed that throughout the years, the coefficient for Castilla y León in the beginning of the observed period (2008) and towards the end (2017) are very similar. When compared with the Euro area, overall, the region also seems to be more egalitarian.

Figure 11: Gini coefficient evolution (2008-2017)



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Spain	32,4	32,9	33,5	34	34,2	33,7	34,7	34,6	34,5	34,1
Castilla y Leon	28,8	30,1	29,7	29,8	29,9	30,5	32,5	31,1	30,5	28,5
Euroarea - 19 countries	30,5	30,3	30,3	30,6	30,5	30,7	31,0	30,7	30,7	30,4

Source: INE[49] *and Eurostat*

Castilla y León has one of the lowest at-risk-of-poverty rates, reaching 16.7%[50] compared to the 20.7% of Spain. This is also below the EU average in 2017 of 16.9%.[51] There are also other indicators that show a relatively better performance of the region compared to the rest of the country. For instance, in 2019, 7.6% of Spaniards were not able to properly warm their home while in Castilla y León 5.3% could not. In the EU27, the number reached 6.9% in the same year. Also in 2019,

anual/informe-anual-2018-epigrafes-pdf/capitulo-2-mercado-laboral-castilla-leon-2018/2-3-dialogo-social-castilla-leon

[49] Instituto Nacional de Estadística (2020) *Living conditions survey*. Retrieved from https://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736176807&menu=resultados&secc=1254736194793&idp=1254735976608

[50] Eurostat (2021) *People at risk of poverty or social exclusion by NUTS regions*. Retrieved from https://ec.europa.eu/eurostat/databrowser/view/ilc_peps11/default/table?lang=en

[51] Eurostat (2020) *Income poverty statistics*. Retrieved from https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Income_poverty_statistics&oldid=440992#At-risk-of-poverty_rate_and_threshold

7.8% of Spaniards had difficulties/delays in paying home-related bills (utility bills, rent, etc.). In Castilla y León the number represented 5.3% of the population. In Europe, the figure represents 8.1% of the population.[52] [53]

2.2.4 Political context and climate and energy policies

Since democratic restoration in 1975, there has been one government from PSOE and, since 1986, six governments from the main centre-right party (PP).[54] The current government is formed between PP and Ciudadanos (liberal party, Renew in the European Parliament). Politics in the region have been somewhat more stable compared with the rest of the country. Governments have been able to form stable majorities and the role of the emerging parties after 2015 has been rather limited. Most seats are currently largely held by the two traditional parties PP: 29 seats, PSOE: 35 seats, out of 81.

Over the last decade, the government of Castilla y León has developed a series of plans, regulations, and subsidies programs to boost renewable energy deployment in the region. Most of the plans have reached their expiry date and it is likely that these will be renewed in the upcoming years.

- 'Wind power Plan of Castilla y León' had the objective to organise the regional territory for the installation of wind power and to coordinate this with environmental and socio-economic issues in the region.[55]

- 'Solar Plan of Castilla y León' aimed to enhance the solar power sector in the region with three specific action plans: financing installations, businesses and manpower, and institutional diffusion of solar energy.[56]

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[52] Eurostat (2021) *EU statistics on income and living conditions (EU-SILC) methodology – economic strain*. Retrieved from https://ec.europa.eu/eurostat/statistics-explained/index.php?title=EU_statistics_on_income_and_living_conditions_(EU-SILC)_methodology_-_economic_strain

[53] Instituto Nacional de Estadística (2020) *Poverty risk survey by regions*. Retrieved from https://www.ine.es/dynt3/inebase/es/index.htm?padre=1928&capsel=1930

[54] Historia Electoral (2021) Elecciones a Cortes de Castilla y León 1983 – 2019. Retrieved from http://www.historiaelectoral.com/acleon.html

[55] Junta de Castilla y León (2021) *The wind power plan of Castilla y León*. Retrieved from https://energia.jcyl.es/web/es/energias-renovables-ordenacion-energetica/plan-eolico-castilla-leon.html

[56] Junta de Castilla y León (2021) *The solar power plan of Castilla y León*. Retrieved from https://energia.jcyl.es/web/es/energias-renovables-ordenacion-energetica/plan-solar-castilla-leon.html

- 'Bioenergy Regional Plan of Castilla y León' established indicative targets for the year 2020.[57]

In addition, back in 2009 the region promoted a set of measures to tackle climate change with the release of the 'Regional Strategy to against Climate Change 2009-2012-2020'[58] focused on CO2 emissions reduction in the context of the Kyoto Protocol.

2.2.5 Regional energy governance

Spain is constitutionally a unitary state but in practice it is a quasi-federal state where regions have a high degree of autonomy. In fact, it is considered one of the most decentralised countries in the world alongside Denmark, Canada, or Germany.[59] All 17 Spanish regions and the 2 autonomous cities have competencies over a wide range of policies such as education, healthcare, internal territorial organisation, environmental protection, etc.

Spanish autonomous regions also have relevant competences concerning the energy sector. The Estatuto de Autonomia[60] of Castilla y León states that the region has the following competences over energy:

- Mining and energy regime, including renewable energy sources
- Industry, in compliance with State regulations for reasons of security, military or health interests and regulations relating to industries subject to mining, hydrocarbon and nuclear energy legislation.
- Installations for the storage, production, distribution and transport of any type of energy, **where they are confined to the territory of the Region and their use does not affect another Region**.

In Spain, the common framework and coordination of energy issues across the whole country is dictated at the national level. Then, it is up to the regions to

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[57] Junta de Castilla y León (2021) *The secotral biomass plan of Castilla y León*. Retrieved from https://energia.jcyl.es/web/jcyl/Energia/es/Plantilla100Detalle/1267710822752/Programa/1284151659081/Comunicacion

[58] Junta de Castilla y León (2021) *Climate Change Regional Strategy*. Retrieved from https://medioambiente.jcyl.es/web/jcyl/MedioAmbiente/es/Plantilla100Detalle/1259064156693/Preguntas-Respuestas/1284429650101/Soporte

[59] OECD (2019) OECD *Multi-level governance studies, making decentralization work. A handbook for Policy-Makers*. Retrieved from https://www.oecd-ilibrary.org/sites/53013b71-en/index.html?itemId=/content/component/53013b71-en

[60] Junta de Castilla y León (2021) *Estatuto de Autonomia*. Retrieved from https://www.jcyl.es/web/es/administracionpublica/estatuto-autonomia.html

decide their own energy policy, in accordance with National legislation and when it only affects the region itself. Finally, local authorities have competences over spatial planning. The public body in charge of regional energy issues is the EREN (Ente Publico Regional de la Energia de Castilla y León).[61] The functioning of the energy system at the national level is supervised by the National Commission of Markets and Competition (CNMV)[62] the regulatory body in charge of promoting and ensuring the proper operation of all markets in Spain.

Concerning planning rules and approval processes, the regional government provides instructions on the installation of different energy infrastructures, both renewable and non-renewable and for both businesses and consumers.[63] Overall, several permits issued by the authorities are required (depending on the size of the power installation) and some provinces have tax benefits to promote such investments. The different administrative steps can be done online.

2.2.6 EU Funds for renewable energy deployment

Castilla y León has received EU funds for renewable energy deployment in the region. The European Regional Development Fund (ERDF) provides specific allocations for several thematic areas, including funding for a 'low-carbon economy'.[64] Castilla y León, for the 2015-2020 period, received €22,693,882 (50% from EU Funds and 50% from regional/national funds) for the Objective 4 'Fostering the transition to a low-carbon economy in all sectors', which encompasses both renewable energy deployment and energy efficiency improvements. For renewable energy deployment, the region received € 2,407,170.[65]

The region also received €357,125,579 (€ 233,696,267 from EU funds and € 123,429,312 from national funding) in the context of the ERDF 2007-2013 plan for the region[66] for the 'Transport and Energy' priority, which includes funding for

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[61] Junta de Castilla y León (2021) *EREN*. Retrieved from https://www.jcyl.es/web/jcyl/Portada/es/Plantilla100Directorio/1248366924958/1279887997704/1142233486661/Directorio-Padre

[62] CNMC (2021). *What is the CNMC?* Retrieved from https://www.cnmc.es/en/sobre-la-cnmc/que-es-la-cnmc

[63] Junta de Castilla y León (2021) *Instructions related to energy installations*. Retrieved from https://energia.jcyl.es/web/es/energias-renovables-ordenacion-energetica/instrucciones-materia-energia.html

[64] European Commission (2021) *European Regional Development Fund*. Retrieved from https://ec.europa.eu/regional_policy/en/funding/erdf/

[65] Junta de Castilla y León (2021) *Operative Plan for 2014 - 2020*. Retrieved from https://hacienda.jcyl.es/web/es/fondos-europeos-2014-2020/programas-operativos.html

[66] Junta de Castilla y León (2021) *Operative Plan for 2007 - 2013*. Retrieved from http://www.jcyl.es/web/jcyl/Hacienda/es/Plantilla100/1199779412642/1246993414328/_/_

renewable energy deployment of a value of € 3,446,970. Similarly, the region also received funds for priority number 6.9 of the 2000-2006 ERDF plan for the region, with a value of € 12,490,142 (50% from EU Funds and 50% from regional funds).[67] A substantial decrease in regional funds can be observed for Castilla y León after the 2006 plan due to the 2004 EU accession wave.[68]

Table 4: ERDF funds for renewable energy deployment in Castilla y León (EUR)

	Total (EU + national contributions)	Fund allocation to Energy/Low carbon priorities	Specific allocation for renewable energy
2000 – 2006	5,032,836,105	2,043,022,621*	**12,490,142**
2007 – 2013	818,194,437	357,125,579*	**3,446,970**
2014 – 2020	651,732,622	22,693,882	**2,407,170**

Source: Own elaboration from JCyL data - * this is the allocation to the Transport and Energy theme area. In the 2014-2020 plan, Energy had a differentiated treatment.

2.3 Renewable energy deployment in Castilla y León

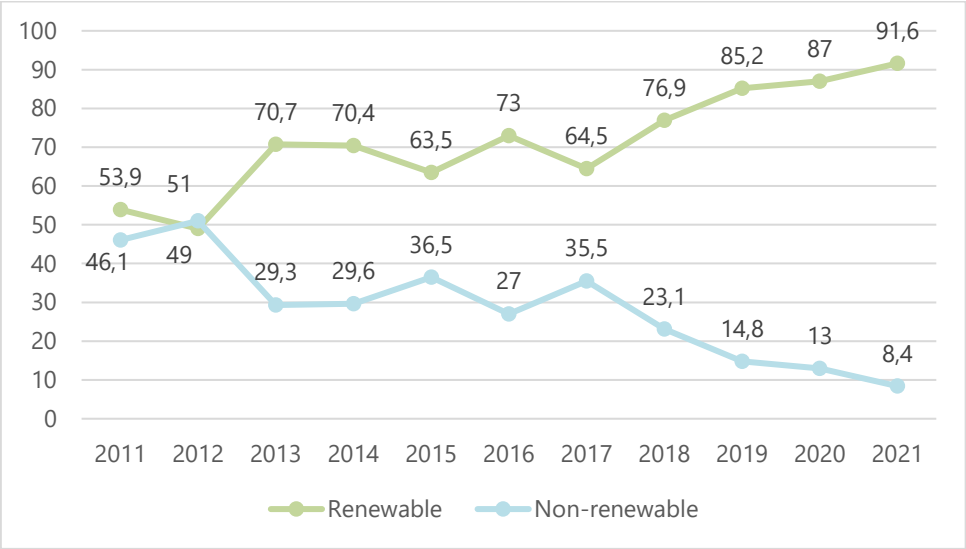
Castilla y León is the region with the highest share of renewable energy generation in Spain. In 2020, the power generation structure of the region was largely dominated by renewable energy with an 87% of total power generation while only 13% was generated by non-renewable energy sources (Figure 12). The trend continues upwards for 2021. The region had a total installed capacity of 12,197 MW in 2020.[69]

[67] Junta de Castilla y León (2021) *Operative Plan for 2000 - 2006*. Retrieved from https://hacienda.jcyl.es/web/es/fondos-europeos-2000-2006/20002006-programa-operativo-integrado.html

[68] Real Instituto Elcano (2004) *Adapting to a New Funding Relationship with Europe: Spain and Cohesion Policy*. Retrieved from http://www.realinstitutoelcano.org/wps/portal/rielcano_en/contenido?WCM_GLOBAL_CONTEXT=/elcano/elcano_in/zonas_in/dt53-2004

[69] Red Eléctrica de España (2021) *National energy generation*. Retrieved from https://www.ree.es/en/datos/generation/installed-capacity

Figure 12: Power generation in Castilla y León in % (2011-2021)

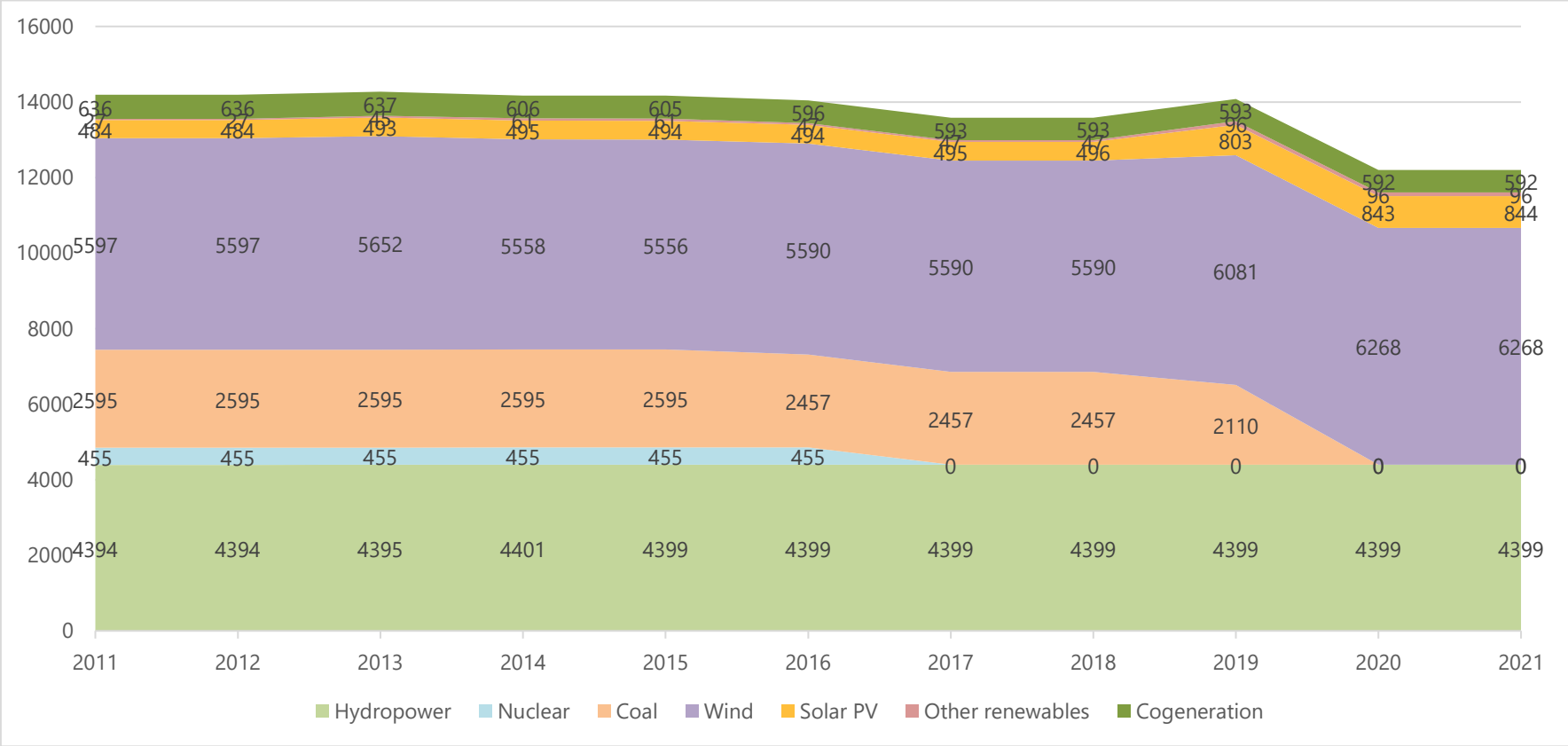


Source: REE[70]

By energy source, during the 2015-2021 period both nuclear and coal production has virtually ended in the region while wind (51%) and solar energy power (7%) have grown. Hydropower has remained stable at 36% of total energy generated (Figure 13).

[70] Red Eléctrica de España (2021) *Evolution of renewable and non-renewable energy generation*. Retrieved from https://www.ree.es/es/datos/generacion/evolucion-renovable-no-renovable

Figure 13: Installed capacity of energy sources in Castilla y León (MW)



Source: REE[71]

[7171] Red Eléctrica de España (2021) *National statistical series*. Retrieved from https://www.ree.es/es/datos/publicaciones/series-estadisticas-nacionales

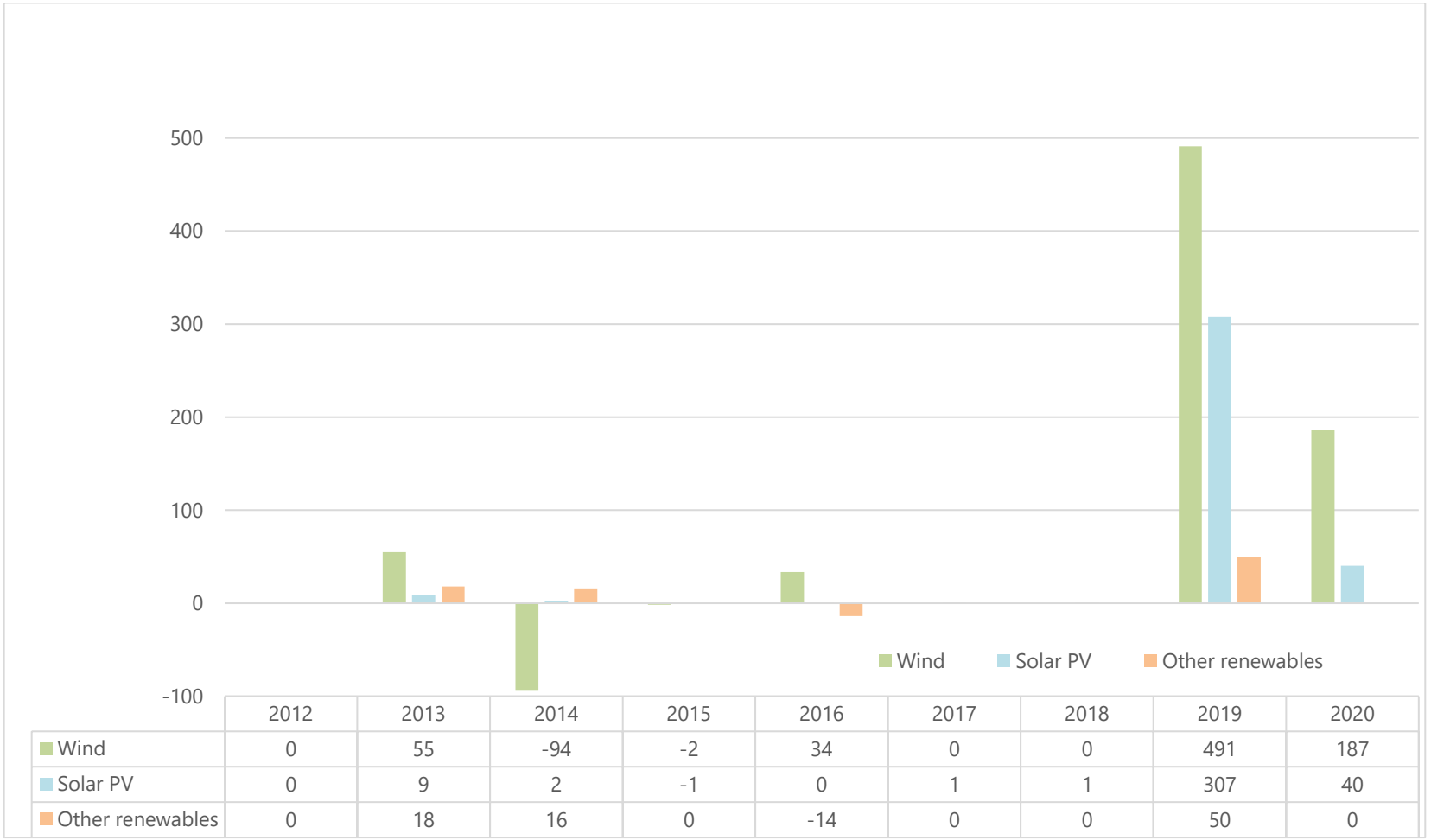
Figure 14 shows the regional year on year changes of installed capacity in MW. The biggest change observed comes from the year 2019. When compared with Figure 15, which shows gross investment flows in the region, the year 2019 also stands out: that year, €1,844 million.

The 2019 investment flow is attributed mainly to a single operation related to the paper industry on one hand, and to investments in renewable energy on the other.[72] During that year important investments in renewable energy were carried out: the region added 862 MW of wind power in 2019 after an investment of €789 million. This represents 43% of total gross investment flows in the region, which will result in a job creation of 2,471 during the construction phase. These investments are expected to have annual income of €2.3 million on property incomes and €20 million for local administrations for taxes on construction activities and €3.5 million on taxes and fees. In addition, the region expects to receive additional €3 million in environmental tax revenues annually on average for the next 20 years.[73]

[72] Valladolid section (2019, November 8) 'Castilla y León lidera la inversión británica en España con 1.648 millones de euros, la mitad del país'. *El Mundo* https://diariodevalladolid.elmundo.es/articulo/castillayleon/castilla-leon-lidera-inversion-britanica-espana-1648-millones-euros-mitad-pais/20191108120027353983.html

[73] Editorial (2019, February 19) 'Castilla y León añadirá 862 MW de eólica hasta 2020 tras invertir 789 millones y crear 2.471 empleos.' *El Periódico de la Energia* https://elperiodicodelaenergia.com/castilla-y-leon-anadira-862-mw-de-eolica-hasta-2020-tras-invertir-789-millones-y-crear-2-471-empleos/

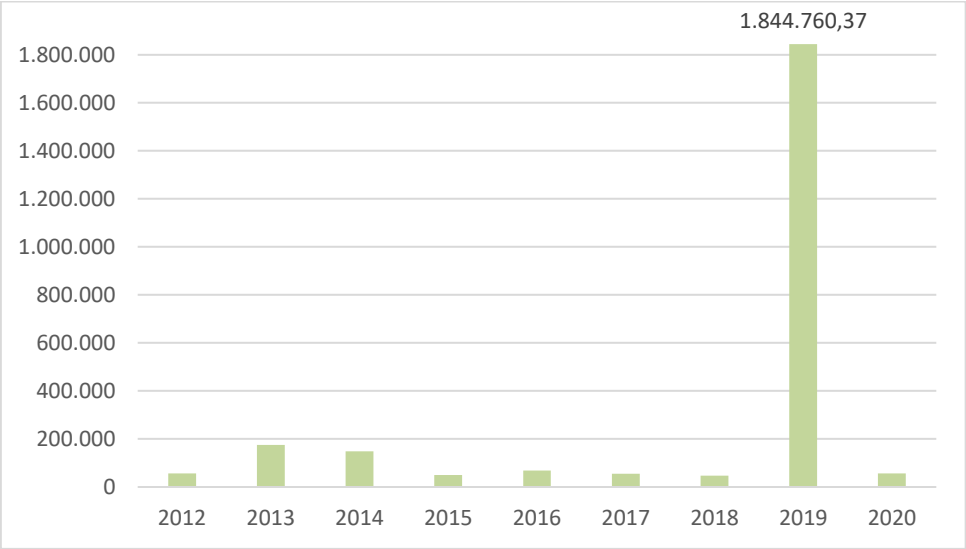
Figure 14: Year-on-year changes on installed capacity for renewable energy in Castilla y León (MW, baseline 2011)



	2012	2013	2014	2015	2016	2017	2018	2019	2020
Wind	0	55	-94	-2	34	0	0	491	187
Solar PV	0	9	2	-1	0	1	1	307	40
Other renewables	0	18	16	0	-14	0	0	50	0

Source: Own elaboration from REE data

Figure 15: Gross Investment Flows in Castilla y León (thousands of euros)



Source: Own elaboration from Ministry of Industry and Trade[74]

2.3.1 Ownership structure

Most of the renewable power capacity, both for wind and solar, consists of medium to large scale installations operated by large energy companies such as Iberdrola, Naturgy, Endesa or EDP. Other ownership modalities, such as cooperative schemes, although with growth projections, still account for a residual amount of total energy generation according to Energética Cooperative, one of the leading cooperative associations in the region.

However, the self-consumption modality (e.g., when the electricity consumed is produced by a, usually small and solar, power installation off the grid) has grown substantially recently. In 2020, almost 65,000 kW of solar power self-consumption installations have been executed in Castilla y León. This represents an 800% increase with respect to 2019. According to Energética Cooperative, the standard profile investing in self-consumption installations has a high-middle income level.

Due to this growth rate, the regional government launched in October 2020 the 'Mesa de Autoconsumo Energético' or 'Energy self-consumption Roundtable'. Its main objective is to promote the self-consumption modality, facilitate administrative procedures, remove barriers and to explore possible incentive measures, such as tax credits. The Roundtable is made up of representatives of the regional government and the private sector. The latter includes energy

[74] Gobierno de España (2021) *Foreign investments*. Retrieved from https://comercio.gob.es/Inversionesexteriores/Paginas/Index.aspx

producers and distributors, installations organizations, as well as energy associations from the different provinces.[75]

In parallel, the government proceeded to reduce the administrative burden for consumers desiring to install by a Decree approved in July 2020[76] modifying the 1999 urban planning law[77]. With this update, citizens no longer need an approved license to install their own power installations. Instead, they only need to submit a declaration of responsibility stating that the installation fulfills all legal obligations. This effectively reduces the administrative burden as well as the time needed to proceed with the installation. Finally, the regional government has a dedicated website on self-consumption, with all requirements, definitions and other relevant information available.[78]

The provincial administrations also have some economic incentives for self-consumption, although it varies among provinces. For instance, in the provinces of Avila, Burgos, Salamanca and Palencia, citizens can enjoy tax reductions on solar self-consumption installations. Meanwhile Leon, Valladolid, Zamora, Soria and Segovia have no incentive programs.[79]

Concerning profitability of self-consumption investments, Castilla y León can be considered a leader within Europe. A study carried out by Otovo took into account the available economic support measures and the available sunlight hours and found out that profitability of self-consumption structures in Castilla y León

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[75] Junta de Castilla y León (2021) Communication: 'La Mesa de Autoconsumo Energético en Castilla y León inicia su trabajo con acciones destinadas a identificar y agilizar los trámites administrativos de las instalaciones, para apoyar el tejido empresarial local y promover el autoconsumo'. Retrieved from https://comunicacion.jcyl.es/web/jcyl/Comunicacion/es/Plantilla100Detalle/1284877983892/NotaPrensa/1285016062572/Comunicacion

[76] 'Decreto-Ley 4/2020, de 18 de junio, de impulso y simplificación de la actividad administrativa para el fomento de la reactivación productiva en Castilla y León. *Official Journal of Castilla y León' (2020) Núm. 122, pág. 18492*

[77] Noticias Jurídicas (2021) *Ley 5/1999, de 8 de abril, de Urbanismo de Castilla y León*. Retrieved from https://noticias.juridicas.com/base_datos/CCAA/cl-l5-1999.html

[78] Junta de Castilla y León (2021) *Self-consumption*. Retrieved from https://energia.jcyl.es/web/es/energias-renovables-ordenacion-energetica/autoconsumo.html

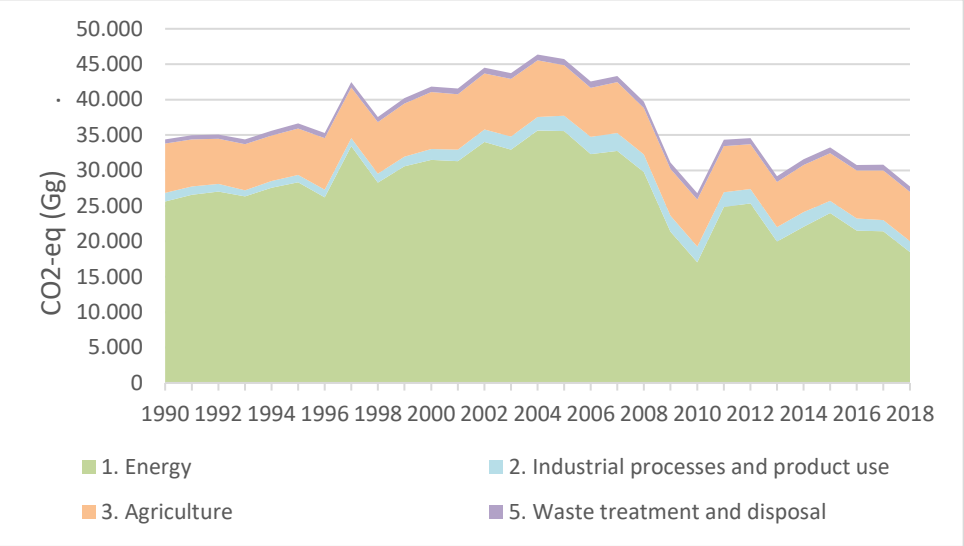
[79] Otovo (2021) *Solar panels for self-consumption in Castilla y León*. Retrieved from https://www.otovo.es/blog/autoconsumo/placas-solares-autoconsumo-castilla-y-leon/#bonificacionesdelicioparaplacassolaresensalamanca

reached 15%,[80] compared with an 8-9% profitability in some of the main European capitals such as Berlin, London and Amsterdam.[81]

2.3.2 Regional GHG emissions

Regional GHG emissions over the last 30 years have decreased from 34,364 tonnes CO2 equivalent (CO2-eq) in 1990 to 27,719 tonnes of CO2-eq in 2018 (Figure 16). The number peaked in 2004, reaching 46,364 tonnes of CO2-eq. This represents a total fall in emissions of 19% for the period 1990-2018. After the 2007 Financial Crisis, a drop in CO2 emissions can be observed due to lower economic activity, followed by a recovery in 2010. However, from 2012 onwards, economic growth and CO2 emissions from energy seem to have somewhat decoupled, as emissions have dropped in parallel to the increase of renewable energy production in the region while regional GDP grew[82], as observed in Figure 12.

Figure 16: Evolution of CO2 equivalent emissions in Castilla y León



Source: JCyL[83]

[80] Ibid.

[81] Candal, B. (2021, February 24) Castilla y León, entre las regiones europeas lideres en rentabilidad para el autoconsumo. *Energetica21* https://energetica21.com/noticia/castilla-y-leon-entre-las-regiones-europeas-lideres-en-rentabilidad-para-autoconsumo-segun-otovo

[82] Datosmacro.com (2019) GDP of Castilla y León. Retrieved from https://datosmacro.expansion.com/pib/espana-comunidades-autonomas/castilla-leon#:~:text=En%202019%20la%20cifra%20del,PIB%20de%20las%20comunidades%20aut%C3%B3nomas.

[83] Junta de Castilla y León (2020) *Emissions inventory*. Retrieved from https://medioambiente.jcyl.es/web/es/calidad-ambiental/inventario-emisiones.html

3. ANALYSIS AND CONCLUSIONS

3.1 Key factors determining regional renewable energy development

There seem to be three specific determinant factors in the deployment of renewable energy deployment in Castilla y León:

- the absence of energy generation from non-renewable sources
- the potential for clean energy,
- support from public institutions at the EU, national and regional levels

3.1.1 Lack of fossil fues for energy generation

Castilla y León now has virtually no production of energy from fossil fuel sources. As we have seen in Figure 14, coal and nuclear energy production came to an end during the period 2011- 2020. This is due to the closure of the last nuclear energy plant, Santa María de Garoña plant, located in the province of Burgos after 43 years of functioning due to technical and economic reasons.

In addition, the coal mining industry in the region, which played an important role in the 19th and 20th centuries for Castilla y León (more specifically in the province of Leon), entered into decay at the end of the 20th century, due to lack of profitability of coal mining in Spain and its low quality.[84] Out of the 135 mines the province of Leon had active, only 9 remain active today.[85] In 2020, the last three coal power plants of the region shut down in the provinces of Leon and Palencia.[86]

The absence large amounts of fossil fuel resources in the region and the relatively low levels of economic activity related to fossil fuel extraction and processing, allows the region to switch towards different energy sources more easily than

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[84] **LIBRE MERCADO (2012, JUNE 7) EL CARBÓN ESPANOL, UN NEGOCIO RUINOSO DESDE HACE UN SIGLO.** ***LIBRE MERCADO*** HTTPS://WWW.LIBREMERCADO.COM/2012-07-04/EL-CARBON-ESPANOL-UN-NEGOCIO-RUINOSO-DESDE-HACE-UN-SIGLO-1276463068/#:~:TEXT=IMPORTAR%20ES%20M%C3%A1S%20RENTABLE&TEXT=NO%20EN%20VANO%2C%20LOS%209,DE%20TONELADAS%20DE%20RESERVAS%20MUNDIALES.

[85] Carnero, M. (2018, July 16) De las 132 minas que llego a tener Leon solo 15 permanecen en activo. *Diario de Leon*. https://www.diariodeleon.es/articulo/provincia/132-minas-llego-tener-leon-solo-15-permanecen-activo/201807160400001781334.html

[86] Energía de Castilla y León (2021, July 12) Endesa comienza a desmantelar la histórica central térmica de Compostilla, en Cubillos del Sil. *Energía de Castilla y León*. https://energiacastillay-leon.com/tag/centrales-termicas/

regions heavily linked to fossil fuels. However, some fossil fuel legacy remains: the former direct and indirect jobs linked with the last carbon-fuelled power plants, coal mines in the province of Leon and nuclear plant have not been replaced yet (see section 3.2 below). The implementation of effective just transition programs in the region will be key to repurpose and relocate these jobs to other sectors, including the renewable energy sector.

3.1.2 The potential for clean energy generation in the region

The only abundant energy sources in Castilla y León, as illustrated in the JRC report in section 2.4.1, are renewable ones. The region scores high in solar, wind and biomass potential for energy generation. In addition, due to the climate conditions of the region that make it necessary to build dams to retain water, the region also has a remarkable penetration of hydropower.

3.1.3 Institutional support

Since the early 2000's the Spanish central government developed several strategies and a regulatory framework that enabled renewable energy to kick-off. In addition, the regional government also developed its own plans to boost clean energy deployment from different energy sources for consumer's self-consumption, as described before. More importantly, there has been a substantial contribution from EU funds for subsidies for renewable energy installations in the region, as seen in section 2.2.6. Academic literature has confirmed that the existence of subsidies, fiscal incentives and other legislative and non-legislative initiatives has a positive impact in renewable energy deployment.

However, Spain is the country with the lowest rate of implementation of EU Funds: for the period 2014-2020, only 43% of EU funds were implemented to date. This is a major barrier. The main reason for the delays in implementation is due to excessive bureaucratic hurdles.[87] It has to be said that although 1) this report has not analysed in depth the different steps in order to get approval from the regional administration for renewable energy installations, and 2) we lack data on EU funds implementation at the regional level, the regional government does outline clearly the different steps and documents needed in order to be granted a permit.

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[87] elEconomista (2021, March 1) España es incapaz de gastar el dinero que recibe de la UE: tiene la peor ejecución, por detrás de Eslovaquia o Rumanía. *elEconomista* https://www.eleconomista.es/economia/noticias/11078468/03/21/Espana-es-el-pais-mas-retrasado-en-la-ejecucion-de-los-fondos-estructurales-del-antiguo-presupuesto-de-la-UE.html

3.2 Socio-economic impacts of renewable energy deployment in Castilla y León

Renewable energy deployment has brought several socioeconomic changes in Spain and in the region:

The transition towards clean energies meant the decay of traditional energy sources. In June 2020 the last coal-powered plants were closed in Castilla y León, one located in the province of Leon and another one in the province of Palencia. More specifically, the closure of the coal plants had an estimated effect of 400 direct and 600 indirect jobs loses[88] in the province of Leon and 208 direct jobs in the Province of Palencia[89]. The closure of the Santa María de Garoña nuclear plant in 2013 also translated in a job loss of 700-800 employees.[90]

The different administrations (local, provincial, regional and national) and private companies have already agreed to relocate the workers and repurpose existing installations in order to avoid depopulation of these areas. In the short term, some of the previous employees and other additional ones will work on the decommissioning of the closed power plants. For instance, the nuclear plant will require between 250 and 300 employees.[91] Several areas of the provinces of Leon have raised concerns, since the closing of the coal mines and related industries (including the coal plants) has not been substituted yet by other industrial structures, hence these areas risk further depopulation.

Following the closure of the coal plants, the industry - Iberdrola, Endesa, Naturgy – and the Unions – CCOO and UGT – and central government representatives signed an 'Agreement for a Just Transition' to provide solutions to the workers

[88] Energia de Castilla y León op. cit.

[89] Benito Iglesias, J. (2020, July 9) El último negocio del poblado de la térmica. *Diario Palentino* https://www.diariopalentino.es/Noticia/ZDE980B34-EA09-2C14-3B74F9D516FA33DB/202007/El-%C3%BAltimo-negocio-del-poblado-de-la-t%C3%A9rmica

[90] A. C. (2021, March 1) Garoña generará en su desmantelamiento la mitad de empleo. *Diario de Burgos* https://www.diariodeburgos.es/noticia/Z2A184105-FD8B-30F4-AACAAE1EE245AC3C/202102/Garona-generara-en-su-desmantelamiento-la-mitad-de-empleo

[91] Servimedia (2021, March 20) El desmantelamiento de la central nuclear de Garoña requerirá entre 250 y 400 trabajadores. *Expansion* https://www.expansion.com/empresas/energia/2021/03/20/6055c84ae5fdeaa33a8b4655.html

and municipalities concerned. Among the different measures, the stakeholders have agreed to:[92]

- A labor exchange program through the public administrations to re-employ workers in the decommissioning of the plants and in new industrial projects
- Specific measures for workers that will not be needed for the decommissioning works, with special attention to workers above 52 years old.
- A support plan for professional development and training for workers to reorient their careers.

The plans include a participative consultation for its elaboration. The basis of this specific agreement has to be understood in the broad context of the Spanish Just Transition, which under the National Energy and Climate Plans and the Just Transition Strategy[93] will provide technical, legislative and financial support for the coal dependent areas in Spain from governments at all levels.

In Spain, the renewable energy sector grew 15.6% in 2019, after growing 10.7% in 2018, and contributed with € 12,540 million to Spanish GDP. The sector employed 95,089 people and exports related to the sector amounted to €4.273 billion, resulting in a positive balance of €1.186 billion. In addition, renewable energy reduced the market price by €4.365 billion and in terms of energy dependency, renewable energy production resulted in savings of €8.702 billion in fossil fuel imports and €1.017 million in emission rights.[94]

Since Castilla y León was, in 2019, the region with the highest renewable energy power installation with 11,492 MW of the 57,512 MW nationally, that is 20% of the total, we can safely assume the region benefited from these economic benefits measured at the national level.

Already in 2009 (the last year for which reliable figures are available regionally) renewable energy accounted for 15% of industrial Gross Value Added (GVA) of the region. More than 6,027 workers were employed in renewable energy

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[92] Gobierno de España (2020). *Acuerdo por una transición energética justa para centrales térmicas en cierre: el empleo, la industria y los territorios*. Retrieved from https://www.miteco.gob.es/es/transicion-justa/acuerdoporunatransicionenergeticajustaparacentralestermicasencierrees_tcm30-509582.pdf

[93] Gobierno de España (2021) *Just Transition National Strategy*. Retrieved from https://www.miteco.gob.es/es/transicion-justa/default.aspx

[94] APPA (2019) *Estudio del Impacto Macroeconómico de las energías Renovables en España*. Retrieved from https://www.appa.es/wp-content/uploads/2020/11/Estudio_Impacto_Macroeconomico_Renovables_Espana_2019.pdf

production sector, representing 1.97% of the industrial workers in the region.[95] Since renewable energy generation has increased by 38% for the period 2010 - 2020 (54% to 87% of regional generation), we can make a rough estimate that employment levels in the sector have increased in a similar way. Hence, if in 2009 there were 6,027 workers in the region in the renewable energy sector, in 2020 the workforce in the sector could potentially amount to 8,317 workers (+38%).[96]

In addition, renewable energy has had a positive effect in the creation of auxiliary industries. For instance, Castilla y León has developed its own industrial base for the production and maintenance of components for wind power plants. In fact, it is the coal transition region with the highest number of such industries. In the region, there are around 25 industrial centers dedicated to wind power-related components.[97]

According to the Joint Research Centre of the European Commission, by 2030 the sector could employ up to 21,379 workers in the renewable energy sector, mostly in the wind energy sector. This makes Castilla y León the region with the highest potential for job creation among the coal transition regions.[98]

However, renewable energy installations employ the bulk of workers during their construction phase, for instance: Endesa is a big energy company building several renewable energy installations in Castilla y León, adding 700 MW to the energy production of the region. The company has calculated that, during the construction phase of such plants between 2023 and 2025, there will be around 2,900 workers employed. Once the construction phase is over, there will only be 55 indefinite workers. This represents only 1.9% of the workers initially employed during the construction phase.[99]

Overall, the Spanish population has historically had a positive attitude towards renewable energy. According to the Spanish Centre for Sociological Research (CIS), in 2007 already 60% of Spaniards considered that renewable energy was an 'efficient and cheap' energy source. In 2020, another barometer showed that investments in renewable energy should be a priority, only behind

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[95] Junta de Castilla y León (2021) *Suministro de la electricidad en Castilla y León*. Retrieved from https://energia.jcyl.es/web/es/biblioteca/suministro-electricidad-castilla-leon.html

[96] These are raw calculations and do not take into account other factors, such as innovations in the sector that might lead to a less intensive workforce or synergies due to economies of scale.

[97] CCOO – ISTAS (2020) Las energías renovables en el marco de una transición energética justa en la provincia de Leon. Retrieved from https://istas.net/sites/default/files/2020-09/Renovables-Leon_final.pdf

[98] Kapetaki, Z. op. cit.

[99] CCOO – ISTAS op. cit.

investments in the healthcare systems and in recycling and waste management activities.[100] In addition, a Eurobarometer from winter 2021 stated that investments in renewable energy should be the top priority for the European Green Deal.[101] Although these trends are focusing on the Spanish society as a whole, it can be extrapolated to the region of Castilla y León, where renewable energy is often seen as an opportunity to modernise the regional economy and tackle depopulation, with the exception of the areas that were dependant on coal or nuclear energy production. More specifically, according to the online magazine 'energias-renovables.com', in those municipalities where wind power installations have been placed, 70% of residents consider them beneficial while only 3% consider them harmful. Depending on the area, between 79% and 91% of citizens considered that the environmental benefits of wind power overcome the possible harmful impacts.[102]

In terms of energy poverty, renewable energy production does not seem to have had an impact. The region has energy poverty at slightly lower than average rates for Spain and the EU as a whole (See: Section 2.2.3) according to measures from Eurostat. Continuing energy poverty is linked to a range of factors, such as the age of buildings, the type of family structures, the cost of energy, or the poverty and employment rates. In this case the deployment of renewable energy regionally has not apparently remedied this situation, nor worsened it.

[100] CIS (2020) *Barómetro de Octubre*. Retrieved from http://datos.cis.es/pdf/Es3296marMT_A.pdf
[101] Eurobarometer (2021) *Public Opinion in the European Union*. Retrieved from https://europa.eu/eurobarometer/surveys/detail/2355
[102] Junta de Castilla y León (2002) *Nuevas ocupaciones profesionales y necesidades de formación ocupacional en relación con las energías renovables*. Retrieved from https://www.yumpu.com/es/document/read/14477640/energias-renovables-en-castilla-y-leon-instituto-de-estudios-del-

3.3 Relevant factors that determine socio-economic impacts associated with renewable energy deployment

To support socioeconomic development in the region, it is important to address the root causes of population loss. This requires a combination of policies at the regional, national and EU level.

The main stakeholders in the transition towards a green energy mix have been, and will continue to be, the public administrations, namely the regional government as well as the EU institutions. Private companies, namely big energy companies such as Iberdrola have also been investing in renewable energy installed capacity and will continue to do so. There are some key barriers/issues that must be taken into consideration:

- Enhance the existing supporting frameworks for renewable energy deployment in the form of subsidies, tax deductions and other economic instruments can lead to a dynamization of the economy. How? Jobs associated with renewable energy powerplants often are high-quality and highly-educated jobs. Renewable energy technologies can also boost R&D activities as well as rise the general technology level in the region. In addition, since renewable energy systems are rather decentralised, remote areas once populated can benefit from local energy sources.

- Given the potential for renewable energy generation in the region, and its geographical location with 9 other Spanish regions, including Madrid, and with Portugal, Castilla y León has position itself as an energy exporter as well as an energy nexus. Castilla y León is already net exporter of energy to other regions with more than 10,973,679 MWh exported in 2020. This tendency has been a constant for at least 10 years (data available from 2010). This makes the region the second biggest energy exporter of energy in Spain, second to the region of Extremadura, with 16,339,701 MWh exported in 2020 thanks to its nuclear power plant. As illustrated in figure 3, both Castilla y León and Extremadura are below the Spanish GDP per capita average.[103]

- The continuation of EU funds for renewable energy deployment is also key to make sure investments in this area are done in the region, since these funds are co-financed with other regional and national funds.

[103] Red Eléctrica de Espana (2021) *Electric balance*. Retrieved from https://www.ree.es/es/datos/balance/balance-electrico

- All levels of public administration must ensure clarity and accessibility to consumers and companies alike to the different administrative processes and tools available for renewable energy installation. In this regard, bureaucratic processes must be simplified and digitalised. This becomes even more relevant with the incoming NextGenerationEU funds.

Interviews conducted

Interview with Santiago Campos from Energetica, an energy cooperative in the region of Castilla y León. Held online via Teams on the 10th of June 2021.

3.4 Key conclusions

1. Public support remains one of the biggest enablers for the decarbonisation of the energy systems and the consequent socio-economic benefits. To maximise employment and other socio-economic benefits, both the regional and national governments have to make sure an appropriate legislative framework is put in place in order to:

    a. Eliminate as much as possible administrative burdens that hamper installation of renewable energy systems, both for companies and individuals. The region has recently implemented one such measure to remove the need for individuals to seek prior approval to install micro-RES.

    b. Further incentivize the deployment of renewable energy installations owned at the household level. This is a potentially important modality particularly in this region with excellent solar potential. Recent government coordination on tax incentives and removal of barriers is a good example from this region.

    c. Create an industrial ecosystem that maximizes economic benefits by attracting industries related to renewable energy (e.g., batteries production) that might also contribute to the development of other industries (e.g., chemicals, automotive, AI, etc.)

2. Ensure a Just Transition. The substitution of conventional energy sources (fossil fuels, nuclear) by renewable energy, despite some economic and environmental benefits, can result in a net loss of employment and the depopulation of local areas if not accompanied by supporting policy. Public administrations and other relevant stakeholders (trade unions, business organisations and citizens associations) must work together to ensure these communities can continue to prosper. For this to happen, ambitious re-

skilling programs as well as the conversion of former polluting industries into new clean and productive systems are needed. These transitions must also contain participatory mechanisms to involve the local communities alongside other key stakeholders. A good example is the Just Transitions Guidelines approved in November 2020 between relevant stakeholders with provisions for clean industry conversion, innovation and participation of the local communities for the former coal province of Leon.[104]

3. Given the potential for renewable energy of the region and the geographical position of the region, Castilla y León can become an important exporter of renewable energy. Most importantly, the region shares a border with the Region of Madrid, one of the biggest importers of energy in Spain. By locating renewable energy installations in the region and exporting to other regions, including Portugal, Castilla y León could benefit from additional revenues and employment levels, part of a potential strategy to prevent ongoing depopulation. Studies show that there is significant potential for employment in this region, particularly if it can develop strategic competences in RES technologies.

[104] Gobierno de Espana (2020) Communication: El MITECO, el Gobierno de Castilla y León y la FEMP firman el protocolo para elaborar los Convenios de Transición Justa de tres áreas del norte de la comunidad. Retrieved from https://www.miteco.gob.es/es/prensa/ultimas-noticias/el-miteco-el-gobierno-de-castilla-y-le%C3%B3n-y-la-femp-firman-el-protocolo-para-elaborar-los-convenios-de-transici%C3%B3n-justa-de-tres-%C3%A1reas-del-norte-d/tcm:30-517236

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