STEAM3D Academy

National Desk Research

Comparative Report

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Contents

 Project No: 2021-1-PL01-KA220-VET-000029792

Poland

Full name: Republic of Poland

Area: 312,679 km2

Borders: Russia (210 km, Kaliningrad Oblast), Lithuania (104 km), Belarus (418 km), Ukraine (535 km), Slovakia (541 km), the Czech Republic (796 km), Germany (467 km)

Population: 37 340 001 inhabitants

Population density: 121 people/km2

Administrative division: 16 provinces/voivodeships

Capital: Warsaw

Currency: zloty (PLN) = 100 grosz

Background

Poland covers an area of approximately 312,679 km2, of which 98,52% is dry land and 1,48% is water. Extending across several geographical regions, the country is the 9th largest by area in Europe and 69th largest in the world. Topographically, Poland is diverse and has access to the sea, the mountains and open terrain. Although most of the central parts of the country are flat, there is an abundance of lakes, rivers, hills, swamps, beaches, islands, and forests elsewhere.

The climate is mostly temperate throughout the country. The climate is oceanic in the north-west and becomes gradually warmer and continental towards the south-east. Summers are generally warm, with average temperatures between 18 and 30°C depending on the region. Winters are rather cold, with average temperatures around 3°C in the northwest and −6°C in the northeast. Precipitation falls throughout the year, although, especially in the east, winter is drier than summer.

Poland is a parliamentary republic with a head of government – the prime minister – and a head of state – the president. The government structure is centered on the council of ministers. The country is divided into 16 provinces/voivodeships, largely based on the country's historic regions. Administrative authority at provincial level is shared between a government-appointed governor, an elected regional assembly and an executive elected by the regional assembly.

The most important sectors of Poland's economy in 2018 were: wholesale and retail trade, transport, accommodation, and food services (26,2%), industry (25,6%) and public administration, defense, education, human health and social work activities (14%).

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Intra-EU trade accounts for 80% of Poland's exports (Germany 28%, Czechia, and France both 6%), while outside the EU 3% go to both Russia and the United States.

In terms of imports, 69% come from EU Member States (Germany 27%, the Netherlands 6% and Italy 5%), while outside the EU 8% come from China and 7% from Russia.

Energy from renewable sources has continued to grow in the EU in recent years. Renewable energy sources in the EU include wind power, solar power, hydropower, tidal power, geothermal energy, biofuels, and the renewable parts of waste. Although, in Poland only 6,88% of energy comes from renewable sources.

Energy policies

- **Evolution in the last 10 years**

The European Union climate and energy policy, including its long-term vision of striving for EU climate neutrality by 2050 and regulatory mechanisms stimulating the achievement of effects in the coming decades, had a significant impact on shaping the national energy strategy. Achieving the EU's 2020 and 2030 climate and energy targets is key to a low-carbon energy transition. Following the dynamically accelerating EU climate and energy trends was a huge challenge for Poland.

Energy consumption increased in year 2019 in comparison with year 2000 by 13,8% in case of primary energy and by 25,3 in case of final consumption. The key driver of this growth was the increase in activity, understood as bigger production, more travels, bigger homes, etc. Energy saving reflecting energy efficiency improvement were achieved in year 2000-2019 in all sectors being large energy consumers: industry, transport, households. Total energy savings rate amounted in 2019 to 32,1%, making energy efficiency as important in energy economy as other fuels.

Among the pro-efficiency measures most significant were projects supported by national funds through environmental funds and from the European Union Cohesion Fund within the framework of Regional Operational Programs and the Operational Program Infrastructure and Environment. Stimulating for improvement of energy efficiency in industry was a modified white certificate system implemented by the Law on energy efficiency. The information and education campaigns of the National Fund for Environmental Protection and Water Management and of the ministry responsible for energy affairs raised awareness and knowledge on energy efficiency improvement options and served practical help to citizens and institutions and enterprises.

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The most important documents defining energy efficiency policy until 2020 were:

- Poland Energy Policy until 2030,
- National Energy Efficiency Action Plans (NEEAPs: 1, 2, 3, 4 from 2007, 2012, 2014, 2017 respectively).

The Fourth Energy Efficiency Action Plan, adopted in 2018 and prepared in 2017, took stock of the energy efficiency improvement targets achieved, presented the targets for 2020 and updated the actions and measures taken and planned to achieve them.

Regarding legal regulations, the Energy Efficiency Act was adopted in 2011, the aim of which was to develop mechanisms stimulating the improvement of energy efficiency. First, the Act introduced the obligation to obtain an appropriate number of energy efficiency certificates, the so-called white certificates, by energy companies selling electricity, heat or natural gas to final customers connected to the grid on the territory of the Republic of Poland. The Act of 2011 was replaced by the new Energy Efficiency Act of 20th May 2016, aimed at further improving the energy efficiency of the Polish economy and ensuring the implementation of the national energy efficiency target.

The Act introduced a regulation according to which a public sector entity may implement and finance projects since an energy efficiency improvement contract. All Polish public authorities are obliged to purchase energy-efficient products and services. They must buy or rent energy-efficient buildings and comply with energy efficiency recommendations in state-owned and retrofitted buildings.

In 2019, the European Commission published a communication on the European Green Deal, i.e., a strategy whose ambitious goal is to achieve climate neutrality by the EU by 2050 - as a world leader in this field. Poland supported this goal, however, working out a specific national derogation, due to the difficult starting point of the Polish transformation and its socio-economic aspects. In the last dozen or so years, Poland has made great strides in reducing the environmental impact of the energy sector, through the modernization of generation capacity and diversification of the energy generation structure. Our dependence on carbon fuels is still much higher than that of other EU Member States, which is why a fair (just) transition is so important to us, which means considering the starting point, the social context of the transformation and counteracting the uneven distribution of costs between countries, which is more burdensome for economies with high use of carbon fuels. It should be noted that the costs relate to both the regions of coal (mining and energy production), as well as entire economies, which in a short time incur expenditures for new capacity, often immature economically more expensive technologies, network infrastructure, which is also reflected in the price of energy.

- **Current situation**

The Polish energy sector is on the verge of changes. In 2019, the work on the Clean Energy for All Europeans regulatory package was completed. The package indicates how to operationalize the EU's 2030 climate and energy targets. The Polish government took an active part in shaping the final wording of the provisions, as these regulations strongly affect the functioning and determination of the future of the energy market model in Poland.

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The share of coal in Poland, although still high – 73,6% in 2019 – is gradually decreasing, while the importance of renewable energy sources is growing – the dynamics of increasing power in photovoltaic sources is unprecedented, and the consumption of gas for energy purposes is also increasing.

At the TOGETAIR 2021 Climate Summit, Poland informed that enormous changes are being prepared in the Polish energy sector. The most important of these is the abandonment of the use of coal, which was finally approved by the mining industry. According to the plan, Poland is reducing coal consumption in the energy sector from 75% now to 11% in 2040, and to zero in 2049.

In 2020, the world was hit by the coronavirus pandemic, affecting all global economies. This emergency also highlighted the important role of the energy sector, including energy security, for the functioning of the economy of Poland and other European countries. In the coming years, the energy sector will face several post-COVID challenges related to the reconstruction or substitution of supply chains to conduct investments, mobilize financial resources in budgets strained by the effects of the epidemic, and sometimes – verification of investment plans and accumulation of funds for key projects. And so, it is important that investment decisions are made taking into account the aspect of green and low-carbon economic recovery. Post pandemic recovery efforts are designed to create a rapid and effective growth impulse and create new opportunities for the national economy.

When it comes to regional and local level, it is seen that the challenges mobilize cities and towns to change. Contemporary cities are an area that, on the one hand, is exceptionally strong thanks to the development of technology. On the other hand, they are particularly sensitive, because they are the concentration of the greatest ecological deficiencies and the most urgent challenges in the field of environmental protection. It is where everyday life meets the idea of sustainable development. It is where the investments are planned and implemented not only with a better life of residents in mind, but also with care for the environment. There is one goal: fighting the progressive climate change and improving the quality of life of the local community.

For several years, regional and local governments have been carrying out pro-climatic and ecological activities increasingly and in greater numbers, achieving measurable social and environmental effects of implemented investments. Polish cities are more and more often proud of solutions in the field of environmental protection, electromobility and resource management. They are working on the topics of energetic efficiency, waste management, water management, municipal greenery, and sustainable transport.

There are many examples of such investments, and few can be mentioned among others: extension of bicycle paths and adoption of sustainable urban mobility plans, increasing the number of public transport passengers, reducing air pollution caused by individual transport, greening cities through new plantings, pocket parks and community gardens, ban on the use of single-use plastic at events organized by the municipality, development of the landfill site for a photovoltaic farm and many more. These and similar investments are currently taking place all over the country.

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- **Future tendencies**

The base point on the path of energy transition are the 2020 targets. In 2009, a regulatory package was adopted setting out three headline targets for counteracting climate change by 2020 (the so-called 3 x 20% package), with Member States participating in accordance with their capabilities. Poland is obliged to:

- increase energy efficiency by saving primary energy consumption by 13.6 Mtoe in 2010-2020 compared to the forecasts of demand for fuels and energy from 2007;
- increase the share of energy from renewable sources in gross final energy consumption to 15% by 2020;
- contribute to the EU-wide reduction of greenhouse gas emissions by 20% (compared to 1990) by 2020 (in terms of 2005 levels: -21% in the EU ETS sectors and -10% in non-ETS).

In 2014, the European Council maintained the direction of combating climate change and approved four targets for the 2030 perspective for the entire EU, which after the 2018 and 2020 revision have the following shape:

- reduction of greenhouse gas (GHG) emissions by at least 55% compared to 1990 emissions;
- at least 32% share of renewable energy sources in gross final energy consumption;
- increase in energy efficiency by 32,5%;
- completion of the EU internal energy market.

The above objectives are the EU's contribution to the implementation of climate agreements.

In the future, it is assumed that the key EU regulations concerning the energy sector will be further revised, which will refer to the goals and tools of the European Union's energy and climate policy in a time horizon that goes beyond the 2030 framework. This applies in particular to the decisions regarding the long-term vision of reducing greenhouse gas emissions in the EU until 2050. For this reason, the perspective after 2030 has been defined in a directional manner, although the forecasts made for Energy Policy of Poland until 2040 (EPP2040) have a 2040 perspective in accordance with statutory requirements.

The energy transformation will require the involvement of many entities and incurring capital expenditure. In the years 2021–2040 their scale may reach approx. PLN 1,600 billion. Investments in the fuel and energy sectors will involve approximately PLN 867-890 billion. The projected outlays in the electricity generation sector will amount to PLN 320-342 billion, of which approx. 80% will be allocated to zero-emission capacities, i.e., renewable energy and nuclear energy. As a result of transformations in the fuel and energy sector, energy costs may increase. Numerous investments may obtain financial support (operational and capital), which enable changes to take place as quickly as possible and on a larger scale. It is important that the way in which the transformation is carried out ensures socially acceptable energy prices and does not intensify energy poverty.

Through the implementation of the goals and activities indicated in PEP2040, a low-emission energy transformation will be carried out with the active role of the end-user and the involvement of the

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domestic industry, giving an impulse to the economy, while ensuring energy security, in an innovative, socially acceptable way and with respect for the environment and climate.

The energy transformation that will be carried out in Poland will be:

a. just – will not leave anyone behind,
b. participatory, carried locally, initiated from bottom up – everyone will be able to participate,
c. focused on modernization and innovation – it is a plan for the future,
d. stimulating economic development, efficiency and competitiveness – it will be the motor of economic development

The energy transition will be based on three pillars:

I pillar Just transition	II filar Zero-emission energy system	III filar Good air quality
Transformation of coal regions Reduction of energy poverty New industries related to renewable energy and nuclear energy	Offshore wind energy Nuclear energy Local and civic energy	Heating transformation Transport electrification House with Climate

It is also worth saying that behind many changes, especially at the local level, there are people who can responsibly and boldly implement visions that bring long-term benefits to the residents of cities. Urban challenges require the mobilization of deep layers of energy, provoking socio-economic changes and forcing a review of our attitude towards the environment. The energy of change released in this way shapes trends and revives the tissue of cities for a long time. By using the energy and knowledge of their inhabitants, cities will be able to become part of the solutions to nowadays problems and phenomena. It will also be easier for them to develop effective strategies against new, dramatic events, such as global epidemics. Thanks to these efforts numerous innovative solutions have been already implemented or initiated and many more will be developed.

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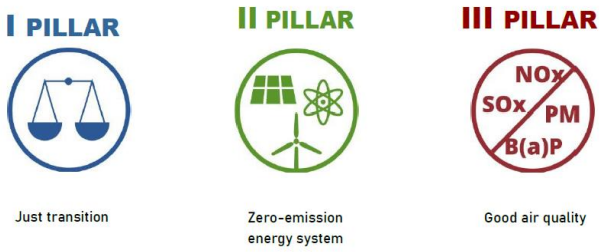
- **Main threats and challenges**

Energy Policy of Poland until 2040 (EPP2040) establishes the framework for the energy transformation in Poland. It contains strategic decisions regarding the selection of technologies for building a low-emission energy system.

EPP2040 is a national contribution to the implementation of the EU's climate and energy policy, whose ambition and dynamics have increased significantly in the recent period. The policy takes into account the scale of challenges related to the adaptation of the national economy to the EU regulatory conditions related to the 2030 climate and energy targets, the European Green Deal, the economic recovery plan after the COVID pandemic and the striving to achieve climate neutrality as a contribution to the implementation of the Paris Agreement, according to national potential. The low-emission energy transformation provided for in EPP2040 will initiate broader modernization changes for the entire economy, guaranteeing energy security, ensuring a fair distribution of costs and protection of the most vulnerable social groups.

EPP2040 describes the state and conditions of the energy sector and indicates three pillars of EPP2040, on which the eight specific objectives of EPP2040 were based, along with the activities necessary for their implementation, and strategic projects.



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SPECIFIC OBJECTIVE 1. Optimal use of own energy sources	SPECIFIC OBJECTIVE 2. Development of electricity generation and network infrastructure	SPECIFIC OBJECTIVE 3. Diversification of supplies and expansion of the network infrastructure of natural gas, crude oil and liquid fuels
STRATEGIC PROJECT 1. Transformation of coal regions	STRATEGIC PROJECT 2A. Capacity market, STRATEGIC PROJECT 2B. Implementation of smart power grids	STRATEGIC PROJECT 3A. Construction of the Baltic Pipe STRATEGIC PROJECT 3B. Construction of the second line of the Pomeranian Pipeline
SPECIFIC OBJECTIVE 4. Development of energy markets		SPECIFIC OBJECTIVE 5. Implementation of nuclear power
STRATEGIC PROJECT 4A. Implementation of the Action Plan (aimed at increasing cross-border electricity transmission capacity) STRATEGIC PROJECT 4B. Gas hub,		STRATEGIC PROJECT 5. Polish Nuclear Power Program
SPECIFIC OBJECTIVE 6. Development of renewable energy sources	SPECIFIC OBJECTIVE 7. Development of district heating and cogeneration	SPECIFIC OBJECTIVE 8. Improvement of energy efficiency
STRATEGIC PROJECT 6. Implementation of offshore wind energy	STRATEGIC PROJECT 2A. Development of district heating	STRATEGIC PROJECT 8. Promotion of the improvement of energy efficiency

The statutory goal of the state's energy policy is energy security, while ensuring the competitiveness of the economy, energy efficiency and reducing the impact of the energy sector on the environment.

The specific objectives of EPP2040 cover the entire energy supply chain – from obtaining raw materials, through energy production and supply (transmission and distribution), to the method of its use and sale. Each of the eight specific objectives of EPP2040 contributes to the implementation of three elements of the state energy policy objective and serves Poland's energy transformation.

Implementing such a vision, Poland will be better prepared for the challenges the whole world is facing and experiencing – the climate crisis, loss of biodiversity, the effects of technological progress, global inequalities, or the demographic changes. Climate change and smog are a real threat to large agglomerations. Heat waves, downpours and storms are more and more common and at stake is the fight for the health and safety of the inhabitants. For this reason, investments are made to green areas, build water storage tanks, develop renewable energy sources and more sustainable public transport and to reduce CO2 emissions. Moreover, objectives, areas and policies are set and implemented based on respect for both natural and cultural values.

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- **Legislation and Regulations about green energies in cities infrastructures**

  - Energy Policy of Poland until 2040 (EPP2040), Ministry of Climate and Environment, Warsaw 2021 – EPP2040 is one of nine integrated sectoral strategies resulting from the Strategy for Responsible Development. EPP2040 is compatible with National Energy and Climate Plan for the years 2021-2030;
  - National Energy and Climate Plan for the years 2021-2030, Ministry of State Assets, Warsaw 2019 – the document has been developed in fulfilment of the obligation set out in Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action and presents an integrated approach to the implementation of the five dimensions of the Energy Union;
  - Strategy for Responsible Development, Ministry of Development Funds and Regional Policy (former Ministry of Economic Development), Warsaw 2017 – The Strategy covers the period up to 2020 (including the perspective up to 2030) and is an applicable and key document the Polish State in the field of the medium- and long-term economic policy.

Grants and subsidies

About PLN 260 billion from EU and national funds under various mechanisms will be allocated to the national energy and climate transformation by 2030, including:

a. Cohesion Policy,

b. Recovery and Resilience Facility,

c. Just Transition Fund,

d. ReactEU,

e. Other instruments (e.g., priority programs of the National Fund for Environmental Protection and Water Management and funds from the Common Agricultural Policy),

f. New instruments that will support the transformation of the energy system in Poland, e.g. the Modernization Fund and the national special purpose fund, supplied with funds from the sale of CO2 emission allowances, i.e. the Energy Transformation Fund.

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- Ambasada Francji w Polsce, Centrum UNEP/GRID-Warszawa; Eco-Miasto 2021 Zielona Odbudowa; Warsaw 2022 (https://www.eco-miasto.pl/konferencja/);
- https://www.gridw.pl/publikacje;
- Ministerstwo Klimatu i Środowiska; Miasto z klimatem - Podręcznik Dobrych Praktyk; Warsaw 2021

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Bulgaria

Full name: Republic of Bulgaria

Area: 110,993.6 km^2

Borders: Turkey (259 km), Greece (493 km), North Macedonia (165 km), Serbia (341 km), Romania (609 km)

Population: 6 520 314 inhabitants

Population density: 63 people/km2

Capital: Sofia

Currency: Lev

Background

Bulgaria is located in Southeast Europe, in the northeast part of the Balkan Peninsula. It falls within the southern part of the temperate climate zone with subtropical influence. Its location on the transition line between two climate zones influences the climate, soils, vegetation and animal species. All of them are characterized by great diversity. The Black and the Aegean Sea also influence the country's climate. The influence of the Mediterranean is extensive for the climate in the southern parts of the country, while the Black Sea influences the climate over an area extending some 40 km inland, supporting diverse flora and fauna. The Danube River is important for the country, both with regard to water resources and for species diversity. Bulgaria's favorable geographic location creates excellent preconditions for the development of tourism. Bulgaria is also a transport crossroad, affording access to Western Europe, the Near East and the Middle East, and the Mediterranean. The total length of Bulgaria's borders is 2,245 km. Of these borders, 1,181 km are on land, 686 km are on rivers, and 378 km are on the sea. Bulgaria borders to the north with Romania, to the east with the Black Sea, to the south with Turkey and Greece, and to the west with Macedonia and Serbia [1].

Bulgaria is a parliamentary republic with local self-government and a clear division of powers: legislative, executive and judicial. The supreme law of the country is the Constitution of the Republic of Bulgaria, adopted by the Grand National Assembly in July 1991. The National Assembly of the Republic of Bulgaria is a parliament. It consists of 240 members who are elected by the people every four years. The President is the head of state of the Republic of Bulgaria and one of the bodies of state power. The President is the Supreme Commander-in-Chief of the Armed Forces of Bulgaria and is

[1] https://bulgariatravel.org/about-bulgaria/geographic-location/

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elected directly by the voters for a term of five years. On 1 January 2007, Bulgaria became member state of the European Union (EU) in the fifth wave of EU enlargement.

Current population 6,871,914. This decrease between 2011 and 2021 is the largest recorded so far. The country has shrunk by 844,000. Much of this decrease (53%) is due to negative demographic trends, higher mortality than birth rates and negative natural growth, as well as people who have left the country and not returned. The overall assessment of the population made by the NSI shows that the negative trends are deepening, the population is shrinking and aging. There is also a continuing depopulation in certain areas of the country. The population in the cities is increasing (74% are the people there), according to NSI data. Compared to the previous census in 2011, only Sofia-city increased its population by 14.7%. All other districts registered a decrease in population, ranging between -8 and -26%[2]. The number of residences in the country as of September 7, 2021 is 4,182,000 and increases by 295,000 compared to 2011. Basically, this increase is in the cities. Most homes are in Sofia, Plovdiv, Burgas and Varna. The buildings are also increasing - 36,000, again mainly in the cities - Varna, Burgas, Blagoevgrad[3].

Energy policies

- **Evolution in the last 10 years**

Energy policy of the Republic of Bulgaria is consistent with the main objectives of energy policy of the European Union for energy security, competitiveness and sustainable development. Directive 2012/27/EC was transposed into national law by the adoption of the new Energy Efficiency Law, promulgated in State Gazette. 35 on 05/15/2015.

The Energy Strategy of the Republic of Bulgaria is assumed that "energy efficiency is the highest priority in the energy policy of the country." On this basis are set ambitious targets for improving energy efficiency[4]. There is a steady trend of increasing the use of renewable energy. During the period 2000-2016, the ratio between the final and primary energy consumption increased from 45 to 52 %. This growth is primarily due to the reduction of electricity exports and increased use of renewable energy. The Energy Strategy is a fundamental document of the national energy policy that is approved by the Council of Ministers and passed by the National Assembly of the Republic of Bulgaria. The present National Energy Strategy reflects the political vision of the Government of European Development of Bulgaria pursuant to the up-to-date European energy policy framework and the global trends in the development of energy technologies. The main priorities in The Energy Strategy can be summarized in the following five directions: to guarantee the security of energy supply; to attain the targets for renewable energy; to increase the energy efficiency; to develop a competitive energy market and policy for the purpose of meeting the energy needs, and to protect

[2] https://nsi.bg/bg
[3] https://dariknews.bg/novini/bylgariia/
[4] https://www.odyssee-mure.eu/publications/national-reports/energy-efficiency-bulgaria.pdf

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the interests of the consumers. These priorities also determine the Government's vision for development of the energy in the coming years, namely:

- Maintaining of a safe, stable and reliable energy system;
- The energy sector remains a leading branch of the Bulgarian economy with definite orientation to foreign trade;
- Focus on clean and low-emission energy – nuclear and from renewable sources;
- Balance between quantity, quality and prices of the electric power produced from renewable sources, nuclear energy, coal and natural gas;
- Transparent, efficient and highly professional management of the energy
- companies[5].

Other important laws and regulations are:

ERSA- Act on Renewable Energy Sources

This law regulates the public relations related to the production and consumption of: 1. electricity, heat and cooling energy from renewable sources; 2. gas from renewable sources; 3. biofuels and energy from renewable sources in transport.

Clean Ambient Air Act

The purpose of the law is to protect the health of people and their offspring, animals and plants, their communities and habitats, natural and cultural values from harmful effects, as well as to prevent the occurrence of hazards and damage to society in the event of a change in air quality as a result of different activities.

EEA- Energy Efficiency Act

This law governs public relations related to the implementation of government policy to increase energy efficiency. The law aims to increase energy efficiency and frequency the policy of sustainable development of the country

Energy Act

This law regulates public relations related to the implementation of activities for production, import and export, transmission, distribution of electricity and heat and natural gas, transmission of oil and petroleum products by pipeline, trade in electricity and heat and natural gas, and the powers of state bodies in determining energy policy, regulation and control

The European Green Pact

On 11 December 2019, the Commission presented its Communication on the European Green Pact (COM (2019) 0640). This Green Pact sets out a detailed vision for making Europe a climate-neutral continent by 2050 by providing clean, affordable and secure energy.

[5] file:///D:/Energy%20Strategy%20of%20the%20Republic%20of%20Bulgaria%20till%202020.pdf

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- **Current situation**

Renewable energy sources (wind, solar, hydroelectric, ocean, geothermal, biomass and biofuels) are alternatives to fossil fuels that help reduce greenhouse gas emissions, reduce energy diversification and diversify energy supplies, and reducing dependence on unreliable and volatile fossil fuel markets, especially oil and gas.
In Bulgaria, electricity from renewable sources is mainly promoted through a premium tariff. All power plants using renewable energy and CHP with an installed capacity of 4 MW and higher should sign contracts with the Electricity System Security Fund (ESSF) on the granting of a premium to offset the difference between the stock price and the price in the long-term contracts that RES-E producers have with the National Electricity Company (NEK). The plants below the threshold will continue to operate under the existing system of FiT and be paid by NEK.

The connection of renewable energy plants to the grid is subject to the provisions of the general legislation on energy. Renewable energy is not given priority access.

The use of renewable energy for heating and cooling is promoted through a subsidy from the European Regional Development Fund, several loan schemes and through an exemption for building owners from property tax.

In Bulgaria, the main support scheme for renewable energy sources used in transport is a quota system. This scheme obliges companies importing or producing petrol or diesel to ensure that biofuels make up a defined percentage of their annual fuel sales. Furthermore, biofuels are supported through a fiscal regulation mechanism.

The following policies aim at promoting the development, installation and usage of RES-installations in Bulgaria: There is a professional training programme for RES-installers as wells as a building obligation for the use of renewable heating and for the exemplary role of public authorities[6].

- **Future tendencies**

Now in Bulgaria there are companies that actively promote and are an example of the use of 100% green energy, which ensures that the company promotes the production of electricity from renewable sources in Bulgaria - solar energy, wind and hydropower. This trend is assumed to continue in the future.

The country's policy in this direction also shows a desire to make the use of renewable energy sources a priority. In Bulgaria, there is already an opportunity to conclude such long-term contracts for the purchase of electricity.

[6] http://www.res-legal.eu/search-by-country/bulgaria/tools-list/c/bulgaria/s/res-e/t/gridaccess/sum/112/lpid/111/

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- **Main threats and challenges**

A sustainable environment is a key prerequisite for achieving sustainable economic development. Air pollution with dust particles is a permanent problem, covering the entire territory of Bulgaria and hiding serious health risks. Focusing efforts on reducing
harmful emissions of gases into the environment is mandatory. Identifying the source of the problem and preparing all future policies in line with the priority of reducing emissions is extremely important.

Bulgaria's progress in the field of new renewable energy sources (RES) is slow. Bulgaria relies heavily on imports and foreign know-how with respect to green technologies.

The development of green technologies and business in Bulgaria depends on the availability of highly qualified specialists. Therefore, policies are needed to create, and build educated human capital in the field of green technologies.
In general, Bulgarian energy policy downplays the need for change in public behavior and perceptions of individual users. The active participation of municipalities in these processes is mandatory condition for achieving goals such as improving energy efficiency and energy saving.

At present, most households do not take measures to increase energy efficiency, not because consumers are wasteful, uninformed and / or disinterested, but because they cannot afford investment.

- **Legislation and Regulations about green energies in cities infrastructures**
    - Renewable Energy Act
    - Energy Efficiency Act
    - Law on structure and construction
    - Forest Act

Grants and subsidies

- Rural Development Program 2014-2020
- Energy Efficiency and Renewable Sources Fund

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Greece

Full name: Greece or Hellenic Republic

Area: 131 957 km^2

Borders: Bulgaria (494 km), Albania (282 km), North Macedonia (246 km), Turkey (206 km)

Population: 10 603 810 inhabitants

Population density: 82 people/km^2

Capital: Athens

Currency: Euro

Background

In modern Greek, the country is known as Ellada. The corresponding form of the name in the ancient Greek and scholarly tongue is "Hellas". Hence the name Hellas, which in most European languages is used in archaic and poetic contexts today. The offensive form of the word is “Hellenic” or, “hellénique” and today it is used for more official purposes in Greece, mainly for names of state institutions and the Hellenic Republic.

The name of Greece in English and most European languages comes from the Latin terms Graecia and Graecus, from the name of the Grecos, who were among the first Greek tribes to colonize Magna Graecia in southern Italy. The term comes from the proto-Indo-European term ǵerh- (= grow up).

1(Lencer (map asset)derivative work: Yiyi (placenames and islands in Italian)derivative work: Gts-tg (translation to Greek + small updates) - File:Isole_della_Grecia.svg, CC BY-SA 3.0)

Greece, under the official constitutional name of the Hellenic Republic, is a country of southeastern Europe located at the southern tip of the Balkan peninsula. It is bordered on the northwest by Albania, on the north by Bulgaria and Northern Macedonia, and on the northeast by Turkey. It has coastlines in the eastern Mediterranean and is washed east by the Aegean Sea, west by the Ionian Sea and south by the Libyan Sea. It ranks 97th in the world in terms of size. According to official

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estimates by the European Statistical Office, the country's population on 1 January 2020 is estimated at 10,691,204. Its capital and largest city is Athens.

Greece holds the 9th place in the world in the countries with the longest coastline at 15,147 km, as it has an enormous number of islands estimated at 2,500 with 165 being habitable.

In the last decade, Greece may have supplied the world with negative news. But the standard of living of the Greeks is compared only to that of the inhabitants of the developed Western states. The Greek economy ranks 51st in the world for calendar year 2020. This is also the 55th purchasing power, at 280.11 billion euros in spite of its relatively small population, at only 10.7 million. The economy is developed with a high standard of living and a "very high" human development index. A large part of it is based on services, 79.1% of GDP, industry, 16.9% and agriculture, 4.1%.

Greece is a founder member of the Organisation for Economic Co-operation and Development (OECD) and the Organisation for Economic Cooperation of the Black Sea (ESBC). The country joined the EEC in 1981 and in 1999 the Economic and Monetary Union (EMU) adopting the euro as its currency in 2001. Greece is a member of the International Monetary Fund and the World Trade Organization.

Greece has the largest economy in the Balkans and is an important investor for the countries of the region.

The main sectors of the Greek economy are tourism, marine, industrial food production and tobacco processing, textiles, chemicals and metal products, mining and petroleum refining factories.

Tourism is a major contributor to Greece's economy and development. Greece is a popular destination worldwide mostly for summer holidays, where they are promoted much more than its winter and alternative destinations. In the period 2013-2019, tourist arrivals showed a significant increase and from about 18 million it exceeded to more than 31 million, with a value of more than 18 billion euros. Accommodation in Greece is recognized for its quality in terms of amenities and level of service to visitors.

2The performance of Greek tourism in the period 2013-2019

The maritime industry has been an important part of Greece's economic activity since antiquity. Today, the Greek merchant fleet is among the most important industries in the country. The Greek-owned merchant fleet is the largest in the world with significant growth rates both in absolute number

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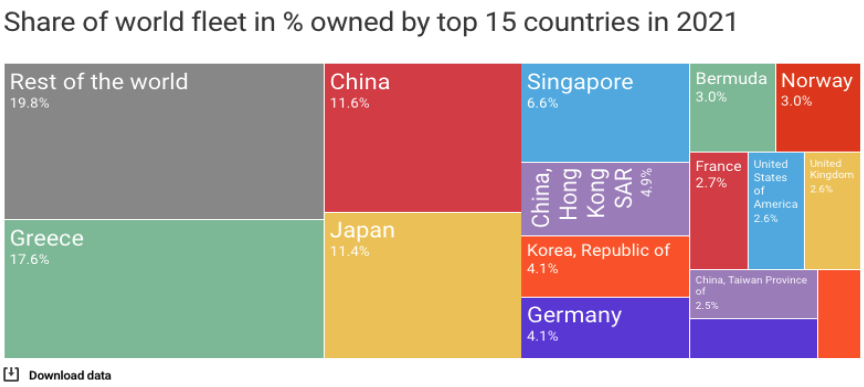
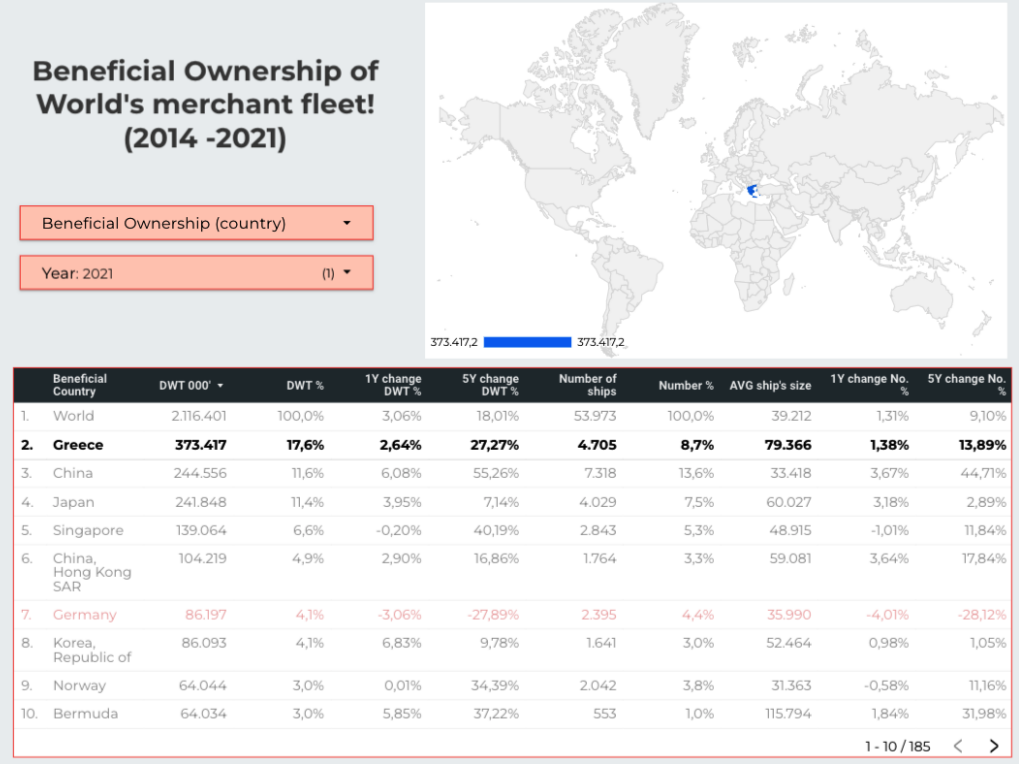
of vessels and in total displacement. Greece ranks first in tankers and bulk carriers, fourth in container carrier ships, and also fourth in other types of ships. Today, the Greek merchant fleet, with a value of more than 500 billion euros, is in the process of upgrading with the purchase of modern liquefied natural gas carriers, presenting the highest growth rate in the world.



3The 15 countries with the largest share of the global merchant fleet



	Beneficial Country	DWT 000'	DWT %	1Y change DWT %	5Y change DWT %	Number of ships	Number %	AVG ship's size	1Y change No. %	5Y change No. %
1.	World	2.116.401	100,0%	3,06%	18,01%	53.973	100,0%	39.212	1,31%	9,10%
2.	**Greece**	**373.417**	**17,6%**	**2,64%**	**27,27%**	**4.705**	**8,7%**	**79.366**	**1,38%**	**13,89%**
3.	China	244.556	11,6%	6,08%	55,26%	7.318	13,6%	33.418	3,67%	44,71%
4.	Japan	241.848	11,4%	3,95%	7,14%	4.029	7,5%	60.027	3,18%	2,89%
5.	Singapore	139.064	6,6%	-0,20%	40,19%	2.843	5,3%	48.915	-1,01%	11,84%
6.	China, Hong Kong SAR	104.219	4,9%	2,90%	16,86%	1.764	3,3%	59.081	3,64%	17,84%
7.	Germany	86.197	4,1%	-3,06%	-27,89%	2.395	4,4%	35.990	-4,01%	-28,12%
8.	Korea, Republic of	86.093	4,1%	6,83%	9,78%	1.641	3,0%	52.464	0,98%	1,05%
9.	Norway	64.044	3,0%	0,01%	34,39%	2.042	3,8%	31.363	-0,58%	11,16%
10.	Bermuda	64.034	3,0%	5,85%	37,22%	553	1,0%	115.794	1,84%	31,98%

1 - 10 / 185

4Greece is the global leader as merchant fleet owner.

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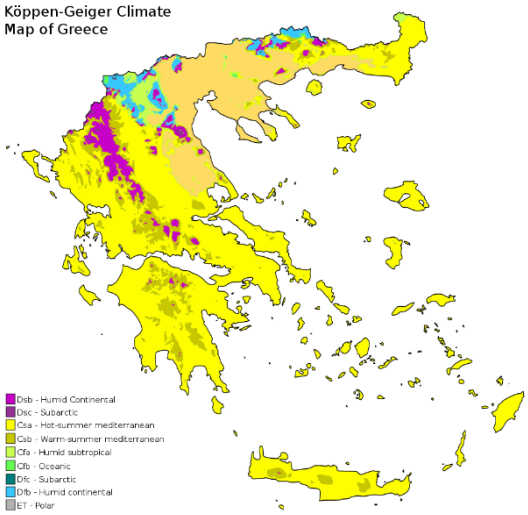
The climate of a geographic area is mainly affected by the following 3 factors:

- Latitude: Greece lies between the geographical widths of the 34th (Libyan Sea, southern Crete) and 42nd (borders of Greece-Bulgaria-Turkey, in Thrace). This zone is located in the Temperate Zone, which is defined between 23:27′ (Tropic of Cancer) and 66:33′ (Arctic Circle) northern latitude.

- The land/sea ratio: Greece is a multifaceted peninsula with a rich horizontal (coastal) and vertical (relief) dismemberment. Its area (land) amounts to 132,000 km2, while the total surface of the seas in which the island complexes are scattered, amounts to 300,000 km2 (in total, the wider area of The Greek area amounts to 432,000 km2). Of the aforementioned area, almost 2/3 of Greece consists of the sea. As a peninsula exposed in the south, Greece has a great open sea in the south. On the contrary, in the north, Greece is connected to the compact landmass of the Balkans peninsula.

- The relief (altitude): The country has an extremely vertical dismemberment. Although a sea country, it is at the same time mountainous and is classified in the most mountainous countries of Europe. From the surface of the sea to the highest point of the country (Olympus), there is an altitude difference of 2,918 meters and the average altitude of the country is about 585 meters. The shape of the land has a decisive influence on the weather. Under stable atmosphere conditions, the air temperature drops by 6oC per 1000 meters in height or 0.6oC per 100 meters. Together, the above three factors shape the climate of our country, which varies considerably from region to region.



5Figure 7: (https://www.wikiwand.com/el) Climate classification of Greece based on the Koppen methodology

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Energy policies

- **Evolution in the last 10 years**

According to the national and European reports over the last 10 years, as elaborated by the European Commission, the main challenges identified for Greece in the implementation of EU environmental policy and legislation were the following:

- tackling problems in the field of waste management and, in particular, the closure of illegal landfills and the treatment of hazardous waste;
- improving the protection of the natural environment through the establishment of an effective national protection system, improving information and providing appropriate incentives for sustainable investment; and.
- completion of the implementation of the Urban Waste Water Management Directive.

The complexity of Greek administrative structures and procedures, which can lead to significant delays and bottlenecks, is sometimes the main obstacle to the implementation of environmental legislation. Since the 2019 OECD – Environmental Performance Review, however, some progress has been recognized in the field of the waste management, as the strategic waste management framework is now in place and national and regional waste management plans have been adopted. In addition, the number of illegal landfills remaining in operation or requiring remediation has declined over the years. However, it will be especially difficult to shut down the remaining landfill sites if new facilities are not built. With regard to the protection of the natural environment, Greece has recently considerably enlarged the coastal section of the Greek Natura 2000 network. It developed legislation for the establishment of the management bodies of sites that have been included in the Natura 2000 network. In parallel, a fully integrated LIFE project for nature conservation was launched. In the area of urban wastewater treatment, positive steps have been taken, such as the systematic assessment and strategic reorganisation of the country's investment needs. These efforts should lead to the rapid establishment of the necessary infrastructure, particularly in urban areas (i.e., community centres or places of economic activity).

- **Current situation**

Greek legislation is fully harmonized with European law. Consequently, all European Union policies are subject to national legislation. For their full and efficient implementation, the relevant Ministry of Energy and Environment Affairs cooperates with Greek universities, professional and scientific associations and with local authorities for the creation and implementation of plans that meet the requirements and objectives EU has set. The main pillars of the effort of the Greek authorities are as follows:

- Energy
- Environment
- Forests

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- Spatial planning
- Waste management

These 5 sectors are analyzed as follows:

Energy

a. Renewable energy sources
    i. Wind energy
    ii. Solar energy
    iii. Biomass
    iv. Hydroelectric plants
    v. Geothermal energy
    vi. Co-generation systems based on renewable energy sources.
b. Electrical energy
c. Hydrocarbons
d. Energy efficiency plans.
e. Green transport
f. Energy Research & Innovation.
g. Mineral resources.

Environment

a. Circular economy
b. Climate change
    i. Policies for fighting climate change.
    ii. Emissions trading system.
    iii. Flexible Procedures of the Kyoto Protocol Protection of the ozone layer.
    iv. Fluoridated greenhouse gases.
    v. F-GASES & ODS Monitoring Information System to carry out the above tasks.
c. Biodiversity
    i. NATURA 2000 network
    ii. "Nature 2000" Committee, which is the central scientific advisory body of the State for the coordination, monitoring and evaluation of policies and measures for the protection of Greek biodiversity.
    iii. Protected Areas (national parks, wildlife refuges, protected landscapes and natural formations)
d. Waters Protection
    i. Management of water resources
    ii. Nitrates
    iii. Floods
    iv. Swimming shores
    v. INTERREG programmes:
        1. WATenERgy CYCLE: Urban water-energy cycle
        2. Plastic Busters MPAs
        3. AQUARES: Promotion of water recycling policies for resource-efficient European regions.

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4. LOODGUARD: Integrated actions for joint coordination and reaction to flood risks in the transboundary area/ flood guard.

e. Air quality
f. Noise and radiation

Forest

a. Forest's Protection
b. Forest's management
c. Implementation of the CITES Convention, to protect flora and fauna and control their trade.

Spatial planning

a. Spatial planning
b. Urban planning
c. Urban design
    i. Sustainable mobility
    ii. Accessibility
    iii. Development of an electric vehicle recharging network.
d. Buildings
    i. Traditional architecture
    ii. Preserved buildings
e. Monitoring of the built environment
f. Development of geo-spatial data

Waste management

a. Solid waste
    i. Recycling
    ii. Non-hazardous waste
    iii. Hazardous waste
    iv. Extractive waste
b. Urban wastewater
    i. Nationwide installation database.
    ii. Wastewater treatment
    iii. Wastewater reuse
c. European programmes
d. Life programs aimed at contributing to the implementation of the National Waste Management Plan, the National Strategic Waste Prevention Plan and the National Circular Economy Strategy.

- **Future tendencies**

Greece's energy objectives have been identified and described in the National Energy and Climate Plan (NECP). This is a detailed road map for achieving the specific energy and climate objectives by 2030. The long-term strategy considers the range of options available and the different scenarios. The

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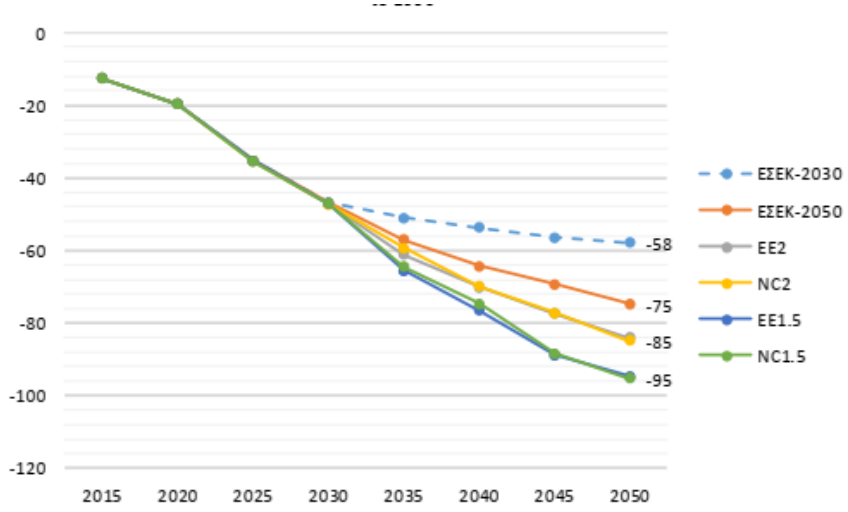
development of the energy system and the need for an energy transition in the most economically competitive manner are the objectives of the plan.
Long-term strategy scenarios that have been developed and reviewed include:

- Scenario EE2 (Energy Efficiency and Electrification for 2oC)
- Scenario NC2 (New energy carriers for 2oC)
- Scenario EU1.5 (Energy and Efficiency electrification for 1.5oC)
- Scenario NC1.5 (New energy carriers for 1.5oC)

These scenarios present different possibilities for achievement (low ambitious – very ambitious) according to international conditions of economic and geopolitical stability. The reduction in greenhouse gas emissions in percent from 1990 is projected to reach 60 percent by 2030 and 95 percent by 2050.



6Total greenhouse gas emissions total reduction target in % compared to 1990 in Greece

Energy saving procedures in buildings and residences are among the main policies with undeniable benefits, and the sector with the greatest potential to reduce energy consumption in a cost-effective manner. Long-term strategy scenarios, as well as NECP-2050, include particularly ambitious targets and similar policies to drastically reduce energy use, especially for thermal uses.
The objectives of the long-term strategy scenarios are based on the objective of the building fleet to approach near-zero energy consumption standards by 2050.

For the building stock to approach zero energy consumption, Greece must:

- to apply strict specifications for new buildings regarding the energy performance of its thermal shell and
- large-scale energy retrofitting of older buildings so that almost all of the remaining stock of older buildings in 2050 will be retrofitted.

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- **Main threats and challenges**

Compared with the 2030 target, the 2050 targets are significantly more ambitious and therefore policy instruments must be broader in scope. Given that the construction rate for new buildings is relatively low and is expected to remain so in the future, energy retrofits for older buildings are important. The long-term strategy scenarios, for analysis and economic evaluation purposes, slightly differentiate the scope of implementation from the above policy. The ambitious energy improvement programme calls for major investments, which have, on average, increased the cost per unit of building surface, as they are applied to almost the entire building stock.

Also important is the penetration of geothermal heat pumps, whose number is expected to be multiplied in relation to 2030 data, particularly in scenarios with improved energy efficiency.

The climate neutral roadmap includes eliminating the use of solid and liquid fossil fuels in buildings.

- **Legislation and Regulations about green energies in cities infrastructures**

  - Regulation of Energy Performance of Buildings (KENAK). It includes, in addition to the thermal insulation, characteristics of the structural elements of the external surface of the building (shell). Other factors such as heating / air conditioning and hot water production installations, the use of renewable energy sources, passive heating and cooling elements, shading, indoor air quality, adequate natural lighting and the archtectural design of the building, are getting into consideration. The methodology for calculating energy performance covers the annual energy performance of the building and has been developed according to the applicable European standards.
  - Each building in Greece must have an energy efficiency certificate after a study according to KENAK.
  - All new public buildings must be in the "Almost Zero Energy Consumption" category.
  - Law on Sustainable Housing Development (Law 2508/97). Residential organization should be governed by the principle of the maximum possible economy of residential subdivisions. Urban planning must be in line with the protection of the natural and built environment and the preservation of highly productive farmland.

Grants and subsidies

- "ELECTRA": Funding Programme for the Energy Upgrade of Public Buildings.

- "I move electrically": Subsidy program for the purchase or long-term rental of an electric vehicle and the purchase of an electric motorcycle or bicycle. It is possible to subsidize for the installation of a smart home charger in the main residence or the withdrawal of the old vehicle.

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- "Energy Saving at home": The design of the program considers the integrated energy saving intervention in the residential building sector. Its main objective is to reduce the energy needs of buildings and the polluting emissions which contribute to the greenhouse effect.

- "Replacement and Recycling of Energy-Intensive Electrical Devices": The program includes the replacement and recycling of air conditioners, refrigerators, and freezers, as these devices create the largest loads of electricity.

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Spain

Full name: Spain

Area: 505 990 km^2

Borders: France (656.3 km), Andorra (63.7 km), Morocco (19 km), Gibraltar (1.2 km)

Population: 47 450 795 inhabitants

Population density: 94 people/km2

Capital: Madrid

Currency: Euro

Background

Most of Spain's national territory is located on the Iberian Peninsula (which it shares with Portugal and Andorra) situated in the southwest corner of Europe. However, the Canary Islands, the Balearic Islands, a few smaller islands and the cities of Ceuta and Melilla in North Africa are also territories of Spain. Covering an area of 506,030 square kilometres, Spain is among the fifty largest countries in the world.

The geological history of the Iberian Peninsula has given rise to mountains forming large chains that surround a high inland plateau situated at over 600 metres above average sea level. As a result of this geography, the peninsula is characterised by a rich variety of unique enclaves and natural environments. Due to its geographic location, Spain is influenced by two very different bodies of water: the vast and open Atlantic Ocean; and the Mediterranean Sea, whose only physical connection to the former is a narrow channel called the Straits of Gibraltar, which permits the exchange of water between the two masses of very different salinity and temperature. The Spanish coastline is 5,755 kilometres long.

The surface of Spain is extremely varied and characterised by a relatively high average altitude; over 600 metres above sea level. The mountain ranges exert a tremendous influence on the continental climate by creating natural barriers against banks of moist air from the Atlantic Ocean, which would otherwise temper inland temperatures.

The natural fluvial regime of Spain's rivers mainly depends on the pattern of precipitation, where its waters originate and transform into surface water or groundwater runoff. However, this natural fluvial pattern is affected by human action in the form of infrastructures used to regulate and modify its temporal distribution, as well as other types of actions that remove volumes of water from rivers.

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The climates in Spain are the following:

- Atlantic or Oceanic Climate
- Continental Climate
- Mediterranean Climate
- Mediterranean Mountain Climate

There are other smaller but nevertheless significant climate zones: Cold Steppe Climate, Hot Steppe Climate, and Subtropical Climates.

Spain's rich diversity in terms of climate, petrography and topography has given rise to the formation of several clearly defined ecological regions, which in turn have led to the development of a broad spectrum of vegetation types. Another influential factor is the intensity of human activity, which has gradually transformed its natural surroundings since the Neolithic period, often adding to the already diverse array of habitats. The vegetation cover in Spain resembles a type of mosaic in which the natural formations of trees, shrubs and herbaceous plants are distributed unevenly throughout the land alongside crop fields and reforested areas. This varied landscape is clearly reflected in the equally varied flora, which comprises approximately eight thousand species and includes plants from the whole of Europe and North Africa. Hence, the European beech co-exists with the Mediterranean holm oak, Aleppo pine, African palm and even the Australian eucalyptus[7].

Spain is a constitutional monarchy, with a hereditary monarch and a bicameral parliament, the Cortes Generales (General Courts). The executive branch consists of a Council of Ministers presided over by the Prime Minister, who is nominated as candidate by the monarch after holding consultations with representatives from the different parliamentary groups, voted in by the members of the lower house during an investiture session and then formally appointed by the monarch.

As of 1 January 2020, Spain had a total population of 47,431,256, which represents a 0.9% increase since 2019. Spain's population peaked in 2019, surpassing for the first time in history 47 million inhabitants. As of January 2020, there were already 47,431,256 people living in Spain. Its population density, at 91.4 inhabitants per square kilometre (237/sq mi), is lower than other Western European countries yet, with the exception of microstates, it has the highest real density population in Europe, based on density of inhabited areas. With the exception of the capital Madrid, the most densely populated areas lie around the coast.[8]

[7] https://www.lamoncloa.gob.es/lang/en/espana/Paginas/index-old.aspx
[8] https://en.wikipedia.org/wiki/Spain

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Energy policies

- **Evolution in the last 10 years**

Traditionally, Spain has been a two-party state in which governments used to rotate between the Socialist Party and the Popular Party, and it was originally them who came up with the little few green policies. Today, there is a ministry in charge of green policies called the Ministry of Ecological Transition and Demographic Challenge, but it was not of great importance until 1996, when the Popular Party established it as the Ministry of the Environment. Prior to its creation, decisions on ecological matters were taken by lower-ranking governmental bodies. This shows that concern for the environment did not emerge until the 1990s, following the global trend.[9]

Environmental issues account for only a tiny part of the topics dealt with in the Congress, despite being one of the most controversial issues at local and regional level, due to the growing importance that the population has been attributing over the last decade to issues related to environmental deterioration and sensitivity. It is worth mentioning that Spain lags far behind in terms of environmental policy, as there is no tradition of public environmental policies. However, the pressure exerted by the EU in this regard is forcing Spain to comply with European directives.[10]

These are some of the implemented laws over the last 10 years:

- Law 21/2013, of 9 December, on environmental assessment. This law establishes the exclusive competence of the State in matters of basic legislation on environmental protection.
    - It facilitates the incorporation of sustainability criteria in project evaluation.
    - Strategic decision-making, through the evaluation of plans and programmes.
- Law 30/2014 on National Parks. This law brings together measures such as reinforcement in emergency situations due to environmental catastrophe, intervention in cases of unfavourable conservation status, or the prohibition of incompatible activities such as sport fishing and hunting, logging for commercial purposes or the management of other of its resources, among others.
- Royal Decree 630/2013 on invasive alien species. Invasive species are the cause of biodiversity loss. For this reason, Royal Decree 630/2013, of 2 August, regulates the Spanish Catalogue of invasive alien species. With regard to the aquatic environment, at the national level, one law and two royal decrees are noteworthy.
- Royal Decree 876/2014, General Coastal Regulation. Royal Decree 876/2014, of 10 October, regulates coastal protection and occupation requirements.[11]
- Law 7/2021 of 20 May on climate change and energy transition. The law establishes a framework to facilitate equity in the transition to a decarbonised economy by providing mandatory learning and transparency tools to help identify and assess risks and opportunities and improve investment decisions.

[9] https://repositorio.comillas.edu/xmlui/bitstream/handle/11531/37126/TFG-201502692.pdf?sequence=2&isAllowed=y
[10] https://blogs.upm.es/puma/
[11] https://www.gndiario.com/leyes-medio-ambiente-espana

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- Royal Decree 390/2021, of 1 June, approving the basic procedure for the certification of the energy performance of buildings.

- **Current situation**

Within the Sustainable Development Goals[12], there are several points that deal exclusively with environmental protection such as: "Point 6: Clean Water and Sanitation, 7: Affordable and Clean Energy, 11: Sustainable Cities and Communities, 13: Climate Action, 14: Underwater Life and 15: Terrestrial Ecosystem Life".[13] Despite the fact that Spain has been one of the countries with the worst compliance with environmental regulations in recent years, legal changes have been made in the area of pollution:

- "(…) reduction of national emissions of certain atmospheric pollutants, (...) establishes emission reduction commitments that will achieve levels of air quality that do not give rise to significant negative effects on, and risks to, human health and the environment. In particular, it establishes new national emission reduction commitments for 2020 and 2030 for sulphur dioxide (SO2), nitrogen oxides (NOx), non-methane volatile organic compounds (NMVOCs), ammonia (NH3) and fine particulate matter PM2.5." (MITECO[14], 2018).
- Spain has also taken action on point 7 on clean energy: The Renewable Energy Directive set a binding reviewable EU target of at least 32% of energy from renewable sources by 2030.
- Regarding point 6 and point 14, on February 2022, they established a criteria to better identify nitrate impaired waters and sets higher thresholds for designation as vulnerable zones. The application of the new regulations should increase the surface area of protected areas by 50%, which will require more rigorous action programmes and will include limitations on the use of fertilisers. This updates the transposition into Spanish law of the European Directive against pollution caused by nitrates of agricultural origin, originally approved more than 25 years ago.
- The year 2018 was the eleventh season of the application of Royal Decree 1341/2007 of 11 October 2007 on the management of bathing water quality and, in general terms, the quality of marine bathing water has improved throughout this period.
- In June 2019, the Government amended the annex of Royal Decree 139/2011 that develops the List of Wild Species under Special Protection Regime and the Spanish Catalogue of Threatened Species, to include in these records 27 species of fauna and flora threatened in Spain, obliging the administrations to monitor their conservation status and the threats that affect them. For the species included in the catalogue, moreover, specific action plans must be implemented for their conservation or recovery. Among the species included, the populations of the Iberian wolf south of the Duero River in Castilla y León and the Community of Madrid are included in the List of Wild Species under Special Protection Regime.

Based on Spain's 2018 environmental profile, a clear evolution in some of the current ecological problems can be seen. In issues such as the conservation of the biosphere and terrestrial ecosystems, the evolution has been positive in the last 5 years, but in others such as emissions and air quality, we observe that the evolution has been negative, increasing the concentration of harmful gases.

[12] THE 17 GOALS - Sustainable Development Goals - the United Nations: https://sdgs.un.org/goals
[13] United Nations, 2015
[14] MITECO: Ministry for Ecological Transition and the Demographic Challenge

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Other laws that involve legistation regarding contructions, viability in sustainable cities, etc, are the following:

- Law 7/2021, of 1 December, on the promotion of territorial sustainability in Andalusia, of an integrating and transversal nature, including in the same regulatory text the planning of territory, urban development, coastline and landscape, with the aim of providing the sectoral policies that intervene in the territory with a common and coherent strategy for the development of Andalusia and urban planning with a support based on the planning of interests of supralocal scope, in order to allow the economic and social cohesion of the territory and environmental sustainability.
- Law 3/2020, of 27 July, on the recovery and protection of the Mar Menor, establishes the control of discharges into the sea, containing in Article 21 the prohibition of discharges into the Mar Menor; in Article 22, the regulation on discharges of rainwater, and in Article 23, that of groundwater.
- Law 4/2021, of 16 September, amending Law 3/2020, of 27 July, on the Recovery and Protection of the Mar Menor: "The decomposition of tons of organic material, the high temperatures and the discharges that the lagoon receives put the ecosystem of this sea in a delicate situation, which is why it is necessary to boost protection measures even more. To this end, it is essential to continuously monitor the different types of discharges that reach the lagoon, increasing their control and surveillance."
- Order 6/2018, of 25 June, of the Regional Ministry of Housing, Public Works and Territorial Planning, which approves the regulatory bases for aid for the rehabilitation of housing located in collective residential buildings, within the Programme for the promotion of conservation, improvement of the safety of use and accessibility in housing of the State Housing Plan 2018-2021 (Valencian Community).
- Order TES/7/2020, of 17 January, approving the regulatory bases for subsidies to promote the acquisition of electric and low-emission vehicles intended for taxi service or commercial use, operating in areas of special protection of the atmospheric environment.

- **Future tendencies**

To be certain about the future in Spain is important to understand how the country has reacted in the past – regarding the raise of the sea level, the extreme temperatures, etc. all of them related to climate change.

Spain has not treated them as a priority, which has led the country to be the one with the highest number of environmental infringements in the European Union in 2017. This is a ranking that Spain usually tops, occupying either first or second place. This is probably due to the low political priority that environmental objectives occupy in the country and the correlative sensitivity in the population that such priorities manifest as well as to the governance system itself, characterised, for historical reasons, in the unilateral nature of the decision.

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Spain has been slower than other countries to wake up to the imminent threat posed by climate change, but it has finally taken a step towards protecting the planet. The following measures were taken in 2021:

1. Cutting down CO2 emissions.
2. Stopping unnecessary energy consumption. The Senate expects that in just under 30 years, all electricity will be generated from renewable sources. By 2030, the origin of energy should be clean and Spain should be using 39% of this to achieve compliance with the law.
3. End the sale of petrol and diesel cars. Road transport releases 84 million tonnes of gases into the air in Spain alone. These figures have forced the country to take measures and set 2040 as the last year in which cars with petrol or diesel engines can be sold. However, after that year, vehicles already purchased will be able to continue to circulate. For its part, Greenpeace is already working on alternatives that are less costly for the environment while being affordable for everyone. The environmental NGO does not rule out "opening the door to fossil gas", a solution that a priori was only seen as viable in the air sector.
4. Creating an efficiency plan for households. The government is obliged to approve a housing renovation plan. This is a series of guidelines that will help people make better use of energy in their homes. As well as consuming less, they will be contributing to improving their own savings.
5. Stop using oil, gas and uranium. The law hopes to gradually establish a habit that will lead to a shift away from dependence on oil. To this end, the search for fossil fuels within the territory will be banned. Congress has also decided to say goodbye to uranium mining.[15]
6. Spain will close its seven nuclear power plants between 2027 and 2035. The nuclear shutdown is scheduled to take place until 2035, as agreed between the companies that own the plants and the Ministry for Ecological Transition.

However, the implementation of these rules could have some side effects that do not fit in with the idea of respecting the environment. The construction of infrastructures that generate electricity from renewable energies implies the destruction of ecosystems wherever they are implemented. To avoid reaching this point, development must be carried out gradually and responsibly.

The European Investment Bank (BEI) published in 2020 the 'Climate Survey 2021-2022', that announced that 81% of Spaniards are in favour of "stricter government measures that impose changes in people's behaviour to deal with the climate emergency" similar to those already adopted during the covid-19 pandemic. This is what the BEI reported in the first part of its study, which deals with

[15] The amendment concerning uranium mining was particularly important as it could affect the plans of the Australian company Berkeley to build an open-pit uranium mine in Retortillo (Salamanca). Despite the fact that this amendment was considered to be one of the most controversial, the modification to the initial text to veto uranium did finally receive support by the majority of the parties. The modification read “as of the entry into force of this law, no new applications for exploration, research or direct concessions for the exploitation of mines of this type will be accepted. Nor will extensions to exploitation be allowed when the resources are extracted for their radioactive, fissile or fertile properties”. At present, the dossier on the open-pit uranium mine in Retortillo is pending the opinion of the Nuclear Safety Council (CSN), which is mandatory for the Ministry for Ecological Transition and Demographic Challenge to authorise or not the mining concession. However, while parliamentary representatives understand that if the permit is not granted before the law enters into force, the project will be cancelled, Berkeley understands that the law will not mean the cancellation of any of its exploitation concessions or rights already acquired, as it explicitly refers to "new applications".

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relevant issues regarding climate change and its consequences, something that 82% of Spaniards consider to be "the greatest challenge facing society in the 21st century".

The European Union and the Spanish Government share a roadmap aimed at creating energy-efficient new buildings. New construction should include the use of renewable energy, sustainable materials and good thermal insulation.

- **Main threats and challenges**

Spain is the driest country in the European Union, the most fire-prone and one of the most energy-dependent. Since 1990 it has increased its CO2 emissions per person at four times the rate of France, Italy and the United States, and at twice the rate of China. Energy consumption in all its forms (petrol, electricity, gas, etc.) is growing five times faster than the population, and the most polluting means of transport - the diesel-powered private car - is the one that has developed the most, leaving rail and public transport almost marginal. Renewable energies have increased significantly but their weight in overall energy expenditure has decreased. The consumption of pesticides and fertilisers, which damage land and water, has intensified, while organic farming, which has made significant progress, covers only 2% of cultivated land, half that of the EU-15.

Urbanisation and material consumption are increasing in Spain at a faster rate than in neighbouring countries, and waste recycling - despite the progress made - is not sufficient. A clear example is La Manga del Mar Menor, a town in Murcia. This urban development has resulten into critic environmental problems, such as the disappearance of dunes and natural beaches, the drying up of lagoons, continuous dredging, the elimination of landscape values and the loss of biodiversity. It has also altered the original environmental conditions of the Mar Menor, such as salinity.

Water consumption for public supply is growing at four times the rate of population growth and 66% of agricultural irrigation - the country's main water consumer - is still carried out using the more wasteful gravity method. According to the Ministry of Ecological Transition, in the last ten years the number of endangered species has doubled and those classified as 'vulnerable' have tripled. Although Spain is one of the European countries with the greatest wealth of flora and fauna, the International Union for the Conservation of Nature and Natural Resources classifies it as the country with the highest number of endangered species due to environmental deterioration.

- **Legislation and Regulations about green energies in cities infrastructures**

  - In 2000, Barcelona adapted its building code to require solar thermal to cover at least 60% of hot water demand in new buildings and buildings undergoing major renovation. More than 50 Spanish towns and cities followed Barcelona's example, culminating in the implementation of national technical building regulations in 2007.
  - In Barcelona, the City Council renewed its housing renovation subsidy in 2020 to offer subsidies of up to 55% of the total cost of renovations to residential households installing solar thermal or solar photovoltaic.
  - HolaDomus is a PACE pilot programme launched in 2020, co-led by GNE Finance and Olot City Council; it finances renewable energy and other innovative home improvements.

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- In Madrid, only battery electric, fuel cell electric and certain plug-in hybrid vehicles can circulate and park in the ZLE (2018) without restrictions.
- Barcelona approved an EZE in 2019 that came into force in 2020.
- Scaling up renewables to address energy poverty is a major challenge in Spain: Martorell and other Spanish municipalities have collaborated with the cooperative Som Energia to cover the electricity bills of households in need.
- Interest in hydrogen begins: the Port Authority of Santa Cruz de Tenerife partnered with Hyundai Canarias and Enagás to build a renewable hydrogen generation facility for transport.
- Several Spanish cities have municipal energy infrastructures, including Barcelona. Barcelona Energia began supplying renewable electricity to city council buildings and facilities in 2018 and to the public in 2019.
- Spanish citizens are involved in community energy projects through several regional cooperatives, including Som Energia (67,800 members) and GOIENER (> 10,000 members).
- City councils have spearheaded community energy projects in Spanish cities such as Barcelona, Cadiz, Girona, Madrid, Pamplona, San Sebastian, Valencia, and Valladolid.
- The concept of collective self-consumption, introduced in 2019, allows citizens in densely populated areas to join and become "external prosumers" by investing in solar PV installations near their homes and on neighbouring buildings.

Grants and subsidies

- 29/06/2021: **The Government approves 1,320 million euros for self-consumption, batteries and renewable air conditioning**. The programmes will have an initial budget of 660 million euros, which can be increased to 1,320 million euros as the autonomous communities exhaust their initial allocations. The aid will be divided into six programmes that will distribute a maximum of 900 million euros for self-consumption, 220 million for storage behind the meter and 200 million for air conditioning and hot water with renewables. These actions will allow the construction of 1,850 MW of renewable energy, including heating and cooling in more than 40,000 homes. More than 25,000 jobs will be created, GDP will grow by more than 1.7 million for every million of aid and CO2 emissions will fall by more than one million tonnes per year.

- **Subsidies for the improvement of energy efficiency and the use of renewable energies in companies and residential buildings**, co-financed with ERDF in the scope of the Operational Programme of the Canary Islands.

  Target group: Citizens and SMEs and Large companies.

  Amount: The subsidy rate will be 45% of the eligible expenditure, with a maximum subsidy of 60,000 euros per project. A maximum grant amount of EUR 90 000 per beneficiary is established, taking into account the provisions of base 25. For the business sector, projects with a subsidy of less than 15,000 euros will not be eligible. For the residential sector, projects whose subsidy is less than EUR 4,500 will not be eligible.

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- **Direct grant subsidy dossiers - Subsidy dossiers intended for Geoparks. To meet needs considered to be of public or social interest, encouraging and promoting certain actions by natural or legal, public or private persons.**

  Addressed to: Local Administration

  Amount: 20,000 euros for Geoparks.

- **Direct grant subsidy dossiers - Subsidy dossiers to the Neotrópico Foundation** (The Neotrópico Foundation is the only exotic fauna Centre in the Canary Islands with a certified Biosecurity level 3 quarantine).

  Addressed to: Fundación Neotrópico

  Amount: 130.000 euros

- **Grants for Renewable Energies and Biofuels, for the financial year 2021** (Comunidad Valenciana).

  Target group: Any entity or legal person, of a public or private nature, including groups without legal personality and communities of property, as well as businesswomen or individual entrepreneurs.

  Amount: Up to 45% of the eligible cost of the project, with a maximum of 200,000 euros per project.

- **Aid programme for energy efficiency actions in SMEs and large companies in the industrial sector.**

  Aimed at: SMEs, self-employed, large companies and public companies in the water cycle.

  Amount: Incentive of 30% of the incentive investment, subject to state aid limit. The maximum incentive is €15 M per project and/or beneficiary.

- **Aid for investments for singular local clean energy projects in municipalities with demographic challenges.**

  Target group: Everyone.

  Amount: Initial allocation for the whole of Spain of 75 million euros.

- **Programme of aid for the energy rehabilitation of buildings.**

  Target group: Natural or legal persons of a private or public nature who are owners of existing buildings intended for any use; communities of owners or groups of communities of owners of residential buildings for residential use; owners who as a group are owners of buildings; building operators, lessees or concessionaires (by means of a long-term contract in force with the property), which gives them express authority to undertake the refurbishment works that are the object of the action; energy services companies (ESCOs). They must act in accordance with the contract with the property and carry out the investments; town councils, provincial

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councils, the institutional public sector of any public administration or equivalent local bodies, and the Mancomunidades or groupings of Spanish municipalities; renewable energy communities and citizen energy communities.

Amount: The budget for Catalonia €5,574,330.

- **Electrical energy storage systems with batteries associated with self-consumption photovoltaic installations.**

  Target group: Natural persons who do not carry out an economic activity; communities of owners.

  Amount: The amount of the subsidy will be 60% of the total cost of the eligible expenses of the storage system with lithium-ion technology batteries, with a limit of 5,000 euros per system.

- **Grants for local authority projects favouring the shift to a low-carbon economy.**

  Aimed at: Municipalities or groupings of municipalities with no limit on the number of inhabitants.

  Amount: 50% of the eligible expenditure, with a maximum of 5 million Euros per municipality.

- **Aid for the generation of renewable thermal and electrical energy.**

  Target group: Natural or legal persons, public or private, who can carry out the projects or activities that motivate the granting of this aid may obtain the status of beneficiaries.

  Amount: EUR 10 million.

- **R&D activities in Circular Economy projects in companies, specifically in the field of waste.**

  Target group: Profit-making companies that have an operational establishment in Catalonia and that have been in existence for at least one year at the date of the application for aid, counted from the date of registration of the company in the Companies Register (or similar register).

  Amount: Maximum intensities, in accordance with Community state aid rules, may be up to:

  - Small enterprise Industrial research activities 50%.
    - Experimental development activities 45%.
  - Medium-sized enterprise Industrial research activities 50% Experimental development activities 35
    - Experimental development activities 35% Large enterprise
  - Large enterprise Industrial research activities 50% Experimental development activities

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- Experimental development activities 25%.

The maximum grant per project will be 125,000 euros for individual projects and 300,000 euros for collaborative projects.

The minimum project budget will be 200,000 euros for individual projects and 500,000 euros for collaborative projects.

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Cyprus

Full name: Republic of Cyprus

Area: 9 251 km^2

Population: 1 189 265 inhabitants

Population density: 123.4 people/km^2

Capital: Nicosia

Currency: Euro

Background

Cyprus, in Greek Kípros, is an island located in the eastern Mediterranean Sea, renowned since ancient times for its mineral wealth, superb wines and produce, and natural beauty. As the Greek-Cypriot poet Leonidas Malenis once cited, Cyprus is A “golden-green leaf thrown into the Sea” and a land of “wild weather and volcanoes’’, since it comprises tall mountains, fertile valleys, and wide beaches (Cyprus | History, Flag, Map, & Facts, 2022). Cyprus, which has been inhabited for over ten millennia, is located at a cultural, linguistic, and historical crossroads between Europe and Asia. Specifically, Cyprus is approximately 40 miles (65 km) south of Turkey, 60 miles (100 km) west of Syria, and 480 miles (770 km) southeast of mainland Greece (Figure 1).

Moreover, the country’s four dominant cities; Nicosia, Limassol, Famagusta, and Paphos, have absorbed the influences of generations of conquerors, pilgrims, and various travelers, transitioning the country to being prominent for tourist destinations (Cyprus | History, Flag, Map, & Facts, 2022). Hence, due to its diversified history, Cyprus is currently inhabited by 1,230,161 individuals (male= 51.1%, female= 48.9%) and is hypothesized to be expanded by 7,585, due to migration (Cyprus population, 2022). Nonetheless, Cyprus is leading with a democratic policy, since its government is compromised in three representative states as it is a Unitary state, it involves a Presidential system and a Constitutional republic.

Evidently, since Cyprus is settled in the Mediterranean, the climate is strongly Mediterranean, consisting of strongly marked seasonal rhythm. In other words, the country is comprised of hot, dry summers and rainy winters, but simultaneously with short autumns and breezy springs. During the summers, Cyprus’ capital Nicosia, reaches exceedingly high temperatures, with an average daily maximum of 37°C, in contrast with the winter’s average temperature of 21°C (Cyprus | History, Flag, Map, & Facts, 2022).

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Energy policies

In Cyprus, the department of Environment, is the progressive occurrence of the Environmental Service, which was devised in 1986. After the integration of Cyprus into the European Union in 2004, a variety of environmental legislations have been adopted in the Cypriot National Law. As the Regulatory Authority, the department of Environment is crucial for coordinating and involving other relevant Services and Departments, in addition to implementing laws and regulations.

For instance, a few of the regulations implemented by the department are the Environmental Impact Assessment (EIA), Waste Management, Control of Water and Soil Pollution, Climate Action and the Protection and Management of Nature. Further to the instruments enacted as part of the European acquis, the Department serves as a contact point for implementing the requirements of numerous United Nations environmental conventions, while also participating in the execution of the United Nations Mediterranean Action Plan (MAP) (Home, 2022). Unfortunately, despite Cyprus' efforts and significant improvement, the country still performs poorly in the sector of eco-innovation (Department of environment, 2022).

According to the Eco-Innovation Scoreboard in 2019, the country reached a score of 56, ranking it in the 26th position, placing it behind the EU average (Eco-Innovation, 2022). Thus, such outcomes might be explained by the fact that eco-innovation in Cyprus, is predominantly produced by individual sectors such as research institutes. However, the country contributes to the alleviation of environmental pressures through its significant natural habitat in renewable energies of solar and wind, allowing the possibility of cultivating eco-innovation through these activities. Research depicted that the country is ranked first in solar DHW (Domestic Hot Water Heating) per capita (Eco-Innovation, 2022).

Nonetheless, Cyprus aims to follow the regulations implemented by the EC to the extend at which the country is capable. The current policy situation includes the national policy framework derived from the framework of the National Energy and Climate Plan (NECP). This framework is governed by the respective EU framework for its implementation and involves policy measures from a variety of categories (technical, regulatory and financial). In other words, the already reinforced policy measures for energy, target the reduction of greenhouse gas emissions through sectors such as business, energy, transport, agriculture, education etc. (Mesimeris, 2020). Initially, this plan is a detailed roadmap for achieving Cyprus' Energy and Climate targets by 2030.

The program was approved by the Council of Ministers on the 15th of January 2020 and delivered to the European Commission on 21st January 2020 (Cyprus and the EU Green Deal, 2022). Moreover, regardless of the Cyprus' Energy and Climate targets, the NECP also lists principal policy priorities which will be incorporated to allow the country to succeed in reaching its targets, that are in accordance with the European Green Deal (Directorate General Growth, 2022). A few of these priorities are:

- Reducing greenhouse gas emissions and environmental objectives;
- Increasing the share of Renewable Energy Sources (RES) in energy consumption;
- Improve energy efficiency (Cyprus and the EU Green Deal, 2022).

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Furthermore, an additional policy the country aims to reinforce is the EU's Green Action Plan guidelines and presented the 'Cyprus Action Plan for the transition to a circular economy 2021-2027' (Cyprus CEAP, 2022). The Minister of Energy, Commerce and Industry claimed that this forthcoming transition to a circular economy, will create opportunities regarding the transformation of firms and industry. Evidently, this will help firms gain increased competitive advantages and become more resilient and more sustainable at a local and international level.

Hence, the four pillars that the Cypriot government is basing the achievement of this transition are:

- **1st Pillar** – *Cultural change for a circular economy*;
  - It involves educating the community, the consumers and businesses about the various prospects of circular economy.
- **2nd Pillar** – *Providing incentives for investments in a circular economy*;
  - Developing a Consulting and Financial Guidance plan of €1m to distribute to companies.
- **3rd Pillar** – *Development of circular economy infrastructures*;
  - To identify which waste streams, need to be declassified, produce an online platform for companies to share resources and information and create an integrated system for supervising waste management projects.
- **4th Pillar** – *Municipal Waste Management*;
  - Implementation of the 'Pay as you Throw' scheme to ensure the proper collection, recycling, fertilization through compost and reduction of waste (Cyprus CEAP, 2022).

However, despite the country's efforts, it is undeniable that various challenges and threats might arise throughout the process of implementing the environmental policies. For instance, a dominant challenge for switching to the environmental policies, it is the country's high dependency on fossil fuels for energy, which ultimately was labelled as the biggest share in the EU. Thus, the country must rapidly develop both its hydrocarbon and renewable energy sources (National energy and climate plan, 2022). An additional strategy that Cyprus is aiming to incorporate into its policies is the Sustainable Development Strategy (SDS). This strategy involves a coordinated process of actions, in particular the Sustainable Development Goals (SDGs) to achieve the environmental, social and economic objectives in an integrated manner (A Sustainable Europe by 2030, 2022).
Watch this video for more information: https://www.youtube.com/watch?v=M-iJM02m_Hg

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Unfortunately, there are significant issues in the areas of sustainable agriculture, clean water, and sanitation. In terms of inexpensive and clean energy, responsible use and production, and climate action, Cyprus continues to lag behind. However, the data demonstrated that most environmental goals are being satisfied, indicating the success of focused government policies and activities (Sustainable development knowledge platform, 2022).

Nonetheless, despite the fact that Cyprus' has not depicted the expected improvements, the country is tirelessly supporting the implementation of green energy policies in cities, such as the NECP. Through a diversified subcategorized measures of the NECP, the country introduced strategies to increase the number of nearly zero-energy buildings (NZEBS), and decrease the amount of utilized energy in the primary, secondary and tertiary sector (Pirpitsi, 2017). Moreover, as the country follows the policies by the International Renewable Energy Agency (IRENA), it incorporated a roadmap for the improvement of energy utilization, which should:

- Focus on solely on the power sector;
- Determine options for economically optimal levels of renewable energy power generation;
- Examine how to best integrate variable renewable energy into the Cyprus power grid;
- Analyze impacts of the planned electrical interconnection to Greece and Israel;
- Investigate options under consideration for the planned production of domestic natural gas (Renewable Energy Roadmap for the Republic of Cyprus, 2022).

Furthermore, through this roadmap the country aims to lower the electricity demand, invest in environmental technologies such as solar PV and once indigenous natural gas will become available, Cyprus will be shifting from mostly imported oil -based power generation to fully domestic-based power generation, dominated by solar PV, wind and domestic natural gas, improving the trade balance, increasing energy security and significantly reducing cost of electricity supply (Renewable Energy Roadmap for the Republic of Cyprus, 2022).

Grants and subsidies

Through the countries efforts to convert its linear economy into a circular economy, the government is providing a variety of funds that will assist this transition (National Grant Schemes, 2022). Some of these grants are (Cyprus CEAP, 2022; National Grant Schemes, 2022):

- Go circular Grant Scheme.
- Research and Innovation Foundation (RIF).
- Industry and Technology service.
- Scheme for the Purchase of Electric Vehicles (H14).

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- Grant Scheme to encourage the use of Renewable Energy Sources and Energy Saving in Homes (2022).
- Grant Scheme for the installation or replacement of solar water heating systems (2022).
- Grant Scheme to encourage the use of Renewable Energy Sources and Energy Saving in Local Authorities and Non-Profit Organisations (2022).
- Support Scheme for the installation/expansion of photovoltaic systems for the charging of electric or hybrid vehicles.
- Scheme for replacement of electrical appliances in homes of vulnerable electricity consumers - First Call.
- Sponsorships Programme 2021 (SPONSORSHIPS/0721).

For more information check these websites:

https://www.fundingprogrammesportal.gov.cy/en/program-major-category/national-grant-schemes/

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