



NATIONAL REPORT SPAIN

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1. INTRODUCTION: PHYSICAL CONTEXT AND GEOGRAPHY

Spain has an area of 505,944 km², from west to east. Its geographical situation is in the southern Europe, in the Iberian Peninsula. In addition to the peninsular territory, it includes the Balearic Islands in the Mediterranean Sea, the cities of Ceuta and Melilla in North Africa and de Canary Islands in the Atlantic Ocean (1).

The administrative division is in 17 autonomous communities, 50 provinces and 2 autonomous cities, Ceuta and Melilla (Figure 1).



Figure 1: Administrative map of Spain.

The population (as of January 1, 2018) was 46,659,302 inhabitants (2), with a 9.8% foreign people. In this group, the most numerous are Moroccans, 1.46%, Romanians, 1.45%, and British, 0.61%. The population by cities is: Madrid, the capital, (3,182,981), Barcelona (1,620,809), Valencia (787,808), Seville (689,434), Zaragoza (664,938), and Málaga (569,002).

The population density is 92.2 inhabitants/km² with an annual growth rate of 0.03%. By ages: 0-14 are 15%; 15-64 are 66% and more than 65 years old 19%.

The principal religion is Catholic, 68%; and believers of other confessions, 2.6%.

Spanish is the official language of the entire State. There are other Spanish languages that are also official in the respective Autonomous Communities in accordance with their Statutes. English is the most studied foreign language.

To enter Spain (5), citizens of any State of the European Union, Switzerland, Norway, Iceland and Liechtenstein, only need the National Identity Document or passport in force. A passport is required for people coming from The United Kingdom and Ireland. Those from the rest of the world also require a visa¹.

The climate that predominates in Spain is the temperate Mediterranean, which propitiates dry summers and winters with balanced temperatures. In Spain, there are more than 3,000 hours of sunshine per year. It is not strange, therefore, that this area is one of the warmest in Europe. A summary map is shown in Figure 2:

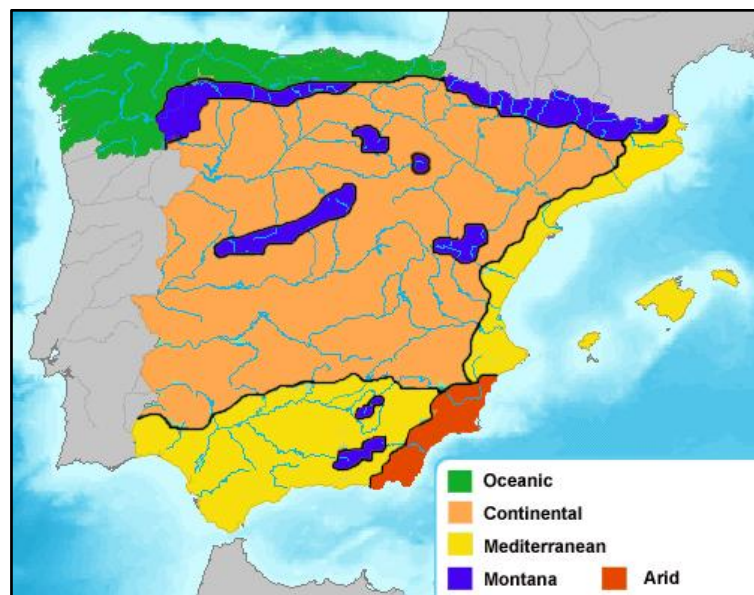


Figure 2: Climatic map of Spain.

Main natural resources are: copper, zinc, lead, potash, gypsum, sepiolite, sodium sulfate, ornamental rocks and arable land (3).

1. Some social welfare indexes (2016) (4):

- Human Development Index 27 (placed in world ranking, 188 countries)
- Public expenditure on health/GDP² 6.4%
- Public spending on education/GDP 4.3%
- Gini index of inequality 0.359

2. Some economic indicators (2017)

- Current GDP 1,163,662 (millions of euros)

¹ More information at www.exteriores.gob.es.

² Gross Domestic Product

Sectorial distribution:

- Services 73.3%
- Industry 18.1%
- Construction 5.8%
- Agriculture 2.9%
- Active population with more than 16 years 58.8%
- Population occupied by sectors
 - Agriculture 4.3%
 - Industry 14.1%
 - Construction 5.9%
 - Services 75.6%
- Unemployment 17.2%
- Energy, communications R&D. Composition of electricity generation (% of total, 2016)
 - Hydraulic 13.2%
 - Coal 19.5%
 - Oil 5.5%
 - Natural gas 18.3%
 - Nuclear 20.4%
 - Wind 17.8%
 - Solar (PV and thermoelectric) 4.9%
 - Energy dependence 72.3%

3. Highlights of the market

- Great market. The Spanish market is one of the largest in Europe, with an outstanding purchasing power in line with the European average, to which we should add the 82 million international tourists who visited Spain in 2017, a quantity that has been increasing every year.
- Platform for business. On the other hand, Spain is a platform to do business with the EU, but also with the whole Mediterranean area, North Africa, the Middle East and especially Latin America. In fact, Spain is the country of its environment with the largest number of double taxation treaties and protection of investments with Latin America countries.

- Favorable business climate. The more than 12,000 foreign companies present in Spain benefit from a favorable business climate: taxation is very moderate, with a fiscal pressure notoriously lower than the EU average, and the tax treatment of R&D is the second most favorable among the OECD countries, both for large companies and for SMEs.
 - High level. Spain also stands out for its communications and infrastructure network and for its highly qualified and competitive workforce.
 - Productive model of technological cutting. Furthermore, Spain is currently focusing on a new production model that creates business opportunities in sectors with high added value and a strong technological component. The strategic sectors for investment in Spain are currently: the chemical, information and communication technologies (ICT), environment, water and its treatment, Health Sciences, biopharma and biotechnology, aeronautics, automotive, and logistics and energy.
4. The main highway network, rivers, railways and commercial areas are shown in Figure 3.



Figure 1: Main highway network, rivers, railways and commercial areas.

2. CHARACTERISTICS OF THE SPANISH LOGISTICS SECTOR

In recent years, environmental concern has gained special importance in our society, which is why the logistics sector is constantly looking for a more sustainable and environmentally friendly transport system.

In 2016, the economic weight of the logistics sector represented 2.8% of the GDP of the Spanish economy, maintaining similar levels to the previous year. For comparative purposes, it is observed that the weight of the sector logistics in the main European powers is situated at levels similar to that of Spain. Regarding employment, the sector achieved a growth of +2.0%, reinforcing the increase achieved in 2015, which places the sector with a weight of 3.4% in the economy. This growth is mainly based on greater employment in the “Freight transport by road and moving services” (which represents 51% of workers).

Regarding the surfaces associated with the logistic nodes, a stable trend continues to be maintained, with hardly any changes. There is a trend in the rail sector towards flexible solutions in the management of terminals, with growth (+9.4%) in the number of freight terminals that can be managed on a self-service basis.

The total area of logistics facilities in Spain amounted to 78.9 million m² in the year 2017 (+1.9%), where maritime transport continues to lead above all other modes (49.8%). According to the logistic intensity, (m² logistics facilities / € GDP per capita), values similar to those of the year 2016.

Regarding the transportation of goods, in 2017 the growth initiated in 2014 was maintained, being globally of + 8.9% and somewhat higher in the national scope than in the international one. All modes registered growths in both areas. In the same way, both at the national level and in the international transport, the predominant modes of transport strengthened its leadership, with the share of the 94.7% at the national level, and the maritime mode share of 79.9% at the international level.

Regarding multimodal transport, it had a remarkable growth in 2017 of +11.4%, being higher than the aforementioned unimodal transport growth. The increases obtained by the air-road and maritime-highway chains stand out, above the rest of the chains. On the other hand, regarding intermodal transport in container, it obtained a growth lower than the multimodal, being +8.9% and maintaining the growing trend originated in

2013. It has to be highlighted the increase obtained by the intermodal rail transport, which It has been above average (8).

2.1 TRANSPORT INFRASTRUCTURES

Transport infrastructures make up the physical network that channels merchandise flows and, consequently, constitute an essential part of the logistics chain.

The road network is the most developed transport infrastructure, presenting an extensive geographic network of 165.907 km in length, which allows companies to have universal accessibility to the territory far higher than that provided by other modes of transport. Of the entire network, 14,701 km are high-capacity roads (highways, toll roads and freeways), so that Spain is currently the country in Europe with the longest such roads.

In accordance with the provisions of the Railway Sector Law (LSF in Spanish) we consider the Railway System of General Interest (RFIG in Spanish), i.e., the network managed by the Railway Infrastructure Administrator (ADIF in Spanish), that includes Iberian gauge railway (1,668 mm), standard-gauge (1,435 mm), and from the 1st of January, 2013, also the metric width, and the network managed by the corresponding Port Authorities. The railway system also includes those of the Government of Catalonia (FGC), Valencia Regional Railway (FGV), rail network of the País Vasco (ETS), and Perthus for the Figueras-Perpignan line (LFP). All of it with a total of 15,781 km (6).

Ports are a key element, since through them most of the merchandise imports and exports are channeled. The Spanish port system is composed of 46 Ports of General Interest, managed by 28 Port Authorities.

The main peninsular air cargo airports are Madrid - Barajas, Barcelona - El Prat, Zaragoza, Vitoria and Valencia. Regarding non-mainland airports, the airports of Gran Canaria, Tenerife Norte and Palma de Mallorca stand out (7).

2.1 LOGISTIC NODES

Logistic nodes are merchandise exchange points where activities that add value to the transport chain are carried out, such as handling, processing and, where appropriate, storage of the merchandise.

Below is a description of the logistics nodes in Spain:

- **Road transport centers:** Sometimes also called logistics parks, are logistical platforms for road transport.

They have a consolidated logistics area and a service area, which includes services to people and vehicles as well as administrative centers for transport companies, and cargo contracting centers. In addition, logistics parks and transport centers serve a large number of companies in the transport sector in their area of influence.

The following figure shows the location of the main road transport centers in Spain. As can be seen, the highest concentration of road transport centers corresponds to the large metropolitan areas of Madrid and Barcelona. It also highlights the concentration in the Basque Country and Galicia. The distribution in the rest of the Peninsula is considerably more dispersed.



Figure 2: Main road transport centers (8).

- Infrastructure of supply (fuels):

The geographic information system³ shows the 296 replenishment stations for biodiesel and ethanol distributed throughout Spain. The geographic information system⁴ shows seven open biogas service stations for vehicles currently in Spain. According to the data collection within the EU-funded project for the year 2009 MADEGASCAR, in Spain there are 545 stations for recharging biogas for buses used in public transport. The European funded project BEST has about 15 E85 Flexifuel service stations in Spain, of which 10 are in País Vasco and 5 in the Community of Madrid. In País Vasco the local distributor EVE has 60 pumps; most of them will sell biodiesel and bioethanol in the near future. The

³ www.biodieselspain.com/mapa_biogasolineras.php

⁴ <http://www.metanoauto.com/modules.php?name=Distributori&op=Mappa>

geographic information⁵ offers a real overview of the Spanish vehicle refueling infrastructure as well as alternative fuels, with information available for various devices. The geographic information⁶ system lists 18 hydrogen service stations in Spain, three of which are currently in operation. The national map of charging points⁷, according to the e-mobility master plan MOVELE. The city of Madrid operates its own biogas plant and the service station for the refueling of the municipal vehicle fleet of 450 buses and 500 vehicles that collect waste (9).

- ADIF railway installations:

The network of railway facilities or ADIF's terminals consists of those facilities that ADIF places for the service of the different railway companies to facilitate modal interchange and the transport of goods by rail.

According to the Declaration on the Network of 2013, ADIF has 57 main logistics facilities, of which 47 are open 24 hours a day, 365 days a year, to access and issue trains. In addition, it has 107 logistics facilities managed under self-service. The ADIF logistics facilities classified according to the number of treated trains are shown in Figure 5.



Figure 3: ADIF logistics facilities classified according to the number of trains treated (2012).

- Ferroportuarias terminals

⁵ <http://geoportal.mityc.es/hidrocarburos/eess/dispmovil.jsp>

⁶ www.h2stations.org

⁷ <http://www.movele.es/index.php/mod.puntos/mem.mapa/reلمenu.20>

The ferroportuarias terminals are those railroad terminals located in the ports they serve, thus forming a railroad complex.

The connection agreements between the respective Port Authorities and ADIF regulate the rail connection of the ports with the rest of the Railway of General Interest (RFIG). However, not all Spanish ports with rail connections have signed this agreement, which does not prevent traffic from being made on them.

The following figure shows the Ports of General Interest as they have a rail connection to the RFIG and connection agreements in August 2013. The following can be observed:

- Seventeen have rail connection to the RFIG and connection agreement.
- Four have a railway connection to the RFIG, but no connection agreement.
- Four do not have a rail connection to the RFIG, which are those of Motril, Almería, San Cibrao and Sagunto.



Figure 4: Spanish ports according to the railway connection to the RFIG (August 2013).

The railway infrastructure of the Port of Barcelona is noteworthy. In addition to having railway lines in almost all of its docks, it is immersed in the renovation of its internal network to adapt it to the UIC width and extend the length of its tracks for trains of 750m, especially the container terminals. The Port of Valencia, although at a lower level of development, is also in the process of adapting its interior network to European standards (UIC width, 750m).

There are also a series of ports with a railway infrastructure appropriate to the type of traffic they make. Within this category, you can include the Port of Gijón, Bilbao, Tarragona, Huelva, among others.

However, weaknesses are generally detected in the rail infrastructures of the ports, among which are the short length of the railway tracks and the limited access to the port derived from the coexistence of the access with railway traffic of passengers or interferences with the urban developments.

- Special derivations:

The private derivations are privately owned railway infrastructures connected to the RFIG. This group includes nodes of very different scope and activity range and include Dry Ports, private intermodal terminals, factories, automotive fields, etc.

As shown in the following figure, there are a total of 206 individual derivations in commercial exploitation connected to the ADIF network.

The types of products that have the greatest number of particular derivations are steelmaking, railway material and fuels.

- Dry Ports and internal maritime terminals:

The Dry Ports arise as support to maritime ports that, for various reasons, can not extend their port domains to the same extent that their logistical needs require it.

For this reason, Dry Ports are conceived as intermodal freight terminals located within an economic country or region that connect, through the railway network, with one or more maritime ports of origin or destination of traffics treated.

They offer the possibility of postponing customs control until the entrance to the dry port, which allows expediting the exit of goods from the ports towards their destination, helping to decongest their operations. Some ADIF railway facilities have customs services, so they could also be considered as Dry Ports.

They are therefore intermodal platforms, as they combine rail, maritime and road transport. The main functional area is the one destined to rail-highway intermodal transfer, although other functional areas may be associated.

- Logistics Activity Zone (in Spanish, ZAL).

Logistics Activity Zones are specialized areas in the activities of storage and distribution of merchandise, where activities are developed and services of added value are provided. ZALs are especially linked to port developments, to which they provide the logistical services necessary to add value to the logistics chain.

The areas of a ZAL are conceived and designed for logistics operations and favor the optimization of processes among the different actors involved in them, as well as representing one of the highest levels of supply of the logistics node. Likewise, the ZAL must have promotion and development activities, such as the provision of services, training, the promotion of the logistics community or assistance to final customers.

The installation of a ZAL generates positive effects in its geographical environment, both on the port area itself, on logistics companies, on the urban environment and transport.

The ZAL that exist in the Spanish territory are shown in Figure 7, classified in ZAL in service and ZAL in the planning or implementation phase.



Figure 5: Logistics Activity Zone.

- Air cargo centers:

The main air cargo centers are located at the airports of Madrid - Barajas, Barcelona - El Prat, Zaragoza, Vitoria and Valencia. Below is a description of each of them.

Madrid - Barajas air cargo center: The Madrid - Barajas air cargo center is the center with the highest density of air cargo companies in Spain, with more than 200 companies installed. The center has a first phase of 32.5 Ha, and the second one of 8.8 Ha, which together add up to an available area of 41.3 Ha.

The center has a general services building of 15,210 m², located at the main entrance of the center, which is its epicenter. This building houses more than 125 companies that intervene in the activity of air transport of goods, airlines, freight forwarders and customs agents, among others.

Barcelona Air Cargo Center - El Prat: The Barcelona Air Cargo Center - El Prat has an area of 40 Ha, housing more than 80 companies that intervene in the logistics chain of

air freight. In the general services building, the most important airlines, freight forwarders and customs agents, among others, are listed.

Valencia Air Cargo Center: The Valencia air cargo center has an area of 3.1 hectares on the first line, with warehouses for handling and cargo autohandling activities, and a second-line area of 2.8 hectares, with warehouses for freight forwarders and logistics operators. In addition, the Center has a Border Inspection Post (PIF) and a three-floor general services building.

Zaragoza Air Cargo Center: Zaragoza Airport has a logistics area of approximately 10,000 m², which houses four facilities, developed in different stages, for the activity of handling companies, integrators and other logistics operators.

Vitoria air cargo center: Vitoria airport, the fourth airport of the network in freight traffic, has an air cargo activity area that includes a total of five logistics warehouses. With a total area of more than 12,000 m², this logistics zone houses handling companies, integrators and other logistics operators, as well as a site for the Border Inspection Post (BIP) and Customs (7).

2.3 ASSOCIATIONS AND LOGISTICS AGENTS

In 2011, three logistics and transport associations merged into the new UNO employer. The three associations in the sector of logistics and transport activity in Spain have merged to create an employer that will be called UNO (Business Organization of Logistics and Transportation) and will group a total of 400 companies, according to this organization. It groups 400 companies that employ 80,000 workers. The merged organizations are Logic (Logistic Operators Business Organization), AECAF (Spanish Fractional Freight Business Association) and AECI (Spanish Association of International Couriers). The new UNO employer association is formed with the objective of giving a boost to the sector and positioning it as one of the reference activities in the country's economy. The companies that comprise it employ 80,000 workers and add up to a turnover of 10,000 million euros. UNO is born with a clear integrating vocation of all the companies that operate in the supply chain to give a new impulse to the sector, improve the answers to the needs of society and contribute to the advances of the sector towards the future. Its main objective will be to contribute to the positioning of the logistics and

transport sector as one of the reference activities in the country's economy, promoting transparency, ethics and sustainability⁸.

2.3. DIAGNOSIS OF THE SITUATION OF THE SPANISH LOGISTICS SECTOR

The SWOT analysis (Weaknesses, Threats, Strengths and Opportunities) corresponding to the strategic diagnosis is then carried out (Table 1). It identifies the key factors, positive and negative, of internal and external origin, which reflect the current situation of Spanish logistics system and allow visualizing the role to be played by it in Table 1.

Table 1: SWOT Analysis of the SPANISH Logistics Sector (7).

WEAKNESSES	THREATS
- Strong atomization of the sector, with average size of the companies remarkably reduced.	- Shortage of global business projects in the logistics sector.
- Unbalanced modal split.	- Specific regulations on modes of transport and Absence of own regulations on logistics.
- Low participation of intermodal transport.	- Rigidity in administrative procedures and customs controls.
- Insufficient coordination in the planning and development of logistics infrastructures.	- Difficulties of interconnection with France.
- Reduced use of ICTs in some sectors and modes of transport of goods.	- Low availability of financial resources and decrease in European funding.
- Little dimension of the international activity of the Spanish logistics.	- Conflicts in the use of infrastructures in access to large cities.
- Lack of professional qualification in the sector.	
- Absence of a clear scheme at the national level of platforms and logistics areas.	
STRENGTHS	OPPORTUNITIES
- First level transport infrastructure.	- Development of the main European freight corridors.
- Release of capacity for rail freight transport in conventional network.	- Strategic geographical position of Spain.
- Private investment initiatives and PPP experiences in railway and logistics facilities (port terminals, loading nodes and connections, etc.).	- Support from the Ministry of Development to boost the logistics sector (Logistics Unit).
- Development of railway port connection agreements between the port Authorities and ADIF.	- Enhancement of intermodality in the PITVI.
- Ability to innovate and raise awareness about the role of training and education in the sector.	- Growing interest in the use of the railroad by shippers and logistic operators.

⁸ <https://www.europapress.es/economia/transportes-00343/noticia-economia-empresas-tres-asociaciones-logistica-transporte-fusionan-nueva-patronal-20110928171453.html>

	- High potential for improvement via management measures or with adjusted investment.
	- Dynamism of the Spanish export sector.
	- Positive results in logistics and intermodal transport in nearby European countries.

3. SITUATION OF SPAIN IN THE EUROPEAN LOGISTICS SECTOR

Spain has very good conditions to become a major European logistics node. Indeed, although it is situated on the periphery of the continent, its privileged geographical location, both at continental and insular level, makes it an ideal gateway to Europe for goods coming from North Africa as well as from America or Asia.

In addition to this excellent location, Spain has first class transport infrastructure in all modes (road, rail, maritime and air transport). Likewise, the integration of a large part of the national transport network in the major European and international freight corridors facilitates and ensures the transport of goods abroad.

Spain is located in a strategic position to take advantage of the large maritime transport routes of goods that go around the world, the so-called Round the World routes that all major shipping companies (Maersk, MSC, CMA CGM, etc.) offer among their services.

Short Sea Shipping (TMCD) or Short Sea Shipping consists of the movement of merchandise and passengers by sea between ports located in the territory of the European Union or between those ports and ports located in non-European countries with a coastline in the seas that surround Europe. The geographical position of Spain, with numerous ports on both the Atlantic and Mediterranean façades, allows connections with numbers of countries in its environment that provide great efficiency to the flows of goods.

The main destination countries of the TMCD of ro-ro cargo (Ro-Ro and Ro-Pax) of Spain are the United Kingdom, Morocco and Algeria, with more than 10 lines. The main ports of destination of the Spanish TMCD are Tangier Med, Casablanca and Civitavecchia. Regarding the container TMCD, the more than 20 lines from Spain with Italy stand out, as well as the more than 15 existing ones with Morocco and France. The main destinations of the Spanish TMCD container lines are Felixstowe, Genoa, Rotterdam and Casablanca.

According to the Statistical Observatory of Short Sea Shipping in Spain, there are two special types of TMCD services:

- **TMCD Alternative to the Road:** this category includes maritime container or road services in which there is an alternative ground transportation. Therefore, traffic from Spain and countries or archipelagos not accessible by land, as well as bulk and vehicles, have been excluded from this category.
- **Motorways of the Sea:** Alternative TMCD services to the Highway that meet certain selection criteria, that is, a minimum frequency of 3 weekly departures and 3 stopovers in different ports at most, and that are provided in the corridors of Highways of the Sea of the Transeuropean Transport Network in which Spain is present.

In this way, the Motorways of the Sea are a subset of the TMCD Alternativa a Carretera services and these are a subset of TMCD's total services.

The Trans-European Transport Network is a planned set of priority transport networks designed to facilitate the communication of people and goods through the European Union. Throughout the Spanish territory, there are several corridors that are included within this international transport network, both by rail and road.

In addition, other European-level corridors designed to optimize environmental efficiency (SuperGreen project of the European Commission) and freight logistics (EuroCarex network) are planned in Spain.

Therefore, if the Spanish logistics sector manages to take advantage of all these advantages, it can turn the country into the great Logistics Platform of Southern Europe and a point of concentration and manipulation of international freight traffic, carrying out the main logistics activities and other of important added value such as labeling, packaging, consolidation and deconsolidation of load, etc. (7).

4. ENVIRONMENTAL CONSIDERATIONS IN THE TRANSPORT OF GOODS

The Spanish Ministry of Development publishes each year a report of the indicator that collects the balance of the final energy consumption of the different transport modes (rail, air, maritime and road) (8). It is shown in Table 2.

Table 2: Energy consumption in transportation (in TeraJoules, TJ).

Transport mode	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
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Rail	14,803	14,869	15,651	15,794	16,301	17,383	16,737	16,175	16,513	16,344	15,933
Air	56,088	58,518	54,789	48,045	47,785	46,409	38,571	32,892	32,655	34,038	36,737
Maritime	70,148	60,831	55,037	45,752	43,902	34,102	35,677	21,181	13,487	17,893	25,281
Road	1,304,325	1,352,363	1,291,717	1,229,180	1,201,237	1,154,610	1,096,570	1,062,175	1,077,363	1,114,598	1,149,591
Urban road	478,392	487,637	449,536	424,946	424,658	396,885	380,203	364,303	373,633	379,812	393,097
Non-urban road	825,933	864,726	842,182	804,233	776,579	757,725	716,366	697,872	703,729	734,786	756,495
Non-urban road-travelers	439,975	447,226	444,842	456,117	444,360	438,769	419,188	412,460	409,745	424,908	441,636
Non-urban road-goods	385,957	417,501	397,340	348,117	332,219	318,956	297,178	285,411	293,985	309,878	314,858
Total national transport	1,445,363	1,486,582	1,417,194	1,338,771	1,309,226	1,252,504	1,187,554	1,132,423	1,140,019	1,182,873	1,227,543

This report includes the final energy consumption, considering only national transport. Neither electric energy consumption for road transport nor the consumption of fuel cells are included, as there are no official sources available at national level with this information.

If we consider greenhouse gases (GHG) emissions and other transport contaminants, we can see in Table 3 data from emissions of GHG (carbon dioxide, methane and nitrous oxide) weighted with the global warming potential at 100 years. Transportation activities are excluded by other means (pipe). Only national transport is included (8).

Table 3: Emissions of greenhouse gases in transport (kt of equivalent CO₂).

Kt of equivalent CO ₂	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Rail	312	310	304	293	274	271	278	259	244	248	245	234
Air	4,047	4,123	4,302	4,028	3,532	3,513	3,412	2,836	2,418	2,401	2,502	2,701
Maritime	4,862	5,372	4,661	4,213	3,507	3,345	2,618	2,719	1,643	1,048	1,389	1,996
Road	92,999	95,82	98,623	93,374	87,27	84,04	79,68	74,118	75,5	76,43	79,13	81,27
Urban road	34,073	35,758	36,223	33,193	30,84	30,37	28,09	26,471	26,46	27,08	27,57	28,49
Non-urban road	58,925	60,062	62,4	60,181	56,43	53,68	51,6	47,647	49,04	49,35	51,56	52,78
Non-urban road - travelers	31,722	32,014	32,328	31,893	32,13	30,82	30,02	28,113	29,04	28,78	29,86	30,91
Non-urban road - goods	27,204	28,048	30,072	28,288	24,3	22,86	21,58	19,534	20	20,57	21,7	21,87
Total national transport	102,219	105,625	107,89	101,91	94,58	91,17	85,99	79,932	79,8	80,13	83,27	86,2

From these data the decreasing of greenhouse gases emission can be appreciated, from a total amount of 102,219kt in 2005 to 86,2kt in 2016.

Furthermore, the use of biofuels in road transport has also increased from a 0.3% in 2000 to 4.32% in 2016. In general, Spain is using clean energy more and more every year. Thus, the use of electric energy has increased from 64.8% in 2000 to 74.5% in 2016 (8).

5. GREEN LOGISTICS IN SPAIN

Road transport has the greatest impact on the environment (83.7%), followed by air (14%). Since the 1990s there has been a growing interest in seeking solutions to reduce its polluting emissions: improvements in the design of vehicles, new fuels, efficient

driving, control of traffic levels and efficient planning of operations, which has led to the proposal of the Green Logistics

The reduced attention to the impact that the logistics chain generated on the environment, often resulted in not only an evil in terms of the impact on the environment, but in the very management of the activity that in many cases was not optimal. For example, inverse logistics has become a fundamental part of the entire process.

From the moment in which the sector assumes that green logistics is an essential part for the development of the sector, socially, economically and environmentally, several companies begin to bet on their policies and practices. In Spain there has been a current in recent years that has changed the activity of logistics companies and their impact in the context in which it develops.

And this change becomes possible when green logistics is understood as an integral part of all actions that have to do with regular logistics and must be applied, with the added factor of respect for the environment. And always assuming that being respectful with the environment, is also betting on economic growth, since the goal of green logistics is to promote effective and efficient action plans.

5.1 THE BEGINNING OF GREEN LOGISTICS

In order for change to be possible, it was necessary to be aware of the aspects on which improvements should be made.

The logistics in Spain, like many other sectors on which this investment in green economy should be made, had the following determining aspects:

- Size of logistics companies.
- Strong dependence of the administrations to operate large changes.
- Sector very polarized with some large companies and many small ones.
- Weak R & D system.
- Strong dependence on foreign technology (negative balance in the trade balance).
- Deficit of technology-based SMEs / Absence of industrial policy
- Absence of a clear environmental policy aimed at creating socio-economic value, together with the lack of long-term strategic planning and the continuous changes in fiscal stimulus policies.

In 2005, it was when the energy intensity of transport in Spain began a downward trend that remained until 2013. the graphic in Figure 8 shows the evolution of the intensity of energy consumption (in relation to GDP) in transport in the EU-28, Spain, France, Germany and Italy (9).

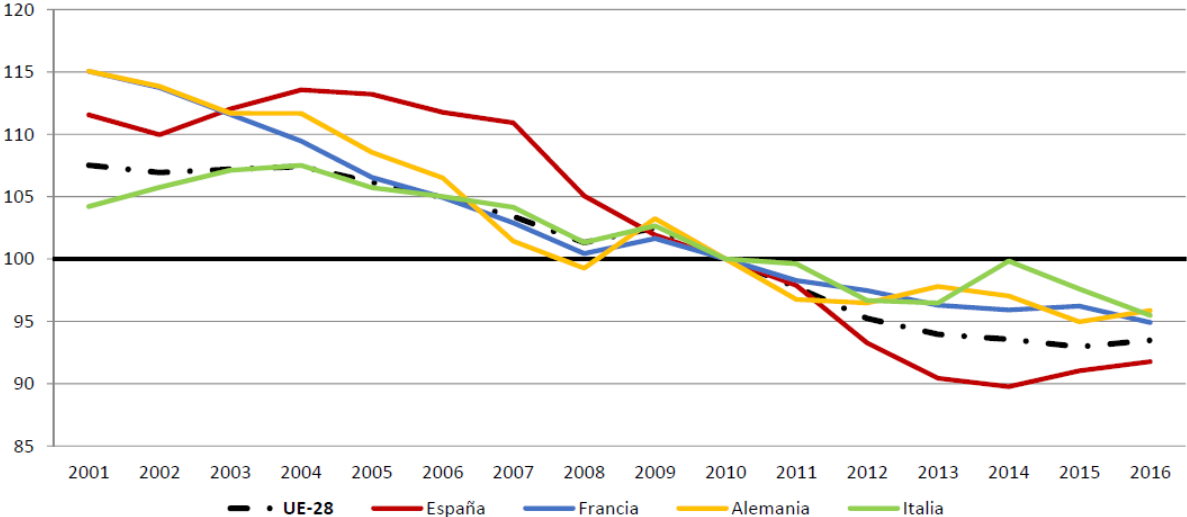


Figure 6: Evolution of the intensity of energy consumption (in relation to GDP) in transport in the EU-28, Spain, France, Germany and Italy. Index 2010 = 100 (8).

5.2 Spanish strategy for climate change and clean energy 2007-2012-2020

Climate change is one of the main threats to sustainable development, representing one of the main environmental challenges with effects on the global economy, health and social welfare.

Spain, due to its geographical situation and its socioeconomic characteristics, is a country very vulnerable to climate change, as it has been shown in the most recent evaluations and investigations. The serious environmental problems that are reinforced by the effect of climate change are: the decrease of water resources and the regression of the coast, the losses of biological diversity and natural ecosystems and the increases in the processes of soil erosion. There are also other effects of climate change that will also cause serious impacts on economic sectors.

The evolution of emissions highlights reveals the difficulties that are being faced in the attempt to combine the economic convergence with the European Union and limiting the increase in GHG emissions. This Strategy tries to approach the following objectives simultaneously:

- To respect the international commitments assumed by Spain with the ratification of the Kyoto Protocol.
- To preserve and to improve the competitiveness of the Spanish economy and employment.
- To be compatible with economic and budgetary stability.
- To guarantee the security of energy supply

The Government has adopted a set of important measures to favour Energy Saving and Efficiency as well as the increase of energy from renewable sources, and this has favoured the beginning of a change in trends. According to consumption data, there is a trend change in terms of the power intensity of the economy and this seems to indicate a reduction of GHG emissions.

The Spanish Climate Change and Clean Energy Strategy aims to fulfil the commitments of Spain in matters of climate change and support to clean energies, while improving at the same time, social welfare, economic growth and environment protection. The operational objectives are (10):

- To ensure the reduction GHG emissions in Spain, giving special importance to measures related to the energy sector. According to the national inventory, and following the IPCC classification, in 2005, emissions from energy process represented about 78.87% of total national emissions.
- To contribute to sustainable development and the fulfilment of our climate change commitments by strengthening the use of flexible project-based mechanisms.
- To promote additional reduction measures in sectors concerned with diffuse pollution.
- To apply the National Climate Change Adaptation Plan so as to integrate adaptation measures and strategies in sectoral policies.
- To increase public awareness with respect to clean energy and climate change.
- To promote research, development and innovation in matters of climate change and clean energy.
- To guarantee energy supply security by means of cleaner energies, mainly from renewable sources, achieving other environmental benefits (for example, air quality) and limiting the growth rate of external energy dependence.

- To boost the rational use of energy and saving of resources both for companies and end users.

Specifically within the Transport Sector, the following objectives within the Strategy are marked as some of the fundamentals to be achieved:

- For energy efficiency:
 - To limit the consumption of non-renewable resources and improve the energy efficiency of transport services facilities, prioritizing these requirements both in the renovation or rehabilitation of existing ones, and in the projects of new facilities.
 - To improve the energy efficiency of the different modes of transport, reducing the levels of final energy consumption specific to internal transport per unit of gross domestic product and per unit transported.
- For environmental quality:
 - To reduce specific emissions - per unit transported - of greenhouse gases and other pollutants, as well as absolute emissions when necessary for compliance with international commitments - Kyoto Protocol or National Plans for the Allocation of emission rights - or air quality objectives in urban environments.

2.3 NATIONAL REFORM PROGRAM OF SPAIN

When dealing with the Transport Sector, the National Program proposes that the actions on the use of investments in infrastructures be directed towards the rationalization and optimization of resources.

The main objective is to ensure that the transport service is efficient and competitive, ensuring that the peripheral situation of Spain does not constitute a competitive disadvantage for commercial relations.

5.4 EUROPE 2020 STRATEGY FOR A SMART GROWTH

One of the flagship initiatives of the European Union is to undo economic growth and the use of resources, reducing carbon emissions in our economy, increasing the use of renewable energy, modernizing the transport sector and promoting efficient use of energy.

5.5 THE EVOLUTION TOWARDS GREEN LOGISTICS

The growth of the logistics sector has been a continuous process during the last years, which has meant in employment data an occupation of seven million people. Of them, more than 30% work in road transport.

The same data translated into the Spain, tells us that within the logistics sector, 45% develop their work in the sector of transport of goods by road, surpassing the European level within the logistics sector. This specific weight of transport within the overall activity of the logistics sector gives us a clear sign of the importance of the development of green policies within the sector.

When we analyze the number of companies in the road transport sector, we get: in Spain, 60% of the companies in the logistics sector are engaged in the transport of goods by road, while in Germany this specific area of logistics represents the 39 %, in France it represents 45%. The data of the European Commission therefore speak of a fundamental weight of the distribution segment within Spanish logistics, which represents almost 60% of the total volume of the sector.

Therefore, the dependence within the vehicle sector as the main tool of work seems evident. This, transferred to a policy of sustainability and green logistics, requires a detailed analysis and a policy of actions that is capable of combining the development of the logistics activity, with respect for the environment.

The impact on the environment, in terms of emissions, is directly related to the economic impact within the activity by logistics companies, since this dependence on fuels together with the price increase experienced in the last months above all, they heavily tax the logistics activity of the companies. Hence, actions on responsible driving, be a clear example of the actions that the sector has had to undertake.

The logistics sector has to face several constraints:

- Price of oil.
- Environmental costs.
- Motorway tolls.
- Taxes.
- Road congestion.
- Lack of infrastructure capacity.
- Material costs (vehicles, etc.).
- Aging of the transport fleet.
- Security for professionals.

- Increasingly complex and global processes in Logistics.

It seems clear that sustainability is one of the main issues that should continue to face the logistics sector.

It should be clear that all those measures aimed at strengthening the sustainability that the development of activity in the sector must represent for the environment, will be inseparable, making the activity itself more solid. That is, the competitive sustainability of Spanish companies thanks to this activity.

Within this vision of the future, we intend to determine the strategic areas and actions that will serve as a tool to implement the necessary changes to achieve that vision in a sustainable manner, promoting the technological development of the activity and its subsequent strengthening.

5.6 THE NEED FOR A GREEN LOGISTICS

The demonstration that logistics activities consume a large amount of energy and that this is a growing concern in the sector, is demonstrated by the fact that more and more companies are trying to achieve savings in energy consumption seeking greater efficiency in several processes within the logistics activity.

From this global set of actions within the logistics sector, the concern includes, from the packaging of products, to the emissions produced in the development of the activity by the consumption of polluting fuels.

This need for a green logistics is endorsed by the implementation of regulatory standards that came from Europe in relation to the manufacture of engines so that they were more respectful of the environment, reducing their impact.

But energy consumption does not only occur in the field of transport within the sector, although it can be more. This phenomenon occurs throughout the logistics chain. In fact, both in the storage and in the design of the logistics processes, this energy consumption is also taken into account, from an optics that bets on the increasing use of specific equipment and machinery that affect less polluting processes and therefore more respectful .

This same need has been understood in the handling of goods in storage centers where, both the use of trucks and other transport equipment has been acted to avoid the contamination that existed, minorizing it. Aspects such as the use of solar and wind energy systems are increasingly visible in these work centers.

All these actions focus on a necessary, at the same time desirable, energy efficiency within the logistics sector, which advocates responsible consumption, avoiding unnecessary energy costs. In this way, within the transport sector, environmental efficiency is sought through more efficient transport equipment that improves the distribution and the displacements on which it is based, combining the reduction of costs, as well as the impact that distribution of goods represents for the environment.

In this way in Europe in the last twenty years, there are a number of factors (legal pressure on driving times, increases in fuel costs, etc.) that in the last decade are leading to the elimination of companies from the market, which, in turn, translates into the survival of those seeking innovation through the introduction of more transport equipment, the use of new vehicle combinations that allow to increase the number of transported tons more accentuated of information technologies for the rationalization of the kilometers traveled, search for itineraries that fuel, the optimization of the volume of paper documentation reduction, etc.

In a word: sustainability.

In addition to the progress of the processes undertaken by green policies within the logistics sector, there is no doubt that it is also an incentive for customers, increasingly interested in this type of issues.

The control of polluting emissions in the sectors of logistics and transport has gone hand in hand, many times, hand in hand, often, the pressure of customers, who, knowing that a carrier or a logistics operator carry the image of your company everywhere, look for providers of logistics services aware of the environmental impact of their activities and that intervene in achieving improvements, in evolving, in the acquisition of more modern and less polluting equipment, or in obtaining certifications that guarantee their environmental management (11).

The need for a Green Logistics, demonstrated by the data we have been contributing, tries to respond to the changes that in recent years have been taking place in the supply chain, which demanded increasingly complex processes.

This growth in the development of the logistics chain influenced from a negative point of view the impact that the environment meant, also converting the tasks into larger and

more complex processes, costs for the logistics processes that directly affect competitiveness in the sector.

At the same time, this reality focused the activity towards greater consumption and higher costs.

For all that, the keys on which green logistics could be effective would go through increasing the level of cooperation among logistics service providers, in order to respond to this increase in competition among supply chains.

In this way, cost savings and the reduction of energy consumption by sharing both means of transport and storage to seek greater efficiency are being promoted.

As cited in the report (11), Green logistics is characterized by a highly developed ecological conscience that seeks optimization in the management of the supply chain in order to reduce the ecological impact of transport and storage of products, among other logistic processes.

In all this context, the fundamental tool to carry out the ideas on which green logistics is based is and should be, the increase of investment in R & D in the logistics sector, so that through technology it is can optimize the use of energy, minimizing the impact of logistics activity.

We present in Table 4 a summary where we try to structure how the process becomes visible and the need for improvement in the sector.

Table 4: Summary about the visibility of the process and the need for sector improvement.

ITEM	HANDICAP	SOLUTION
TRANSPORT	Polluting emissions	<ul style="list-style-type: none"> - To develop solutions as alternative energy sources. - Planning and optimization of routes. - To work on the maintenance of vehicles.
DISTRIBUTION	Large number of delivery units (vehicle)	- To implement actions in the distribution plant for the planning of lines of work that streamline the process and minimize waiting times and the number of trips with less load or empty, thereby acting on fuel costs, rationalizing.
STORAGE	Impact on the environment	<ul style="list-style-type: none"> - To plan the storage spaces thinking of an infrastructure that allows a manipulation of the merchandise, both in its storage, as in its loading and unloading. - To implement energy saving measures, such as: structures that maximize the use of natural light, placement of solar panels, photoelectric cells so that artificial light is activated only if there

		is someone at the determined point of work, respectful construction materials with the environment, insulating measures that reduce the consumption of heating and air conditioners.
LOADING AND UNLOADING	Generation of waste	<ul style="list-style-type: none"> - To reuse at the beginning of the chain of generated waste. - To encourage the use of tools for loading and unloading that enable the reduction of time and therefore of energy used.
PACKAGING	Waste management	<ul style="list-style-type: none"> - Introduction of techniques that reduce the use of packaging, enhancing the use of biodegradable materials and respecting the environment, so that the impact on the context is as low as possible.
PROCESS INFORMATION FLOW	Pérdida de información para su seguimiento	<ul style="list-style-type: none"> - To take control of information to promote feedback that ensures efficient processes, sharing experiences and good practices. - To promote improvement.

6. TRAINING IN GREEN LOGISTICS

Table 4 includes a detailed description of current situation of institutions and master degrees in Spain.

Table 5: Master Degrees in Logistics⁹.

	University/Institution	Title	Related to green logistics
1	INSTITUTO EUROPEO DE POSGRADO	Online Master degree in Logistics and Supply Chain Management	--
2	MBA BUSINESS SCHOOL	Executive Master in Operations Management and Logistics	--
3	MIP POLITECNICO DI MILANO SCHOOL OF MANAGEMENT	Global Executive Master in Operations and Management of the Supply Chain (GEMOS)	Innovative and Sustainable Supply Chain Management
4	EAE BUSINESS SCHOOL	Master Degree in Supply Chain Management & Logistics	No info
5	EAE BUSINESS SCHOOL	International Master Degree in Supply Chain Management & Logistics	No info
6	GBSB GLOBAL BUSINESS SCHOOL	Master in Operations and Supply Chain Management in Barcelona	--
7	GBSB GLOBAL BUSINESS SCHOOL	Master in Operations and Supply Chain Management in Madrid	No info
8	ESIC BUSINESS & MARKETING SCHOOL	Master in Logistics and Supply Chain Management + SAP ERP	Reverse logistics Quality and environmental strategies.
9	INSA BUSINESS, MARKETING & COMMUNICATION SCHOOL	Master in integrated logistics: operations and management of the supply chain	--

⁹ <https://www.master-maestrias.com/Master-Posgrado/Logística/Espana/>.

10	ZARAGOZA LOGISTICS CENTER	Master's Degree in Logistics Engineering and Supply Chain Management (ZLOG)	No info
11	BEBS BARCELONA EXECUTIVE BUSINESS SCHOOL	Master Online in Operations Management and Logistics	Integrated Management Systems
12	ISEB - INSTITUTO SUPERIOR EUROPEO DE BARCELONA	Master in Management and Logistic Management	Corporate Social Responsibility
13	INSTITUTO SÉNECA - CENTRO INTERNACIONAL DE POSTGRADO	Master in Logistics Management	--
14	UNITED INTERNATIONAL BUSINESS SCHOOLS	MS Executive - Master of Science in Operations Management	No info
15	IMF BUSINESS SCHOOL	Master in Logistics and Supply Chain Management	--
16	UNIR-La Universidad en Internet	Master's Degree in Logistics Management	Environmental sustainability, reverse logistics management
17	UOC -Universitat Oberta de Catalunya	Master's Degree in Logistic Management	Sustainability
18	Universitat Abat Oliba CEU	Master's Degree in Logistics and International Trade	Inverse logistics, green logistics and environment
19	U-ERRE Universidad Regiomontana	Master in Online Logistics	--
20	Escuela Europea Formación Continua	Master's Degree in Logistics and Supply Chain	Inverse logistics Environmental impact. Sustainable logistics
21	UVA- Escuela Universitaria Politécnica en Valladolid	Logistics	--

Appart from Master degrees, the University of Zaragoza offers a Doctoral Program in Logistics and Management of the Supply Chain.

7. GREEN LOGISTICS INITIATIVES

A particular case of effort to carry out logistics processes more committed to the environment is for example the one that has led the company Fedex. Its commitment is to connect different parts of the world in a more responsible manner and for this it has committed itself to reducing the emission of aircraft by 30 percent by the year 2020; Likewise, in terms of energy efficiency in vehicles, it is expected to increase by 20%,

increasing the use of alternative sources and the acquisition of renewable energy credits at the local level.

Among private initiatives, companies such as Linde have started using diesel trucks that are greener and emit 83% less particles than currently required by the European directive. This reduces emissions by 39%. Also in Madrid, the European project for the distribution of goods under an electric system begins. It is a pilot project involving the City Council of the capital and companies such as Seur, the Madrid EMT and Renault.

Another example of logistics sustainability is that carried out by LIDL with its logistics platform in Murcia, which has already been recognized with the "Green building council Spain2 certificate, which proves that its design and construction meets environmental sustainability requirements. The German platform has 40,000 square meters and has involved an investment of around 35 million euros.

Research projects are also being promoted, such as the one that attempts to create biodegradable plastics for the interior part of the transport trucks. The investigations are carried out by six SMEs, including two Spanish and four European and the manufacturer Renault Trucks within the framework of the European project Naturtruck. The biodegradable material used is derived from corn starch and is provided by the European consortium of biodegradable material.

Other companies such as Mahou or San Miguel have generated alliances to reduce their emissions. For this they have designed a plan that tries to minimize emissions up to 1300 tons per year. There is a REDD + plan (Reduction of Emissions Derived from Deforestation and Forest Degradation) that attempts to conserve and sustainably manage CO₂ in the Amazon. Mahou and San Miguel try in this way to minimize their impact on the environment with this initiative to prevent the deforestation of thousands of hectares of virgin forest.

Among other great advances, last year a simulator was developed in Spain, whose purpose is to measure the emissions of land transport. This invention was developed in the Higher Technical School of Industrial Engineers of the Polytechnic University of Madrid and has already been applied to Spain in various scenarios. According to the study born from this initiative, it has been possible to identify which are the main causes that influence emissions. Looking ahead, it is known that the relationship between diesel and gasoline vehicles and the age of the park are the most determining factors in the emissions of nitrogen oxides. For its part, in the emission of CO₂, the speed of circulation

on motorways and the displacement of vehicles used for the transport of goods are the two factors that most include and in which it should affect each of the next years (12).

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