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Supporting the design and implementation of a regional energy strategy

ELISE Energy and Location Applications
Final Report

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Enabling digital government through geospatial & location intelligence

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Abstract

The main problem addressed by this report is the lack of data and of documented data flows supporting the design and implementation of a regional energy strategy. The scarcity of existing documentation/best practices focusing on the role that geospatial data and technologies - particularly INSPIRE data - can play in the context of a regional energy strategy is also tackled.

The report provides insights on three main aspects of the problem:

- It provides an overview of the territorial competences in the field of energy in the Member States (national vs regional), as well as a summary of the public data sources potentially relevant to a regional energy strategy;
- It presents a deep analysis of a real case of regional energy strategy, consisting in the Regional Energy Efficiency Strategy of Castilla y León (EEE-CyL-2020) in Spain;
- Based on the previous analyses, it explores the potential of harmonised and interoperable geospatial data, including from the INSPIRE Directive, to support the regional energy policy cycle in the European Union.

A key message is that creating or renewing a regional energy strategy could greatly benefit from location interoperability. Location interoperability can facilitate data sharing for better cross-sector modelling, considering the potential interlinkages between the different strategic sectors in the region and the implemented measures. This cross-sectoral modelling would allow capturing how changes occurring in a specific sector may impact other sectors.

This study has been executed in the frame of the Energy & Location Applications of the ELISE (European Location Interoperability Solutions for e-Government) action of the ISA^2 (Interoperability solutions for public administrations, businesses and citizens) Programme.

Executive Summary

The Digital Economy Unit of the European Commission's Joint Research Centre (JRC), in cooperation with other services of the European Commission, is coordinating the "European Location Interoperability Solutions for e-Government (ELISE)", Action 10 of the ISA^2 (Interoperability Solutions for Public Administrations, Business and Citizens) Programme.

The ISA^2 Programme supports long-standing efforts to create a European Union free from electronic barriers at national borders. It facilitates interaction between European public administrations, businesses, and citizens to enable interoperable cross-border and cross-sector public services and ensure the availability of common framework and solutions.

The ELISE action is a package of guidance and solutions facilitating efficient and effective electronic cross-border or cross-sector interactions between European public administrations, citizens and businesses, in the domain of location information and services.

The ELISE Energy & Location Applications consist of a series of use cases aiming to show how location data can support different stakeholders involved in the energy policy cycle at different geographical scales, ranging from local to European-wide level.

This report focuses on the use case named "Supporting the design and implementation of a regional energy strategy", investigating the **role that geospatial data and technologies can play to support the design, implementation and monitoring of regional energy strategies**.

The main problem addressed by this use case is the lack of data and of documented data flows supporting the design and implementation of a regional energy strategy. More particularly, it focuses on the lack of existing documentation/best practices on the role that geospatial data and technologies can play in the context of a regional energy strategy and the limited fitness-for-purpose of INSPIRE data.

Several stakeholders would benefit from filling in such gaps:

- Regional energy agencies:
    - achieving efficiency gains in the business processes related to the regional energy strategy lifecycle (anticipation, design, implementation, monitoring, reporting, reviewing), deriving from better data flows providing more information to support decision-makers,
    - increasing the effectiveness of the regional energy strategy, addressing more accurately specific local needs, and ultimately facilitating reaching the energy policy targets.
- National energy agencies, being facilitated in the implementation of energy policies at the national level, thanks to a better coordination of regional energy strategies based on the use of standardised data flows and harmonised geospatial data.
- Companies involved in the energy sector, increasing their growth opportunities by accessing geospatial data contained in the regional energy strategy allowing them to understand specific local conditions, which can support their decisions to localise their business better.
- Citizens:
    - receiving, transparently and easily, general knowledge on energy-related aspects upon which the actions within the energy strategy are founded and being empowered with enough knowledge to be able to comment on specific actions contained in the regional energy strategy,
    - increasing their awareness regarding the planned actions and the expected effects that the regional energy strategy has in their region/area, and that can influence their decisions. For example, where to buy a new house based on the plans to build a district heating network or a local grid, where the building stock needs more refurbishment, etc.

The use case has been executed into three steps:

- **Step 1, Understanding of the European context,** aimed to provide an overview of the territorial competences (national vs regional) in the field of energy in the EU Member States, and an overview of the public data sources potentially relevant to a regional energy strategy.

- **Step 2, Analysing a real case: Regional Energy Efficiency Strategy in Castilla y León region, ES**, provides a deep analysis of the Spanish Regional Energy Efficiency Strategy of Castilla y León (EEE-CyL-2020).
- **Step 3, INSPIRE potential to support regional energy planning in the EU**, Based on the results of the two previous steps, exploring the potential of harmonised and interoperable geospatial data, primarily through but not limited to the INSPIRE Directive, to support the regional energy policy cycle in the EU.

Each step helped drawing some interim conclusions.

Step 1, Understading of the European context:

- **Variety of data and access options:** In analysing the selected data sources, it was observed that there is a vast amount of available data from statistical offices and derived from Projects. Similarly, the accessibility options to these data are highly heterogeneous and sometimes not immediate (as in the case of Projects data). Additionally, the option to view data through cartographic visualisations in user-friendly websites that use map representation is available in several data sources. However, special efforts should be placed in providing data in formats that are also easy to process (e.g. CSV, enable connections through API, etc.).
- **Coverage and scale:** whereas the geographical coverage of all datasets analysed was either European or international, the scale at which the data was presented was, in most cases, at the national level. However, to support regional energy strategies, it is essential to count also on sub-national (regional or local) level datasets. Sub-national scales would allow establishing comparable methodologies among the Member States. Hence, data provided by Eurostat at the different NUTS levels is greatly beneficial.
- **Supporting the modelling of other variables:** some of the data analysed cannot be directly used to potentially support regional energy strategies but they can be leveraged to extract variables to calculate relevant indicators. This is the case of sources like Copernicus or OpenStreetMap.

Step 2, Analysing a real case: Regional Energy Efficiency Strategy in Castilla y León region, ES:

- **High complexity of the Castilla y León regional energy efficiency strategy:** regional energy strategies entail a high complexity as they involve different sectors, as it has been confirmed by the in-depth analysis of the Castilla y León one. Additionally it is necessary to comply with the energy objectives coming from the European Union (EPBD, EED, RED, etc.). Moreover, this progress needs to be reported at the national scale. As a consequence, counting on multi-scale quality data that can enhance the analysis of the status of the region at the appropriate scale and support the actions to be taken is fundamental.
- **Essential role of objectives and monitoring**: the objectives set from external sources (i.e. European Commission through its Directives) guide the implementation of the regional energy strategy. Based on this, a monitoring of the proposed actions is implemented to check whether the objectives have been achieved or not. Two considerations should be highlighted in this field:
    - Regarding the definition of the objectives, a question that should be posed is whether the objectives to comply at the regional level should be the same as at the ones at the national or European levels, or if they should be fine-tuned according to the regions' characteristics. In the case of the Spanish Castilla y León region, they commit to comply at least with those coming from the European level.
    - Monitoring is a crucial activity that helps determining whether a specific action has had the expected impact and contributed to achieving the established objective or not. To this end, the lines of action and the specific objectives to be achieved in each sector (industrial, building, transport, public services, administrative) have been presented. However, the way to measure the impact of each of the actions (aspect not been explored in this report) is crucial to assure the success of the strategy.
- **Lack of timely data:** while identifying the required datasets, a lack of timely data was observed in some cases. Indeed, when using official statistical data sources, the date of publication of the data versus the timeframe covered in the data was extremely distant. The latter can result in decision-making processes based on potentially obsolete data. Thus, a balance between using updated data coming from reliable sources versus delayed official statistical data should be found.

— **No location data**: the Energy Efficiency Strategy of Castilla y León does not use geo-located data for implementation or monitoring purposes. Nevertheless, the scale of some of the data used as a basis in the energy efficiency strategy definition can cover the province level (NUTS 3), hence, covering the nine provinces in Castilla y León region. Thus, there is a great opportunity to explore how location data can support the development of regional energy strategies in Castilla y León.

Step 3, INSPIRE potential to support regional energy planning in the EU:

Harmonised geospatial data, including INSPIRE data, can support regional energy strategies in a series of applications related to different sectors impacted by the strategies themselves.

However, deepening into each sector (industrial, building, transport, public services, administrative, etc.) to discover the relevant data sources is fundamental. Equally important is understanding how a sector is linked to another and the factors that affect their development, such as the economy, population, land use, etc. and the different indicators that contribute to characterise the region and have a clear impact on the development of the mentioned sector.

To this end, a potential improvement to the Regional Energy Strategy of Castilla y León would be to represent the different sectors considered as strategic in an appropriate **holistic framework** modelling. Such modelling framework can help:

1. representing the potential interlinkages between the different sectors and implemented measures;
2. capturing how changes taking place in a specific sector impact others (e.g. measures related to deployment of Renewable Energy Sources, indirectly affect other aspects such as land-use).

In addition, the transversal sectors (e.g. economy, land use allocation, social and population) need to be reflected in the regional energy strategy to adequately project the variables of interest toward the future. The latter could help analysing better the needs and identifying additional issues that could arise and their potential solutions. For example, a better representation of the regions' economic development, population trends (also considering migration issues), land use availability and related opportunities can foster a more accurate strategic analysis of the region. At the same time, it can allow finding better solutions adjusted to the particular state of the region.

All in all, the use of INSPIRE data could play a key role when defining the holistic framework modelling since the main sectors analysed for the Castilla y Leon region are already covered by some INSPIRE data themes.

The presented approach can help design a **pan-European modelling framework** to support any European region when developing or evaluating energy strategies.

1 Introduction

The ELISE Energy & Location Applications consist of a series of use cases aiming to show how location data can support different stakeholders engaged in the energy policies' cycle at different geographical scales, from local up to EU level.

In particular, one of the use cases, named "Supporting the design and implementation of a regional energy strategy", aimed to investigate the role that geospatial data and technologies can play to support the design, implementation and monitoring of a regional energy strategy.

The use case has been executed in three steps, as can be seen in Figure 1 below. First **(step 1, Understading the European context)**, the European context is provided, including an overview of the functioning of the EU in terms of energy competences. It also proposes an overview of public data sources potentially relevant to a regional energy strategy.

The main objective of Step 1 is to explore the context found in Europe in the field of energy. This will be analysed from two perspectives. Firstly, by focusing on the administrative structure of the countries in the energy policy field, to understand how the regional level is considered, as an intermediate level between the national and the local level. This can influence what data is required and at which level (conditioning, thus, the level of granularity required). Secondly, by analysing publicly available data sources at the EU level that can support the implementation of regional energy strategies. Due to the vast amount of data present, this document intends to present some of the most relevant data sources and covers a relevant set of categories that could potentially be used for regional energy strategies. However, it should be highlighted that this information is non-exhaustive.

Secondly **(step 2, Analysing a real case: Regional Energy Efficiency Strategy in Castilla y León region, ES)**, the Regional Energy Efficiency Strategy of Castilla y León (in Spain) case is analysed. A realistic view of the challenges and data necessities is provided after a detailed study of its context, structure and sectors, and required datasets.

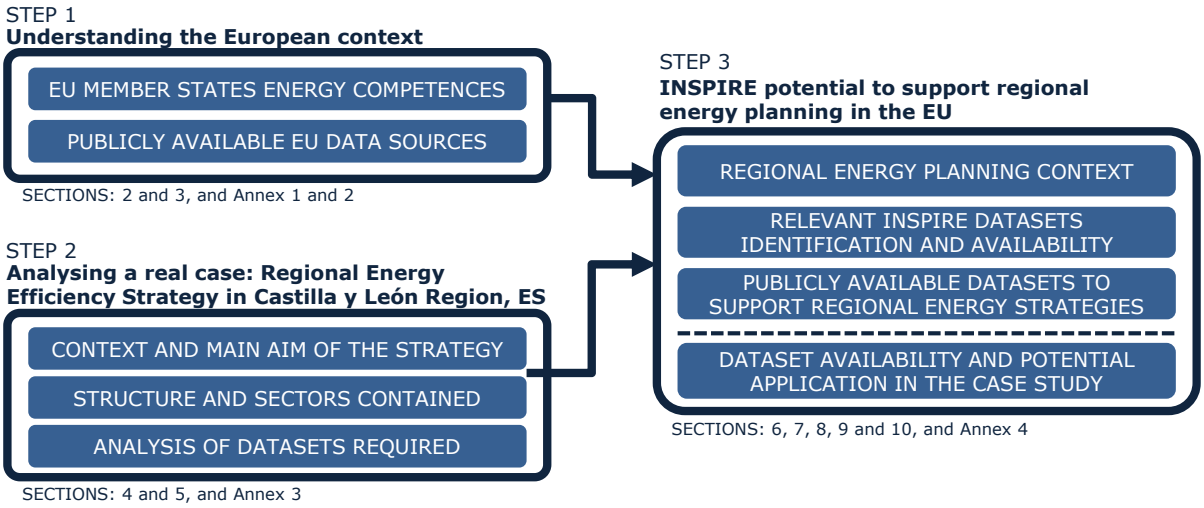
The main objective of Step 2 is to delve into the challenges of a regional energy strategy, in particular by observing their data needs. This document will focus on a real case, in particular, the Regional Energy Efficiency strategy in Castilla y León (EEE-CyL-2020) [103], developed by the Ente Regional de Castilla y León (regional energy agency in the region of Castilla y León). To this end, the region will be contextualised, and the strategy and all of the sectors it tackles will be analysed and described.

Finally, in **Step 3, INSPIRE potential to support regional energy planning in the EU**, the two previous results are combined to explore the potential that INSPIRE harmonised data holds in supporting energy planning in the EU. To this end, the regional energy planning context is reviewed, relevant INSPIRE datasets identified, and their availability presented. Also, the publicly available data sources identified in the first step will be related to the needs in regional energy strategies. To conclude, based on the availability of data in the case study of Castilla y León, a series of applications are proposed showcasing the potential of combining statistical data with georeferenced data and how can this support regional energy strategies implementation and monitoring.

The main objective of Step 3 is to propose methods/applications/combinations of datasets that can be of support for regional energy planning in the EU. In particular, a special focus is placed on deploying datasets with location-related content, and more specifically, on exploring the potential of datasets that follow the INSPIRE Directive. To this end, it is essential to understand the spatial planning context, know what INSPIRE can offer in its different themes, as well as know if other open data can be of use to regional strategies. Then, and to realistically propose some applications, the case study proposed in step 2 (the regional energy efficiency strategy of Castilla y León) will be resorted to again. In this case, an analysis of available INSPIRE datasets in this region will be presented. This will allow measuring the potential nowadays to implement a series of applications. In this line, two examples will be proposed in section 9.2, focusing on two specific sectors: buildings and transport. Finally, to incite action and actively contribute to the further generation of INSPIRE data, two other examples are presented. These are focused on datasets related to energy production sites and to statistical data that could be of support for regional energy strategy development in the Castilla y León region. However, even when this data is available, it has not been harmonised yet to INSPIRE.

All in all, the three steps intend to constitute a first glimpse of the challenges faced at the regional level and the potential of combining data sources. It must be highlighted, though, that further research is required in this domain.

Figure 1. Structure of the activities carried out in the Energy Location Applications - Regional Energy Strategy Use Case.



Source: CARTIF, own elaboration

This report is divided into several sections, classified below according to the steps shown in Figure 1:

STEP 1: Undestanding the European Context

- **Section 2** provides an overview of the division of powers in the energy field. In particular, it focuses on the Member States from the EU which have (or not) legislative competences in the energy field at the sub-national level. This is complemented by Annex 1, where exhaustive information from the Committee of the Regions is provided for each Member State analysed.
- **Section 3** focuses on the available data. In particular, it is subdivided into two additional categories (data related to numerical data sources (section 3.1) and geospatial data sources (section 3.2)) to provide a complementary vision. Moreover, to understand the scope of this dataset analysis, an identification and description of information sources are provided. Lastly, more details about Eurostat regional data is provided in Annex 2.
- **Annex 1** provides exhaustive information from the Committee of the Regions for each of the Member States analysed.
- **Annex 2** provides detailed information about Eurostat data.

STEP 2: Analysing a real case: Regional Energy Efficiency Straegy in Castilla y León region, ES

- **Section 4** will describe the context of Castilla y León region and the Energy Efficiency strategy subject of this report. In particular, the region will be characterised based on the analysis of Eurostat data, which will enable us to compare this region to the country where it is located (Spain) and also to the general average found in the EU (section 5.1). Then, the Energy Efficiency strategy of this region is presented and the process that is followed in its development.
- **Section 5** focuses on the content of the strategy by explaining how objectives are set, analysing each of the sectors covered (industrial, building, transport, public services, administrative), exploring the monitoring indicators used to track the progress of the strategy, as well as other activities and financial mechanisms deployed. Finally, the section ends by summarising the main categories of datasets used in the strategy definition (section 0). This is complemented with Annex 3, where a more detailed vision of the datasets used in the strategy per sector is provided.
- **Annex 3** complements section 5 by providing a detailed description of the datasets used in the Regional Energy Efficiency Strategy of Castilla y León.

STEP 3: INSPIRE potential to support regional energy planning in the EU

- **Section 6** will provide an overview of the challenge of integrating energy aspects with spatial planning and public land development at different scales to accelerate the energy transition, specifically focusing on supporting the regional level.
- **Section 7** presents the INSPIRE data themes of the three different annexes as an introduction to INSPIRE beginners, which is complemented by the description of each of the themes in Annex 4 and the access points to further information. In addition, this section highlights the specific themes that will be tackled in the report.
- **Section 8** is devoted to linking the publicly available datasets presented in step 1 to the sectors and challenges identified in step 2. Thus, it will contribute to initially determine whether the open datasets identified could be of use for this purpose or not. In this case, the same consideration as in the previous section should be performed: the appreciations should be seen as an initial analysis, and further research should be performed to check the usability of this data in real cases more in detail.
- **Section 9** focuses on a real-life application by delving into the challenges found in the Castilla y León region. To start with, the availability of INSPIRE datasets in the region will be observed (section 9.1). Then, two applications to support the regional energy strategy based on the availability of the data will be presented. In particular, methods in the buildings and transport sectors have been developed and applied in this region (section 9.2). Finally, to encourage data provisioning, two examples are presented in the topics of Energy Generation Sites and the use of Statistical Data (section 9.3).
- **Section 10** provides some conclusions and proposes the next steps in geospatial data and technologies supporting the regional energy policy cycle.
- **Annex 4** describes the INSPIRE data themes.

1.1 Identification and description of information sources

This section describes the main information sources that can bring vital information when designing a regional strategy, including public data sources and originated in other projects. In addition, datasets that are standardised at the European level, covering different Member States, allow providing an aligned methodology across countries and between different scales and coordinate action between European, national, and regional levels.

The Committee of the Regions plays an essential role in joining regional and local authorities across Europe, supporting the necessary multilevel governance, which translates into agreed legislation resolutions promoting further action in the EU. An explanation of the Committee of the Regions is provided (section 1.1.1), then relevant projects related to regional planning are presented (section 1.1.2), and finally, the relevant publicly available data sources are listed in section 1.1.3, which will be described in depth in section 3.

1.1.1 Committee of the Regions (CoR)

The European Committee of the Regions (CoR)[1] is the most important body in the European Union, representing local and regional authorities from cities and regions. It is formulated as a political assembly composed of 329 members and 329 alternates from all EU countries who have been elected at the local or regional level (for example, Mayors or Presidents of a region). The CoR provides cities and regions information and support on new laws that impact regions and cities, representing 70% of all EU legislation.

The EC and the council of the European union consult the CoR when any new suggestion is made in the fields of economic, social and territorial cohesion, Structural Funds, European Regional Development Fund, European Social Fund, employment and social affairs, education, youth, vocational training, culture and sport, environment, energy and climate change, transport, trans-European networks, and public health.

As a result of the coordination action between the European, national, regional and local levels, the CoR provides recommendations on draft EU laws and proposes new policies, laws and issues on the EU agenda.

The CoR can be a relevant source of information when defining a regional strategy; it provides regional planners with useful analyses and reports on potential territorial impact assessment of EU legislative proposals under the Territorial Impact Assessment (TIA) Strategy "Territorial Impact Assessment in the CoR political process". The CoR's TIA Strategy has the following main objectives:

(1) https://cor.europa.eu/en

— to enable access to relevant analysis that can be used to improve the territorial perspective of CoR opinions, to serve as an evidentiary base for its political and consultative work;

— to improve the quality of EU policymaking by ensuring that the EU institutions consider the territorial impacts of new policy proposals and existing EU legislation;

— to improve the visibility of territorial impact assessment as an important element of better legislation;

— to develop new TIA instruments in close co-operation with DG REGIO[2] and ESPON[3].

Following these objectives, the TIA strategy provides periodically reports on territorial impact assessment on different topics such as biodiversity; demographic change; energy poverty; climate neutrality; bioeconomy; place-based industrial strategy; the establishment of the European Labour Authority; the implementation of the 2030 Agenda; Energy performance of Buildings Directive; etc.

An extensive analysis is provided on the energy competences of the different member States and their multilevel governance system. This has been used, in section 2, to analyse the division of powers in the energy field. For additional information on each country in this respect, please refer to Annex 1.

1.1.2 Projects related to regional planning

This section lists a selection of projects related to regional planning that could provide relevant insight into the development of regional energy strategies. These have emerged from different funding programmes (Intelligent Energy Europe Programme, Interreg Europe or Horizon 2020), and all of them have an international dimension.

Table 1. SPECIAL project overview

Project	SPECIAL - Spatial Planning and Energy for Communities In All Landscapes
Financial programme	Intelligent Energy Europe Programme of the European union
Duration	08.03.2013 – 07.03. 2016
Objectives	The SPECIAL project aims to foster the exchange of experiences and competence building amongst national and regional town planning associations and organisations to demonstrate the integration of sustainable energy aspects into spatial planning strategies at local and regional levels. The project stimulates the improved energy-related competence of town planners working within public authorities leading to good practice examples on integrated spatial planning strategies for low carbon towns and regions. To achieve this, the partners organise training programmes, workshops, study visits not only to improve the competence of their planning organisations but also of 'multiplier networks' that represent town planners. The 'multiplier networks' will have their capacity improved to deliver spatial and energy planning competence building and training in the long term, and the town planners will receive concrete for integrating energy aspects into spatial planning strategies.
Website	http://www.special-eu.org/

Source: abovementioned website

Table 2. SET-UP project overview

Project	SET-UP - Smart Energy Transition to Upgrade Regional performance
Financial programme	Interreg Europe
Duration	01.04.2016 - 31.03.2021

(2) https://ec.europa.eu/knowledge4policy/organisation/dg-regio-dg-regional-urban-policy_en
(3) https://www.espon.eu/

Objectives	The SET-UP project's overall goal is to improve the energy performance of the six partner regions thanks to enhanced policies on smart grids. In the medium to long term, better energy demand management achieved thanks to SET-UP reduces energy consumption and greater energy security, with connected socio-environmental and economic benefits. SET-UP uses interregional exchange to build on regional competencies on smart grids, supported by selected regional policy instruments (ERDF ROP, Axis on energy / low carbon). SET-UP improves policy instruments by identifying efficient energy management tools, with a specific focus on solutions to three main challenges to smart grid deployment: — empowering consumers; — economic and business models; — Investment possibilities for smart network infrastructure.
Website	https://www.interregeurope.eu/set-up/

Source: abovementioned website

Table 3. BIO4ECO Project overview

Project	BIO4ECO - Sustainable regional bioenergy policies: a game-changer
Financial programme	Interreg Europe
Duration	01.04.2016 - 30.09.2020
Objectives	With the objective of the transition to a low carbon economy, some countries and regions in Europe are developing energy and land use policies in separate ways by different administrations. To improve the energy sector in balance with the natural resources, a challenge is to work on bridging those conflicting views and policies. BIO4ECO aims to improve regional and national policy processes and policy implementation and delivery, addressing the transition to a low carbon economy concerning renewable energy use, the energy efficiency of buildings and forest and agricultural biomass.
Website	https://www.interregeurope.eu/bio4eco/

Source: abovementioned website

Table 4. RESOR project overview

Project	RESOR - Supporting energy efficiency and renewable energy in European islands and remote regions
Financial programme	Interreg Europe
Duration	01.06.2018 - 30.11.2022
Objectives	ESOR aims to promote best practices to support energy efficiency and renewable energy use in businesses of the secondary and tertiary sectors in European islands and other remote regions. Maximising energy savings and reaching high energy efficiency levels are crucial challenges currently faced by the EU.

	The focus chosen by partners targets remote territories, which on the one hand represent less-favoured areas of Europe but which, on the other, are often well placed on employing innovative solutions and attracting energy investments. Remote regions, as those partners in the RESOR project, are characterised by a higher dependence on fossil fuels and generally less efficient energy choices and behaviours among citizens and even more among businesses, for whom investment in renewables or energy efficiency are often not a priority or financially feasible.
Website	https://www.interregeurope.eu/bio4eco/

Source: abovementioned website

Table 5. DeCarb project overview

Project	DeCarb - Supporting the clean energy transition of coal-intensive EU regions
Financial programme	Interreg Europe
Duration	01.06.2018 - 31.05.2023
Objectives	DeCarb will support public authorities to initiate efforts, join forces and exchange experiences to a) identify growth strategies to mitigate the impact of decarbonisation, b) make the most of EU funds & financing tools, and c) promote public dialogue on conflicting interests. DeCarb brings together nine partners (9 countries) to exchange experiences & transfer knowledge on how to transition from the carbon-intensive era towards the clean energy future. It cansupport regions to secure sustainable development, economic & societal stability, and a role in the 2030 energy mix.
Website	https://www.interregeurope.eu/decarb/

Source: abovementioned website

Table 6. Planheat project overview

Project	Planheat - Integrated tool for empowering public authorities in the development of sustainable plans for low carbon heating and cooling
Financial programme	Horizon 2020
Duration	01.10.2016 - 31.01.2020
Objectives	Public bodies face the lack of appropriate easy-to-use tools to support them in the definition, simulation and evaluation of suitable strategies for sustainable heating and cooling tailored to local conditions for achieving the ambitious targets set up in their local plans. In light of this, PLANHEAT main objective is to develop and demonstrate an integrated and easy-to-use tool to support local authorities (cities and regions) in selecting, simulating and comparing alternative low carbon and economically sustainable scenarios for heating and cooling that includes the integration of alternative supply solutions (from a panel of advanced key technologies for the new heating and cooling supply) that balances the forecasted demand. The PLANHEAT integrated tool was designed to support local authorities in 1) mapping the potential of locally available low carbon energy sources (with specific reference to available RES and waste energy recoverable at urban and industrial level) 2) mapping the forecasted demand for heating and cooling 3) define and simulate alternative environmentally friendly scenarios based on district heating and cooling as well as highly efficient cogeneration systems matching the forecasted demand, levering on the use of RES and waste energy sources and with proven economic viability 4) understanding

	the interactions of these new scenarios with the existing infrastructures and networks (among which district heating and cooling gas, electricity, sewage, transportation) and identify potential for further extension and upgrade of district heating and cooling networks 5) evaluate the benefits (in terms of energetic, economic and environmental KPIs) that the adoption of the new scenarios will generate against the current situation (i.e., baseline).
Website	http://www.planheat.eu/

Source: abovementioned website

Table 7. HotMaps project overview

Project	HotMaps - Heating and Cooling: Open Source Tool for Mapping and Planning of Energy Systems
Financial programme	Horizon 2020
Duration	01.10.2016 - 30.09.2020
Objectives	HotMaps developed, demonstrated and disseminated a toolbox to support public authorities, energy agencies and planners in strategic heating and cooling planning on local, regional and national levels and inline with EU policies. The toolbox facilitates the following tasks on a spatially disaggregated level: (1) Mapping heating and cooling energy situation including renewable and waste heat potentials in GIS layers; (2) Model the energy system, considering hourly matching of supply and demand, demand response etc.; (3) Supporting the comprehensive assessment of efficient heating and cooling according to the Energy Efficiency Directive; (4) Comparative assessment of supply and demand options and given scenarios until 2050 regarding e. g. CO_2-emissions, costs, share of renewables. An open data set for EU-28 was created to perform those tasks in virtually any EU region up to a 250x250m level, which reduces barriers for authorities to heating and cooling planning. HotMaps allows for updating locally available data and links to existing models. The software was developed in close cooperation with the target group within the consortium and beyond. Moreover, the toolbox was validated and demonstrated in 7 pilot areas to provide a tested and user-friendly software based on user needs.In the proposal, a strategy how to ensure the wide usability, adjustability and application of the toolbox within and beyond the project duration was presented: (1) The consortium is fully committed to the open-source idea: All EU-28 data and the source code is open and a link was established with open-source energy modelling communities; (2) Training activities were carried out, including a strategy how to continue after the project; (3) Academic partners trained students on HotMaps in their teaching activities. Their consortium included leading experts on energy planning in Europe, modelling and tool development, dissemination and various public authorities.
Website	http://www.hotmaps-project.eu/

Source: abovementioned website

Table 8. INTENSSS-PA project overview

Project	INTENSSS-PA - A systematic approach for inspiring training energy-spatial-socioeconomic sustainability to public authorities
Financial programme	Horizon 2020
Duration	01.02.2016 - 31.07.2018

Objectives	INTENSSS-PA supported public authorities to integrate the energy theme into spatial planning and regional physical and socioeconomic landscapes. To achieve this objective INTENSS-PA provided human and institutional capacity building to public authorities and the wider network of private and public actors related to energy and regional planning by implementing the Living Lab concept, i.e. an innovative environment of co-creation. Specifically, a network of seven Regional Living Labs (RLL) within the seven different Countries/Regions that participated in the consortium (Thessaly-Greece, Calabria-Italy, Castilla y Leon- Spain, Association of Municipalities-Slovenia, Groningen-Netherlands, Triangle-Denmark and Zemgale-Latvia), was created. Involving public authorities, private and civil society actors, the RLLs were focused on improving and designing a shared and integrated sustainable energy planning concept and applying it to develop seven sustainable energy plans, i.e. one for each Region. The overall approach will involve learning sessions and experiential projects alongside intense networking. Communication and exploitation activities were envisaged, including national Roadshows and a survey with policy makers. It was expected that over 200 people participate in the capacity-building activities performed within the RLLs network, while the stakeholders and policy makers informed on the project results and activities was expected to exceed the 1000 individuals. The project objectives are completely in line with topic EE07's scope since they consider innovative capacity building activities to public authorities for integrated energy planning through the establishment of a network of RLLs, i.e. of an ecosystem that stakeholders bring their own specific wealth of knowledge and expertise to the collective, helping to achieve boundary-spanning knowledge transfer. Special consideration will be provided on planning requirements deriving from the 27/2012/EU Directive.
Website	http://www.intensssspa.eu/

Source: abovementioned website

Table 9. SIMPLA-A project overview

Project	SIMPLA - A systematic approach for inspiring training energy-spatial-socioeconomic sustainability to public authorities
Financial programme	Horizon 2020
Duration	01.02.2016 - 31.01.2019
Objectives	SIMPLA ultimate goal is empowering public authorities to develop, implement and finance sustainable energy policies and actions by creating the conditions for a smart integration between SEAPs (Sustainable Energy Action Plans) and SUMPs (Sustainable Urban Mobility Plans) - or similar plans - in cities, towns and their aggregations with a population between 50.000 and 350.000 inhabitants. SIMPLA's work-plan focused on the establishment of a network of National Focal Points (NFPs) in 6 countries (expanding to further 12 through replication actions), merging technical expertise, methodological know-how and institutional capacity of technical partners and public authorities. The NFPs realized an ambitious, innovative work-plan, encompassing capacity building and coaching (on-site and via the web), enhancement of multilevel governance looking for synergies and economies of scale, extensive involvement of public authorities and stakeholders, promotion of mutual learning and best practices. EU added value (involving countries and areas with different levels of tradition in integrated multi-sector planning) and capitalisation of previous EU-funded initiatives are among the project's guiding principles. SIMPLA contributed to the EU's energy and climate targets for 2020 and beyond, reducing GHG emissions, increasing the share from RES and improving energy efficiency, focusing

	upon sectors with high energy-saving potential (primarily buildings, renewables for electricity production, urban freight transport and passengers' mobility). The intensive exploitation of existing networks to promote and support the implementation of project activities in the framework of a sound and comprehensive promotion and dissemination plan helped guarantee a consistent and significant impact on a wide, relevant and varied audience.
Website	http://www.simpla-project.eu/

Source: abovementioned website

Table 10. C-Track 50 project overview

Project	C-Track 50 - Putting regions on track for carbon neutrality by 2050
Financial programme	Horizon 2020
Duration	01.03.2018 - 28.02.2021
Objectives	The project aimed to mobilize and guide public authorities in defining long-term energy policy priorities, promoting multilevel governance, and supporting regional and local authorities in developing, financing and implementing ambitious integrated sustainable energy and climate policy action plans to achieve climate resilience and carbon neutrality by 2050. This will be achieved through: — Facilitation of the vertical and horizontal multilevel governance cooperation in eleven European countries. — Identification of strategic policy priorities at a national level, fostering multilevel governance to capitalise on synergies and economies of scale for implementing energy efficiency and renewable energy actions. — Capacity building at local/regional level. — Development of at least 116 sustainable energy and climate policy action plans for 2050 at the local and regional level. — Development of at least 105 funding proposals for implementing sustainable energy and climate actions/projects. — Targeted promotion of the concept of carbon neutrality to at least 50,000 relevant stakeholders across Europe. Support EU policies and initiatives, such as the Global Covenant of Mayors on Energy and Climate. C-TRACK 50 is expected to contribute considerably towards achieving the 2030 and 2050 EU energy and climate targets.
Website	http://www.c-track50.eu/

Source: abovementioned website

Table 11. ENERGee Watch project overview

Project	ENERGee Watch - The European Network of Regional GhG Emissions and Energy Watch
Financial programme	Horizon 2020
Duration	01.09.2020 - 31.08.2023
Objectives	The overall aim of ENERGee Watch is to enable peer to peer learning for regional and local authorities to precisely define, monitor and verify their sustainable energy and climate

	actions. Its main targets are associations and networks of cities and regions, and the learning process will be focused on how different sustainable energy and climate mitigation projects have been monitored and evaluated. Primarily, we will build on existing platforms and needs assessment surveys to perform a needs assessment and gaps identification with public bodies for learning and match these needs with available best practices. Then, public authorities and their associations and agencies will be selected and matched with one of the seven mentors who are all partners of ENERGee Watch. The learning program will be divided into four modules that include: i) data collection, ii) monitoring and verification, iii) indicators for adaption to climate change, iv) data display, dissemination and validation by final users (local authorities).
Website	https://energee-watch.eu/#

Source: abovementioned website

Table 12. INNOPATHS project overview

Project	INNOPATHS –Innovation pathways, strategies and policies for the Low-Carbon Transition in Europe
Financial programme	Horizon 2020
Duration	01.02.2016 - 31.07.2021
Objectives	INNOPATHS (Innovation Pathways, Strategies and Policies for the Low-Carbon Transition in Europe) is a research project which aims to work with key economic and societal actors to generate new, state-of-the-art low-carbon pathways for the European Union. First, it will do this by assessing the anatomy of existing scenario and pathway studies for the low-carbon transition from technical, economic, and social perspectives. The innovation systems and policy landscapes for key energy-using sectors of the economy will also be examined. The insights from this process will feed into the structure of new low-carbon pathways, 'co-designed' with a wide range of stakeholders from government, industry, academia and civil society. These scenarios will then be quantitatively and qualitatively assessed for their technical, economic and social outcomes. INNOPATHS will assess how the benefits of these pathways, such as new industries, jobs and competitiveness, may be maximised, and how any negative impacts, such as those on low-income households, or carbon-intensive sectors, may be mitigated. Detailed outputs from the project will be disseminated through four interactive 'online tools', providing decision-makers and other stakeholders with a vital resource for continuing analysis.
Website	https://innopaths.eu/

Source: abovementioned website

1.1.3 Publicly available data sources

This section is centered on the publicly available data sources that can support the design, implementation and monitoring of regional energy strategies. It focuses on the availability of data of different sectors (land, industry, agriculture, energy, buildings, etc.) at the **European level** to examine the data analysis potential of European regions. In addition, the existence of common data can enable the alignment between the strategies from different Member States, allowing better to measure the progress towards the achievement of energy EU objectives, as explicited in the Energy Peformance of Buildings Directive (EPBD), Energy Efficiency Directive (EED), or Renewable Energy Directive (RED). Thus, it is fundamental to identify international data sources that allow the development of a standardised pan-EU dataset, where possible, based on open data.

Evidently, not only international data sources are helpful when dealing with regional strategies, but also specific local and regional data sources. As shown in the analysis of the regional energy strategy in Castilla y León (step 2 of Figure 1), there are vast amounts of data used in its design and implementation, which are generated only at the regional level.

Bearing all of these aspects into consideration, Table 13 provides an overview of the data sources analysed in this report. As it can be seen, data can be of different types: e.g. statistical data (Eurostat, FAOstat, EEA…), geographical information (NUTS classification), maps (OpenStreetMaps), etc. The different data sources are described in detail in Section 3.

Table 13. Overview of data sources analysed

	Data category	Data source	Description
NUMERIAL DATA	General statistical data	EUROSTAT	The most common data source for statistical data in the EU covering a great variety of topics. In particular, this report will focus on those datasets that have a geographical component attached: those related to NUTS levels. NUTS classification defines a classification of regions in Europe based on different population thresholds. The sizes of the NUTS are different for each region and are used to develop statistical data [4].
		FAOSTAT	FAO (Food and Agriculture Organization of the United Nations) database, containing food and agriculture data from different world countries.
		EEA (European Environment Agency)	Data related to environmental issues (policy, topics related to the environment). The main topics are climate, nature, sustainability and well-being, and economic sectors (agriculture, energy, industry…).
		IEA (International Energy Agency)	Agency with global impact, whose main objective is to secure a sustainable energy future for all. Among the areas of work is developing a database collecting data and statistics related to energy from more than 100 countries.
		ESPON Database and Data Navigator	The ESPON Data Navigator covers regional statistical data sources for 28 EU Member States plus Iceland, Liechtenstein, Norway and Switzerland. It also provides the contact details of 41 National Statistical Offices and 41 Geographic Institutes.
	Urban and regional data	Urban Data Platform Plus (UDPplus)	The UDPplus is an initiative developed by the Joint Research Centre and the Directorate General for Regional and Urban Policy (DG REGIO), providing information on their status and trends to support urban and territorial strategies development.
		Census Data	The Census database was developed by the European Statistical System (ESS) for better dissemination of the results of the Population and Housing Censuses in Europe, providing users with easy access to detailed census data that are structured in the same way and methodologically comparable between countries
		Covenant of Mayors data	Sustainable Energy and Climate Action Plans generated by the signatories of the Covenant of Mayor's initiative.

			Baseline Emission Inventory and a Risk and Vulnerability Assessment are provided.
	Building Stock Data	TABULA / EPISCOPE	The TABULA / EPISCOPE projects (coordinated by IWU) have generated a typology analysis of the building stock in selected countries and provide highly relevant information on their characteristics, energy systems or potential energy conservation measures to apply. This is provided to the user through a web tool.
		ENTRANZE	The ENTRANZE project (Intelligent Europe), to actively support policy making towards achieving a strong penetration of nZEB and RES-H/C, provides a data tool with an in-depth analysis of the structure and dynamics of buildings and related energy systems in EU-17, Croatia and Serbia; and scenario results of the development of the building stock and its energy demand for nine target countries and the EU-28 up to 2030.
		Building Stock Observatory	Established in 2016 as part of the Clean Energy for all Europeans package [1], it aims to provide a better understanding of the energy performance of buildings through reliable, consistent and comparable data. To this end, it provides a database with 250 indicators, a data mapper as an online tool and factsheets per country.
		DEEP database	DEEP is an open-source database to enlarge the European energy efficiency investment by providing a detailed analysis of existing projects in buildings and industries across Europe.
		ODYSEE / MURE	ODYSEE and MURE initiatives are open databases that provide information on energy efficiency indicators and energy consumption by end-use and energy efficiency policies and measures by country.
MAPS & GEO DATA	Copernicus data	Copernicus is the Earth Observation Programme of the EU that offers free and open access to Earth Observation (EO) and other related data. Copernicus Programme has six main services: atmosphere monitoring, marine environment monitoring, land monitoring, climate change, emergency monitoring and security.	
	OpenStreetMap	OpenStreetMap (OSM) is a collaborative and open-source database to develop a set of maps that can be used (for the purpose of the research presented in this report) to complement the data provided by public administrations such as Cadastre buildings, roads or railways.	

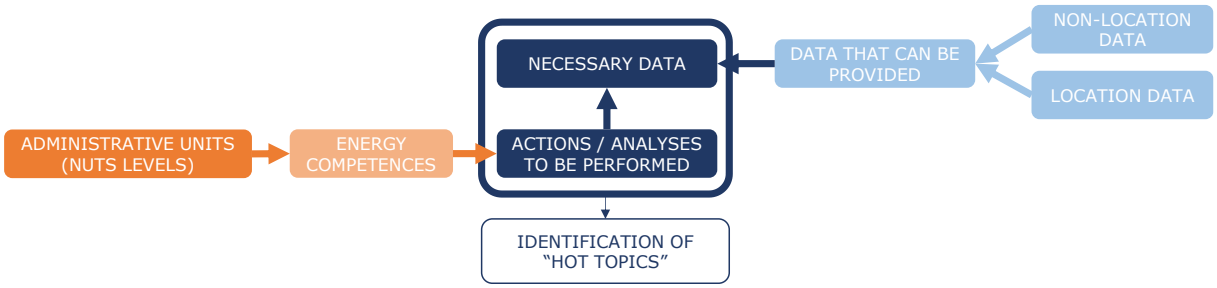
Source: own elaboration

2 Division of powers in the energy field

This section analyses the division of powers in the energy field in the EU is, with the final objective of determining how energy strategies are conceived, legislated, and implemented. The different enforcement levels this division of powers entails will influence the type of data required by each administration and its level of detail.

The analysis is aligned with the general objective of the use case (as specified in section 1), i.e. finding methods to support regional energy strategies.. The final analysis of what data can be used to support regional energy strategies will be presented in the last sections of the report]. The following figure depicts this approach.

Figure 2. Schema on how administrative levels have an impact on the necessary data



Source: CARTIF, own elaboration

As it can be seen in the figure above, the Member States and their corresponding sub-division levels are considered different **Administrative Units**. These will always be considered linked to geographical reference and spatial boundaries, which the NUTS levels will represent (see section 3.1.1.1 for more information). This link is initially thought to facilitate the combination of **data that can be provided** further in this research, which can be **non-location data** (statistical data or other which is not directly linked to a geographical representation) or **location data** (coming from INSPIRE or other sources).

The different Administrative Units will have to comply with their specific **energy competences**, which will determine the type of **actions / analyses to be performed** that each Administrative Unit has to undergo. To this end, they will require **necessary data**, which should be matched with the **data that can be provided**.

An in-depth analysis of the Energy Competences in all EU Member States to determine the Actions and Analyses to be Performed, and the consequent Necessary data required, would be ideal to ensure the adequate analysis of the data needed, and thus provide specific recommendations to support energy strategies at regional and national level by identifying specific data gaps. However, in this approach, a specific Regional Energy Strategy (Castilla y León Regional Energy Strategy 2016-2020) is currently being analysed, and specific knowledge of its content and implementation difficulties will be diagnosed (refer to sections 7, 8, 9 and 10 of this report); specific data gaps will be identified this way. As a result, the current analysis of the division of powers in the energy field present in this report will serve as an initial test to check if the proposed approach could be replicable in the EU Member States. The data used for this analysis is extracted from the Committee of the Regions website (see section 1.1.1 for further reference).

The Committee of the Regions provides information on the energy competences at different levels of Member States [2]. In particular, it classifies the countries into two main categories: those who have legislative powers (in energy matters) at the sub-national level and those who do not fall within EU27 countries. In addition, there is information available on candidate countries, potential candidates, eastern partnership countries, and southern neighbourhood area countries. For each of them, the competences at each level, the authorities in charge, and responsible ministries /bodies are depicted. To identify the countries covered in the Committee of the Regions, the following summary 0 is provided:

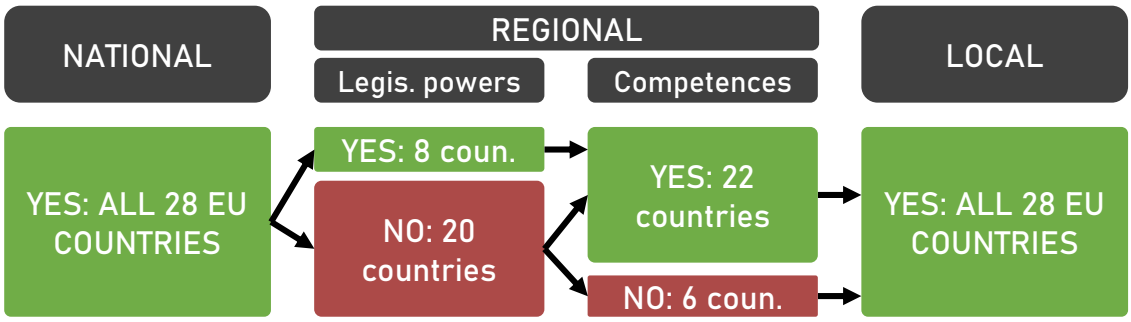
Table 14. Countries covered in the energy competences description of the Committee of the Regions

State's category	Countries considered
Member states with legislative powers at the sub-national level	Austria (AT), Belgium (BE), Finland (FI), Germany (DE), Italy (IT), Portugal (PT), Spain (ES).
Member states without legislative powers at the sub-national level	Bulgaria (BG), Croatia (HR), Cyprus (CY), Czech Republic (CZ), Denmark (DK), Estonia (EE), France (FR), Greece (EL), Hungary (HU), Ireland (IE), Latvia (LV), Lithuania (LT), Luxembourg (LU), Malta (MT), Poland (PL), Romania (RO), Slovakia (SK), Slovenia (SL), Sweden (SE), The Netherlands (NL).
Candidate countries	Montenegro (ME), Serbia (RS), North Macedonia (MK), Turkey (TR), Albania (AL).
Potential candidates	Bosnia and Herzegovina (BA), Kosovo.
Eastern partnership countries	Armenia (AM), Azerbaijan (AZ), Belarus (BY), Georgia (GE), Moldova (MD), Ukraine (UA).
Southern neighbourhood area candidates	Algeria (DZ), Egypt (EG), Israel (IL), Jordan (JO), Lebanon (LB), Libya (LY), Mauritania (MR), Morocco (MA), Palestine (PS), Syria (SY), Tunisia (TN).
Other countries	Iceland (IS), United Kingdom (UK).

Source: CARTIF, own elaboration based on information of the Committee of the Regions

The analyses have focused on the first two groups: the Member States with legislative powers at the sub-national level and without them. In particular, more detailed information on the data categories mentioned above of these two groups of countries can be found in Annex I. According to analyses performed on Committee of the Regions data of the EU28[4], there are eight countries with legislative powers at the sub-national level, whereas the rest of the countries do not count on this privilege. However, from the latter, there are 14 in which the regional level holds energy competences (+8 with legislative powers). Finally, all of the countries have energy competences at the local level to be deployed through the municipalities, as it can be seen in the following Figure 3.

Figure 3. Summary of EU Member States competences at different levels



Source: CARTIF, own elaboration based on information of the Committee of the Regions

This varied panorama in Europe suggests the adequacy of proposing methods and counting on data that decision-makers can homogeneously use at these different scales, which can be aggregated and disaggregated at different scales in a robust manner. This would contribute to more easily transpose objectives established in policies at higher levels to the lower levels and reporting and monitoring the implementation of energy actions at different scales.

[4] It should be noted that the analysis was performed before the Brexit.

3 In-depth analysis of public data sources

In this section, a detailed description of the public data sources analysed is provided, distinguishing between two main categories: "Numerical data sources", mainly providing statistical data, (section 3.1) and "Geospatial data sources", represented by Copernicus and OpenStreetMap (section 3.2). Public data sources are analysed over private ones in order to assure that consistent support can be offered by these sources throughout the EU, in contrast to private sources, which could cover only certain geographical areas and be available only under specific conditions.

3.1 Non-geospatial data sources

This category includes statistical data and various types of indicators:

- **General statistical data** (section 3.1.1): where statistical data related to different fields is depicted. It is worth noting that whereas all other data sources offer data at the national level, EUROSTAT is the only one offering a higher level of granularity, providing also regional/local statistics at different NUTS levels.
- **Urban and regional data** (section 3.1.2): even when urban and regional data can be expressed also as general statistical data, a specific focus is placed in this scale, due to its direct relationship to the development of Regional Energy Strategies.
- **Building stock data** (section 3.1.3): following the same reasoning as before, the characterization of the building stock is of high importance for the diagnosis of the current status of a region in energy terms, and, thus, of the utmost importance for regional energy strategy development.

3.1.1 General statistical data

This sub-section is devoted to presenting data sources that provide general statistical data on specific topics both at the European and global level. In this line, the descriptions will cover the following sources:

- **Eurostat** (section 3.1.1.1), the statistical office of the European Union, as the general knowledge access point to a varied set of themes. Special focus will be placed on those statistics which have a location component and are related to NUTS (Nomenclature of territorial units for statistics) levels, which are provided at a higher granularity than country level and are for some indicators reported even at province level (NUTS3).
- **FAOSTAT** (section 3.1.1.2), Food and Agriculture Organization of the United Nations, provides data on the food and the agriculture sector of 245 countries.
- **EEA** (section 3.1.1.3), the European Environment Agency, provides data related to the environment, supporting the implementation of environmental policies.
- **IEA** (section 3.1.1.4), the International Energy Agency contributes to shaping a secure and sustainable energy future for all by providing analysis, data and policy recommendations in energy sustainability.
- **ESPON programme**: co-financed by the European Regional Development Fund, this programme aims at promoting and fostering a European Territorial dimension. In terms of data provision, ESPON Database [section 3.1.1.5] and ESPON Data Navigator [section 3.1.1.6] will be presented.

Firstly, these data sources have been selected because of being provided by official institutions in each of their corresponding domains to support the reliance on official statistics and evaluate the scope of the data provided. Secondly, as it can be seen, these data sources cover different domains that characterise an area from different perspectives, and not only an energy one, since this holistic view is necessary for the development of regional energy strategies.

3.1.1.1 Eurostat

Eurostat is the statistical office of the European Union. It provides high quality and data on Europe. Statistics are produced in partnership with the National Statistical Institutes and other national authorities of the European Union member States. This partnership is known as the European Statistical System (ESS). In addition, Eurostat includes the statistical authorities of the European Economic Area countries and Switzerland.

For this report, four aspects with respect to EUROSTAT will be presented in the following sub-sections in more depth: (1) Eurostat database (where all Eurostat statistics can be accessed), (2) Eurostat data related to NUTS

classification, (3) Statistical Atlas and (4) Regions and Cities Illustrated. More details about Eurostat data are provided in Annex 2.

3.1.1.1.1 Eurostat database

The Eurostat database provides access to the full range of publicly available data at Eurostat. The figure below shows a way to navigate this data through the data navigation trees. This way, the user can access the multi-dimensional tables provided with various selection features and export formats.

Figure 4. Eurostat Database homepage

Source: EUROSTAT [3]

As it can be seen, apart from individual queries for each indicator, bulk downloads are also facilitated. The following data categories can be accessed following this navigation tree:

Table 15. Data categories in EUROSTAT database

Data categories in EUROSTAT database	
Database by themes*	— General and regional statistics — Economy and finance — Population and social conditions — Industry, trade and services — Agriculture, forestry and fisheries — International trade in goods — Transport — Environment and energy — Science, technology, digital society *The themes in these two access points are the same
Tables by themes*	
Tables on EU Policy	— Macroeconomic imbalance procedure indicators — Euro indicators / PEEIs — Europe 2020 indicators — Circular economy indicators — Sustainable development indicators — Employment and social policy indicators — European pillar of social rights (EPSR)
Cross-cutting topics	— Quality of life — Migrant integration and children in migration — Economic globalisation indicators — Equality (age and gender) — Quality of employment — Agri-environmental indicators — Climate change — Skills-related statistics
New items (sorted by code)	These two links depend on the new data introduced into EUROSTAT.
Recently updated items (sorted by code)	

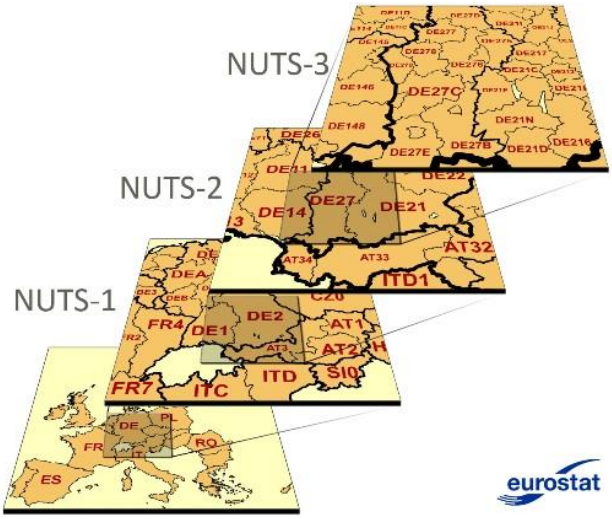
Source: EUROSTAT

3.1.1.1.2 Eurostat data related to NUTS classification

Especially interesting within the data provided by Eurostat are those datasets that have a location component and hold a higher degree of granularity since they refer to a smaller unit than a country. These data are related to NUTS levels (Nomenclature of territorial units for statistics) and provide statistical data in the following levels (as per Figure 5 below):

- NUTS-1: major socio-economic regions
- NUTS-2: basic regions for the application of regional policies
- NUTS-3: small regions for specific diagnoses

Figure 5. NUTS classification according to EUROSTAT



Source: EUROSTAT

The NUTS classification is based on three main principles and thresholds: population, favour administrative divisions and, regular and extraordinary amendments.

Considering these principles and thresholds, the NUTS regulation defines the minimum and maximum population threshold for the size of the NUTS regions. These thresholds are presented in Table 16. Considering the administrative levels of the NUTS, it is sufficient if the average size of the corresponding region is included in the thresholds. In case of a region that is not adjusted to an administrative level, the previous criteria are also mandatory. This principle tries to ensure that regions have a comparable size at the same NUTS level, but some exceptions exist.

Table 16. Population threshold for each NUTS region

Level	Minimum	Maximum
NUTS1	3000000	7000000
NUTS2	800000	3000000
NUTS3	150000	800000

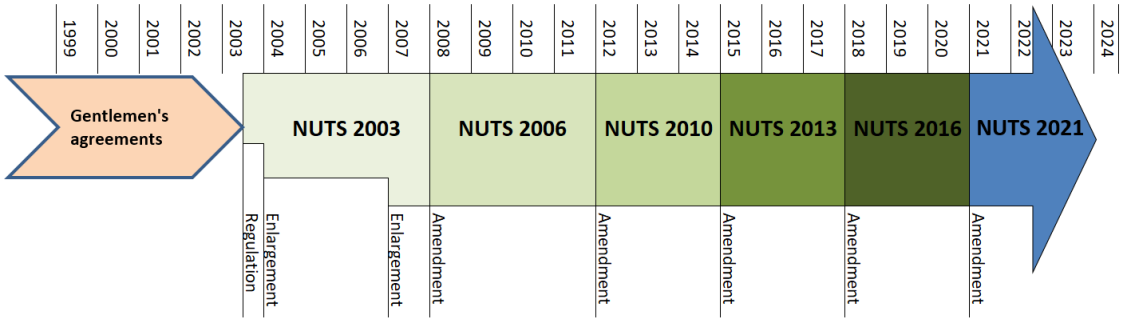
Source: Eurostat. NUTS-Nomenclature of Territorial Units for Statistics [4]

In addition, NUTS classification is generally adjusted to the territorial administrative division of the Member States. This supports the availability of data and the implementation capacity of policy.

Finally, the NUTS classification can be amended. The amendments are usually based on changes in the territorial structure in one or more Member States. The amendments are developed with a frequency of not more than every three years, but in case of a substantial reorganisation of the administrative structure of a Member State, amendments to the NUTS may be adopted at intervals of less than three years.

These amendments are established in a NUTS Regulation that specifies the stability of the classification for at least three years. Stability makes sure that data refers to the same regional unit for a certain period that is crucial for statistics. However, changes could happen according to national interests that require changing the regional breakdown of a country. To achieve the change in NUTS boundary, the country needs to inform the EC about the changes. The amendment to the classification will be developed at the end of the stability period according to the rules of the NUTS Regulation. Figure 6 presents the amendments periods to the different NUTS versions. The different NUTS versions cover the following periods: 1995-1999, 1999-2003, 2003-2006, 2006-2010, 2010-2013, 2013-2016, 2016-2021 and 2021 to the future amendment.

Figure 6. Timeline with amendments and different NUTS versions



Source: Eurostat. NUTS-Nomenclature of Territorial Units for Statistics [4]

It is worth highlighting that to be able to deal with the variations in the NUTS proposed in the abovementioned timeline; the Joint Research Centre has generated an open, web-based tool that enables the conversion of European regional statistical data between different versions of the Nomenclature of Territorial Units for Statistics [5]. In particular, it converts statistical data reported at various regional levels in the 2006, 2010, 2013 and 2016 versions for regions in EU + EFTA + UK. It accepts numerical data expressed as absolute or relative values and input formats (csv, xls, xlsx, odt or json), and it automatically detects the NUTS version of input data.

The datasets that are discoverable in Eurostat by NUTS classification are the following:

Table 17. Regional statistics by NUTS classification

Regional statistics by NUTS classification (reg)	
— Area by NUTS 3 region (reg_area3)	— Regional tourism statistics (reg_tour)
— Regional agriculture statistics (reg_agr)	— Regional transport statistics (reg_tran)
— Regional economic accounts (reg_eco10)	— Regional labour costs statistics (reg_lcs)
— Regional education statistics (reg_educ)	— Regional digital economy and society (reg_isoc)
— Regional science and technology statistics (reg_sct)	— Regional environmental and energy statistics (reg_env)
— Regional structural business statistics (reg_sbs)	— Regional poverty ad social exclusion statistics (reg_ilc)
— Regional business demography (reg_bd)	— Regional crime statistics (reg_crim)
— Regional health statistics (reg_hlth)	

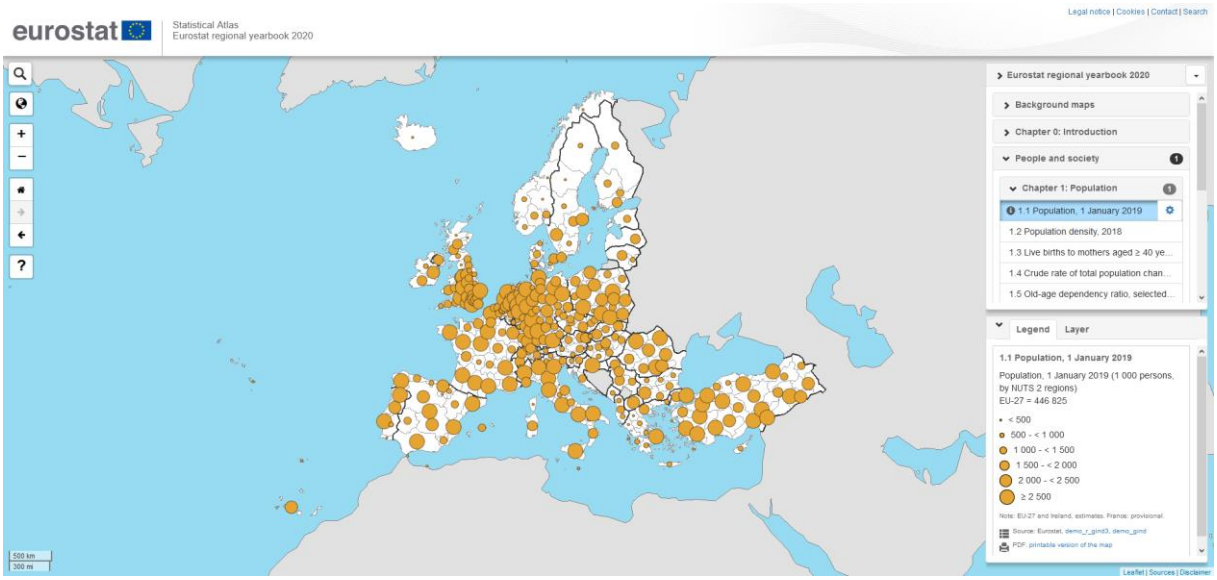
Source: EUROSTAT [6]

3.1.1.1.3 Statistical Atlas

The Statistical Atlas is an interactive map viewer [7] for statistical and topographical maps. The user can access and combine geographical information from different "base maps" based on the boundaries of the NUTS regions

or cities, with information from statistical maps. The statistical Atlas (Figure 7) contains the maps from the Eurostat regional yearbook and provides the user with various functionalities such as zooming, changing the transparency of the map layers and retrieving the code, geographical label and statistical data of specific regions and cities covering different NUTS levels.

Figure 7. Interactive map viewer of the Statistical Atlas

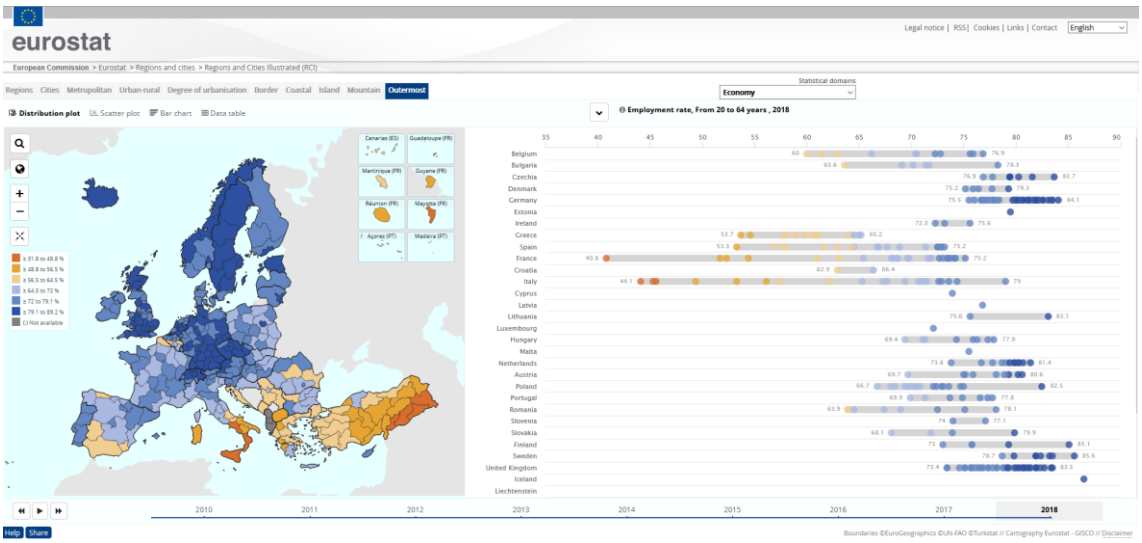


Source: Eurostat, Statistical Atlas [7]

3.1.1.1.4 Regions and Cities Illustrated

Regions and Cities Illustrated provides an interactive map and statistical information visualiser that highlights specific regional and territorial aspects at the European level. The visualiser (Figure 8) is available at [8] and help us to analyse changing patterns and the impacts of policy decisions on our daily life. It includes a vast range of statistical data where outermost regions are also included.

Figure 8. Interactive map viewer of the Regions and Cities Illustrated (RCI).



Source: Eurostat, Regions and Cities Illustrated (RCI) [8]

3.1.1.2 FAOSTAT

FAOSTAT is the fundamental database of FAO (Food and Agriculture Organization of the United Nations). It provides information about the food and agriculture sector covering 245 countries and includes information from 1961 to the most recent year. The information can be obtained at different levels: world, regions of the world (Africa, Americas, Asia, Europe and Oceania), and also at country level. The level of aggregation of the data and the years with information vary depending on the availability of the specific data of interest.

The following table summarises the main sectors and themes that the database [9] provides. Concerning each theme, it is possible to find different "elements/items" or indicators. For example, in "Crops", information related to "Area harvested", "Yield", and "Production Quantity" can be found. It is necessary to choose the item of interest that would by the type of crop (disaggregated: almonds, apples, apricots, etc., or aggregated: cereals, fruit primary, oil crops, etc.). The list of themes is the following:

Table 18. FAOSTAT database: themes covered

FAOSTAT database		
Domains	Subdomains	
Production	— Crops — Crops processed — Live Animals — Livestock Primary	— Livestock Processed — Production Indices — Value of Agricultural Production
Investment	— Machinery — Machinery Archive — Government Expenditure — Credit to Agriculture	— Development Flows to Agriculture — Foreign Direct Investment (FDI) — Country Investment Statistics Profile
Trade	— Crops and livestock products — Live animals	— Detailed trade matrix — Trade Indices
Macro-Statistics	— Capital Stock	— Macro Indicators
Food Balance	— New Food Balances — Food Balances (old methodology and population) — Commodity Balances - Crops Primary Equivalent	— Commodity Balances - Livestock and Fish Primary Equivalent — Food Supply - Crops Primary Equivalent — Food Supply - Livestock and Fish Primary Equivalent
Agri-Environmental Indicators	— Fertilizers indicators — Land use indicators — Land Cover — Livestock Patterns — Livestock Manure	— Pesticides indicators — Emissions shares — Emissions intensities — Temperature change
Food Security	— Indicators from Household Surveys (gender, area, socioeconomics)	— Suite of Food Security Indicators

Prices	— Producer Prices — Producer Prices (old series) — Consumer Price Indices	— Deflators — Exchange rates - Annual
Emissions-Agriculture	— Agriculture Total — Enteric Fermentation — Manure Management — Rice Cultivation — Synthetic Fertilizers — Manure applied to Soils	— Manure left on Pasture — Crop Residues — Cultivation of Organic Soils — Burning - Savanna — Burning - Crop Residues — Energy Use
Emissions- Land Use	— Land Use Total — Forest Land — Cropland	— Grassland — Burning - Biomass
Inputs	— Fertilizers by Nutrient — Fertilizers by Product — Fertilizers archive — Pesticides Use	— Pesticides Trade — Land Use — Employment Indicators
Population	— Annual population	
Forestry	— Forestry Production and Trade	— Forestry Trade Flows
ASTI R&D Indicators	— ASTI-Researchers	— ASTI-Expenditures
Emergency Response	— Food Aid Shipments (WFP)	

Source: FAOSTAT database [9]

Finally, FAO also provides information about specific SDGs (Sustainable Development Goals) [10] indicators related to food, hunger, gender equality, fishing, water and land. In addition, it has other parallel databases of interest, such as Aquastat (water resources and management) [11], FPMA (food prices) [12], FRA (Global Forest Resources) [13], or Fishstat (fishery and aquaculture) [14].

3.1.1.3 EEA (European Environment Agency)

The European Environment Agency, focuses on providing data related to environmental policies and other topics related to the environment taking advantage of its extensive network. The main task or objectives of the EEA is to provide information and integrate environmental issues in policies (such as economic policies): integrated environmental assessments to reach sustainability.

In addition, EEA coordinates Eionet (The European environment information and observation network) [15]. Eionet is coordinated via the national focal points (NFPs): national environment agencies, environment ministries… Eionet objectives are: institutional cooperation across levels (national, regional, EU, international), agreed common content (data, information, indicators, analysis), shared infrastructure (standards, tools).

The topics and subtopics covered in the database [16] are included in the following table. As can be seen in the topics, they are varied (from economic sectors like transport, up to policy instruments. However, the common transversal topic is the environment, being this the approach on which the analyses are based. Based on the topics listed in the following table, the data in the EEA database can be filtered[16]:

Table 19. Topics and subtopics covered in the EEA database

EEA database		
Domains of the data	Topics	Themes covered
Air and climate	— Air pollution — Climate change adaptation — Climate change mitigation	— Air quality: sources, COVID-19, concentrations, index, management, air pollution data, health impacts, and urban air quality — Climate-ADAPT, impacts, vulnerability and risks, policies and actions — EU greenhouse gas inventory, financing EU´s low carbon, climate-resilient future, ozone-depleting substances and climate change, policies and measures, trends and projections in EU.
Nature	— Biodiversity — Ecosystems — Land use — Soil — Water and marine environment	— Introduction to habitats, species, habitat types and protected sites across Europe (EUNIS), forests, green infrastructure, Mapping Europe's ecosystems (MAES), Protected Areas, State of Nature in the EU, The Natura 2000 protected areas network. — Analytical assessment framework, land cover country factsheets. — Contamination from local sources, soil and climate change. — Europe's seas and coasts and European freshwater.
Sustainability and well-being	— Environment and health — Policy instruments — Resource efficiency and waste — Sustainability transitions	— Chemicals, human biomonitoring, noise. — European environmental policies, evaluation of their effectiveness, — Resource efficiency, waste management, and waste prevention. — Global megatrends and planetary boundaries, state of the Environment reporting in Europe, urban environment.
Economic sectors	— Agriculture — Energy — Industry — Transport	— Greening agricultural policy — Renewable energy — Industrial pollution country profiles — Electric vehicles, heavy-duty vehicles, speed limits, fuel consumption and air pollution, transport and Environment Reporting Mechanism (TERM), vehicles taxation

Source: EEA database [16]

3.1.1.4 IEA (International Energy Agency)

The IEA (International Energy Agency) [17] primary objective is to “shape a secure and sustainable energy future for all”. This agency is international (global impact) and provides analysis, data, policy recommendations, and solutions to energy sustainability. For this purpose, the IEA collaborates with governments and industry.

The IEA was born to design a response to disruptions related to the supply of oil, being this an objective that remains, but also covering now the rest of types of fuel and technologies, including renewables, oil, gas, coal

supply/demand, energy efficiency, clean energy technologies, electricity systems and markets, access to energy, demand-side management, etc.

In particular, the areas of work of IEA are the following:

- Promoting energy efficiency: it advises the governments to improve and to measure the effectiveness of efficiency policies.
- Ensuring energy security: the objectives are to ensure that the markets have energy assured and improve system resilience.
- International collaborations: organisations, forums, in the field of energy. It includes organisations such as the Clean Energy Ministerial (CEM), active role in energy discussions (e.g. within the International Energy Forum (IEF)), adviser in the Conference of Parties (COP), collaborating with statistical offices such as EUROSTAT, or regional organisations such as the African Union (AU).
- Data and statistics: from more than 100 countries (monthly or annual basis)
- Training: training activities covering modelling, technology, energy efficiency and renewable policies.
- Technology collaboration: partnership with international public and private research.
- Global engagement: international cooperation.
- Industry engagement: shaping policies in real-world (investments, actions, etc.)

In relation to the data, the covered energy categories are coal, electricity, natural gas, oils, renewables, and waste. On the other hand, the different topics[5] and data services[6] that the International Energy Agency cover are the following:

Table 20. IEA database (data and statistics topics, and data services)

IEA database		
Data and statistics: Energy topics	— Key indicators — Energy supply — Energy consumption — Imports/exports — Coal — Natural gas — Oil — Renewables and waste	— Electricity and heat — Nuclear — CO_2 emissions — Efficiency indicators — Prices — Sustainable Development Goals — Energy transition indicators
Data services	— Statistics package — World energy balances and statistics — Oil statistics — Natural gas statistics — Coal statistics — Electricity statistics	— Renewables statistics — Energy efficiency statistics — CO_2 emissions statistics — Prices and taxes — Energy technology RD&D — Energy policies data

Source: IEA database [17]

5 IEA database: data filtered by topics: https://www.iea.org/data-and-statistics/?country=WORLD&fuel=Energy%20supply&indicator=Total%20primary%20energy%20supply%20(TPES)%20by%20source

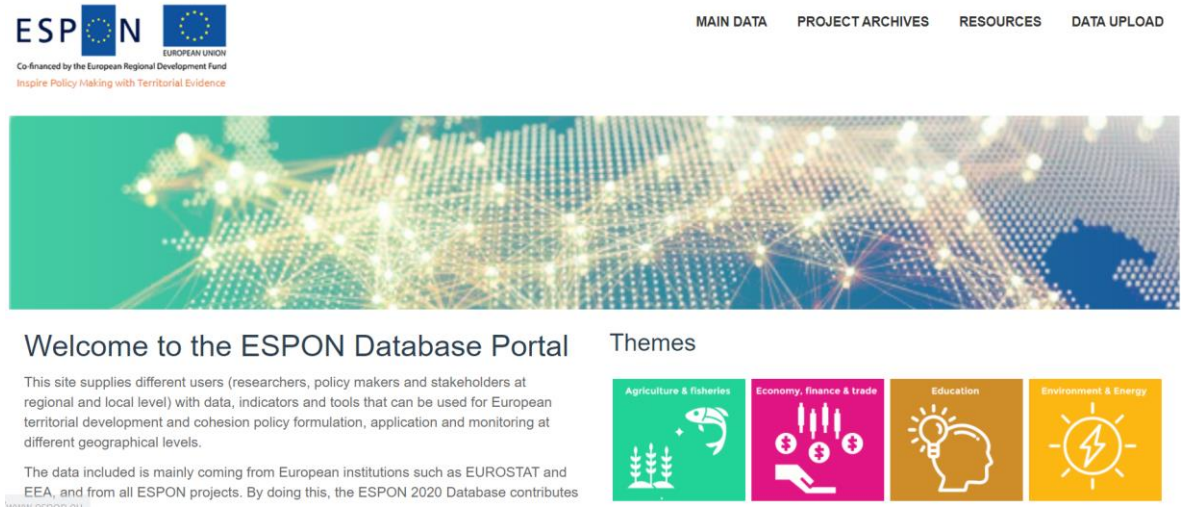
6 IEA data services: https://www.iea.org/subscribe-to-data-services/

Finally, the energy topics can also be filtered by type of indicator (e.g. coal production by type) and country or region.

3.1.1.5 ESPON Database

Co-financed by the European Regional Development Fund, the ESPON programme aims at promoting and fostering a European territorial dimension in development and cooperation by providing evidence, knowledge transfer and policy learning to public authorities and other policy actors at all levels.

Figure 9. ESPON Database portal homepage



Source: ESPON database [18]

Improved territorial observation and tools for territorial analyses are one of its most important objectives. Consequently, ESPON provides a wide range of tools to support the address of the current policy development, with valuable information and data for countries, regions, cities and citizens.

Table 21. ESPON database content

ESPON Database		
Country	— EU countries — Other countries: Albania, Belarus, Bosnia and Herzegovina, Kosovo, Montenegro, Serbia, The former Yugoslav Republic of Macedonia, Turkey, Ukraine	
Territorial scales covered	— NUTS 0, NUTS 1, NUTS 2, NUTS 3, LAU 1 or LAU 2.	
Data themes (and number of indicators by theme)	— Agriculture and fisheries (22) — Economy, finance and trade (226) — Education (48) — Environment and Energy (260) — Governance (23) — Health and Safety (00)	— Information Society (9) — Labour Market (57) — Population and living conditions (291) — Science and Technology (40) — Territorial Structure (68) — Transport and Accessibility (24)

International data sources	— EUROSTAT — EEA	— ESPON Projects
Type of data provided	— Graph data (.csv and .xls)	— Map data (shapefile)
Online access	https://database.espon.eu/	

Source: ESPON database (abovementioned link)

The data included mainly comes from European institutions such as EUROSTAT and EEA and from all ESPON projects.

3.1.1.6 ESPON Data Navigator

The ESPON Data navigator tool provides unique access point data from different relevant data sources at different regional levels.

Figure 10. ESPON Data Navigator homepage

Source: ESPON Data Navigator [19]

The ESPON Data Navigator is complementary to the ESPON Database because it provides an overview and access to data sources of National Statistic Institutes, whereas the ESPON Database provides data itself.

Table 22. ESPON Data Navigator content

ESPON Data Navigator	
Countries covered	— EU countries — Other countries: Albania, Belarus, Bosnia and Herzegovina, Kosovo, Montenegro, Serbia, The former Yugoslav Republic of Macedonia, Turkey, Ukraine

Territorial scales covered	— NUTS 0, NUTS 1, NUTS 2, NUTS 3, LAU 1 or LAU 2.	
Data themes	— Economy, finance and trade — Population and living conditions — Labour Market — Education — Health and Safety — Information Society	— Agriculture and fisheries — Transport and Accessibility — Environment and Energy — Science and Technology — Governance — Territorial Structure
International data sources	— Inspire Geoportal — The Organisation for Economic Co-operation and Development — GEOSTAT 1km² population grid-EUROSTAT — Corine Land Cover 2000 raster data-EEA	— Vegetation and land cover 1km² grid- University of Maryland — WorldClim grid-University of California — UN DATA — World Bank
National data sources per country	— National Statistical Offices	— Geographic Institutes
Online access	https://apps.espon.eu/datanavigator/	

Source: ESPON Data navigator (abovementioned link)

3.1.2 Urban and Regional Data

This section is devoted specifically to urban and regional data within statistical data. In this line, several data sources have been highlighted:

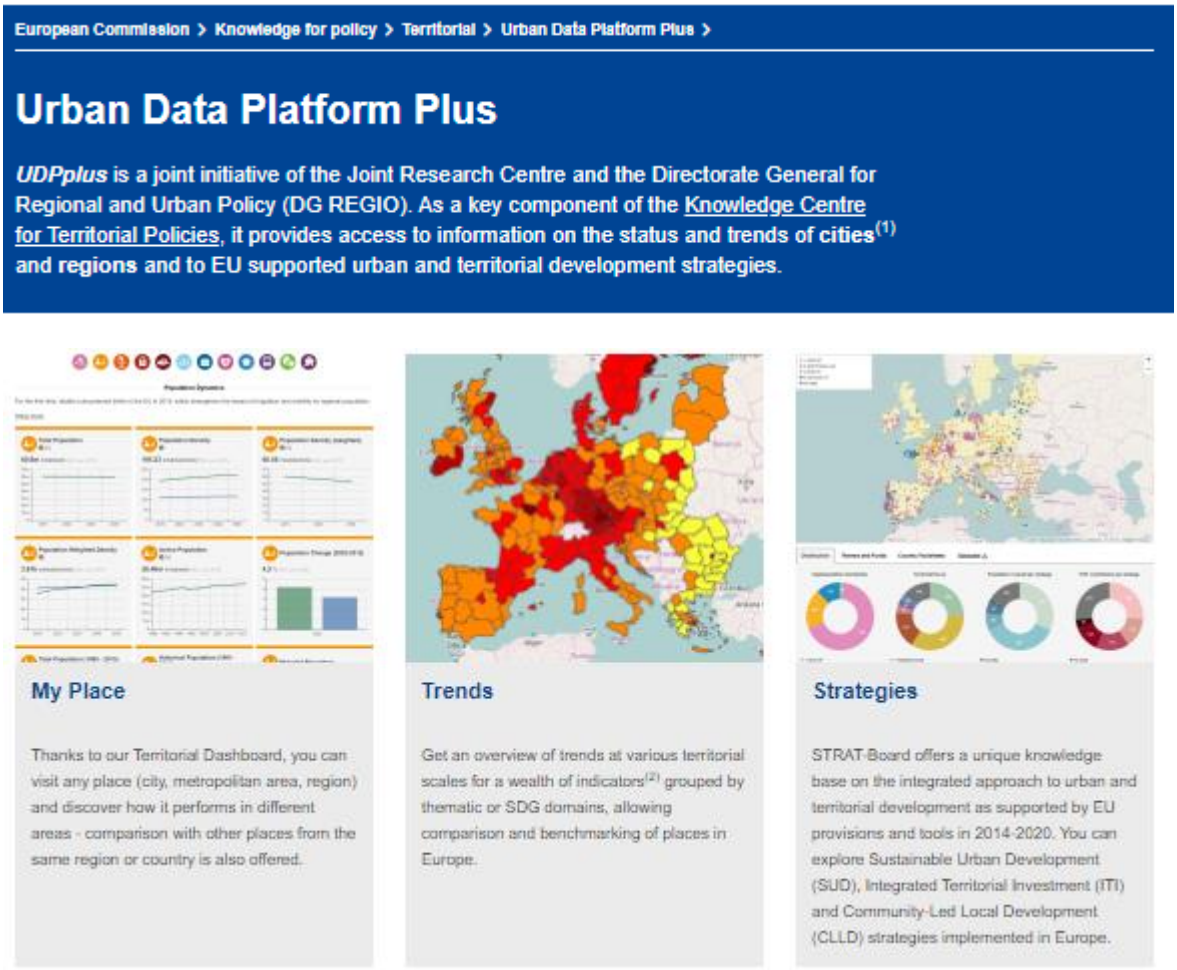
- Urban data Platform Plus (section 3.1.2.1)
- Census data (section 3.1.2.3)
- Covenant of Mayors data: SECAPs (section 3.1.2.4)

3.1.2.2 Urban Data Platform Plus (UDPplus)

The Knowledge Centre for Territorial Policies (KTCP)[7] provides access to platforms and models that aim at generating scenarios and making information available to stakeholders and partners. Following an integrated and multi-disciplinary approach, KTCP supports the analysis of policy effects holistically and at the most appropriate level.

Among the tools provided by the KCTP, the UDPlus[8] provides access to information on the status and trends of cities[9] and regions and EU supported urban and territorial development strategies.

Figure 11. Urban Data Platform Plus (UDPlus) homepage



Source: UDPlus [20]

The platform is structured in four parts:

1. The Territorial Dashboard provides information on the status of several indicators at different scales
2. Trends, provides information and analysis on the tendency of each indicator to understand dynamics and contributes to inform debated on changes.
3. Thematic Analyses combines data with analytical capabilities, trying to connect the dots by drawing meaningful messages.

7 https://ec.europa.eu/knowledge4policy/territorial_en
8 https://urban.jrc.ec.europa.eu/#/en
9 The cities included in Urban Data Platform comply with the EU-OECD definition: 'A city is a local administrative unit where the majority of the population lives in an urban centre of at least 50 000 inhabitants'

4. Territorial and Urban Strategies Dashboard (STRAT-Board) provides knowledge based on the integrated approach to urban and territorial development supported by EU provisions and tools in 2014-2020. This part will be further explained in section 3.1.2.2.3.

3.1.2.2.1 Dashboard

The following tables summarise the information that UDPlus provide in the Dashboard section.

Table 23. Dashboard (Urban Data Platform Plus) content

Contextual scope	Territorial scope	Territorial scale	Country
Complete Africa GHS Urban centres ARDECO	Typology Border regions Coastal regions Mountain regions Geographycal area European Union Macro region Adriatic and Ionian regions Alpine regions Baltic sea regions Danube regions	National Larger regions/Länder Regional Sub-regional Metropolitan Regions Functional Urban Areas Cities	Austria (AT), Belgium (BE), Bulgaria (BG), Cyprus (CY), Czechia (CZ), Germany (DE), Denmark (DK), Estonia (EE), Greece (EL), Spain (ES), Finland (FI), France (FR), Croatia (HR), Hungary (HU), Ireland (IE), Italy (IT), Lithuania (LT), Luxembourg (LU), Latvia (LV), Malta (MT), Netherlands (NL), Poland (PL), Portugal (PT), Romania (RO), Sweden (SE), Slovenia (SI), Slovakia (SK), United Kingdom (UK)

Source: UDPlus [20]

Table 24. Indicators contained in the Dashboard (Urban Data Platform Plus)

Indicator(s) in UDP Plus Dashboard		
Population dynamics	Demography	— Total population — Total population by age — Total population by sex — Population weighted density — Median population age — Total population growth rate — Crude rate of Natural change
	Migration	— Share of Population by Citizenship — Crude rare of Net Migration — Foreign Population over 15 years old — Foreign Population > 15 years old (EU28 vs Extra-EU)
Economy	GDP	— Total GDP at current market prices — GDP/inhabitant at current market prices — GDP/inhabitant in % of EU average — Total GDP in PPS

		— GDP/inhabitant in PSS — GDP per inhabitant in % of EU average (PPS) — GVA per inhabitant in % of EU average (PPS) — GVA at current prices
	Competitiveness	— European Regional Competitiveness index
Labour market	Employment	— Total Employment (15-64) — Total Employment / Jobs — Employed of Foreigners vs Nationals (15-64) — Employment of EU and non-EU Foreigners (15-64) — Employment rate (15-64)
	Unemployment	— Total Unemployment (15-64) — Unemployment of Nationals and Foreigners (15-64) — Unemployment of Foreigners non-EU / EU28(15-64) — Unemployment rate (20-64) — Unemployment rate by sex (20-64) — NEET 15-24
Education	Education	— Secondary Educational Attainment (25-64) — Secondary Educational Attainment (25-64) by Sex — Early leavers from Education (18-24) — Early leavers from Education (18-24) by Sex — Tertiary Educational Attainment (25-64) — Tertiary Educational Attainment (25-64) by Sex — Tertiary Educational Attainment (30-34) — Tertiary Educational Attainment (30-34) by Sex
Research& Innovation	Research& Innovation	— Intramural R & D expenditure — Intramural R & D expenditure by Sector
Social Issues	Social Issues	— Age Dependency ration — Age Dependency ratio by Age class (old / young) — Risk of Poverty and Social Exclusion — People at Risk of Poverty — Severe Material Deprivation
	Social progress	— Houses with Broadband Access — Individuals who have never use a computer
Transport & Accessibility	Accessibility	— Daily Accessibility — Network Efficiency — Potential Accessibility

		— Transport Performance
	Transport	— Cars per thousand inhabitants — Passenger Cars — Motorbikes — Motor coaches and Buses — Utility Vehicles
Environment & Climate	Environment	— Land Use — PM2.5 Emissions — Emissions of volatile organic compound — SO2 Emissions — NH3 Emissions — CO_2 Emissions — CO Emissions — NOx Emissions — PM10 Emissions — Land Abandonment
	Climate	— Heating Degree days — Cooling Degree days
Security & Safety	Security	— Number of murders and violent deaths
	Safety	— Killed in Road Accidents (per million inhabitants) — Injured in Road Accidents (per million inhabitants) — Killed in Road Accidents — Injured in Road Accidents

Source: Dashboard (Urban Data Platform Plus) [21]

Last but not least, the indicators available at different scales, and can be downloaded in csv and json formats.

3.1.2.2.2 LUISA Territorial Modelling Platform

The Land-Use based Integrated Sustainability Assessment (LUISA) Modelling Platform [22] is developed by the Joint Research Centre (JRC) of the European Commission (EC). This Platform is primarily used for the ex-ante evaluation of the direct and indirect territorial impact of EC, linking macroeconomic and biophysical models and different thematic databases. It is based on the concept of 'land function' for cross-sector integration and the representation of complex system dynamics. These land functions also allow a multi-scale approach, as their dynamics interact from local to global scales influenced by muti-sector drivers, and they are temporally and spatially dynamic.

The baseline (or reference) scenario or LUISA assumes official socio-economic trends (from DG ECFIN and EUROSTAT economic and demographic databases), including the effect of established European policies.

The outcome of LUISA is a set of spatially explicit indicators that can be combined according to the 'function' of interest and/or to the sector under assessment. These sectors cover different themes: resource efficiency, sustainable urban development, ecosystems services, accessibility, etc.

In addition, LUISA also provides information to the Urban Data Platform by obtaining urban indicators at various levels of aggregation.

Technical aspects

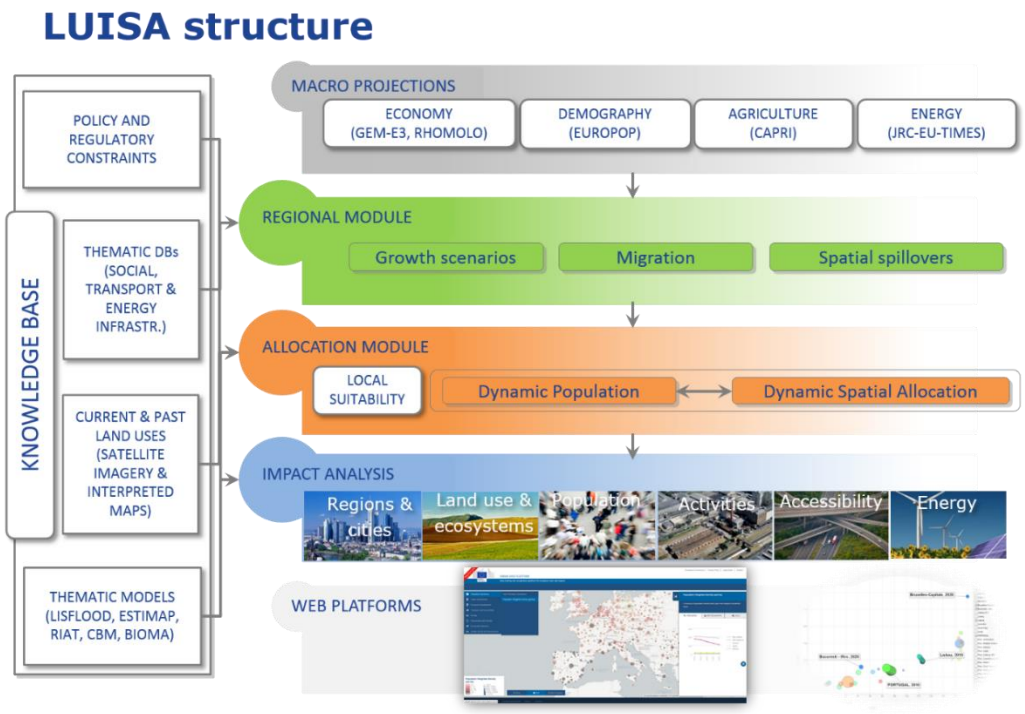
The LUISA platform integrates different models that evaluate different policies and measures in time (when) and spatially (where). Some of these measures can be infrastructural investments, valuation of regional subsidies, the setting of binding regulations, and the avoidance of impacts of climate extremes. For this purpose, the method works by dynamically allocating the demand (regional demand) and the supply of resources, the space occupied by socio-economic activities (housing, tourism…) and the infrastructures (transport, energy, etc.). This allocation of population, services and activities is based on the most optimal 100 grid cells. In the allocation it must be considered the biophysical suitability (suitability maps), policies and regulatory framework, and other factors such as economic criteria.

Land use demand is allocated to 100 grid cells following two steps:

1. Regional population changes allocated to the grid cells based on an attractiveness function of each pixel for residence. The basic rules are that if a grid cells holds at least six people, land is converted to urban land use. On the other hand, if urban grid cell holds less than two people is converted to abandoned urban land use.
2. Competition between "non-urban" land uses. For this, land use specific functions are based on a large number of factors, and the competition is also determined by attractiveness. In summary, the allocation is based on maximising the land utility but constrained by land-use demands (upstream) and supply land in a region.

In the following Figure 12 [23] it is possible to check the structure and workflow of Luisa. As shown in the figure, the first step is to obtain the macro-economic variables resulting from specific sectoral models. This information is mixed with geospatial models, which provide the spatial information (physical and geographical layers). Eurostat and ECFIN give demographic and economic projections and trends.

Figure 12. LUISA Structure and workflow



Source: EU Science Hub. Technical description of LUISA. [23]

The regional module generates the socio-economic scenarios, and the results of LUISA are spatially explicit indicators projected in time (20030 or 2050) at various levels (national, regional, or other).

Table 25 presents the different models integrated in LUISA:

Table 25. Models integrated in LUISA platform covering different sectors

Model	Sector/ Policy
EUROPOP 2010	Demography
GEM-E3	Economy
RHOMOLO	Regional economy
LEITAP-IMAGE	Economy
CAPRI	Agriculture
G4M, CBM	Forestry sector
TRANSTOOLS	Transportation
POLES, PRIMES, JRC-EU-TIMES	Energy sector
LISFLOOD/QUAL	Water quality
GREEN/EPIC	Water quality
RIAT	Air quality
ESTIMAP +	Ecosystems services

Source: EU Science Hub. Technical description of LUISA. [23]

On the other hand, the land functions can be physical (e.g. hydrology, topography), ecological (landscape, phenology), social (housing, recreation), economic (production, employment, infrastructural) and political (policy decisions consequences). Thus, these functions are multi-sectorial, covering the following specific sectors:

Table 26. Sectors covered in the land functions for the allocation of the following aspects

Function	Subfunction
Economic	Employment
	Sectoral GVA (Gross Value Added)
Social	Recreational and cultural services
Provision of products	Water
	Food and biofuels
	Wood biomass
Settlements and infrastructures	Residential
	Industry, commerce
	Transport, technological infrastructures
	Mediation of nuisances

Regulation services by (natural) physical structures and processes	Atmosphere composition and climate regulation
	Mediation of flows
	Maintenance of physical, chemical, biological conditions
Ecosystems and biodiversity	Biodiversity conservation
	Maintaining ecosystems

Source: EU Science Hub. Technical description of LUISA. [23]

3.1.2.2.3 StratBOARD

Within StratBOARD platform, users can explore Sustainable Urban Development (SUD), Integrated Territorial Investment (ITI) and Community-Led Local Development (CLLD) strategies implemented in Europe under the ESIF (European Structural and Investment Funds) type and the different thematic objectives covered. In the following Table 27, the content of StratBOARD can be observed.

Table 27. StratBOARD content

Countries	European Structural and Investment Funds (ESIF) type	Thematic objective
European Union (EU), Austria (AT), Belgium (BE), Bulgaria (BG), Croatia (HR), Cyprus (CY), Czech Republic (CZ), Germany (DE), Denmark (DK), Estonia (EE), Finland (FI), France (FR), Greece (EL), Hungary (HU), Ireland (IE), Italy (IT), Latvia (LV), Lithuania (LT), Luxembourg (LU), Malta (MT), Netherlands (NL), Poland (PL), Portugal (PT), Romania (RO), Slovenia (SI), Slovakia (SK), Spain (ES), Sweden (SE), United Kingdom (UK)	European Regional Development Fund (ERDF) European Social Fund (ESF) Cohesion fund (CF) European Agricultural Fund for Rural Development (EAFRD) European Maritime and Fisheries Fund (EMFF) ERDF-European Territorial Cooperation No data	TO-01 Research and Innovation TO-02 Information and Communication Technologies TO-03 competitiveness of SMEs TO-04 Low Carbon Economy TO-05 Climate change adaptation and Risks prevention TO-06 Environment protection and resource efficiency TO-07 Network infrastructures in Transport and Energy TO-08 Sustainable and Quality Employment TO-09 Social Inclusion TO-10 Educational and vocational training TO-11 Efficient Public administration

Source: StratBOARD [24]

Per strategy, the information provided is summarized in the following Table 28:

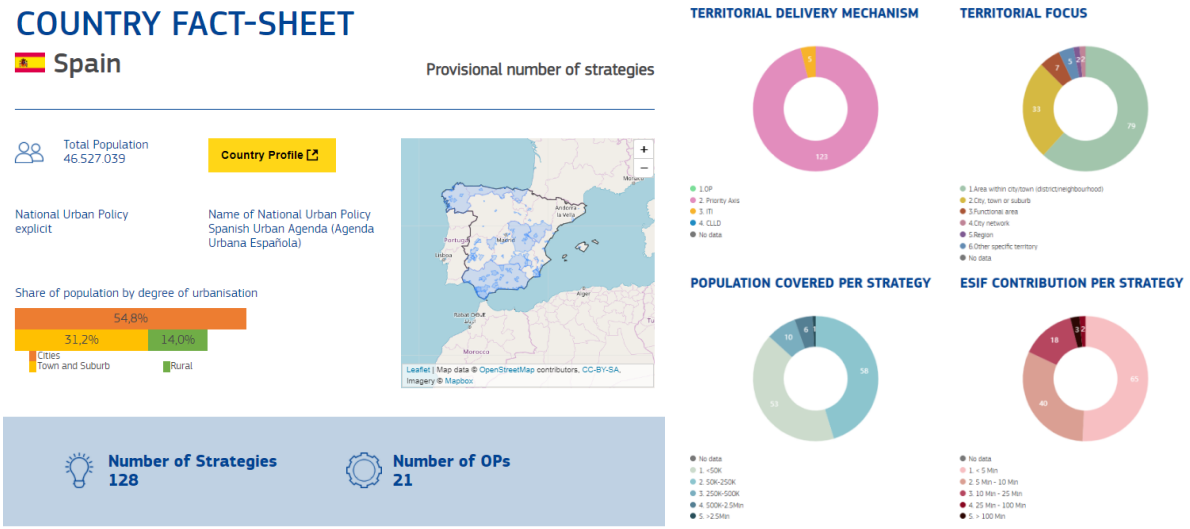
Table 28. Information provided in STRATBoard

Territorial delivery mechanism	Territorial focus	Population covered per strategy	ESIF contribution per strategy
1.OP 2. Priority Axis 3. ITI 4. CLLD No data	1.Area within city/town (district/neighbourhood) 2.City, town or suburb 3.Functional area 4.City network 5.Region 6.Other specific territory No data	No data 1. <50K 2. 50K-250K 3. 250K-500K 4. 500K-2.5Mln 5. >2.5Mln	No data 1. < 5 Mln 2. 5 Mln - 10 Mln 3. 10 Mln - 25 Mln 4. 25 Mln - 100 Mln 5. > 100 Mln

Source: StratBOARD [24]

StratBOARD also provides the option of downloading a factsheet per country. The information reported in previous tables is collected at country level for easy use.

Figure 13. Fact sheets provided in STRATBoard



Source: STRATBoard [24]

3.1.2.3 Census data

Census data [25] is the European Statistical System that provides useful information on population and housing census. This database offers valuable information at different geographical levels (from nations to municipalities including NUTS2 and NUTS3 levels). Data can be initially filtered by families and households, dwellings and persons to show the more relevant statistics. The following tables (0, 0 and Table 31) summarize the data that are included on the Census database.

Table 29. Census data related to persons

Persons		
Geographic level:	Residence / Place of work	
Geographical level	Nations / NUTS 2 Regions / NUTS 3 Regions / Municipalities	
Sex	Male and Female data	
Age	Broad groups	Groups by different age ranges
	Five-years groups	
	Single-years groups	
Marital status	— Never married — Married — Widowed — Divorced — In a registered partnership — Register partnership ended with the depth of a partner — Register partnership legally dissolved — Not stated	
Family status	Broad groups	— Partners — Lone partners — Sons/daughters — Not stated — Not applicable
	Detailed groups	Include subdivisions from broad groups.
Household status	Broad groups	— Persons living in a private household — Persons not living in a private household
	Intermediate groups	Include subdivisions from broad groups.
	Detailed groups	Include subdivisions from intermediate groups.
Current activity status	Broad groups	— Currently economically active (employed, unemployed) — Currently not economically active — Not stated
	Detailed groups	Include subdivisions from broad groups.
Occupation	— Managers, — Professionals	

	— Technicians and associate professionals — Clerical support workers — Service and sales workers — Skilled agricultural, forestry and fishery workers — Craft and related trades workers — Plant and machine operators and assemblies — Elementary occupations — Armed forces occupations — Not stated — Not applicable.	
Industry	Broad groups	— Agriculture, forestry and fishing — Manufacturing, mining and quarrying, and other industry — Construction — Wholesale and retail trade, transportation and storage, accommodation and food service activities — Information and communication — Financial and insurance activities — Real estate activities — Professional, scientific, technical, administrative and support service activities — Public administration, defence, education, human health and social work activities — Other services — Not stated — Not applicable
	Detailed groups	Include subdivisions from broad groups.
Status in employment	— Employees — Employers — Others — Not stated — Not applicable	
Place of work	— In the territory of the Member State — Not in the territory of the Member State — Not applicable (not working)	
Educational attainment	— No formal education — Primary education — Lower secondary education — Upper secondary education	

	— Post-secondary non-tertiary education — First stage of tertiary education — Second stage of tertiary education — Not stated (of the persons aged 15 years or over) — Not applicable (persons under 15 years of age)	
Size of the locality	Groups by different inhabitants' ranges	
Place of birth	In the country, abroad	— Place of birth in reporting country — Place of birth not in reporting country — Other — Not stated
	Continents	Include subdivisions from in the country, abroad labels.
	Individual countries	Data at country level from continents subdivisions
Country of citizenship	Nationals, foreigners	— Citizenship of reporting country — Citizenship not of reporting country — Stateless — Not stated
	Continents	Include subdivisions from national, foreigner's labels.
	Individual countries	Data at country level from continents subdivisions
Presence in the country since 2000	— Ever resided abroad and arrived in 2000 or after — Resided abroad and arrived in 1999 or before, or never resided abroad — Not stated	
Year of arrival in the country	Five-years groups	— Ever resided abroad and arrived in 1980 or after — Resided abroad and arrived in 1979 or before, or never resided abroad — Not stated
	Single-years groups	The same as previous but in yearly data
Residence one year before	— Usual residence unchanged — Usual residence changed — Not stated — Not applicable	
Housing arrangements	Broad groups	— Occupants living in a conventional dwelling or in a collective living quarter — Occupants living in another housing unit and the homeless — Not stated

	Detailed groups	More detailed labels for broad groups

Source: Census Hub [25]

Table 30. Census data related to families and households

Families and households: show data on residences		
Geographic level	Nations / NUTS 2 Regions / NUTS 3 Regions / Municipalities	
Type of family nucleus	Broad groups	— Married coupled families — Registered partnership couple families — Consensual union couple families — Lone father families — Lone mother families
	Detailed groups	More detailed labels for broad groups
Size of family nucleus	Broad groups	— 2 persons — 3 to 5 persons — 6 and more persons
	Intermediate groups	Detailed labels for broad groups
	Detailed groups	— 2 persons — 3 to 5 persons — 6 and more persons — 11 and more persons — (detailed labels in each group)
Type of private households	Broad groups	— Non-family households (one person or multi-person household) — One-family households — Two-or-more-family households
	Detailed groups	Detailed labels for broad groups
Size of private households	Broad groups	— 1 person — 2 persons — 3 to 5 persons — 6 and more persons
	Intermediate groups	Detailed labels for broad groups
	Detailed groups	— 1 person — 2 persons — 3 to 5 persons

		— 6 and more persons — 11 or more persons — (detailed labels in each group)
Tenure status of households	— Households of which at least one member is the owner of the housing unit — Households of which at least one member is a tenant of all part of the housing unit — Household occupying all or part of a housing unit under some other form of tenure — Not stated	

Source: Census Hub [25]

Table 31. Census data related to dwellings

Dwellings: Show data on Location		
Geographic level	Nations / NUTS 2 Regions / NUTS 3 Regions / Municipalities	
Type of living quarter	— Occupied conventional dwellings — Other housing unit — Collective living quarters — Not stated	
Occupancy status	— Occupied conventional dwellings — Unoccupied conventional dwellings (for seasonal or secondary use, or vacant dwellings) — Not stated	
Type of ownership	— Owner-occupied dwellings — Dwellings in cooperative ownership — Rented dwellings — Dwellings in other types of ownership — Not stated — Not applicable	
Number of occupants	Broad groups	— 1 person — 2 persons — 3 to 5 persons — 6 and more persons
	Intermediate groups	Detailed labels for broad groups
	Detailed groups	— 1 person — 2 persons — 3 to 5 persons — 6 and more persons

		— 11 or more persons — (detailed labels in each group)
Useful floor space	Groups by different square metres	
Density standard (floor space)	Groups by different square metres per occupant	
Number of rooms	Groups for 1 to 9 rooms and more	
Density standard (number of rooms)	Groups by different number of rooms per occupant	
Water supply system	— Piped water in the housing unit — No piped water in the housing unit — Not stated	
Toilet facilities	Flush toilet in the housing unit No flush toilet in the housing unit Not stated	
Bathing facilities	Fixed bath or shower in the housing unit No fixed bath or shower in the housing unit Not stated	
Type of heating	Central heating No central heating Not stated	
Type of building	— Conventional dwellings in residential buildings (one-dwelling, two-dwelling, three or more dwelling building) — Conventional dwellings in non-residential buildings — Not stated	
Period of construction	— Before 1919 — 1919-1945 | 1946-1960 | 1961-1970 | 1971-1980 | 1981-1990 | 1991-2000 | 2001-2005 | 2006 and later — Not stated	

Source: Census Hub [25]

Census data could be useful to evaluate general statistical data at the regional and country level. The Census database includes aggregated data useful to understand persons, families and households and dwelling in a general context, developing a common framework to obtain making possible to understand the general baseline of different European regions. However, more local and detailed data are necessary to improve regional evaluation considering energy assessment requirements.

3.1.2.4 Covenant of Mayors data: SECAPs

An additional source of data at a local scale potentially useful in the context of a Regional Energy Strategy policy cycle is represented by SECAP (Sustainable Energy and Climate Action Plans), provided by the signatories of the Covenant of Mayor initiative[10].

Each action plan defines mitigation target(s) and adaptation goal(s) and is based on a Baseline Emission Inventory and a Risk & Vulnerability Assessment, which analyses the current situation at a given moment. They serve as a basis for defining a comprehensive set of actions that signatories plan to undertake to reach the climate mitigation and adaptation goals and alleviate energy poverty.

Local authorities joining the Covenant of Mayors for Climate and Energy initiative commit to submitting an action plan within two years after formally signing up to the initiative.

Based on the following documents:

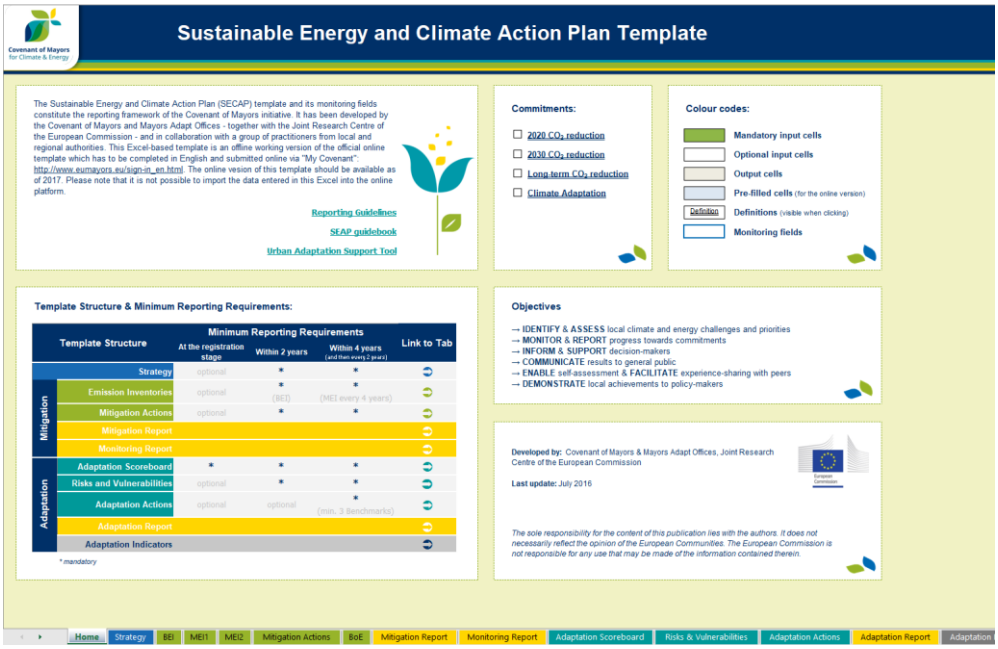
- Guidebook 'How to develop a Sustainable Energy and Climate Action Plan (SECAP)' - Part 1: The SECAP process, step-by-step towards low-carbon and climate-resilient cities by 2030[11],
- Guidebook 'How to develop a Sustainable Energy and Climate Action Plan (SECAP)' - Part 2: Baseline Emission Inventory (BEI) and Risk and Vulnerability Assessment (RVA)[12],
- Guidebook 'How to develop a Sustainable Energy and Climate Action Plan (SECAP)' - Part 3: Policies, key actions, good practices for mitigation and adaptation to climate change and Financing SECAP(s)[13],

the signatories fill-in a SECAP template[14] (0), providing data potentially useful for a Regional Energy Strategy, such as the baseline emission inventory, containing an estimation of the final energy consumption per energy carrier (electricity, district heating and cooling, several types of fossil fuels, several types of renewable energies) per sector (municipal buildings and equipment/facilities, public lighting, tertiary buildings, residential buildings, Industry – not subject to the Emission Trading Scheme, municipal transport, public transport, private and commercial transport, agriculture/forestry/fisheries).

It is to be highlighted that the potential relevance of this kind of data in the context of a Regional Energy Strategy can be hindered by a series of obstacles such as the possible inaccuracy and/or incompleteness of the estimations of the final energy consumption, the presence of data gaps in terms of the spatial coverage of the region (not all the municipalities of the region are Covenant signatories) and the current poor interoperability of the SECAP data (the SECAP are currently publicly available as pdf documents and hopefully in the near future available as open data structured in a database).

10 https://www.covenantofmayors.eu/en/
11 https://publications.jrc.ec.europa.eu/repository/bitstream/JRC112986/jrc112986_kj-na-29412-en-n.pdf
12 https://publications.jrc.ec.europa.eu/repository/bitstream/JRC112986/jrc112986_kj-nb-29412-en-n.pdf
13 https://publications.jrc.ec.europa.eu/repository/bitstream/JRC112986/jrc112986_kj-nc-29412-en-n.pdf
14 https://www.covenantofmayors.eu/support/library.html

Figure 14. Sustainable Energy and Climate Action Plan Template



Source: Covenant of Mayors

3.1.3 Building Stock Data

Like the previous section, this section focuses on a specific relevant sector that can impact the generation of regional energy strategies: the built environment. To this end, main data sources related to building stock characterization are explained, in particular:

- TABULA/ EPISCOPE (section 3.1.3.1)
- Building Stock Observatory (section 3.1.3.2)
- ENTRANZE (section 3.1.3.3)
- DEEP database (section 3.1.3.4)
- ODYSEE/MURE (section 3.1.3.5)

3.1.3.1 TABULA / EPISCOPE

The **TABULA web tool** is one of the main outcomes of the TABULA project (IEE/08/495, June 2009 – May 2012), whose analyses were continued with the EPISCOPE project (IEE/12/695/SI2.644739, April 2013 – March 2016) [26]. Both projects were coordinated by the Institut Wohnen und Umwelt, Darmstadt / Germany. Whereas the first project (TABULA) focused on the residential typologies of 13 countries in the EU, the EPISCOPE project went one step further and aimed at making the refurbishment processes in Europe more transparent and effective with the aim to ensure that the climate protection targets will actually be attained and that corrective or enhancement actions can be taken in due time [27]. Other relevant results of both projects can be found below:

Table 32. TABULA / EPISCOPE relevant results

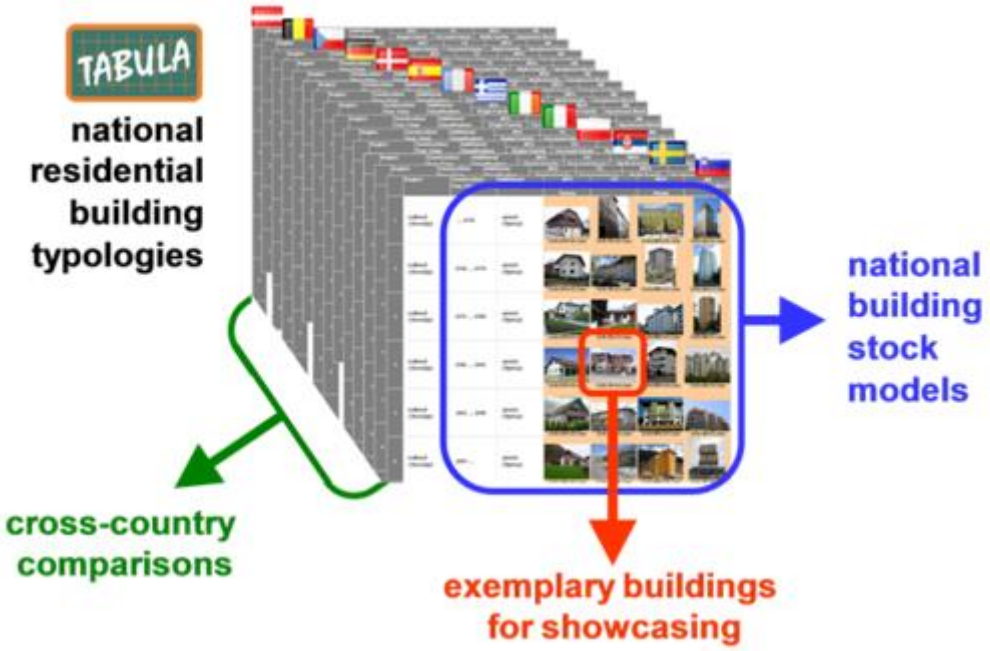
TABULA / EPISCOPE relevant results	
Tabula web tool	Described below, access point here [28]
Monitor progress towards climate targets in European Housing Stocks	Final EPISCOPE Project report [29]

Scenario Analyses on Local Building Stocks	Available for BE, CY, CZ, FR, HU. IE, RS, SI [30]
Regional and national building stocks	Available for AT, DE, ES, GB, GR, IT, NL, NO, SI. [31]
Monitoring report	Available for AT, BE, CY, CZ, DE, ES, FR, EN, GR, HU, IE, IT, NL, NO, RS, SI. [32]
Application of Energy Performance Indicators for Residential Building Stocks	Explains the indicator concepts (monitoring and scenario indicators) used for residential building stock as used in the EPISCOPE project [33]
TABULA calculator	Excel workbook that includes current TABULA typology data [34]
Calculation methods [35]	The calculation method used within the abovementioned excel, which are based on CEN standards, are shown in the referenced document. [36]

Source: own elaboration, based on information of TABULA / EPISCOPE projects [26]

In particular, in the TABULA project ("Typology Approach for Building Stock Energy Assessment"), residential building typologies were developed for 13 European countries (AT, BE, CZ, DE, DK, ES, FR, EL, IE, IT, PL, RS, SE, SI). Each typology is defined according to the building's size, age and additional parameters. Summary sheets per country are provided in each of the countries' language ("Building Typology Brochures"). However, to enable the exchange of information on the European level, the TABULA web tool was created, which allows users to make cross-country comparisons of national residential building typologies and provides exemplary buildings for showcasing, as well as national building stock models. This is depicted in Figure 15.

Figure 15. TABULA web tool scheme

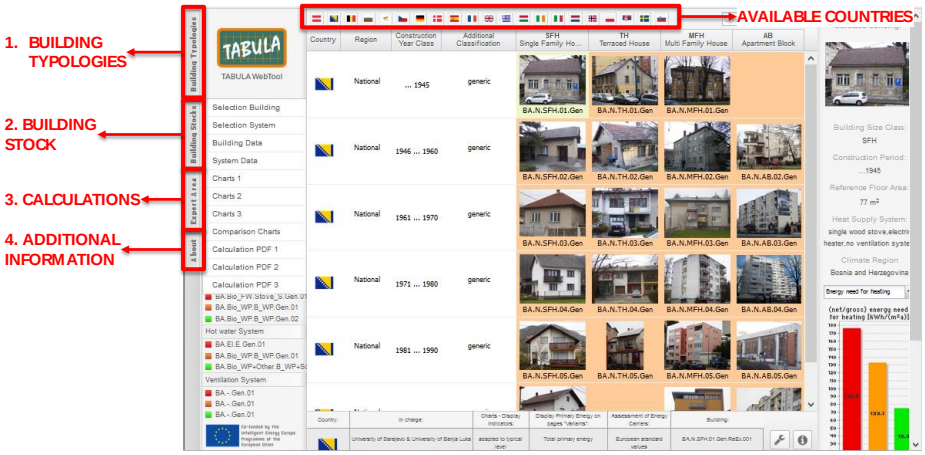


Source: TABULA / EPISCOPE [26]

When accessing the web tool, the number of countries has been broadened during the EPISCOPE project to end up covering: AT, BA, BE, BG, CY, CZ, DE, DK, ES, FR, GB, GR, HU, IE, IT, NL, NO, PL, RS, SE, and SI, as it can be observed in the following Figure 16. As it can be seen, there are four main tabs to consult information on the building typologies. It is worth mentioning that for each of the building typologies, three energy performance levels are depicted: (1) the existing state, (2) usual refurbishment and (3) advanced refurbishment:

1. **Building typologies**: shows an overview of the typologies contained in the selected country. In the case of Figure 16, the building typologies for Bosnia Herzegovina are displayed. How these typologies are presented will be explained in the following sections. Also, within this tab, there is the possibility to select buildings (figure shown), select systems, display building and system data, display charts of the energy balance of the building typologies available (charts 1, 2, 3), show comparison charts on a series of indicators, and download PDFs (Calculation PDF 1, 2, 3) with the energy balance calculations of each of the performance levels.
2. **Building stock**: this tab allows to consult EPISCOPE case studies by presenting the starting point data for the scenarios developed in this country ("basic case"). For this basis data, some of the outcomes of the TABULA project have been used. These case studies are available at three different scales: national level (for DE, DK, GB, GR, NL, NO, and SI), regional (for AT, ES, and IT), and local (for BE, CY, CZ, DK, FR, HU, IE).
3. **Calculations**: known as "Expert Area", this tab allows experts to select specific typologies and systems and export calculations in excel and pdf format on thermal insulation measures and energy balance calculations. This is particularly useful to export and analyse information in a more user-friendly manner than through the abovementioned "Tabula calculator" (Table 32).
4. **Additional information**: the "about" section provides additional information on using the tool, the terms used, access methods, etc. Thus, to appropriately use the tool, it is highly recommendable to consult this tab first.

Figure 16. TABULA web tool content



Source: own elaboration based on TABULA web tool [28]

Finally, as mentioned above, an explanation of the characterisation of the building typologies is provided in the following table:

Table 33. TABULA Building typology configuration

TABULA Building typology configuration	
Country	AT, BA, BE, BG, CY, CZ, DE, DK, ES, FR, GB, GR, HU, IE, IT, NL, NO, PL, RS, SE, and SI
Region	Depending on the country, this value corresponds to the scope of the typology presented. It can be a dataset that refers to the national level of that country (e.g. in the case of BA or CY), to a region defined in administrative terms (e.g. DE), or to a region defined to its climate (e.g. ES, IT). Thus, in some countries, only typologies for a portion of their territory are present.

Construction year class	Ranges of construction years. These years are established differently according to the country.
Additional classification	For instance, if a further classification is required, specifying a building type that needs to be further characterised, this additional column allows doing so. This is the case of BE, BG, or DE.
Building type	The building type considers general geometrical characteristics of the residential buildings. In this line, four categories are identified: single-family house (SFH), terraced house (TH), multi-family house (MFH), and apartment block (AB). Not all countries cover all building types for all the construction year ranges.
Energy performance level	The TABULA web tool also provides three levels of energy performance for each of the established typologies. The buildings can be: (1) in their original state, (2) under a normal refurbishment, or (3) advanced refurbishment. For each of the levels, the typical construction elements used can be seen.
Systems consideration	The characterisation of possible systems within the building typologies is also present. It is also classified as the energy performance levels (i.e. there are three possible energy performance levels for each possible system). However, more than one system set can exist for every building typology established.

Source: own elaboration based on TABULA web tool [28]

3.1.3.2 Building Stock Observatory

The Building Stock Observatory (BSO) emerges to support the implementation of policies mainly related to energy (EPBD [37], EED [38], RED [39]), as part of the Clean Energy for all Europeans package [1] to monitor the improvement of energy efficiency in the buildings and evaluate its impact in the energy consumption in the sector in the European Member States.

It is developed under the contract ENER/C3/2014-54 by a consortium formed by BPIE, ECN, Enerdata, Ecofys and SEVEn, in cooperation with 20 national partners and a varied set of actors.

The main objectives of this project can be summarised as followed:

- Generation of a methodological framework for monitoring the building stock of the EU-27 countries in the context of the energy efficiency policies, including a series of quantitative, guidance in the gathering and data analysis and strategies to deal with the lack of data.
- Statistics gathering in the EU-28 countries and providing an image of the current state of the energy performance in the European building stock.
- Dissemination of results through a publicly accessible web portal.
- Establishment of a methodology for the continuous monitoring of the building sector and maintenance of the website, as well as all communication channels.

Three main results are presented to the public:

3. **The database** [40]: contains a series of 250 indicators on the following topics:
    (a) Building stock characteristics
    (b) Building shell performance
    (c) Technical building systems
    (d) Nearly Zero-Energy Buildings
    (e) Building renovation
    (f) Energy consumption
    (g) Certification

(h) Financing

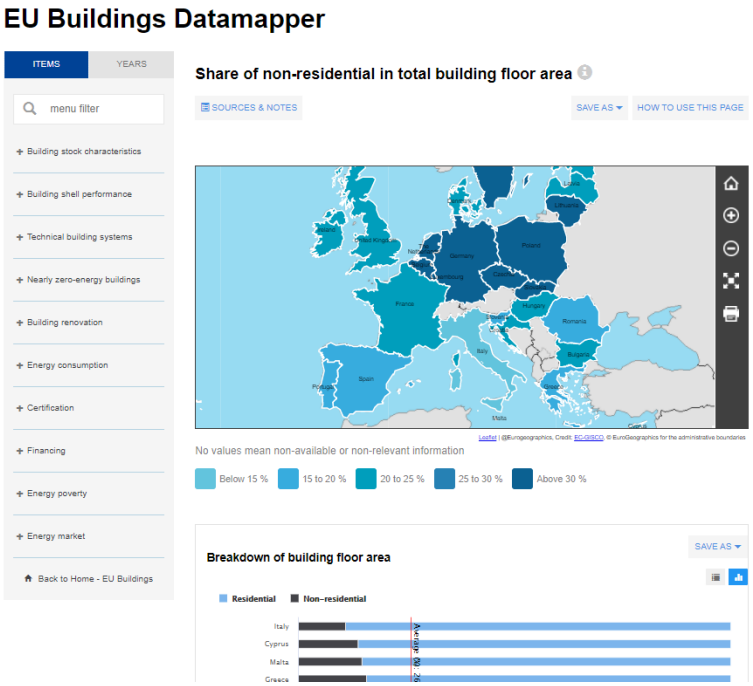
(i) Energy poverty

(j) Energy market

4. **The data mapper** [41]: the BSO data mapper is a user-friendly way to access the data. It allows users to navigate the data by presenting maps and graphs that can be downloaded. A picture of the data mapper can be found in Figure 17.

5. **The factsheets** [42]: thematic and country-specific factsheets that address the most relevant issues are available. They present the most important features, including indicators and recommendations in relation to the implementation of EU buildings legislation and key statistics.

Figure 17. EU Buildings Datamapper

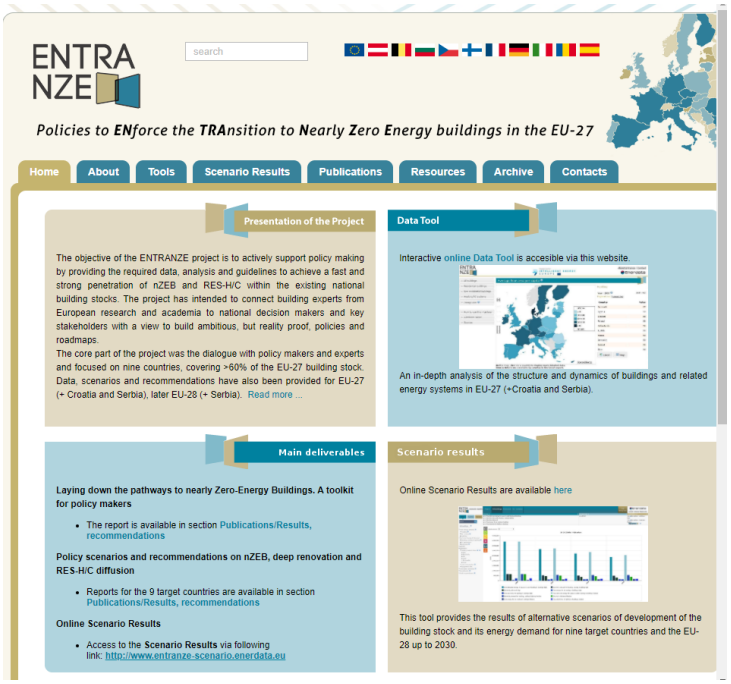


Source: EU Building Stock Observatory [41]

3.1.3.3 ENTRANZE

ENTRANZE is a project funded by the Intelligent Energy Europe Programme. Its main objective is to actively support policy making by providing the required data, analysis and guidelines to achieve a fast and strong penetration of nZEB and RES-H/C within the existing national building stocks. The project intends to connect building experts from European research and academia to national decision makers and key stakeholders to build ambitious but reality proof policies and roadmaps [43].

Figure 18. ENTRANZE website



Source: ENTRANZE website [43]

Two main results have to be highlighted about this project:

1. The **online data tool** [44] provides maps and graphs that enable to characterise the buildings stock (residential, non-residential buildings) and information on their heating and AC systems and energy use. The European sources behind the data displayed are the following, which were complemented by national specific national sources:
    a. Odysee (more information on section 3.1.3.5)
    b. Building Performance Institute Europe (BPIE)
    c. TABULA (more information on section 3.1.3.1)
    d. EUROSTAT (more information on section 3.1.1.1)
    e. European Union of Developers and House Builders (UEPC)
2. **Scenario results** provide alternative scenarios of the development of the building stock and its energy demand for nine target countries up to 2030.

3.1.3.4 DEEP database

The DEEP database is the main outcome of EEFIG De-risking Project, which is a continuation of the Energy Efficiency Financial Institution Group (EEFIG) 2015 report and the findings.

Aiming to create an open-source database for energy efficiency investments performance monitoring and benchmarking, the project delivered de-risking energy efficiency platform (DEEP), and an open-source initiative to enlarge energy efficiency investments in Europe through a transparent and enhance the analysis of the existing projects in buildings and industries.

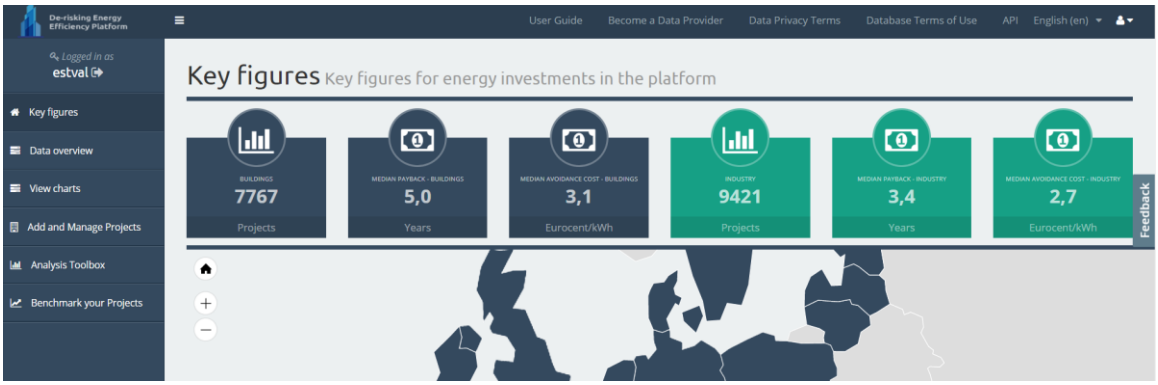
The data provided in the platform is divided into two main groups: EE projects in buildings and in industries, and there are currently data from 7767 projects on EE in industries and 9421 projects on EE in industries, which have been provided by financial and financing institutions, both public and authorities, national and regional authorities, and providers of energy efficiency solutions.

The main objective of the DEEP Platform is to better understand the real risks and benefits of energy efficiency investments based on market evidence and track record.

The DEEP platform offers several services to the users:

1. A quick overview of the buildings and industry projects in the DEEP.

Figure 19. DEEP database homepage



Source: DEEP database [45]

2. A comprehensive (but still aggregated) overview of the energy efficiency projects in the DEEP, presenting the distribution of the indicators payback time and avoidance cost of the energy efficiency projects in Buildings or Industry.
3. A functionality to view and filter a number of predefined charts for buildings and industry energy efficiency projects.

Detailed information per project is presented as "Charts" in which the user can filter the projects that will be included in the analysis and shown in the charts based on:

Table 34. Filter possibilities available in the DEEP platform

Filter category	Filter subcategory	
	Buildings	Industry
Country	EU-27 / Canada / United states	
Measure type	Building fabric measures Combination of Building Fabric and HVAC Integrated Renovation Lighting HVAC plant Ventilation and air conditioning Other	Compressed Air Cooling Heating ICT Metering, Monitoring and Energy Management Motors Power Systems Pumps Refrigeration Street Lighting Waste heat (without power generation) Waste heat (with power generation) Other

Building/Company type	Detached single family dwellings Data centre Other single-family dwellings Multi-family buildings 1-4 storeys Multi-family buildings 5+ storeys Office buildings Wholesale and retail trade Hotel & restaurants Health care Educational buildings Sports facilities Industry	MICRO for Micro-enterprises SMALL for Small enterprises MEDIUM for Medium-sized enterprises LARGE for Large enterprises
Verification	Verified / Non-verified / Unknown	
Discount rate for avoidance cost	0%, 1%, 2%, 3%, 4%, 5%, 6%, 7%, 8%, 9%, 10%, 11%, 12%, 13%, 14%, 15%	

Source: DEEP database [45]

Once the filter criteria have been defined, the projects' data is shown and the user can visualize the following charts:

Table 35. Data per project available in the DEEP platform

Data / project	Detailed description
Energy savings	Energy saving potential in buildings (GWh/a) by average payback time (year) and use. Median data per building type is shown.
Payback per measure	Distribution of payback time on 10%, 25% 75% and 90% percentiles per measure type. Median data per type of measure is shown.
Payback per building type	Distribution of payback time on 10%, 25% 75% and 90% percentiles per building type. Median data per building type is shown.
Avoidance cost per measure	Avoidance cost per measure on 10%, 25% 75% and 90% percentiles per measure type. Median data per type of measure is shown
Avoidance cost per building type	Avoidance cost per measure on 10%, 25% 75% and 90% percentiles per building type. Median data per building type is shown.
Unit energy service per measure	Annual energy cost savings distribution per measure type (EUR/m2year) on 10%, 25% 75% and 90% percentiles per measure type Median data per type of measure is shown.
Unit energy service per building type	Annual energy cost savings distribution per building type (EUR/m2year) on 10%, 25% 75% and 90% percentiles per measure type Median data per type of measure is shown.

Internal rate of return (IRR)	Distribution on IRR on 10%, 25% 75% and 90% percentiles per measure type. Median data per type of measure is shown.
Net present value (NPV)	Distribution on NPV on 10%, 25% 75% and 90% percentiles per measure type. Median data per type of measure is shown. (Calculated by introducing the energy price €/kWh and the discount rate %)
CO_2 Savings	CO_2 Savings (ton CO_2/y) on 10%, 25% 75% and 90% percentiles per measure type. Median data per type of measure is shown. (Calculated by introducing the country and the energy fuel)
Energy Demands	Specific energy demand before/after investments on 10%, 25% 75% and 90% percentiles per measure type. Expressed in kWh/m2year and in CO_2 g/m2year (Calculated by introducing the country)

Source: DEEP database [45]

4. A functionality for data providers to upload and manage data on their energy efficiency projects.
5. An analysis Toolbox, which allows users to create charts in a dynamic and highly customizable manner
6. A functionality, which allows users to benchmark their own projects and portfolios of projects against a selected group of reference projects from the DEEP database.

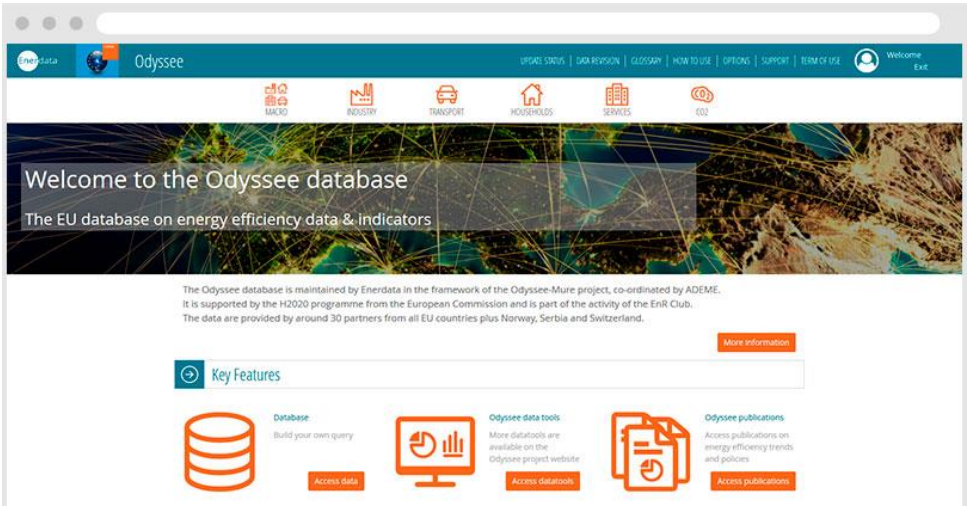
The De-risking Energy Efficiency Platform (DEEP) can be accessed online at http://deep.eefig.eu

3.1.3.5 ODYSSEE / MURE

The Odyssee-Mure project relies on two complementary databases:

— Odyssee, the European Energy Efficiency Data base, has collected for the last two decades valuable and detailed energy efficiency and CO_2 emissions indicators so that it provides a review and benchmark of EU members' progress in the energy efficiency target. It contains detailed information on energy consumption by end-use,

Figure 20. Odyssee Data base homepage



Source: Odyssee Data base [46]

Table 36. Odysee database content

Odyssee database		
Managed by	Enerdata	
Data provider	National representatives, such as energy agencies or statistical organization, from all EU countries as well as Norway, Switzerland and Serbia.	
Database content per sector		
MACRO	Macro Sectors	Total Industry Transport Residential-Tertiary-Agriculture
	Macro-Economic Data	Primary consumption Final consumption Demography GDP, Value-added
	Macro Energy Efficiency Indicators	Primary energy intensity Final energy intensity Energy efficiency index CO_2 emissions CO_2 intensity
INDUSTRY	Industry Branches	Chemical industry Primary metals Non-metallic mineral Paper & Printing Food & beverages Textile Machinery & Fabricated metals Transport equipment Miscellaneous industries Wood Mining
	Industry Economic Data	Energy consumption by branch Production index by branch Value added by branch Physical production for intensive products

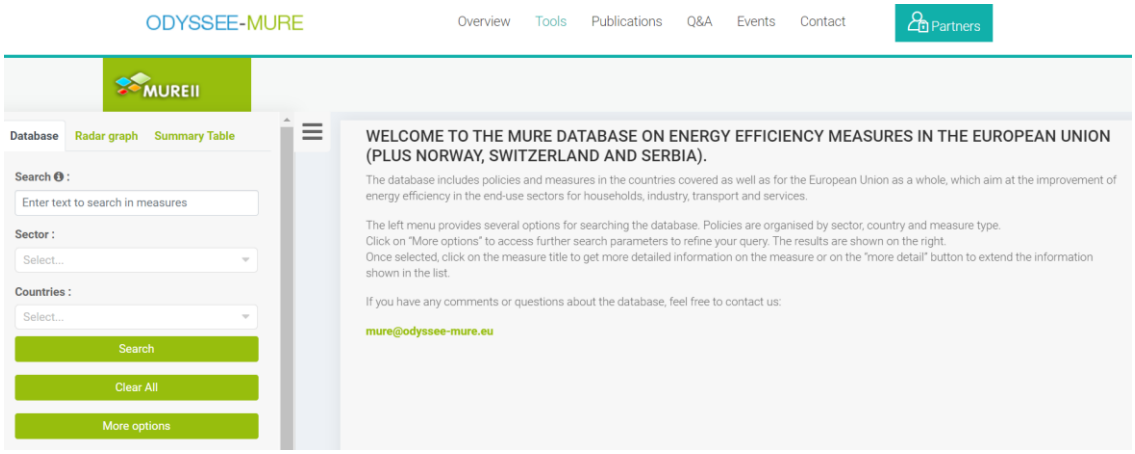
	Industry Energy Efficiency Indicators	Energy efficiency Index Energy intensity by branch Energy intensity at adjusted structure Specific consumption by intensive products (toe/ton) CO_2 intensity by sector
TRANSPORT	Transport modes	Road: Cars, Two-wheels, Bus, Trucks & light vehicles, Light vehicles, Trucks Rail Water Air
	Transport Technical & Economic Data	Energy consumption by fuel and by mode Stock of vehicles by fuel Registrations by vehicle and fuel type Traffic by mode Annual distance travelled by vehicle type
	Transport Energy Efficiency Indicators	Energy efficiency index Specific consumption by vehicle, in liters/100km Specific emissions of CO_2 by mode and vehicle
HOUSEHOLDS	Residential end-uses	Space heating Water heating Cooking
	Residential Technical & Economic Data	Energy consumption Stock of dwellings New dwellings Floor area of dwelling Stock of appliances Equipment rate Degree day
	Residential Energy Efficiency Indicators	Energy efficiency index Specific consumption by dwelling, by end uses and by equipment Specific emissions of CO_2 CO_2 indicators
SERVICES	Services & Agriculture Branches	Hotels & Restaurants Health Education Administration

		Wholesale & retail trade Private offices Agriculture
	Services & Agriculture Economic Data	Energy consumption Value added Floor area Employment
	Services & Agriculture Energy Efficiency Indicators	Energy intensity Electric intensity Specific consumption per employee, floor area CO_2 emissions
Tools		
Six data tools to monitor progress in the market penetration of a selection of energy-efficient technologies and practices, identify the drivers responsible for the variation of energy consumption, and compare and benchmark the energy efficiency of performance of countries. — Key indicators tool — Market diffusion — Decomposition — Comparison — Energy saving — Indicators Scoreboard tool		
Access	Free for all EU Ministries, Concerted Action EED, EED Committee Members and EU universities and research centres for non-commercial uses	
Online access	https://www.odyssee-mure.eu/private/	

Source: Odyssee Data base [46]

— MURE (Mesures d'Utilisation Rationnelle de l'Energie) database provides information on energy efficiency policies and measures that have been carried out in the Member States of the European Union (plus Norway, Switzerland and Serbia).

Figure 21. MURE Data base homepage



Source: MURE Data base [47]

Table 37. MURE database content

MURE II database			
Managed by	Fraunhofer-ISI with the technical support of Enerdata		
Policy Database structure	Sector	General cross-cutting Household Industry Service Transport	
	Country	European Union Norway, Switzerland and Serbia	
	Measure	Status: completed, ongoing, proposed, Starting year Impacts Relation to EU Policy Frame	
Data provided per policy	Country Short description Reference Status Type		Targeted energy end use Policy description Interaction with other policies Historical data sources
Access	Free		
Online access	https://www.measures.odyssee-mure.eu/energy-efficiency-policies-database.html#/		

Source: MURE Data base [47]

3.2 Geospatial data sources

This section has a more geographical focus to provide georeferenced data that can support the numerical data sources that have been introduced in the previous section, without analysing the INSPIRE data themes and the corresponding available datasets, which will be covered in the next deliverables. In particular, this section will focus on Copernicus data (section 3.2.1) and Open Street Map data (section 3.2.2).

3.2.1 Copernicus data

Copernicus is the European system for Earth monitoring. It offers information services based on Earth Observation and "in situ" data covering six thematic areas: atmosphere monitoring, marine environment monitoring, land monitoring, climate change, emergency management and security. Data provided by Copernicus could be useful to develop geographical energy models, including the potential of areas for renewable energy and suitability analysis (land availability) to develop different scenarios. These energy models based on geographical data could help decision-makers and experts to enforce the energy transition.

Considering the data available in the different thematic areas of Copernicus, the following table includes the most relevant data that can be used to develop regional assessment in the energy context, considering renewable energy potential and suitability areas.

Table 38. Most relevant data contained in Copernicus Services: Land Monitoring and Climate Change Services

Copernicus Land Monitoring Service	
Urban atlas	It is currently composed of 438 Functional Urban Areas covering land-use types in urban environments. It also includes attributes for the population at urban scale
Building heights	Include building heights in urban areas of capitals in the EEA39
European Settlement Map	It provides a spatial raster dataset that maps human settlements in Europe. It could be helpful in obtaining building footprints or to develop spatial planning analysis
Corine Land Cover	It consists of an inventory of land cover in 44 classes being useful to develop spatial planning analysis
Copernicus Climate Change Service	
CORDEX regional climate model data on single levels for Europe	Climate data useful to model different potential for renewable energy using historical data and data provided by different future scenarios
Water quantity indicators for Europe	Flow data useful to model different potential for hydro energy using historical and future data
CMIP5 daily data on single levels	Global climate data at an hourly level for historical and future scenarios

Source: Own elaboration based on data from Copernicus Services.

Copernicus data are freely available. It is only required to be registered in each service to access and download the relevant data for your analysis.

Finally, demonstrator projects using Copernicus data are available in the Climate Change Service, whose data could be useful to analyse energy trends. This is the case of The European Climatic Energy Mixes (ECEM), whose proof-of-concept offers data at the country level considering the relevant impacts of climate change in the energy mix. Energy demand, hydro, wind and solar energy data for different scenarios developed under the Representative Concentration Pathways (RCPs) are available.

3.2.2 OpenStreetMap

OpenStreetMap (OSM) is a collaborative and open-source framework to develop a set of maps that complement the data provided by public administrations such as Cadastre, roads or rails. This database is useful to develop urban energy models requiring georeferenced data of the cities infrastructures that are mainly represented by the location, function and occupancy of the different buildings. Each person can be a contributor of OpenStreetMap, developing his or her own maps to be included in the database. Consistency and accuracy of the data can vary from region to region. Data are available by the following services:

- **Overpass API**: This API will create a square to obtain a copy of the OpenStreetMap database.
- **OSM planet**: The files found here are regularly updated. It includes complete copies of the OpenStreetMap.org database.
- **Geofabrik's free download server**: This server has data extracts from the OpenStreetMap project, which are typically updated every day. You can select your continent and then your country of interest to download your data.
- **Other sources**: it includes other additional sources that are included in the OpenStreetMap wiki.

In the OSM database, different types of georeferenced objects can be mapped and stored. Such objects are streets, buildings, land use and transportation networks (roads and railways). Data are available by three different data types representing the most common objects. These types are nodes, ways and relations. Nodes are georeferenced points in space, which are defined by their geographical coordinates. Ways are a collection of connected nodes, which either define a non-closed object such as paths or closed objects (e.g. footprint area of a building). Ways can represent either an empty polygon or an area (a filled polygon). Relations are the most complex data type in OSM and are used to represent objects in relations to each other, such as a bus route including all stops and road sections. The most common way of mapping objects in OSM is employing GPS devices or by mapping from a satellite image or a combination of both methods. After the development, maps are uploaded to the database.

In the following, we introduce the main features in the OSM catalogue in detail, which could be useful to collect data for modelling urban energy systems. Table 39 describes the most common attributes included to describe OSM layers, and Table 40 includes the layers available in the OSM feature catalogue.

Table 39. Common attributes for each OSM layer.

Key attribute	Description
id	Id of this feature. Unique in each layer
osm_id	OSM Id taken from the Id of this feature (node_id, way_id, or relation_id) in the OSM database
Code	4 digit code (between 1000 and 9999) defining the feature class. The first one or two digits define the layer, the last two or three, the class inside a layer
fclass	Class name of the feature. This includes the same information than the code
Name	Name of the feature, like a street or place name

Source: Own elaboration based on OSM data.

Table 40. Available layers from OSM catalogue

Geometry	Code	Layer	Description
Point	10xx	Places	Cities, towns, suburbs, villages, etc.
	2xxx	Pois	Points of Interest

	20xx		Public facilities such as government offices, post office, police, etc.
	21xx		Hospitals, pharmacies, etc.
	22xx		Culture, Leisure, etc.
	23xx		Restaurants, pubs, cafes, etc.
	24xx		Hotel, motels, and other places to stay the night
	25xx		Supermarkets, bakeries, etc.
	26xx		Banks and ATMs
	27xx		Tourist information, sights, museums, etc.
	29xx		Miscellaneous points of interest
	3xxx	Pofw	Places of worship such as churches, mosques, etc.
	41xx	Natural	Natural feature
	52xx	Traffic	Traffic-related
	50xx	Transport	Parking lots, petrol (gas) stations, etc.
Line	51xx	Roads	Roads, tracks, paths,
	61xx	Railway	Railway, subways, light rail, trams, etc.
	81xx	Waterways	Rivers, canals, streams, etc.
Polygon	15xx	Buildings	Building outlines
	72xx	Landuse	Forests, residential areas, industrial areas, etc.
	82xx	Water	Lakes, etc.

Source: Own elaboration based on OSM data.

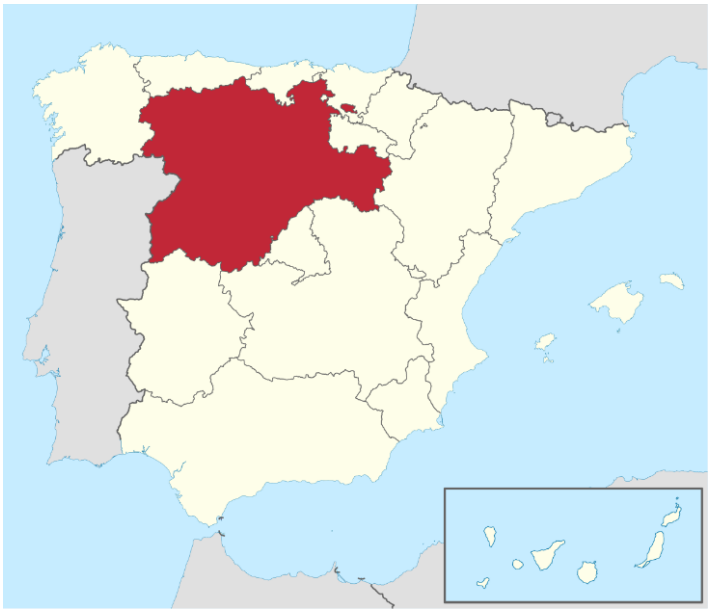
4 Characterisation of Castilla y León region and its Energy Efficiencystrategy

This section presents Castilla y León region, its main characteristics and the most important aspects that affect the deployment of the Energy Efficiency Strategy (section 4.1) and the steps this Energy Efficiency Strategy has followed towards its development and its context (section 4.2).

4.1 About the Castilla y León region

The region of Castilla y León is one of the biggest in Europe and is located in central Spain, to the north, as it can be seen in Figure 22 below:

Figure 22. Castilla y León region



Source: Wikipedia

The following table depicts the situation of the Castilla y León region (NUTS 2 – ES41), as measured by EUROSTAT in the year 2019[15], in comparison to Spain and Europe's average values in the fields of:

1. General and regional statistics
2. Economy and finance
3. Population and social conditions
4. Industry, trade and services
5. Agriculture and fisheries
6. Transport
7. Science, technology and digital society

It is worth noting that these values offer a static depiction of the Castilla y León region; however, for an adequate understanding of the region's situation, it would be advisable to study the trends the region has undergone [103].

[15] Only the indicators which offered a value for 2019 have been depicted in this table.

Table 41. Characterisation of the Castilla y León Region through indicators

GENERAL AND REGIONAL STATISTICS			
Regional socioeconomic developments	Castilla y León	ES average	EU 27 average
GDP per inhabitant, pace of economic recovery since 2008 (first year after the crisis when GDP per inhabitant in PPS was above its 2008 level)	2015	2016	2011
GDP per inhabitant, 2017 (PPS; %, average change per annum of this ratio between 2008 and 2017)	0.6	0.26	1.6
Household disposable income, 2016 (EUR per inhabitant; overall change of this ratio between 2008 and 2016)	300	-10	1500
Labour productivity per hour worked, 2016 (EUR, gross value added per hour worked; %, average change per annum of this ratio between 2008 and 2016)	1.2	1.2	1.9
Tertiary educational attainment, 2018 (%, share of persons aged 25-64 years with a tertiary level of educational attainment; percentage points, change of this share between 2008 and 2018)	6	2.3	8.1
Working-age population, 2018 (%, people aged 20-64 years as a share of the total population; percentage points, change of this share between 2008 and 2018)	-2.5	-2.6	-1.7
Employment rate, 2018 (%, people aged 20-64 years in employment as a share of all people aged 20-64 years; percentage points, change of this share between 2008 and 2018)	0.8	-1.2	2.9
ECONOMY AND FINANCE			
Economy	Castilla y León	ES average	EU 27 average
Gross Domestic Product (GDP) (Billion €)	58	1202	13484
GDP per inhabitant (2018) (Index based on GDP in purchasing power standards (PPS) in relation to the EU-27 average = 100)	85.39	87.59	100
Primary income per inhabitant, 2017 (purchasing power standard (PPS)	15300	16037	18800
Labour productivity per hour worked (2017) (Index, based on gross value added per hour worked in EUR in relation to the EU-27 average = 100)	86.7	89.22	100
POPULATION AND SOCIETY			
Population	Castilla y León	ES average	EU 27 average
Population, 1 January 2019 (1000 persons)	2407.7	46937.06	446825

Population density, 2018 (persons per km²)	25.7	93.1	108.8
Live births to mothers aged ≥ 40 years, 2018 (%, share of total number of live births)	10.4	9.5	5.2
Health	Castilla y León	ES average	EU 27 average
Life expectancy at 65 years, 2018 (years)	19.3	18.5	20
Number of (practising) physicians, 2017 (per 100 000 inhabitants)	417.7	431,57	375.8
Standardised death rates from cancer, 2016 (per 100 000 inhabitant)	229.9	235.98	257.1
Standardised death rates from cancer among people aged < 65 years, 2016 (per 100 000 inhabitants aged < 65 years)	69	72.1	77.3
Education	Castilla y León	ES average	EU 27 average
Participation rates in early childhood education, 2018 (%)	98.5	97.8	96.2
Students enrolled in upper secondary education that followed vocational programmes, 2018 (%)	39.4	35.6	48.4
People aged 25-64 years having attained at least an upper secondary level of education, 2019 (%)	61.4	60.2	78.4
Tertiary educational attainment of people aged 30-34 years, 2019 (%)	45.8	43.0	40.3
4.5 Early leavers from education and training among people aged 18-24 years, 2019 (%)	14.3	17.2	10.2
Labour market	Castilla y León	ES average	EU 27 average
Employment rate (%, share of people aged 20-64 years)	69.8	67.0	73.0
Employment gender gap, 2019 (percentage points, based on people aged 20-64 years)	12.9	12.5	11.7
Employment rate of older persons, 2019 (%, share of people aged 55-64 years)	57.7	54.1	59.1
Youth unemployment rate, 2019 (%, share of labour force aged 15-24 years)	29.5	34.4	15.1
Long-term unemployment share, 2019 (%, share of unemployed persons aged 15-74 years)	39.2	39.1	41.8
People who stated that childcare responsibilities had an effect on their employment, 2018 (%, share of people aged 18-64 years in employment)	23.8	22.4	24.1

Living conditions	Castilla y León	ES average	EU 27 average
People at risk of poverty or social exclusion, 2018 (%)	19.5	26.1	21.6
At-risk-of-poverty rate, 2018 (%)	16.1	21.5	16.8
INDUSTRY, TRADE AND SERVICES			
Structural business statistics	Castilla y León	ES average	EU average
Enterprise birth rate, 2017 (% of active enterprises in the business economy)	7.2	9.1	9.3
Enterprise death rate, 2016 (% of active enterprises in the business economy)	7.9	8.8	8.1
High-growth enterprises, 2017 (% share of total number of enterprises in the business economy with 10 employees or more)	14.2	14	11.3
Employment in the manufacture of wearing apparel, 2017 (%, share of regional non-financial business economy employment)	0.2	0.3	0.7
Employment in food and beverage service activities, 2017 (%, share of regional non-financial business economy employment	10	10.5	6.2
Tourism	Castilla y León	ES average	EU average
Nights spent in tourist accommodation, 2018 (million nights spent)	11.4	24.6	2786
Annual rate of change for nights spent in tourist accommodation, 2017-2018 (%)	1	0.2	2.6
Nights spent in tourist accommodation relative to total area, 2018 (nights spent in tourist accommodation per km^2)	121	3239.7	656
AGRICULTURE AND FISHERIES			
Agriculture	Castilla y León	ES average	EU 27 average
Young farm managers, 2016 (%, share of farm managers aged < 40 years)	7.7	8.5	10.7
Harvested production of common wheat and spelt, 2018 (million tonnes)	3.59	6.72	115.6
Number of bovine animals, December 2018 (thousand head of livestock)	1422.7	6510.7	77840
TRANSPORT			
Transport	Castilla y León	ES average	EU 27 average

Motorisation rate, 2018 (number of passenger cars per 1 000 inhabitants)	544	516.2	503
Fatal road accidents 2018 (per million inhabitants)	73	42.2	52
SCIENCE, TECHNOLOGY AND DIGITAL SOCIETY			
Research and innovation	Castilla y León	ES average	EU average
Researchers, 2017 (%, share of total number of persons employed measured in FTEs)	0.64	0.58	0.89
Human resources in science and technology, 2018 (%, share of the economically active population)	43	42.5	44.2
Gender gap for scientists and engineers, 2018 (percentage points, difference between male and female shares of the economically active population)	-1.6	-0.5	1.5
Digital society	Castilla y León	ES average	EU average
Daily internet users during the three months preceding the survey, 2019 (% of people aged 16-74 years)	73	76.6	77
People accessing the internet away from home or work during the three months preceding the survey, 2019 (% of people aged 16-74 years)	82	86.1	73
People buying/ordering goods or services over the internet for private use during the 12 months preceding the survey, 2019 (% of people aged 16-74 years)	53	56	60

Source: Eurostat Regional Yearbook years 2019 and 2020.

4.2 About the Energy Efficiency Strategy and its development

The Energy Efficiency Strategy of Castilla y León analysed in these reports is valid during 2016-2020. To understand its key features, it is necessary to understand its context (section 4.2.1) and the steps that are usually carried out to elaborate an Energy Efficiency Strategy (section 4.2.2).

4.2.1 Energy Efficiency Strategy of Castilla y León context

In the energy efficiency context, it is worth knowing the agreement reached in 1990 by the Member States to reduce 20% the energy consumption and CO_2 emissions up to the year 2020. This objective is far from reached. In this line and to comply with the objective previously established, at the end of 2012, the Energy Efficiency Directive was published [105].

In Castilla y León, it is the Ente Regional de la Energía (EREN) the responsible institution to propose the Savings and Energy Efficiency Plan of Castilla y León, as per the Law 7/1996 of 3rd December.

This plan is an Energy Efficiency strategy at medium and long term, where the programme with the actions to be carried out during the following years in the different energy consumption sectors should be defined, together with its financing, energy indicators, its monitoring, and the establishment of who does what to achieve the objectives set.

In the action programme that the Economy and Finance council is going to put in practice in its IX legislature, it is worth highlighting the following priorities:

— Consolidate the economic recovery to achieve a stable growth that generates quality employment.

— Guarantee the big public services that constitute the essence of the regional competences, and are key towards achieving social cohesion.

— Strengthen Castilla y León as a region, deepening in its institutional development and territorial cohesion.

The attainment of the three priorities will be achieved partially, thanks to the implementation of measures that boost the economic competitiveness of the region, acting in three axes:

— Recovering the business tissue

— Maintaining the already established business, especially the industrial ones.

— Fostering the business growth, strengthening local and familiar SMEs, enhancing the growth of businesses in traditional sectors and supporting the growth especially in priority sectors and with more innovation potential

With this objective, international promotion, technology innovation and productive specialization are enhanced, infrastructures are improved, and clusters are developed, leading to the decrease of energy costs, which are highly relevant in producing goods and services.

The intensification of the actions focused on energy efficiency and savings is prioritised since they generate benefits directly related to reducing energy and environmental costs, apart from their contribution to reducing energy dependency and modernising installations and generating employment.

To this end, the Energy Efficiency Strategy of Castilla y León 2016-2020 is designed. It will implement different types of measures oriented to achieving significant energy (and economic) savings in the Administration of Castilla y León, Local Entities, and the private entities, with a special focus on the industrial production sector.

4.2.2 Steps followed in the Energy Efficiency Strategy definition

The generation of the Energy Efficiency Strategy of Castilla y León follows the next steps and spans over a period of 16 – 18 months.

Table 42. Steps followed in the Energy Efficiency Strategy definition

Steps followed in the Energy Efficiency Strategy definition	
INITIAL PHASE	The EREN submits the proposal to elaborate the Energy Efficiency Strategy to the corresponding Office in charge of Energy Efficiency, in this case, the Economy and Finance Office.
	The Office approves the elaboration of the mentioned document
DRAFTING DOCUMENT	The EREN drafts the Energy Efficiency Strategy and offers it to the discussion.
	Each affected organism must identify itself in the drafted document, most importantly in relation to economic and budgetary implications.
PUBLIC CONSULTATION	The document is offered to public information (Open Government) If there are any allegations or observations, they are studied, and the new version of the document is drafted.
BUDGETARY ANALYSIS	A report is asked to the Budget and Statistic DG of the Economy and Finance Office due to the budgetary implications.
INFORMING LOCAL ENTITIES	Since it affects local entities, the Commission for Local Cooperation needs to be informed.
FINAL CONSULTATION	Delegated Economy Commission
	Secretary Commission

	Board of Governors
AGREEMENT AND PUBLICATION	Agreement publication in the BOCyL

Source: own elaboration based on input from EREN

In this process, the contacted organisations are the following: entrepreneurs, trade unions, consumers and users, universities, research centres, gas and electricity company associations.

5 Analysis and description of the current regional Energy Efficiency strategy (EEE-CyL-2020)

The different sections of the EE Strategy are explained and analysed in the following. First, how the objectives are set will be presented (section 5.1), then the sectors included within the strategy will be described (section 5.2), as well as the monitoring strategy used to measure their progress (section 5.3). Finally, cross-cutting aspects will be presented, such as other activities carried out (section 5.4) and financing mechanisms established (section 5.5).

A special focus will be placed on the data required to describe all of these sectors and monitor their progress. In this line, an introductory section presenting some of the data sources used in the Regional Energy Strategy is presented in section 0 and is complemented with Annex I, where all the detected datasets used in the strategy are listed.

5.1 Objective setting

To develop the Castilla y Leon Energy Efficiency Strategy (CyL EES) and the design of the different actions plans, it is necessary first to define and quantify the objectives of these plans that need to be aligned with the European Strategy 2020. In addition, the main objective of the Strategy is to achieve the European objectives for 2020 concerning climate change and energy sustainability, which all the Member States must assume.

First of all, the EE Strategy analyses the context and the main aspect of the EE Strategy, considering historical aspects, such as the energy efficiency plans developed and applied in the past until 2015, according to UE objectives. These past activities are mainly the following two:

- Energy Saving and Efficiency Plan of Castilla y León 2002-2007 (PAEE-Castilla y León 2002-2007).
- Energy Saving and Efficiency Plan of Castilla y León 2008-2012 (PAEE-Castilla y León 2008-2012) coincided with the 2008-2012 Action Plan of the Spanish Energy Efficiency Strategy.

In addition, it evaluates the integration of this strategy in the specific Castilla y León policies regarding the specific policy areas and social development of the region. In particular, the different sectorial domains evaluated in the region are research and innovation (sustainable and inclusive growth: social and territorial, competitiveness, specialized activities of the region), agriculture and livestock farming, tourism, industrial sector, environmental sustainability (considering past strategies, such as the Regional Strategy for Climate Change 2009-2012-2020, or the Energy Sector Mitigation Plan for promoting energy efficiency and renewable energies, the Industrial Sector Mitigation Plan that includes emissions reduction actions, or the Regional Strategy for Sustainable Development of Cyl 2009-2014), commercial sector, urban mobility (clean and energy-efficient vehicles, electric vehicles, new infrastructure), urban regeneration, cogeneration and district heating, and the regional and local administrative sector.

To obtain all the necessary information to quantify the specific objectives in the strategy is fundamental to develop different scenarios to project in the future the energy consumption and final energy in Castilla y Leon (up to 2020).

The strategy aligns with the European and national regulatory framework, as it is a tool to define the lines for policy action, covering the different energy-consuming sectors. For this reason, firstly, the strategy specific areas or strategic sectors have been defined: industrial activity, building sector, transport, public services and local entities, public administration, research and development, and communication, dissemination and training activities. These sectors will be analysed in more detail in the following two sections.

Secondly, the current energy situation of Castilla y Leon is analysed (along with the international and national current energy situation), including primary energy consumed, primary energy produced, and energy final consumed. All this information is presented differencing between types of fuel including renewable energy share. In addition, it is also disaggregated by province and the different strategic sectors that are considered. In addition, the energy intensity (final energy consumption/GDP) is also analysed to reflect energy-economic relationships.

Considering all the above: European Union and national objectives and directives and plans, the strategic sectors in Castilla y Leon, and the current energy situation, the Energy Strategy objectives are defined and quantified by developing three scenarios (along with hypothesis from exogenous variables which could be reformulated).

- "BASE" scenario: scenario without new energy policies to be applied. Past trends until 2007 remain in the future (projections since 2007). Growth rates are used for primary energy, final energy, and GDP.

— "REAL" scenario to 2014: real data until 2014. Then, starting from 2014 (last year with historical data), the projections are developed using past trends (the same growth rates as in the BASE scenario).

— "2020" OBJECTIVE scenario: aligned with the EU objectives in 2020 and the Energy and Climate Plan for Spain.

These scenarios allow projecting the primary energy consumption and final energy consumption in Castilla y León for the 2016-2020 year's horizon, based on different hypothesis which can be iteratively reformulated.

The three main energy-related objectives considered in the last scenario (2020 Objective scenario) are the following:

— Reduction of Greenhouse Gas (GHG) emissions: 20 percent less regarding 1990 levels.

— Energy efficiency increase: energy consumption reduction (20%) in 2020 (base year: 2007).

— Renewable energy share: renewable energy share in the energy mix increased to 20% for the 2020 year.

Analysing the scenarios, it was found in the energy strategy that the EU objective of reducing primary energy by 20% was already achieved (due to implemented policies and economic crisis). For this reason, the objective was redesigned: 10% of additional energy consumption saving. These savings were also traduced to final energy reductions.

In addition, these energy savings have been aggregated among sectors considering the specific areas of savings in the strategic sectors defined before. In particular, industry, transport (type of fuel, public transport), residential buildings (energy efficiency), services and administration.

Finally, the two main objectives established in the energy efficiency strategy of Castilla y Leon are the following:

— Objective 1: to reduce 10% actual trends in primary energy consumption regarding the 2014 base year. This means a saving of 32,45 % regarding the previous base year (2007).

— Objective 2: energy consumption decarbonisation of 30,24 % regarding values of 1990 (reference year for GHG emissions from energy consumption).

As can be seen, the objectives have been notably modified (approx. 30 % of reduction) concerning the initial value of 20% reduction for both objectives fixed in UE energy directives. The analysis and measures to be proposed in each of the strategic sectors are explained in the following sector considering the final aggregated objectives to be achieved.

5.2 Sectors' analysis and measures proposed

This section offers an overview of the sectors contained within the strategy and the measures proposed in each of them. It is worth mentioning that the Energy Efficiency Strategy of the Castilla y León region is structured into the following sectors:

— Industrial sector (section 5.2.1)

— Building sector (section 5.2.2)

— Transport sector (section 5.2.3)

— Public services (local entities) (section 5.2.4)

— Administrative sector (section 5.2.5)

5.2.1 Industrial sector

In this section, the industrial sector included the Energy Efficiency Strategy of Castilla y León, is presented. In this sector, the objectives set result from the aggregation of savings calculated by grouping lines of action for each industrial subsector.

Firstly, to the evolution of GVA (Gross Value Added) in this sector, Castilla y Leon shows better results than in the rest of the country. In addition, it also has a high industrial production index (IPI). For this reason, industry plays an important role in Castilla y Leon.

Some results of the Energy Efficiency Strategy of Castilla y Leon present the industrial composition, number and size of the companies according to each specific sub- sector (e.g. extractive, food and drink industry, etc.). It also contains the current employment situation and the foreign trade of the region, i.e. number of exports

and imports. The results show that the total number of industry companies have been reduced due to the economic crisis. Concerning the employment issue, the industry is 16,2% of the total (regional value above national value), noting Burgos province. Although the main industry is the food industry in Castilla y Leon, the highest number of exports corresponds to the car industry.

In relation to the region's energy situation, the industry also plays an important role, covering 22, 37 % of the total energy consumption. This information is disaggregated by type of fuel (fuel oil, electricity, natural gas and bioenergy). In this regard, the highest share in the industry is the one from natural gas. The sector with the highest electricity and natural gas consumption is the food, drink and tobacco industry.

To meet the general objectives, those set for the industrial sector are the following:

Table 43. Objectives for the industrial sector in 2020

Final energy savings in 2020 (ktep)	Primary energy saved in 2020 (ktep)	Diversified energy in 2020 (ktep)	CO_2 emissions avoided in 2020 (ktCo2)
253,5	372,9	22,8	844,5

Source: Energy Efficiency Strategy of Castilla y León 2016-2020

Considering all the information analysed, and considering that industry is very important for the regional economy, different strategies and activities are defined. In the following table, a brief description of energy efficiency measures described in the document is presented together with the main lines of action consistent with the final objectives.

Table 44. Energy efficiency lines of action and measures in the industrial sector

Energy efficiency lines of action and measures in the regional strategy	
Lines of action	Measures
Promotion of investments in energy efficiency in processes, equipment and facilities and energy diversification in the industrial sector	Improvement of available technology, promoting the use of more efficient equipment and industrial processes (electrical and thermal) thanks to the presentation of financing lines and subsidies.
	Diversification towards less polluting fuels.
	Introduction of tax incentives for investment.
Efficient management of facilities through the implementation of energy management (SGE), the performance of energy audits, development of R + D + i activities and promotion of training and dissemination.	Promotion of the implementation of energy management systems and development of energy audits in the industry.
	Development of pilot projects for sectoral application focused on application of energy-saving and efficiency measures (R + D + i).
	Development of training programs and dissemination of savings and efficiency energy in industrial sectors.
Support for the participation of SMEs in the ESCO market at an industrial level for the implementation of energy-saving and efficiency measures.	Technical support.
	Legal-administrative support.
Promote the use of centralized generation through District Heating and Cooling (DHC) in industrial estates.	Study of the thermal demand of the existing and/or new industrial estates and the available energy sources, analysing the feasibility of the generation centralized.
	Measurement and verification plan of the energy savings obtained through the DHC system in the industries belonging to the industrial estate.

Source: Energy Efficiency Strategy of Castilla y León 2016-2020

5.2.2 Building sector

In the field of energy efficiency and savings, it is essential to highlight the importance of the building sector in energy consumption. To contribute to the achievement of the objectives of the Europe Strategy 2020, the European Union and public entities at the national and regional level, develop programmes, strategies, and

grants that facilitate the application of actions towards improving energy efficiency and savings in the mentioned sector.

The buildings sector includes all buildings within the domestic and the services sector. Most of the energy consumed is due to heating, cooling, ventilation, domestic hot water, lighting, appliances, and many other necessities.

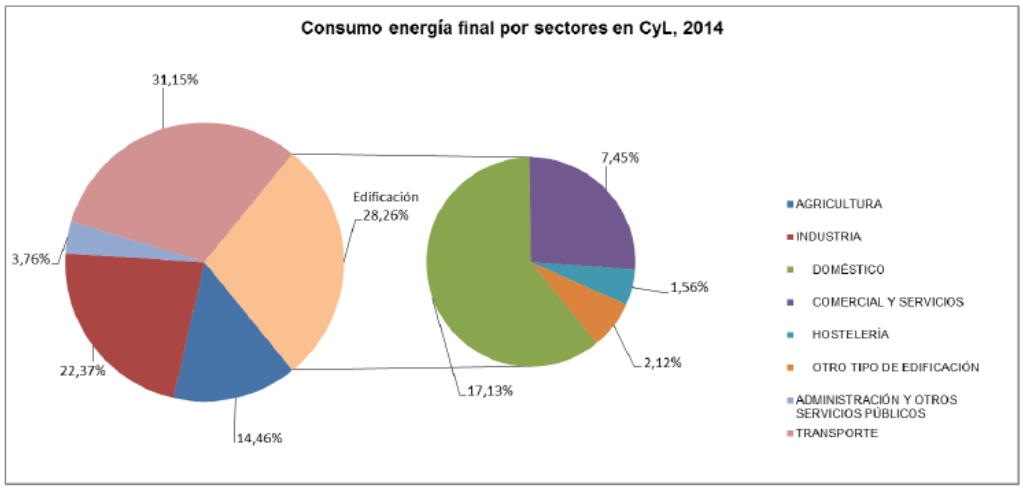
Within the economic structure of Castilla y León, the building sector was the second to consume the most energy in the region in 2014, representing 28% of the total share (1,612.39 ktep). In 2015 it still held the same position, but the consumption decreased, representing 26.10% of the total share (1,435.84 ktep).

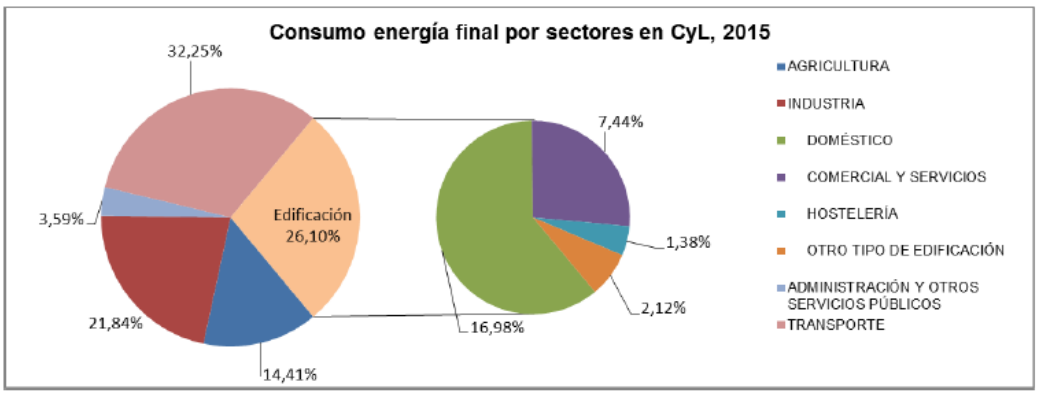
Analysing the data from 2014, sub-sectors within the building sector can be established. The most relevant sub-sector is the domestic sector (17% of total share, 977.68 kteps). In the second place, the commercial and services sector is to be found (7.45% of total share, 425 kteps). Then, there are other types of buildings consuming 120.69 kteps (2.12% of total share). Finally, the hotel industry has 1.56% of the total share (89 kteps).

In 2015 the same structure of consumption was maintained.

This can be seen in the following figure:

Figure 23. Final energy consumption per sector in CyL in 2014 and 2015





Source: Energy Efficiency Strategy of Castilla y León 2016-2020

In addition, the energy mix of this sector is presented in the following 0, for the two years presented above: 2014 and 2015.

Table 45. Consumption per energy source in the building sector in 2014 and 2015

Energy source	Percentage in 2014	Percentage in 2015
Electricity	36%	34%
Natural gas	33%	37%
Liquified Petroleum Gas	4%	5%
Diesel C	13%	11%
Bioenergy	14%	13%

Source: Energy Efficiency Strategy of Castilla y León 2016-2020

To contextualise further the sub-sector that consumes most of the energy within the building stock (domestic sector), the following Table 46 shows the dwellings distribution in the different provinces of Castilla y León and their evolution from 2010 to 2015.

Table 46. Dwellings distribution and evolution from 2010 to 2015

	2010	2011	2012	2013	2014	2015
Ávila	163.311	163.662	164.767	165.282	165.607	166.005
Burgos	252.114	253.527	255.295	255.794	256.498	257.038
León	324.067	325.538	326.988	327.500	328.041	328.726
Palencia	111.994	112.251	112.968	113.436	113.876	114.052
Salamanca	235.186	236.983	238.300	238.841	239.514	239.948
Segovia	123.013	124.262	125.453	126.104	126.399	126.796
Soria	76.045	76.819	77.481	77.881	78.272	78.579
Valladolid	287.118	288.292	289.480	290.134	290.406	290.722
Zamora	136.810	139.048	139.992	140.342	140.638	140.989
Castilla y León	1.709.658	1.720.382	1.730.724	1.735.314	1.739.251	1.742.855

Source: Energy Efficiency Strategy of Castilla y León 2016-2020

As it can be seen, there is a constant increase of these values. To meet the general objectives, those set for the residential and tertiary sector are the following:

Table 47. Objectives for the residential and tertiary sectors in 2020

Final energy savings in 2020 (ktep)	Primary energy saved in 2020 (ktep)	Diversified energy in 2020 (ktep)	CO_2 emissions avoided in 2020 (ktCo2)
134.4	197.7	10.7	447.6

Source: Energy Efficiency Strategy of Castilla y León 2016-2020

Table 48. Energy efficiency lines of action and measures – Building sector

Energy efficiency lines of action and measures in the regional strategy [BUILDING SECTOR]	
Lines of action	Measures
Equipment improvement in the domestic sector	Plan RENOVE de Electrodomésticos: plan to replace appliances
	Plan RENOVE de Aires Acondicionados: plan to replace air conditioning systems
	Plan RENOVE de Calderas: plan to replace boilers
	Plan RENOVE de Ventanas: plan to improve windows
Energy efficiency improvement in the domestic sector	Promote the use through incentives of the centralized generation of heating and cooling for residential districts.
	Promote the replacement of existing systems for more efficient ones.
	Replacement of heat generators for the best technology available and installation of equipment to recuperate thermal fluids.
	Energy refurbishment of existing buildings.
	Incentives for nearly zero energy buildings.
Energy efficiency improvement in the tertiary sector	Improve the energy efficiency of the thermal envelope.
	Promote and incentivize improvements in the air conditioning systems.
	Promote and incentivize improvements in the domestic hot water systems.
	Promote and incentivize improvements in the lighting systems.
	Promote and incentivize improvements in auxiliary energy generation equipment.
	Improve the energy efficiency of the thermal envelope.
Energy saving actions in common areas	Use of high-efficient lifts and mechanical stairs
	Lighting replacement in common areas for low-consumption ones.
	Implementation of presence detection sensors in common areas.
Programme to sensitise and inform about energy savings in dwellings	Elaboration of a good practice at home guide and promote its use in dwellings.
	Campaigns to promote energy savings

Source: Energy Efficiency Strategy of Castilla y León 2016-2020

5.2.3 Transport sector

In this section, an analysis of the main data provided by the Energy Efficiency Strategy of Castilla y León for the transport sector is included. Transport is one of the most strategic sectors, being relevant for the social and economic development of the region.

The transport sector's benefit brings to the region ranges between 3% and 5% of Gross National Product (GNP) and employs more than 94,000 employees distributed among the 14,000 companies. The public investment associated with it represents between 2% and 2.5% of GNP and can increase up to 3.5% in those countries that are involved in processes of creation and modernization of transport infrastructures.

In terms of energy efficiency and saving, it is essential to highlight the impact that the transport sector has on energy consumption. For this reason, public authorities such as the European Union, National and Regional governments include this sector as relevant to develop their strategies at different levels of detail. In addition, transport is considered an essential sector to facilitate the application of actions to improve energy savings and efficiency.

The final energy consumption in the transport sector in the Castilla y León is similar to the consumption in the Spanish state (around 32% of the total final energy consumption), being road transport the most important in consumption. In addition, it is important to mention that the sector that generates the most greenhouse gas emissions in the Spanish state is perfectly extrapolated to the regional framework.

In this section of the Energy Efficiency Strategy, a huge analysis of the most relevant data in the sector is provided considering the different transport and mobility models. This analysis includes the main energetic targets of the transport sector, measures to increase energy efficiency and a regional strategy for the inclusion of electric and alternative fuels vehicle in the region. For each data, a complete analysis including a brief description of the data and their units is included. All these data create a general view of the transport sector in the region. The data analysis for the transport sector in the Energy Efficiency strategy of Castilla y Leon is included in Annex I.

After the general description of the sector, including the status of each transport by model and the general situation of this sector in the region, the main objectives to safe and improve energy efficiency are provided. The emissions safe with these objectives are also determined.

Finally, a description of the energy efficiency measures and their possible impacts determined as the CO_2 emission saved is presented. Measures were proposed in five main areas (see Table 50) to meet the objectives set in the Europe 2020 Strategy.

To meet the general objectives, those set for the transport sector are the following:

Table 49. Objectives for the transport sector in 2020

Final energy savings in 2020 (ktep)	Primary energy saved in 2020 (ktep)	Diversified energy in 2020 (ktep)	CO_2 emissions avoided in 2020 (ktCo2)
332.6	489.2	2.0	1,107.9

Source: Energy Efficiency Strategy of Castilla y León 2016-2020

These objectives will be pursued with the following lines of action:

Table 50. Energy efficiency lines of action and measures – Transport sector

Energy efficiency lines of action and measures in the regional strategy [TRANSPORT SECTOR]	
Lines of action	**Measures**
Modal change in the mobility of people and goods towards models of more rational and efficient mobility	Promotion of sustainable transport plans to work for companies and business activity and administration centres.
	Promotion and dissemination of efficient driving courses for professional drivers.
	Promotion and dissemination of the legislative/ regulatory instruments in the transport sector to a more efficient transport.
Dissemination and promotion of the efficient use of both current means of transport as futures	Management of transport fleets, in order to promote improvements in the efficient management of transport fleets.
Improvement in the energy efficiency of the technologies used and promotion of use of alternative fuels to conventional ones	Vehicle fleet renewal

Adequacy and planning of transport infrastructures	Planning of transport infrastructures that improve the incorporation of new alternative vehicles and the development of more efficient urban mobility.
Development and use plan of the electric and plug-in hybrid vehicle in the Administration of Castilla y León.	-

Source: Energy Efficiency Strategy of Castilla y León 2016-2020

A special mention is necessary to develop the strategy for the alternative vehicle in Castilla y León. This Strategy is based on the three strategic axes set by the European Union (EU) for the horizon 2020. The EU urges all States Members to develop and use new fuels and sustainable propulsion systems. The technological characteristics of each of them are considered to determine the strategic prioritization in the introduction of vehicles. It is fundamental for road transport to discern journeys in urban, interurban areas and long-haul ones due to their energy and environmental impacts on different infrastructure needs.

As a final part of this sector assessment, the Strategy includes a Plan for the electric and plug-in hybrid vehicle implementation in the Administration of Castilla y León. A preliminary analysis of the recharge requirements and the number of vehicles per province is included. To conclude, a brief description of the application of energy-saving and efficiency measures in the transport sector is provided to be favoured by applying financial instruments developed by the different public administrations at European, national and regional levels.

5.2.4 Public services (local entities) sector

In this section, a resume of the main data and analysis regarding the public services sector provided by the Renewable Energy Strategy of Castilla y León is included. This sector covers services and buildings that depend on municipal management (local entities). In the next section, the "Administrative" sector is covered.

In this sector, to obtain energy consumption data, it has been used by the Strategy Document a particular tool called "OPTE". This tool gives information of various municipalities, and this data is extrapolated to the rest of the municipalities obtaining the total consumption. In relation to the energy consumption distribution by type of fuel, electricity is the one with maximum shares, followed by gasoil.

Firstly, it is necessary to know that in Castilla y Leon, there are nine provinces and 2,248 municipalities in total, and the total population has decreased, being Valladolid the province with more habitants (21.,3%) followed by Leon (19.4 %). A high percentage of this population is concentrated in the province capitals (42.2 %), being again Valladolid, the city with the highest population. However, most municipalities have less than 1000 habitants (88.5%), indicating that the area of the region is very dispersed regarding population, being the population density of just 26.6 habitants/km^2, representing one of the regions with the lowest population density value in Spain.

The municipal services and buildings consuming energy and analysed by the Energy Strategy of Castilla y León, with information about the distribution by provinces, type and number, are the following:

- Buildings:
  - Public health care centres.
  - Educational centres
  - Sports centres and facilities (e.g. swimming pools).
  - Unique cultural buildings: museums, theatres, libraries, cultural centres, etc.
  - Police and fire brigade (municipal security)
- Local entities consuming electricity, natural gas, gasoil and fuel gasoline:
  - Municipal lighting (electricity)
  - Water Waste Treatment Plants (WWTPs) (electricity)
  - Buildings and dependencies (municipally managed buildings in which activities associated with public services are carried out).
  - Waste treatment centres and landfills.

The highest consumption in the public sector services is electricity, followed by gasoil, natural gas and gasoline. In addition, this electricity consumption is disaggregated between municipal lighting, water cycle, and buildings.

In order to meet the general objectives, those set for the public services sector are the following:

Table 51. Objectives for the public services sector in 2020

Final energy savings in 2020 (ktep)	Primary energy saved in 2020 (ktep)	Diversified energy in 2020 (ktep)	CO_2 emissions avoided in 2020 (ktCo2)
29.7	43.6	0.0	98.8

Source: Energy Efficiency Strategy of Castilla y León 2016-2020

Considering all the information analysed covering the different dependencies and buildings from the public services sector, in the following table, a brief description of energy efficiency measures from the strategy document is presented together with the main lines of action consistent with the final objectives.

Table 52. Energy efficiency lines of action and measures in the public services sector

Energy efficiency lines of action and measures for the public services sector in the regional strategy	
Lines of action	Measures
Street lighting	Support municipalities for managing public lighting and companies contracting.
	Development of energy audits of public lighting
	Savings measurement and verification plans.
	Encourage partial or complete shutdown of special non-road lighting
Implementation of Energy Management Systems	Training of personnel in charge of municipal facilities
Water depuration	Promote awareness of the rational use of water.
	Encourage and assist in the replacement of equipment with other more efficient ones.
	Realization of sustainable urban drainage systems using rainwater.
	Encourage and assist in the performance of energy audits.
Garbage collection	Optimization of routes of the garbage collection trucks
Public buildings	Energy efficiency measures.
Energy studies and audits.	To detect potential improvements.

Source: Energy Efficiency Strategy of Castilla y León 2016-2020

Finally, in the regional strategy of Castilla y Leon, a summary of the energy certifications carried out in buildings belonging to this sector is presented to know the energy situation of these buildings. The results show that the buildings have a high potential to be renovated to reduce energy consumption and CO_2 emissions.

5.2.5 Administrative sector

This section provides an analysis of the data included for the administrative sector in Castilla y León. In general, the administrative sector analysis is based on the energy consumption of the building stock that is part of the public administration. The energy consumption of these buildings is monitored to provide energy savings on a monthly basis.

The energy consumption of the buildings of the autonomous administration is only an 85% (the year 2015) of the total final energy consumption in Castilla y León, but they play an important role due to the exemplary effect and the step towards a "low carbon economy" in the management of the buildings of this Administration. The autonomous administration manages 2.000 public buildings and facilities in the region with different typologies (e.g. hospitals, health centres or schools) and important consumption.

To manage and optimise the electricity and natural gas contracts for public buildings and promote energy savings, the autonomous administration has been developed the OPTE platform, which is the core dataset provider to assess the administration sector in Castilla y León. The data provided by OPTE and EREN for the administration sector in the Energy Efficiency Strategy of Castilla and León are included in Annex I.

Finally, energy efficiency measures, actions and financial instruments are included for their application in this section of the Strategy where the administrative sector is evaluated. Energy efficiency measures could be applied in the following areas:

- Thermal envelope of buildings,
- Air conditioning, heating and Domestic Hot Water (DHW) systems.
- Lighting systems
- Other consumptions and energy uses (e.g. computers, laptops, TVs) in the buildings.
- Good practices
- Establishment of an Energy Optimization records system.
- Implementation of Energy Management Systems type ISO-50001 (SGE) in buildings of the autonomous Administration.
- Energy training in the autonomous Administration.
- Promote energy service contracts.
- Energy Certification of buildings.

All the proposed measures in the previous areas aim to improve energy savings in public buildings by obtaining a better building certificate, being examples for the rest of the buildings in the region. 0 includes the main priority lines, and measures promote by the autonomous administration. These measures could be applied using the financial instruments developed by the different public administrations at the European, national and regional level.

To meet the general objectives, those set for the administrative sector are the following:

Table 53. Objectives for the administrative sector in 2020

Final energy savings in 2020 (ktep)	Primary energy saved in 2020 (ktep)	Diversified energy in 2020 (ktep)	CO_2 emissions avoided in 2020 (ktCo2)
7.1	10.4	0.6	23.6

Source: Energy Efficiency Strategy of Castilla y León 2016-2020

These objectives will be pursued with the following lines of action:

Table 54. Energy efficiency lines of action and measures

Energy efficiency lines of action and measures in the regional strategy	
Lines of action	Measures
Improvement of the equipment in the administration buildings	RENOVE air conditioning Plan
	RENOVE boiler Plan
	RENOVE window Plan
Improvement of the energy efficiency in the administration buildings	Encourage the replacement of existing equipment with more efficient ones
	Diversification of NG boilers
	Energy rehabilitation of existing administration buildings
	Incentives for buildings "Near Zero Energy Building" (NZEB)
	Improve the energy efficiency of the thermal envelope
	Encourage and incentivize improvements in air conditioning systems
	Encourage and incentivize the improvement of DHW systems
	Encourage and incentivize the improvement of lighting systems
	Promote energy service contracts
Energy saving actions in common areas	Use of high-efficiency elevators and escalators
	Replacement of lighting in common areas with lower consumption lights
	Implementation of presence detectors in common areas
Awareness and information programs on energy saving in government buildings	Preparation of a guide to good practices in administration buildings
	Campaigns to promote energy saving
Training campaigns for those responsible for building maintenance	-

Source: Energy Efficiency Strategy of Castilla y León 2016-2020

5.3 Monitoring indicators

The monitoring and the attainment of the objectives of the Energy Efficiency Strategy 2016-2020 consists of the periodic analysis and the gathering of information of the action lines proposed and those which are put in practice during its development, to evaluate the degree of compliance and improve its betterment effectively and efficiently.

It is possible that important changes occur related to external aspects to energy policy in Castilla y León or related to technology advances during the 2016-2020 period when the Strategy is in force. Consequently, the monitoring proposed for this strategy will allow that the mechanisms established to comply with the objectives can be modified if they do not work appropriately or if the circumstances change.

The elements of the Monitoring plan are the following:

— Annual monitoring reports of the EEE-CyL-2016/2020. Its drafting will be coordinated by the Ente Regional de la Energía de Castilla y León (EREN). They will summarise all the actions carried out in the framework of the strategy during the year, of the changes in the energy framework and the evolution of

the monitoring indicators concerning the established objective to take advantage of synergies and complementarities that can arise during the process. Moreover, and to enhance transparency, the documents will be available through the Junta de Castilla y León website.

- Continuous evaluation system. The monitoring and assessment of the EEE-CyL-2016/2020 will be enabled and its reorientation if it were necessary, and it will serve to establish the basis for the next energy efficiency strategy. The design of this monitoring system is directly related to the IDAE's intention of carrying out the monitoring and assessment of the energy savings and energy efficiency action plans.
- Indicators. A set of indicators will be available and a methodology that allows comparing the results with another energy strategy of other territories based on the efficiency and effectiveness of the actions. The indicators used are presented in Annex I. The indicators and their quantification will set the basis for monitoring the objectives of the strategy and the potential action plans.

The EREN will be responsible for the follow-up of the strategy. Doing so will count on a system that allows it to access the data and measure its effectiveness and efficiency of the different actions. It is worth noting that, as a result of this periodic evaluation, the EREN could incorporate changes in the sectorial distribution or in the actions proposed with the aim of guaranteeing the attainment of the objectives of the final and primary energy savings set. The comparison of the established objectives in the strategy with the results obtained in reality in the 2016-2020 period will allow to control the strategy and detect existing deviations and apply corrective measures.

To supervise the execution of the strategy, the indicators used should be based on quality and consistent information that reflects the real energy situation in Castilla y León and allows to measure the actions implemented and their impact. Two types of indicators are present:

- **Result indicators**: they are linked to the objectives of the EEE-CyL-2016/2020 and count on a base reference value, corresponding to the last available data before the strategy entered into force, and provides the objective values for the year 2020. They are homogeneous, comparable, and stable indicators.
- **Realization indicators**: they measure each of the actions performed in each of the defined sectors and will be dimensioned depending on the budget of each year and the specific plans to be carried out. Their base value is zero, and they will be cumulative once the different initiatives have started. These objectives must be coherent with the Operative Programme of Castilla y León and should be established for the different plans developed in the EEE-CyL-2016/2020.

Please refer to Annex I for a complete list of the indicators used in the strategy.

5.4 Other activities

This section is devoted to exploring other activities promoted within the Energy Efficiency Strategy. In particular, those related to research in Energy Efficiency (section 5.4.1), communication, dissemination (section 0), training (section 5.4.3) and international cooperation (section 5.4.4).

5.4.1 Research in Energy Efficiency

To understand the research in energy efficiency, firstly, the research context in Castilla y León is explained (section 5.4.1.1), then the financing of R+D+I is presented (section 5.4.1.2), as well as the workforce (section 5.4.1.3). Finally, the legal framework (section 5.4.1.4) and the research lines established are presented (section 5.4.1.5).

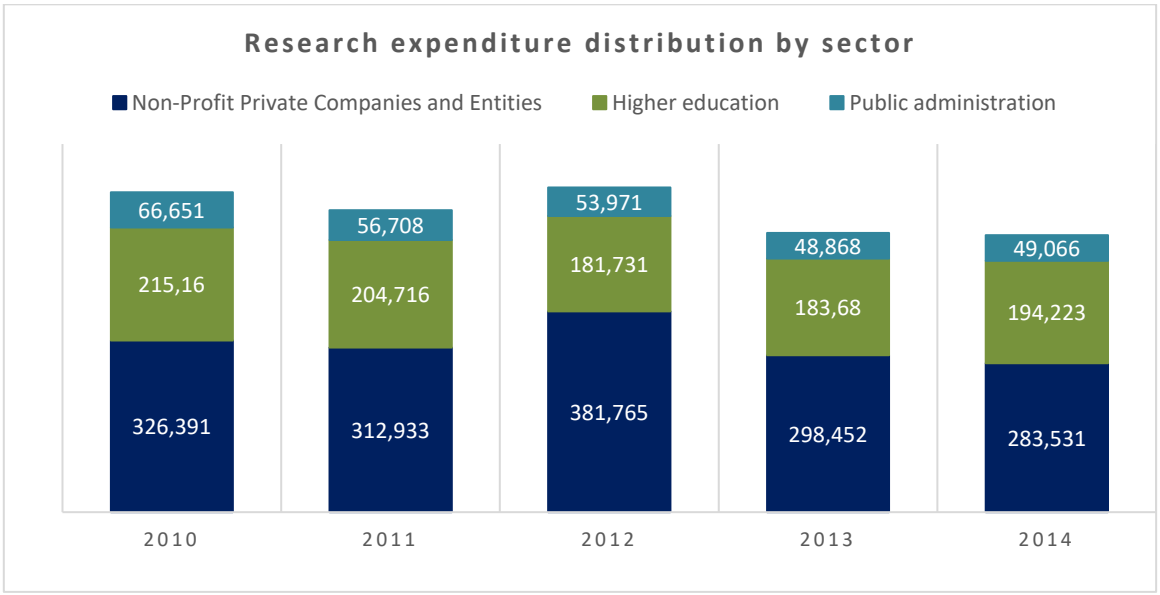
5.4.1.1 The research context in Castilla y León region

The internal expenditure on research in Castilla y León region before the strategy development (2014) amounted to € 526.82 million, which accounted for 4.1% of the total expenditure on research devoted to this aim in Spain. Castilla y León was the sixth region in 2014 concerning the budget assigned to research activities.

Regarding the evolution of the expenditure on research in Castilla y León region, it should be noted that the highest expenses were devoted in 2012 (€ 617,467 thousand) while the lowest in 2014 (€ 526,820 miles).

The distribution research expenditure by sector for the 2010-2014 period in Castilla y León is presented in the following graph:

Figure 24. Research expenditure distribution by sector in Castilla y León for 2010 to 2014 period.



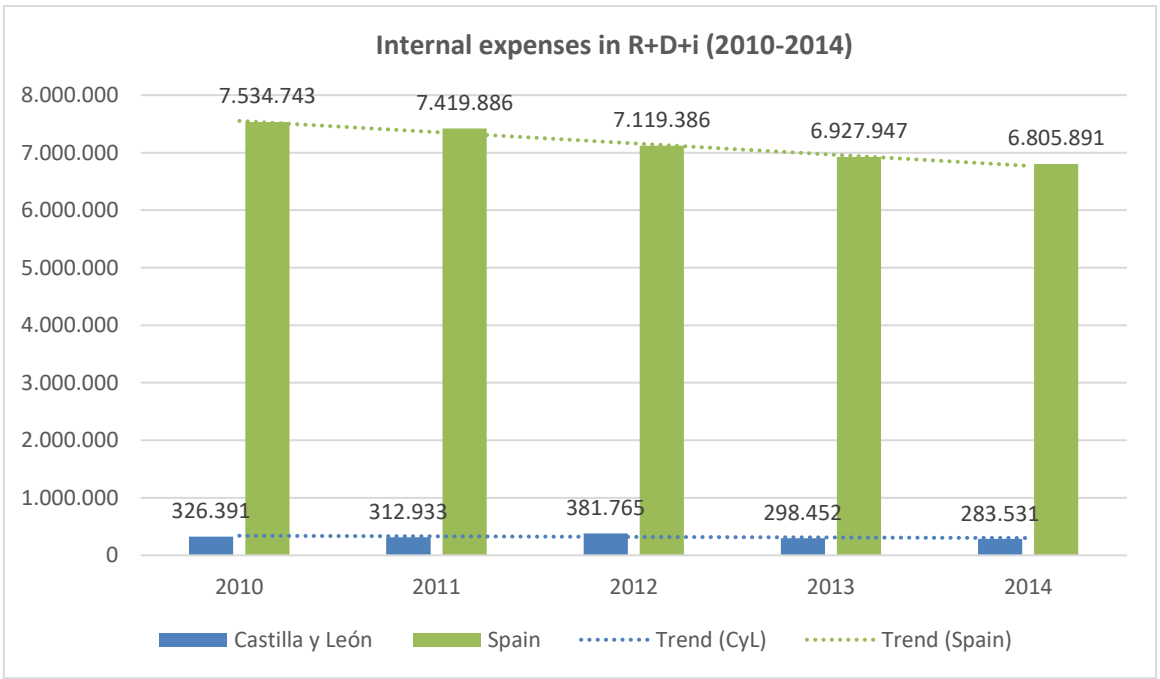
Source: CARTIF, own elaboration

Regarding the distribution by sectors, in Castilla y León during 2014, the private spending on R+D+I in the Private companies' sector represented the highest percentage of spending total in R+D+i (53.8%). Secondly, the Higher Education sector was ranked with 36.9% and finally the Public Administrations sector with 9.3% of the total. The distribution described is repeated for all the years of the period (2010-2014), varying the percentage value but not the order of impact of each sector on the total.

- Non-profit Private Companies and Entities sector

Below are presented the expenses of the Non-profit Private Companies and Entities in internal R+D+i (thousands of €)

Figure 25. Internal R+D+I expense (thousands of €) according to where the expense is made



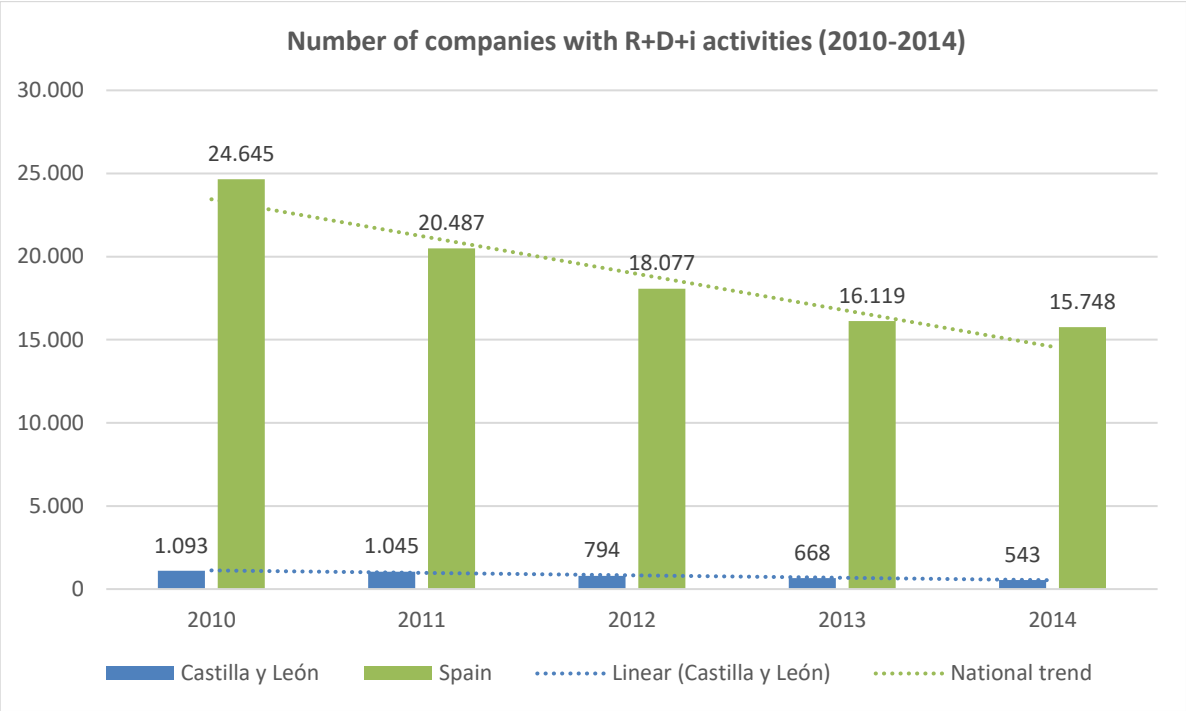
Source: CARTIF, own elaboration

In Castilla y León, the variation regarding R+D+I expense did not suffer much variation during the years 2010-2014. The highest expenditure was in 2012, reaching € 381,765 thousand. In 2014, internal expenditure on R+D+i amounted to € 283,531 thousand, representing 4.2% of national internal expenditure on R+D+i (6,805,891 thousands of €).

This internal expenditure was distributed practically evenly among the different types of companies (42.2% (companies with less than 250 employees) and 57.8% (companies with 250 and more employees)). Noted that this homogeneous distribution did not occur at the national level since that company with at least 250 employees registered 65.3%, while companies with less than 250 employees registered 34.7%.

The number of companies that carried our innovation activities during the 2010-2014 period is detailed in the following figure:

Figure 26. Number of companies that have carried out activities for technological innovation according to headquarters of the company.



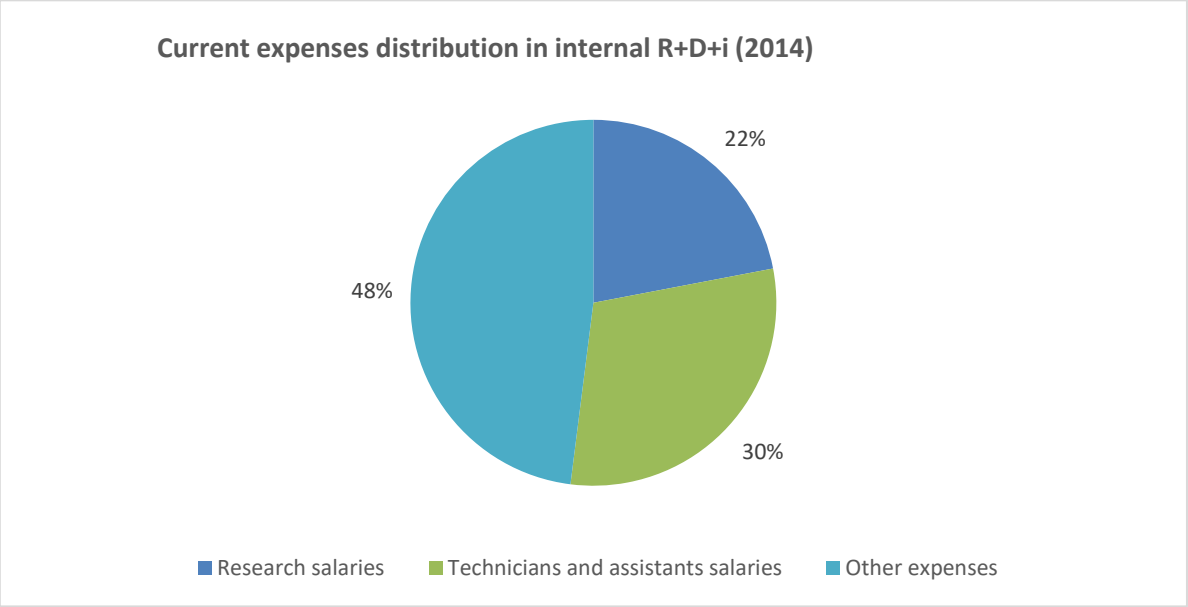
Source: CARTIF, own elaboration

In 2010 the number of companies that carried out technological research activities was 1,093 companies. In 2014, 543, the latter representing 3.4% of companies that carried out this type of activity nationwide (15,748 companies). Furthermore, the weight of companies with technological innovation activities in Castilla y León, with respect to the total national, has been declining annually.

The nature of spending on internal R+D+i in 2014 in Castilla y León indicates that 5.9% corresponded to capital expenses and 94.1% to current expenses. This same distribution was presented for the whole of Spain in the same year (7.2% capital expenditures and 92.8% current expenses).

Below is a detailed distribution of each expense's types indicated for Companies and Private Non-Profit Institutions in Castilla y León during 2014:

Figure 27. Distribution of current expenses in R+D+i of Companies and Private Non-Profit Institutions based in the region.

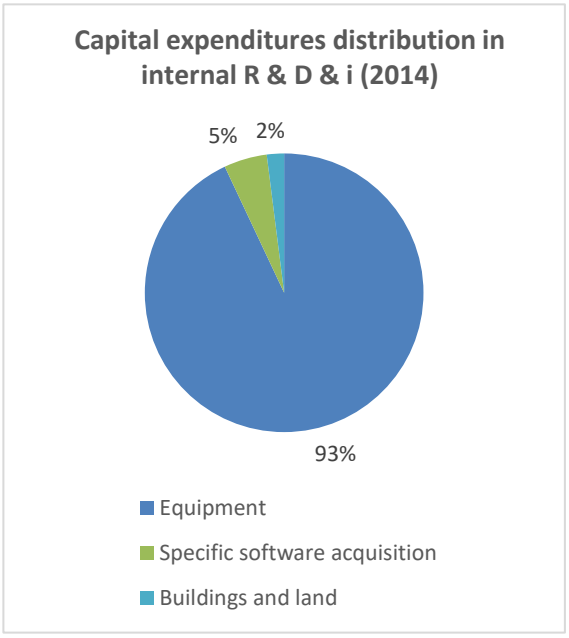


Source: CARTIF, own elaboration

As it can be seen in the figure, most of the current expenses in R+D+i corresponded to expenses not associated with salaries of researchers, technicians or assistants.

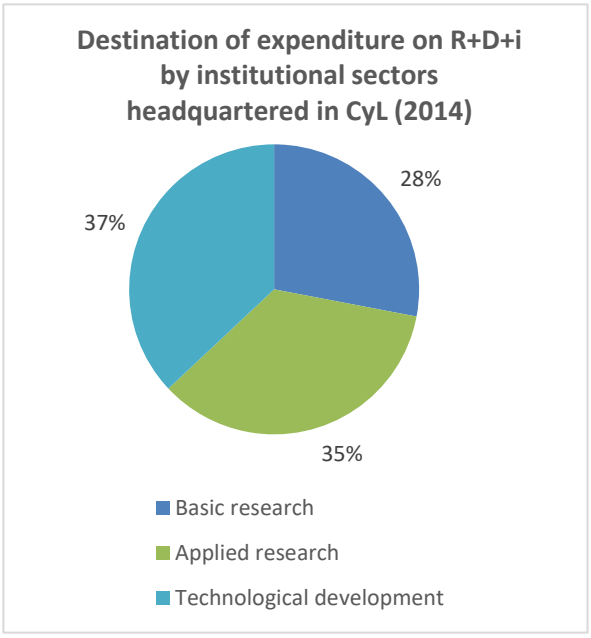
Regarding the capital expenses, 93% of them were devoted to equipment purchase.

Figure 28. Distribution of capital expenditures in internal R+D+i of Companies and Private Non-Profit Institutions based in the region.



Source: CARTIF, own elaboration

Figure 29. Destination of current expenditure on internal R+D+i carried out by institutional sectors with headquarters in Castilla y León (2014).



Source: CARTIF, own elaboration

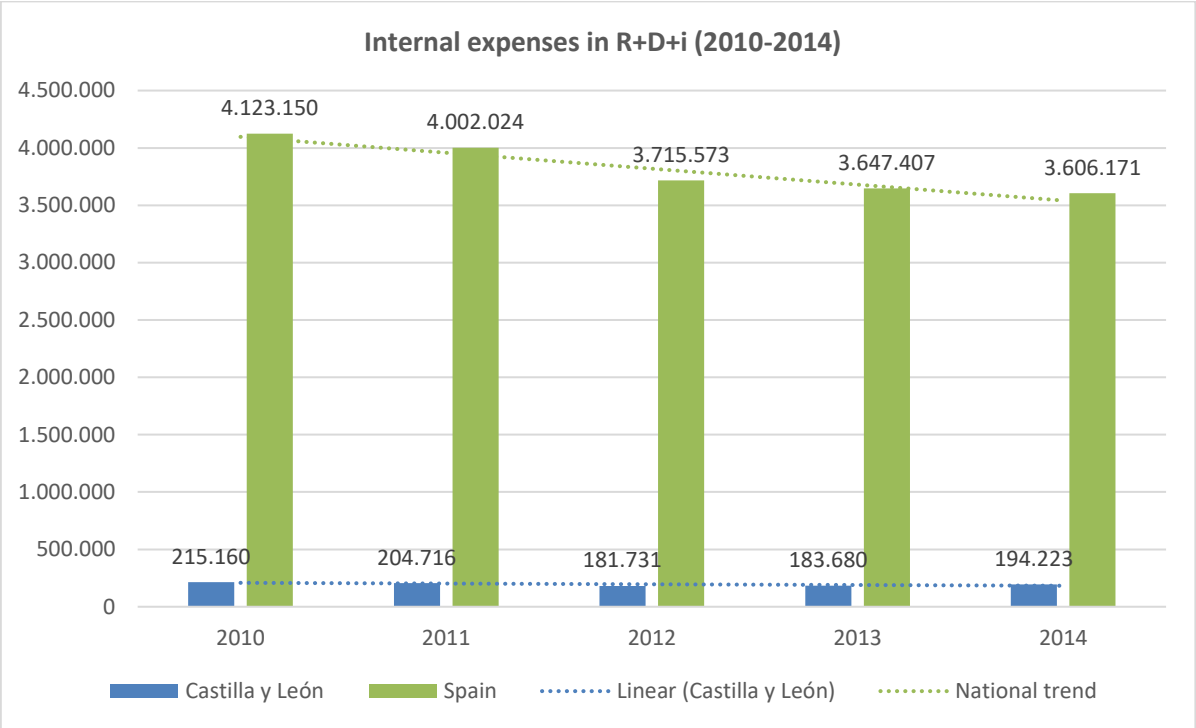
In 2014, the current expenditure destination on internal R+D+i made by the sector's institutions with headquarters in Castilla y León presented the following distribution:

From the expenditure made by the institutional sectors in internal R+D+I, 37% were allocated to Technological Development, 35% to Applied Research and 28% to Basic research.

- Higher Education sector

The internal expenses in internal R+D+i (thousands of €) in the higher education sector are presented below.

Figure 30. Evolution of internal expenses in R+D+i (thousands of €) in Higher Education in Castilla y León for the period (2010-2014).

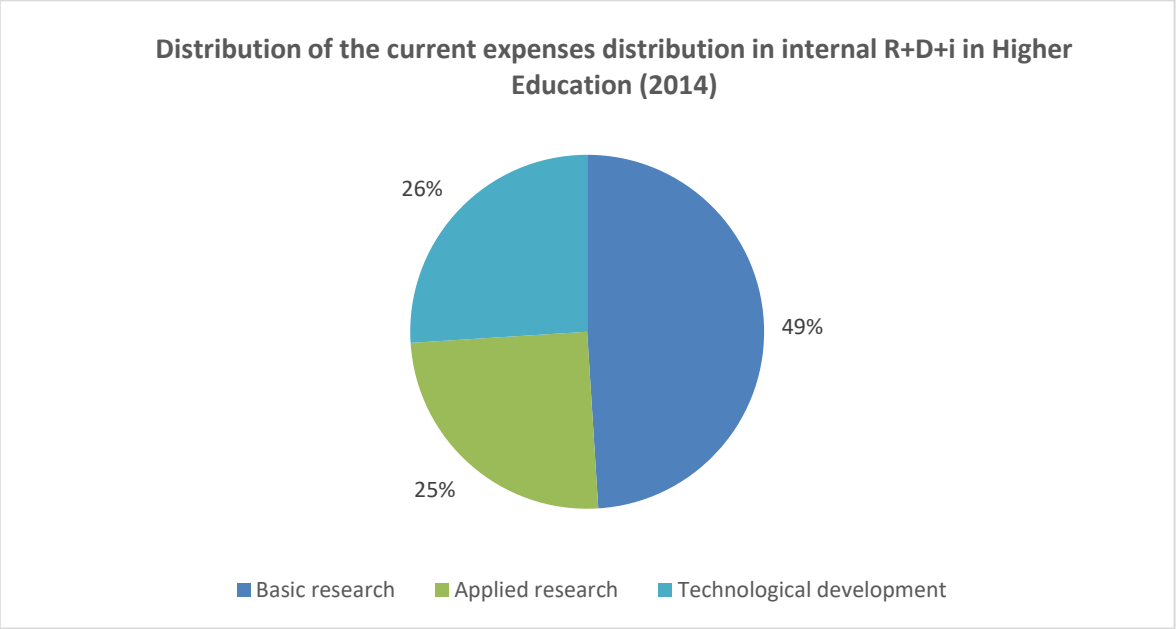


Source: CARTIF, own elaboration

In Castilla y León, the highest expenditure on R+D+i in the 2010-2014 period was achieved in 2010, reaching € 215,160 thousand. In 2014, internal spending on R+D+i amounted to 194,223 € thousand, assuming 5.4% of national internal expenditure on R+D+i (3,606,171 thousand €) in the Higher Education sector. In any case, during the period 2010-2014, it could be concluded a decreasing trend in internal R+D+i spending in the higher education sector.

With regard to the nature of internal R+D+i expenditure in Castilla y León, for 2014, 7.7% corresponded to capital expenses and 92.3% to current expenses. This same distribution was presented at the national level in Spain (7.2% capital expenditures and 92.8% current expenses).

Figure 31. Distribution of current expenses on R+D+i in higher education in Castilla y León in 2014.



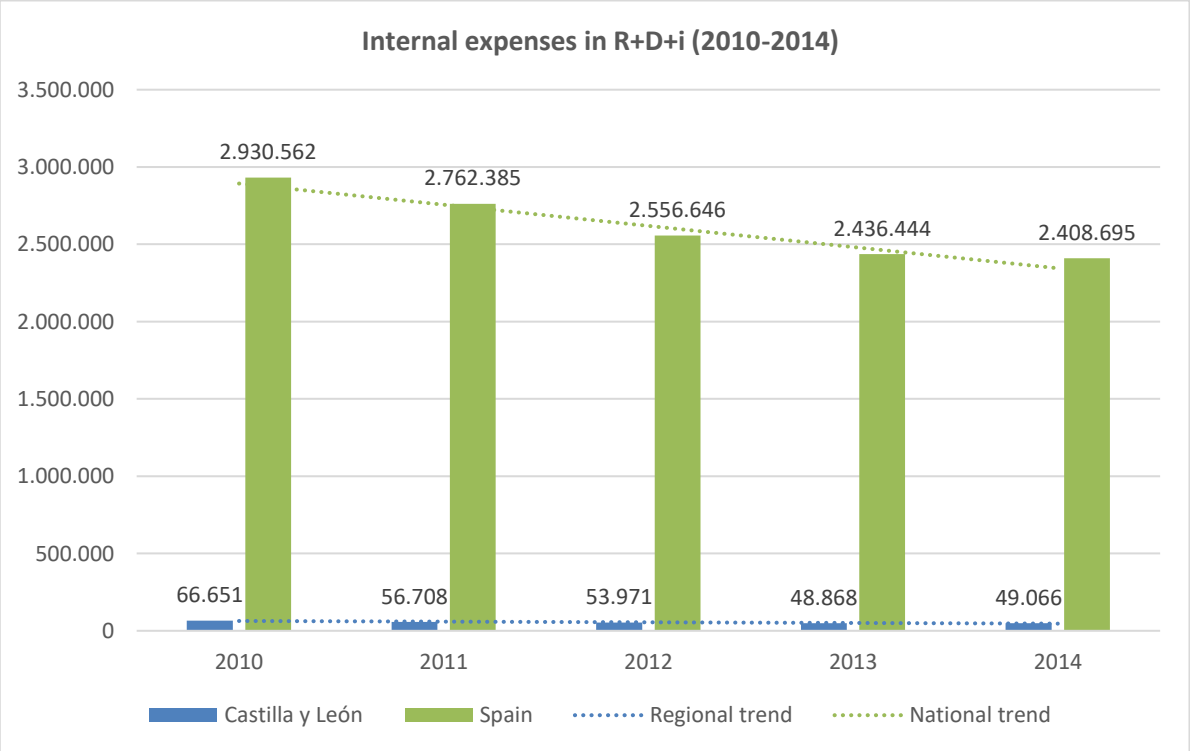
Source: CARTIF, own elaboration

Most of the expenses in R+D+i corresponded to basic research expenses (49%). Expenses for Applied research and technological development were practically the same amount (25% and 26% respectively).

- Public administration sector

The internal expenses in internal R+D+i (thousands of €) of the Public administration sector are presented below.

Figure 32. Evolution of internal expenses in R+D+i (thousands of €) in Public administrations in Castilla y León for the period (2010-2014).



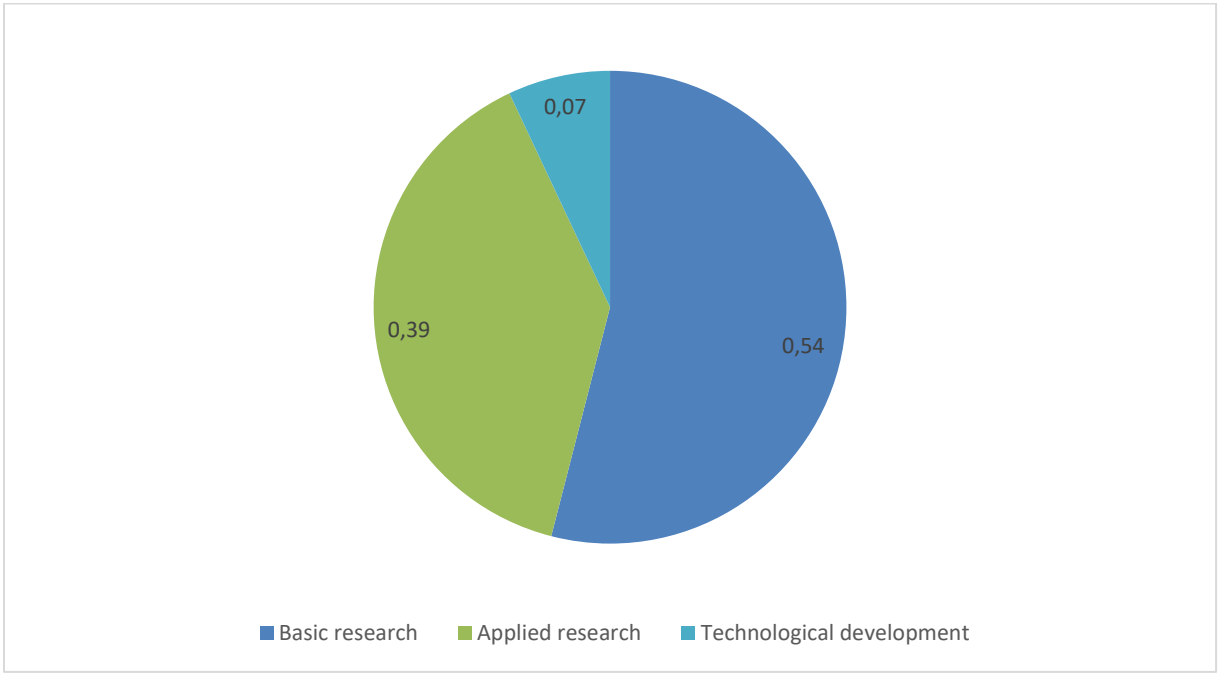
Source: CARTIF, own elaboration

The expenditure on R+D+i in 2010 was € 66,651 thousand. In 2014, the internal expenditure on R+D+i amounted to € 49,066 thousand in the community of Castilla y León, representing 2% of the National internal expenditure on R+D+i (€ 2,408,695 thousand) in the sector mentioned above.

Concerning the nature of internal R+D+i expenditure in Castilla y León, for 2014, 54.5% corresponded to capital expenses and 45.5% to current expenses.

Below is detailed the distribution of each type of current expenses in R+D+i activities carried out in the Public Administrations of Castilla y León during 2014:

Figure 33. Distribution of current expenses on R+D+i in higher education in Castilla y León in 2014.



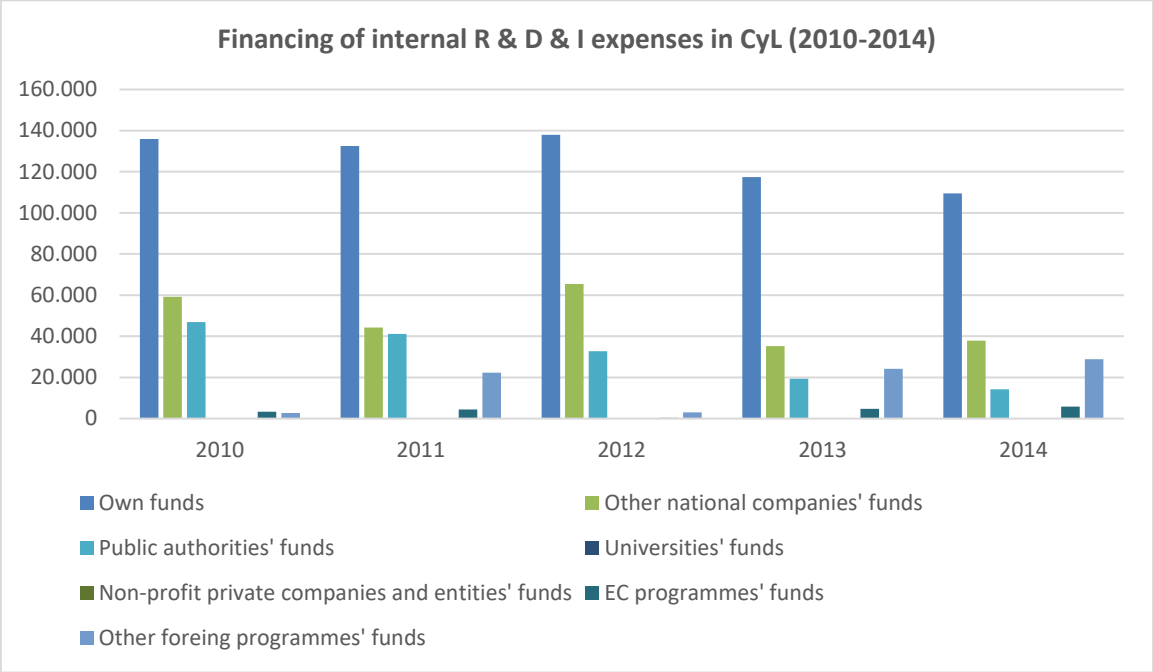
Source: CARTIF, own elaboration

Most of the current expenses in R+D+i corresponded to Basic research (54%), followed by Applied research (39%) and technological development (7%).

5.4.1.2 Financing R+D+i activities

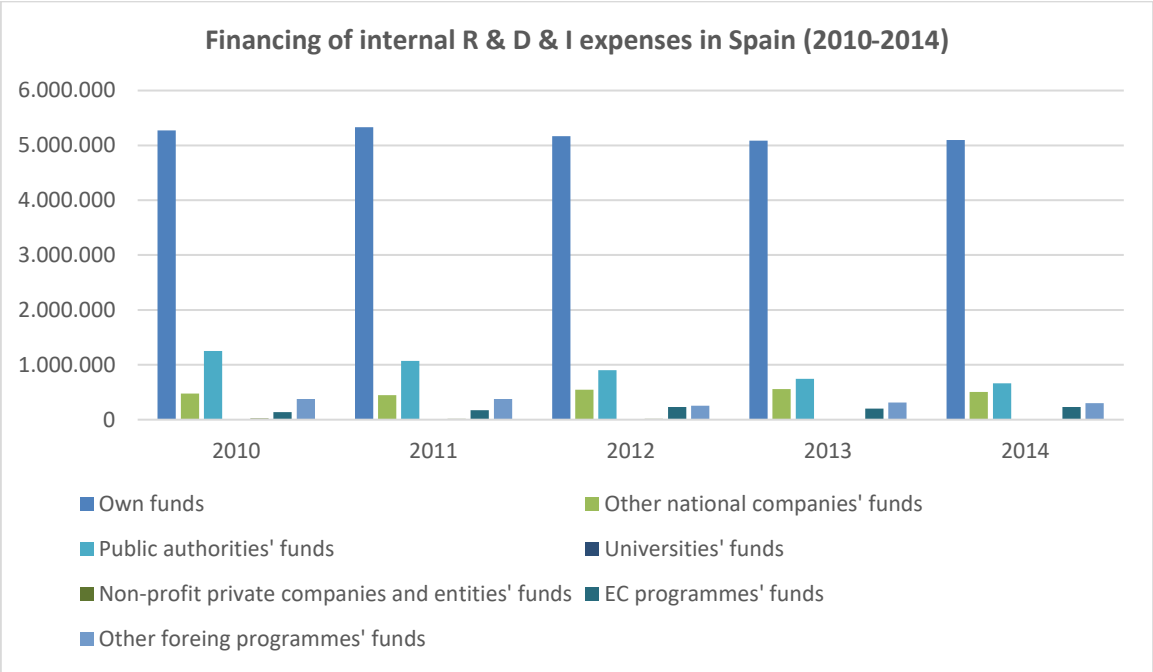
In Castilla y León, for the year 2014, the financing sources used in R+D+I activities were mainly national funds (82%), with only 18% of the funds from foreign origin (16.7% from the European Union and 83.3% from other foreign sources). The same distribution occurred in Spain (92.2% funds of national origin and 7.8% funds of foreign origin, 7.8%).

Figure 34. Financing of internal R+D+i expenses in Castilla y León for 2010- 2014.



Source: CARTIF, own elaboration

Figure 35. Financing of internal R+D+i expenses in Spain for 2010- 2014.



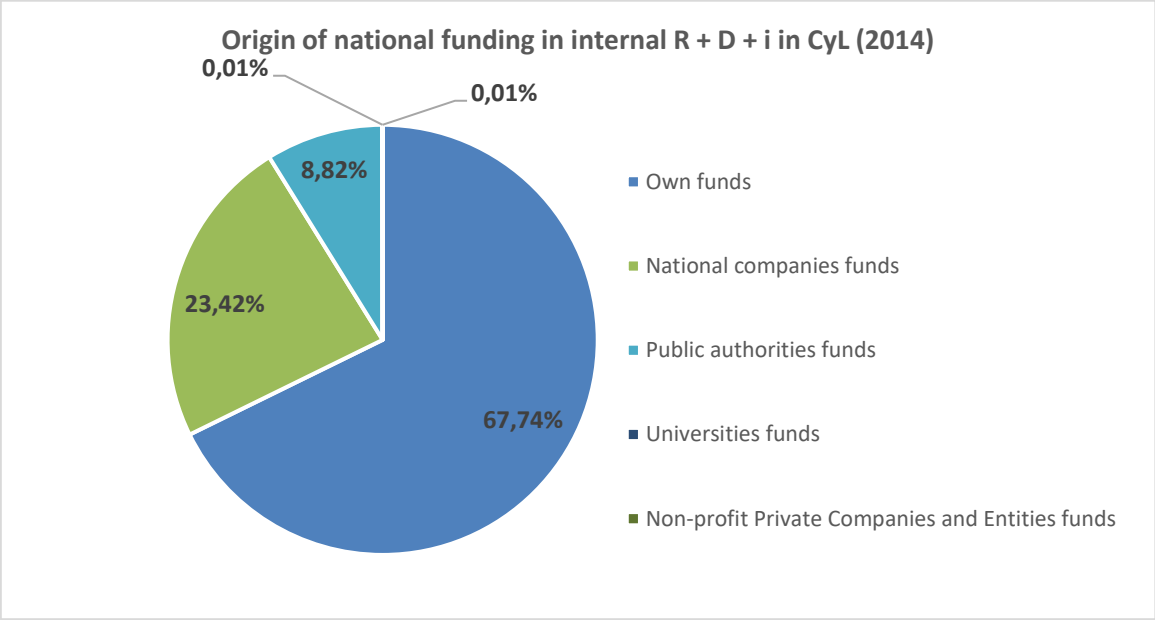
Source: CARTIF, own elaboration

In Castilla y León, for the year 2014, the sources of financing used in activities of R+D+I were mainly national funds (82%), with only 18% of the funds from foreign origin (16.7% from the European Union and 83.3% from other sources foreign). The same distribution occurred in Spain (92.2% funds of national origin and 7.8% funds of foreign origin, 7.8%).

In 2014, the national financing came mainly from own funds of the companies (67.74%), and to a lesser extent, funds from other national companies (23.4%) and funds from Public Administrations (8.8%). Funds from universities and Non-profit Private Companies and Entities were not higher than 0.01%. This same distribution

was presented for the financing of national origin in the whole of Spain (own funds 81.2%, funds from other national companies 8%, funds from Public Authorities 10%, funds from universities 0.04% and 0.2% Non-profit Private Companies and Entities funds).

Figure 36. Distribution of national funding in R+D+i in Castilla y León for the year 2014.

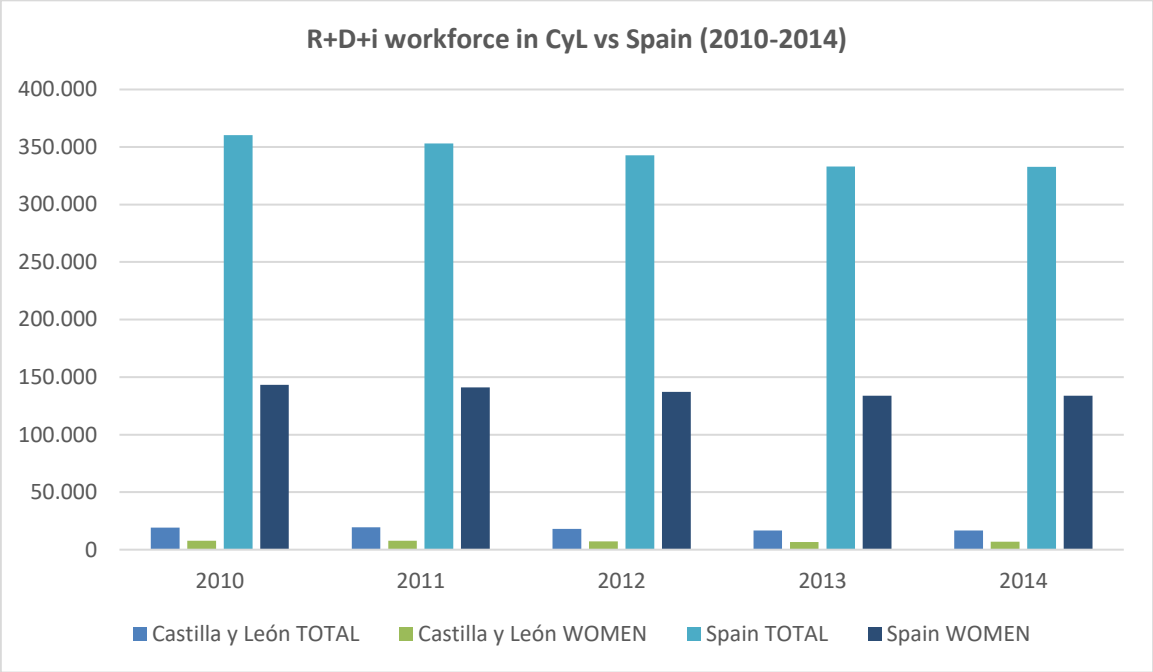


Source: CARTIF, own elaboration

5.4.1.3 R+D+ I Workforce

Below, the analysis of the R+D+i staff in Castilla y León and Spanish companies is presented.

Figure 37. Workforce in R+D+I area in Castilla y León and Spain for 2010- 2014.



Source: CARTIF, own elaboration

In general, in Castilla y León, the number of personnel hired in R+D+I suffered a decreasing trend, registering 19,360 workers in 2011 and 16,592 in 2014, assuming in 2014 5% of the national weight (332,871 people).

Considering the type of professionals who worked in R+D+i during 2014 in Castilla y León indicate that 944 people worked in the Public Administration sector as a researcher (61.4% of the total number of people in the aforementioned sector), representing 3% of the national group in the aforementioned sector (31,094 people). In the Higher Education sector, 7,724 people worked as researcher (8.6% of the total people of the sector mentioned above), assuming 6.5% of the national group of the aforementioned sector (119,290 people).

5.4.1.4 Legal framework

The **Spanish Strategy for Science, Technology and Innovation**[16] **was the national framework** instrument in which the general objectives to be achieved during the 2013 to 2020 period are established.

It aims to promote and develop research activities in Spain aligned with the European Union Horizon 2020 research programme for 2014 to 2020, supporting the active participation of the Spanish System of Science, Technology and Innovation stakeholders in the European context.

The strategy was developed in a collaborative way between the national administration and regional administrations.

During its period of validity, scientific and technical research, technological development and innovation will be oriented towards the great challenges of Spanish society.

[16] Estrategia Española de Ciencia y Tecnología y de Innovación 2013-2020. Ministerio de Economía y Competitividad. Gobierno de España. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjS9tam5YftAhXqaRUIHbQhC84QFjABegQIARAC&url=https%3A%2F%2Fwww.ciencia.gob.es%2Fstfls%2FMICINN%2FInvestigacion%2FFICHEROS%2FEstrategia_espanola_ciencia_tecnologia_Innovacion.pdf&usg=AOvVaw2s804yG2VNF3hs4BC5VqYL

Figure 38. Spanish Strategy for Science, Technology and Innovation challenges

Source: CARTIF, own elaboration

Eight challenges were set in the Spanish Strategy for Science, Technology and Innovation. Specifically, the objective of Challenge 3, regarding promoting "Safe, sustainable and clean energy" was the main, was to facilitate the transition towards a safe, sustainable and competitive energy system to reduce dependence on fossil fuels in a scenario in which there is a shortage of them, the growth of demand worldwide and its impact on climate change.

For this purpose, it was necessary to establish close coordination between energy policies, policies to promote research and innovation as well as industrial policies. Also, the joint action of public administrations and business agents aiming at eliminating existing technological and regulatory barriers and establishing an adequate framework for the distribution of costs and risks associated with the development of the new energy system was crucial.

In the energy field, research and innovation activities that were a priority for Spain refer to the following four critical aspects:

- Sustainability to actively fight against climate change, reducing GHG emissions and favoring the development of capture and geological storage of CO_2 and energy sources - wind, solar, bioenergy, marine, geothermal, hydrogen and nuclear energy - and energy efficiency.
- Competitiveness, to improve the efficiency of the Spanish and European network through the development of the internal energy market.
- Supply security, to better coordinate energy supply and demand national in an international context.
- The social and technological impulse towards patterns of lower energy consumption.

At the regional level, Castilla y León developed the Regional Strategy for Research and Innovation for an Intelligent Specialization RIS3 of Castilla y León 2014-2020, whose key aspects are listed below:

Figure 39. Spanish Strategy for Science, Technology and Innovation challenges

Source: CARTIF, own elaboration

The RIS3 gave continuity to the strategic planning work that Castilla y León region carried out in the field of research and innovation since 1997, addressing 2014-2020 period aspects that were key, such as prioritisation, participation and a shared future vision of Castilla y León region by citizens, companies, research organizations and the government.

5.4.1.5 Research lines

The following Table 55 presents the research lines established within the Energy Efficiency Strategy of Castilla y León:

Table 55. Research lines in the Energy Efficiency Strategy of Castilla y León

Research lines	
Agreements with research groups from the universities of Castilla y León	Aiming at supporting the scientific production and making visible the results of studies that are expected to be achieved in terms of energy efficiency, it was proposed to carry out agreements with research groups of public universities of Castilla y León
Patents, prototypes, pre-industrial phase	To protect the studies carried out, patents and prototypes would be developed in the pre-industrial phase. For its development, it would collaborate with universities, research centres and professional associations of the specific sector to which the patents and prototypes were directed.
Specialized studies in the Energy Efficiency field (EE). EE research actions in which EREN will participate until 2020	The EREN has among its functions promoting energy efficiency, innovative technologies and rational use of energy. In this sense, EREN developed various pilot and demonstration projects of emerging technologies, such as electric and hybrid vehicles, LED lighting, new patents, high-efficiency cogeneration facilities, etc. The initiatives identified were: — Collaboration with research groups or researchers from the Public Universities of Castilla y León — Nearly Zero Energy Buildings. Bioclimatic solutions — Nearly Zero Energy Buildings. New construction materials — District heating networks, cogeneration and reuse waste heat in industry — Use of residual heat in the building

Source: EEE-CyL 2016/2020

5.4.2 Communication, dissemination and training

5.4.2.1 Communication and dissemination channels

5.4.2.1.1 Web page (www.energia.jcyl.es)

The EREN provided specific access in its website[17] to EEE-CyL-2016/2020, in which the progress of the strategy, savings achieved and energy efficiency ratios were continuously displayed and updated, as well as all the conferences and events that were proposed for communication and dissemination purposes.

5.4.2.1.2 Social media

The EREN provided the necessary technical support for disseminating and communicating the EEE-CyL-2016/2020 in social media channels, like Facebook, LinkedIn, Twitter, etc.

Figure 40. EREN Twitter account (screenshot)

Source: https://twitter.com/EnergiaJCyL

5.4.2.1.3 Mailing and telephone

An email address has been available so that the Public Administration could establish communication with citizens, complying with data protection laws, and answer their doubts.

Additionally, citizens had a telephone number (012) to carry out the same service.

5.4.2.1.4 Media: Radio, TV and press

The media was another communication channel. Press releases and articles that were disseminated were adapted to the media language, using headlines, subtitles, organizing the information according to its importance, using visual tools (graphics, photographs, etc.) and offering data to attract attention. The language has been clear and direct, with short sentences that offer relevant and understandable information.

In particular, collaboration with local radio stations was proposed to disseminate all of the important aspects of the strategy regarding energy savings and efficiency in Castilla y León.

Within the dissemination campaign, radio announcements and information spots were inserted to increase the influx of the public and the criterion of reaching the maximum audience.

[17] https://energia.jcyl.es/web/es/ahorro-eficiencia-energetica/estrategia-eficiencia-energetica-2020.html

5.4.2.2 Journeys

Communication campaigns and promotional actions were carried out to disseminate energy savings, energy efficiency, and renewable energies to promote and establish social behavioural patterns to make better energy use.

In addition, awareness-raising actions were done to bring society the knowledge of renewable energies and the possibilities that their use offers.

Some of the actions expected are listed below:

5.4.2.2.1 EREN headquarters study visit

To promote energy efficiency in the construction of administrative buildings, bioclimatic and highly energy-efficient building, the headquarters of the EREN and the General Directorate of Energy and Mines, hosted guided visits from various groups, educational centres, professional associations, associations of consumers, architecture and engineering professionals. In these visits, they were able to learn about its main energy facilities and its bioclimatic operation.

5.4.2.2.2 Training sessions for municipal staff

Training actions were organized for technicians from the municipal staff to explain both the main aspects of the energy efficiency strategy and the projects and investments that were planned to be carried out at the local level.

5.4.2.2.3 Training days in the Universities

EREN held an annual round of training and information sessions at the University of each province of Castilla y León. During these interactive days, students were encouraged to participate.

The objective of these conferences was to inform students of the energy savings and energy efficiency strategy that was being carried out in each town and the degree of development.

5.4.2.2.4 Information, dissemination and communication sessions with citizens

Different informative sessions were held by the EREN for citizens, where the key aspects of EEE-CyL-2016/2020 strategy were exposed, especially the implementation of energy-saving and efficiency measures in each sector.

5.4.2.2.5 Awareness campaigns

Awareness campaigns were organized annually by publishing guides, advertisements, messages addressed to companies, technicians, citizens, etc.

5.4.2.2.6 Celebration of energy efficiency day in Castilla y León

It was proposed the "Celebration of energy efficiency day in Castilla y León", the International Day of energy efficiency (March 5). To this end, EREN organised a series of talks, exhibitions, activities, information sessions, etc.

5.4.2.3 Dissemination material

During the dissemination campaigns, brochures, videos[18] and documents in paper and digital format that were necessary to promote disseminating the results obtained during the development of the EEE-CyL-2016/2020 were produced.

5.4.2.4 Articles publication in specialized magazines

Thanks to the collaboration with universities and technology centres, EREN worked in promoting the results obtained during the development and implementation of the EEE-CyL-2016/2020 through publication in specialised magazines and conferences on energy saving and efficiency.

[18] https://energia.jcyl.es/web/es/ahorro-eficiencia-energetica/video-sobre-estrategia.html

5.4.2.5 Awards for promoting a good energy use

The regional administration has encouraged and disseminated any calls for awards related to energy efficiency in Castilla y León. Some of them are listed below:

Table 56. Awards related to Energy Efficiency in Castilla y León

Award	Link
EnerAgen awards	http://www.eneragen.org/es/premios-eneragen/
Sustainable construction of Castilla y León awards	http://www.premioconstruccionsostenible.es/
Roger Leron awards	https://www.fedarene.org/the-roger-leron-award-2019-is-on-29906
AVEBIOM awards	https://www.avebiom.org/que-hacemos/eventos-para-profesionales/premios-fomenta

Source: EEE-CyL 2016/2020

5.4.3 Training

The training of the users of the facilities has been essential to guarantee the correct operation of them and promote energy saving and energy efficiency. In this sense, various specialised training courses on energy efficiency were planned.

5.4.3.1 Specialised courses

Specialised courses were given to professionals from different sectors.

Table 57. Specialized courses taught to professionals

Sector	Topic of the course planed
Industrial	Courses on energy efficiency measures aimed at workers in industries Courses on efficient driving in vehicles for industrial use.
Transport	Efficient driving courses for private vehicles. Efficient driving for industrial vehicles. Efficient driving for fleets of municipal vehicles.
Buildings	Trainers on Energy Performance Certificates Energy Performance Certificates
Public services	Municipal Energy Management
Public administration	Energy Efficiency aimed at maintenance staff of public buildings. Energy Performance Certificates aimed at technicians from different public administration of Castilla y León

Source: EEE-CyL 2016/2020

5.4.3.2 Guidelines

Good practice guidelines related to energy savings and energy efficiency were developed for each key sector, the transport sector, the building sector, public services, and the administration sector of Castilla y León to inform and raise awareness among both workers and citizens.

5.4.4 International cooperation

Within the European context, the presence of Castilla y León was strengthened, seeking the participation of entities from the region, promoting international collaboration through the exchange of experiences with organizations with similar competences, and seeking implementation in Castilla and León of European companies. Furthermore, being present in the main forums and associations in the field of energy, such as FEDARENE (European Federation of Energy and Environment Agencies) and ENERAGEN (Association of Spanish Energy Management Agencies), taking an active role in joint initiatives and in defending the energy interests of the region.

EREN has actively participated in issuing reports on directives and opinions of the European institutions:

- Public consultation of the GREEN BOOK A framework for climate and energy policies in 2030.
- Amendments through the Committee of Regions to the proposal for a Directive of the European Parliament and the Council on creating an infrastructure for alternative fuels.
- Amendments through the Committee of Regions to the Communication from the Commission to the European Parliament, the Council, the Economic and Social Committee and the Committee of Regions on Clean Energy for Transport: European Alternative Fuels Strategy.
- Amendments through the Committee of Regions to the Communication from the Commission to the European Parliament, the Council, the Economic and Social Committee and the Committee of regions.
- Participation in the different European programs related to Energy Efficiency, such as Horizon 2020, Interreg Europe, Interreg Sudoe, Poptec, Life etc

5.5 Financing mechanisms

This section presents the financial mechanisms used in the Energy Efficiency Strategy of Castilla y León by first presenting the total investment (section 5.5.1) and then the investments per sector (section 5.5.2).

5.5.1 Total investment

The energy savings established in terms of primary and final energy due to the implementation of the actions defined in the strategy require a total amount of 799,1 M€ to ensure the target accomplishment during the period considered (2016-2020).

The investment corresponds to stakeholders from the public and private sector, having been estimated that the investment from the private sectors will be higher than the public ones. Specifically, 31.4% of the investment will come from the public sector, whereas 68.8% from the private sector investors.

Besides the strategy defined, the public investment distribution along with the strategy period duration (2016-2020) is detailed in the following table:

Table 58. Annual distribution of investment from public funds.

Year	2016	2017	2018	2019	2020
Public investment (M€)	33.2	55.9	59.2	52.4	50.5

Source: Energy Efficiency Strategy of Castilla y León (2016/2020)

5.5.2 Investments per sector

The investment per sector distributions relies on the weight of the energy consumption from each sector in the total energy consumption of Castilla y León and the potential savings estimated to be achieved by the actions defined in each sector.

Following this approach and considering the sectoral distribution defined in the strategy, the investments per sector distribution is presented in the table below:

Table 59. Sectoral distribution of the investment required for the entire period (2016-2020)

Year	Industrial sector	Building sector	Transport sector	Public services sector	Administration sector
Investment (M€)	410.0 million	200.5 million	86.4 million	79.7 million	18.9 million
Percentage	51.3%	25.1%	10.8%	10%	2.4%

Source: Energy Efficiency Strategy of Castilla y León (2016/2020)

It should be noted that the actions planned in the administration, R+D+I and dissemination, training and communication sectors will be financed entirely with public funds (100%), while the investments planned in the industrial sector, in the building and tertiary sectors, transport and public services, funds of public origin, will be 22.8%, 23.16%, 34.82% and 81.79% respectively.

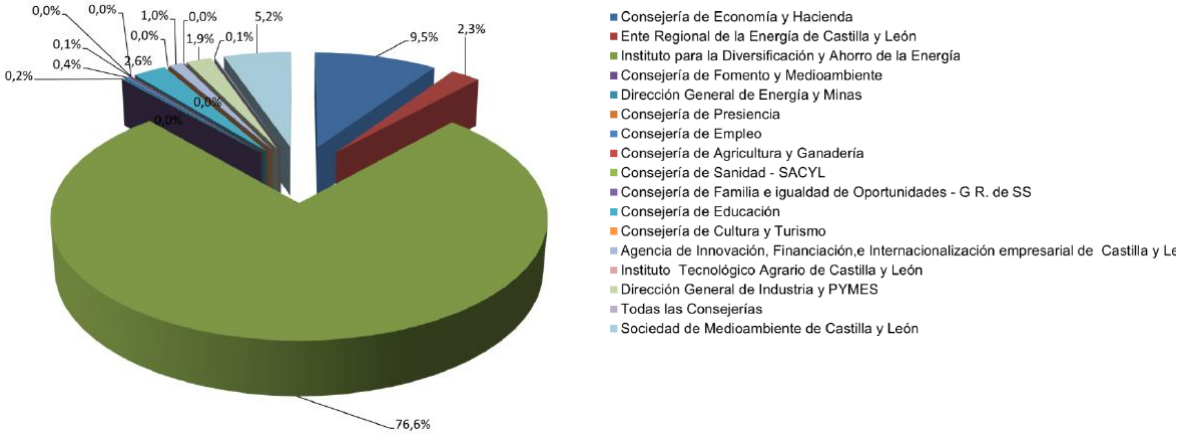
The public funds need in the strategy come from different bodies, most usually presented in Programs and Grants focused on promoting energy saving and efficiency. The most important ones are listed below:

Table 60. Main public funds management bodies

Management bodies	Public fund	Percentage
Instituto para la diversificación y ahorro de la energía (IDAE)	€ 192.4 million	76.61%
Ministry of Economy and Finance	€ 23.9 million	9.52%
Ente regional de la energía (EREN)	€ 5.8 million	2, 33%
Sociedad de Medioambiente de Castilla y León (SOMACYL)	€ 13.14 million	5.23%

Source: Energy Efficiency Strategy of Castilla y León (2016/2020)

Figure 41. Public funds distribution per the public body who will manage them



Source: Castilla y Leon Energy Efficiency strategy 2020, EREN own elaboration

5.6 Data sources used in the strategy definition

The following table presents examples of data sources used to define the regional energy efficiency strategy of Castilla y León. However, specific datasets per sector used in the strategy can be found in Annex I.

Table 61. Data sources used in the energy efficiency strategy of Castilla y León

Topic	Source	Brief description	Data format/access
World energy situation	BP Statistical Review of World Energy 2017 [106]	This statistical review provides world information on energy, such as primary energy consumption (in total, by fuel type or per capita), oil data, gas, coal, nuclear energy, hydroelectricity, renewables, electricity, and other key materials (such as cobalt, lithium, graphite, rare earth, etc.). The data is provided at the country or regional level (understanding regions in this case as groups of countries/parts of continents).	The data is provided in excel format or PDF format.
Spanish primary and final energy	IDAE (Studies and reports on energy balances) [107]	The IDAE provides energy balances of final energy from 1990-2018, detailed consumption of the service sector in 2018, and energy consumption in the residential sector (2010-2018). Particularly interesting is the first, where energy balances per year, activity sector and energy source are available.	The data can be accessed via the web and downloaded in excel format (xls), csv or html.
Energy intensity in Spain	Industry, Energy and Transport ministry [108]	The Industry, Energy and Transport ministry provides annually a report on the Energy field at the country level. The energy intensity (primary and final) evolution in Spain expressed as consumption of final energy per unit of GDP. The data is provided at the country level and per sector.	The data is provided in PDF format.
Degree of self-sufficiency	EREN own elaboration	The degree of self-sufficiency at the country level is provided by Industry, Energy and Transport ministry following the EUROSTAT methodology for its calculation. [108] At the regional level, there are no sources of data.	The data is provided in PDF format.
Primary energy in Castilla y León	EREN Castilla y León energy statistics [109]	The regional energy statistic portal provides an annual report where, among others, the primary energy production in the region per month is provided at the regional level, and province level expressed per tonne equivalent of oil for each energy sources available: carbon, natural gas, Hydraulic, nuclear, wind power, solar PV and solar thermal.	The data is provided in PDF format.

National balance of the electric system	Red eléctrica de España (Spanish electricity network) [110]	The REE data portal provides an electricity balance at the country level on a daily and monthly basis by means of the electricity demand and the electricity production from renewable sources and non-renewable sources, expressed in GWh.	The data is provided in PDF format.
Installed power	Red eléctrica de España (Spanish electricity network) [110]	The REE data portal provides national statistical series at the country and regional level through the installed power for electricity production per energy source (Hydraulic, nuclear, carbon, gas, combined cycle, wind, solar, cogeneration), expressed in MWh	The data can be accessed via web, as well as downloaded in excel format (xls) and csv
Electric energy production in Castilla y León	EREN Castilla y León energy statistics [109] Red eléctrica de España (Spanish electricity network) [110]	The REE data portal provides on a daily and monthly basis an electricity balance at country level using the electricity demand and the electricity production from renewable sources and non-renewable sources, expressed in GWh.	The data is provided in PDF format.
GDP of CyL	Estadística Castilla y León statistics [111]	The D.G. de Presupuestos y Estadística de la Junta de Castilla y León, provides on annual basis statistics of the region by means of economic indicators such as the GDP (gross domestic product) and supply and demand components. Quarterly and annual GDP is provided to assess the GDP evolution easily.	The data can be downloaded in excel format (xls).
Business sector in CyL	Castilla y León industrial promotion master plan[112]	This plan elaborated by Castilla y León provides detailed information about its business sector and productive structure through the number of industrial companies per type of activity. The data provided come from other sources such as Eurostat [113] and the Regional countability of Spain [114] or the National statistics institute (INE)[115].	The data is provided in PDF format.
Industry energy consumption	Energy, tourism and digital agenda ministry [116]	This database provides downable statistical series on the country level, about sectoral data. Among others, the energy consumption of the industrial sector is provided at the regional level.	The data can be accessed via web, as well as downloaded in excel (xls), .xml and HTML formats
Building sector	Statistical Yearbook of Castilla y León [117]	The annual report provided by the Castilla y León statistics collects territorial, climatological, demographic, economic, social, health, labour, business data, and education and research and technological	The data can be accessed via web, as well as downloaded in excel (xls) format

		development data for Castilla y León region. A detailed report about the building stock characterization is provided annually at the region and province level. Information about the number, type, status, use, size among others, is reported.	
Building sector	Statistics of the Transport, Mobility and Urban Agenda Ministry [118]	These statistics contain the statistical information prepared by the General Sub-Directorate of Economic Studies and Statistics, a unit dependent on the General Directorate of Economic Programming and Budgets, framed in the Sub-secretariat of Development. Data about Protected housing and refurbishment, housing stock estimation, new housing stock, real estate transactions (sale), the Appraised value of the housing, Prices of urban land are provided at the province, regional, and national level an annual basis but monthly detailed.	The data can be accessed via web, as well as downloaded in excel (xls) format
	Statistical Plan of Castilla y León 2018-2021 [119]	Among the statistical operations included in the Statistical Plan of Castilla y León 2018-2021 is to provide population figures, whose objective is to know the official population of all the municipalities of Castilla y León as of January 1 of each year differencing by sex.	The data can be accessed via web, as well as downloaded in excel (xls) format
	General Directorate of Energy and Mines - Ministry of Economy and Finance [120]	Existing Energy Performance Certificates are provided and updated daily in order to be checked and downloaded. Information on the thermal energy demand, CO_2 emissions and the energy rating are delivered per building certificated.	The data can be accessed via web and downloaded in excel (xls) and json formats.
Transport sector	Statistical Yearbook of Castilla y León [117]	Data about the transport and communication sector is provided annually at region and province-level using road transport characterization (road network types, vehicles stock, vehicle inspections, goods transportation, traffic accidents), Railway transport (number of passengers per origin and destination, goods transport), Aerial transport (number of passengers, goods, and aeroplanes)	The data can be accessed via web, as well as downloaded in excel (xls) format
	General direction of Traffic [121]	The General direction of Traffic publishes on an annual basis a General Statistical yearbook, where the vehicle stock is charactersed as well as other information such as Registrations, Change of vehicle	The data can be accessed via web, as well as downloaded in .pdf format.

		ownership, Unsubscription, National vehicle stock, Driving authorizations issued, Revised driving authorizations, Duplicates and modifications of authorizations to drive, Drivers census, Test scores, Complaints made. All this information is provided at city, regional and national levels.	
Transport sector	Spanish railway observatory [122]	On an annual basis the Spanish Railway Observatory publishes a report where the national railway infrastructure, the passengers and goods transport are characterized. Furthermore, socio-economic and sustainable indicators are provided at the national to elaborate a diagnosis of the Spanish railway system with respect to the rest of European countries. Most of the data is provided at the national level, except the passenger characterization.	The data can be accessed via web, as well as downloaded in .pdf format.
	Ministry of Interior [123]	The Spanish Ministry of Interior publishes annual dowloadable data about traffic and Traffic and road safety. Data about the vehicles stock characterization, Registrations, Change of vehicle ownership, Unsubscription, National vehicle stock, Drivers census, Driving authorizations, traffic accidents. Data is provided at the national level.	The data can be accessed via web, as well as downloaded in excel (CSV) format

Source: own elaboration based on EREN data

6 Spatial Planning challenge to support the energy transition

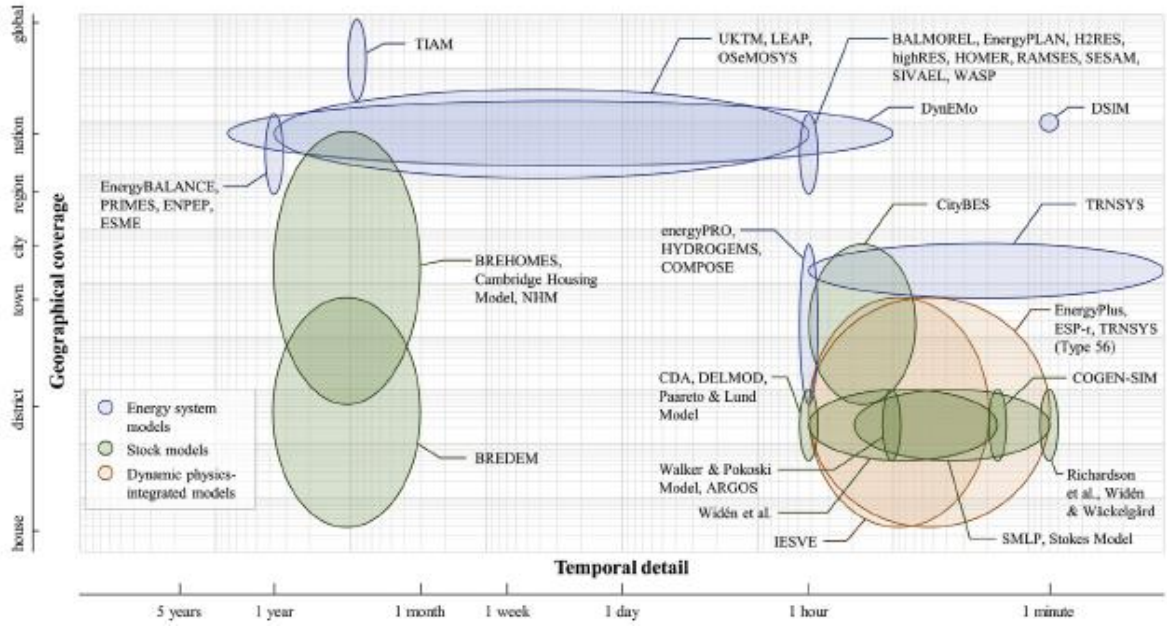
This section will focus on spatial planning related to energy and how this discipline can support this transition. To explore these aspects, two main sections are proposed. Firstly, the focus will be placed on integrating energy aspects with spatial planning (section 6.1) to then analyse the spatial planning competences in the EU (section 6.2).

6.1 Integrating energy aspects with spatial planning

Either due to the lack of resources, or the short-term vision of politicians, energy planning, in general, lacks one very important activity: continuous and integrated analysis of the effectiveness of the strategic energy plans.

It is commonly extended the use of energy system analysis models or tools when defining and evaluating energy policies, such as LEAP[19], OSeMOSYS[20] or EnergyPLAN[21]. These energy system analysis models are characterised by a high geographical coverage (regional, national or even global) but lower temporal detail of the results provided (a year, a month or a day). However, when evaluating the effectiveness of specific energy action, sectoral models (e.g. Building stock models) with higher temporal detail (an hour, a minute) are required to evaluate the real impacts after the action's implementation, as it can be seen in the following figure:

Figure 42. Depiction of temporal detail and geographical coverage of various numerical models



Source: [124]

Inappropriate policy decision-making or lack of effectiveness of the strategic plans is often attributed to uncertainty in modelled results, **insufficient transparency in the models** and **input data**, and a **lack of integration between the underlying sub-models**.

In this regard, integrating energy aspects with spatial planning and public land development could play a key role to accelerate the energy transition, since every energy action's implementation depends on other development activities in the built environment, either a new urban development, a provision of land or a land-use change.

The European Commission defines spatial planning as:

[19] LEAP stands for the Low Emissions Analysis Platform, is software system for integrated energy planning and climate change mitigation assessment, developed by the Stockholm Environment Institute.

[20] OSeMOSYS is an open source modelling system for long-run integrated assessment and energy planning.

[21] EnergyPLAN simulates the operation of national energy systems on an hourly basis, including the electricity, heating, cooling, industry, and transport sectors. It is developed by the Sustainable Energy Planning Research Group at Aalborg University, Denmark.

"The methods used largely by the public sector to influence the future distribution of activities in space. It is undertaken with the aims of creating a more rational territorial organisation of land uses and the linkages between them, to balance demands for development with the need to protect the environment, and to achieve social, economic objectives." (European Commission 1997).

Therefore, spatial planning is about defining a vision for the future development of a territory, expressed in spatial terms. It embraces measures to coordinate other sectoral policies' spatial impacts by coordinating ecological, economic and social activities and their distribution in the city and regional areas.

Spatial planning policies provide the long-term framework for using the limited resource "land" and can either hinder or support the transition to a low-carbon society. So that, an energy policy can be evaluated by analysing the spatial impacts its produce by means of:

- **Spatial planning impacting urban energy demand**

Spatial planning actions have direct implications in the energy demand of a territory and in the other way around, employing energy demand for heating, cooling and illumination of buildings, demand for the provision of technical infrastructure and utilities, demand for the provision of public social services, demand for transportation.

- **Spatial planning impacting renewable energy**

Most renewable energy technologies require large land areas for producing notable amounts of energy available for final use. Some renewable technologies are also very site-specific and can only be installed in selected locations. Spatial planning policies are needed to reserve land for the increasing demand for renewable energy production that is close enough to main urban areas to minimise losses occurring due to the transport and transmission of the energy to the centres of consumption.

Since the transition of the EU's energy system towards greater reliance on renewables, more land will also be needed for expanding and reinforce our electricity network infrastructure.

- **Spatial planning impacting GHG absorption and emissions due to land-use change**

Spatial planning plays a particularly important role in GHG absorption and emissions from changing land covers as land-use change has a long-term effect and cannot be easily reversed. Common spatial planning instrument in zoning or land use plans, which, on the municipal level, determine the possible use of properties for different land use categories, thus mapping both the status quo as well as possible future land-use changes in a comprehensive and integrated manner.

6.2 Spatial planning competences

In this context, spatial planning agencies are central players since they can manage the opportunities to adopt and distribute energy solutions. The competences for spatial planning in the European Union lie on the national, sub-national or local level, depending on each country's spatial planning system, which is rooted in national legislation and planning cultures and differs significantly between countries. Most EU Member States have a system where three levels of government (national, regional and local) are fitted with some sort of competence in planning. Exceptions to this approach exist, e.g., in the Republic of Ireland, where four levels of government have competences in planning, while, e.g. in the United Kingdom, the national level has no planning competences at all. On the other hand, Finland is characterised by a great degree of devolution of planning powers to the local level [125].

Some common patterns exist regarding the linkages between governmental level and types of spatial planning instruments available to policy-makers:

- At the national level, planning instruments (e.g. territorial development strategies) often take a visionary approach, set the general goals, or define the agenda for spatial planning.
- At the sub-national (regional) level, instruments (e.g. regional development plans) typically have a strategic or framework-setting character, defining concrete policies and guidelines for decision making and coordinated action.
- At the local level, most planning instruments (e.g. zoning plans) are regulatory in nature, designating (parcels of) land for concrete land uses and specifying general parameters such as density, use, building height, etc.

As a general principle, it can be said that national and regional spatial planning policies and instruments are defined as guiding principles or objectives. Local policies, on the other hand, are typically enshrined in legally binding plans. Still, it has to be noted that land use or zoning plans are typically updated every 10-15 years, often partially, and their content is therefore often outdated and superseded by reality.

The EU itself has no general competence in spatial planning. Nonetheless, several ways in which EU legislation and policies influence spatial planning in Europe through its sectoral competencies in, e.g. environmental, energy, maritime or competition law, and agenda and discourse setting are often referred to as "Europeanisation of spatial planning" [126].

In this context, it is important to highlight that INSPIRE Directive could be the main driver to integrate the energy aspects into the spatial planning process. This way, it can support the energy transition by easing the decision-making process since INSPIRE establishes spatial data infrastructures of all Member States, under 34 spatial themes needed for any environmental application such as a regional energy strategy definition.
Using data structures under the INSPIRE DirectiveIRECTIVE, some of the energy modelling weaknesses could be addressed, such as the input data and the lack of integration between the underlying sub-models. In section 9.2, some existing sectoral models that take advantage of the data structured by INSPIRE (to estimate or analyse several energy aspects) will be presented.

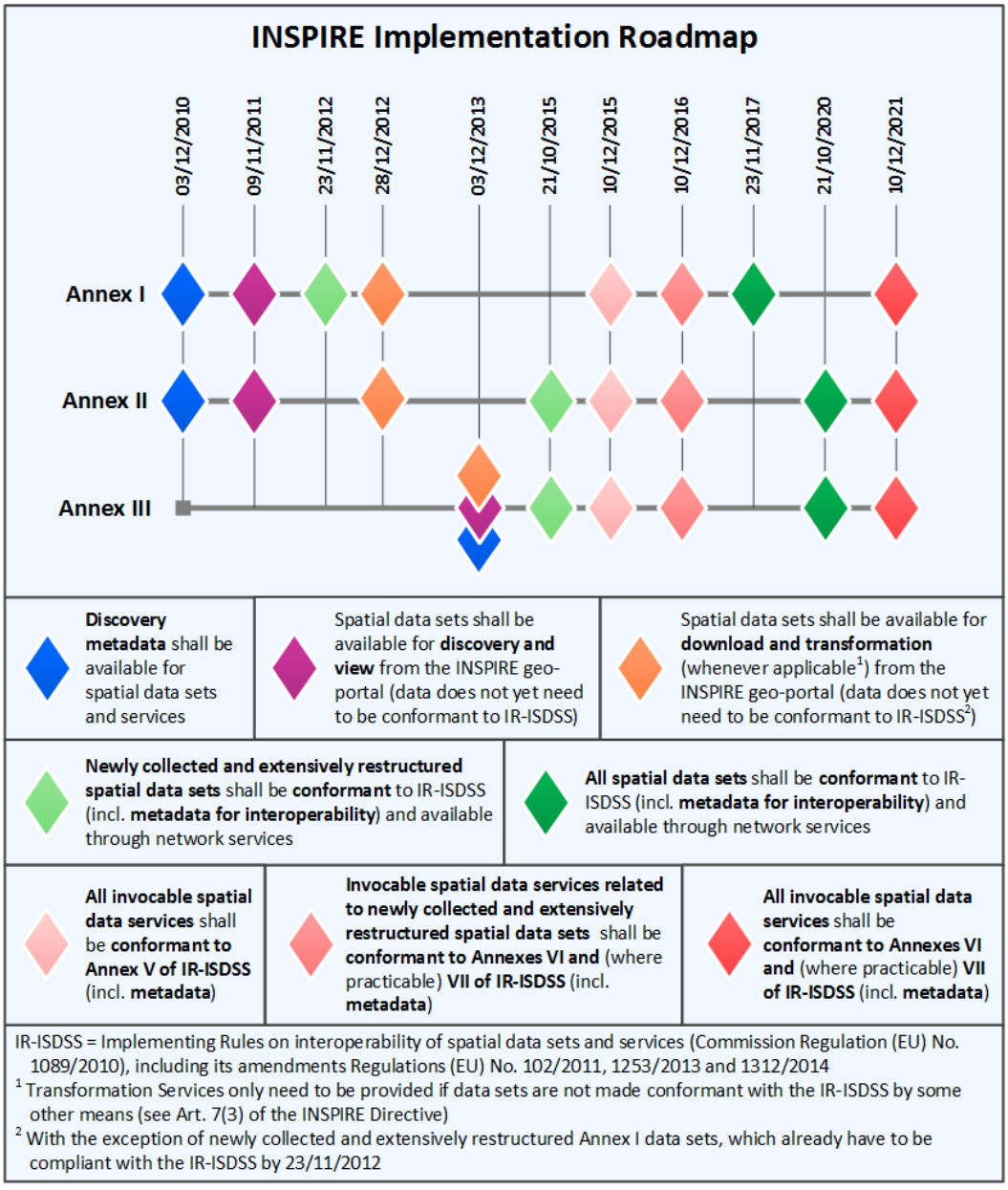
7 INSPIRE general objectives and data themes presentation

As presented in the introduction, one of the main objects of this report is to explore the applicability of the INSPIRE Directive within regional energy strategies. In this context, this section introduces INSPIRE.

7.1 INSPIRE Introduction

The INSPIRE Directive (Infrastructure for Spatial Information in the European Community, 2007/2/EC) [127] is one of the most relevant initiatives at the European level in the context of standardisation of geospatial data. It aims to create a data infrastructure for spatial data to support environmental policies or those that can impact the environment. To this end, a series of common data models and exchange mechanisms are established, which is to be fully applied by 2021 by all Member States to guarantee the interoperability of their spatial data infrastructures, according to an implementation roadmap shown in the Figure 43 below:

Figure 43. INSPIRE implementation roadmap



Source: INSPIRE Knowledge base

The Directive also aims at solving specific obstacles identified in public consultations in the course of the preparation of the INSPIRE Directive from 2001 – 2004 [128], in particular:

- Spatial data is often missing or incomplete.
- The description (documentation) of available spatial data is often incomplete.
- Spatial datasets can often not be combined with other spatial datasets.
- The systems to find, access and use spatial data often function in isolation only and are not compatible with each other.
- Cultural, institutional, financial and legal barriers prevent or delay the sharing and re-use of existing spatial data.

With these obstacles in mind, the INSPIRE Directive entered into force in 2007, grounded on the following principles:

INSPIRE principles:

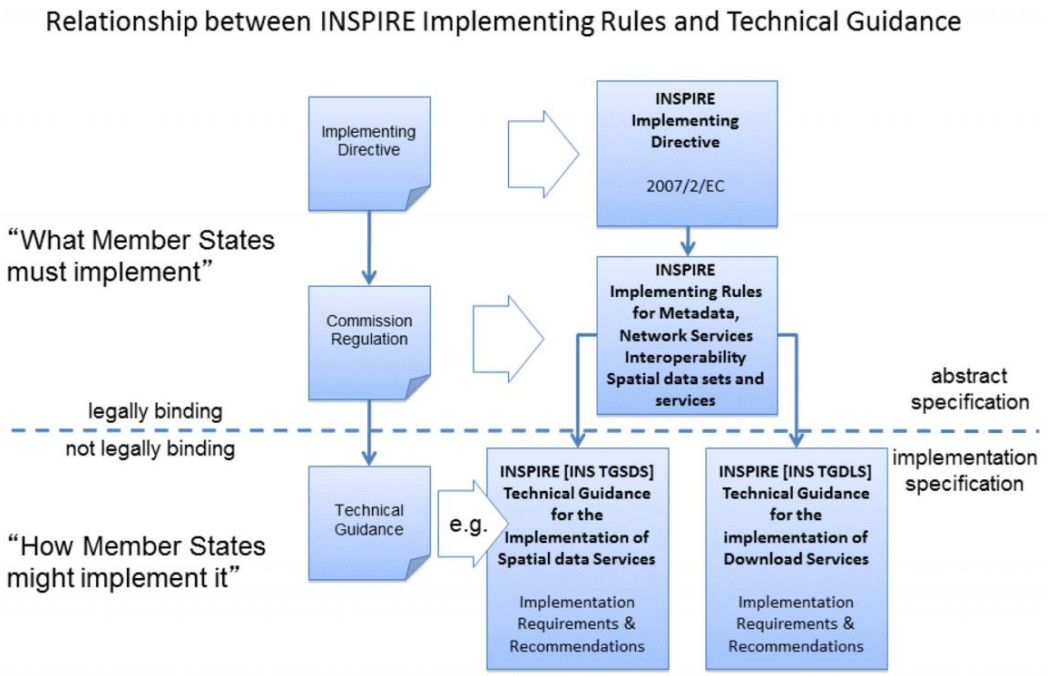
- Data should be collected only once and kept where it can be maintained most effectively.
- It should be possible to combine seamless spatial information from different sources across Europe and share it with many users and applications.
- It should be possible for information collected at one level/scale to be shared with all levels/scales; detailed for thorough investigations, general for strategic purposes.
- Geographic information needed for good governance at all levels should be readily and transparently available.
- Easy to find what geographic information is available, how it can be used to meet a particular need, and under which conditions it can be acquired and used.

To enable its implementation, the INSPIRE Directive defined the following elements of the infrastructure:

- Metadata
- Interoperability of spatial data
- Spatial data services
- Network services
- Sharing data and services
- Procedures for monitoring and report.

Besides the Directive, the legally binding aspects of each of the elements listed above are covered by specific Implementing Rules, whilst a series of Technical Guidelines provide non legally-binding guidance about how to technically implement what is required in the Implementing Rules. This is reflected in the following Figure 44:

Figure 44. Relationship between INSPIRE Implementing Rules and Technical Guidance



Source: INSPIRE Knowledge Base

The Directive, as well as the Implementing rules and the Technical Guidelines, are available in the INSPIRE Knowledge base (www.inspire.ec.europa.eu). To guarantee an adequate implementation and the maintenance of the Directive, a working group called "MIG" (Maintenance and Implementation Group") has been established. It is responsible for updating the implementation process of the Directive, serves as a contact point, provides advice, identifies and solves errors, and proposes good practices. In addition, on the following website [129], it is possible to observe the status of the INSPIRE Directive's transposition in the Member States.

7.2 INSPIRE themes

The INSPIRE 34 data themes represent the topics that are covered in the Directive. They are organised into three annexes linked to the roadmap towards their implementation, as depicted in Figure 43. A list of the data themes covered in each annex is provided below. For a brief description of each of the themes and corresponding links to explore further information on each of them, please refer to Table 108 in Annex 4.

Table 62. INSPIRE themes per Annex

Annex I: 9 themes		Annex II: 4 themes
1. (AD) Addresses **2.** (CP) Cadastral Parcels **3.** (GG) Geographical grid systems **4.** (HY) Hydrography **5.** (TN) Transport Networks	**6.** (AU) Administrative Units **7.** (RS) Coordinate Reference Systems **8.** (GN) Geographical Names **9.** (PS) Protected Sites	**10.** (EL) Elevation **11.** (LC) Land Cover **12.** (GE) Geology **13.** (OI) Orthoimagery
Annex III: 21 themes		

14. (AF) Agricultural and aquaculture facilities **15.** (AC) Atmospheric conditions **16.** (BU) Buildings **17.** (EF) Environmental monitoring facilities **18.** (HH) Human health and safety **19.** (MF) Meteorological geographical features **20.** (NZ) Natural risk zones	**21.** (PD) Population distribution and demography **22.** (SR) Sea regions **23.** (SD) Species distributions **24.** (US) Utility and governmental services **25.** (AM) Area management / restriction / regulation zones and reporting units **26.** (BR) Bio-geographical regions **27.** (ER) Energy resources	**28.** (HB) Habitats and biotopes **29.** (LU) Land use **30.** (MR) Mineral resources **31.** (OF) Oceanographic geographical features **32.** (PF) Production and industrial facilities **33.** (SO) Soil **34.** (SU) Statistical Units

Source: INSPIRE Knowledge base

7.3 INSPIRE within this report

INSPIRE will be analysed in the context of regional energy strategies by exploring the case study of Castilla y León. To this end, firstly, the available datasets in the region will be explored (section 9.1), and then applications will be proposed. From all the available INSPIRE data themes, the following will be observed more in detail through the applications proposed. In the following Table 63, the INSPIRE theme, its description, the application presented in the document and the section where it is presented are displayed.

Table 63. INSPIRE data themes analysed in the present document

INSPIRE Theme & Description	Application
BU – Buildings Geographical location of buildings.	Energy in buildings (Section 9.2.1)
TN – Transport networks Road, rail, air and water transport networks and related infrastructure. Includes links between different networks. Also includes the trans-European transport network as defined in Decision No 1692/96/EC of the European Parliament and of the Council of 23 July 1996 on Community Guidelines for the development of the trans-European transport network (1) and future revisions of that Decision	Transport networks: road (Section 9.2.2)
PF – Production and industrial facilities Industrial production sites, including installations covered by Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control (1) and water abstraction facilities, mining, storage sites.	Energy generation sites (Section 9.3.1)
PD – Population distribution and demography Geographical distribution of people, including population characteristics and activity levels, aggregated by grid, region, administrative unit or other analytical units.	Statistical data (Section 9.3.2)
SU – Statistical units Units for dissemination or use of statistical information.	
ER – Energy Resources Energy resources including hydrocarbons, hydropower, bio-energy, solar, wind, etc., where relevant including depth/height information on the extent of the resource.	Energy resources (Section 9.4)

Source: own elaboration based on definitions from INSPIRE Knowledge Base

8 Other open data to support regional energy strategies implementation

Based on the main sectors identified as crucial within regional energy strategies, the following Table 64 is presented. For each strategic sector in the Castilla y León Efficiency Regional Strategy (industrial, building, transport, public services and administrative sector), some relevant data and potential data sources from those analysed in section 3 are shown below:

Table 64. Potential open data sources to support regional energy strategies in EU

Source	Themes	Industrial	Building	Transport	Public services	Administrative	Section in this report
EUROSTAT- Statistical office of the EU	Economy and finance	CROSS-CUTTING					Section 3.1.1.1
	Population and social conditions	CROSS-CUTTING					
	Industry, trade and services	x			x		
	International trade in goods	x					
	Transport			x			
	Environment and energy	CROSS-CUTTING					
	Science, technology, digital society	CROSS-CUTTING					
FAOSTAT- Food and Agriculture Organization of the United Nations database	Production (crops, livestock…)	x					Section 3.1.1.2
	Investment	CROSS-CUTTING					
	Trade (crops, livestock, live animals)	x			x	x	
	Food Balance and food security	x			x	x	
	Agri-Environmental Indicators	x			x	x	
	Prices (producer, consumer)	x					
	Emissions-Agriculture, Land Use				x	x	
	Inputs (fertilizers, pesticides, land use)	x			x		

Source	Themes	Industrial	Building	Transport	Public services	Administrative	Section in this report
FAOSTAT- Food and Agriculture Organization of the United Nations database	Population	CROSS-CUTTING					Section 3.1.1.2
	Forestry production and trade	x			x	x	
EEA –. European Environment Agency	Air and climate (air pollution, climate change impacts, adaptation, mitigation)	CROSS-CUTTING					Section 3.1.1.3
	Nature (biodiversity, ecosystems, land use, soil, water)	CROSS-CUTTING					
	Sustainability and well-being (environment, health, policy instruments)	CROSS-CUTTING					
	Agriculture	x			x	x	
	Energy	CROSS-CUTTING					
	Transport			x			
	Industry	x					
IEA – International Energy Agency	Energy supply	CROSS-CUTTING					Section 3.1.1.4
	Energy consumption	CROSS-CUTTING					
	Prices and taxes	CROSS-CUTTING					
	Statistics by fuel type	CROSS-CUTTING					
ESPON programme – co-financed by the European Regional Development	Agriculture and fisheries	x				x	Section 3.1.1.5
	Economy, finance and trade	CROSS-CUTTING					
	Education, Health and Safety	CROSS-CUTTING					
	Environment and Energy	CROSS-CUTTING					
	Governance	CROSS-CUTTING					
	Information Society	CROSS-CUTTING					

Source	Themes	Industrial	Building	Transport	Public services	Administrative	Section in this report
ESPON programme – co-financed by the European Regional Development	Territorial Structure	CROSS-CUTTING					Section 3.1.1.5
	Transp. and Accessibility			x			
	Labour Market, population and living conditions	CROSS-CUTTING					
Urban Data Platform Plus (UDPplus)	Population dynamics	CROSS-CUTTING					Section 3.1.1.6
	Economy	CROSS-CUTTING					
	Labour market	CROSS-CUTTING					
	Education	CROSS-CUTTING					
	Research & Innovation	CROSS-CUTTING					
	Social issues	CROSS-CUTTING					
	Trans. and accessibility			x			
	Environment and climate	CROSS-CUTTING					
	Security and safety	CROSS-CUTTING					
StratBOARD	Strategies (SUD, ITI, CLLD) under ESIF	CROSS-CUTTING					Section 3.1.2.1.3
Building Stock Data	TABULA data (resid)		x				Section 3.1.3.1
	B. Stock Observatory		x		x	x	Section 3.1.3.2
	ENTRANZE		x		x	x	Section 3.1.3.3
DEEP database	Energy efficiency projects in buildings and industries.	x	x		x	x	Section 3.1.3.4
ODYSEE	Macro (macro sectors, macro-economic data, macro energy efficiency indicators)	CROSS-CUTTING					Section 3.1.3.5

Source	Themes	Industrial	Building	Transport	Public services	Administrative	Section in this report
ODYSEE	Industry (industry branches, economic data, efficiency indicators)	x					Section 3.1.3.5
	Transport (modes, technical and economic data, energy efficiency indicators)			x			
	Households (residential end-uses, technical and economic data, energy efficiency indicators)		x				
	Services (services and agriculture branches, economic data, energy efficiency indicators)	CROSS-CUTTING					
MURE	General cross-cutting policies	CROSS-CUTTING					
	Household policies		x				
	Industry policies	x					
	Service policies				x	x	
	Transport policies			x			
Copernicus data	Copernicus Land Monitoring Service	CROSS-CUTTING					Section 3.2.1
	Copernicus Climate Change Service	CROSS-CUTTING					
Open Street Maps	Description of urban settings	CROSS-CUTTING					Section 3.2.2

Source: own elaboration

It is worth highlighting that this table provides a preliminary approach towards the potential applicability of these data to the respective sectors in a regional energy strategy. However, it is crucial to analyse more specifically each data source to determine its relevance (especially those marked as cross-cutting) and explore the data access offered in each of the cases. The combination of both aspects will determine if the datasets provided can be used in practice or not.

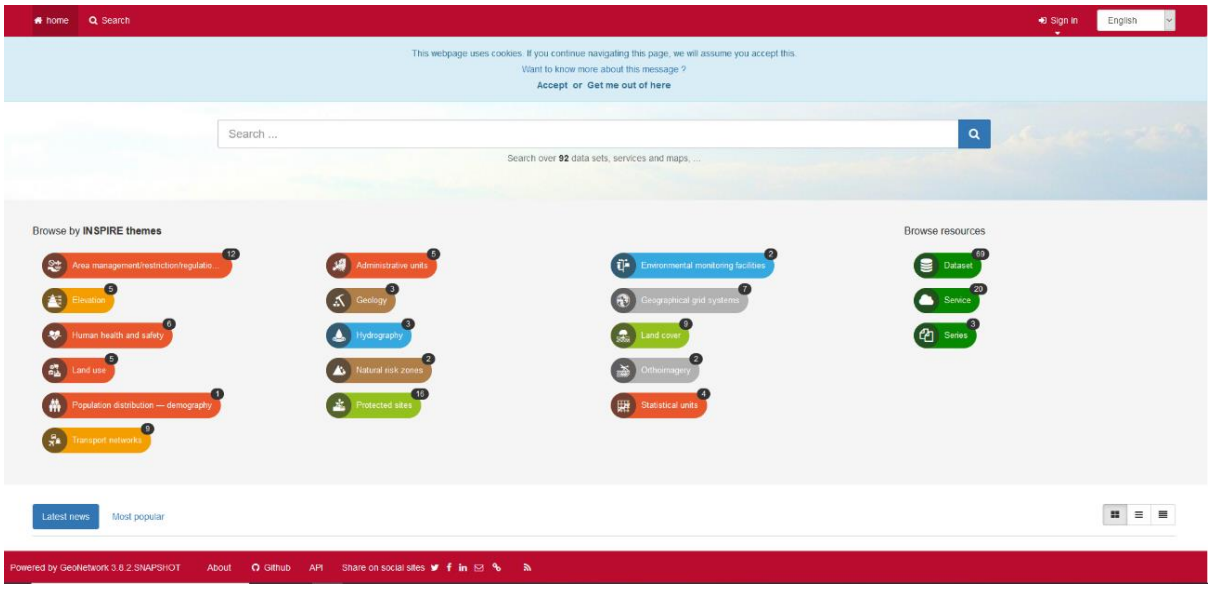
9 Castilla y León region case study

This section analyses the Castilla y León region case study based on the understanding of its regional energy strategy (explained in sections 4 and 5). To this end, the available INSPIRE datasets are listed (section 9.1), two applications based on these datasets are presented (section 9.2), two examples based on data coming from other sources are provided (section 9.3), and a final section (section 9.4) describing the role that data harmonised according to the Energy Resources INSPIRE theme could play is provided.

9.1 INSPIRE Datasets to support CyL Regional Energy Strategy

The Regional Administration of Castilla y León has a geoportal where data is discoverable by searching by INSPIRE themes. The geoportal is accessible, and data can be downloaded under this link: https://idecyl.jcyl.es/geonetwork/srv/eng/catalog.search#/home. These datasets cover 16 INSPIRE data Themes (Figure 45), with 92 being the total number of resources included in November 2020, of which 69 datasets, 3 dataset series and 20 services. By clicking on each dataset, a brief description of the attributes included can be found, as well as their metadata or its accessibility (viewable as WMS or downloadable).

Figure 45. Homepage of the Geoportal of Castilla y León.



Source: Castilla y León Geoportal [130].

At this date (Nov.2020), these regional datasets are not discoverable in the INSPIRE Geoportal yet. This could be due to a problem of competences between the different levels in the Spanish governance scheme that has a direct influence on the sharing of geospatial information. Taking this into account, different datasets in each geoportal can be found (at the Regional or National level) with different attributes and a great variety of spatial resolutions. All the analysed data are provided in Table 65.

Table 65. Datasets in Castilla y León by INSPIRE theme and available format/accessibility.

Dataset	Resource type
Area management / restriction / regulation zones and reporting units	# of items: 12 (10 WMS, 9 downloadable shapefile, 3 online visual)
Areas subject to management, restrictions or regulations and notification units of Castilla y León	WMS service
Thermopluviometric potentiality of forest species in Castilla y León	WMS service

Flora of Castilla y León: thermopluviometric potentiality of forest species	Shapefile
Livestock routes: Valladolid province	WMS service and shapefile
Flora of Castilla y León: forest reproduction material (FRM) of plant species	WMS service and shapefile
Forest of Castilla y León: forest inventory plots	WMS service and shapefile
Forest of Castilla y León: forest planning	WMS service and shapefile
Forest of Castilla y León: sustainable forest certification (PEFC)	WMS service and shapefile
Fishing in Castilla y León: Fishing Sections 2020	WMS service, shapefile and online visualization
Fishing in Castilla y León: Crab Fishing Sections 2020	WMS service, shapefile and online visualization
Hunting of Castilla y León: hunting grounds	WMS service and shapefile
Cartography of the plan for use and management in the Guadarrama mountains	Online visualization
 Geology	# of items: 3 (2 WMS, 2 downloadable shapefile, 1 online visual)
Geology of Castilla y León: tectonics	Shapefile and online visualization
Geology of Castilla y León	WMS service
Geology of Castilla y León: lithology	WMS service and shapefile
 Hydrography	# of items: 3 (3 WMS, 2 downloadable shapefile)
Hydrography of Castilla y León: water bodies	WMS service and shapefile
Hydrography of Castilla y León: river courses	WMS service and shapefile
Hydrography of Castilla y León	WMS service
 Natural risk zones	# of items: 2 (2 WMS, 1 downloadable shapefile)
Risk areas of Castilla y León	WMS service
Forest fires in Castilla y León: high risk areas	WMS service and shapefile
 Protected sites	# of items: 16 (15 WMS, 15 downloadable shapefile)
Natura 2000 Network: Special Protection Areas for Birds of Castilla y León	WMS service and shapefile

Fauna of Castilla y León: areas of application of protected species	WMS service and shapefile
Natura 2000 Network: Special Conservation Zones of Castilla y León	WMS service and shapefile
Natural Recreation Areas of Castilla y León	WMS service and shapefile
Assets of Cultural Interest of Castilla y León: axes	WMS service and shapefile
Forests of Castilla y León: cataloged protective forests	WMS service and shapefile
Assets of Cultural Interest of Castilla y León: real estate	WMS service and shapefile
Protected places of Castilla y León	WMS service
Cataloged Wetlands of Castilla y León	WMS service and shapefile
Flora of Castilla y León: remarkable trees	WMS service and shapefile
Forests of Castilla y León: forest of public utility	WMS service and shapefile
Fauna of Castilla y León: critical areas of protected species	WMS service and shapefile
Fauna of Castilla y León: areas of relevance of the Lark Ricotí	WMS service and shapefile
Network of Natural Spaces of Castilla y León	WMS service and shapefile
Natural resources management Plan of the Sierra de Guadarrama natural space	Shapefile
Assets of Cultural Interest of Castilla y León: protection areas	WMS service and shapefile
Administrative units	# of items: 5 (5 WMS, 4 downloadable shapefile)
Administrative units of Castilla y León	WMS service
Provincial boundaries of Castilla y León: enclosures	WMS service and shapefile
Autonomic boundaries of Castilla y León: enclosures	WMS service and shapefile
Municipal boundaries of Castilla y León: enclosures	WMS service and shapefile
Municipal boundaries of Castilla y León: boundary lines	WMS service and shapefile
Geographical grid systems	# of items: 7 (7 WMS, 6 downloadable shapefile)
Geographical grid distribution MTN200 of Castilla y León	WMS service and shapefile
Geographical grid distribution MTN10 of Castilla y León	WMS service and shapefile
Geographical grid system of Castilla y León	WMS service
Geographical grid distribution MTN25 of Castilla y León	WMS service and shapefile
Geographical grid distribution MTN5 of Castilla y León	WMS service and shapefile

Geographical grid distribution MTN100 of Castilla y León	WMS service and shapefile
Geographical grid distribution MTN50 of Castilla y León	WMS service and shapefile
Land cover	# of items: 9 (9 WMS, 4 downloadable shapefile, 1 WTS)
Land cover of Castilla y León	WMS service
Urban Topographic Cartography Series of Castilla y León 1: 1,000	WMS service and shapefile
Urban Topographic Cartography of Castilla y León 1: 1,000	WMS service
Topographic Map Series of Castilla y Leon: 1: 5,000	WMS service and shapefile
Topographic Map of Castilla y León 1: 5,000	WMS service
Unified Topographic Map of Castilla y León	WMS and WTS service
Topographic Map Series of Castilla y Leon: 1: 10,000	WMS service and shapefile
Topographic Map of Castilla y León 1: 10,000	WMS service
Geographic Information System of Agricultural Parcels (SIGPAC) of Castilla y León	WMS service and shapefile
Orthoimagery	# of items: 2 (2 WMS, 1 TIF/ECW, 1 PNG)
Aerial orthophoto of Castilla y León	WMS service and TIF/ECW
Aerial orthophoto of population areas of Castilla y León	WMS service and PNG
Statistical units	# of items: 4 (4 WMS, 3 downloadable shapefile)
Statistical units of Castilla y León	WMS service
Territorial sections of the Environment of Castilla y León	WMS service and shapefile
Castilla y León Environmental Regions	WMS service and shapefile
Boundaries of population entities of Castilla y León: enclosures	WMS service and shapefile
Elevation	# of items: 5 (5 WMS, 4 TIF, 1 ASCII)
Digital Elevation Model of Castilla y León: aspects	WMS service and TIF
Digital Elevation Model of Castilla y León: hillshade	WMS service and TIF
Elevation map of Castilla y León	WMS service
Digital Elevation Model of Castilla y León	WMS service, TIF and ASCII
Digital Elevation Model of Castilla y León: slopes	WMS service and TIF

Human health and safety	# of items: 6 (4 WMS, 4 downloadable shapefile, 2 online visual, 1 TIF)
Health in Castilla y León: Health Areas	WMS service and TIF
COVID19 in Castilla y León - Provinces	Online visualization and shapefile
Health in Castilla y León: Health Centers	WMS service and shapefile
Health in Castilla y León: Basic Health Zones	WMS service and shapefile
COVID19 in Castilla y León - Basic Health Zones	Online visualization and shapefile
Human health and safety: Castilla y León	WMS service
Land use	# of items: 5 (5 WMS, 4 downloadable shapefile, 4 online visual)
Land use in Castilla y León	WMS service
Urban planning in Castilla y León: development sectors	WMS service, shapefile and online visualization
Urban planning in Castilla y León: municipal scope	WMS service, shapefile and online visualization
Urban planning in Castilla y León: soil classes	WMS service, shapefile and online visualization
Urban planning in Castilla y León: land categories	WMS service, shapefile and online visualization
Population distribution - demography	# of items: 1 (1 WMS, 1 downloadable shapefile, 1 online visual)
Population of Castilla y León: density / mesh 1km (Census 2011)	WMS service, shapefile and online visualization
Environmental monitoring facilities	# of items: 2 (1 WMS, 1 downloadable shapefile, 1 online visual)
Castilla y León Environmental Prevention: vulnerable zones 2020	Shapefile and online visualization
Environmental observation facilities	WMS service
Transport networks	# of items: 9 (9 WMS, 8 downloadable shapefile)
Railway of Castilla y León: Train stations	WMS service and shapefile
Roads of Castilla y León: mountain passes	WMS service and shapefile

Airstrips of Castilla y León: Delimitation	WMS service and shapefile
Railway in Castilla y León: train tracks	WMS service and shapefile
Roads of Castilla y León: road network links	WMS service and shapefile
Transport networks of Castilla y León	WMS service
Roads of Castilla y León: road network	WMS service and shapefile
Roads of Castilla y León: kilometer points	WMS service and shapefile
Airstrips of Castilla y León: Location	WMS service and shapefile
Total themes: 15 / 34	Total items: 91

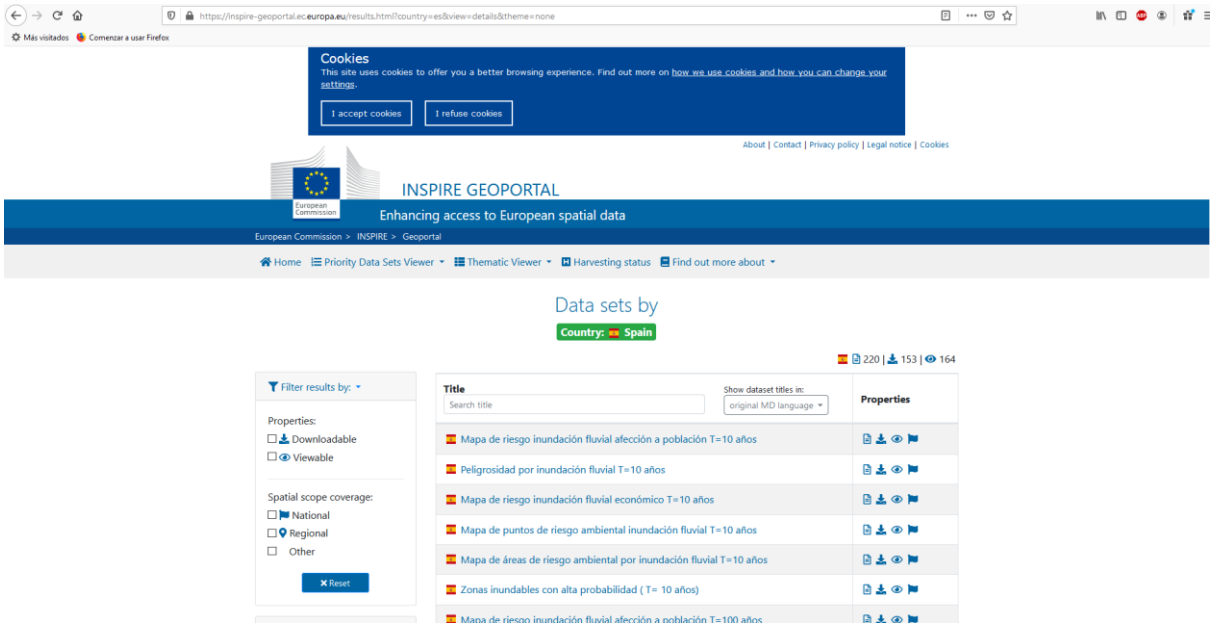
Source: Own elaboration, based on information from Geoportal of Castilla y León.

On the other hand, data from the INSPIRE Geoportal at the National Level were analysed due to their added value for regional analysis. In the Spanish case, 220 datasets are included (Figure 46). A review of these datasets was developed by classifying the data according to the following criteria:

- Dataset metadata: yes or no.
- Downloadable: yes or no.
- Viewable: yes or no.
- Scale: Regional, National or Local. This attribute indicates the spatial coverage of the data.

The data were analysed in November 2020 by accessing the following link: https://inspire-geoportal.ec.europa.eu/results.html?country=es&view=details&theme=none.

Figure 46. Homepage of the INSPIRE Geoportal



Source: INSPIRE Geoportal [131].

We found that the same data could be included in two or more INSPIRE data themes. For this reason, 240 datasets are included in Table 66. This is quite confusing, taking into account the different specifications for sharing data using different INSPIRE data models. In this table 6 aspects are analysed:

- **Dataset metadata**: if metadata of the dataset is available
- **Downloadable**: if the dataset is downloadable
- **Viewable**: if the dataset viewable:
- **National scale**: if the dataset has a national scope and covers the whole of Spain
- **Regional/local**: if the dataset has a regional or local scope
- **Appl. CyL**: if the dataset covers Castilla y León and could be used in this region

Table 66. INSPIRE datasets available at country level (Spain).

Dataset	Dataset metadata	Downloadable	Viewable	National Scale	Regional/Local	Appl- CyL
 Addresses	6	4	5	3	2	1
Address	X	X	X	X	-	X
Navarra Addresses. INSPIRE	X	X	X	-	X	-
Addresses of Giopuzkoa, INSPIRE	X	X	X	-	X	-
Addresses of Cartocity project of Spain	X	X	X	X	-	X
Base map of La Rioja	X	-	X	-	X	-
CA08000 - Streets 1:1,000	X	-	-	-	X	-
 Administrative units	7	5	7	2	5	0
Shape of Administrative units of Araba/Álava (INSPIRE)	X	X	X	-	X	-
Database of Administrative units of Spain	X	X	X	X	-	X
Administrative units of Gipuzkoa, INSPIRE	X	X	X	-	X	-
Shape of Administrative boundaries of Araba/Álava (INSPIRE)	X	X	X	-	X	-
Maritime boundaries of Spain (INSPIRE)	X	X	X	X	-	-
Administrative boundaries of Cataluña	X	-	X	-	X	-
Base map of La Rioja	X	-	X	-	X	-
 Cadastral parcels	5	5	5	1	4	0
Building shape of Araba/Álava (INSPIRE)	X	X	X	-	X	-

Parcels shape of Araba/Álava (INSPIRE)	X	X	X	-	X	-
Cadastral Parcel	X	X	X	X	-	X
Cadastral Parcels of Navarra. INSPIRE	X	X	X	-	X	-
Cadastral parcels of Gipuzkoa, INSPIRE	X	X	X	-	X	-
Geographical grid systems	0	0	0	0	0	0
Not available	-	-	-	-	-	-
Geographical names	7	4	4	1	6	0
Valencian Toponymic Nomenclàtor harmonized to INSPIRE model	X	X	X	-	X	-
Basic Geographical Nomenclator of Spain	X	X	X	X	-	X
Basic Geographical Nomenclator of Aragon	X	X	-	-	X	-
Geographical names of Gipuzkoa, INSPIRE	X	X	-	-	X	-
Topographic Cartography 1: 1,000	X	-	X	-	X	-
Base map of La Rioja	X	-	X	-	X	-
Geographical Nomenclator of Andalucía	X	-	-	-	X	-
Hydrography	7	4	2	5	2	0
Coast line of Spain	X	X	X	X	-	-
IGR hydrography of Spain	X	X	X	X	-	X
Complete river sub-basins classified according to modified Pfafstetter	X	X	-	X	-	X
Spanish river sections classified according to modified Pfafstetter	X	X	-	X	-	X
Topographic Cartography 1: 1,000	X	-	X	-	X	-
Base map of La Rioja	X	-	X	-	X	-
Dams inventory	X	-	-	X	-	X
Protected sites	9	8	1	8	1	0
Natura 2000 network	X	X	-	X	-	X
Special Protection Area for Birds_ZEPA	X	X	-	X	-	X
Biosphere Reserves (MaB_ES)	X	X	-	X	-	X

Place of Community Importance. LIC	X	X	-	X	-	X
Wetlands included in the Ramsar Convention List. Ramsar_ES	X	X	-	X	-	X
OSPAR Network of Marine Protected Areas (OSPAR)	X	X	-	X	-	-
Specially Protected Areas of Importance for the Mediterranean (ZEPIM_ES)	X	X	-	X	-	X
Natural Protected areas (ENP_ES)	X	X	-	X	-	X
I-09_Goods of Cultural Interest (BIC)	X	-	X	-	X	-
Coordinate reference systems	0	0	0	0	0	0
Not available	-	-	-	-	-	-
Transport networks	4	2	2	2	2	0
Transport networks	X	X	-	X	-	X
Adif Rail Transport Network	X	X	-	X	-	X
Topographic Cartography 1: 1,000	X	-	X	-	X	-
Base map of La Rioja	X	-	X	-	X	-
Elevation	7	1	6	4	3	0
Digital Terrain Model in areas of significant potential risk of flooding (ARPSIs)	X	X	X	X	-	X
Topographic Cartography 1: 1,000	X	-	X	-	X	-
Digital Terrain Model of Cataluña (15x15m y 5x5m)	X	-	X	-	X	-
LiDAR map of Spain (2.5m)	X	-	X	X	-	X
Digital Terrain Model of Spain (5, 25 y 200 m)	X	-	X	X	-	X
Digital Terrain Model (DTM) of 1 m of the Basque Country. Year 2016	X	-	-	-	X	-
Marine Management Entities: Reference Isobaths	X	-	X	X	-	-
Geology	2	0	0	2	0	0
Geological Map of the Iberian Peninsula, Balearic Islands and the Canary Islands at a scale of 1: 1,000,000, 1995 edition	X	-	-	X	-	X
Hydrogeological Map of Spain at 1: 200,000 continuous digital scale	X	-	-	X	-	X

 Land cover		6	4	2	6	0	0
Land Occupation Information System in Spain (SIOSE), year 2014		X	X	X	X	-	X
CORINE Land Cover 2018 of Spain		X	X	X	X	-	X
Forest Map of Spain of maximum actuality		X	X	-	X	-	X
Spanish Inventory of Wetlands (IEZH_ES)		X	X	-	X	-	X
Enclosures of the geographic information system of agricultural parcels (SIGPAC)		X	-	-	X	-	X
Atlas of the Landscapes of Spain		X	-	-	X	-	X
 Orthoimagery		5	0	2	1	4	0
Orthophoto of Catalonia 1: 2 500 (OF-25C) v3.3		X	-	X	-	X	-
Update PNOA orthophotos from Spain		X	-	X	X	-	X
Orthophotography series of Extremadura with a 10 cm pixel in the field. (Extremadura joint)		X	-	-	-	X	-
16cm orthophotography of the three capitals of the Basque Country. Year 2005		X	-	-	-	X	-
7cm orthophotography of urban areas of the Autonomous Community of the Basque Country. (2007-2009)		X	-	-	-	X	-
 Atmospheric conditions		0	0	0	0	0	0
Not available		-	-	-	-	-	-
 Agricultural and aquaculture facilities		2	0	0	2	0	0
Irrigation Horizon 2008		X	-	-	X	-	X
Modernized Irrigation, Shock Plan: Projects		X	-	-	X	-	X
 Area management/restriction/regulation zones and reporting units		43	41	0	43	0	0
Vulnerable areas to contamination by nitrates (Quadrennium Report 2012-2015. Dir 91/676 / CEE)		X	X	-	X	-	X
Status of groundwater bodies PHC 2015-2021		X	X	-	X	-	X
Status of surface water bodies (polygons) PHC 2015-2021		X	X	-	X	-	X
Drinking water protected areas (lines) PHC 2015-2021		X	X	-	X	-	X

Surface water bodies (polygons) PHC 2015-2021	X	X	-	X	-	X
Groundwater bodies PHC 2015-2021	X	X	-	X	-	X
Status of surface water bodies (lines) PHC 2015-2021	X	X	-	X	-	X
Surface water bodies (lines) PHC 2015-2021	X	X	-	X	-	X
Hydrographic Demarcations PHC 2015-2021	X	X	-	X	-	X
Protected drinking water areas (polygons) PHC 2015-2021	X	X	-	X	-	X
Protected areas aquatic species: PHC molluscs 2015-2021	X	X	-	X	-	X
Catchment areas of sensitive areas (Q2015. Dir 91/271 / CEE)	X	X	-	X	-	X
Urban agglomerations (Q2015. Dir 91/271 / CEE)	X	X	-	X	-	X
Sensitive areas identified by polygons (Q2015. Dir 91/271 / CEE)	X	X	-	X	-	X
Sensitive areas identified by lines (Q2015. Dir 91/271 / CEE)	X	X	-	X	-	X
Strategic Noise Maps (MER) _Lden_Airports	X	X	-	X	-	X
Strategic Noise Maps (MER) _Airports_Ln	X	X	-	X	-	X
Strategic Map Units (UME) _Airports	X	X	-	X	-	X
Strategic Noise Maps (MER) _Industrial_Lden Agglomerations	X	X	-	X	-	X
Strategic Noise Maps (MER) _Roads_Agglomerations_Ln	X	X	-	X	-	X
Strategic Noise Maps (MER)_Railway_Agglomerations_Ln	X	X	-	X	-	X
Strategic Noise Maps (MER)_Railway_Agglomerations_Lden	X	X	-	X	-	X
Strategic Noise Maps (MER) _Roads_Agglomerations_Lden	X	X	-	X	-	X
Strategic Map Units (UME) _Aglomerations	X	X	-	X	-	X
Strategic Noise Maps (MER) _Aglomerations_Total_Ln	X	X	-	X	-	X
Strategic Noise Maps (MER) _Industrial_Aglomerations_Ln	X	X	-	X	-	X
Strategic Noise Maps (MER) _Total _Aglomerations_Lden	X	X	-	X	-	X
Air quality zones from historical assessment information	X	X	-	X	-	X
Strategic Noise Maps (MER) _Roads_Lden	X	X	-	X	-	X
Strategic Map Units (UME)_Roads	X	X	-	X	-	X
Strategic Noise Maps (MER)_Roads_Ln	X	X	-	X	-	X
Strategic Noise Maps (MER) _Railwaylines_Ln	X	X	-	X	-	X

Strategic Noise Maps (MER) _Railwaylines_Lden	X	X	-	X	-	X
Eutrophication assessment marine areas	X	X	-	X	-	X
River basin districts (land area)	X	X	-	X	-	X
Marine boundaries	X	X	-	X	-	-
River basin districts (land and sea)	X	X	-	X	-	X
Maritime Terrestrial Public Domain (Excluded cores)	X	X	-	X	-	-
Land Maritime Public Domain	X	X	-	X	-	X
Land Maritime Public Domain (Unnecessary land)	X	X	-	X	-	X
Strategic Map Units (UME)_Rail lines	X	X	-	X	-	X
Mountains of Public Utility	X	-	-	X	-	X
Ownership of the Mountains	X	-	-	X	-	X
Biogeographical regions	1	1	0	1	0	0
Biogeographical regions. State	X	X	-	X	-	X
Buildings	8	3	7	1	7	0
Araba/Álava Buildings (INSPIRE)	X	X	X	-	X	-
Cadastral parcels of Araba/Álava (INSPIRE)	X	X	X	-	X	-
Buildings of Gipuzkoa. INSPIRE	X	X	X	-	X	-
Topographic Cartography 1: 1,000	X	-	X	-	X	-
Base map of La Rioja	X	-	X	-	X	-
Building	X	-	X	X		X
Organizational Entities of the Marine Environment in Galicia	X	-	X	-	X	-
Galicia Topographic Base 1: 5,000	X	-	-	-	X	-
Environmental monitoring facilities	27	27	0	27	0	0
Nitrate control network in groundwater (Quadrennium Report 2012-2015. Dir 91/676 / CEE)	X	X	-	X	-	X
Nitrate control network in surface waters (Quadrennium Report 2012-2015. Dir 91/676 / CEE)	X	X	-	X	-	X

Hydrographic network formed by union of bodies of water PHC 2015-2021	X	X	-	X	-	X
Surface water monitoring networks PHC 2015-2021	X	X	-	X	-	X
Groundwater monitoring networks PHC 2015-2021	X	X	-	X	-	X
Supply Control	X	X	-	X	-	X
Control Changes Anthropogenic Activity	X	X	-	X	-	X
Capacity Stations in SAIH reservoir	X	X	-	X	-	X
SAIH River Capacity Stations (Flow)	X	X	-	X	-	X
Integrated Network of Gauging Stations (SAIH-ROEA)	X	X	-	X	-	X
Weather Stations of the Meteorological State Agency	X	X	-	X	-	X
Monitoring network for the quantitative status of groundwater	X	X	-	X	-	X
Subterranean Water Chemical Status Control Network	X	X	-	X	-	X
Air quality sampling points	X	X	-	X	-	X
Air quality stations	X	X	-	X	-	X
Air Quality Model Areas	X	X	-	X	-	X
Control of emissions to the Mediterranean (BARCELONA AGREEMENT)	X	X	-	X	-	-
Transects that will contribute to the monitoring of Spain's marine strategies	X	X	-	X	-	-
Stations that will contribute to the monitoring of Spain's marine strategies	X	X	-	X	-	-
Control of Cross-Border Rivers with Portugal (Albufeira Agreement)	X	X	-	X	-	X
Control Changes in Natural Conditions (Reference Network)	X	X	-	X	-	X
Control of Hazardous Substances	X	X	-	X	-	X
Pesticide Control	X	X	-	X	-	X
General Operational Control	X	X	-	X	-	X
Pole network of the ERHIN program	X	X	-	X	-	X
Telenivometers used by the ERHIN program	X	X	-	X	-	X
SAIH rainfall stations	X	X	-	X	-	X
 Energy resources	4	1	2	2	2	0

Wind Farms of La Rioja	X	X	X	-	X	-
Petrol Stations Geoportal	X	-	X	X	-	X
Easements of the General Municipal Planning Plan of the year 2013 at a scale of 1: 15000 of the A Coruña City Council	X	-	-	-	X	-
Hydrocarbon Mining Domain and drilling	X	-	-	X	-	X
 Habitats and biotopes	1	1	0	1	0	0
Habitat of Community Interest. (2007-2012)	X	X	-	X	-	X
 Human health and safety	2	2	0	0	2	0
Captures, tanks and treatment plants in La Rioja.	X	X	-	-	X	-
Studies of the sound levels in the whole period day, afternoon and night of La Rioja.	X	X	-	-	X	-
 Land use	16	3	2	4	12	0
Land Occupation Information System in Spain (SIOSE), year 2014	X	X	X	X	-	X
Forest Map of Spain of maximum actuality	X	X	-	X	-	X
Urban Information (Urban Information System of Spain)	X	X	-	X	-	X
Topographic Cartography 1: 1,000	X	-	X	-	X	-
Management of Urbanizable and Rustic Land of the Municipal Planning General Plan of the year 2013 at 1: 5000 scale of the A Coruña City Council	X	-	-	-	X	-
Land Cover and Land Use map of Galicia at a scale of 1: 25000	X	-	-	-	X	-
Easements of the General Municipal Planning Plan of the year 2013 at a scale of 1: 15000 of the A Coruña City Council	X	-	-	-	X	-
Land Use of the Management Plan of the Coast (POL) 1: 20000 Galicia	X	-	-	-	X	-
Zoning of Urban Land of the General Plan for the Municipal Planning of 2013 at a scale of 1: 2000 of the City Council of A Coruña	X	-	-	-	X	-
Global uses of the General Plan for the Municipal Planning of 2013 at a scale of 1: 2000 of the City Council of A Coruña	X	-	-	-	X	-
Urban land of the General Plan for the Municipal Planning of 2013 at a scale of 1: 2000 of the City Council of A Coruña	X	-	-	-	X	-
Urban Planning of the Management Plan of the Coast of Galicia 1: 20000	X	-	-	-	X	-

Enclosures of the geographic information system of agricultural parcels (SIGPAC)	X	-	-	X	-	X
Thematic Cartography of Extremadura. Qualification of Soils	X	-	-	-	X	-
Thematic Cartography of Extremadura. Classes of Soils	X	-	-	-	X	-
Thematic Cartography of Extremadura. Categories of Soils	X	-	-	-	X	-
Meteorological geographical features	0	0	0	0	0	0
Not available	-	-	-	-	-	-
Mineral resources	2	1	1	0	2	0
Mining rights (points) of La Rioja.	X	X	X	-	X	-
Mining Domains	X	-	-	-	X	-
Natural risk zones	34	32	5	34	0	0
Danger due to river flooding T = 10 years	X	X	X	X	-	X
Coastal flood hazard T = 100 years	X	X	X	X	-	-
Danger due to river flooding T = 100 years	X	X	X	X	-	X
Coastal flood hazard T = 500 years	X	X	X	X	-	-
Danger due to river flooding T = 500 years	X	X	X	X	-	X
River flood risk map affecting population T = 10 years	X	X	-	X	-	X
Map of environmental risk points due to river flloding T=10 years	X	X	-	X	-	X
Floodplains with high probability (T = 10 years)	X	X	-	X	-	X
Map of environmental risk areas due to river flooding T = 10 years	X	X	-	X	-	X
Economic fluvial flood risk map T = 10 years	X	X	-	X	-	X
Map of environmental risk areas due to river flooding T = 100 years	X	X	-	X	-	X
Map of environmental risk points river flooding T = 100 years	X	X	-	X	-	X
River flood risk map affecting population T = 100 years	X	X	-	X	-	X
Coastal flood risk map for population affection T = 100 years	X	X	-	X	-	-
Coastal flood extension T = 100 years	X	X	-	X	-	-
Flood areas of medium or occasional probability (T = 100 years)	X	X	-	X	-	X

Economic fluvial flood risk map T = 100 years	X	X	-	X	-	X
Map of coastal flood risk areas environmental impact T = 100 years	X	X	-	X	-	-
Coastal flood risk map economic impact T = 100 years	X	X	-	X	-	-
Map of coastal flood risk points environmental impact T = 100 years	X	X	-	X	-	-
Areas of Significant Potential Risk of Flooding (ARPSIs) 2nd cycle (2018)	X	X	-	X	-	X
Flood areas of frequent flooding (T = 50 years)	X	X	-	X	-	X
Economic fluvial flood risk map T = 500 years	X	X	-	X	-	X
Coastal flood extension T = 500 years	X	X	-	X	-	X
Map of coastal flood risk points environmental impact T = 500 years	X	X	-	X	-	-
Map of environmental risk points river flooding T = 500 years	X	X	-	X	-	X
Flood zones of low or exceptional probability (T = 500 years)	X	X	-	X	-	X
River flood risk map affecting population T = 500 years	X	X	-	X	-	X
Coastal flood risk map economic impact T = 500 years	X	X	-	X	-	-
Map of environmental risk areas due to river flooding T = 500 years	X	X	-	X	-	X
Coastal flood risk map population affection T = 500 years	X	X	-	X	-	-
Map of coastal flood risk areas environmental impact T = 500 years	X	X	-	X	-	-
Exploitation Standards of Flooding Zones	X	-	-	X	-	X
Forest fire frequency map by municipality	X	-	-	X	-	X
 Oceanographic geographical features	1	0	0	0	1	0
Hourly data of the HF Radar of Galicia last 5 days	X	-	-	-	X	-
 Population distribution-demography	1	0	0	0	1	0
Spatial distribution of the population of Andalucia	X	-	-	-	X	-
 Production and industrial facilities	2	2	1	0	2	0
Wind Farms of La Rioja	X	X	X	X	-	-
Captures, tanks and treatment plants in La Rioja.	X	X	-	X	-	-
 Species distribution	1	0	0	1	0	0

Species distribution	X	-	-	X	-	X
 Soil	5	0	0	5	0	0
N Inventory of Soil Erosion (2002-2019). Erosion in riverbeds	X	-	-	X	-	X
N Inventory of Soil Erosion (2002-2019). Wind erosion	X	-	-	X	-	X
N Inventory of Soil Erosion (2002-2019). Potential for mass movements	X	-	-	X	-	X
N Inventory of Soil Erosion (2002-2019). Potential erosion	X	-	-	X	-	X
N Inventory of Soil Erosion (2002-2019). Lamellar and streaked erosion	X	-	-	X	-	X
 Sea regions	4	3	1	4	0	0
Coast line of Spain	X	X	X	X	-	-
Eutrophication assessment marine areas	X	X	-	X	-	-
Marine demarcations	X	X	-	X	-	-
Marine Physical Environment: Nature of the Seabed	X	-	-	X	-	-
 Statistical units	4	0	0	4	0	0
Census Sections of the Register of Inhabitants of Spain	X	-	-	X	-	X
Census Sections of Spain	X	-	-	X	-	X
Census Sections of General Censuses of Spain	X	-	-	X	-	X
Census Sections of the Electoral Census of Spain	X	-	-	X	-	X
 Utility and governmental services	17	8	3	13	4	0
Volunteer groups in La Rioja	X	X	X	-	X	-
Educational centers in La Rioja	X	X	X	-	X	-
Health resources in La Rioja	X	X	X	-	X	-
Dumping points of urban treatment plants (Q2015. Dir 91/271 / CEE)	X	X	-	X	-	X
Wastewater treatment plants (Q2015. Dir 91/271 / CEE)	X	X	-	X	-	X
Isolated Populations	X	X	-	X	-	X
Guide to Beaches in Spain	X	X	-	X	-	X
Waste Landfills	X	X	-	X	-	X

SE08000 - Municipal services and equipment 1: 1000	X	-	-	-	X	-
Map of attention and information centres of the Social Security of Spain	X	-	-	X	-	X
Map of municipal social services centres in Spain	X	-	-	X	-	X
Map of health centres in Spain	X	-	-	X	-	X
Maps of Day centres for the elderly in Spain	X	-	-	X	-	X
Map of clinics in Spain	X	-	-	X	-	X
Local Infrastructure and Equipment Survey	X	-	-	X	-	X
Map of Residences for the elderly in Spain	X	-	-	X	-	X
Spain Hospital Map	X	-	-	X	-	X
Total themes: 34 /34						

Source: Own elaboration, based on information from INSPIRE Geoportal.

A deep analysis of all the datasets listed in Table 65 and in Table 66 to assess to what extent they are relevant to support the regional energy strategy is out of scope. Nevertheless, some preliminary considerations can be made:

- Regarding the Energy Resources INSPIRE theme, no data is provided in the regional geoportal, and no relevant data at national level is available in the INSPIRE geoportal (only regional data sets for La Rioja and the location of petrol stations and mining facilities). This lack of data provided under the Energy Resource theme could represent a data gap when trying to improve the development of the Regional Energy Strategy for the next evaluation period.
- None of the two geoportals provide data containing the geographical distribution of energy production sites, which is a key factor in developing the region's baseline, taking into account the potential for renewable energy and the location of the population in the region. By understanding this factor, energy planners could understand how to use the potential avoiding problems and impacts to create a more suitable strategy to achieve a reduction in the level of emissions to meet the objectives proposed with the new strategy.
- Both geoportals provide relevant datasets that are useful for determining local and regional energy consumption. These datasets are included in the INSPIRE themes "Buildings", "Transportation networks", "Land use", and "Land cover". The Spanish cadastre provides the first at the national level, which is useful for determining energy demand and the level of emissions at the local and regional levels. The transport network could be useful in understanding the role of the transport sector in GHG emissions. Finally, land use and land cover are relevant to assess the spatial distribution of different areas in the region having different energy uses.
- Combining these datasets with statistical information about socio-economical characteristics of the region using appropriate models could be useful to define the baseline emissions level of the region and assess how to reduce it.

9.2 Applications in the Castilla y León Regional Energy Strategy

Based on the challenges identified in the analysis of the Castilla y León Region Energy Efficiency Strategy and the available data, this section presents two applications that can potentially support two key sectors of the strategy: the **energy use in buildings** (section 9.2.1) and **the transport sector** (section 9.2.2). As it has been observed, these two sectors are key within regional energy strategies. This section aims to explore the re-usability of the applications in other EU regions, assuming the availability of INSPIRE data.

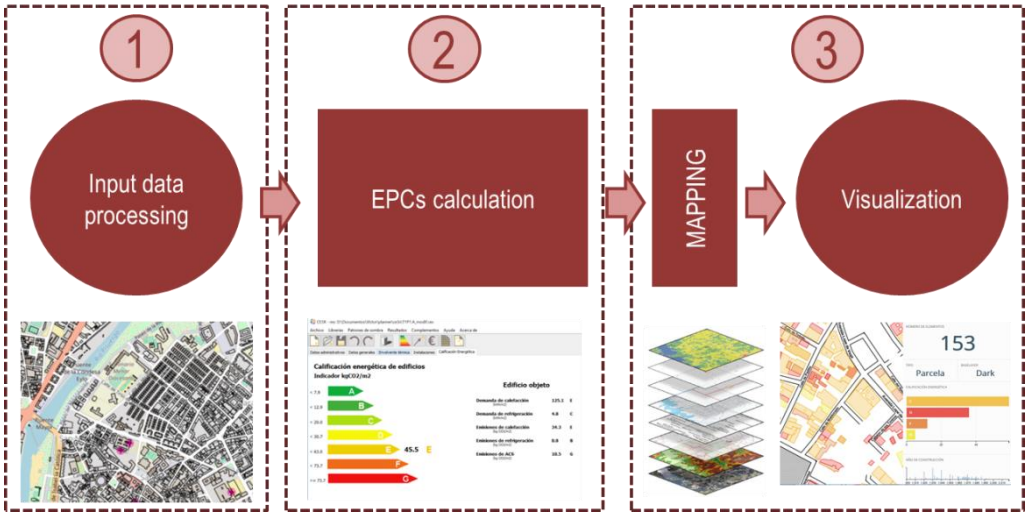
9.2.1 Energy use in buildings

ENERGIS is an integrated sectoral modelling tool whose main objective is to estimate energy heating and cooling demand at the building level and aggregate this information at coarser scales (e.g. at district or city level) in the most energy-demanding areas. This will allow for planning and allocating the necessary resources to specific areas and to match the energy demand to the energy supply available in the area (both from renewable and non-renewable energy sources).

In this line, the application proposed (ENERGIS tool [140]) only focuses on the first step: calculating the heating and cooling energy demand. To this end, it relies on publicly available data and validated calculation methods at the national level, as Energy Performance Certificate calculation tools. In particular, the CE3X tool [141] has been automated to calculate the energy demand at the building level.

The ENERGIS tool, to achieve these objectives, deals with three main aspects: (1) information processing and treatment; (2) estimation of the energy demand and (3) the storage, mapping and visualisation of the data. The process can be seen below.

Figure 47. Scheme of the ENERGIS tool



Source: Own elaboration, CARTIF

There are three main types of data required by the platform and processed in step 1: climate zones, building thermal properties and geometry data on buildings. The two first types of data National Code for Building Construction [142] in Spain, were queried.

For the geometry data on buildings, the key data source is the Spanish cadastre. The cadastre, for each building, provides geometrical information (in a GML file) and general semantic information that will be used to identify and characterize the building. More specifically, the information obtained from the cadastre to be used within the platform is the geographical information of the building (the footprint of the building,) and also important information as the number of the building floors above ground and below ground, the year of the construction, current use of the building and the address of the building.

The geometry information automatically collected from the cadastre in GML files is processed to offer the energy demand estimation engine the information as is required in step 2 for feeding the CE3X tool. The main processes are, on the one hand, the generation of the information for the different envelope elements of the building, with their dimensions and the orientation, and on the other hand, the production of shadows patterns with the information of the façades of neighbouring buildings and the implementation of calculation methods to obtain how these façades influence the direct incidence of the sun.

Finally, in step 3, the results are stored and organized to be presented visually through an online web tool.

The following sections will focus on how publicly available data has been deployed, particularly that coming from the Spanish cadastre (section 9.2.1.1). Then, the next section will focus on the processing required to achieve the abovementioned goals, in particular, by listing the necessary geometry calculations that need to be performed on cadastral data and how they need to be enriched (section 0). Finally, the results achieved are

presented (section 9.2.1.3) and some final considerations to facilitate the replicability of this approach (section 9.2.1.4).

9.2.1.1 Spanish cadastral data

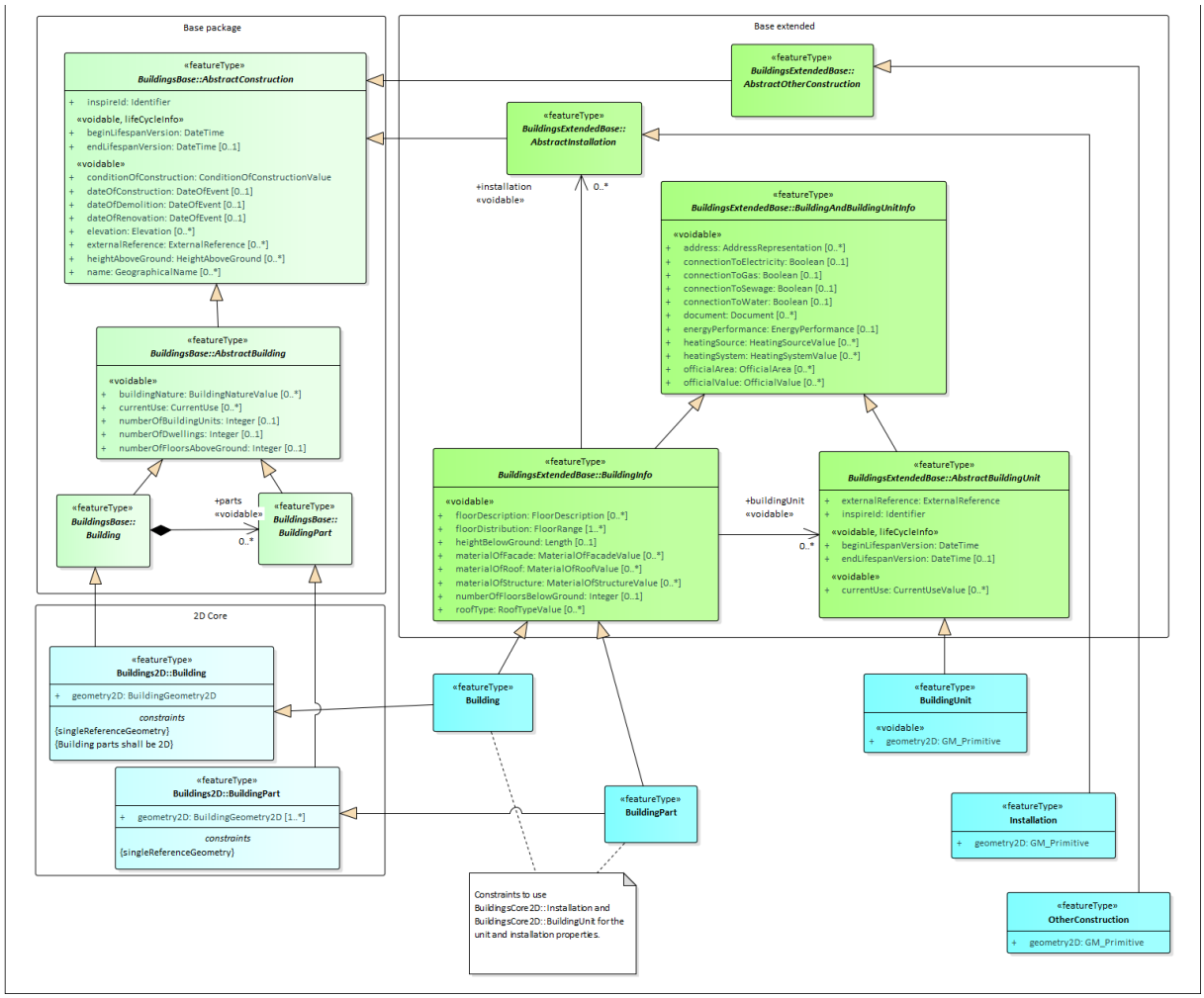
The role of the cadastre when dealing with buildings is highly important since it is the most stable source for this type of information. In the case of Spain, it is one of the most advanced countries in the INSPIRE implementation by presenting the data according to the INSPIRE Cadastral Parcel, Address and Building specifications in the GML format. The analysis of the cadastral data is crucial towards the INSPIRE harmonisation of EPCs datasets since it can be used as a basis for this aim and even more so when evaluating the level of compliance of an advanced country in this sense as it is Spain.

The Spanish Cadastre has dealt with the INSPIRE specifications on Cadastral Parcel, Address and Building, but for the information needed in the ENERGIS, only Building data is used.

"Buildings" is one of the most relevant to support energy policies [143]. The INSPIRE Data Specification on Buildings [144] offers six data models (application schemes) considering different semantics and geometrics points of view: BuildingsBase, Buildings2D, Buildings3D, BuildingsExtendedBase, BuildingsExtended2D and BuildingsExtended3D. The extended versions include more detailed information about buildings and building-related objects, with data required, but choosing harmonisation at the European level is not easily achievable.

The representation of buildings in the Spanish Cadastre is complex, and they are defined as a multi-surface that represents the enclosed areas of all constructions with volume above ground in each cadastral parcel, excluding cantilevers, terraces or balconies. The schema deployed to represent these data in the Spanish Cadastre corresponds to the INSPIRE 2D extended BU, which can be seen in Figure 48.

Figure 48. INSPIRE 2D extended BU application schema



Source: INSPIRE Knowledge Base

More specifically, three feature types (Building, BuildingPart and OtherConstruction) are provided separately in the Spanish Cadastre, whilst the BuildingUnit Feature type is not implemented. The information of the Spanish Cadastre contained in the Features Types Building and BuildingPart is used by the ENERGIS tool to provide the information required in turn by the CE3X tool. The following tables describe the attributes “Building” and “BuildingPart”. Marked in grey are those attributes that exist in the INSPIRE definition but are not deployed in the Spanish Cadastre.

Table 67. Attributes and contents within Building in the Spanish Cadastre

Building	
Attribute Name	Description of contents in Spanish Cadastre
gml:FeatureCollection	Heading GML object where the extended 2D Building scheme is defined. It has the gml:id ES.SDGC.BU.
gml:featureMember	Structure containing every building object.
bu-ext2d:Building	Main structure with a *gml:id* composed of values defined in "*inspireID*" and it is a unique identifier for all the data group.
gml:boundedBy	Structure that defines the rectangle covering the geometry of the object defined by its low-left and above-right coordinates. The coordinates will be defined in the reference system indicated in "srsName".
bu-core2d:beginLifespanVersion	Date when the data has been submitted to the cadastral data base.
bu-core2d:conditionofConstruction	Values that expresses the condition of the construction. It can be: ruin, declined or functional. In case that in the same parcel there are different units, this value will be the best among them.
bu-core2d: dateOfConstruction	Structure that defines the date of construction. It is composed by two attributes: bu-core2d:beginning and bucore2d:end. If there is more than one building unit, in the "beginning" field the oldest date is adopted and in the "end" field the newest. They are always referenced to the 1st of January.
bucore2d: endLifespanVersion	Date when the data has been deprecated. This value is not defined since it does not provide historical information.
bucore2d: externalReference	Structure where the URL to the direct access to the cadastral information in the Sede Electrónica del Catastro is added (field "building2d:informationSystem". The field "bu-core2d:reference" contains the reference to the cadastral parcel.
bu-core2d:inspireId	Unique identifier for all the groups of data in INSPIRE. It is composed by a base:Identifier structure with the two following values.
base:localId	First 14 characters of the cadastral reference.
base:namespace	For buildings it is "ES.SDGC.BU", which corresponds to the acronym of the country, producer entity and the group of data.
bu-core2d:addresses	Address object, through a "xlink:href" the WFS service of the address(es) associated to the building can be accessed.

bu-core2d:cadastralParcels	Cadastral parcel object, through a "xlink:href" the WFS service of the cadastral parcel associated to the building can be accessed.
bu-ext2d:geometry	Geometry of the building in GML. It is a gml:MultiSurface structure that can hold several gml:Surface. These objects have to have a unique gml:id composed by the gml:id of the cadastral zoning and a prefix and a suffix. The geometry is defined by exterior ring vertices and holes can exist which are defined in an interior ring structure. The coordinate list of the rings (gml:postList) duplicates the first and last vertex. The exterior one is defined clockwise and the interior one counter-clockwise. The reference system is the one defined in "srsName". It holds the other two attributes defined below.
bu-core2d: horizontalGeometryEstimatedAccuracy	Accuracy in meters, which adopts the value of 0.1.
bu-core2d:horizontalGeometryReference	Indicates that the geometry of the building is the footprint of what is built above ground. It has the value: "footprint".
bu-ext2d:currentUse	Predominant use of the building. The value is obtained calculating the use that covers more surface in the cadastral parcel where the building is located. The following values are admitted: 1_residential, 2_agriculture, 3_industrial, 4_1_office, 4_2_retail, 4_3_publicServices.
bu-ext2d:numberOfBuildingUnits	Number of properties of the cadastral parcel that are contained in the building.
bu-ext2d:numberOfDwellings	Number of properties of the cadastral parcel that are contained in the building with a residential use.
buext2d: numberOfFloorsAboveGround	Number of floors of the building. This data cannot be provided at building level, since in the Spanish cadastral data model the volume cannot be delimited for the complete building, it is a value which is reflected in BuildingPart.
bu-ext2d:document	Structure where in the field "bu-ext2d: documentLink" an URL is provided with access to an image of the façade. It is possible that the query will not provide an image if this is not contained in the data base. The structure includes the field "bu-ext2d: format" with the value "jpeg" and the field "bu-ext2d:sourceStatus" with the value "NotOfficial".
bu-ext2d:officialArea	Structure that represents the surface of the building in square meters in the field "buext2d:value" and the type of Surface measured, which will always be grossFloorArea in the field "bu-ext2d:officialAreaReference".

Source: Spanish Cadastre

Table 68. Attributes and contents within Building Part in the Spanish Cadastre

BuildingPart	
Attribute Name	Description of contents in Spanish Cadastre
gml:FeatureCollection	Heading GML object where the extended 2D Building scheme is defined. It has the gml:id ES.SDGC.BU.
gml:featureMember	Structure containing every building part.

Bu-ext2d:BuildingPart	Structure of each part of a building has a gml:id composed by the values defined in "inspireID" and it is a unique identifier for all the group of data. Its value is the identifier of the building with the suffix "partX", being X a sequential number.
bucore2d: beginLifespanVersion	Date when the data has been submitted to the cadastral data base.
bucore2d: conditionofConstruction	It has no value for building parts.
bu-core2d:inspireId	Unique identifier for all the groups of data in INSPIRE. It is composed by a base:Identifier structure with the two following values.
base:localId	First 14 characters of the cadastral reference and a sequential suffix "partX".
base:namespace	For buildings it is "ES.SDGC.BU", which corresponds to the acronym of the country, producer entity and the group of data.
bu-core2d:addresses	Address object, through a "xlink:href" the WFS service of the address(es) associated to the building can be accessed.
bu-core2d: cadastralParcels	Cadastral parcel object, through a "xlink:href" the WFS service of the cadastral parcel associated to the building can be accessed.
bu-ext2d:geometry	Geometry of the building part in GML. It is a gml:MultiSurface structure that can hold several gml:Surface. These objects have to have a unique gml:id composed by the gml:id of the cadastral zoning and a prefix and a suffix. The geometry is defined by exterior ring vertices and holes can exist which are defined in an interior ring structure. The coordinate list of the rings (gml:postList) duplicates the first and last vertex. The exterior one is defined clockwise and the interior one counter-clockwise. The reference system is the one defined in "srsName". It holds the other two attributes defined below.
bucore2d: horizontalGeometryEstimatedAccuracy	Accuracy in meters, which adopts the value of 0.1.
bucore2d: horizontalGeometryReference	Indicates that the geometry of the building is the footprint of what is built above ground. It has the value: "footprint".
buext2d: numberOfFloorsAboveGround	Number of floors above ground.
buext2d: heightBelowGround	Height of the floors below ground in meters. It is an estimated height of 3m/floor.
buext2d: numberOfFloorsBelowGround	Number of floors below ground.

Source: Spanish Cadastre

9.2.1.2 Cadastral data processing and enrichment

For the presented process to succeed and perform the energy calculations, it is necessary to extract specific information from each building. In particular, the information from each of the external walls, shared walls, window openings or thermal bridges. As this information is not present in the cadastre, specific hypotheses and geometry analysis are needed. In the end, the following values were extracted from this process:

- Generic information about the building (address, Municipality, Region, Postal Code…)
- Climate zone
- Conditioned Surface
- Number of floors above ground
- Number of floors below ground
- Floor height
- Percentage of glazed surface
- Ventilation rate
- Envelope data: Opaque surfaces (walls, roofs, floors)
- Envelope data: Openings and skylights
- Envelope data: Thermal bridges
- Thermal energy systems
- Use of the building

Then, it is necessary to enrich this information with the thermal characteristics of the building elements. In this case, a buildings physics library has been generated for Spain, based on typical values derived from the Spanish Building Code. Thus, according to where the building is located (i.e. climate zone), and its year of construction, it is possible to assign typical parameters to insert as input values in the calculation method proposed.

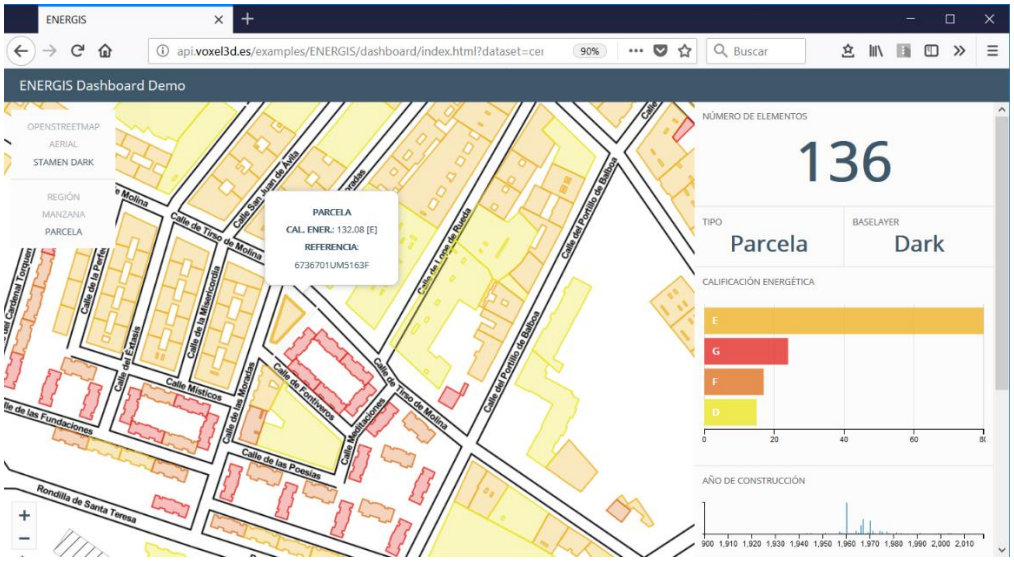
9.2.1.3 Results achieved

As a result of this process, energy calculations (heating and cooling demand) are obtained, but with the particularity that they are geolocated. The output information of the ENERGIS tool is stored in a geodatabase, which is structured in three tables: one table for buildings, one for blocks (groups of buildings) and one for cadastral zones (neighbourhood). These three scales come inherent in the project since they are the ones provided by the Spanish Cadastre's online services.

Thus, the ENERGIS results are provided at these three different scales: the building demand information is directly calculated with the estimation engine, while for the demand in the blocks and the cadastral zones, aggregation operations have been carried out to calculate the demand values. To geo-reference and be able to map this information, the geographical information retrieved in step 1 is also used.

These stored data are shown to the public through the ENERGIS online visualisation tool. The data are presented as reflected in the Figure 49, with the geo-referenced values and a recognisable colour code that corresponds to the Energy Label scale used in Energy Performance Certificates.

Figure 49. ENERGIS web visualisation tool



Source: ENERGIS web portal

Moreover, some widgets providing more information on all the data displayed in the screen are shown in the figure in the column on the right. Using these widgets, the user can filter the information displayed on the screen by building type, demand label and year of construction, among others. In addition, the user can move among the different scales by scrolling in the map or using the shortcuts displayed on the top left corner of the screen. Also, three different base maps are available for the user: openstreetmap, aerial view (ortophotography), and stamen dark (simplified black and white map, as shown in the figure).

In addition, an online web portal with further information on the platform (information about EPCs in the ENERGIS platform, instructions on how to use the tool, etc.) has been implemented in the following link: http://api.voxel3d.es/examples/ENERGIS/portal/.

With this tool, the user can visualise the estimated label of one specific location (district, city or region, depending on the scale at which the tool was previously run) to identify areas with greater capacity for improvement in energy efficiency.

9.2.1.4 Considerations for its replicability

Given the needs and challenges of the energy planning sector, tools like ENERGIS represent an important progress due to their capacity to exploit publicly available data to support multi-scale decision-making. This way, different stakeholders can be addressed, who share the same knowledge by analysing clear and understandable results presented through the deployment of GIS and maps, inherent to any planning related to urban areas. However, several aspects need to be considered towards the replication of this methodology: firstly, related to the availability and processing of data, and secondly, to the interpretation of results.

One of the first problems faced was the **absence or inaccuracies of input data**. The data provided at the building level by the cadastre are not enough in order to implement this methodology. This is why some hypothesis based on the processing of data had to be set, for example, dimensions of openings and lengths of thermal bridges, which could vary for different locations and/or climate zones. In addition to applying these hypotheses, the extraction and identification of individual building elements was necessary, but this could be performed through geometrical processing. Among these analyses, the detection of shared walls by identifying neighbouring buildings is crucial, since grouped buildings help reduce the energy demand by substantially reducing heat losses from neighbouring walls compared to external ones. It is worth noting that only after having identified the elements that compose a building, it is possible to assign thermal building characteristics, which are based on typical values in a catalogue and vary according to the building age climate zone. There is an estimation in this approach that should also be considered when analysing the results of this approach.

Furthermore, and even when not related to the actual implementation of the calculations proposed, two additional aspects should be considered towards the **adequate interpretation of the results derived with this methodology**. Firstly, as mentioned before, it should be noted that this methodology provides estimations

of energy demand based on publicly available data; thus, its accuracy relies highly on these data (as well as on the hypothesis performed). In this line, how these data capture the real status of the buildings is crucial. For instance, it is crucial to know whether a building has been refurbished or not, and the type of retrofitting that has been performed since this would highly influence the energy demand of the building. Unfortunately, this type of information is not updated regularly, but it would highly benefit this type of approaches.

Secondly, and trying to bring the approach closer to reality, dealing with the real occupation of the buildings is fundamental. The approach proposed calculates the energy demand assuming that all buildings are occupied. However, if we go one step further to energy demand and think about real energy consumption, this value would highly vary since not all buildings are occupied. In this same line of thought, the user of these buildings should be considered since it can impact the energy consumption of a building. Indeed, the energy patterns expressed by users cover the whole spectrum: users can exist that consume energy above the usual limits that would enable comfort to be achieved in dwellings, whereas others can show restraint in their consumption which can arise from energy poverty situations.

The key challenges remaining are mostly related to increasing the accuracy of data: better characterising the building stock, having a more realistic approach towards energy consumption by including real consumption patterns that consider the occupation and the behaviour of users etc. It is clear that the current advances in technologies (smart sensors, IoT devices, etc.) and the application of big data analytics or artificial intelligence will pave the way for more robust decision-making and the application of location intelligence. In this line, the role of INSPIRE and the amount of data that it should hold remains an open question, which maybe should be answered through the careful analysis of the different applications of data models that users have performed during the years. Since, in the context of data, knowing the answer to the question “what do we need these data for?” remains at the core, which can only be answered through the analysis of the needs of the main beneficiaries (citizens), and actors (stakeholders in the energy value chain) involved.

9.2.2 Transport

The main objective of this application is to map the estimated CO_2 emissions caused by transport networks in the Castilla y León region, which depend on the different transport network levels (e.g. highways, motorways, urban roads) and their traffic intensity. These calculations are included within a methodology named Planning CO_2 whose broader objective is to map the estimated CO_2 emissions from vehicles and land uses, buildings, etc., with the final objective of supporting local energy planning. However, in this application, only the transport calculations have been included since transport is one of the key sectors contained in the regional energy strategy definition.

The following sections will focus on reference INSPIRE data, in this case, related to the Transport Networks theme (section 9.2.2.3). Then the data used for this application will be explained and how it has been enriched. These data do not originate from INSPIRE data but share many of its characteristics (section 9.2.2.1). Finally, the results achieved are presented (section 9.2.2.2).

9.2.2.1 Location data used and enrichment

To implement the Planning CO_2 methodology to determine the level of emissions generated by land transport, it is necessary to extract specific information from each road or “road section”. Some of the needed information is included in the dataset's attributes provided under the INSPIRE harmonization scheme but does not have a direct link to the statistical traffic data, as more information is necessary for developing the emissions methodology calculation. For this reason, it is necessary to use other datasets and develop some processing algorithms to convert the data to be suitable for the estimation of CO_2 emissions.

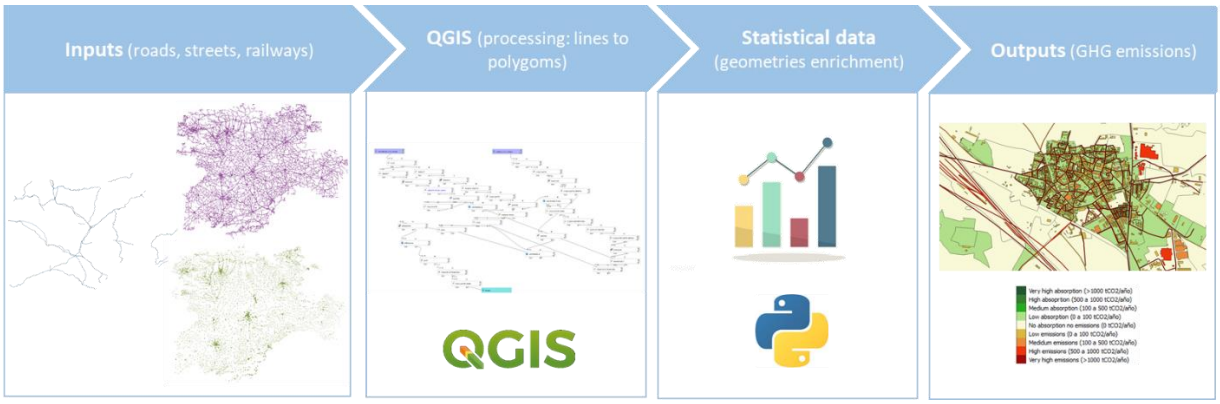
The first step in calculating CO_2 emissions at the regional and local level is to understand and organise the information provided by each data set and how we might link this information with statistical information. To do so, the data sets provided by the Regional geoportal and the INSPIRE geoportal were analysed. Table 69 includes the most relevant geographical datasets which can be used for the analysis and for the estimation methodology considering the Spanish and “Castilla y León” case study. After reviewing each dataset, we found that the most suitable data sets to develop the analysis and methodology considering their spatial resolution, accuracy in relation to real location, coverage scale and attributes provided are: Transport network (INSPIRE) for railways and streets, and the Topographic Map Series from Spain: 1: 25,000 (IDEE Geoportal) for roads. The last one was selected due to its accuracy, but it could be changed by the INSPIRE Transport network.

Table 69. Transport datasets available for Spain considering different geoportals.

Transport networks (Geoportal of Castilla y León)	Dataset description
Railway of Castilla y León: Train stations	Map of train stations of the railway network of Castilla y León 1: 25,000
Roads of Castilla y León: mountain passes	Location of mountain passes of the road network of Castilla y León 1: 25,000
Airstrips of Castilla y León: Delimitation	Map delimiting the landing strips of Castilla y León 1: 25,000
Railway in Castilla y León: train tracks	Railway in the Autonomous Community of Castilla y León.
Roads of Castilla y León: road network links	Map of links of the road network of Castilla y León 1: 25,000
Roads of Castilla y León: road network	Map of the road network (lines) in Castilla y León 1: 25,000
Roads of Castilla y León: kilometer points	Location of kilometer points from roads in Castilla y león
Airstrips of Castilla y León: Location	Landing strips location map of Castilla y León 1: 25,000.
Transport networks (INSPIRE Geoportal)	**Dataset description**
Transport networks	Roads clasification including streets
Adif Rail Transport Network	National railway lines manage by Adif
Land cover (IDEE Geoportal of Spain)	**Dataset description**
Topographic Map Series of Spain: 1: 25,000	Main topographic map of Spain including building, roads, water and other land cover categories

Source: Own elaboration, based on information from INSPIRE, Regional and IDEE Geoportal.

Figure 50. Steps of the Planning CO_2 methodology.



Source: CARTIF, own elaboration

In particular, the data taken from these sources for the road network are the following:

- Geometry
- Name of the road,
- Type of the road (conventional, highway, etc.) and
- Classification: "dual carriageway" or not.
- In use or abandoned.

In the case of railways, the information used is:

- The length,
- Type of railway (electrified or not).
- In use or abandoned.

Once the geographical reference of the roads is established thanks to the combination of the roads' location sources named in the previous paragraph, it is necessary to enrich all this information with other additional data sources (Figure 50). In particular, the indicator that is assigned to the road locations processed is the "tCO_2/km". This indicator is calculated using different statistical data and even georeferenced information consistent with the roads network. These traffic data come from measurement stations which are located in specifics kilometre points and cover road sections. This information comes from two different sources (depending on the road property: national or regional):

- Traffic data provided by DGT (General Directorate of Roads)[22] [134]. The information included are:
  - Province
  - Traffic intensity in vehicles/day. IMD (Average Daily Intensity) for both light and heavy vehicles by road
  - Length of road (in km)
- Traffic data provided by "Junta de Castilla y León"[23], including other roads apart from national [135]. It includes the following data for each road section:
  - Province
  - Traffic intensity in vehicles/day. IMD (Average Daily Intensity) for both light and heavy vehicles by road.
  - Length of road (in km)
  - Average speeds (km/h)
- Statistical information (not geolocated):
  - In the case of traffic data in the national data source, the average speed was not provided. For this reason, the information was enriched by applying national traffic statistics.
  - Other information not provided is the mobility distribution according to the type of vehicle. This information was found in national sources, but it was disaggregated at the regional and province level, which facilitated the assignment to the roads.

Finally, the information used to assign the emission factor was the following, considering the name of the road, being this one attribute of the road networks generated in the first step:

- Measurement stations positions (kilometre points and name of the road).
- Type of road: based on a previous study developed with the available data. This was necessary due to the high percentage of roads without information in each section (measurement station). In particular, the general classification of roads for the assignment of the indicators are: highways, dual carriageway, and conventional roads.

[22] Web access: http://mapas.fomento.gob.es/mapatrafico/2016/

[23] Web access. https://datosabiertos.jcyl.es/web/jcyl/set/es/transporte/intensidad_circulacion/1284733182199 Updated data directly received by the Junta de Castilla y León.

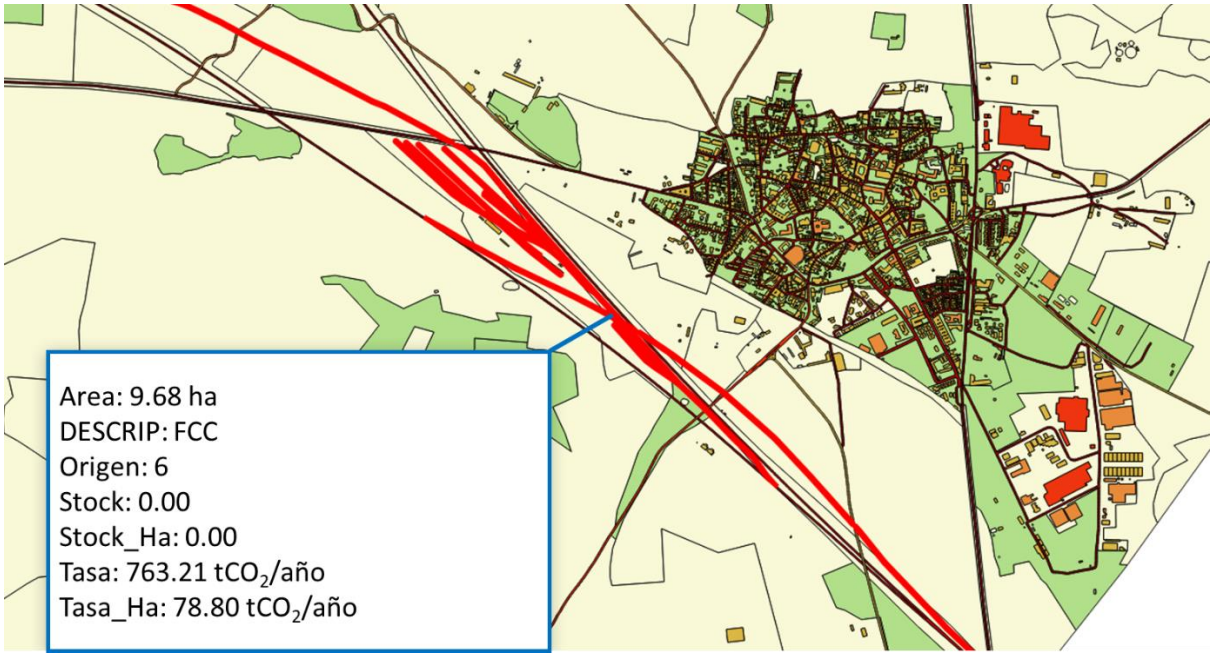
On the other hand, in the case of rail transport, the indicators calculated previously have the same units as in the road transport: "tCO_2/km". In this case, the main attribute included in the rail network to be considered is the difference between electrified and non-electrified railways (diesel). In addition, national statistics, including energy consumption (electricity and fuel) by type of railway and railways total length, were necessary to calculate the emission factor/indicator.

9.2.2.2 Results achieved

Considering all the information provided and mixed in the previous section, the final results were achieved by assigning the factor emissions indicator calculated: tCO_2/km for each road and type of railway. This information was multiplied by the length of the road, road section, or railway section, being this an attribute of the network´s polygons. The final results (attribute assigned to each polygon) is the CO_2 emissions in tCO_2 (units):

In Figure 51, it is possible to see a graphical example of the results obtained by the Planning CO_2 methodology. The total amount of emissions calculated by our methodology considering road transport and emissions assigned to railway network for a case study is provided in Table 70.

Figure 51. Results of the Planning CO_2 methodology at local scale.



Source: Own elaboration, based on the results of Planning CO_2 methodology.

Table 70. Results obtained applying Planning CO_2 methodology in different transport lines.

AREA	Stock	Stock_Ha	Tasa	Tasa_Ha	DESCRIP
0.84	0.00	0.00	50.58	59.93	VP-1104
2.94	0.00	0.00	170.27	57.74	VA-405
0.78	0.00	0.00	46.91	60.07	VP-9904
7.52	0.00	0.00	984.23	130.89	VA-410
0.76	0.00	0.00	57.51	75.47	Road links
1.50	0.00	0.00	89.86	59.86	VP-9107
2.56	0.00	0.00	153.54	59.95	VP-9010
0.65	0.00	0.00	39.15	60.13	VP-1105

2.82	0.00	0.00	169.34	59.99	VP-9105
2.52	0.00	0.00	151.82	60.29	Not catalogued
8.40	0.00	0.00	1742.81	207.43	CL-602
9.68	0.00	0.00	463.21	78.80	FCC

Source: Own elaboration, based on the results of Planning CO_2 methodology.

The main final results that can be seen in Table 70 are the following:

- **Area**: area occupied by the polygon of the transport line. It will be used to calculate "emissions densities" for comparison porpuses
- **Stock**: carbon stock (attribute interesting for other types of land)
- **Stock_ha**: carbon stock density
- **"Tasa"**: emissions. Units: tCO_2/año
- **"Tasa_Ha"**: emissions density. Units: tCO_2/año
- **DESCRIP**: name of the transport line

9.2.2.3 INSPIRE Transport Network possible contribution

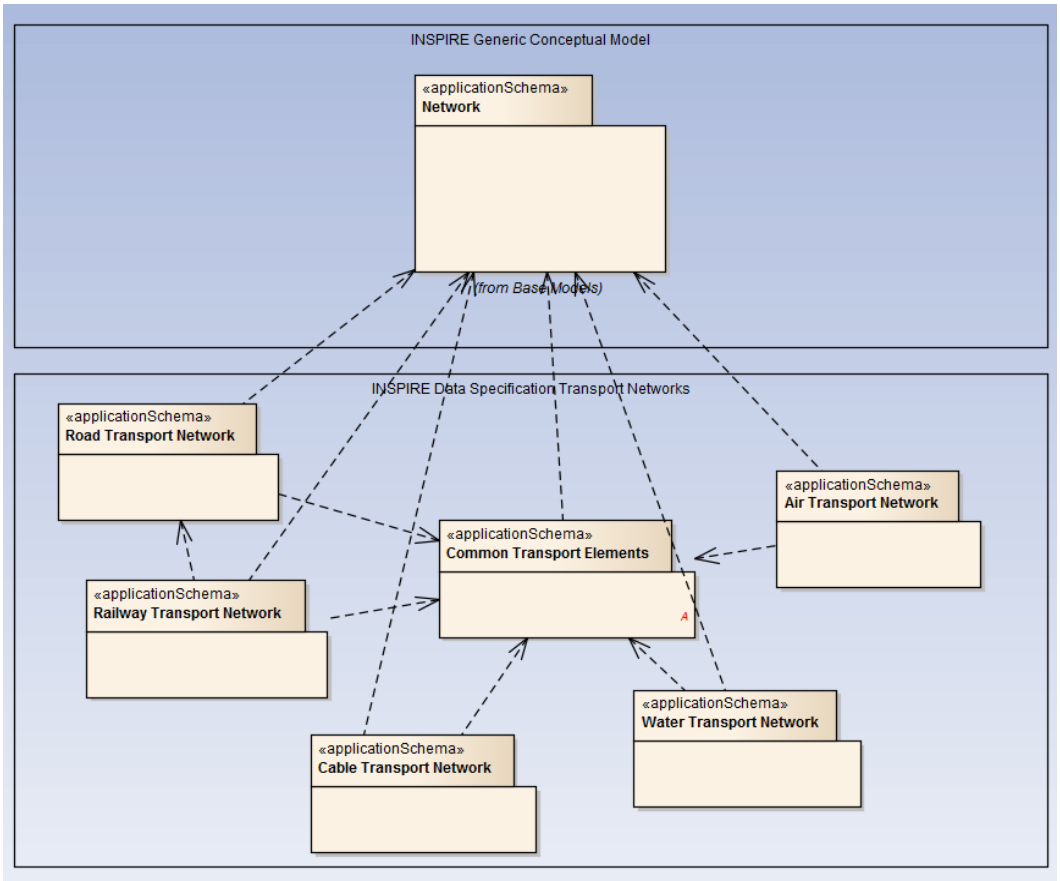
Transport Network (TN) is one of 34 INSPIRE themes. Its definition and description are available in the INSPIRE theme register[24] . The related data specification is available in the INSPIRE Document library[25]. The main characteristics of the data model in the context of the application presented in the previous sections are provided in the following.

TN data theme consists of the following data models, shown in Figure 52:

- Generic Network Model (GNM)
- Common Transport Elements (containing elements common to all transport modes)
- Five mode-specific Transport Network (road, railway, air, water, cable)

[24] https://inspire.ec.europa.eu/theme/tn
[25] https://inspire.ec.europa.eu/id/document/tg/tn

Figure 52. TN overview



Source: INSPIRE Knowledge base

The elements in the network are handled as nodes, links, aggregated links, areas and points. Moreover, the individual transport links can be combined to form transport link sequences or, further, the combination of both can be used to form the transport link sets, as shown in Figure 53.

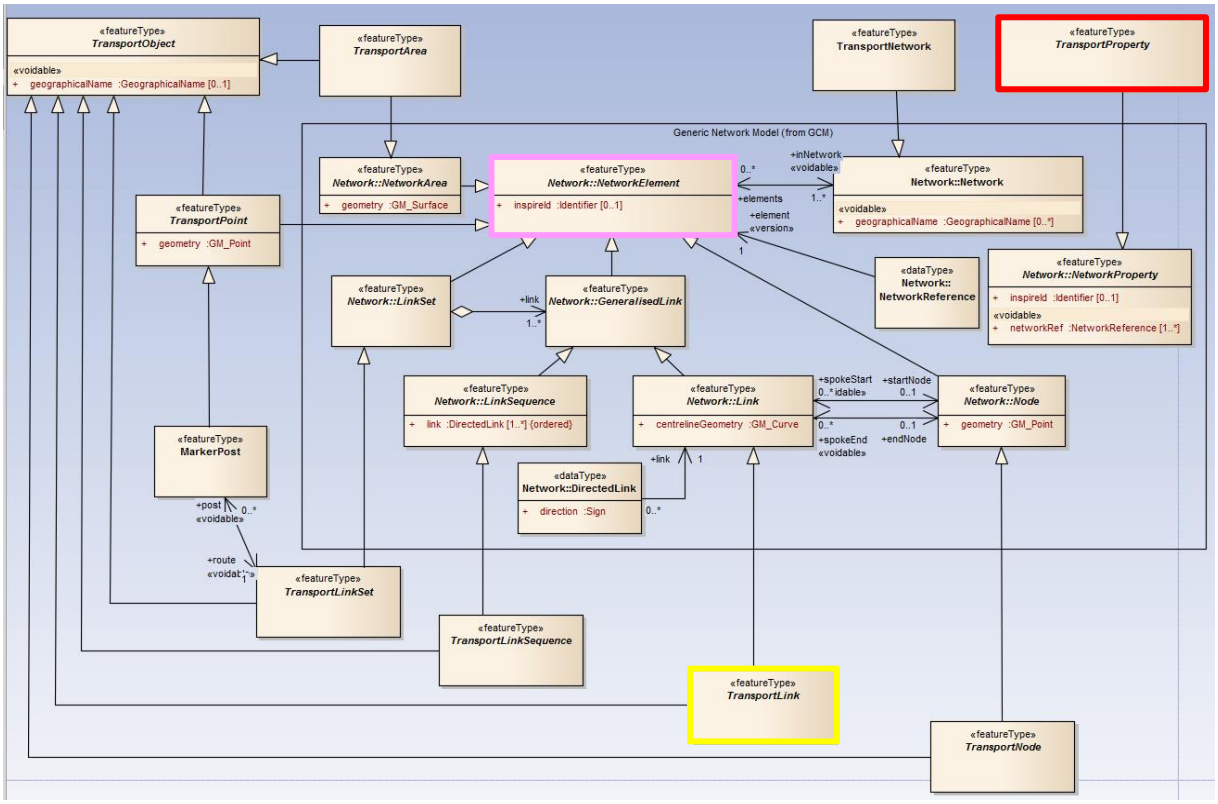
Figures 53, 54 and 55 also distinguish between feature types providing geometric information and feature types (without geometries) providing semantic information as “properties” associated with the geometries.

In particular, the Figure 54 shows the Road Network feature types with geometries.

As an example, the *RoadLink* feature type (containing the geometry) is a subtype of the *TransportLink* feature type (highlighted in yellow in Figure 53 and Figure 54), which in turn is a subtype of the Link feature type, which in turn is a subtype of the GeneralisedLink feature type, which is, in turn, a subtype of the NetworkElement feature type (highlighted in pink in Figure 53).

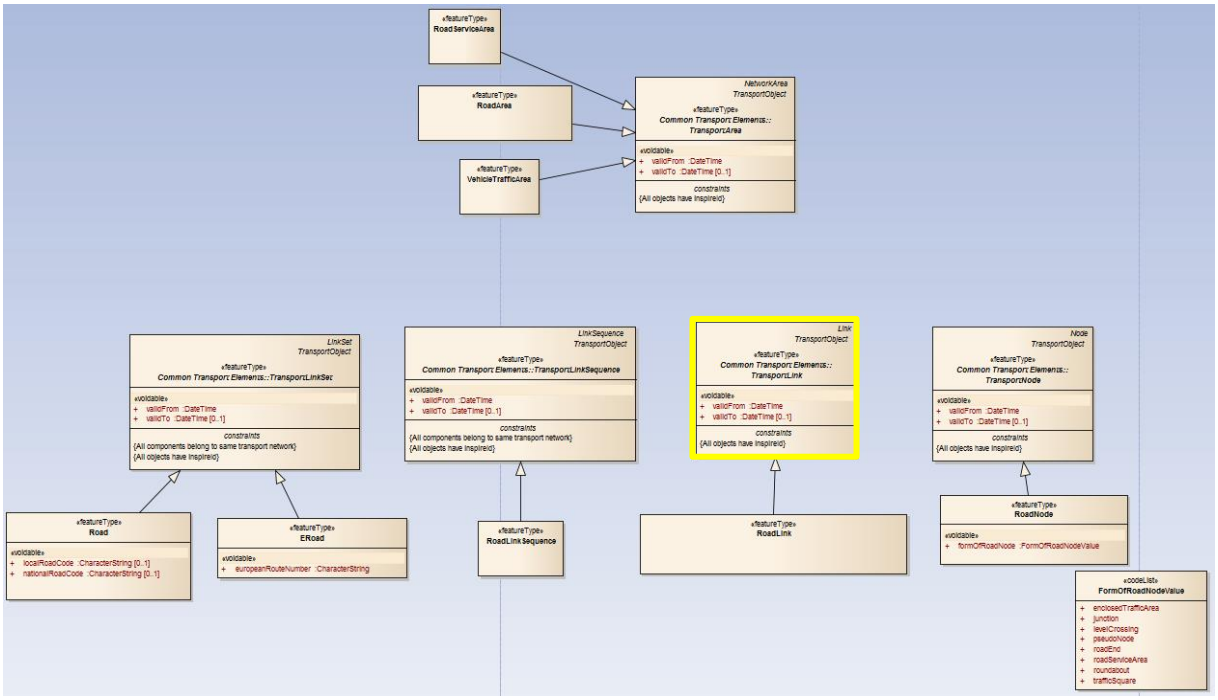
Conversely, feature types as RoadName, NumberOfLanes, FunctionalClassRoad, FormOfWay (containing the semantic information) shown in Figure 55 are subtypes of the TransportProperty feature type (highlighted in red in Figure 53 and in Figure 55), which in turn is a subtype of the NetworkProperty feature type, which has the networkRef attribute, whose data type is NetworkReference, having finally an association to the NetworkElement feature type and therefore allowing the link between the geometric information of the RoadLink feature type with the semantic information of the RoadName, NumberOfLanes, FunctionalClassRoad feature types.

Figure 53. Common Transport Elements overview



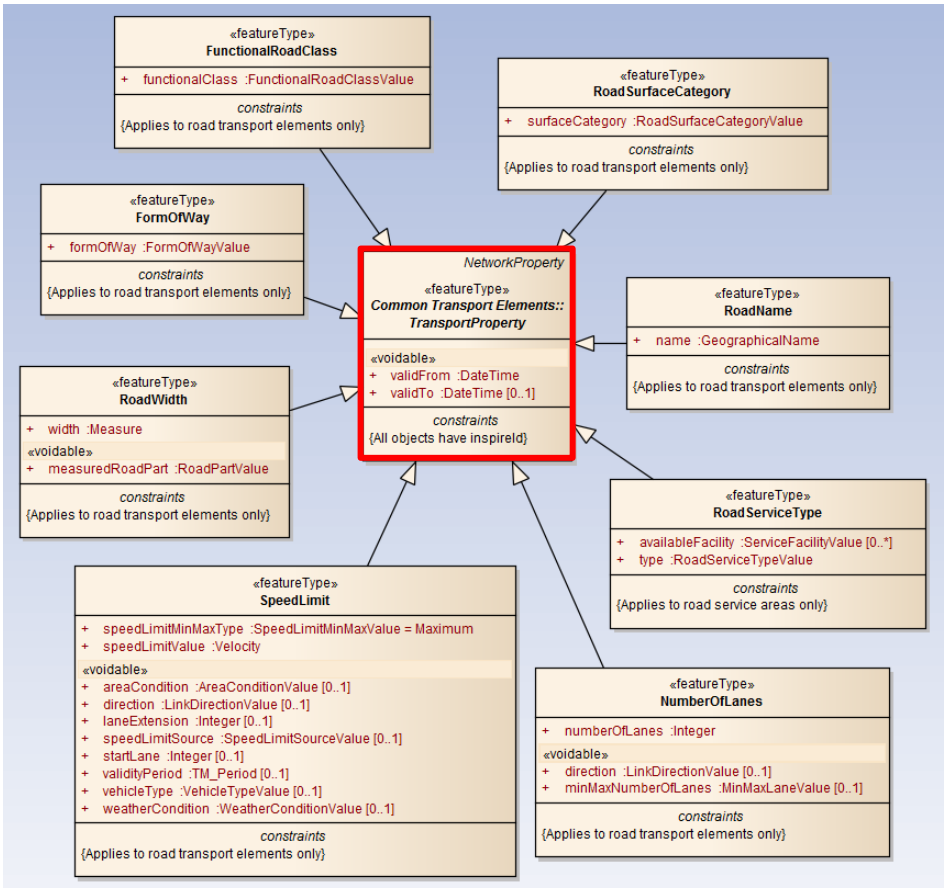
Source: INSPIRE Knowledge base

Figure 54. Road Network feature types with geometries



Source: INSPIRE Knowledge base

Figure 55. Road Transport Networks Spatial Object Types: Transport Properties



Source: INSPIRE Knowledge base

Regarding the values of the attributes of the feature types containing the semantic information:

- the values allowed for the attributes of the feature types *FunctionalRoadClass* and *FormOfWay* are those of the *FunctionalRoadClassValue* enumeration and the *FormOfWayValue* code list, respectively, shown in Figure 56;
- the value type of the attribute *numberOfLanes* of the *NumberOfLanes* feature type is an integer;
- the value type of the attribute name of the *RoadName* feature type is the *GeographicalName* complex data type.

Regarding the Railway Transport Network data model, it is worth to mention the Transport Property represented by the RailwayElectrification feature type, with its unique boolean attribute electrified.

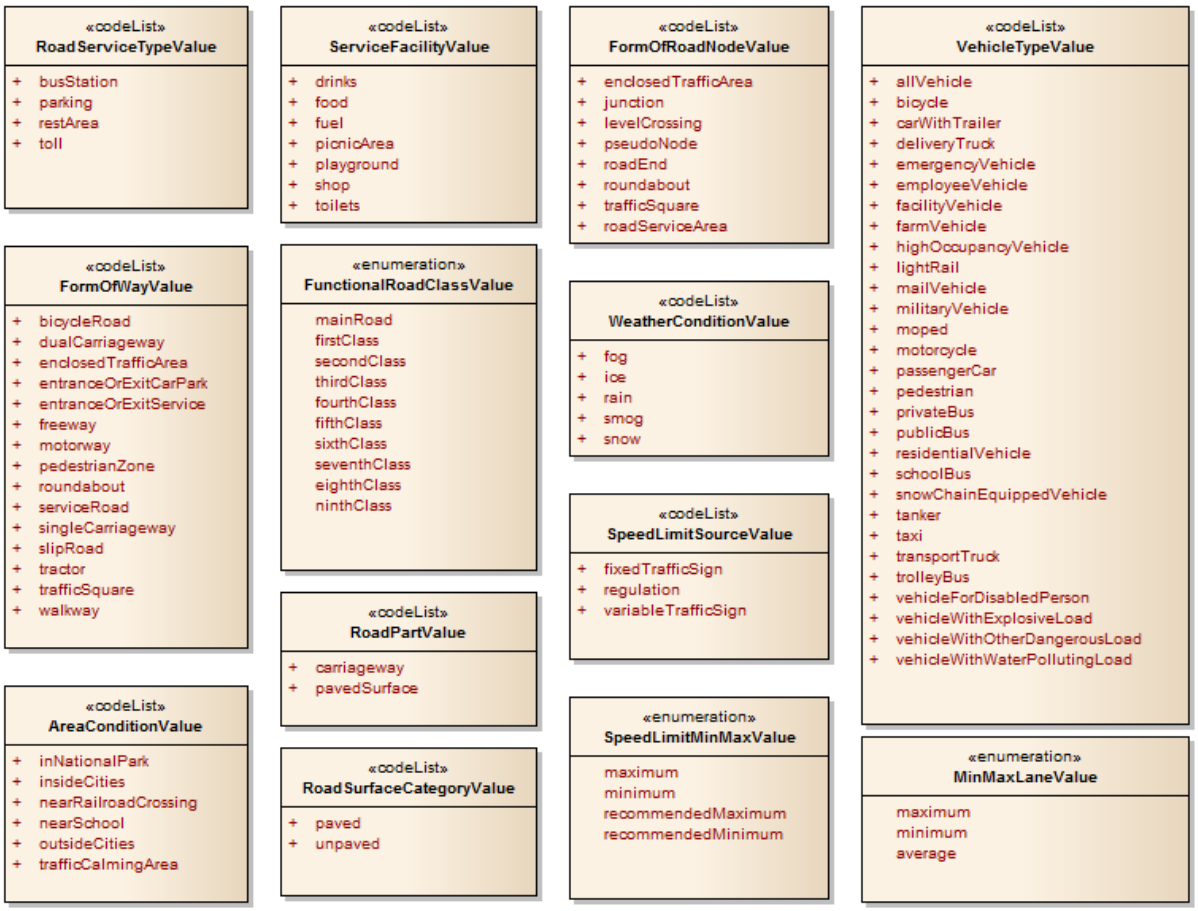
This section shows that the INSPIRE Transport Network data model contains several elements matching the data requirements of the Planning CO_2 methodology.

Therefore, it is expected that data providers in Europe should make accessible national/regional TN datasets providing the content needed to re-use the methodology in other geographical areas.

However, the potential complexity of some of its aspects, primarily the mechanism to link the semantic information of the transport properties to the geometric information of the spatial objects of a transport network, could represent a potential obstacle to the datasets provision.

An analysis of the national/regional TN datasets discoverable in the INSPIRE Geoportal aiming to assess their usability in the context of the Planning CO_2 methodology is out of the scope of the present study and should represent one of its next steps.

Figure 56. Road Transport Networks: Enumerations and Code List Class diagram



Source: INSPIRE Knowledge base

9.3 Additional examples

The analysis of existing regional geospatial data (in Europe and Castilla y León) with some relevance to energy in regions has led to some clear conclusions. First, a broad set of open data is available with a huge potential waiting to be exploited, especially statistical data. However, this potential can only be unlocked if proper data interoperability mechanisms are implemented, e.g. harmonising and making them available according to the INSPIRE requirements and principles. The two examples presented in this section are related to two types of data that are not yet available in the two geoportals.

9.3.1 ENERGY GENERATION SITES

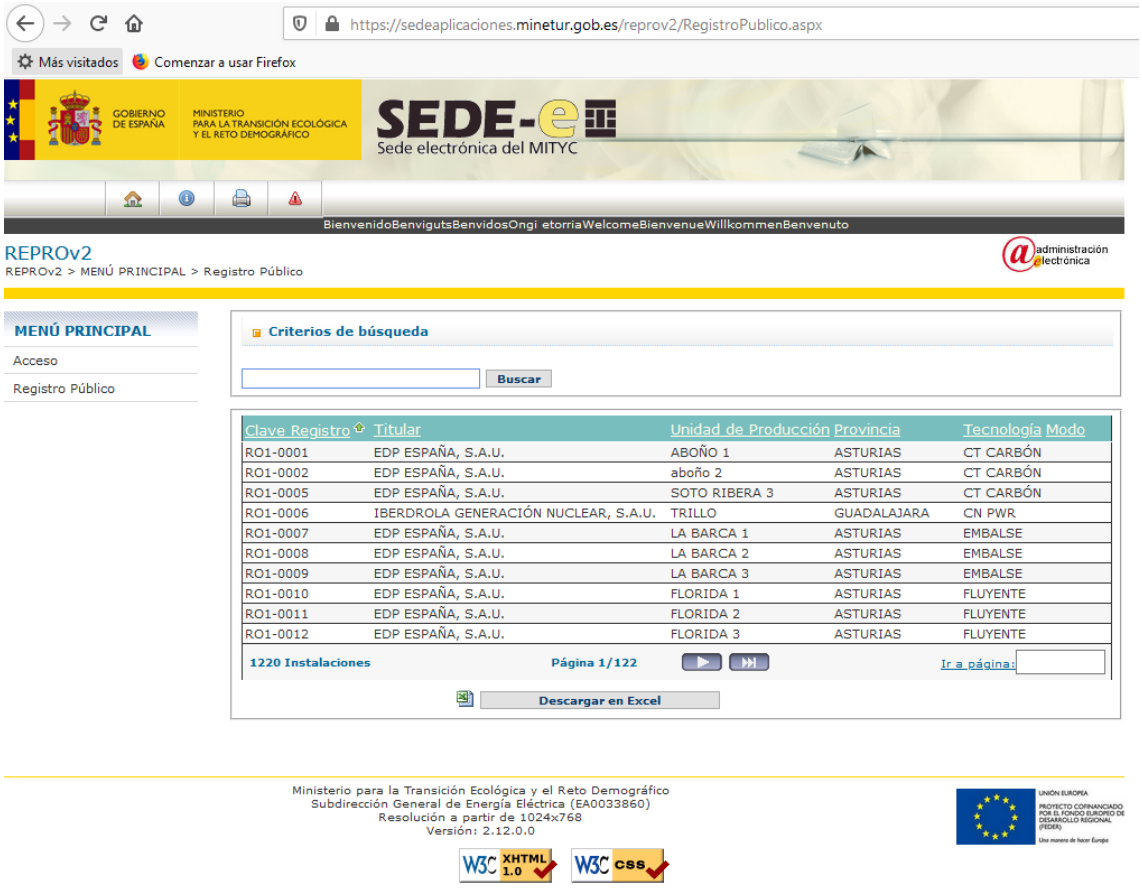
To contribute to the availability of more harmonised data, the objective of this example is to check whether the harmonisation of existing data on energy generation sites in the Castilla y León region (available in Excel format) is possible. This will be performed by exploring the possibility to link these data to the best candidate INSPIRE data theme (in this case, Production Facilities).

To this end, the available energy generation sites datasets (section 9.3.1.1) and the candidate data model (section 9.3.1.2) are presented.

9.3.1.1 Available energy generation sites datasets

The National Spanish Administration (Ministry for Ecological Transition and Demographic Challenge) has a public electronic register where all types of generation facilities are collected. The register is accessible, and data can be downloaded at [132]. More than 1200 facilities are included in this register in November 2020 (Figure 57).

Figure 57. Homepage of the REPROv2 register of the Spanish Administration.



Source: Ministry for Ecological Transition and Demographic Challenge [132]

At this date (Nov.2020), this register includes the main energy production sites in Spain. They are classified according to the energy type, but no geographical location of each facility is provided. They only include the name of the municipality in which it is located. The main attributes provided by REPROv2 data are included in Table 71.

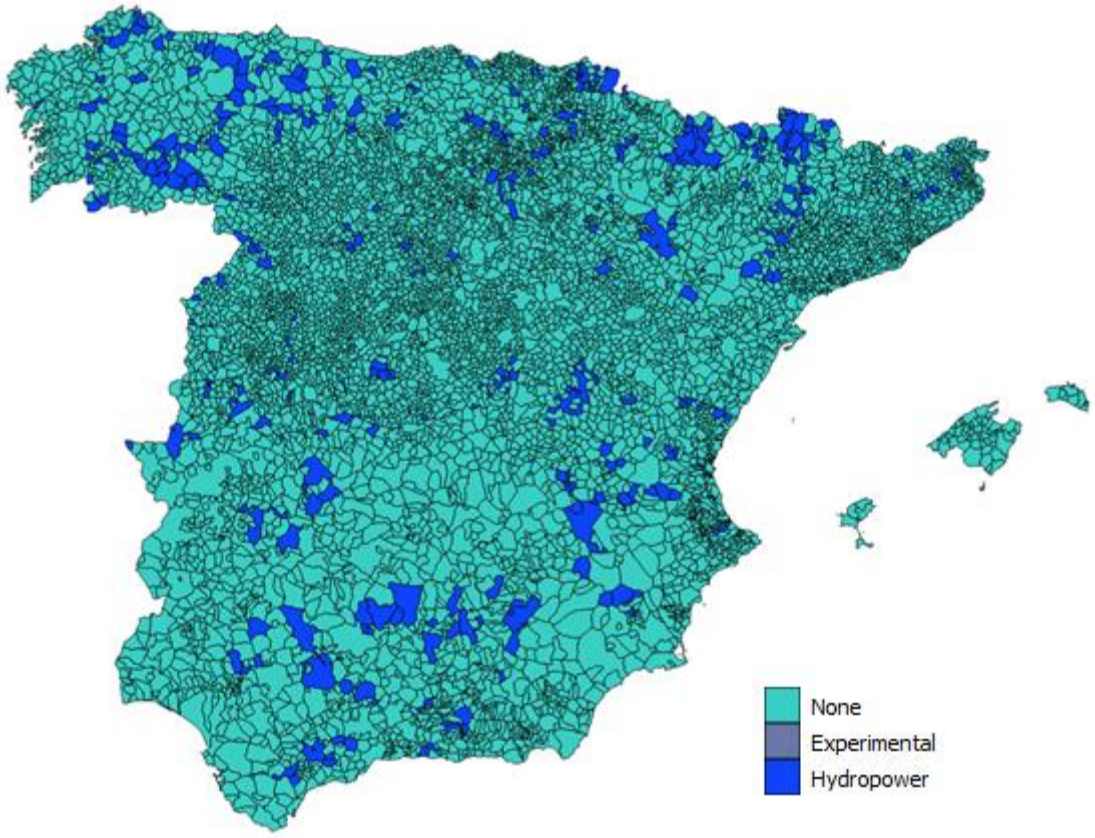
Table 71. Main attributes of REPROv2 data provided by the Ministry for Ecological Transition and Demographic Challenge

Attributes	Register key
	Name of the production unit
	Status
	Address of the production unit
	Municipality of the production unit
	Province of the production unit
	Name of the owner of the production unit
	Owner's Address
	Owner's municipality
	Owner's postal code
	Owner's province
	Participation, in %, of the Owner in the Production Unit

	Name of the 2nd Owner of the Production Unit
	Participation, in %, of the 2nd Owner of the Production Unit
	Name of the 3rd Owner of the Production Unit
	Participation, in %, of the 3rd Owner of the Production Unit
	Name of the 4rd Owner of the Production Unit
	Participation, in %, of the 4rd Owner of the Production Unit
	Date of commissioning of the Production Unit
	Production Unit Type
	Production Unit Technology
	Installed Power in MW
	Total Gross Power in MW
	Total Net Power in MW
	Connection Voltage of the Production Unit at the Connection Point
	Name of the Company that owns the network where the Production Unit has a connection point
	Node of the connection point of the Production Unit
	Name of the Hydraulic Management Unit (if it is Hydraulic type)
	River Name (if it is Hydraulic type)
	Name of the most used Fuel (if the Unit is of the Classic Thermal type)
	Name of the 2nd most used Fuel (if the Unit is of the Classic Thermal type)
	Name of the 3rd most used Fuel (if the Unit is of the Classic Thermal type)
	Subsection
	Combined Cycle Designation
	Declared Technical Minimum
	Net Power Combined Cycle
	Technical Minimum Declared Combined Cycle
	Operating mode
	A (th/h)
	B (th/h.MW)
	C (th/h.MW2)
	A' (th)
	B' (hours)
	D (€/arranque)
	O&MVDi (€/MWh)

Using a map downloaded from the National Geographic Institute of Spain that contains the boundaries of each municipality, a power generation map for each municipality has been produced (Figure 58). This map includes the data provided by REPROv2 after processing to obtain the total energy production for each municipality.

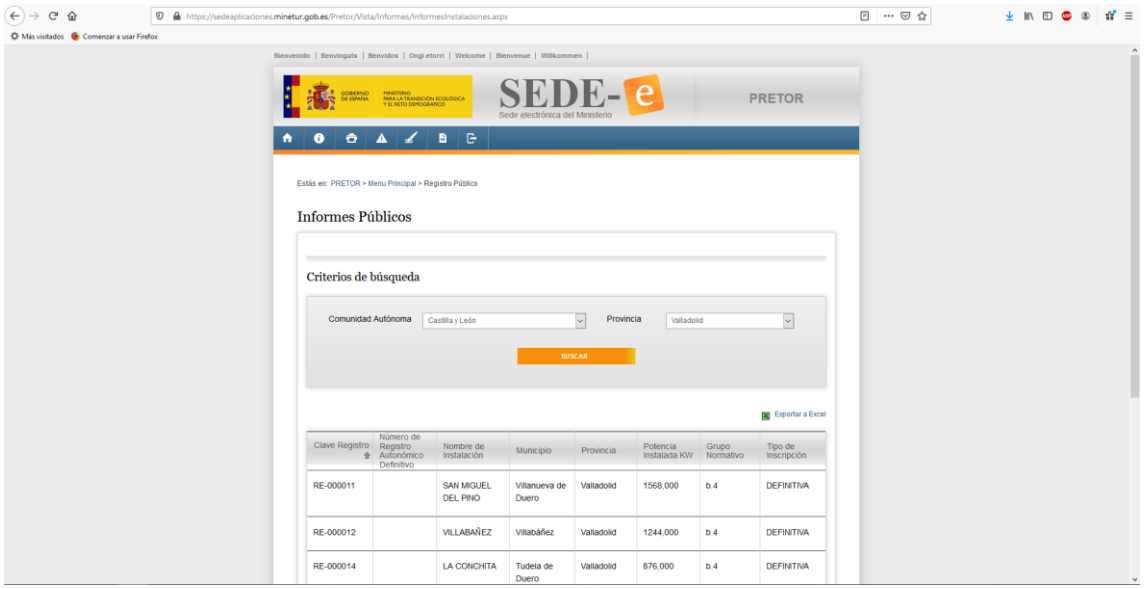
Figure 58. Map of energy production developed for Spain.



Source: Own elaboration.

Another additional dataset provided by the National Spanish Administration (Ministry for Ecological Transition and Demographic Challenge) is the public register named PRETOR that includes energy production facilities under different regulations developed by the Spanish law. The register is accessible, and data can be downloaded by province (Figure 59) [133].

Figure 59. Homepage of the PRETOR register of the Spanish Administration.



Source: Ministry for Ecological Transition and Demographic Challenge [133].

At this date (Nov.2020), this register includes the main energy production sites by province, including renewable energy facilities. Facilities are classified according to their regulatory group that is closely related to the energy type, but no geographical location of each facility is provided. They only include the name of the municipality in which it is located. The main attributes provided by PRETOR data are included in Table 72.

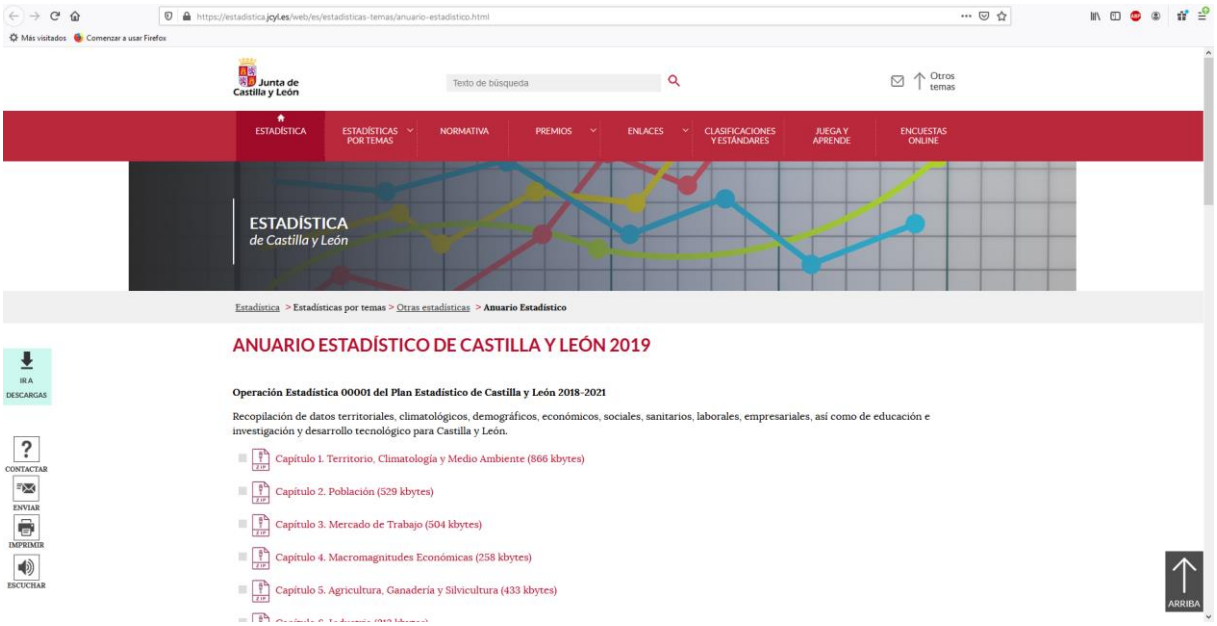
Table 72. Main attributes of PRETOR data provided by the Ministry for Ecological Transition and Demographic Challenge.

Attributes	Register key
	Facility name
	Municipality of the facility
	Province of the facility
	Phase number
	Definitive Autonomous registry number
	Installed power (KW)
	Regulatory group
	Registration Type
	Provisional Autonomous registry date
	Definitive Regional registration date
	Date commissioning tests
	Final commissioning date

These two statistical datasets provided by the Ministry of Ecological Transition and Demographic Challenge are important to define the location of each production site and to understand its link with the statistical data of energy production (0). These statistical data are collected yearly by the Regional Administration and are available in [136]. Chapter eight of the Statistical Bulletin is related to Energy covering energy production and the main energy sources at the regional level. This data were used by the Regional Energy Authority in the development of the Regional Energy Strategy that was analysed in Deliverable 4.2.

Regarding the datasets previously described, it can be observed that the spatial distribution of energy production is a key factor in defining the baseline of the Regional Energy Strategy, but not all the facilities are taken into account to determine the capacity of energy production at the regional level. For example, in the case of hydroelectric power, there are more registered facilities in the region than those included in the statistical production data, which only take into account those with installed power greater than 10MW.

Figure 60. Homepage of the Statistical Bulletin of the Administration of Castilla y León.



Source: Regional Administration of Castilla y León [136].

9.3.1.2 INSPIRE Production Facilities data model

Production and Industrial Facilities (PF) is one of 34 INSPIRE themes. Its definition and description are available in the INSPIRE theme register[26] , and the related data specification are available in the INSPIRE Document library[27].

The PF theme seems fitting for purpose (regarding the energy generation sites) because, as stated in the Informal description of the data specification, "The overall set of activities considered within the Production and Industrial Facilities theme spans from extraction of resources, to their transformation in products or by-products, and their storage" and "Transformation of resources should be seen both as transformation of one resource or product into another, or as transformation into energy, thus **including power generation plants within the scope of this theme**".

Regarding the "within the scope of this theme" clause, it is important to highlight that "the theme Production and Industrial Facilities comprises information about industrial facilities and activities of production (focusing on extraction, transformation or storage of resources, including energy production) and the main related environmental issues".

Moreover, "The definition of the types of industrial activities to be considered can be related primarily to Annex I of the IPPC Directive [Directive 2008/1/EC] and the E-PRTR Regulation [Regulation 166/2006/EC]." and "Another more recent directive which allows describing in a comprehensive way Production and Industrial Facilities is the Directive on Industrial Emissions [Directive 2010/75/EU]. Annex I of this Directive lists the types of production considered in its scope and may be used as a reference to identify industrial activities.".

Another relevant excerpt of the PF data specification is the following:

"The Production and Industrial Facilities theme is not concerned with the description of the actual flow of materials occurring from one facility to another, or to distribution of a final product to the market.

A production and industrial facility is typically composed by an extremely variable layout of buildings, plots and other technical units, represented by machinery, piping, private railway sidings, docks, unloading quays, jetties, etc. Such units are grouped in installations, related to the execution of a specific production process.

Key feature types with spatial properties considered within the Production and Industrial Facilities theme include: Site, Facility, Installation and Installation Part. These allow a breakdown of the elements composing a

26 https://inspire.ec.europa.eu/theme/pf
27 https://inspire.ec.europa.eu/id/document/tg/pf

production and industrial facility, with a focus on processes related to activities taking place within the facility itself."

The main characteristics of the data model in the context of the application presented in the previous section are provided in the following.

An overview of the Production and Industrial Facilities application schema is shown in Figure 61 and on overview of the Cross-Theme Relationships in Figure 62.

With reference to Figure 61, it can be noted that:

- A *ProductionFacility* may be located on one *ProductionSite*. A ProductionSite hosts one or more ProductionFacilities.
- A ProductionInstallation is grouped by one ProductionFacility. A ProductionFacility may group one or more ProductionInstallations.
- A ProductionInstallationPart is grouped by one ProductionInstallation. A ProductionInstallation may group one or more ProductionInstallationParts.
- A ProductionPlot is grouped by one or more ProductionFacilities, this means a Plot may be shared by different ProductionFacilities. A ProductionFacility may group one or more Plots.
- A ProductionBuilding may be grouped by one or more ProductionFacilities, this means an ProductionBuilding may be shared by different ProductionFacilities. A ProductionFacility may group one or more ProductionBuilding. A ProductionBuilding can be related to an AbstractBuilding (BU).

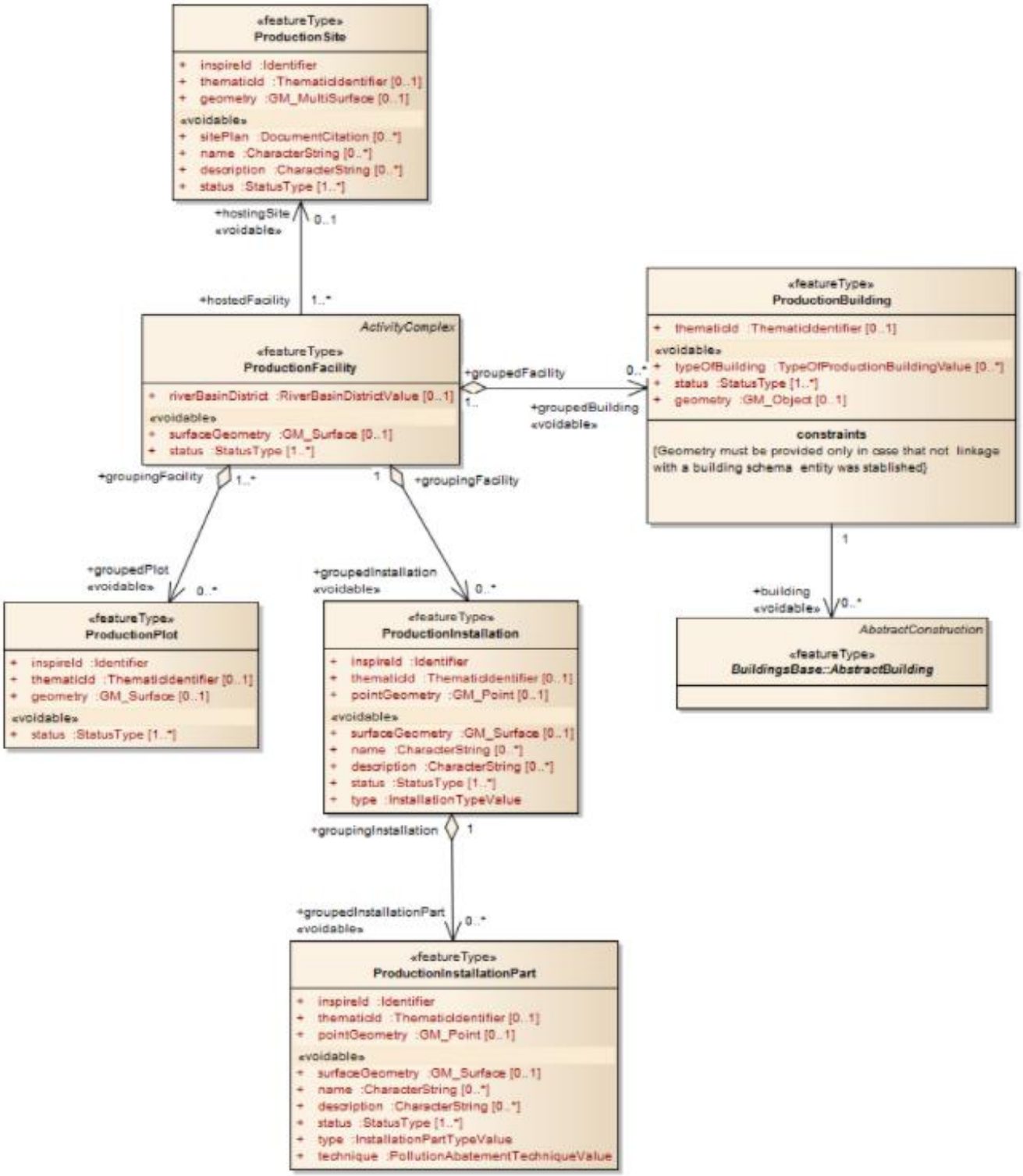
With reference to Figure 62, it can be noted that a *ProductionFacility* is a special kind of *ActivityComplex*, which is the feature type of the *Activity Complex schema,* which in turn is one of the INSPIRE Base Models re-used by the application schemas of some of the 34 INSPIRE themes.

Figure 63 shows the Data Types of the ActivityComplex feature type.

It is to be highlighted that one of the ActivityComplex feature type attributes is 'function', whose value type is the complex data type Function, whose attributes (activity, input, output and description) can be used to provide the semantic information related to the energy production sites.

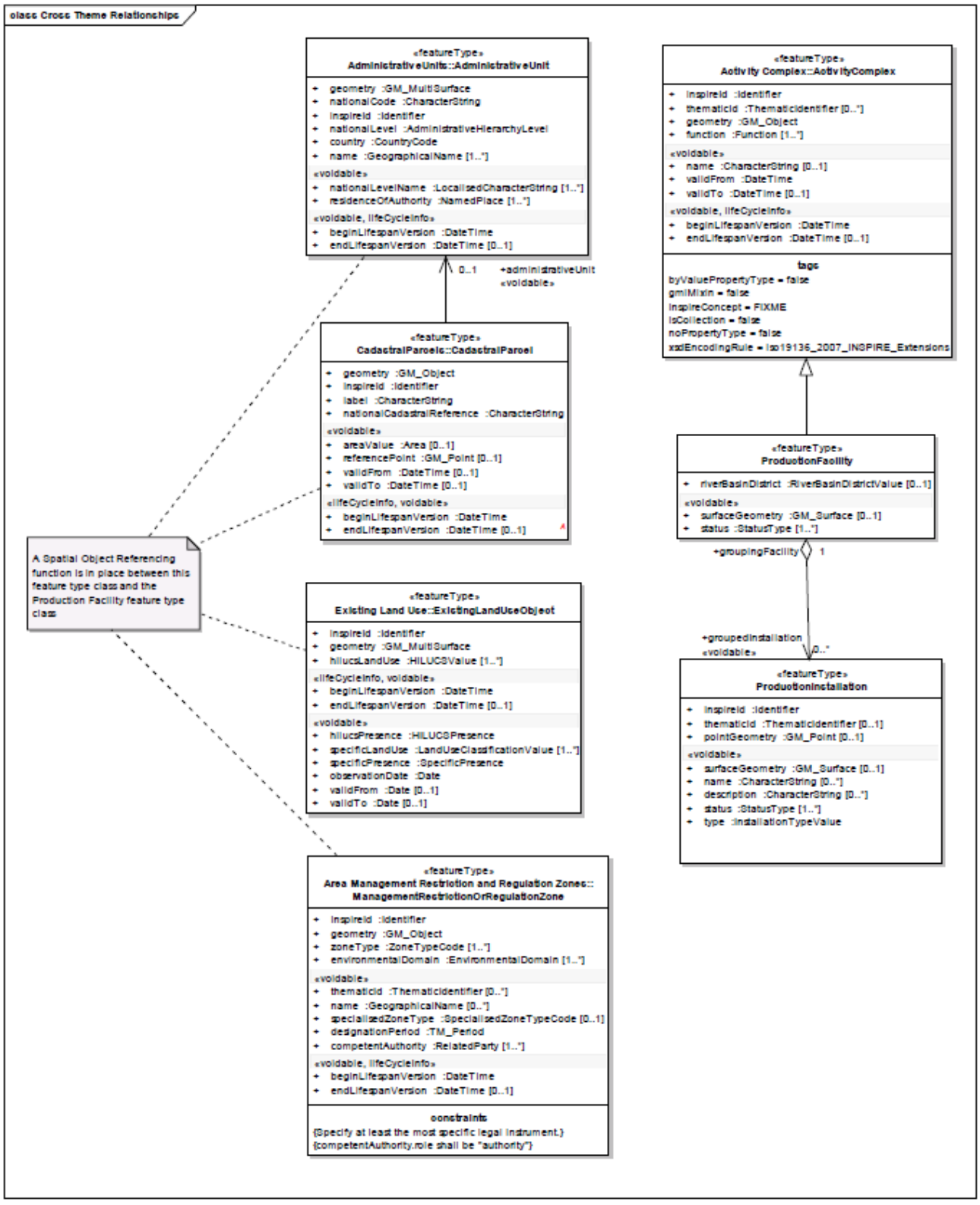
The information related to the geometry and location of the energy production sites can be instead provided using one of the feature types shown in Figure 61, selecting the more appropriate one(s) based on the information provided in the source datasets.

Figure 61. Overview of the Production and Industrial Facilities application schema



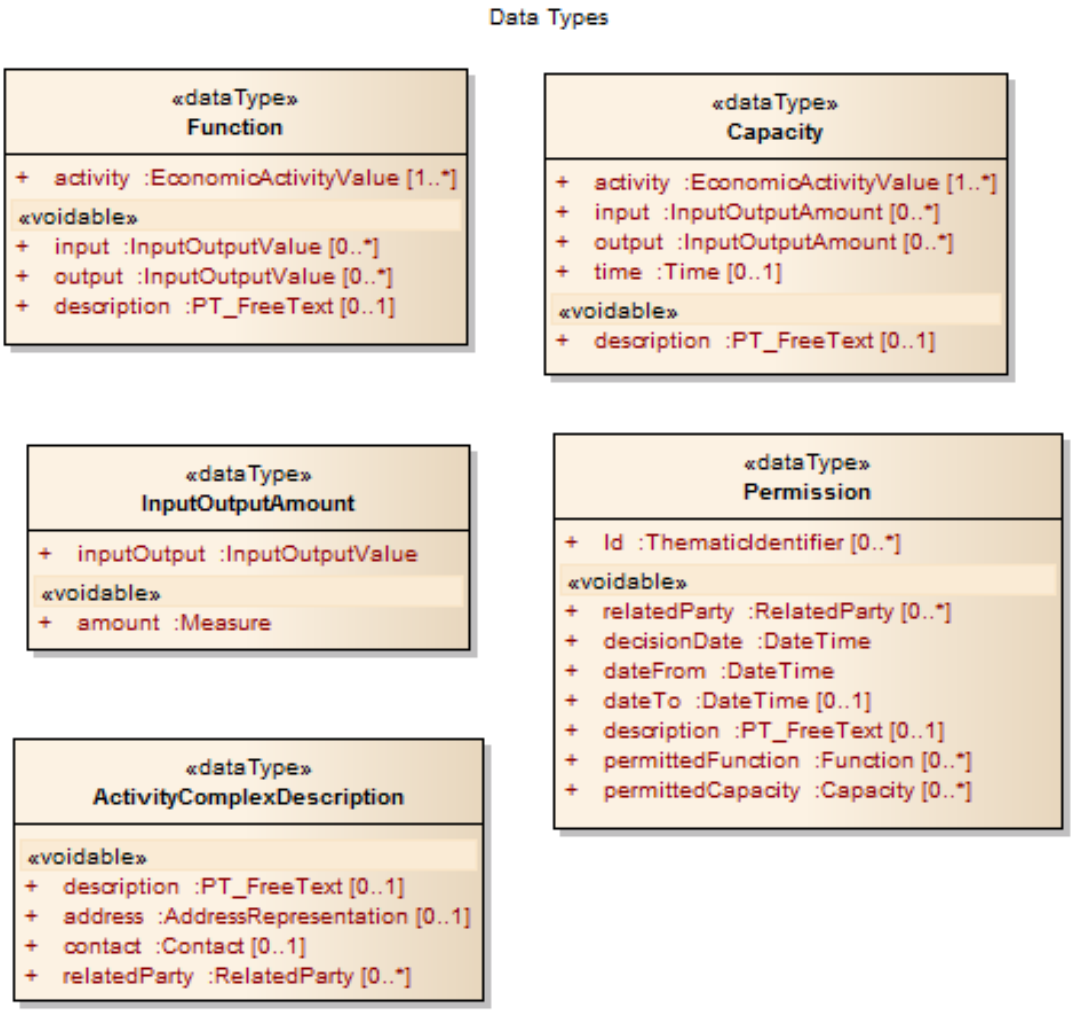
Source: INSPIRE Knowledge base

Figure 62. Overview of the Production and Industrial Facilities application schema – Cross Theme Relationships



Source: INSPIRE Knowledge base

Figure 63. Data Types of the ActivityComplex feature type



Source: INSPIRE Knowledge base

A possible INSPIRE harmonisation of the energy production datasets described in section 9.3.1.1 using PF as the target data model would require a deeper investigation, which is out of the scope of the present study.

As a final remark on possible data related to energy production sites already harmonised, it could be worth checking the data delivered at the country level according to the EU-Registry reporting obligations[28].

9.3.2 Statiscial data

This section aims to explore the potential link between statistical data available in a region and location data. To this end, in section 9.3.2.1, examples of statistical data available used in the regional energy strategy in Castilla y León are provided, and then the possibilities to integrate these data within INSPIRE are explored in section 9.3.2.1.

9.3.2.1 Examples of statistical data available in the Castilla y León region

As it has been observed in section 5 of this report, the amount and variety of data used in the design of the regional energy strategy are very vast. This implies having to deal with different data sources, levels of detail and granularity. However, a selection of datasets used in the regional energy strategy is presented in the table below to explore its potential integration within INSPIRE.

[28] http://cdr.eionet.europa.eu/help/euregistry

Table 73. Examples of statistical data used in the Castilla y León Energy Efficiency strategy

Topic	Source	Description	Scope / scale	Data format
Annual statistics in Castilla y León	Junta de Castilla y León, Estadística de Castilla y León, Yearly statistics [136]	In 21 chapters, indicators on territory, population, labour market, energy, commercial activity, tourism, public sector, etc., are provided. Many of these chapters help contextualise the region, whereas others are directly used in the strategy (e.g. chapter 8 on energy, chapter 14 on buildings and dwellings)	Scope: Castilla y León Scale: Castilla y León region as a whole or provinces. level	The data is presented in a catalogue, and a zip file can be downloaded per chapter and year. Within it, one or more excel files are contained, with different sheets.
Economic indicators in Castilla y León	Junta de Castilla y León, Estadística de Castilla y León, Economic indicators [137]	The economic indicators provide valuable information on regional quarterly accountancy, consumer price index, commercial societies, demand and offer indicators, etc.	Scope: Castilla y León Scale: Castilla y León region as a whole or provinces. level	The data is presented in a catalogue, and individual Excel filesper year can be downloaded, containing different sheets.
Primary and final energy (Spain)	IDAE (Studies and reports on energy balances) [107]	The IDAE provides energy balances of final energy from 1990-2018, detailed consumption of the service sector in 2018, and energy consumption in the residential sector (2010-2018). Particularly interesting is the first, where energy balances per year, activity sector and energy source are available.	Scope: Spain Scale: National level	The data can be accessed via web, as well as downloaded in excel format (.xls), CSV or HTML.
World energy situation	BP Statistical Review of World Energy 2017 [103]	This statistical review provides world information on energy, such as primary energy consumption (in total, by fuel type or per capita), oil data, gas, coal, nuclear energy, hydroelectricity, renewables, electricity, and other key materials (such as cobalt, lithium, graphite, rare earth, etc.).	Scope: global Scale: The data is provided at the country or regional level (understanding regions in this case as groups of countries/parts of continents).	The data is provided in excel format or PDF format.

Source: own elaboration

9.3.2.1 Harmonisation and interoperability of statistical data

According to the current version of the INSPIRE Implementing Rules and Technical, statistical data should be harmonised with the combined use of the two themes Statistical Units (providing the geometries) and Population Distribution (providing the statistical data associated with the geometries).

Because data so harmonised exhibit some issue in terms of usability and exploitation and because statistical data are already globally harmonised according to SDMX (Statistical Data and Metadata Exchange) standard[29], within the INSPIRE Community, there is a proposal for the adoption of SDMX encoding for statistical data, waiting to be endorsed. Further details on the related best practice can be found in a dedicated INSPIRE Community Forum discussion[30].

9.4 Energy Resources INSPIRE theme

Energy Resources (ER) is one of 34 INSPIRE themes. Its definition and description are available in the INSPIRE theme register[31] . The related data specification is available in the INSPIRE Document library[32].

According to the description provided in the INSPIRE theme register:

> "Energy Resources in INSPIRE covers historic, current and future energy resources and the entire lifecycle of energy resources, irrespective of its viability in terms of economic, social and technological aspects. It considers resources that are depleted due to exploitation in the past and resources currently not viable but may become so in the future. Information about location and the potential of energy resources have a significant impact on the environment. This impact can have both positive and negative implications, therefore appropriate knowledge about the extent, distribution and volumes of the resources is of great value.
>
> There is a main distinction between fossil fuels and renewable energy resources. The concept of energy resources provides focus to the resource aspect and the extent/distribution of the resources. Energy use, e.g. petrol consumption, is not covered by this theme. Fossil fuel resources include oil accumulation, natural gas accumulations, coal, lignite or peat deposits and Uranium ore deposits.
>
> Renewable energy resources include Hydropower in which water resources mapped according to energy potential.
>
> Bio-energy resources contains forest resources, cereals or agricultural residues which can be used for energy purposes, Wind energy - estimated by wind measurement together with topographical information. Geothermal energy the natural heat flow is of high interest as a renewable and clean energy source."

Moreover, as stated in the ER data specification:

"The main purpose therefore of this specification is to allow identification of geographical locations of each type of Energy Resource, providing information about their extent, distribution and volume (where possible and relevant) of the resource".

"Energy resources are commonly divided into two main types: Primary and Secondary Energy. Primary energy is either extracted or captured directly from natural resources (such as coal, crude oil, wind or solar radiation) whereas Secondary energy (Energy Carriers) is the result of a conversion of primary or secondary energy types (see Figure 64). Electricity is one of the most common secondary energy types, being transformed from various primary energy sources such as coal, oil, natural gas, and wind. Although within the INSPIRE context only Primary Energy Resources are considered, links to the secondary energy form are allowed for through the connection via statistics."

"Considering the INSPIRE definition as well as the scope of the remaining INSPIRE themes, this theme addresses each of the subcategories of primary energy resources: non-renewable resources, renewable resources and waste."

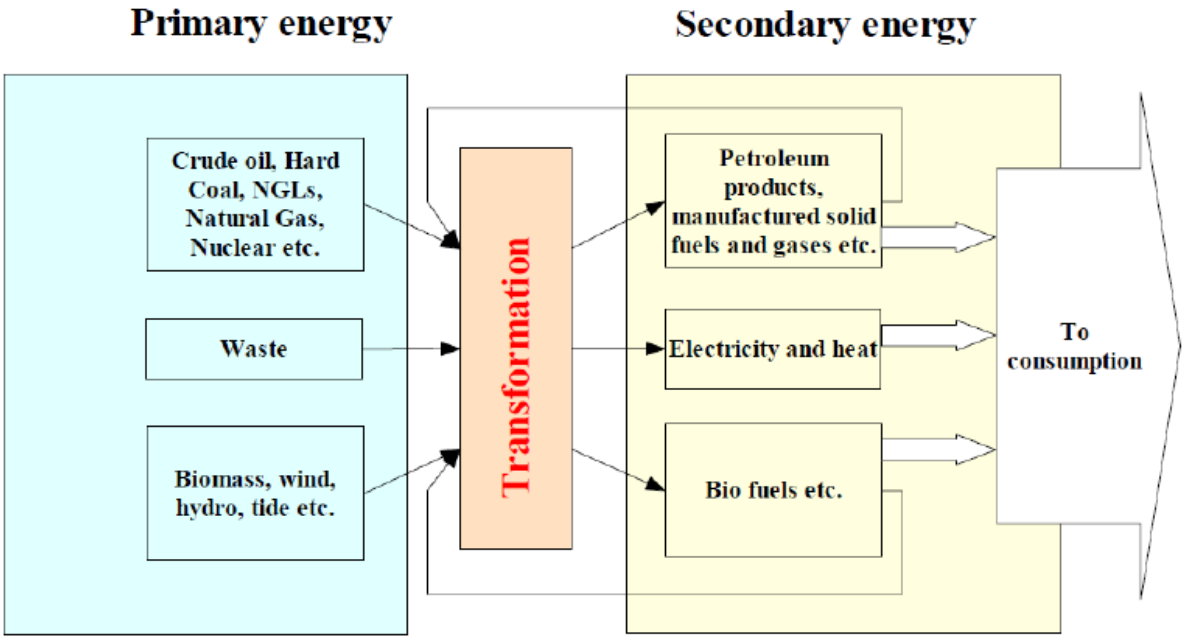
- "Non-renewables: Natural resources which, due to long-term formation, cannot be produced, grown, generated, or used on a scale which can sustain its consumption rate. These resources, also known as fossil fuels (crude oil, coal, natural gas) and nuclear fuels, exist in a fixed amount, or are consumed much faster than nature can replenish them."
- "Renewables: Naturally occurring and theoretically inexhaustible source of energy that is not derived from fossil or nuclear fuel. Renewable resources are widely abundant all over the Earth, but their energy intensity per unit area is typically smaller compared to non-renewable resources."

[29] https://sdmx.org/
[30] https://wayback.archive-it.org/12090/20210119161700/https://inspire.ec.europa.eu/forum/discussion/view/261536/inspire-good-practice-sdmx-for-human-health-and-population-distribution
[31] https://inspire.ec.europa.eu/theme/er
[32] https://inspire.ec.europa.eu/id/document/tg/er

— "Waste is a fuel that may consist of many different materials coming from combustible industrial, institutional, hospital and household wastes such as rubber, plastics, waste fossil oils and other similar commodities. It is either solid or liquid in form, renewable or non-renewable, biodegradable or non-biodegradable."

"Given that Nuclear fuels (Uranium and Thorium) are excluded from the energy resource types and are modelled within the Mineral Resources data specification, this data specification addresses only the fossil fuel element of the non-renewable resources."

Figure 64. Transformation from Primary to Secondary Energy (Statistics Norway, 2008)



Source: INSPIRE ER DS

The following energy-related aspects are out of the scope of the ER INSPIRE theme:

— Secondary Energy Types, e.g. electricity.

— Energy use, e.g. petrol consumption.

— Smart grids.

— Storage of energy resources based on natural constructions (lakes for hydro, or empty natural reservoirs).

— Underground Coal Gasification (UCG).

Moreover:

— "Uranium and Thorium as energy resource types are modelled within the Mineral Resources data specification."

— "The technical constructions for abstraction, transport and treatment are largely covered by Production and Industrial Facilities."

— "Basic data for wind and temperature distributions are modelled within the Atmospheric Conditions data specification."

— "Aerothermal energy resource is covered by the Atmospheric Conditions theme."

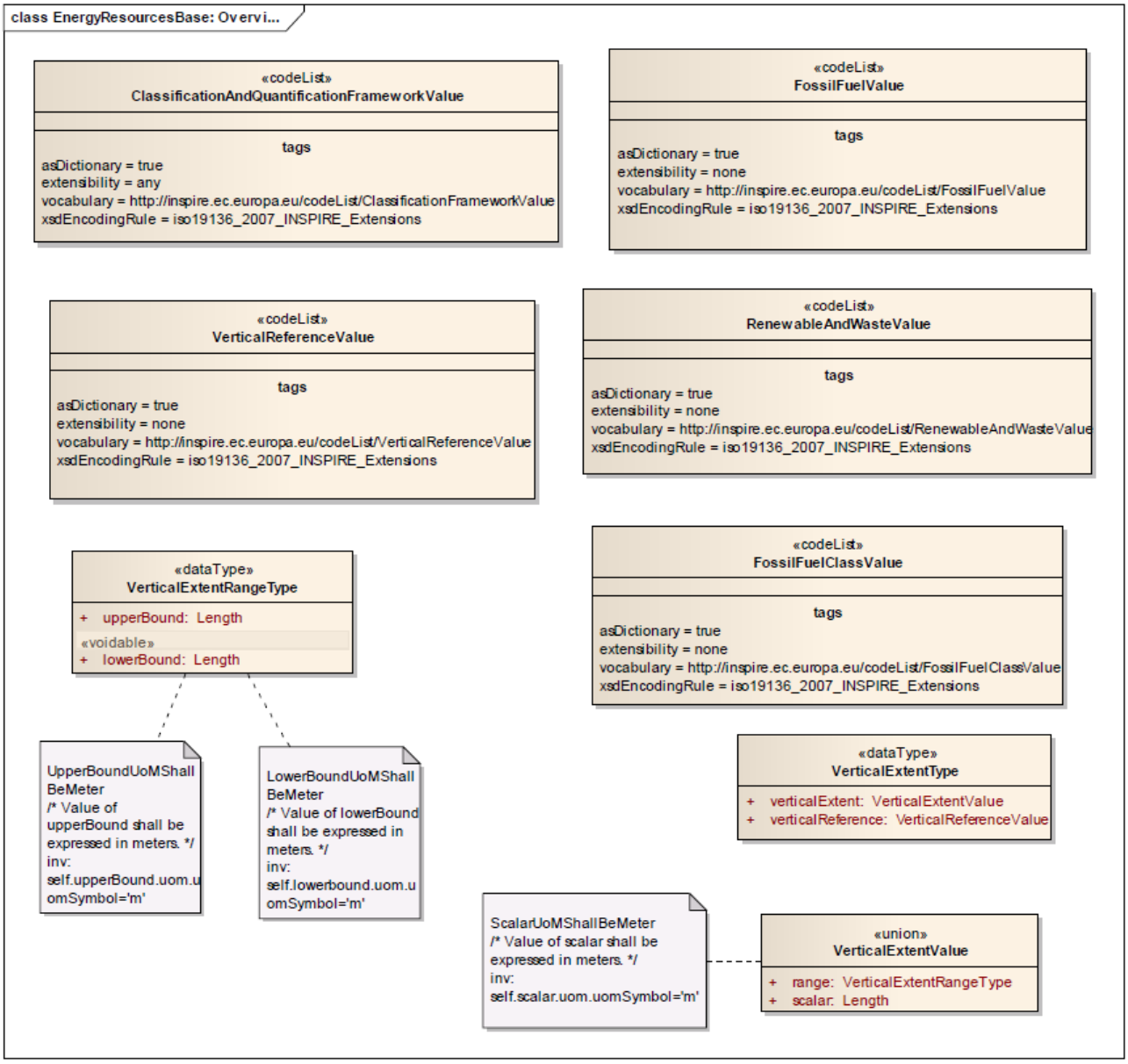
— "Although an energy resource type of biogas can be derived from a landfill feature type (currently modelled within Production and Industrial Facilities), biogas is retained within the Energy Resources code lists in order that it is possible to define a future area of interest with an estimation of the energy production value."

The ER theme contains three application schemas:

- "The Energy Resources Base application schema provides a base set of common Energy Resource classes including coded values for the classification of Energy Resources that fall within the scope of this theme."
- "The Energy Resources Vector application schema provides the means for modelling discrete spatial features representing fossil fuels and renewables."
- "The Energy Resources Coverage application schema provides a simple scheme for assessing the variation of energy potential of renewable resources including waste."

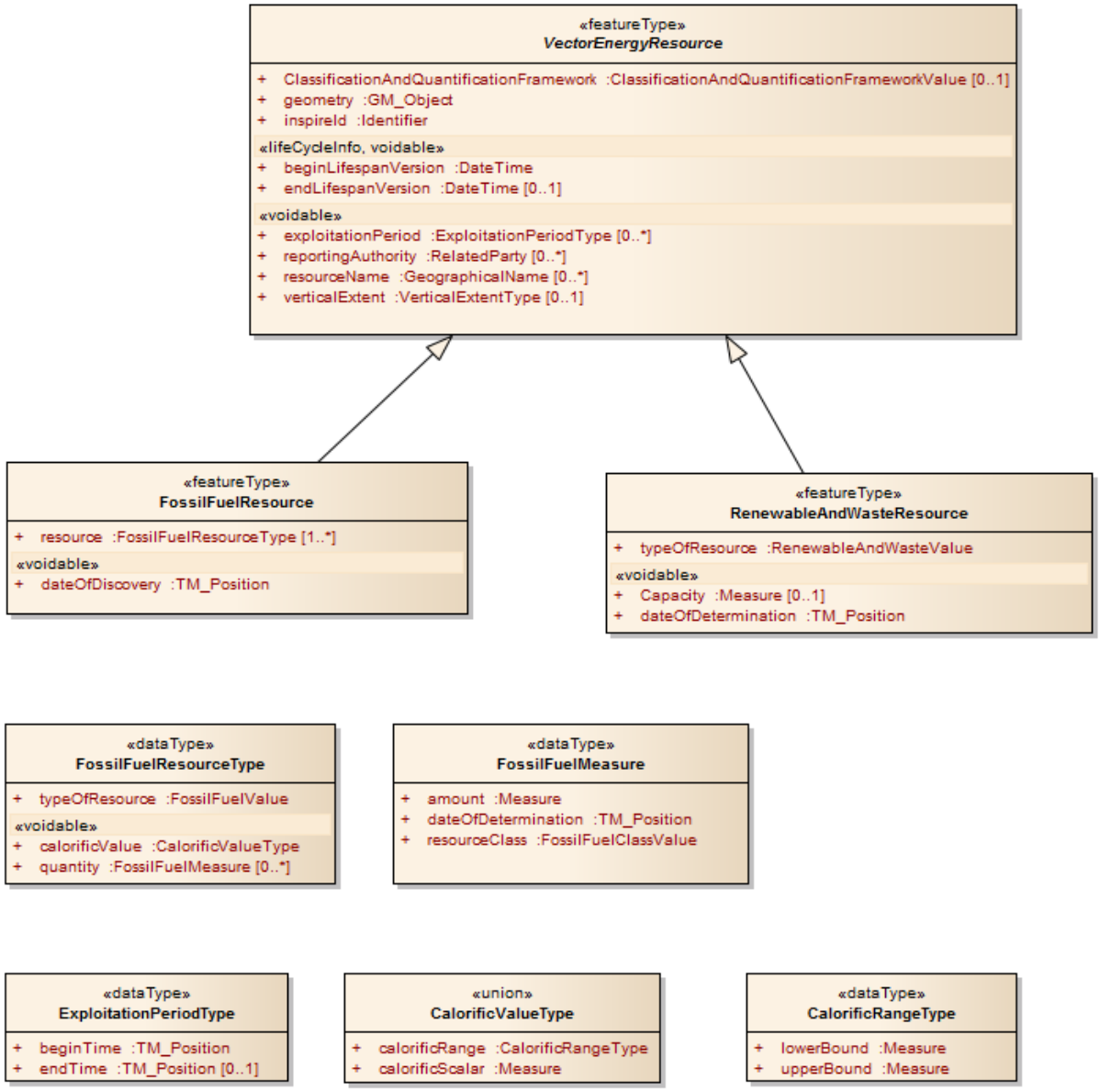
An overview of the three application schemas is provided in Figure 65, Figure 66 and Figure 67.

Figure 65. Overview of Energy Resource Base application schema



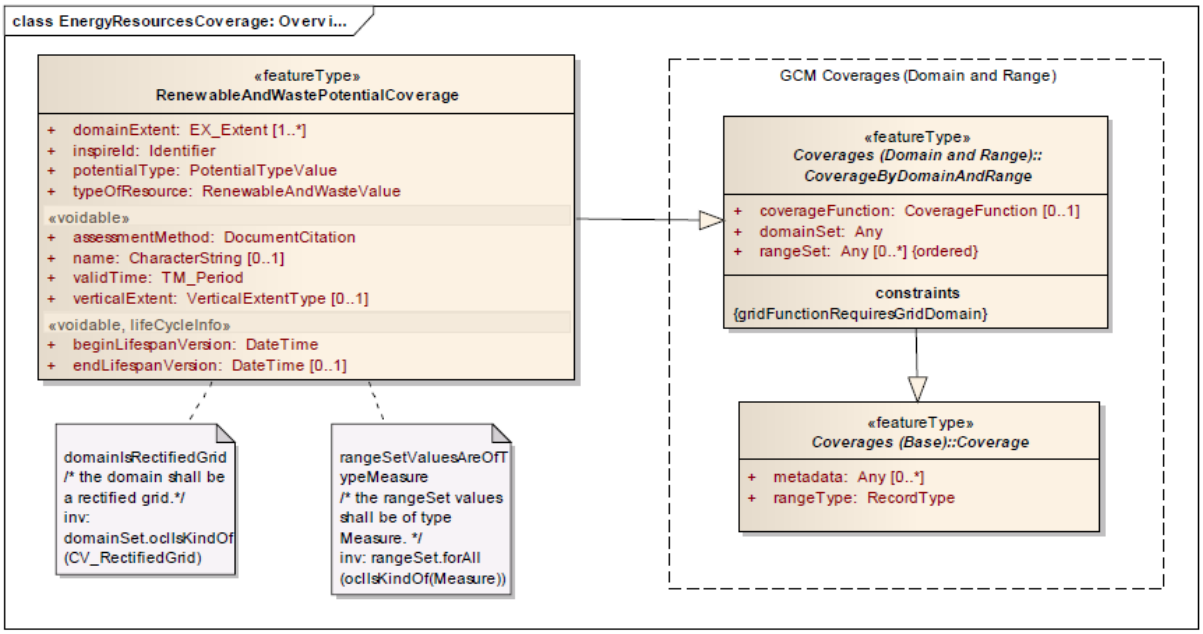
Source: INSPIRE Knowledge base

Figure 66. Overview of Energy Resource Vector application schema



Source: INSPIRE Knowledge base

Figure 67. Overview of Energy Resource Raster application schema



Source: INSPIRE Knowledge base

From the description of the Energy Resource theme provided, it is evident that the availability of datasets harmonised according to the vector or raster data model could play a key role in the definition/update of a regional energy strategy.

10 Conclusions

The report has presented several aspects related to a regional energy efficiency strategy, ranging from the territorial jurisdiction in the field of energy to an overview of possible data sources, then analysing a specific regional energy strategy and highlighting the main challenges to be tackled. Finally, potential solutions were proposed in order to deal with some of the detected challenges in the specific analysis of the Energy Efficiency strategy of Castilla y León region. One of the main burdens was the availability of adequate data. In particular, in sections 2 and 3 of this report (Step 1: Understanding of the European context), a relevant number of public data sources that cover energy aspects, as well as complementary sectors which are present in regional energy strategies, such as the environment, industrial or agricultural activities, have been analysed. In addition, the sources presented cover all European countries. Nevertheless, despite the data sources described so far should be considered non-exhaustive, the analysis provides a good overview of the data sources potentially relevant to the development of regional energy strategies at the European level. Several conclusions can be extracted from this analysis:

- **Variety of data and access options**: In analysing the selected data sources, it was observed that there is a vast amount of available data from statistical offices and derived from Projects. Similarly, the accessibility options to these data are highly heterogeneous and sometimes not immediate (as in the case of Projects data). Additionally, the option to view data through cartographic visualisations in user-friendly websites that use map representation is available in several data sources. However, special efforts should be placed in providing data in formats that are also easy to process (e.g. CSV, enable connections through API, etc.).
- **Coverage and scale**: whereas the geographical coverage of all datasets analysed was either European or international, the scale at which the data was presented was, in most cases, at the national level. However, to support regional energy strategies, it is essential to count also on sub-national (regional or local) level datasets. Sub-national scales would allow establishing comparable methodologies among the Member States. Hence, data provided by Eurostat at the different NUTS levels is greatly beneficial.
- **Supporting the modelling of other variables**: some of the data analysed cannot be directly used to potentially support regional energy strategies but they can be leveraged to extract variables to calculate relevant indicators. This is the case of sources like Copernicus or OpenStreetMap.

All in all, the underlying conclusion after having analysed the selected data sources is the remarkable complexity and huge amount of the datasets present at European level. Moreover, this data increase is a trend that will continue to persist and is currently being exacerbated due to the existence of monitoring devices, IOT etc that capture real-time data.

In this context, not only having a common access point with clear filter options and identification of resource formats (as the EU Open Data Portal proposes) will be fundamental; but also, the deployment of big data analytics and AI to be able to exploit this data and extract relevant information. Based on current trends, the challenge of the near future will not be the lack of data, but, apart from other challenges, the clear identification of what decisions need to be made and what information is required to do so, in order to know what data need to be exploited.

For this reason, the challenges found in a specific case study, consisting of the Energy Efficiency Strategy of the Castilla y León region, have been deeply analysed, realising that the development of a regional energy strategy entails a lot of challenges. These are related to data needs, as well as assessments to be performed and actions to be proposed in order to comply with the objectives established and directly transposed from the energy European Directives.

In sections 4 and 5 (Step 2: Analysing a real case: regional energy efficiency strategy in Castilla y León region) the context of Castilla y León has been presented, the current regional energy efficiency strategy analysed, by delving into each of the sectors. In these analyses, a special focus has been placed on the data sources required to characterise and monitor each of the sectors. All the datasets identified are shown in detail in Annex 3. However, this analysis should be considered preliminary, since a much more in-depth analysis would be required to analyse the complexities that each sector entails.

The main conclusions drawn from the analyses made on the Energy Efficiency Strategy of the Castilla y León region are:

- **High complexity of the Castilla y León regional energy efficiency strategy:** regional energy strategies entail a high complexity as they involve different sectors, as it has been confirmed by the in-

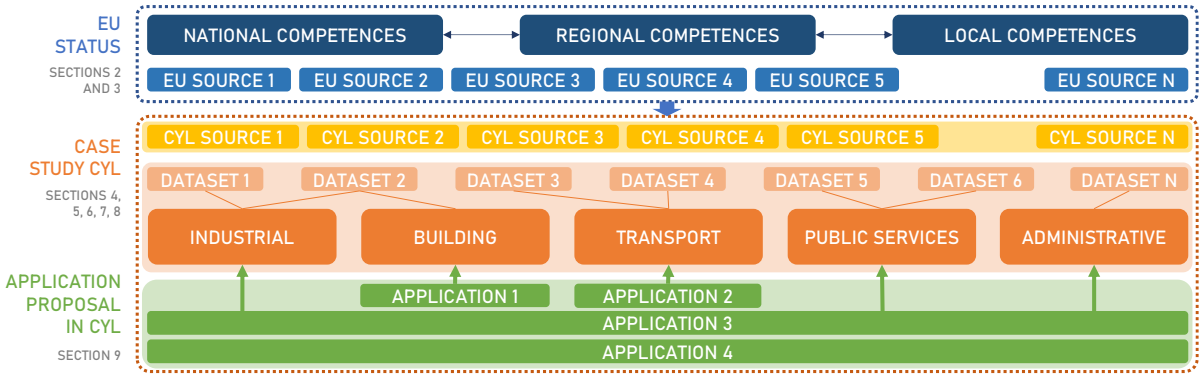
depth analysis of the Castilla y León one. Additionally it is necessary to comply with the energy objectives coming from the European Union (EPBD, EED, RED, etc.). Moreover, this progress needs to be reported at the national scale. As a consequence, counting on multi-scale quality data that can enhance the analysis of the status of the region at the appropriate scale and support the actions to be taken is fundamental.

- **Essential role of objectives and monitoring**: the objectives set from external sources (i.e. European Commission through its Directives) guide the implementation of the regional energy strategy. Based on this, a monitoring of the proposed actions is implemented to check whether the objectives have been achieved or not. Two considerations should be highlighted in this field:
    - Regarding the definition of the objectives, a question that should be posed is whether the objectives to comply at the regional level should be the same as at the ones at the national or European levels, or if they should be fine-tuned according to the regions' characteristics. In the case of the Spanish Castilla y León region, they commit to comply at least with those coming from the European level.
    - Monitoring is a crucial activity that helps determining whether a specific action has had the expected impact and contributed to achieving the established objective or not. To this end, the lines of action and the specific objectives to be achieved in each sectors (industrial, building, transport, public services, administrative) have been presented. However, the way to measure the impact of each of the actions (aspect not been explored in this report) is crucial to assure the success of the strategy.
- **Lack of timely data:** while identifying the required datasets, a lack of timely data was observed in some cases. Indeed, when using official statistical data sources, the date of publication of the data versus the timeframe covered in the data was extremely distant. The latter can result in decision-making processes based on potentially obsolete data. Thus, a balance between using updated data coming from reliable sources versus delayed official statistical data should be found.
- **No location data**: the Energy Efficiency Strategy of Castilla y León does not use geo-located data for implementation or monitoring purposes. Nevertheless, the scale of some of the data used as a basis in the energy efficiency strategy definition can cover the province level (NUTS 3), hence, covering the nine provinces in Castilla y León region. Thus, there is a great opportunity to explore how location data can support the development of regional energy strategies in Castilla y León.

Finally, in sections 6 to 9 (Step 3. INSPIRE potential to support regional energy planning in the EU), it is shown how data harmonised according to INSPIRE and other geospatial data can support the implementation of regional energy strategies.

To this end, concepts on spatial planning have been explored first; then, the INSPIRE Directive has been presented, and other datasets to support regional energy strategies. Based on the knowledge of the regional energy strategy's challenges, several applications for specific sectors have been described. As a result, the following Figure 68 depicts the progress performed in the whole use case:

Figure 68. Use case "Supporting the design and implementation of a regional energy strategy."



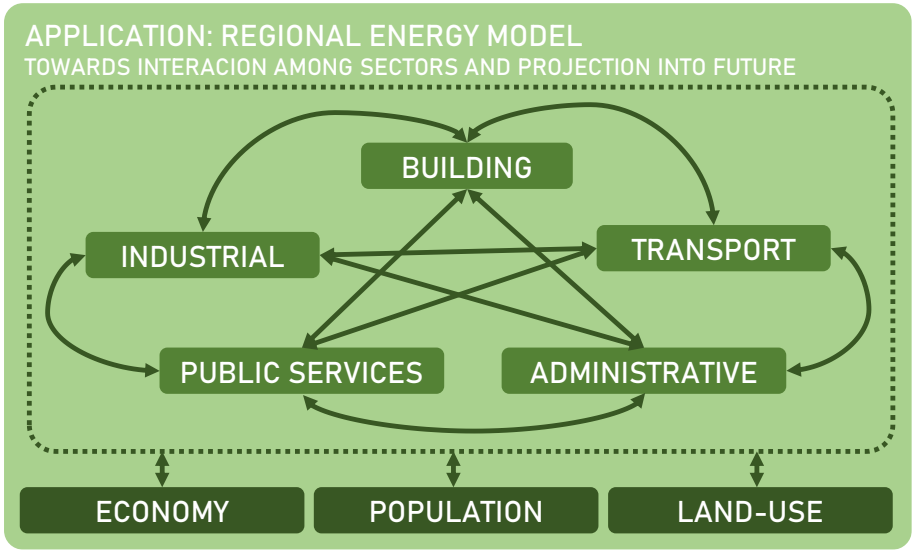
Source: CARTIF, own elaboration

As exposed, the complexity of regional energy strategies is very high since there is a lot of data that needs to be gathered for a variety of sectors, which come from different and heterogeneous sources. In this line, the applications described, that link location data to other available data using specific models, can effectively support a series of analyses in specific sectors, contributing to facilitating the assessment of the specific sector concerned. Indeed, this in-depth analysis of what each sector entails would be the necessary next step in this research. Only by determining how to characterise each sector would it be possible to monitor its progress and to propose adequate actions, and monitor their effects.

However, deepening into each sector and potentially relevant data sources would be fundamental, but also understanding how each sector is linked to each other and other factors and transversal sectors affecting their development. Among these cross-sectoral factors, there are the economy, population, land use, etc. The many different indicators contribute to characterising the region and have a clear impact on the development of the mentioned sector.

To this end, a potential clear improvement of the Regional energy strategy of Castilla y Leon would be to represent in an appropriate **holistic framework modelling** the different sectors considered as strategic in the region (Figure 69). The main purpose of a cross-sectoral modelling would be to reflect better the potential interlinkages between the different sectors and implemented measures to capture how changes taking place in a specific sector impact the others (e.g. measures related to energy efficiency affect not only the energy sector but also other sectors in an indirect way).

Figure 69. Proposed next steps for the use case



Source: CARTIF, own elaboration

In addition, the transversal sectors (e.g. economy, land use allocation, social and population) need to be reflected in the regional energy strategy, to adequately project the variables of interest toward the future, analysing better the needs, additional issues that can arise and the potential solutions. For example, a better representation of the economic development of the regions, along with population trends (also considering migration issues), land use availability and related opportunities, can foster a more accurate strategic analysis of the region. At the same time, it can allow finding better solutions adjusted to the particular state of the region.

All in all, the use of INSPIRE data sets could play a key role when defining the holistic framework modelling since the main sectors analysed for the Castilla y Leon region are already covered by some INSPIRE data themes.

It could also be considered, as a final goal, to provide a **pan-European modelling framework** to support any European region when developing energy strategies as well as during its evaluation phase.

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List of abbreviations and definitions

API	Application Programming Interfaces
ASTI	Agrarian Studies Training Institute
AU	African Union
BEI	Baseline Emission Inventory
BOCyL	Boletín Oficial de Castilla y León (Official Bulletin in Castilla y León)
BSO	Building Stock Observatory
CEM	Clean Energy Ministerial
CLLD	Community-Led Local Development
CoM	Covenant of Mayors
COP	Conference of Parties
CoR	Committee of the Regions
CyL	Castilla y León
DEEP	De-risking Energy Efficiency Platform
DGT	Dirección General de Tráfico – General Directorate of Roads
DHW	Domestic Hot Water
EA	Enterprise Architect
EC	European Commission
ECEM	European Climatic Energy Mixes
ECFIN	DG for Economic and Financial Affairs
EEA	European Environment Agency
EEFIG	Energy Efficiency Financial Institution Group
EO	Earth Observation
EPC	Energy Performance Certificate
EPSR	European Pillar of Social Rights
EREN	Ente Regional de la Energía de Castilla y León
ESIF	European Structural and Investment Funds
ESS	European Statistical System
EU	European Union

FAO	Food and Agriculture Organization of the United Nations
FPMA	Food Price Monitoring and analysis tool
FRA	Forest Resources Assessment
FTE	Full-time equivalent
GCD	General Directorate of Roads
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GML	Geography Markup Language
GNM	Generic Network Model
GNP	Gross National Product
GPS	Global Position System
GVA	Gross Value Added
H/C	Heating and Cooling
IDEE	Infraestructura de Datos Espaciales de España – Spanish Spatial Data Infrastructure
IEA	International Energy Agency
IEF	International Energy Forum
IMD	Average Daily Intensity
IOT	Internet of Things
IPPC	International Plant Protection Convention
ITI	Integrated Territorial Investment
JRC	Joint Research Centre
KCTP	Knowledge Centre for Territorial Policies
LEAP	Low Emissions Analysis Platform
LUISA	Land-Use based Integrated Sustainability Assessment
MIG	Maintenance and Implementation Groups
MS	Member States
MURE	Mesures d'Utilisation Rationnelle de l'Energie
NFP	National Focal Points
NUTS	Nomenclature of Territorial Units for Statistics

nZEB	Nearly Zero Energy Building
OPTE	Optimización de Tarifas Energéticas (Energy tariffs optimization)
OSM	OpenStreetMaps
PAEE	Plan de Ahorro y Eficiencia Energética (Energy efficiency and savings plan)
PEEIs	Principal European Economic Indicators
PPS	Purchasing Power Standard
PRTR	Pollutant Release and Transfer Registers
RCI	Regions and Cities Illustrated
RCP	Representative Concentration Pathways
R+D+I	Research, development and innovation
REE	Red Elétrica Española (Spanish Electric Network)
RES	Renewable Energy Source
RIS3	Research and Innovation Smart Specialisation Strategy
RVA	Risk and Vulnerability Assessment
SDG	Sustainable Development Goal
SECAP	Sustainable Energy and Climate Action Plan
SUD	Sustainable Urban Development
TIA	Territorial Impact Assessment
UCG	Underground Coal Gasification
UDPplus	Urban Data Platform Plus
WFP	World Food Programme
WMS	Web Map Service

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Annexes

Annex 1. Energy competences in the EU

This annex compiles the information provided by the Committee of the Regions on the energy competences in the EU, in particular, and as expressed in section 2, focusing only on the Member States with and without legislative powers at the sub-national level. The summary tables first present the countries with legislative powers at the sub-national level and those that do not.

Table 74. Energy competences in Austria (AT) according to the Committee of the Regions

AUSTRIA (AT)			
Legislative powers at the sub-national level	YES		
Description of competences			
Central level	**State authorities** are responsible for: - Legislative and administrative competence to set norms and lay down classifications for electric facilities as well as taking security measures in this field. (Art. 10 (10) Constitution); - Legislative and administrative competence to ensure the security of energy supplies; - Legislative and administrative competence for the control of fissile material and technology for the production of the same; - Competence to set minimum standards for the energy efficiency of electronic equipment as well as to label electronic equipment according to its energy efficiency as well as the organisation of the energy efficiency; - Framework legislation for the production, transition, distribution and provision of electricity industry; - Price setting for the usage of power grids; - Support of energy from renewable sources		
Regional level	**Regional authorities** are responsible for: - Provincial energy plans; - Administration of renewable energy policies; - Energy taxes; - Financial grants to promote the development of renewable energy technologies.		
Local level	**Local authorities** are responsible for: - Local energy plans; - Administration of the 'e5 programme' – a programme which provides support for the municipalities to achieve energy efficiency and improve climate protection; - Providing energy efficiency information.		
Responsible ministries /	Ministry of Science, Research and Economy	Multilev. govern.	Austria's multilevel governance system can be consulted here [49]
Sources	- Energielenkungsgesetz - Erdöl-Bevorratungs- und Meldegesetz - e5 Österreich – Programm für energieeffiziente Gemeinden - Ökostromgesetz - Sicherheitskontrollgesetz - Elektrotechnikgesetz		

Source: Committee of the Regions, Energy competences in Austria [50] above

Table 75. Energy competences in Belgium (BE) according to the Committee of the Regions

BELGIUM (BE)			
Legislative powers at the sub-national level	YES		
Description of competences			
Central level	The **central government** is responsible for: - Nuclear energy; - Federal equipment plans for electricity; - Major energy storage infrastructure, and - The transport and production of energy, and prices. - Security of supply - National indicative investment plans for gas and electricity (in collaboration with - The CREG, the federal regulator) - Nuclear fuel cycles and related research and development (R&D) programmes. - Large stockholding installations for oil - Production and transmission/transport of energy (including electricity grid >70 kV), - Including large storage infrastructure - Transport tariffs and prices - Product norms - Offshore wind energy.		
Regional level	**Regional authorities** are responsible for: - Local transport and distribution of electricity; - The public distribution of gas; - The rational use of energy, and - Distribution tariffs (gas and electricity) will be transferred from the federal to the regional level (except tariffs of the transmission system operators). - Regulation of gas and electricity retail markets - Distribution and transmission of electricity (electricity grid <70 kV) - Distribution of natural gas - Distribution tariffs - District heating equipment and networks - Renewable sources of energy (except offshore wind energy) - Recovery of waste energy from industry or other uses - Promotion of the efficient use of energy - Energy R&D (except nuclear) - Use of firedamp (coal-bed methane) and blast furnace gas.		
Local level	**Local authorities** are responsible for: - Energy supply; - The management of the public distribution of energy. (Communes frequently use intercommunal associations for this purpose).		
Responsible ministries / bodies	- Directorate-General for Energy - Department of Environment, Nature and Energy within the Ministry of the Flemish Community - Operational Directorate-General for Land Management, Housing, Patrimony and Energy – Walloon Region - IBGE/BIM – Brussels-Capital Region	Multilev. govern.	Belgium's multilevel governance system can be consulted here [51]
Sources	- Constitution of Belgium (Constitution belge texte coordonné du 17 février 1994). In particular Art. 39 - Special law of Institutional Reform (Loi Spéciale de réformes institutionnelles du 8 Août 1980). In particular Art. 6, paragraph 1, indent VII - The French Speaking Community (Fédération Wallonie-Bruxelles) - IEA Belgium - Belgium, IEA Review, 2016		

Source: Committee of the Regions, Energy competences in Belgium [52]

Table 76. Energy competences in Finland (FI) according to the Committee of the Regions

FINLAND (FI)			
Legislative powers at the sub-national level	YES		
Description of competences			
Central level	- Overall policy; - Adopt of the National Climate and Energy Strategy; - Adopt of supplementary programmes; - Facilitate international co-operation on energy in the IEA (International Energy Agency) and the NEA (International Energy Agency). The Energy Authority (under the Ministry of Employment and the Economy) - Provide expert advice; - monitors compliance with the electricity market legislation - promotes the operation of the competitive electricity and natural gas markets; - grant network permits - monitor compliance by system operators with the obligations - implement and administer systems promoting the production and use of renewable energy. Regional State Administrative Agencies (State authorities) - Issue permits for larger and medium-sized industrial plants.		
Regional level	Regional Council - Regional natural resources and the environment plans Åland competences - Resources management; - Central authorities have legislative competence in the field of nuclear energy, nevertheless, the consent of the Åland Government is required for the construction, possession and operation of a nuclear power plant and the handling and stockpiling of materials in Åland.		
Local level	- Energy management; - Distribute electricity and district heating; - Issue environmental permits needed by smaller plants and facilities; - The bigger municipalities have their own energy production companies.		
Responsible ministries /	- Regional State Administrative Agencies - Regional Council - Aland Government - Municipalities	Multilev. govern.	Finland's multilevel governance system can be consulted here [53]
Sources	- Act 2014/7 on regional development and the management of Structural Fund operations - Act on the autonomy of Aland (1991/1144), Section 18 and 27 - AFLRA portal, Good living environment - Ministry of Environment portal, Environmental protection - The Energy Authority - Local Government Act 410/2015. - Energy and Climate Roadmap 2050		

Source: Committee of the Regions, Energy competences in Finland [54]

Table 77. Energy competences in Germany (DE) according to the Committee of the Regions

GERMANY (DE)			
Legislative powers at the sub-national level	YES		
Description of competences			
Central level	- Nuclear Energy - Adopts legislation and policy on reducing energy dependency. - Subsidies and loans to reduce energy consumption. - Promotion of alternative energy sources - Online energy monitoring - Energy performance certificates - Germany Network Agency is responsible for the deregulation of the energy infrastructure.		
Regional level	- Implementation of legislations - Local programmes to promote energy savings Intermediate level - Kreise - Implementation of legislations - Local programmes to promote energy savings		
Local level	- Implementation of legislations - Local programmes to promote energy savings - Street lighting - Management of energy supply utilities		
Responsible	Ministry of Economy and Energy	Multilev. govern.	Germany's multilevel governance system can be consulted here [55]
Sources	- Energie - Bundesnetzagentur - Power, A. & Zulauf, M., Cutting Carbon Costs: Learning from Germany's Energy Saving Program		

Source: Committee of the Regions, Energy competences in Germany [56]

Table 78. Energy competences in Italy (IT) according to the Committee of the Regions

ITALY (IT)			
Legislative powers at the sub-national level	YES		
Description of competences			
Central level	The **central government** is responsible for: - Defining fundamental principles; - Administrative functions relating to: - Scientific research; - Import, export and storage; - Regulation of standards; - Control over the national agency on new technologies, energy and environment (ENEA); - The use of radioactive material and x-ray machines; - Electric energy production; - The setting up of targets and national programmes on renewable sources and energy conservation; - Nuclear facilities; - Inspection, research and storage of hydrocarbon; - Taxation of oil stocks; - Tariffs; - Statistics; - Regional planning regarding water resources, and - The coordination of research programmes.		
Regional level	**Regional authorities** are responsible for: - Administrative functions relating to energy, including renewable resources, electricity, solar energy, oil and gas, which are neither reserved for the State nor the local authorities; - Grants to support the use of renewable energies; - Contributions for the reduction of energy consumption; - Incentives for the use of renewable energy in agriculture; - Coordinating functions with local authorities, and - Assisting local authorities in awareness and training.		
Local level	**Provincial authorities* are responsible for** administrative functions relating to energy saving and to the rational use of energy, including: - Programmes promoting renewable resources and energy-saving; - Grant permits for the construction of energy production facilities, and - Control over the facilities' efficiency. **Municipal authorities** are responsible for administrative functions relating to energy saving and to the rational use of energy. * Provincial competences and responsibilities are progressively changing due to the entry into force of Law 56/2014 on Metropolitan Cities, the provinces and on the union and merging of municipalities. In addition, it depends on regional laws, which may regulate provinces and municipal responsibilities according to different areas. See the dossier by ANCE (2015) on 'Changes to provincial functions after the Law 56/2014.		
Responsible	- Ministry of the Environment and Maritime Protection - ISPRA	Multilev. govern.	Italy's multilevel governance system can be consulted here [57]
Sources	- Constitution, Article 117. - Decreto Legislativo 31.03.1998, n. 112 "Conferimento di funzioni e compiti amministrativi dello Stato alle regioni ed agli enti locali, in attuazione del capo I della legge 15 marzo 1997, n. 59", GU n. 92 del 21.04.1998 - Supplemento Ordinario n. 77 (Rettifica G.U. n. 116 del 21.05.1997) [Legislative Decree 112/1998] - Decreto Legislativo 18 agosto 2000, n. 267 "Testo unico delle leggi sull'ordinamento degli enti locali" (GU n. 227 del 28.09.2000 - Supplemento Ordinario n. 162) [Legislative Decree 267/2000 on the organisation of local authorities], Art. 19. - Law 1991/10, Article 9		

Source: Committee of the Regions, Energy competences in Italy [58]

Table 79. Energy competences in Portugal (PT) according to the Committee of the Regions

PORTUGAL (PT)			
Legislative powers at the sub-national level	YES		
Description of competences			
Central level	Central government is responsible for: - Energy Policy - Energy infrastructure policies - Renewable Energy deployment initiatives. - Strategies, Monitoring frameworks and evaluations. - National Energy Strategy 2020 - National Energy Efficiency Action Plan 2013-16 - Cross-border co-operation		
Regional level	Regional authorities are responsible for: **The Azores** -The Legislative Assembly legislates in energy policy. It is responsible for: - Production facilities; - Distribution; - The storage and transport of energy, and - The regional production of energy, including renewable energy and efficiency energy. Madeira: - Energy production site, and - Distribution.		
Local level	Municipal authorities are responsible for: - The distribution of electricity at low voltage; - Urban and rural lightening; - Investing in energy-producing centres, and - Managing the distribution networks.		
Responsible ministries /	- Ministry of Economy - National Laboratory for Energy and Geology - Energy Services Regulatory Authority - Portuguese Energy Association	Multilev. govern.	Portugal's multilevel governance system can be consulted here [59]
Sources	- IEA Review, Energy Policy - Lei n.º 2/2009 de 12 de Janeiro Aprova a terceira revisão do Estatuto Político –Administrativo da Região Autónoma dos Açores – [Law on the political and administrative statute of the Autonomous Region of Azores] - Estatuto Político-Administrativo da Região Autónoma da Madeira Aprovado pela Lei n.º 13/91, de 5 de Junho. - Revisto pela Lei n.º 12/2000, de 21 de Junho. [Law on the political and administrative statute of Autonomous region of Madeira] - Lei n.º 159/99 de 14 de Setembro, Estabelece o quadro de transferência de atribuições e competências para as autarquias locais [Law No. 159/99, September 14, that sets out the Framework for the transfer of functions and powers of the local authorities]		

Source: Committee of the Regions, Energy competences in Portugal [60]

Table 80. Energy competences in Spain (ES) according to the Committee of the Regions

SPAIN (ES)			
Legislative powers at the sub-national level	YES		
Description of competences			
Central level	- Responsibility for national mining and energetic basic legislation (Ministry of Industry, Energy and Tourism); - Planning of energy-saving and conservation; - Planning of energy tariff regulations; - Guarantee of energy supply in case of necessity; - Authorisation of construction, functioning, exploitation, ceasing of exploitation, dismantling and closure, as well as change of ownership of nuclear and radioactive infrastructures of first category, with a trans-regional character; - Modification of period and quantities related to the first phase of the cycle of nuclear combustible; - Solving of files and subjects related to mining rights, research and exploitation of hydrocarbons; (State Secretariat for Energy) - Planning transport of energy; - Sustainable energies: development of the Plan de Acción Nacional de Energías Renovables [National Plan of renewable energies – PANER in its Spanish abbreviation] and of the Plan de Acción de Ahorro y Eficiencia Energética [Action plan for saving and energy efficiency] each for 10 years		
Regional level	- Development and implementation of national legislation; - Authorisation for electric infrastructures within the AC territory; - Authorisation for transport of energy within the AC territory; - Planning at autonomic level in the field of sustainable energy, energy efficiency within the frame of national plans.		
Local level	Provincial competences - Securing coordination and provision of municipal services. Municipal competences - Public lighting; - Planning and fostering energy efficiency at local level.		
Responsible	Ministry of Energy, Industry and Tourism	Multilev. govern.	Spain's multilevel governance system can be consulted here [61]
Sources	- Spain, International Energy Agency, Country Review - La energía en España Ministerio de Industria, Comercio y Turismo, Madrid, 2010. P.9 [Energy in Spain. Ministry of Industry, Trade and Tourism, Madrid,2010.p.9]. - Ley consolidada 51/1997 de 27 de noviembre del Sector Eléctrico [Law 51/1997 of 27 November 1997 on the electric sector with amendments]. - Ley consolidada 34/1998 de 7 de octubre del sector de hidrocarburos [Law 34/1998 of 7 October 1998 on the hydrocarbons sector with amendments]. - Ley 2/2011 de 4 de marzo de Economía Sostenible. [Law 2/2011 of 4 March 2011 on the sustainable economy]		

Source: Committee of the Regions, Energy competences in Spain [62]

Table 81. Energy competences in Bulgaria (BU) according to the Committee of the Regions

BULGARIA (BU)			
Legislative powers at the sub-national level	NO		
Description of competences			
Central level	The **central government** is responsible for: - The overall legislation; - Energy forecasting and planning; - Formulating energy policy, control and regulation, and - State Energy and Water Regulatory Commission. - Management of mineral resources to defend national interests - Participation in the construction of a unified and stable European energy market. - Energy efficiency development. - Development of nuclear energy in accordance with contemporary requirements for reliability, safety and efficiency. - Renewable Energy Action Plans - Monitoring frameworks and annual reporting of the Energy Sector. - Provides short-term, Medium Term, and Long-term forecasts of energy balances.		
Regional level	**District authorities** are responsible for: - Electricity and gas distribution, and - Carrying out energy efficiency policy.		
Local level	**Municipal authorities** are responsible for: - Electricity and gas distribution; - Investment in local energy-generating facilities and projects, and - Carrying out energy efficiency policy (municipal buildings, hospitals and schools). - Communicate with energy providers and acquire demand analyses from providers. - Determine infrastructural work required related to energy projects under national programmes in their area of responsibility.		
Responsible	Ministry of Energy	Multilev. govern.	Bulgaria's multilevel governance system can be consulted here [63]
Sources	- Energy from Renewable Sources Act - Energy Act		

Source: Committee of the Regions, Energy competences in Bulgaria [64]

Table 82. Energy competences in Croatia (HR) according to the Committee of the Regions

CROATIA (HR)			
Legislative powers at the sub-national level	NO		
Description of competences			
Central level	**State authorities** are responsible for: - Overall legislation and implementation of EU energy legislation at the national level; - Strategy of energetic development; - Programme of energetic development; - Funding; - Croatian Energy Regulatory Agency. - Energy efficiency policies and strategies. - Introduces and continuously upgrades functionality of the system of measurement and verification of energy savings (SMIV) - Conducts training of all users of SMIV (the first set of regional workshops is planned by the end of the year) - Distributes A Guide through Energy Efficiency Activities - Promotes energy service contracts as required by the Directive (EED 2012/27 / EU) - Renewable Energy Sources, 2020 Plan		
Regional level	**Regional authorities** are responsible for: - Programmes for effective energy exploitation; - Planning and development of gas distribution system at County level; - Concessions for development of gas distribution system and for gas distribution activities; - Participation in decision-making on location and construction of new power plants, energy networks and other facilities; - Optional establishment of regional energy agencies.		
Local level	**Local authorities** are responsible for: - Programmes for effective energy exploitation; - Planning and development of thermal energy distribution facilities and systems; - Concessions for development of thermal energy distribution system and distribution of thermal energy; - Participation in decision-making on location and construction of new power plants, energy networks and other facilities; - Optional establishment of regional energy agencies (in cooperation with other local authorities).		
Responsible	Croatian Energy Regulatory Agency (HERA)	Multilev. govern.	Croatia's multilevel governance system can be consulted here [65]
Sources	- Law on gas market (OG: 28/13, 14/14,). - Law on energy (OG: 120/12, 14/14, 95/15, 102/15,).(ceased in 2013) - Law on thermal energy market (OG: 80/13, 14/14, 102/14, 95/15).		

Source: Committee of the Regions, Energy competences in Croatia [66]

Table 83. Energy competences in Cyprus (CY) according to the Committee of the Regions

CYPRUS (CY)			
Legislative powers at the sub-national level	NO		
Description of competences			
Central level	**The Energy Service of the Ministry of Commerce, Industry and Tourism** has the overall responsibility of Energy in Cyprus and specifically for: - Monitoring and coordinating the supply and availability of sufficient energy capacity for domestic needs; - Monitoring and participating in the formation of European policy for energy issues; - Suggesting ways for the implementation of the European Acquis, assisting in the preparation of laws, regulations and rules etc. and implementing programmes for their promotion; - Preparing and implementing programmes for energy conservation, the promotion of renewable energy sources (RES) and the developing of technologies for the utilisation of RES; - Assisting the government in the formation of the national energy policy for Cyprus in coordination with all other bodies involved.		
Regional level	**District authorities are responsible for:** The administration and coordination of central government policies in the field of energy at the district level.		
Local level	Municipalities and communities have no competencies in this area.		
Responsible	Ministry of Commerce, Industry and Tourism	Multilev. govern.	Cyprus' multilevel governance system can be consulted here [67]
Sources	- Constitution of the Republic of Cyprus, - Government web Portal - Ministry of Commerce, Industry and Tourism, energy service		

Source: Committee of the Regions, Energy competences in Cyprus [68]

Table 84. Energy competences in Czechia (CZ) according to the Committee of the Regions

CZECHIA(CZ)			
Legislative powers at the sub-national level	NO		
Description of competences			
Central level	Central government is responsible for: - Developing the national energy policy; - Issuing state approval to build new source facilities in the electricity and heat sectors, and - Ensuring the fulfilment of obligations arising from the international agreements and treaties binding on the Czechia or obligations arising from membership in international organisations.		
Regional level	**Regional authorities** are responsible for gas and electricity distribution and maintenance of energy networks.		
Local level	**Local authorities** are responsible for gas and electricity distribution and maintenance of energy networks.		
Responsible	Ministry of Industry and Trade	Multilev. govern.	Czechia's multilevel governance system can be consulted here [69]
Source s	Ministry of Industry and Trade		

Source: Committee of the Regions, Energy competences in Czechia [70]

Table 85. Energy competences in Denmark (DK) according to the Committee of the Regions

DENMARK (DK)			
Legislative powers at the sub-national level	NO		
Description of competences			
Central level	The central government is responsible for: - The Danish Energy Agency; - National and international efforts to prevent climate change; - Energy issues; - Conducting national geological surveys in Denmark and Greenland, and - Meteorology. - Windfarms		
Regional Level	No competencies identified at regional level.		
Local level	**Municipal authorities** are responsible for: - Energy supply, through local and regional energy companies, and - Energy-saving promotion and initiatives.		
Responsible	The Ministry of Energy, Utilities and Climate	Multilev. govern.	Denmark's multilevel governance system can be consulted here [71]
Sources	- Energy Policy in Denmark - Danish Energy Agency		

Source: Committee of the Regions, Energy competences in Denmark [72]

Table 86. Energy competences in Estonia (EE) according to the Committee of the Regions

ESTONIA (EE)	
Legislative powers at the sub-national level	NO
Description of competences	
Central level	The **Government** is responsible for: - The elaboration of national development plans in the field of energy, electricity and renewable energy, and ensuring their conformity with other national development plans; - Energy Security and national strategies; - The organisation of the financing, implementation and performance evaluation of such development plans; - Preparing of draft acts in the field of energy and ensuring their compliance with the Constitution and legal acts, as well as performance of the functions established by legal acts; - The organisation of international cooperation in the area of energy, including activities concerning the European Union. - Marine links between Estonia and Finland. - Renewable energy projects and subsidies. - Managing national liquid fuel stocks (through Estonian Oil Stockpiling Agency) in the event of oil supply disruption. The **Ministry of Environment** is responsible for implementation and co-ordination for the use of Oil Shale, policies pertaining to the environment in the energy sector. The **Ministry of Agriculture** is responsible for the implementation and co-ordination of development plans for enhancing the use of biomass and bioenergy.
Regional Level	No competencies identified at the regional level.
Local level	**Local government units** can determine is areas of DH only energy areas which determine providers of district heating. DH energy provision is derived from centralised sites and delivered via networks. This is invoked in areas where there are no practical alternatives for heat supply at the local level. **Local government units** also have responsibilities in licensing and spatial planning in the electricity sector.

Responsible	Ministry of Economic Affairs and Communications	Multilev. govern.	Estonia's multilevel governance system can be consulted here [73]
Sources	Estonia, Energy Policy, IEA Publication, 2013		

Source: Committee of the Regions, Energy competences in Estonia [74]

Table 87. Energy competences in France (FR) according to the Committee of the Regions

FRANCE (FR)			
Legislative powers at the sub-national level	NO		
Description of competences			
Central level	The **central government** is responsible for: - The overall legislation; - The assessment of the needs and planning of energy capacities; - The follow-up of energy policy implementation; - Safeguard measures in case of crisis; - The organisation of research, and - The Energy Regulation Agency.		
Regional level	Intermediate level - Departmental authorities are responsible for: - Electricity and gas distribution, and - Voluntary policies for renewable energy development. - Maîtrise de la demande d'énergie		
Local level	**Municipal authorities** are responsible for: Electricity and gas distribution. **Segolene Royal** give local government units access to accurate data on production and consumption of energy in their areas of responsibility.		
Responsible	Ministry of Environmment, Energy and Marine Affairs	Multilev. govern.	France's multilevel governance system can be consulted here [75]
Sources	- Code de l'Energie [Energy Code], Articles L131-1 to L131-3, L141-1 to L144-1, and L111-51. - Code général des collectivités territoriales [General code of Local Authorities], Article L2224-31.		

Source: Committee of the Regions, Energy competences in France [76]

Table 88. Energy competences in Greece (EL) according to the Committee of the Regions

GREECE (EL)	
Legislative powers at the sub-national level	NO
Description of competences	
Central level	**Central government** is responsible for: - Developing strategic planning about: Exploration and exploitation of hydrocarbons; Enhancement of energy efficiency and energy saving; Liberalisation of the natural gas and electricity markets; Monitoring of oil, gas, electricity and coal markets. - Discovering, protecting and managing sustainable energy resources; - Ensuring the adequacy of energy resources through stocks, international alliances and alternative energy resources; - Respecting the environment and sustainable development. - Improving energy efficiency and promoting energy saving; - Collecting and reporting official energy data to EU and international organisations through EL STAT certification. - Implementation of laws and regulations concerning production, installation, storage, transfer, delivery, supply and safety of energy (in particular oil and natural gas); - Planning and funding projects and actions about "Green Development"; - Developing policy, planning and initiatives on EU and international energy and mineral wealth affairs, as well as promotion of bilateral, multilateral and intergovernmental relations in these fields; - Supervision of the Hellenic Hydrocarbon Resources Management S.A and the Centre for Renewable Energy Sources and Energy Efficiency and the Institute for Geological and Mineral Research; - Developing strategic planning for mineral resources (mineral raw materials) with the constitutional principle of sustainable development and controlling implementation; - Permitting the exploitations of metallic minerals – industrial minerals, ornamental stones and high-temperature geothermal energy.
Regional level	**Regional authorities** are responsible for: - The implementation of programmes that focus on supporting small businesses, utilising renewable energy sources such as solar, wind, geothermal energy, and monitoring development programmes and projects launched by the Ministry of Environment, Energy and Climate Change; - Permitting individuals (for their own use) to install heating/cooling systems by exploiting the energy of geological formations or waters, not qualifying for geothermal materials; - Permitting individuals to construct and operate back power/energy stations as well as the resale of petroleum products for heating; and - The authorisation of installation, operation or expansion of energy/power stations. Minerals: - Establishing aggregates quarrying areas; - Permitting the exploitation of aggregates. Water: - Participating in inter-regional programmes in cooperation with the Directorate General for Water; - Monitoring activities to detect underground bodies of water and exploitation of water resources; - Informing the public about the protection of aquatic ecosystems; - Controlling the release of emissions, implementing and all necessary preventive measures against emergencies and imposing penalties in case of human activities resulting in water pollution; and - Conducting random checks. - Underground inland water management in collaboration with municipalities.
Local level	**Municipal authorities** are responsible for: - The protection, promotion and exploitation of local natural resources and areas of hot springs and mild or renewable energy resources as well as the construction, maintenance and management of respective projects and facilities; - Planning, constructing, maintaining, operating and managing natural gas networks; and - The electrification as well as the extension of electrical networks and power networks, within their administrative boundaries, in order to stimulate the local economy or to foster charity. **Minerals**: Imposition of measures for the reconstruction and restoration of areas with minerals. **Water**: Underground inland water management in collaboration with regions.

Responsible	Ministry of Environment and Energy	Multilev. govern.	Greece's multilevel governance system can be consulted here [77]
Sources	- Law 3463/2006 (OJ A 114/30.6.2006) 'Code for Municipalities and Communities', Article 75. - Law 3852/2010 (OJ A 87/7.6.2010) 'Reorganisation of Local Government - Kallikratis Programme', Articles 94 and 186. - Ministry of Environment, Energy and Climate Change, according to Presidential Decree 85/2012(OG 141/21.06.2012) - Statute Law 3175/2003(OJ A 207/29.8.2003.		

Source: Committee of the Regions, Energy competences in Greece [78]

Table 89. Energy competences in Hungary (HU) according to the Committee of the Regions

HUNGARY (HU)			
Legislative powers at the sub-national level	NO		
Description of competences			
Central level	The **Ministry of National Development State Secretariat** for climate and energy policy is responsible for: - The development of a long-term energy strategy, including the National Energy Strategy 2030, as well as sectoral energy strategies; - Action plans, policies and legislation; - Energy efficiency programmes; - Sustainable economic development. - Policy development; - Research and development; - Cooperation with the Minister of National Development. - Sustainable energy development policies. - Control of limited geological fuel resources, including ownership of mineral resources (particularly coal and uranium) as strategic resources. The **Hungarian Energy Office (MEH)** is the Government agency in charge of the regulation of the electricity and gas sectors. The Hungarian Atomic Energy Authority (HAEA) is responsible for: - Regulating, licensing, inspecting and enforcing nuclear safety; - Safeguarding accountancy for and control of nuclear materials; - Registration of radioactive materials and approval of their transport and packaging; - Policy-making support with regard to nuclear safety; - International relations; - Research and development; - Fulfilment of international conventions' requirements; - Nuclear emergency preparedness, source term assessment, notification; - Public information. The Atomic Energy Coordination Council (AECC) is responsible for: coordination and harmonisation of the ministerial and central administrative organisations activities in the field of safe use of nuclear energy, nuclear safety and radiation protection.		
Regional level	Other than facilitating national policies and ensuring maintenance of energy networks in areas of responsibility, no competencies identified at the regional level.		
Local level	Local authorities are responsible for: - Participating in the local supply of energy; - District heat supply.		
Responsible	Ministry of National Development State Secretariat	Multilev. govern.	Hungary's multilevel governance system can be consulted here [79]

Sources	- National Energy Strategy, 2030, Ministry of National Development, Hungary - An Energy overview of the Republic of Hungary, Department of Energy, USA - Act 74 on Electricity 2007 (Hungarian) - Enercee.net portal, Energy Country Profiles / Hungary - 2011. évi CLXXXIX. törvény Magyarország helyi önkormányzatairól [Local Self-Government Act No. CLXXXIX of 28.12.2011]

Source: Committee of the Regions, Energy competences in Hungary [80]

Table 90. Energy competences in Ireland (IE) according to the Committee of the Regions

IRELAND (IE)			
Legislative powers at the sub-national level	NO		
Description of competences			
Central level	- Electricity and gas policy; - Electricity and gas regulation; - Energy efficiency; - Energy poverty; - Oil security; - Corporate governance of state energy companies North-South energy cooperation; - Peat; - Energy research; - Implementing energy policy		
Regional	No regional competences		
Local level	- Delivering energy efficiency solutions; - Stimulating the increased uptake of renewable energy sources; - Promoting clean and sustainable transport.		
Responsible ministries / bodies	- Department of Communications, Energy and Natural resources - Agencies and Semi-state bodies, namely, the Electricity Supply Board, The Irish Gas Board, the Sustainable Energy Authority of Ireland, the Bord na Móna plc and Eir Grid). (Some of those agencies have a regional office.)	Multilev. govern.	Ireland's multilevel governance system can be consulted here [81]
Sources	- Constitution of Ireland – BUNREACHT NA hÉIREANN - Department of the Environment, Community and Local Government - Department of Communications, Energy and Natural resources - Local Government Act 1991 (Regional Assemblies) (Establishment) Order 2014 (SI 573 of 2014) - Local Government Act, 2001, Number 37 of 2001 - Public Service Information – Citizens Information - The Irish Regions – Brussels Office Website - The Association of Irish Energy Agencies webpage		

Source: Committee of the Regions, Energy competences in Ireland [82]

Table 91. Energy competences in Latvia (LV) according to the Committee of the Regions

LATVIA (LV)			
Legislative powers at the sub-national level	NO		
Description of competences			
Central level	The **Ministry of Economics** is responsible for: - Energy policy is part of the national economy policy; - Ensures efficient, safe and qualitative energy supply; - Promotes efficient use and balanced consumption of energy; - Promote economically justified competition; - Facilitates the use of local, renewable and secondary energy resources; and - Promotes the use of environmentally friendly technologies.		
Regional level	No regional competences		
Local level	**Local authorities** are responsible for: Street lighting.		
Responsible	Ministry of Economics	Multilev. govern.	Latvia's multilevel governance system can be consulted here [83]
Sources	- Energy Law - Ministry of Economics		

Source: Committee of the Regions, Energy competences in Latvia [84]

Table 92. Energy competences in Lithuania (LT) according to the Committee of the Regions

LITHUANIA (LT)			
Legislative powers at the sub-national level	NO		
Description of competences			
Central level	The **central Government** is responsible for the overall responsibility for energy policy. The long-term of the energy policy is laid down in the National Energy Strategy.		
Regional level	No regional competences		
Local level	**Local authorities** are responsible for: - The organisation of supply of heat and drinking water; and - Making arrangements for the lighting of the territories used for public needs.		
Responsible	Ministry of Energy	Multilev. govern.	Lithuania's multilevel governance system can be consulted here [85]
Sources	- Law on Local Self-Government - Law on Energy - National Energy Strategy		

Source: Committee of the Regions, Energy competences in Lithuania [86]

Table 93. Energy competences in Luxembourg (LU) according to the Committee of the Regions

LUXEMBOURG (LU)			
Legislative powers at the sub-national level	NO		
Description of competences			
Central level	The Ministry of Sustainable Development and Infrastructure and the Ministry of Economy, Directorate General Energy are responsible for: - The promotion of renewable energies; - Energie agency; - Financial aid for the use of renewable energies, and - The promotion of rational use of energy. The Economic interest grouping MyEnergy is in charge of information and counsel relating to energy efficiency and renewable energy sources.		
Regional level	No regional competences		
Local level	**Local authorities – municipalities**: Municipalities may benefit from the financial aid for the use of renewable energies and the promotion of rational use of energy.		
Responsible ministries /	- Ministry of Sustainable Development - Ministry of Economy, Directorate General Energy	Multilev. govern.	Luxembourg's multilevel governance system can be consulted here [87]
Sources	- Arrêté grand-ducal du 23 décembre 2013 portant constitution des Ministères [Grand ducal decree on the establishement of ministries of 23 Dicember 2013] (Mém. A – 226 of 27 Dicember 2013, p.4228). - MyEnergy Luxembourg portal, no information as to when it was lastly updated © 1015 (Last consultation:18.08.2015). - Environment Portal, Les énergies renouvelables, updated on 05.03.2014, (Last consultation:18.08.2016). - Code Comunal [Municipal Act] (Dernière mise à jour au 30 juin 2016 (Mémorial A - 111). (Last consultation 18.08.2016) - Règlement grand-ducal du 20 avril 2009 instituant un régime d'aides pour la promotion de l'utilisation rationnelle de l'énergie et la mise en valeur des énergies renouvelables [Grand Ducal Regulation on the establishment of financial aids for the use of renewable energies and the promotion of energies' rational use] (Mém. A –– 83 of 28 April 2009, p. 979), (Last consultation: 08.02.2012).		

Source: Committee of the Regions, Energy competences in Luxembourg [88]

Table 94. Energy competences in Malta (MT) according to the Committee of the Regions

MALTA (MT)	
Legislative powers at the sub-national level	NO
Description of competences	
Central level	The Malta Resources Authority and the Sustainable Energy and Water Conservation Unit is responsible for: - Sustainable energy policy and legislation; - Energy supply; - Energy efficiency; - Energy labelling; - Importation, storage and sale; - Promotion of renewable resources; - Energy sector licenses. - Has regulatory responsibilities relating to energy.
Regional level	No regional level competences
Local level	The **Local Councils** are responsible for adopting measures to ensure the more efficient use of energy.

Responsible	- Malta Resources Authority - The Sustainable Energy and Water Conservation Unit	Multilev. govern.	Malta's multilevel governance system can be consulted here [89]
Sources	- Constitution of Malta, 21 September 1964 - Local Councils Act, 23 July 1993 - Regional Committees Regulation, 5 August 2011 - Malta Resources Authority - The Sustainable Energy and Water Conservation Unit		

Source: Committee of the Regions, Energy competences in Malta [90]

Table 95. Energy competences in Poland (PL) according to the Committee of the Regions

POLAND (PL)	
Legislative powers at the sub-national level	NO
Description of competences	
Central level	The **Ministry of Development** is responsible for: - The overall energy policy; - Improving energy efficiency; - Increasing supply security; - Developing competitive fuels and energy markets; - Introducing nuclear powers; - Increasing use of renewable energies; - Reducing the energy impact on the environment; - Defining priorities in Poland's Energy Policy until 2030; - Implementing tasks to shape the energy policy and regulatory environment; - Coordinating the energy policy; - Energy carrier diversification and energy source diversification. The **Ministry of Treasury** is in charge of: restructuring of public energy companies. The Ministry of the Environment is responsible for: - Creating and implementing Poland's climate policy; - Creating inventories of greenhouse gas emissions and sinks; - Reporting and verification. The **Ministry of Finance** is in charge of: - Regulating end-use energy prices; - Providing funds for state energy enterprises. The Polish National Energy Conservation Agency is responsible for: - Linking governmental and non-governmental organisations with regulatory bodies, the energy distribution sector and end-users; - Developing governmental, regional, local and individual initiatives on energy efficiency and renewable sources use; The **Energy Regulatory Office** (an independent regulatory authority) is in charge of: - Coordinating the energy sector and its prices; - Issuing operating licenses; - Monitoring developments in prices and tariffs; - Promoting energy efficiency. The **National Atomic Energy Agency** is the regulatory authority in charge of atomic energy issues.
Regional level	**Regions** are responsible for: - Testing compliance of energy and fuel supply with the state energy policy; - Promoting and disseminating knowledge about the future directions of energy policy in the Region.
Local level	**Local authorities** are responsible for: - Electricity, gas and heat supply. - Planning and organising activities aimed at achieving energy efficiency, as well as promoting the reduction of energy consumption.

Responsible ministries / bodies	- Ministry of Development - Ministry of Finance - Ministry of Treasury - Energy Regulatory Office - National Atomic Energy Agency - Ministry of Environment - Polish National Energy Conservation Agency - Regional authorities (Voivodships) - County (powiat) - Local authorities (Gmina)	Multilev. govern.	Poland's multilevel governance system can be consulted here [91]
Sources	- Enercee.net portal - Energy Regulatory Office - Ministry of Development - Ministry of Finance - Ministry of Environment - Ministry of Treasury - National Atomic Energy Agency - Energy Act and 2014 amendments [Ustawa z dnia 10 kwietnia 1997 r. Prawo energetyczne (Dz. U. z 2012 r. poz. 1059]		

Source: Committee of the Regions, Energy competences in Poland [92]

Table 96. Energy competences in Romania (RO) according to the Committee of the Regions

ROMANIA (RO)			
Legislative powers at the sub-national level	NO		
Description of competences			
Central level	**Central government** is responsible for: - Provision and implementation of strategy programmes to increase mineral resources; - Development of the regulatory and institutional framework necessary for achieving the strategic objectives in the following areas: energy conservation, recovery facilities, recycling and waste management, and, where appropriate, privatisation of companies; - Managing the international relations in the field of energy; - Application of the Treaty of Accession of Romania to the EU in the field of energy; - Ensuring the uniform application and the compliance of the activities with regulations in the field and the proper functioning of the institutions operating under its authority; - Public administration of: mineral resources, transport, energy production and distribution, transport and oil and gas storage, - Management of EU funding in areas under its responsibility, - Two Nuclear Power Stations		
Regional level	The **County Council** provides, according to its competences and according to the law, the framework for ensuring public services of county interest regarding community services of public utility of county and gas supply.		
Local level	The **Towns and Communes** are responsible for: - Shared competencies between Municipalities, Towns and Communes and the central public administration authorities (Article 24 of Framework Law n°195/2006 on decentralisation): - Network of supply of heat produced by centralised systems.		
Responsible	Ministry of Energy	Multilev. govern.	Romania's multilevel governance system can be consulted here [93]

Sources	- Constitution of Romania of 8 December 1991 amended, published in the Romanian Official Gazette Monitorul Oficial al României, Part I, no. 233 of 21 November 1991. - Decision no. 1634 of December 29, 2009, on the organisation and functioning of the Framework Law no. 195/2006 on decentralisation, published in the Monitorul Oficial al României, Part I, no. 453 of 25 May 2006, revised. - Ministry of Economy, Trade and Business Environment - Law N°215/2001 of Local Public Administration, published in the Monitorul Oficial al României, Part I, no. 204 of 23 April 2001, as subsequently amended; last modified February 2007. - Law no. 315/2004 on regional development in Romania, published in the Monitorul Oficial al României, Part I, no. 577 of 29 June 2004, revised. - Law no. 340/2004 on the institution of the prefect, the consolidated version published in the Monitorul Oficial al României, Part I, no. 225 of 24 March 2008 revised.

Source: Committee of the Regions, Energy competences in Romania [94]

Table 97. Energy competences in Slovakia (SK) according to the Committee of the Regions

SLOVAKIA (SK)			
Legislative powers at the sub-national level	NO		
Description of competences			
Central level	**The central government** is responsible for the overall policy and legislation in the field of: - Electricity industry; - Heating industry; - Improving the thermal performance of buildings through Government insulation schemes and subsidies for systemic defects. - Gas industry; - Electricity and gas market liberalisation and power industry restructuring; - The production and transport of oil; - Coal production: - The use of renewable energy sources; - The diversification of energy sources; - Energy supply, including potential State of emergency; - The rationalisation of fuel and energy consumption, and - Atomic waste disposal. - Measures for increased energy efficiency in industrial production.		
Regional level	- Apply legislative measures at regional level. - Implement measures according to the Energy Efficiency Action Plan, 2014-2016.		
Local level	- Apply legislative measures at municipal level. - Implement measures according to the Energy Efficiency Action Plan, 2014-2016.		
Responsible	Ministry of the Economy of the Slovak Republic through Slovak Innovatino and Energy Agency.	Multilev. govern.	Slovakia's multilevel governance system can be consulted here [95]
Sources	- National Council of the Slovak Republic Act No.221/1996 on the Slovak Republic Territorial and Administrative Organisation, last amendment 453/2001. - National Council of the Slovak Republic Act No.222/1996 on the Organisation of Local State Administration, last amendment 525/2003. - National Council of the Slovak Republic Act No.302/2001 on the Government of higher territorial units (Law on the region), last amendment 445/2008. - National Council of the Slovak Republic Act No.416/2001 on the transfer of some competences from State administration to Municipalities and higher territorial units, last amendment 103/2003. - Slovak National Council Act No. 369/1990 on Municipalities, last amendment 204/2010.		

Source: Committee of the Regions, Energy competences in Slovakia [96]

Table 98. Energy competences in Slovenia (SL) according to the Committee of the Regions

SLOVENIA (SL)			
Legislative powers at the sub-national level	NO		
Description of competences			
Central level	The Ministry of Infrastructure, Energy Directorate is responsible for: - Drawing up energy policy and legislation; - Preparation and implementation of national energy policy (energy generation and processing, production, transfer, distribution and supply, efficient use and renewable sources of energy for heating and transport; - management of the energy sector database information system for the needs of the sectoral ministry and elaboration of economic analyses for the energy sector - Encouraging the use of renewable energy sources and measures for higher energy efficiency; - Granting mining rights for research and exploitation of all types of mineral resources; - Co-operation within bilateral and multilateral regional energy frameworks.		
Regional level	No regional energy competence is identified.		
Local level	Local authorities are responsible for: - Provide for the construction and maintenance of municipal energy supply; - Regulating and maintaining power supply facilities.		
Responsible	Ministry of Infrastructure, Energy Directorate	Multilev. govern.	Slovenia's multilevel governance system can be consulted here [97]
Sources	- Ministry of Infrastructure, Energy Directorate - The Constitution of the Republic of Slovenia (Official Gazette of the Republic of Slovenia, No. 33/91-I, 42/97, 66/2000, 24/03, 69/04, 68/06, 47/13 and 75/16) - Local Self-Government Act (Official Gazette RS, Nos. 94/07 – official consolidated text, 76/08, 79/09, 51/10, 40/12 – ZUJF, 14/15 – ZUUJFO, 11/18 – ZSPDSLS-1, 30/18 and 61/20 – ZIUZEOP-A)		

Source: Committee of the Regions, Energy competences in Slovenia [98]

Table 99. Energy competences in Sweden (SE) according to the Committee of the Regions

SWEDEN (SE)			
Legislative powers at the sub-national level	NO		
Description of competences			
Central level	The central government is responsible for: - The security of supply; - Reliable electricity transmission; - Renewable energy; - Wind power; - Electricity certificates, and - Improved energy efficiency.		
Regional	The County Administrative Board has responsibility in the field of energy.		
Local level	Municipalities may act in the energy area on a voluntary basis		
Responsible	- Ministry for the Environment and Energy - The Swedish Energy Agency	Multilev. govern.	Sweden's multilevel governance system can be consulted here [99]
Sources	Kommunallag (2017:725) [Local Government Act]. Entered into force 1 January 2018, Amended through SFS 2019:835.		

Source: Committee of the Regions, Energy competences in Sweden [100]

Table 100. Energy competences in The Netherlands (NL) according to the Committee of the Regions

THE NETHERLANDS (NL)			
Legislative powers at the sub-national level	NO		
Description of competences			
Central level	The Ministry of Economic Affairs is responsible for: - Developing Dutch energy policy, including policies for renewable energy, energy transition, energy efficiency and bio-based economy, and research, development and demonstration; - Acting as the lead authority for the State Co-ordination Programme for the planning of large-scale energy infrastructure projects - General energy targets (CO_2 reduction strategy) and policies. - Nuclear energy. - Coordinating role on energy production for windmill parks above 100MW. - Providing subsidies for alternative energy sources. - promoting new, sustainable growth and technologies in the energy sector (the National Energy Accord for Sustainable Growth signed in 2013) - promoting the generation of electricity from renewable sources through grants, tax deductions and tax savings The **Ministry of Infrastructure and the Environment** is responsible for energy efficiency in transport policy, The **Ministry of the Interior and Kingdom Relations** is responsible for energy efficiency in buildings. The **Netherlands Authority for Consumers and Markets** (authority under the Ministry of Economic Affairs) has regulatory powers to supervise electricity and natural gas markets as well as district heating markets		
Regional level	**Regional authorities** have relatively extensive competencies and are responsible for: - Installing or expanding energy production installations between 5MW and 100MW. - Ensuring compliance comply with environmental and safety requirements; - Promoting renewable energy for the regional economy (provinces signed the National Energy Accord for Sustainable Growth signed in 2013) - Providing subsidies for alternative energy sources		
Local level	**Local authorities** are responsible for: - Determining the policy regarding public illumination; - Responsible for the maintenance of the electricity cables; - Providing subsidies for alternative energy sources. **Provinces and municipalities** are not permitted to restrict the generation, transport and delivery of energy.		
Responsible ministries /	- Ministry of Economic Affairs - Ministry of Infrastructure and the Environment - Ministry of the Interior and Kingdom Relations - Netherlands Authority for Consumers and Markets	Multilev. govern.	The Netherlands' multilevel governance system can be consulted here [101]
Sources	- Electricity law -Electriciteitswet 1998 as amended to 01-07-2016 - Government in Netherlands, Energy Policy - IEA, 2014, The Netherlands Energy Policy Review - IPO (Interprovinciaal Overleg) - Rijksoverheid - Ministry of Economic Affairs - Ministry of Infrastructure and the Environment - Netherlands Authority for Consumers and Markets - Ministry of the Interior and Kingdom Relations - VNG (Vereniging Van Nederlandse Gemeenten), Beleid openbare verlichting 2011 – 2020: Gemeente Uithoorn - SER, 2013 Summary of the Energy agreement for Sustainable Growth		

Source: Committee of the Regions, Energy competences in The Netherlands [102]

Annex 2. Eurostat regional data

The following Table 101 complements what was exposed in section 3.1.1.1 on Eurostat data by providing direct access to the available datasets and identifying the codes of the indicators for an easy search within Eurostat and the NUTS level they correspond to.

Table 101. Eurostat regional data by NUTS level

reg_agr	1. REGIONAL AGRICULTURE STATISTICS	NUTS
reg_aei	1.1 Agri-environmental indicators	
aei_pr_soiler	Estimated soil erosion by water, by erosion level, land cover and NUTS 3 regions (source: JRC)	NUTS 3
aei_fm_ms	Manure storage facilities by NUTS 3 regions	NUTS 3
reg_ef	1.2 Structure of agricultural holdings	
reg_ef_2010	1.2.1 Structure of agricultural holdings 2010	
reg_ef_kv	1.2.1.1 Key farm variables	
ef_kvaareg	Key farm variables: area, livestock (LSU), labour force and standard output (SO) by agricultural size of farm (UAA), legal status of holding and NUTS 2 regions	NUTS 2
ef_kvecsleg	Key variables: area, livestock (LSU), labour force and standard output (SO) by economic size of farm (SO in Euro), legal status of holding and NUTS 2 regions	NUTS 2
ef_kvftreg	Key variables: area, livestock (LSU), labour force and standard output (SO) by type of farming (2-digit) and NUTS 2 regions	NUTS 2
reg_ef_po	1.2.1.2 Farm land use - Permanent crops, other farmland, irrigation	
ef_oluaareg	Land use: number of farms and areas of different crops by agricultural size of farm (UAA) and NUTS 2 regions	NUTS 2
ef_oluecsreg	Land use: number of farms and areas of different crops by economic size of farm (SO in Euro) and NUTS 2 regions	NUTS 2
ef_popermreg	Permanent crops: number of farms and areas by size of permanent crop area and NUTS 2 regions	NUTS 2
ef_poirrig	Irrigation: number of farms, areas and equipment by size of irrigated area and NUTS 2 regions	NUTS 2
reg_ef_ols	1.2.1.3 Overview - farm livestock	
ef_olsaareg	Livestock: number of farms and heads of animals of different types by agricultural size of farm (UAA) and NUTS 2 regions	NUTS 2
ef_olslsureg	Livestock: number of farms and heads of animals by livestock units (LSU) of farm and NUTS 2 regions	NUTS 2
ef_olsecsreg	Livestock: number of farms and heads of animals by economic size of farm (SO in Euro) and NUTS 2 regions	NUTS 2
reg_ef_molf	1.2.1.4 Farm labour force and management	
ef_olfreg	Labour force: number of persons and farm work (AWU) by sex of workers and NUTS 2 regions	NUTS 2
ef_mporganic	types of animals by agricultural size of farm (UAA) and NUTS 2 regions	NUTS 2
ef_mptenure	Type of tenure: number of farms and areas by agricultural size of farm (UAA) and NUTS 2 regions	NUTS 2
ef_mptenurecs	Type of tenure: number of farms and areas by economic size of farm (SO in Euro) and NUTS 2 regions	NUTS 2
reg_ef_h	1.2.2 Structure of agricultural holdings - historical data (1990 - 2007)	
reg_ef_ov	1.2.2.1 Overview of agricultural holdings	
ef_ov_kvaa	Key variables by legal status of holding, size of farm (UAA) and NUTS 2 regions	NUTS 2
ef_ov_kvftreg	Key variables by type of farming (2-digit) and NUTS 2 regions	NUTS 2
reg_ef_lu	1.2.2.2 Land use	
ef_lu_ovcropaa	Farmland: number of farms and areas by size of farm (UAA) and NUTS 2 regions	NUTS 2

ef_lu_ovcropesu	Farmland: number of farms and areas by economic size of farm (ESU) and NUTS 2 regions	NUTS 2
ef_lu_pcreg	Permanent crops: number of farms and areas by size of farm (UAA), size of permanent crop area and NUTS 2 regions	NUTS 2
ef_lu_ofirrig	Irrigation: number of farms, areas and equipment by size of farm (UAA) and NUTS 2 regions	NUTS 2
reg_ef_ls	1.2.2.3 Livestock	
ef_ls_ovaareg	Livestock: number of farms and heads by size of farm (UAA) and NUTS 2 regions	NUTS 2
ef_ls_ovlsureg	Livestock: number of farms and heads by livestock units (LSU) of farm and NUTS 2 regions	NUTS 2
ef_ls_ovesu	Livestock: number of farms and heads by economic size of farm (ESU) and NUTS 2 regions	NUTS 2
reg_ef_so	1,2.2.4 Special interest topics	
ef_r_nuts	Structure of agricultural holdings by NUTS 3 regions - main indicators	NUTS 3
reg_apro	1.2.3 Agricultural production	
agr_r_accts	Economic accounts for agriculture by NUTS 2 regions	NUTS 2
reg_dem	2. REGIONAL DEMOGRAPHIC STATISTICS	NUTS
reg_dempoar	2.1 Population and area	
demo_r_d2jan	Population on 1 January by age, sex and NUTS 2 region	NUTS 2
demo_r_d3area	Area by NUTS 3 region	NUTS 3
demo_r_d3dens	Population density by NUTS 3 region	NUTS 3
demo_r_pjangroup	Population on 1 January by age group, sex and NUTS 2 region	NUTS 2
demo_r_pjangrp3	Population on 1 January by age group, sex and NUTS 3 region	NUTS 3
demo_r_pjanaggr3	Population on 1 January by broad age group, sex and NUTS 3 region	NUTS 3
demo_r_pjanind2	Population: Structure indicators by NUTS 2 region	NUTS 2
demo_r_pjanind3	Population: Structure indicators by NUTS 3 region	NUTS 3
demo_r_gind3	Population change - Demographic balance and crude rates at regional level (NUTS 3)	NUTS 3
reg_demfer	2.2 Fertility	
demo_r_births	Live births (total) by NUTS 3 region	NUTS 3
demo_r_fagec3	Live births by age group of the mothers and NUTS 3 region	NUTS 3
demo_r_fagec	Live births by mother's age and NUTS 2 region	NUTS 2
demo_r_frate2	Fertility rates by age and NUTS 2 region	NUTS 2
demo_r_find2	Fertility indicators by NUTS 2 region	NUTS 2
demo_r_find3	Fertility indicators by NUTS 3 region	NUTS 3
reg_demmor	2.3 Mortality	
demo_r_deaths	Deaths (total) by NUTS 3 region	NUTS 3
demo_r_mweek3	Deaths by age group, sex, week and NUTS 3 region	NUTS 3
demo_r_magec3	Deaths by age group, sex and NUTS 3 region	NUTS 3
demo_r_magec	Deaths by age, sex and NUTS 2 region	NUTS 2
demo_r_minf	Infant mortality by NUTS 2 region	NUTS 2
demo_r_minfind	Infant mortality rates by NUTS 2 region	NUTS 2
demo_r_mlife	Life table by NUTS 2 region	NUTS 2
demo_r_mlifexp	Life expectancy by age, sex and NUTS 2 region	NUTS 2
reg_cens_11r	2.4 Census 2011 round	
cens_11rdp2	2.4.1 Data on persons	
cens_11rstr	2.4.1.1 Population structure	

cens_11ag_r3	Population by single year of age and NUTS 3 region	NUTS 3
cens_11rfc	2.4.1.2 Population by family characteristics	
cens_11ms_r3	Population by marital status and NUTS 3 region	NUTS 3
cens_11fs_r3	Population by family status and NUTS 3 region	NUTS 3
cens_11rec	2.4.1.3 Population by employment characteristics	
cens_11aed_r2	Population by current activity status, educational attainment level and NUTS 2 region	NUTS 2
cens_11ao_r2	Population by current activity status, occupation and NUTS 2 region	NUTS 2
cens_11an_r2	Population by current activity status, NACE Rev. 2 activity and NUTS 2 region	NUTS 2
cens_11empo_r2	Population by status in employment, occupation and NUTS 2 region	NUTS 2
cens_11empn_r2	Population by status in employment, NACE Rev. 2 activity and NUTS 2 region	NUTS 2
cens_11rmc2	2.4.1.4 Population by migration characteristics	
cens_11ctzo_r2	Population by group of citizenship, occupation and NUTS 2 region	NUTS 2
cens_11cobe_r2	Population by group of country of birth, educational attainment level and NUTS 2 region	NUTS 2
cens_11coba_r2	Population by group of country of birth, current activity status and NUTS 2 region	NUTS 2
cens_11cobo_r2	Population by group of country of birth, occupation and NUTS 2 region	NUTS 2
cens_11arco_r2	Population by period of arrival in the country, country of birth and NUTS 2 region	NUTS 2
reg_cens_01r	2.5 Census 2001 round	
cens_01rstr	2.5.1 Population structure	
cens_01rsctz	Population by sex, citizenship and NUTS 3 regions	NUTS 3
cens_01ract	2.5.2 Active population	
cens_01rapop	Population by sex, age group, current activity status and NUTS 3 regions	NUTS 3
cens_01ramigr	Total and active population by sex, age, employment status, residence one year prior to the census and NUTS 3 regions	NUTS 3
cens_01ractz	Employed persons aged 15 and over by sex, citizenship, economic activity (NACE Rev. 1), status in employment and NUTS 3 regions	NUTS 3
cens_01redu	2.5.3 Educational attainment level	
cens_01reisco	Employed persons by sex, age group, educational attainment level, occupation (ISCO-88) and NUTS 3 regions	NUTS 3
cens_01rews	Population by sex, age group, educational attainment level, current activity status and NUTS 3 regions	NUTS 3
cens_01rhou	2.5.4 Households	
cens_01rhtype	Population by sex, age group, household status and NUTS 3 regions	NUTS 3
cens_01rhsize	Population by sex, age group, size of household and NUTS 3 regions	NUTS 3
cens_01rheco	Private households by composition, size and NUTS 3 regions	NUTS 3
cens_01rhagchi	Private households by composition, age group of children and NUTS 3 regions	NUTS 3
cens_01rdws	2.5.5 Dwellings	
cens_01rdhh	Dwellings by type of housing, building and NUTS 3 regions	NUTS 3
cens_01rdbuild	Persons by type of building and NUTS 3 regions	NUTS 3
reg_eco10	3. REGIONAL ECONOMIC ACCOUNTS	
reg_eco10gdp	3.1 Gross domestic product indicators	
nama_10r_2gdp	Gross domestic product (GDP) at current market prices by NUTS 2 regions	NUTS 2
nama_10r_3popgdp	Average annual population to calculate regional GDP data (thousand persons) by NUTS 3 regions	NUTS 3
nama_10r_3gdp	Gross domestic product (GDP) at current market prices by NUTS 3 regions	NUTS 3
nama_10r_2gvagr	Real growth rate of regional gross value added (GVA) at basic prices by NUTS 2 regions - percentage change on previous year	NUTS 2

reg_eco10brch	3.2 Branch and household accounts	
nama_10r_3gva	Gross value added at basic prices by NUTS 3 regions	NUTS 3
nama_10r_2gfcf	Gross fixed capital formation by NUTS 2 regions	NUTS 2
nama_10r_2coe	Compensation of employees by NUTS 2 regions	NUTS 2
nama_10r_3empers	Employment (thousand persons) by NUTS 3 regions	NUTS 3
nama_10r_2emhrw	Employment (thousand hours worked) by NUTS 2 regions	NUTS 2
nama_10r_2hhinc	Income of households by NUTS 2 regions	NUTS 2
reg_educ	4. REGIONAL EDUCATION STATISTICS	
reg_educ_11	4.1 Regional education statistics - ISCED 2011	
educ_uoe_enrp03	Pupils enrolled in early childhood education by sex and NUTS2 regions	NUTS 2
educ_uoe_enrp06	Pupils enrolled in primary education by sex and NUTS2 regions	NUTS 2
educ_uoe_enrs03	Pupils enrolled in lower-secondary education by programme orientation, sex and NUTS2 regions	NUTS 2
educ_uoe_enrs06	Pupils enrolled in upper secondary education by programme orientation, sex and NUTS2 regions	NUTS 2
educ_uoe_enrs09	Pupils enrolled in post-secondary non-tertiary education by programme orientation, sex and NUTS2 regions	NUTS 2
educ_uoe_enrt05	Ratio of the proportion of tertiary students over the propotion of the population by NUTS1 and NUTS2 regions	NUTS 2
educ_uoe_enrt06	Students enrolled in tertiary education by education level, programme orientation, sex and NUTS2 regions	NUTS 2
educ_uoe_enra11	Pupils and students enrolled by education level, sex and NUTS2 regions	NUTS 2
educ_uoe_enra12	Pupils and students enrolled by sex, age and NUTS2 regions	NUTS 2
educ_uoe_enra13	Distribution of pupils and students enrolled in general and vocational programmes by education level and NUTS2 regions	NUTS 2
educ_uoe_enra14	Participation rates of selected age groups in education at regional level	NUTS 1
educ_uoe_enra15	Participation rates in selected education levels at regional level	NUTS 1
reg_educ_97	4.2 Regional education statistics - ISCED 1997	
educ_renrlrg1	Students by level of education, orientation, sex and NUTS 2 regions	NUTS 2
educ_renrlrg3	Students by age, sex and NUTS 2 regions	NUTS 2
educ_regind	Education indicators by NUTS 2 regions	NUTS 2
trng_lfse_04	Participation rate in education and training (last 4 weeks) by NUTS 2 regions	NUTS 2
edat_lfse_04	Population aged 25-64 by educational attainment level, sex and NUTS 2 regions (%)	NUTS 2
edat_lfse_12	Population aged 30-34 by educational attainment level, sex and NUTS 2 regions (%)	NUTS 2
edat_lfse_16	Early leavers from education and training by sex and NUTS 2 regions	NUTS 2
edat_lfse_22	Young people neither in employment nor in education and training by sex and NUTS 2 regions (NEET rates)	NUTS 2
edat_lfse_33	Employment rates of young people not in education and training by sex, educational attainment level, years since completion of highest level of education and NUTS 2 regions	NUTS 2
reg_sct	5. REGIONAL SCIENCE AND TECHNOLOGY STATISTICS	
reg_rd	5.1 R&D expenditure and personnel	
rd_e_gerdreg	Intramural R&D expenditure (GERD) by sectors of performance and NUTS 2 regions	NUTS 2
rd_p_persreg	Total R&D personnel and researchers by sectors of performance, sex and NUTS 2 regions	NUTS 2
reg_htec	5.2 Employment in high technology sectors	
htec_emp_reg	Employment in technology and knowledge-intensive sectors by NUTS 2 regions and sex (1994-2008, NACE Rev. 1.1)	NUTS 2

htec_emp_reg2	Employment in technology and knowledge-intensive sectors by NUTS 2 regions and sex (from 2008 onwards, NACE Rev. 2)	NUTS 2
htec_emp_risco	Employment in technology and knowledge-intensive sectors by NUTS 1 regions and type of occupation (1994-2008, NACE Rev. 1.1)	NUTS 1
htec_emp_risco2	Employment in technology and knowledge-intensive sectors by NUTS 1 regions and type of occupation (from 2008 onwards, NACE Rev. 2)	NUTS 1
htec_emp_risced	Employment in technology and knowledge-intensive sectors by NUTS 1 regions and level of education (1994-2008, NACE Rev. 1.1)	NUTS 1
htec_emp_risced2	Employment in technology and knowledge-intensive sectors by NUTS 1 regions and level of education (from 2008 onwards, NACE Rev. 2)	NUTS 1
reg_hrst	5.3 Human resources in Science and Technology (HRST)	
hrst_st_rcat	HRST by category and NUTS 2 regions	NUTS 2
hrst_st_rsex	HRST by category, sex and NUTS 1 regions	NUTS 1
hrst_st_rage	HRST by category, age and NUTS 1 regions	NUTS 1
hrst_st_rsec	Employed HRST by category, NACE Rev. 1.1 activity and NUTS 1 regions (1994 - 2007)	NUTS 1
hrst_st_rsec2	Employed HRST by category, NACE Rev. 2 activity and NUTS 1 regions (from 2008 onwards)	NUTS 1
reg_ipr	5.4 Intellectual property rights	
reg_pat	5.4.1 Patent	
pat_ep_rtot	Patent applications to the EPO by priority year by NUTS 3 regions	NUTS 3
pat_ep_ripc	Patent applications to the EPO by priority year by NUTS 3 regions, international patent classification (IPC) sections and classes	NUTS 3
pat_ep_rtec	High-tech patent applications to the EPO by priority year by NUTS 3 regions	NUTS 3
reg_ipr_t	5.4.2 Community trade marks (CTM)	
ipr_ta_reg	European Union trade mark (EUTM) applications by NUTS 3 regions	NUTS 3
ipr_ta_gdpr	European Union trade mark (EUTM) applications per billion GDP by NUTS 3 regions	NUTS 3
ipr_ta_popr	European Union trade mark (EUTM) applications per million population by NUTS 3 regions	NUTS 3
reg_ipr_d	5.4.3 Community design (CD)	
ipr_da_reg	Community design (CD) applications by NUTS 3 regions	NUTS 3
ipr_da_gdpr	Community design (CD) applications per billion GDP by NUTS 3 regions	NUTS 3
ipr_da_popr	Community design (CD) applications per million population by NUTS 3 regions	NUTS 3
ipr_dfa_reg	Community designs (CD) by NUTS 3 regions	NUTS 3
ipr_dr_reg	Registered Community designs (RCD) by NUTS 3 regions	NUTS 3
reg_sbs	6. REGIONAL STRUCTURAL BUSINESS STATISTICS	
sbs_r_nuts06_r2	SBS data by NUTS 2 regions and NACE Rev. 2 (from 2008 onwards)	NUTS 2
sbs_r_3k_my_r2	Multiannual statistics for distributive trades (NACE Rev. 2, G) by NUTS 2 regions	NUTS 2
sbs_r_nuts03	SBS data by NUTS 2 regions (NUTS 2006) and NACE Rev. 1.1 (1995-2007)	NUTS 2
sbs_cre_rreg	Number of local units, persons employed and wages and salaries by NUTS 2 regions	NUTS 2
sbs_r_3f_my	Multi yearly statistics by NUTS 2 regions (NUTS 2006) (sbs_r_3f_my)	NUTS 2
reg_bd	7. REGIONAL BUSINESS DEMOGRAPHY	
bd_hgnace2_r3	Business demography and high growth enterprise by NACE Rev. 2 and NUTS 3 regions	NUTS 3
bd_size_r3	Business demography by size class and NUTS 3 regions	NUTS 3
bd_enace2_r3	Employer business demography by NACE Rev. 2 and NUTS 3 regions	NUTS 3
bd_esize_r3	Employer business demography by size class and NUTS 3 regions	NUTS 3
reg_hlth	8. REGIONAL HEALTH STATISTICS	
reg_hlth_cdeath	8.1 Causes of death	

hlth_cd_acdr2	Causes of death - crude death rate by NUTS 2 region of residence	NUTS 2
hlth_cd_anr	Causes of death - absolute number - annual data	NUTS 1
hlth_cd_acdr	Causes of death by NUTS 2 regions - crude death rate per 100 000 inhabitants - annual data	NUTS 2
hlth_cd_ysdr1	Causes of death by NUTS 2 regions - standardised death rate per 100 000 inhabitants, 3 year average	NUTS 2
hlth_cd_ycdrf	Causes of death by NUTS 2 regions - crude death rate per 100 000 inhabitants, 3 year average - females	NUTS 2
hlth_cd_ycdrm	Causes of death by NUTS 2 regions - crude death rate per 100 000 inhabitants, 3 year average - males	NUTS 2
hlth_cd_ycdrt	Causes of death by NUTS 2 regions - crude death rate per 100 000 inhabitants, 3 year average - total	NUTS 2
hlth_cd_ynrf	Causes of death by NUTS 2 regions - absolute number, 3 year average - females	NUTS 2
hlth_cd_ynrm	Causes of death by NUTS 2 regions - absolute number, 3 year average - males	NUTS 2
hlth_cd_ynrt	Causes of death by NUTS 2 regions - absolute number, 3 year average - total	NUTS 2
hlth_cd_yro	Causes of death - deaths by NUTS 2 region of residence and occurrence, 3 year average	NUTS 2
hlth_cd_ysdr2	Causes of death - standardised death rate by NUTS 2 region of residence, 3 year average	NUTS 2
hlth_cd_ycdr2	Causes of death - crude death rate by NUTS 2 regions of residence, 3 year average	NUTS 2
hlth_cd_ypyll	Causes of death - years and potential years of life lost by NUTS 2 regions of residence, 3 year average	NUTS 2
hlth_cd_yinfr	Causes of death - infant mortality by NUTS 2 region of residence, 3 year average	NUTS 2
hlth_cd_yinfo	Causes of death - infant mortality by NUTS 2 region of occurrence, 3 year average	NUTS 2
hlth_cd_yperro	Peri-neonatal mortality by age of mother and parity, by NUTS2 region of residence and occurrence, 3 year average	NUTS 2
hlth_cd_yperrto	Fetal, peri- and neonatal mortality rates by NUTS 2 region of occurrence, 3 year average	NUTS 2
reg_hlth_care	8.2 Health care: resources and patients (non-expenditure data)	
hlth_rs_prsrg	Health personnel by NUTS 2 regions	NUTS 2
hlth_rs_bdsrg	Hospital beds by NUTS 2 regions	NUTS 2
hlth_co_disch1t	Hospital discharges by diagnosis and NUTS 2 regions, in-patients, total number - total	NUTS 2
hlth_co_disch1m	Hospital discharges by diagnosis and NUTS 2 regions, in-patients, total number - males	NUTS 2
hlth_co_disch1f	Hospital discharges by diagnosis, NUTS 2 regions, in-patients and total number - females	NUTS 2
hlth_co_disch2t	Hospital discharges by diagnosis and NUTS 2 regions, in-patients, per 100 000 inhabitants - total	NUTS 2
hlth_co_disch2m	Hospital discharges by diagnosis and NUTS 2 regions, in-patients, per 100 000 inhabitants - males	NUTS 2
hlth_co_disch2f	Hospital discharges by diagnosis and NUTS 2 regions, in-patients, per 100 000 inhabitants - females	NUTS 2
hlth_co_disch3t	Hospital discharges by diagnosis and NUTS 2 regions, day cases, total number - total	NUTS 2
hlth_co_disch3m	Hospital discharges by diagnosis and NUTS 2 regions, day cases, total number - males	NUTS 2
hlth_co_disch3f	Hospital discharges by diagnosis and NUTS 2 regions, day cases, total number - females	NUTS 2
hlth_co_disch4t	Hospital discharges by diagnosis and NUTS 2 regions, day cases, per 100 000 inhabitants - total	NUTS 2
hlth_co_disch4m	Hospital discharges by diagnosis and NUTS 2 regions, day cases, per 100 000 inhabitants - males	NUTS 2
hlth_co_disch4f	Hospital discharges by diagnosis and NUTS 2 regions, day cases, per 100 000 inhabitants - females	NUTS 2

hlth_co_inpstt	In-patient average length of stay (days) by NUTS 2 regions - total	NUTS 2
hlth_co_inpstm	In-patient average length of stay (days) by NUTS 2 regions - males	NUTS 2
hlth_co_inpstf	In-patient average length of stay (days) by NUTS 2 regions - females	NUTS 2
hlth_co_hosdayt	Hospital days of in-patients by NUTS 2 regions - total	NUTS 2
hlth_co_hosdaym	Hospital days of in-patients by NUTS 2 regions - males	NUTS 2
hlth_co_hosdayf	Hospital days of in-patients by NUTS 2 regions - females	NUTS 2
hlth_rs_bdsns	Long-term care beds in nursing and residential care facilities by NUTS 2 regions	NUTS 2
hlth_db_emrena	Prevalence of disability by sex, economic activity (NACE Rev. 1) and NUTS 2 regions	NUTS 2
reg_tour	9. REGIONAL TOURISM STATISTICS	
reg_tour_occ	9.1 Occupancy in collective accommodation establishments: domestic and inbound toursim	
tour_occ_arn2	Arrivals at tourist accommodation establishments by NUTS 2 regions	NUTS 2
tour_occ_nin2	Nights spent at tourist accommodation establishments by NUTS 2 regions	NUTS 2
tour_occ_nin2d	Nights spent at tourist accommodation establishments by degree of urbanisation and by NUTS 2 regions (from 2012 onwards)	NUTS 2
tour_occ_nin2c	Nights spent at tourist accommodation establishments by coastal and non-coastal area and by NUTS 2 regions (from 2012 onwards)	NUTS 2
tour_occ_anor2	Net occupancy rate of bed-places and bedrooms in hotels and similar accommodation (NACE Rev. 2, I, 55.1) by NUTS 2 regions (from 2012 onwards)	NUTS 2
reg_tour_cap	9.2 Capacity of collective tourist accomodation: establishments, bedrooms and bed-places	
tour_cap_nuts2	Number of establishments, bedrooms and bed-places by NUTS 2 regions	NUTS 2
tour_cap_nuts3	Number of establishments, bedrooms and bed-places by NUTS 3 regions (1990-2011)	NUTS 3
tour_cap_nuts2d	Number of establishments, bedrooms and bed-places by degree of urbanisation and by NUTS 2 regions (from 2012 onwards)	NUTS 2
tour_cap_nuts2c	Number of establishments, bedrooms and bed-places by coastal and non-coastal area and by NUTS 2 regions (from 2012 onwards)	NUTS 2
reg_tran	10. REGIONAL TRANSPORT STATISTICS	
reg_road	10.1 Road freight	
road_go_ta_rl	Annual road freight transport by region of loading (1 000 t, Mio Tkm, 1 000 Jrnys)	NUTS 1
road_go_ta_ru	Annual road freight transport by region of unloading (1 000 t, Mio Tkm, 1 000 Jrnys)	NUTS 1
road_go_na_rl3g	National annual road freight transport by regions of loading (NUTS 3) and by group of goods (1 000 t), from 2008 onwards	NUTS 3
road_go_na_ru3g	National annual road freight transport by regions of unloading (NUTS 3) and by group of goods (1 000 t), from 2008 onwards	NUTS 3
road_go_na7rl3g	National annual road freight transport by regions of loading (NUTS 3) and by group of goods (1 000 t), until 2007	NUTS 3
road_go_na7ru3g	National annual road freight transport by regions of unloading (NUTS 3) and by group of goods (1 000 t), until 2007	NUTS 3
reg_otran	10.2 Other regional transport	
tran_r_net	Road, rail and navigable inland waterways networks by NUTS 2 regions	NUTS 2
tran_r_vehst	Stock of vehicles by category and NUTS 2 regions	NUTS 2
tran_r_acci	Victims in road accidents by NUTS 2 regions	NUTS 2
tran_r_mapa_nm	Maritime transport of passengers by NUTS 2 regions	NUTS 2
tran_r_mago_nm	Maritime transport of freight by NUTS 2 regions	NUTS 2
tran_r_avpa_nm	Air transport of passengers by NUTS 2 regions	NUTS 2
tran_r_avgo_nm	Air transport of freight by NUTS 2 regions	NUTS 2

tran_r_rago	Railway transport - national and international railway goods transport by loading/unloading NUTS 2 region	NUTS 2
tran_r_rapa	Railway transport - national and international railway passengers transport by loading/unloading NUTS 2 region	NUTS 2
reg_otran_his	10.3 Other regional transport - Historical data (1978 -2002)	
tran_r_mapa_om	Maritime transport of passengers by NUTS 2 regions (questionnaire)	NUTS 2
tran_r_mago_om	Maritime transport of freight by NUTS 2 regions (questionnaire)	NUTS 2
tran_r_avpa_om	Air transport of passengers by NUTS 2 regions (questionnaire)	NUTS 2
tran_r_avgo_om	Air transport of freight by NUTS 2 regions (questionnaire)	NUTS 2
reg_lmk	11. REGIONAL LABOUR MARKET STATISTICS	
lfst_r_lfpop	11.1 Regional population and economically active population - LFS annual series	
lfst_r_lfsd2pwn	Population by sex, age, citizenship, labour status and NUTS 2 regions	NUTS 2
lfst_r_lfsd2pwc	Population by sex, age, country of birth, labour status and NUTS 2 regions	NUTS 2
lfst_r_lfsd2pop	Population aged 15 and over by sex, age and NUTS 2 regions (1000)	NUTS 2
lfst_r_lfp2act	Economically active population by sex, age and NUTS 2 regions (1 000)	NUTS 2
lfst_r_lfp2actrtn	Activity rates by sex, age, educational attainment level, citizenship and NUTS 2 regions	NUTS 2
lfst_r_lfp2actrc	Activity rates by sex, age, educational attainment level, country of birth and NUTS 2 regions	NUTS 2
lfst_r_lfp2actrt	Economic activity rates by sex, age and NUTS 2 regions (%)	NUTS 2
lfst_r_lfp2acedu	Economically active population by sex, age, educational attainment level and NUTS 2 regions (1 000)	NUTS 2
lfst_r_lfemp	11.2 Regional employment - LFS annual series	
lfst_r_lfe2emp	Employment by sex, age and NUTS 2 regions (1 000)	NUTS 2
lfst_r_lfe2en2	Employment by age, economic activity and NUTS 2 regions (NACE Rev. 2) - 1 000	NUTS 2
lfst_r_lfe2en1	Employment by age, economic activity and NUTS 2 regions (1999-2008, NACE Rev. 1.1) - 1 000	NUTS 2
lfst_r_lfe2estat	Employment by age, professional status and NUTS 2 regions (1 000)	NUTS 2
lfst_r_lfe2eftpt	Employment by full-time/part-time, sex and NUTS 2 regions (1 000)	NUTS 2
lfst_r_lfe2eedu	Employment by sex, age, educational attainment level and NUTS 2 regions (1 000)	NUTS 2
lfst_r_lfe2ecomm	Employment and commuting by sex, age and NUTS 2 regions	NUTS 2
lfst_r_egad	Employment by sex, age, job tenure and NUTS 2 regions	NUTS 2
lfst_r_lfe2emprtn	Employment rates by sex, age, educational attainment level, citizenship and NUTS 2 regions	NUTS 2
lfst_r_lfe2emprc	Employment rates by sex, age, educational attainment level, country of birth and NUTS 2 regions	NUTS 2
lfst_r_lfe2emprt	Employment rates by sex, age and NUTS 2 regions (%)	NUTS 2
lfst_r_lfe2ehour	Average number of usual weekly hours of work in main job by sex, age and NUTS 2 regions (hours)	NUTS 2
lfst_r_lfu	11.3 Regional unemployment - LFS annual series	
lfst_r_lfu3pers	Unemployment by sex, age and NUTS 2 regions (1 000)	NUTS 2
lfst_r_lfu3rt	Unemployment rates by sex, age and NUTS 2 regions (%)	NUTS 2
lfst_r_lfu2ltu	Long-term unemployment (12 months and more) by NUTS 2 regions	NUTS 2
lfst_r_lfu2gac	Unemployment by sex, age, country of birth and NUTS 2 regions	NUTS 2
lfst_r_lfur2gac	Unemployment rates by sex, age, country of birth and NUTS 2 regions	NUTS 2
lfst_r_lfu2gan	Unemployment by sex, age, citizenship and NUTS 2 regions	NUTS 2
lfst_r_lfur2gan	Unemployment rates by sex, age, citizenship and NUTS 2 regions	NUTS 2
lfst_r_lmd	11.4 Regional labour market disparities - LFS series and LFS adjusted series	

lfst_r_lmder	Dispersion of regional employment rates by NUTS 3 regions (%)	NUTS 3
lfst_r_lmdur	Dispersion of regional unemployment rates by NUTS 3 regions (%)	NUTS 3
reg_jvs	11.5 Regional job vacancy statistics (jvs)	
jvs_a_nace2	Job vacancy statistics by occupation, NUTS 2 regions and NACE Rev. 2 activity - annual data (2008-2015)	NUTS 2
jvs_a_nace1	Job vacancy statistics by occupation, NUTS 2 regions and NACE Rev. 1.1 activity - annual data (2000-2008)	NUTS 2
reg_earn_ses_06	11.6 Regional structure of earnings survey 2006	
earn_ses06_rann	Mean annual earnings by NUTS 1 regions (enterprises with 10 employees or more) - NACE Rev. 1.1, C-O excluding L	NUTS 1
earn_ses06_rhr	Mean hourly earnings by NUTS 1 regions (enterprises with 10 employees or more) - NACE Rev. 1.1, C-O excluding L	NUTS 1
reg_earn_ses_10	11.7 Regional structure of earnings survey 2010	
earn_ses10_rhr	Mean hourly earnings by NUTS 1 regions (enterprises with 10 employees or more) - NACE Rev. 2, B-S excluding O	NUTS 1
earn_ses10_rann	Mean annual earnings by NUTS 1 regions (enterprises with 10 employees or more) - NACE Rev. 2, B-S excluding O	NUTS 1
reg_lcs	12. REGIONAL LABOUR COSTS STATISTICS	
reg_lcs_r2	12.1 Labour costs survey 2008 and 2012 - regional data, NACE Rev. 2 activity	
lc_rcost_r2	Labour cost, wages and salaries, direct remuneration by NACE Rev. 2 activity and NUTS 1 regions - LCS surveys 2008, 2012 and 2016	NUTS 1
lc_rstruc_r2	Structure of labour cost by NACE Rev. 2 activity and NUTS 1 regions - % of total cost, LCS surveys 2008, 2012 and 2016	NUTS 1
lc_rnum1_r2	Number of employees and hours worked, by working time, NACE Rev. 2 activity and NUTS 1 regions - LCS surveys 2008, 2012 and 2016	NUTS 1
lc_rnum2_r2	Average hours worked per employee, by working time, NACE Rev. 2 activity and NUTS 1 regions - LCS surveys 2008, 2012 and 2016	NUTS 1
lc_rstu_r2	Number of statistical units selected for the survey, by NACE Rev. 2 activity and NUTS 1 regions - LCS surveys 2008, 2012 and 2016	NUTS 1
reg_lcs04	12.2 Labour costs survey 2004 - regional data	
lc_r04cost	Labour cost, wages and salaries, direct remuneration by NACE Rev. 1.1 activity and NUTS 1 regions - LCS survey 2004	NUTS 1
lc_r04struc	Structure of labour cost by NACE Rev. 1.1 activity and NUTS 1 regions - % of total cost, LCS survey 2004	NUTS 1
lc_r04num1	Number of employees and hours worked, by working time, NACE Rev. 1.1 activity and NUTS 1 regions - LCS survey 2004	NUTS 1
lc_r04num2	Average hours worked per employee, by working time, NACE Rev. 1.1 activity and NUTS 1 regions - LCS survey 2004	NUTS 1
lc_r04stu	Number of statistical units selected for the survey, by NACE Rev. 1.1 activity and NUTS 1 regions - LCS survey 2004	NUTS 1
reg_lcs00	12.3 Labour costs survey 2000 - regional data	
lc_r00cost	Labour cost, wages and salaries, direct remuneration by NACE Rev. 1.1 activity and NUTS 1 regions - LCS survey 2000	NUTS 1
lc_r00struc	Structure of labour cost by NACE Rev. 1.1 activity and NUTS 1 regions - % of total cost, LCS survey 2000	NUTS 1
lc_r00num1	Number of employees and hours worked, by working time, NACE Rev. 1.1 activity and NUTS 1 regions - LCS survey 2000	NUTS 1
lc_r00num2	Average hours worked per employee, by working time, NACE Rev. 1.1 activity and NUTS 1 regions - LCS survey 2000	NUTS 1
lc_r00stu	Number of statistical units selected for the survey, by NACE Rev. 1.1 activity and NUTS 1 regions - LCS survey 2000	NUTS 1

reg_isoc	13. REGIONAL DIGITAL ECONOMY AND SOCIETY	
isoc_r_iacc_h	Households with access to the internet at home	NUTS 1
isoc_r_broad_h	Households with broadband access	NUTS 1
isoc_r_cux_i	Individuals who have never used a computer	NUTS 1
isoc_r_iuse_i	Individuals who used the internet, frequency of use and activities	NUTS 1
isoc_r_gov_i	Individuals who used the internet for interaction with public authorities	NUTS 1
isoc_r_blt12_i	Individuals who ordered goods or services over the internet for private use	NUTS 1
isoc_r_iumd_i	Individuals who accessed the internet away from home or work	NUTS 1
reg_env	14. REGIONAL ENVIRONMENTAL AND ENERGY STATISTICS	
reg_env_was	14.1 Regional waste statistics	
env_rwas_gen	Municipal waste by NUTS 2 regions - pilot project data	NUTS 2
env_rwas_cov	Coverage rate of municipal waste collection by NUTS 2 regions - pilot project data	NUTS 2
reg_env_wat	14.2 Regional water statistics	
env_watres_rb	Freshwater resources by river basin district (RBD)	RBD
env_watabs_rb	Water abstraction by river basin district (RBD)	RBD
env_watuse_rb	Water use by river basin district (RBD)	RBD
reg_nrg_chdd	14.3 Energy statistics - cooling and heating degree days	
nrg_chddr2_a	Cooling and heating degree days by NUTS 2 regions - annual data	NUTS 2
nrg_chddr2_m	Cooling and heating degree days by NUTS 2 regions - monthly data	NUTS 2
reg_ilc	15. REGIONAL POVERTY AND SOCIAL EXCLUSION STATISTICS	
ilc_peps11	People at risk of poverty or social exclusion by NUTS regions	NUTS 1
ilc_lvhl21	People living in households with very low work intensity by NUTS regions (population aged 0 to 59 years)	NUTS 1
ilc_mddd21	Severe material deprivation rate by NUTS regions	NUTS 1
ilc_li41	At-risk-of-poverty rate by NUTS regions	NUTS 1
reg_crim	16. REGIONAL CRIME STATISTICS	
crim_gen_reg	Crimes recorded by the police by NUTS 3 regions	NUTS 3

Source: own elaboration based on EUROSTAT Regional statistics [6]

Annex 3: Dataset identification in the regional EE strategy (EEE-CyL-2020)

This Annex presents the identified datasets within the Castilla y León Regional Energy Strategy. Each of the datasets used in each sector are defined in the following sections, as well as the monitoring indicators. These, even when not being a sector within the strategy, are crucial towards checking the progress in each of the sectors.

1. Industrial sector
2. Building sector
3. Transport sector
4. Public services (local entities) sector
5. Administrative sector
6. Monitoring indicators

Industrial sector

Table 102. Datasets in the Castilla y León Regional Energy Strategy: Industrial Sector

ID	Page	Sector	Year	Datastet	Unit	Description	Source	Source document
IN-01	167	Industry	2008-2016	Gross Value Added (GVA) variation generated by the industry sector (Spain and CyL)	% of the total	"The measure of the value of goods and services produced in an area, industry or sector of an economy. In national accounts GVA is output minus intermediate consumption; it is a balancing item of the national accounts' production account.	EREN	Produced by EREN
IN-02	168	Industry	2014	Companies distribution in the industrial sector of CyL according to the type of activity	%	Companies distribution in the industrial sector of CyL according to the type of activity (food and beverage, manufacture of metal products, wood and cork, furniture manufacture, manufacture of non-metal mineral products)	EREN	Produced by EREN

ID	Page	Sector	Year	Datastet	Unit	Description	Source	Source document
IN-03	169	Industry	2008-2016	Number of industrial companies evolution in CYL	Num companies	Evolution of the number of industrial companies in CyL	Ministry of Economy and Finance	Industrial promotion master plan for Castilla y León
IN-04	169	Industry	2008-2016	Number of industrial companies evolution in Spain	Num companies	Evolution of the number of industrial companies in Spain	Ministry of Economy and Finance	Industrial promotion master plan for Castilla y León
IN-05	170	Industry	2013-2016	Composition of the business fabric of the CyL industry	Num companies	Sectors covered by the industrial companies in CyL (distribution)	INE (National Statistical Institute)	
IN-06	170	Industry	2014,2015	Distribution of the number of extractive industries in CyL	%	Distribution of the extractive industries in CyL among different activities	EREN	Produced by EREN
IN-07	170	Industry	2014,2015	Distribution of the number of companies of water supply, sanitation activities, waste management and decontamination in CyL	%	Distribution of the number of companies of water supply, sanitation activities, waste management and decontamination in CyL	EREN	Produced by EREN
IN-08	171-2	Industry	2014,2015	Distribution of the number of manufacturing companies in CyL	%	Distribution of the manufacturing companies in CyL among different activities	EREN	Produced by EREN
IN-09	173	Industry	2014-2016	Employees in the industry of Castilla y León	% and Num of employees	Number and percentage of employees n the industry sector in Castilla y León by provinces	EREN	Produced by EREN

ID	Page	Sector	Year	Datastet	Unit	Description	Source	Source document
IN-10	174	Industry		Number of employees by industrial group in CyL	Num employees	Number of employees by industrial group in the manufacturing industry in CyL. Group 1: feed, textile, timber,leather, paper industries. Group 2: Extractive, oil refining, pharmaceutical, chemical, electricity, water supply, waste management…Group 3: construction of machinery, electrical and transport equipment, industrial repair	EREN	Produced by EREN
IN-11	175	Industry	2012-2014	Number of employees in the manufacturing industry evolution in CYL	Num employees	Number of employees in the manufacturing industry evolution in CYL	EREN	Produced by EREN
IN-12	175	Industry	2013-2016	Size of manufacturing industrial companies in CyL	Num companies and %	Classification of companies by number of employees in CyL	INE (National statistical institute)	Produced by EREN
IN-13	176	Industry	2013-2014	Number of employees by type of industry in CyL	% and Num of employees	Number of employees in CyL classified by type of industry	EREN	Produced by EREN
IN-14	177	Industry	2009-2015	Industrial productivity	€/employee	Industrial productivity: Gross Value Added (GVA) /employee (full-time equivalent) (€/employee)	EREN	Produced by EREN
IN-15	178	Industry	2008-2015	Exports and imports evolution	€	Exports and imports by the companies in CyL	EREN	Produced by EREN
IN-16	178	Industry	2008-2015	Degree of openness of CyL industry	%	Degree of openness of CyL industry: (Exports+ Imports) /(GDP)	EREN	Produced by EREN

ID	Page	Sector	Year	Datastet	Unit	Description	Source	Source document
IN-17	179	Industry	2014	Destination of exports (international)	%	Destination of exports: main countries (France, Germany, United Kingdom, and Morocco)	EREN	Produced by EREN
IN-18	180	Industry	2014-2016	Exports by sectors	%	Exports in CyL by sectors (distribution)	EREN	Produced by EREN
IN-19	181	Industry	2014-2015	Consumption by energy source in industry	% and ktoe	Distribution of energy consumption: natural gas, electricity, bioenergy, and fuel oils (BIA), diesel oil	EREN	Produced by EREN
IN-20	182	Industry	2013-2015	Electric energy consumption by type of industry (ktoe)	ktoe (ktoone of oil equivalent)	Electric energy consumption by type of industrial activity (without including energy industry)	EREN	Produced by EREN
IN-21	183	Industry	2014-2015	Distribution of electrical energy consumed by type of industry	%	Distribution of electrical energy consumed by type of industry	EREN	Produced by EREN
IN-22	184	Industry	2014-2015	Natural gas consumption by type of industry (ktoe)	ktoe (ktoone of oil equivalent)	Natural gas consumption by type of industrial activity (without including energy industry)	EREN	Produced by EREN
IN-23	184	Industry	2014-2015	Distribution of natural gas consumed by type of industry	%	Distribution of natural gas consumed by type of industry	EREN	Produced by EREN
IN-24	186	Industry	2000-2015	Final energy intensity in the industry sector (evolution)	toe/EUR millions	Final energy intensity in the industry sector evolution	EREN	Produced by EREN

Source: EREN, Estrategia de Eficiencia Energética de Castilla y León

Building sector

Table 103. Datasets in the Castilla y León Regional Energy Strategy: Building Sector

ID	Page	Sector	Year	Datastet	Unit	Description	Source	Source document
BU-01	211	Building	2014	Final energy consumption per sector in CyL 2014	%	% of final energy consumption in agriculture, industry, residential, retail and services, hotel industry, other type of buildings, administration and other public services, transport in 2014	EREN	Produced by EREN
BU-02	211	Building	2015	Final energy consumption per sector in CyL 2015	%	% of final energy consumption in agriculture, industry, residential, retail and services, hotel industry, other type of buildings, administration and other public services, transport in 2015	EREN	Produced by EREN
BU-03	211	Building	2014	Energy consumption per energy source in the building sector 2014	%	% of energy consumption per energy source (electricity, natural gas, liquefied petroleum gas, diesel c, bioenergy) in 2014	EREN	Produced by EREN
BU-04	212	Building	2015	Energy consumption per energy source in the building sector 2015	%	% of energy consumption per energy source (electricity, natural gas, liquefied petroleum gas, diesel c, bioenergy) in 2015	EREN	Produced by EREN
BU-05	212	Building	2014	Distribution of electricity consumption in the building sector 2014	%	Distribution of electricity consumption in the building sector among: hotel industry, retail and services, other and domestic in 2014	EREN	Produced by EREN
BU-06	213	Building	2015	Distribution of electricity	%	Distribution of electricity consumption in the building sector among: hotel	EREN	Produced by EREN

ID	Page	Sector	Year	Datastet	Unit	Description	Source	Source document
				consumption in the building sector 2015		industry, retail and services, other and domestic in 2015		
BU-07	213	Building	2014	Distribution of natural gas consumption in the building sector 2014	%	Distribution of natural gas consumption in the building sector among: hotel industry, retail and services, other and domestic in 2014	EREN	Produced by EREN
BU-08	214	Building	2015	Distribution of natural gas consumption in the building sector 2015	%	Distribution of natural gas consumption in the building sector among: hotel industry, retail and services, other and domestic in 2015	EREN	Produced by EREN
BU-09	214	Building	2014	Distribution of bioenergy consumption in the building sector 2014	%	Distribution of bioenergy consumption in the building sector among: retail and services and domestic in 2014	EREN	Produced by EREN
BU-10	215	Building	2014	Distribution of liquefied petroleum gas consumption in the building sector 2014	%	Distribution of liquefied petroleum gas consumption in the building sector among: hotel industry, retail and services, other and domestic in 2014	EREN	Produced by EREN
BU-11	215	Building	2015	Distribution of liquefied petroleum gas consumption in the building sector 2015	%	Distribution of liquefied petroleum gas consumption in the building sector among: hotel industry, retail and services, other and domestic in 2015	EREN	Produced by EREN
BU-12	216	Building	2014	Distribution of diesel C consumption in the building sector 2014	%	Distribution of diesel C consumption in the building sector among: hotel industry, retail and services, other and domestic in 2014	EREN	Produced by EREN

ID	Page	Sector	Year	Datastet	Unit	Description	Source	Source document
BU-13	217	Building	2015	Distribution of diesel C consumption in the building sector 2015	%	Distribution of diesel C consumption in the building sector among: hotel industry, retail and services, other and domestic in 2015	EREN	Produced by EREN
BU-14	217	Building	2014	Final energy consumption distribution in the building sector 2014	%	% of final energy consumption in building sector (hotel industry, retail and services, other, domestic)	EREN	Produced by EREN
BU-15	217	Building	2015	Final energy consumption distribution in the building sector 2015	%	% of final energy consumption in building sector (hotel industry, retail and services, other, domestic)	EREN	Produced by EREN
BU-16	218	Building	2000 - 2014	Final energy intensity evolution in service and domestic sector	Energy intensity / year	Energy intensity value per year (2000-2014) of the service and domestic sectors combined	EREN	Produced by EREN
BU-17	219, 220	Building	2010 - 2015	Housing stock in the period 2010 - 2015	Num dwellings / province	Number of dwellings in each of the provinces in CyL and the total value for Castilla y León each year from 2010 to 2015 (expressed as table and as graph)	Ministerio de Fomento	Produced by EREN
BU-18	221	Building	2014	Housing stock in Spain in 2014	Num dwellings	Number of dwellings in Spain in 2014	Ministerio de Fomento	Produced by EREN
BU-19	221	Building	2010 - 2014	Evolution of the distribution of free and protected dwellings in Castilla y León (newly built)	%	Residential / non residential buildings (2010-2014)	Ministerio de Fomento	Produced by EREN

ID	Page	Sector	Year	Datastet	Unit	Description	Source	Source document
BU-20	221	Building	2010 - 2016	Protected / free	%	Protected / free	Ministerio de Fomento	Produced by EREN
BU-21	222	Building	2010 - 2016	Evolution of the distribution of free and protected dwellings in Castilla y León (2010-2016)	Num dwellings / year	Expressed in table format and in graph. Number of free and protected dwellings per year from 2010 - 2016	Ministerio de Fomento	Produced by EREN
BU-22	223, 224	Building	2010 - 2016	Finished protected dwellings in Castilla y León (2010-2016)	Num protected dwellings / year and province	Number of finished protected dwellings per year (2010 - 2016) and province (presented as line graph, bar graph and table). Additional % in Castilla y León	Ministerio de Fomento	Produced by EREN
BU-23	224	Building	2010 - 2016	Finished protected dwellings in Spain (2010-2016)	Num dwellings in the period	Number of protected dwellings in Spain in the period 2010 -2016	Ministerio de Fomento	Produced by EREN
BU-24	225, 226	Building	2010 - 2016	Finished free dwellings in Castilla y León (2010-2016)	Num free dwellings / year and province	Number of finished free dwellings per year (2010 - 2016) and province (presented as line graph, bar graph and table). Additional % in Castilla y León	Ministerio de Fomento	Produced by EREN
BU-25	226	Building	2010 - 2016	Finished protected dwellings in Spain (2010-2016)	Num dwellings in the period	Number of protected dwellings in Spain in the period 2010 -2016	Ministerio de Fomento	Produced by EREN
BU-26	227	Building	2010 - 2015	Interventions in the building sector (2010 - 2015)	% of intervention type	Pie chart describing % of types of intervention in the building sector (newly built buildings, retrofitting actions, demolition actons) in the period 2010 - 2015	DG de Presupuestos y Estadística de la Junta de Castilla	Anuario estadístico, DG de Presupuestos y Estadística

ID	Page	Sector	Year	Datastet	Unit	Description	Source	Source document
								de la Junta de Castilla y León
BU-27	228	Building	2010 - 2015	Annual evolution of interventions performed in the building sector during the period 2010-2015	Number of activities / year	Presented as a line graph, number of activities per year in the period 2010-2015	DG de Presupuestos y Estadística de la Junta de Castilla	Anuario estadístico, DG de Presupuestos y Estadística de la Junta de Castilla y León
BU-28	229	Building	2010 - 2015	Annual evolution of number of dwellings / building in the period 2010-2015	Number of dwellings / building and year	Presented as a line graph, number of dwellings per building and year in the period 2010-2015	DG de Presupuestos y Estadística de la Junta de Castilla	Anuario estadístico, DG de Presupuestos y Estadística de la Junta de Castilla y León
BU-29	229	Building	2016	Population distribution per province capital and other urban settings on 1st January 2016	- Inhabitants / province - Inhabitants / the capital - Inhabitants / not in the capital - % of inhabitants in capital - % of inhabitants not in capital	Expressed as a table, represents the values expressed to the left for all of the provinces (Ávila, Burgos, León, Palencia, Salamanca, Segovia, Soria, Valladolid) and the total values for Castilla y León.	DG de Presupuestos y Estadística de la Junta de Castilla	Anuario estadístico, DG de Presupuestos y Estadística de la Junta de Castilla y León

Source: EREN, Estrategia de Eficiencia Energética de Castilla y León

Transport sector

Table 104. Datasets in the Castilla y León Regional Energy Strategy: Transport Sector

ID	Page	Sector	Year	Datastet	Unit	Description	Source	Source document
TR-01	275	Transport	2014	Final energy consumption per sector in CyL 2014	%	% of final energy consumption in agriculture, industry, residential, retail and services, hotel industry, other type of buildings, administration and other public services, transport in 2014	EREN	Produced by EREN
TR-02	275	Transport	2015	Final energy consumption per sector in CyL 2015	%	% of final energy consumption in agriculture, industry, residential, retail and services, hotel industry, other type of buildings, administration and other public services, transport in 2015	EREN	Produced by EREN
TR-03	276	Transport	2014	Energy consumption per energy source in the transport sector 2014	%	% of energy consumption per energy source (electricity, natural gas, bioenergy, petrol, diesel A, diesel B) in 2014	EREN	Produced by EREN
TR-04	276	Transport	2015	Energy consumption per energy source in the transport sector 2015	%	% of energy consumption per energy source (electricity, natural gas, bioenergy, petrol, diesel A, diesel B) in 2015	EREN	Produced by EREN
TR-05	277	Transport	2012	Energy consumption of the main municipalities of CyL in the transport sector 2012	kWh	kWh of energy consumption by each municipality	EREN	Produced by EREN
TR-06	279	Transport	2012	Types of vehicles in the public fleet of the main municipalities of CyL	Nº	Types of vehicles (Trucks, motorcycles, cars, others) in the public fleet of the main municipalities of CyL	EREN	Produced by EREN
TR-07	280	Transport	2014	Evolution of charge points in the main cities of CyL 2014	Nº	Evolution of the number of charge points in the main cities of CyL	EREN	Produced by EREN

ID	Page	Sector	Year	Datastet	Unit	Description	Source	Source document
TR-08	280	Transport	2016	Evolution of charge points in the main cities of CyL 2016	Nº	Evolution of the number of charge points in the main cities of CyL	EREN	Produced by EREN
TR-09	281	Transport	2014	Distribution of vehicles fleet according to the fuel consumed by vehicle type in CyL 2014	Nº	Number of vehicles by province, type and fuel in 2014	DGT	Produced by EREN
TR-10	281	Transport	2015	Distribution of vehicles fleet according to the fuel consumed by vehicle type in CyL 2014	Nº	Number of vehicles by province, type and fuel in 2014	DGT	Produced by EREN
TR-11	286	Transport	2015	Distribution of vehicles by type and age for each fuel type	%	% of vehicles (motocycles, bus, trucks, cars, tractors and othes) by fuel (petrol, diesel and others) and age	DGT	Produced by EREN
TR-12	287	Transport	2014	Evolution of registrations by province	Nº	Tourism vehicle registrations and CO_2 sections	FACONAUTO and ANFAC	Produced by EREN
TR-13	287	Transport	2015	Evolution of registrations by province	Nº	Tourism vehicle registrations and CO_2sections	FACONAUTO and ANFAC	Produced by EREN
TR-14	288	Transport	2015	CO2 emissions during 2015	g CO_2/km	Total tourism CO_2emissions in 2015	FACONAUTO	Produced by EREN
TR-15	288	Transport	2016	CO2 emissions during 2016	g CO_2/km	Total tourism CO_2emissions in 2016	FACONAUTO	Produced by EREN
TR-16	289	Transport	2014	Activity in the airports of Castilla y León during 2014	Nº and Kg	Passengers, goods, operations, passenger/operation	AENA	Produced by EREN

ID	Page	Sector	Year	Datastet	Unit	Description	Source	Source document
TR-17	289	Transport	2015	Activity in the airports of Castilla y León during 2015	Nº and Kg	Passengers, goods, operations, passenger/operation	AENA	Produced by EREN
TR-18	293	Transport	2015	Registered buses 2007-2015 period by fuel type	Nº	Diesel, petrol and others	General statistical yearbook 2014	Produced by EREN
TR-19	296	Transport	2012	Buses and most significant indicators for different municipalities of Castilla y León 2012	Nº and ratios	Bus/municipalities, Nº viajeros transportados, passengers/bus, consumption/10000passengers	Statistical bulletin of transport and energy of Castilla y León	Produced by EREN
TR-20	297	Transport	2016	Taxis and most significant indicators for different municipalities of Castilla y León 2012-2016 period	Nº	Nº of taxis by city and Nº of taxis by province	INE	Produced by EREN
TR-21	298	Transport	2016	Evolution of the vehicles fleet for the period 2010-2015	Nº	Trucks and vans, buses, cars, motorcycles, tractors and others	General statistical yearbook	Produced by EREN
TR-22	299	Transport	2014	Distribution of vehicle fleet by type in 2014	Nº	Trucks and vans, buses, cars, motorcycles, tractors and others	General statistical yearbook	Produced by EREN
TR-23	299	Transport	2015	Distribution of vehicle fleet by type in 2015	Nº	Trucks and vans, buses, cars, motorcycles, tractors and others	General statistical yearbook	Produced by EREN
TR-24	301	Transport	2015	Vehicles registered in CyL for the period 2010-2015	Nº	Trucks and vans, buses, cars, motorcycles, tractors and others	General statistical yearbook	Produced by EREN
TR-25	302	Transport	2015	Vehicle units registered by type in CyL by province for the period 2010-2015	Nº	Trucks and vans, buses, cars, motorcycles, tractors and others	General statistical yearbook	Produced by EREN

ID	Page	Sector	Year	Datastet	Unit	Description	Source	Source document
TR-26	305	Transport	2014	Vehicle units registered by type and province in CyL 2014	Nº	Trucks and vans, buses, cars, motorcycles, tractors and others	General statistical yearbook	Produced by EREN
TR-27	306	Transport	2015	Vehicle units registered by type and province in CyL 2015	Nº	Trucks and vans, buses, cars, motorcycles, tractors and others	General statistical yearbook	Produced by EREN
TR-28	307	Transport	2015	Vehicle fleet, registered vehicles, vehicles renewed annually for the period 2010-2015	Nº	Trucks and vans, buses, cars, motorcycles, tractors and others	General statistical yearbook	Produced by EREN
TR-29	308	Transport	-	Transport sector companies by province in CyL	Nº	Road sector, maritime, air, intermodal and urgent	http://www.castillayleontransportes.com/directorio/mapa.asp	Produced by EREN
TR-30	310	Transport	-	Companies dedicated to logistic by province in CyL	Nº	Automotive, aviation, rail, maritime and logistics	http://www.castillayleontransportes.com/directorio/mapa.asp	Produced by EREN

Source: EREN, Estrategia de Eficiencia Energética de Castilla y León

Public services (local entities) sector

Table 105. Datasets in the Castilla y León Regional Energy Strategy: Public services (local entities) sector

ID	Page	Sector	Year	Datastet	Unit	Description	Source	Source document
PS-01	324	Public services	2014	Energy consumption in the the Administrative and public services sector	ktoe (ktonnes of oil equivalent)	Final energy consumption in the Administrative and Public services sector. Distribution between Administrative sector and Public services sector	EREN	Produced by EREN
PS-02	324	Public services	2015	Consumption by energy source in the public services sector	ktoe /year and %	Distribution of energy consumption: natural gas, electricity, diesel fuel, and petrol	EREN	Produced by EREN
PS-03	325	Public services	2000-2014	Final energy intensity in the Administrative and public services sector (evolution)	toe/EUR millions	Final energy intensity in the Administrative and public services sector evolution (it was not possible to separate Public services from Administrative sector: GDP combines both)	EREN	Produced by EREN
PS-04	326	Public services	Not available	Number of municipalities in CyL by province	Numb municipalities and %	Number of municipalities in CyL by province	DG of Budgets and Statistics of the Junta de Castilla y Leon	Review of the Municipal Register
PS-05	327-328-329	Public services	2015	Number and population distribution (Autonomous Communities and Spain).	Num of people and %	Population distribution for the Autonomous Communities and for the whole of Spain. Differentiating between woman and men	DG of Budgets and Statistics of the Junta de Castilla y Leon	Review of the Municipal Register

ID	Page	Sector	Year	Datastet	Unit	Description	Source	Source document
PS-06	327	Public services	2015	Population variaton by Autonomous Communities and Spain	% and num of people	Population variation by Autonomous Communities and Spain (absolute and relative)	DG of Budgets and Statistics of the Junta de Castilla y Leon	Review of the Municipal Register
PS-07	330	Public services	2015	Population distribution by provinces in CyL	%	Population distribution for CyL by province	DG of Budgets and Statistics of the Junta de Castilla y Leon	Review of the Municipal Register
PS-08	330	Public services	1998-2015	Population evolution in CyL by provinces	Num of people	Population evolution in CyL by provinces	DG of Budgets and Statistics of the Junta de Castilla y Leon	Review of the Municipal Register
PS-09	330	Public services	1998-2015	Anual population variaton in CyL and Spain	%	Anual population variation (average) in CyL and Spain	DG of Budgets and Statistics of the Junta de Castilla y Leon	Review of the Municipal Register
PS-10	331	Public services	2014-2015	Population in provincial capitals and by province	Num of people	Population in provincial capitals and by province	DG of Budgets and Statistics of the Junta de Castilla y Leon	Review of the Municipal Register
PS-11	331	Public services	2014-2015	Population variation in provincial capitals and by province	Num of people	Population variation (absolute) in provincial capitals and by province	DG of Budgets and Statistics of the Junta de Castilla y Leon	Review of the Municipal Register
PS-12	332	Public services	2015	Population distribution by type of urban area in CyL and by province	% and num of people	Population distribution by type of urban area (provincial capitals and rest of urban areas) in CyL and by province	DG of Budgets and Statistics of the Junta de Castilla y Leon	Review of the Municipal Register
PS-13	334	Public services	2015	Population distribution by provincial capitals in CyL	%	Population distribution by provincial capitals in CyL	DG of Budgets and Statistics of the Junta de Castilla y Leon	Review of the Municipal Register

ID	Page	Sector	Year	Datastet	Unit	Description	Source	Source document
PS-14	334	Public services	2015	Distribution of the municipalities of CyL according to the number of inhabitants	Num of municipalities and %	Distribution of the municipalities of CyL according to the number of inhabitants	EREN	Produced by EREN
PS-15	336	Public services	2014	Population density in the Autonomous Communities	inhabitants/km2	Population density in the Autonomous Communities	EREN	Produced by EREN
PS-16	336	Public services	2015	Population density of the provinces in CyL	inhabitants/km2	Population density of the provinces in CyL	DG of Budgets and Statistics of the Junta de Castilla y Leon	" Review of the Municipal Register " y "Extensión superficial"
PS-17	337	Public services		Number of public health care centers by province in CyL	Num centers and %	Number of public health care centers by province in CyL and	EREN	Produced by EREN
PS-18	339	Public services		Distribution by type of health center in CyL	%	Health care centers distributed by type in CyL (speciality centers, health centers, mental health centers, public hospitals..)	EREN	Produced by EREN
PS-19	340	Public services		Distribution of the health centers of CyL according to the body that manages it.	%	Distribution of the health centers of CyL according to the body that manages it.	EREN	Produced by EREN
PS-20	340	Public services		Number of education centers in CyL	Num centers and %	Number of education centers in CyL by type (rural educational centers, FP centers, Home schools, biligual centers, art schools..)	Ministry of Education of the Junta de Castilla y León	N/A

ID	Page	Sector	Year	Datastet	Unit	Description	Source	Source document
PS-21	341	Public services		Number of education centers in CyL	Num centers and %	Number of education centers in CyL by type (rural educational centers, FP centers, Home schools, biligual centers, art schools..)	Ministry of Education of the Junta de Castilla y León	N/A
PS-22	341	Public services		Number of sport centers and facilities in CyL by province	Num centers (includin g pools) and %	Number of sport centers and facilities in CyL by province (sports facilities and pools)	Higher Sports Council	National Census of Sports Facilities
PS-23	342	Public services		Number of cultural singular buildings	Num of buildings	Number of cultural singular buildings, including museums, theaters, and public libraries	EREN	Produced by EREN
PS-24	343	Public services		Number of fire stations and local police stations in the provincial capitals of CyL	Num fire stations and police station	Number of fire stations and local police stations in the provincial capitals of CyL	Town councils of the provincial capitals	Town councils' website
PS-25	343	Public services	2015	Estimated consumption by energy source and by type of service in the public services sector by province in CyL	ktoe /year and %	Consumption by energy source and by type of service in the public services sector by province in CyL (inclding public lighting, water cycle, buildings and vehicles)	EREN	Produced by EREN
PS-26	344	Public services	2015	Estimated average consumption per inhabitant for each energy source and by each service type	kWh/hab	Estimated average consumption per inhabitant for each energy source and by each service type (including public lighting, water cycle, buildings (municipal management) and vehicles)	EREN	Produced by EREN

ID	Page	Sector	Year	Datastet	Unit	Description	Source	Source document
PS-27	346	Public services	2015	Distribution of the estimated electricity consumption in public lighting during 2015 by size of the municipality.	%	Distribution of the estimated electricity consumption in public lighting during 2015 according to the size of the municipality.	EREN	Produced by EREN
PS-28	346	Public services		Number of WWTPs by province in CyL	Numb WWTPs	Number of WWTPs by province and the whole of CyL	Junta de Castilla y León	N/A
PS-29	348	Public services	2015	Distribution of the estimated water cycle consumption during 2015 by size of the municipality.	%	Distribution of the estimated water cycle consumption uring 2015 by size of the municipality.	EREN	Produced by EREN
PS-30	351	Public services	2015	Distribution of the estimated electricy consumption in building (municipal management) during 2015 by size of the municipality.	%	Distribution of the estimated electricy consumption in building (municipal management) during 2015 by size of the municipality.	EREN	Produced by EREN
PS-31	352	Public services		Number of waste management centres and landfills by province	Numb of centres	The information includes number of: -Associations -Transfer plants -Treatment centres - Management areas -Treatment areas In the document the organization of the collection and treatment system for the "rest" fraction is included, naming the responsibles of managment	Junta de Castilla y León	Comprehensive Waste Plan for Castilla y León

ID	Page	Sector	Year	Datastet	Unit	Description	Source	Source document
PS-33	363	Public services		Energy rating for heating demand in buildings in the public services sector of CyL	Numb of buildings and %	Number of buildings and percentage by energy rating in heating demand	EREN	Produced by EREN
PS-34	364	Public services		Energy rating CO_2 emissions by buildings in the public services sector of CyL	Numb of buildings and %	Number of buildings and percentage by energy rating in CO_2 emissions	EREN	Produced by EREN
PS-35	365	Public services		Energy rating for primary energy consumption in buildings in the public services sector of CyL	Numb of buildings and %	Number of buildings and percentage by energy rating in primary energy consumption	EREN	Produced by EREN
PS-33	363	Public services		Energy rating for heating demand in buildings in the public services sector of CyL	Numb of buildings and %	Number of buildings and percentage by energy rating in heating demand	EREN	Produced by EREN

Source: EREN, Estrategia de Eficiencia Energética de Castilla y León

Administrative sector

Table 106. Datasets in the Castilla y León Regional Energy Strategy: Administrative sector

ID	Page	Sector	Year	Datastet	Unit	Description	Source	Source document
AD-1	370	Administration	2014	Energy consumption of the administration buildings of Cyl 2014	%	Electricity, natural gas, biomass and gasoil	OPTE administration of CyL	Produced by EREN
AD-2	371	Administration	2015	Energy consumption of the administration buildings of Cyl 2015	%	Electricity, natural gas, biomass and gasoil	OPTE administration of CyL	Produced by EREN

ID	Page	Sector	Year	Datastet	Unit	Description	Source	Source document
AD-3	371	Administration	2014	Final energy consumption by sector in CyL 2014	%	Agriculture, industry, services, domestic, transport, administration and public services	EREN	Produced by EREN
AD-4	372	Administration	2015	Final energy consumption by sector in CyL 2015	%	Agriculture, industry, services, domestic, transport, administration and public services	EREN	Produced by EREN
AD-5	373	Administration	-	Structure of the Consumer Centers of the Autonomous Administration	Nº	Divided by councils/agencies	OPTE administration of CyL	Produced by EREN
AD-6	374	Administration	-	Number of Consumer Centers of the Autonomous Administration by the different councils	Nº	Divided by councils	OPTE administration of CyL	Produced by EREN
AD-7	375	Administration	2014 /15	Energy consumption of the Administration of CyL for 2014 and 2015	kWh/año	Electricity, natural gas and biomass), by type of administration	EREN	Produced by EREN
AD-8	378	Administration	-	Main consumption centers by type of use, of which the Autonomous Administration takes charge of the electric bill	Nº	Consumption by use defined type	OPTE administration of CyL	Produced by EREN
AD-9	378	Administration	-	Number of electricity consuming centers	Nº	Electricity consumption by use defined type	OPTE administration of CyL	Produced by EREN
AD-10	379	Administration	-	Number of natural gas consuming centers	Nº	Natural gas consumption by use defined type	OPTE administration of CyL	Produced by EREN

ID	Page	Sector	Year	Datastet	Unit	Description	Source	Source document
AD-11	381	Administration	2014	Percentage of administration buildings according to the type of energy consumed in 2014	%	Electricity and electricity+natural gas)	OPTE administration of CyL	Produced by EREN
AD-12	382	Administration	2014	Energy consumption of the buildings of the Administration of CyL 2014 by type of center	kWh/year	Electricity consumption, natural gas and gasoil by type of centre	OPTE administration of CyL	Produced by EREN
AD-13	386	Administration	-	Summary of the energy certification of the EREN building with respect to a reference building	kWh/year, kWh/m^2·year kg CO_2/year	Final energy, primary energy, emissions	EREN	Produced by EREN
AD-14	394	Administration	-	Energy rating of heating demand for CyL administration buildings	Nº	Number of buildings with a certificate and their energy rating for heating	EREN	Produced by EREN
AD-15	395	Administration	-	Energy rating for cooling demand of CyL administration buildings	Nº	Number of buildings with a certificate and their energy rating for cooling	EREN	Produced by EREN
AD-16	396	Administration	-	Energy rating in CO_2 emissions of CyL administration buildings	Nº	Number of buildings with a certificate and their energy rating for CO_2 emissions	EREN	Produced by EREN
AD-17	397	Administration	-	Energy rating in consumption of CyL administration buildings	Nº	Number of buildings with a certificate and their energy rating for energy consumption	EREN	Produced by EREN

Source: EREN, Estrategia de Eficiencia Energética de Castilla y León

Monitoring indicators

In the case of the monitoring indictors, the table is similar to the ones shown above. However, the year has not been considered, since these indicators are meant to be calculated on a yearly basis, as well as the sources, since all of them are own elaboration of the EREN. As it can be seen, the monitoring indicators cover several topics, which correspond to the sectors being tackled:

1. General: measuring cross-cutting aspects
2. Transport
3. Industry
4. Building - Residential
5. Building – Services
6. Public services
7. Administration

Table 107. Datasets in the Castilla y León Regional Energy Strategy: Monitoring indicators

ID	Page	Sector	Datastet	Unit
MI-01	163	General	Primary energy savings with respect to tendency	ktep
MI-02	163	General	Final energy savings with respect to tendency	ktep
MI-03	163	General	Supply % of renewable energy sources	%
MI-04	163	General	CO_2 emissions reduction with respect to 1990	tCO_2
MI-05	163	General	Change in final energy intensity	%
MI-06	163	General	Change in primary energy intensity	%
MI-07	163	General	Public investment	M€
MI-08	163	General	Private investment	M€
MI-09	163	General	Investment ratio with respect to consumption reduction	€/ktep saved

ID	Page	Sector	Datastet	Unit
MI-10	163	General	Energy source diversification to cleaner and more efficient sources	ktep/source
MI-11	163	Transport	Final energy savings with respect to tendency	ktep
MI-12	163	Transport	CO_2 emissions reduction with respect to 1990	tCO_2
MI-13	163	Transport	Public investment	M€
MI-14	163	Transport	Private investment	M€
MI-15	163	Transport	Investment ratio with respect to consumption reduction	€/ktep saved
MI-16	163	Transport	Number of electric vehicles	units
MI-17	163	Transport	Electric vehicle charging points	units
MI-18	163	Transport	Km of bike lanes	km
MI-19	163	Transport	Diversification to biofuels	ktep biofuels / total ktep
MI-20	164	Industry	Final energy savings with respect to tendency	ktep
MI-21	164	Industry	CO_2 emissions reduction with respect to 1990	t CO_2
MI-22	164	Industry	Public investment	M€
MI-23	164	Industry	Private investment	M€
MI-24	164	Industry	Investment ratio with respect to consumption reduction	€/ktep saved
MI-25	164	Industry	Number of energy management systems audits and EMS implemented	units
MI-26	164	Industry	Number of energy service companies	units

ID	Page	Sector	Datastet	Unit
MI-27	164	Industry	Ktep generated through district heating	ktep
MI-28	164	Industry	% of bioenergy as final energy source	%
MI-29	164	Building - Residential	Final energy savings with respect to tendency	ktep
MI-30	164	Building - Residential	CO_2 emissions reduction with respect to 1990	t CO_2
MI-31	164	Building - Residential	Public investment	M€
MI-32	164	Building - Residential	Private investment	M€
MI-33	164	Building - Residential	Investment ratio with respect to consumption reduction	€/ktep saved
MI-34	164	Building - Residential	Investment on "renove" plans (renovation plans)	M€
MI-35	164	Building - Residential	Improvement of the energy efficiency ratio per energy performance certificates submitted	%
MI-36	164	Building - Residential	% of bioenergy as final energy source	%
MI-37	164	Building - Residential	Energy consumption per dwelling	ktep/dwelling
MI-38	165	Building - Services	Final energy savings with respect to tendency	ktep
MI-39	165	Building - Services	CO_2 emissions reduction with respect to 1990	t CO_2
MI-40	165	Building - Services	Public investment	M€
MI-41	165	Building - Services	Private investment	M€
MI-42	165	Building - Services	Investment ratio with respect to consumption reduction	€/ktep saved
MI-43	165	Building - Services	Energy consumption per building	ktep/building

ID	Page	Sector	Datastet	Unit
MI-44	165	Building - Services	Improvement of the energy efficiency ratio per energy performance certificates submitted	%
MI-45	165	Public services (local entities)	Final energy savings with respect to tendency	ktep
MI-46	165	Public services (local entities)	CO_2 emissions reduction with respect to 1990	t CO_2
MI-47	165	Public services (local entities)	Public investment	M€
MI-48	165	Public services (local entities)	Private investment	M€
MI-49	165	Public services (local entities)	Investment ratio with respect to consumption reduction	€/ktep saved
MI-50	165	Public services (local entities)		units
MI-51	165	Public services (local entities)	Number of municipalities with lighting improvements / all municipalities	%
MI-52	165	Public services (local entities)	Number of energy audits in public buildings	units
MI-53	165	Public services (local entities)	Number of energy audits in public lighting	units
MI-54	166	Administration	Final energy savings with respect to tendency	ktep
MI-55	166	Administration	CO_2 emissions reduction with respect to 1990	t CO_2
MI-56	166	Administration	Public investment	M€
MI-57	166	Administration	Private investment	M€
MI-58	166	Administration	Investment ratio with respect to consumption reduction	€/ktep saved
MI-59	166	Administration	Improvement of the energy efficiency ratio per energy performance certificates submitted	%
MI-60	166	Administration	Number of energy audits in public buildings	units

ID	Page	Sector	Datastet	Unit
MI-36	164	General	Primary energy savings with respect to tendency	ktep
MI-37	164	General	Final energy savings with respect to tendency	ktep
MI-38	165	General	Supply % of renewable energy sources	%
MI-39	165	General	CO_2 emissions reduction with respect to 1990	t CO_2
MI-40	165	General	Change in final energy intensity	%
MI-41	165	General	Change in primary energy intensity	%
MI-42	165	General	Public investment	M€
MI-43	165	General	Private investment	M€
MI-44	165	General	Investment ratio with respect to consumption reduction	€/ktep saved
MI-45	165	General	Energy source diversification to cleaner and more efficient sources	ktep/source
MI-46	165	Transport	Final energy savings with respect to tendency	ktep
MI-47	165	Transport	CO_2 emissions reduction with respect to 1990	t CO_2
MI-48	165	Transport	Public investment	M€
MI-49	165	Transport	Private investment	M€
MI-50	165	Transport	Investment ratio with respect to consumption reduction	€/ktep saved
MI-51	165	Transport	Number of electric vehicles	units
MI-52	165	Transport	Electric vehicle charging points	units

ID	Page	Sector	Datastet	Unit
MI-53	165	Transport	Km of bike lanes	km
MI-54	166	Transport	Diversification to biofuels	ktep biofuels / total ktep
MI-55	166	Industry	Final energy savings with respect to tendency	ktep
MI-56	166	Industry	CO_2 emissions reduction with respect to 1990	t CO_2
MI-57	166	Industry	Public investment	M€
MI-58	166	Industry	Private investment	M€
MI-59	166	Industry	Investment ratio with respect to consumption reduction	€/ktep saved
MI-60	166	Industry	Number of energy management systems audits and EMS implemented	units
MI-46	165	Industry	Number of services companies in public lighting	units
MI-47	165	Industry	Ktep generated through district heating	ktep
MI-48	165	Industry	% of bioenergy as final energy source	%
MI-49	165	Building - Residential	Final energy savings with respect to tendency	ktep
MI-50	165	Building - Residential	CO_2 emissions reduction with respect to 1990	t CO_2
MI-51	165	Building - Residential	Public investment	M€
MI-52	165	Building - Residential	Private investment	M€
MI-53	165	Building - Residential	Investment ratio with respect to consumption reduction	€/ktep ahorrado
MI-54	166	Building - Residential	Investment on "renove" plans (renovation plans)	M€

ID	Page	Sector	Datastet	Unit
MI-55	166	Building - Residential	Improvement of the energy efficiency ratio per energy performance certificates submitted	%
MI-56	166	Building - Residential	% of bioenergy as final energy source	%
MI-57	166	Building - Residential	Energy consumption per dwelling	ktep/vivienda
MI-58	166	Building - Services	Final energy savings with respect to tendency	ktep
MI-59	166	Building - Services	CO_2 emissions reduction with respect to 1990	t CO_2
MI-60	166	Building - Services	Public investment	M€

Source: EREN, Estrategia de Eficiencia Energética de Castilla y León

Annex 4. INSPIRE data themes description

This annex provides the relevant links and descriptions of the INSPIRE data themes, in order to allow readers to have an overview and easily be able to consult more in-depth the content of each of the themes, as well as analyse the required data flows that would be necessary to implement in order to deploy any of the datasets under these data models.

Table 108. INSPIRE themes description

	INSPIRE themes and description
A.I	**AD – Addresses** Location of properties based on address identifiers, usually by road name, house number, postal code.
A.I	**AU – Administrative Units** Units of administration, dividing areas where Member States have and/or exercise jurisdictional rights, for local, regional and national governance, separated by administrative boundaries.
A.I	**CP – Cadastral Parcels** Areas defined by cadastral registers or equivalent.
A.I	**RS – Coordinate reference systems** Systems for uniquely referencing spatial information in space as a set of coordinates (x, y, z) and/or latitude and longitude and height, based on a geodetic horizontal and vertical datum.
A.I	**GG – Geographical grid systems** Harmonised multi-resolution grid with a common point of origin and standardised location and size of grid cells.
A.I	**GN – Geographical names** Names of areas, regions, localities, cities, suburbs, towns or settlements, or any geographical or topographical feature of public or historical interest.
A.I	**HY – Hydrography** Hydrographic elements, including marine areas and all other water bodies and items related to them, including river basins and sub-basins. Where appropriate, according to the definitions set out in Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (2) and in the form of networks.
A.I	**PS – Protected sites** Area designated or managed within a framework of international, Community and Member States' legislation to achieve specific conservation objectives.
A.I	**TN – Transport networks** Road, rail, air and water transport networks and related infrastructure. Includes links between different networks. Also includes the trans-European transport network as defined in Decision No 1692/96/EC of the European Parliament and of the Council of 23 July 1996 on Community Guidelines for the development of the trans-European transport network (1) and future revisions of that Decision
A.II	**EL – Elevation** Digital elevation models for land, ice and ocean surface. Includes terrestrial elevation, bathymetry and shoreline.
A.II	**GE – Geology** Geology characterised according to composition and structure. Includes bedrock, aquifers and geomorphology.
A.II	**LC – Land cover** Physical and biological cover of the earth's surface including artificial surfaces, agricultural areas, forests, (semi-)natural areas, wetlands, water bodies.
A.II	**OI – Orthoimagery** Geo-referenced image data of the Earth's surface, from either satellite or airborne sensors.

A.III	**AF – Agriculture and aquaculture** Farming equipment and production facilities (including irrigation systems, greenhouses and stables).
A.III	**AM – Area management / restriction / regulation zones and reporting units** Areas managed, regulated or used for reporting at international, European, national, regional and local levels. Includes dumping sites, restricted areas around drinking water sources, nitrate-vulnerable zones, regulated fairways at sea or large inland waters, areas for the dumping of waste, noise restriction zones, prospecting and mining permit areas, river basin districts, relevant reporting units and coastal zone management areas.
A.III	**AC – Atmospheric conditions** Physical conditions in the atmosphere. Includes spatial data based on measurements, on models or on a combination thereof and includes measurement locations.
A.III	**BR – Bio-geographical regions** Areas of relatively homogeneous ecological conditions with common characteristics.
A.III	**BU – Buildings** Geographical location of buildings.
A.III	**ER – Energy Resources** Energy resources including hydrocarbons, hydropower, bio-energy, solar, wind, etc., where relevant including depth/height information on the extent of the resource.
A.III	**EF – Environmental monitoring facilities** Location and operation of environmental monitoring facilities includes observation and measurement of emissions, of the state of environmental media and of other ecosystem parameters (biodiversity, ecological conditions of vegetation, etc.) by or on behalf of public authorities.
A.III	**HB – Habitats and biotopes** Geographical areas characterised by specific ecological conditions, processes, structure, and (life support) functions that physically support the organisms that live there. Includes terrestrial and aquatic areas distinguished by geographical, abiotic and biotic features, whether entirely natural or semi-natural.
A.III	**HH – Human health and safety** Geographical distribution of dominance of pathologies (allergies, cancers, respiratory diseases, etc.), information indicating the effect on health (biomarkers, decline of fertility, epidemics) or well-being of humans (fatigue, stress, etc.) linked directly (air pollution, chemicals, depletion of the ozone layer, noise, etc.) or indirectly (food, genetically modified organisms, etc.) to the quality of the environment.
A.III	**LU – Land use** Territory characterised according to its current and future planned functional dimension or socio-economic purpose (e.g. residential, industrial, commercial, agricultural, forestry, recreational).
A.III	**MF – Meteorological geographical features** Weather conditions and their measurements; precipitation, temperature, evapotranspiration, wind speed and direction.
A.III	**MR – Mineral resources** Mineral resources including metal ores, industrial minerals, etc., where relevant including depth/height information on the extent of the resource.
A.III	**NZ – Natural risk zones** Vulnerable areas characterised according to natural hazards (all atmospheric, hydrologic, seismic, volcanic and wildfire phenomena that, because of their location, severity, and frequency, have the potential to seriously affect society), e.g. floods, landslides and subsidence, avalanches, forest fires, earthquakes, volcanic eruptions.

A.III	**OF – Oceanographic geographical features** Physical conditions of oceans (currents, salinity, wave heights, etc.).
A.III	**PD – Population distribution and demography** Geographical distribution of people, including population characteristics and activity levels, aggregated by grid, region, administrative unit or other analytical unit.
A.III	**PF – Production and industrial facilities** Industrial production sites, including installations covered by Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control (1) and water abstraction facilities, mining, storage sites.
A.III	**SR – Sea regions** Physical conditions of seas and saline water bodies divided into regions and sub-regions with common characteristics.
A.III	**SO - Soil** Soils and subsoil characterised according to depth, texture, structure and content of particles and organic material, stoniness, erosion, where appropriate mean slope and anticipated water storage capacity.
A.III	**SD – Species Distribution** Geographical distribution of occurrence of animal and plant species aggregated by grid, region, administrative unit or other analytical unit.
A.III	**SU – Statistical units** Units for dissemination or use of statistical information.
A.III	**US – Utility and governmental services** Includes utility facilities such as sewage, waste management, energy supply and water supply, administrative and social governmental services such as public administrations, civil protection sites, schools and hospitals.

Source: INSPIRE Knowledge Base

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