

Green and Circular Economy

Sector report

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Barcelona
Activa

Abstract

Green and Circular Economy

The Green and Circular Economy sector gathers all economic activities and professional profiles that are most directly involved in the **green and energy transition**, which is one of the great challenges that humankind will face in the coming decades. This sector includes activities of production, distribution and consumption of goods and services that aim to reduce and eventually **eliminate the risk of environmental degradation**. The Green and Circular Economy sector also promotes a greater equity in the access to the markets that regulate these economic activities. Besides,

circularity - inspired in the natural ecosystems, where no waste is produced - is a key concept. This sector has its own identity and specificity, but it is also broad and influences the way all other economic activities' work and produce: it is increasingly cross-cutting in nature. Several sources predict a significant increase in employment related to this sector, particularly in the fields of **renewable energy supply** and **energy efficiency**. A political, social and global consensus regarding the need to collectively move forward towards a more sustainable world will doubtlessly ease this transition.





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Get to know the sector

Introduction to the sector

In recent decades, there has been an intense political, academic and social discussion about environmental issues and how to incorporate them into productive activity. Fossil energy sources and uranium, as well as factors such as atmospheric pollution (CO₂ emissions), excessive energy consumption and waste generation result in high **costs for society**, such as those associated with CO₂ emissions and climate change, and others derived from nuclear technology and waste. Such costs are indirectly assumed by companies and citizenship through public health and social policies. A Green and Circular Economy aims to eliminate these costs for society by implementing **policies that favour energy transition and promote a circular economy**, such as purchasing 100% renewable energy and minimising waste.

The following concepts are key to understanding what comprises the Green and Circular Economy sector:



Circular Economy

Circular economy is a set of practices promoted by the public and private sectors. These policies foster producing, distributing and consuming products and services in a way that **minimises** or eliminates the **generation of waste** that remains out of the production and consumption systems. So, when a product reaches the end of its lifespan, the materials it is made of remain in the economic system for as long as possible. Resources can be used over and over again, which creates added value. Circular economy diverges from the established economic linear model, which is mainly based on the “use and waste” flow and requires large amounts of materials and energy that are cheap and easy to access (which is the case of practices such as programmed obsolescence). Therefore, implementing circular economy measures has an effect on major corporations and small companies, on organisations and individuals, at global and local levels.



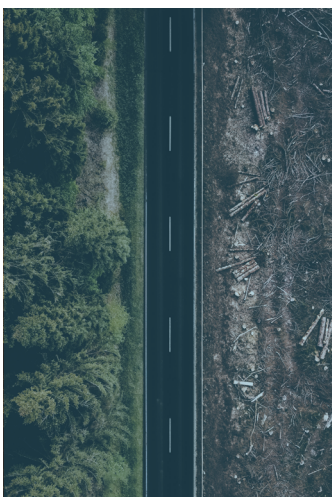
Renewable Energy

Renewable energy is developed and distributed by companies that **produce energy in a sustainable way** and that bring to the market products and services needed to ensure it reaches end consumers: private homes, residents' associations, street lighting and businesses, among many others. Therefore, renewable energy includes all actors involved in the process, from material manufacturing companies (such as solar panels) to companies producing and/or distributing renewable energy. It also includes installation companies, engineering and commercialisation consulting companies, and others. There are different types of renewable energies, and the main ones are **wind power**, **biofuels** (biodiesel, bioethanol), **hydroelectricity**, **photovoltaic** and **thermal solar power**, **geothermal power** and **marine power**.



Energy Efficiency

Energy efficiency promotes **efficient power use** in facilities, installations and homes. All production and transport processes, as well as any processes that involve energy consumption, are susceptible to become more energetically efficient in order to **reduce its contribution to climate change**. When energy consumption per unit of product manufactured or service provided decreases, energy efficiency increases. In this sense, there is a wide range of actions that improve energy efficiency. Such actions generate a growing economic and professional activity related to this market.



Environmental Management and Control

Environmental management and control includes a set of fairly diverse economic activities with a common goal: ensuring **environmental quality**. Practices include preventing the degradation of natural landscapes, spreading the importance of environmental issues, setting up environmental consulting projects and managing the environmental impact of infrastructures and productive activities. This activity is conducted by professionals and service companies as well as public services. In contrast with the previous concepts, this area is not defined by producing capital or consumer goods.



Barcelona and its metropolitan area: promoting a Green and Circular Economy

The city of Barcelona has been fostering a green and circular economy for a long time. As an innovation-oriented city, Barcelona has proven to be a pioneer in designing **solutions to the city's environmental challenges**. Some relevant initiatives include promoting Ecoparks to manage solid urban waste, setting up a waste-water treatment plant and solar panels in the Fòrum grounds, consolidating separate collection of waste, enforcing limits on metropolitan CO₂ emissions by private vehicles, boosting public transport, recovering urban green areas in public spaces, watering with groundwater and creating a public company that distributes clean energy to promote energy efficiency. The goal of these actions is to place Barcelona in a **leading position when it comes to city transformation towards sustainability**. These measures can act as a catalyst for innovation in several economic sectors, which encourages the creation of new professional profiles and **boosts the job market**. To this end, Barcelona and its metropolitan area stimulate demand for the sector through public investment, new regulations and flagship actions that aim to set an example.

Areas of activity

The Green and Circular Economy sector aims to accelerate energy transition and to eliminate the negative environmental impact of human activities by producing environmentally friendly goods and services. It consists of the following sub-sectors:

Renewable energies

This sub-sector brings together companies and professionals producing renewable energy and bringing to the market the products and services needed to ensure that clean and sustainable energy reaches end consumers. The main renewable energy sources and technologies are the following:



Wind energy uses the air's kinetic energy. This technology has been used since ancient times to propel sailboats, operate windmills, mill grains and pump water. But the value of wind energy has remarkably increased since the last decade of the 20th century thanks to certain technology developments and a greater economic competitiveness. The most commonly used technology is the **wind turbine**, a machine that converts wind force into electricity consisting of three blades rotating about a horizontal axis.



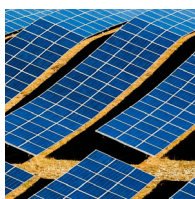
Biofuels are liquid or gas fuels produced from **raw materials of biological origin (vegetable or animal)**. They are the main renewable energy source used in transport. Using biofuels helps to reduce energy dependence on oil and the severe environmental impacts related.



Biomass is the **biodegradable** fraction of products, waste and scraps of biological origin coming from agricultural activities and forestry, as well as the biodegradable fraction of other biological waste. It is used as an energy source. Biomass conversion into **heat** and **electricity** can be achieved through four processes: combustion, anaerobic digestion, aeration and pyrolysis.



Hydropower is the most widely used renewable energy source and the one that has been used for the longest time. It takes advantage of the **kinetic energy of a mass of water**, which spins a turbine; using an axis, this rotatory motion is then transferred to a generator of electricity. Until the mid 20th century, hydropower was the main large-scale source of electricity production due to the construction of large dams.



Solar energy (photovoltaic and thermal): Photovoltaic energy is the direct conversion of solar radiation into electricity. This process takes place in devices called **photovoltaic panels**. On the panels, solar radiation excites electrons on a semiconductor device and generates a small potential difference. Large potential differences are obtained by connecting these devices in series.



Geothermal energy is heat stored **in the Earth's crust**, which may be used to directly produce heat or to generate electricity. As it is produced constantly, this energy source is easier to manage.



Marine energy comes from the set of technologies that use the energy of oceans. Oceans have a great energy potential, mainly present in **waves, tides, currents** and the **temperature difference** between surface and deep sea waters.

Each type or system of renewable energy production has its own market, with specialised companies and specific professional profiles. Lately there has been a strong surge and consolidation of companies distributing renewable energy, which have a different business organisational model than big traditional electricity producers and distributors.

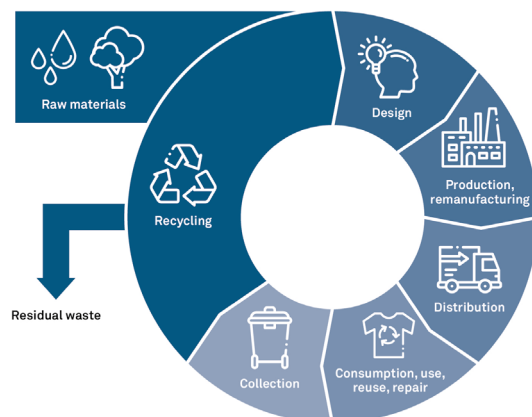
There is a relevant aspect related to energy management in the field of renewable energies: **energy efficiency**. Energy efficiency aims to protect the environment by reducing energy intensity and encouraging **minimum, essential consumption**. Logically, it makes no sense to use renewable energies without an energy efficiency pattern. Besides involving environmental awareness, energy efficiency helps to reduce costs related to energy consumption (for example: insulating a house in order to spend less energy in heating and cooling and installing LED lighting). Operators intervening directly in the energy efficiency market are the following:

- **Material and product manufacturers**, who need to incorporate research and development processes to ensure their products are more energetically efficient.
- **Installation, assembly, construction and maintenance companies**, who take on an energy efficiency perspective by using new materials and products that are more efficient in terms of energy conservation and consumption.
- **Energy audit and consulting companies**, who specialise in evaluating an organisation's energy performance and planning out projects related to energy efficiency and renewable energy generation.

Environmental management

Environmental management and control is shared between the public and private sectors. Public administrations and private companies **manage natural landscapes** and preserved areas, take on **environmental monitoring and safety measures** (such as inspection services, water quality, waste cleaning and management, environmental audits, air pollution control and safety and environmental monitoring in public works) and **environmental consulting services** (environmental education, public uses plan, sustainable product design and sustainable mobility studies). With the energy transition process, environmental consulting -which used to offer services that required highly qualified professional profiles- is incorporating new services related to energy audits, renewable energies, environmental education, circularity, energy communities

Figure 1. Environmental management and circularity



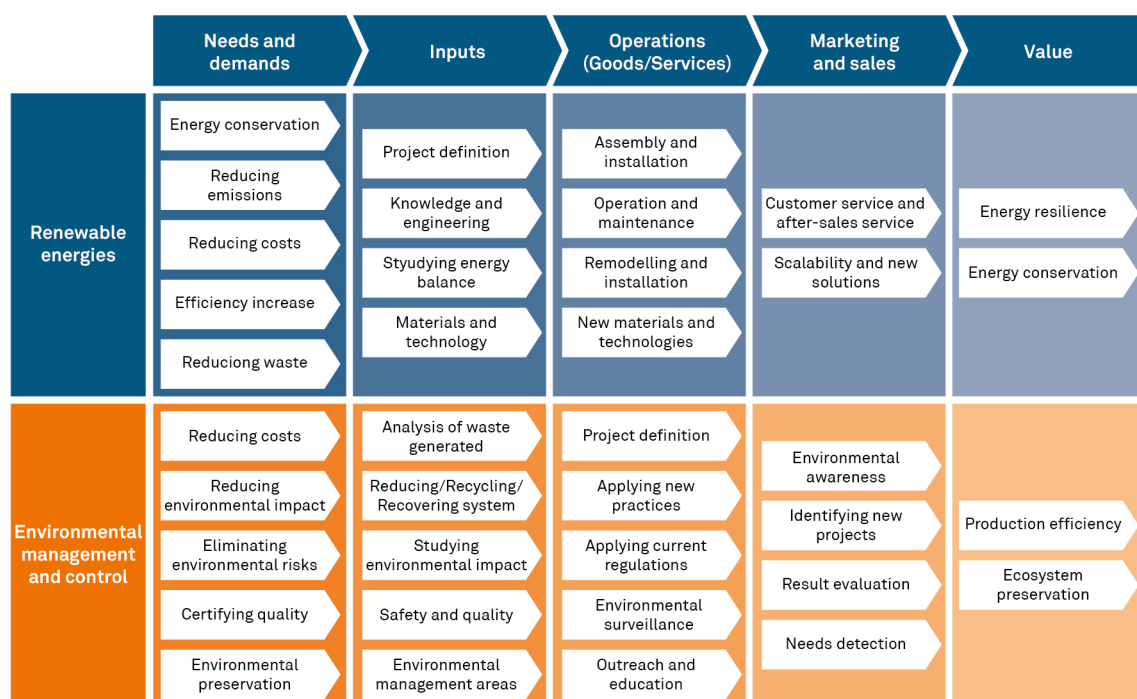
Source: Prepared by the authors, adapted from European Parliament

and ecological footprint of organisations. These are more cross-cutting services that no longer -exclusively- require highly qualified professional profiles.

A key aspect of the Green and Circular Economy is that it **promotes circularity** in the production and consumption system. The current economic model, based on “extracting, producing, throwing away”, is reaching its physical limits. Circular economy redefines the concept of growth by dissociating the economic activity from the consumption of finite resources and by **designing a waste-free system**. A circular model creates economic, natural and social capital, especially when accompanied by a transition to renewable energy sources. Circular economy also applies to the management of cities and regions, both in urban solid waste management and water cycle management. Likewise, regarding the water cycle, reducing water consumption and treating waste-waters is an essential part of the circular economy.

Finally, in terms of value chain, the components of the Green and Circular Economy sector are the following:

Figure 2. Components of the value chain of the Green and Circular Economy sector



Font: Prepared by the authors

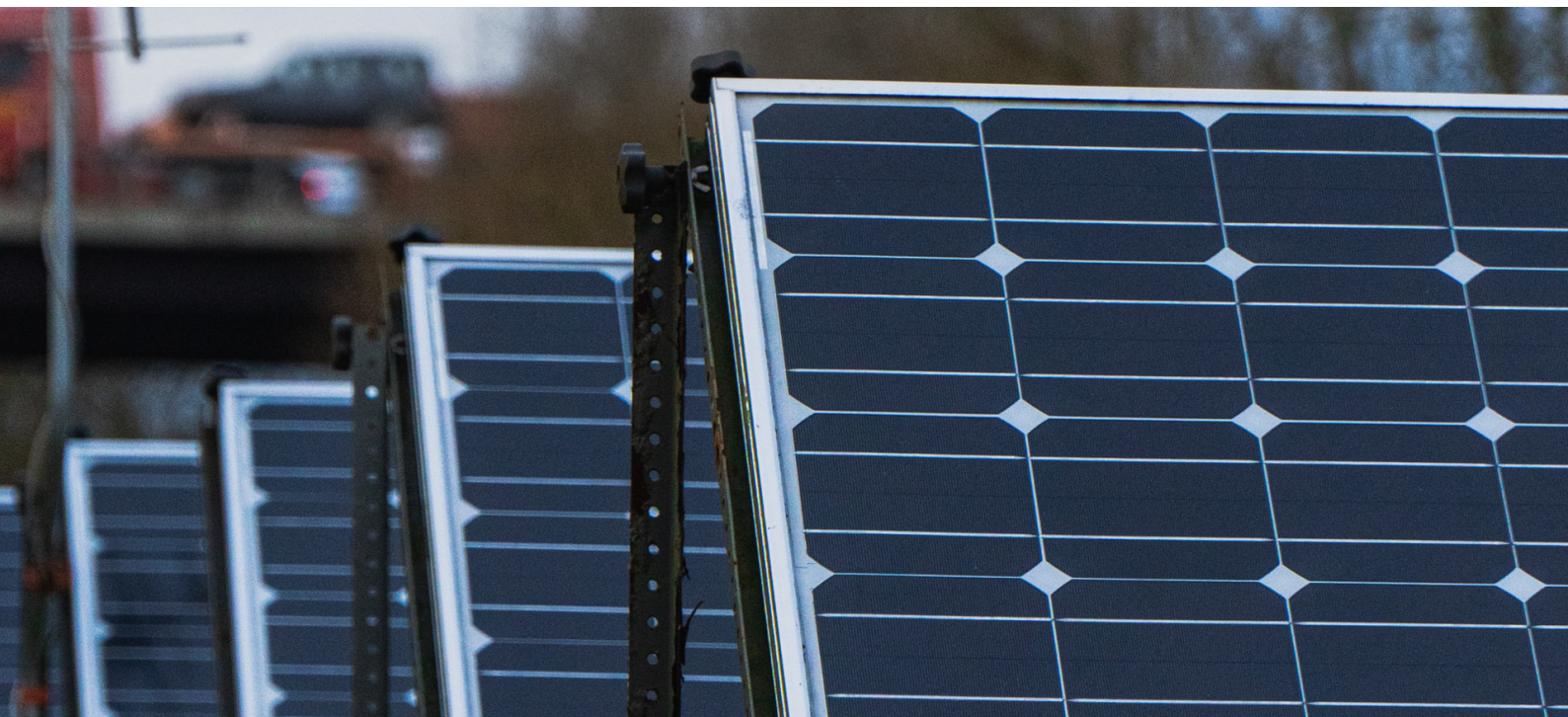
Trends

There is a general consensus that the Green and Circular Economy sector will grow in the upcoming years, which implies that **more companies and employment will be created**. Moreover, administrations are promoting public policies such as regulations, investments and aids that forecast an obvious development of this sector.

Public administrations are implementing plans that amplify the opportunities to create companies and jobs within this sector. In Catalonia, these plans include the Solarcat Strategy, the Strategic Plan for the deployment of recharging infrastructure of electric vehicles in Catalonia, the Energy and Climate Change Plan for Catalonia and the Plan for Energy Saving and Efficiency Buildings and Equipment of the Government of Catalonia.

Established trends

- There is an **upward trend in the consumption of renewable energies** in the EU countries, although there is a clear disparity amongst them. This makes it obvious that we are leaving behind an economic paradigm moved by fossil fuel energies.
- **Construction of housing, equipment and consumption goods is now subject to energy efficiency and circular economy requirements**, which create fewer negative impacts in terms, for example, of CO₂ emissions and waste generation.
- There is a **broad political, economical and social consensus to promote Green and Circular Economy** in order to avoid climate change and boost an Ecology Transition. As a result, public authorities are making actual investments that favour this sector (for example, electrical vehicle subsidies).
- In this sector there is a **demand for professional profiles of all levels of professional qualification** (assembly of installations, manufacture of materials and components, project design, commercialisation and others), which is promoting a transfer of professionals among sectors.



Emerging trends

- **The renewable energy market in Spain is growing considerably** due to the end of the moratorium on renewable energies imposed in the 2010s, especially in the case of solar photovoltaic energy. There has been a surge in the installation of large solar farms destined to massive consumption as well as panels for individual producers / consumers.
- Green and Circular Economy involves a set of practices in the production of goods and services that have a cross-cutting impact on the rest of economic sectors. For this reason, it is expected that **more employment options for Green and Circular Economy professional profiles will be created when compared to other sectors**, as these will increasingly adopt Green and Circular Economy practices and solutions.
- **A distributed generation model will allow new operators into the market**, who will become both energy producers and consumers. For instance, this option will be available to a housing block's residents' association, which will demand more services and products such as solar panel installation, and engineering projects.
- As a consequence of electrification, **consumption will decrease in homes and gas, oil and other fossil fuel companies** will be replaced by electricity sourced from sustainable production systems. This trend will bring changes to the job market, especially for those who will need to undergo training to transfer to a different sector or job position.

Professional profiles

Major international organisations, such as the International Labour Organisation and the European Union, foresee a **spectacular increase of global employment** in the coming years, which will result in 18 to 24 million new jobs.

According to the [International Labour Organization](#)(2018), transitioning towards a green economy will come at a high price for employment, as about 6 million jobs will be lost. But at the same time this transition will create about **24 million new jobs in careers related to sustainability and the environment**. In other words, **for every job lost, four new jobs will be created**. Similarly, the latest report of the [World Economic Forum](#) predicts that up to 46% of the working population will have to change their current occupation in the medium term. However, the destruction of employment will lead to digital transformation, among other sectors, because of the growth in jobs related to the green economy and sustainable product development.

Regarding the most in-demand professional profiles, several sources point out that the green transition will not create a sizable range of new occupations, but will instead boost existing occupations. Professionals working in this sector will become transition leaders and managers and drive their companies and organisations towards sustainability. This trend will be relevant in the **industry** (implementing more sustainable production methods and taking on circular economy practices), **environmental services** (education and social awareness through education, as well as through environmental audits for certification) and occupations related to **sustainable energy sources**. Some of the most relevant occupations will be the following:



Eco-product designer

A designer technician that **considers environmental criteria when conceiving and developing a product**. Preventive measures are taken to reduce environmental impact (such as fashion products and packaging), as well as other technical, economic or quality criteria. Therefore, an eco-product designer takes into account ecologic criteria regarding materials, production process, product lifespan and subsequent recycling of objects.

Waste residue flow manager

A technician aiming to ensure that sustainability and circularity criteria are met when **managing production processes** and **manufacturing products**. This applies both to products and processes placed in the market by companies and those managed by cities and territories (such as urban solid waste generation). Residual flow is a key term within the circular economy. The main goal of this term is to minimise waste, either by reincorporating it to the production chain or by treating it and placing it in safe facilities without an environmental impact.

Environmental educator

A technician specialised in **providing training in ecological, economic and cultural processes related to the environment**. This job entails a wide range of tasks, such as organising courses, conferences, workshops, guided visits, activities and awareness campaigns. Environmental educators should be good communicators, able to synthesise information and interested in training and educating individuals.

Energy facilities planner

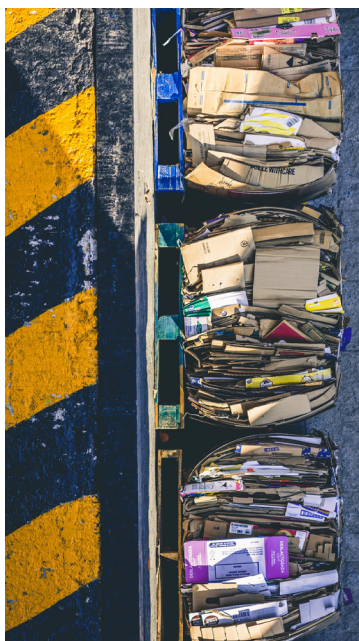
A technician managing the **setup, operation and maintenance** of all kinds of **facilities dedicated to obtaining renewable energy**. An energy facility planner evaluates a project's viability and placement, designs the project, plans its execution and validates it once it has been completed. In order to perform their tasks, they need a medium-high knowledge of mechanics, hydraulics, electricity and structure calculation.

Environmental management system technician in the industry

This professional analyses solutions and designs **sustainable technology projects**. They evaluate an industrial activity or process and determine potential opportunities to **prevent and reduce sources of pollution**, in order to bring technically and economically viable alternatives. An environmental management system technician is in charge of reducing a company's carbon footprint, evaluating the environmental impact or guiding an organisation towards reducing their CO₂ emissions, waste or water use. They may also act as a sustainability consultant.

Environmental auditor

An environmental auditor counsels companies and organisations regarding **risk prevention** regulations and standards, implementing **quality systems, reducing their environmental impact** and improving **corporate social responsibility**. Besides, they audit companies in compliance with the current environmental management regulations and may help businesses obtain environmental certifications. The goal of environmental regulations is to promote environmental management in companies in a similar way as they perform quality management.





Building energy efficiency technician

A building energy efficiency technician cooperates with other professionals to ensure that a building has the **lowest possible environmental impact**. They take part in building remodellings to make them more energetically efficient and guarantee that new buildings comply with strict standards of low carbon levels. Building energy efficiency technicians know the energy sector well, and usually work in engineering companies, architecture studies, construction companies and companies providing energy services (such as energy audits, building energy certificates and implementation of energy management systems).

Industrial and urban waste treatment and management operator

This profile provides assistance to waste technicians. They contribute to **waste management in industrial plants** by controlling, surveilling, informing and distributing it. Their professional activity is conducted within the public administration (councils and assemblies of associations of local councils); in waste management companies, dedicated to preparing waste to be reused or recycled; in chemical waste treatment plants; and in industrial and urban waste transfer stations and waste recovery and treatment facilities.

Besides, other emerging professional profiles in the context of the upcoming expansion of Green and Circular Economy are those related to **electrical motor manufacturing, biogas plant maintenance, drone flying for environmental management purposes** and **cultural management specialised in promoting sustainability**.

The sector in figures

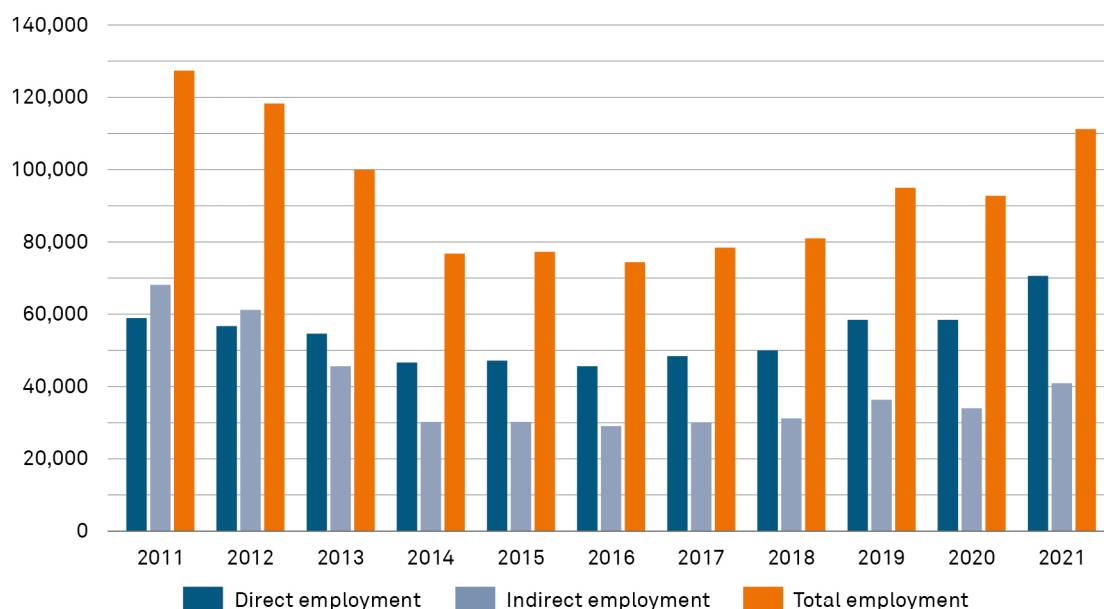
The Green and Circular Economy sector **is not included in official figures as such**. Therefore, it is not possible to offer a statistical overview of the sector as a whole. However, there is partial data available (especially regarding renewable energy generation) that suggests that **the sector is expanding rapidly**, in agreement with what international organisations predicted.

According to the [Spanish Renewable Energy Association \(APPA\)](#), which is the leading association of the sector bringing together companies and entities explaining renewable energy sources, the renewable energy sector **employed a total of 111,409 people** in 2021, which represented a 37% annual increase and confirmed the growing employment trend that began in 2018

APPA states that the main technologies creating employment were **wind energy, solar photovoltaic** and **thermal energy**, as well as **marine energy**. Special mention should be made of the performance of photovoltaic solar technology, which, between installations connected to the grid and self-consumption, has experienced a 59% increase in the number of jobs generated, a trend that is expected to continue to grow in the coming years.

In spite of this emerging recovery in recent years, the renewable energy sector has lost nearly 13% of jobs since 2011 (when it employed 127,548 people) because of **a set of legislative changes that stopped the development of renewable energies** in Spain in the 2010s. However, as can be seen in Figure 3, the recovery in employment from 2014 onwards shows a steady upward trend:

Figure 3. Employment in the Renewable Energy sector in Spain

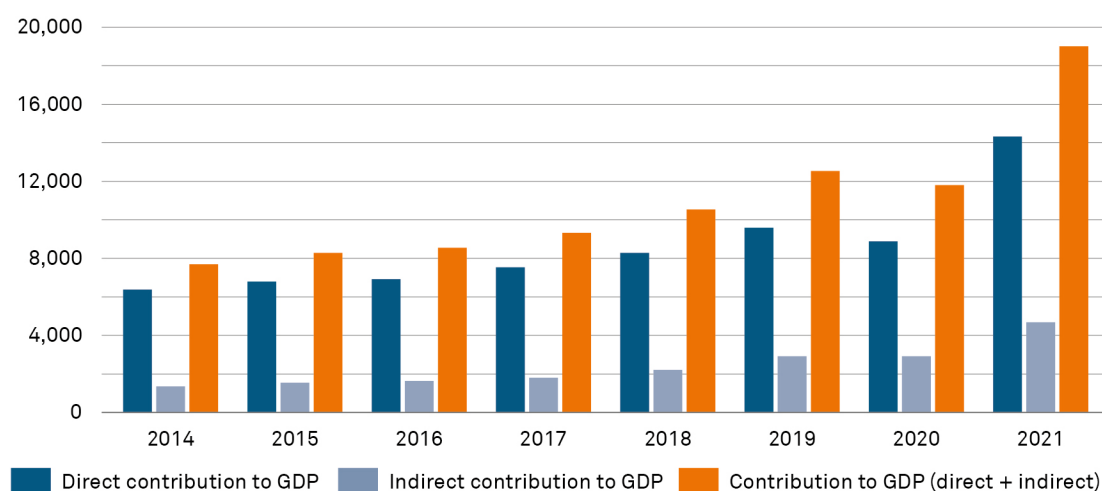


Source: Prepared by the authors, based on data by APPA Renovables.

Additionally, according to APPA, **renewable energy consumption in Spain in 2021 amounted for 46,7%** of electricity in the Spanish electricity system, and wind, hydro and photovoltaic were the main clean generation technologies. This represented an **increase of 2.7% compared to 2020** and consolidates these energies as the main sources. In addition, wind power overtook nuclear power as the specific technology with the greatest contribution of electricity to the system.

The contribution of the renewable energy sector to Gross Domestic Product was **19,011 million euros in 2021**. This figure has increased in recent years and already amounts to 1,58% of Spanish GDP, according to APPA.

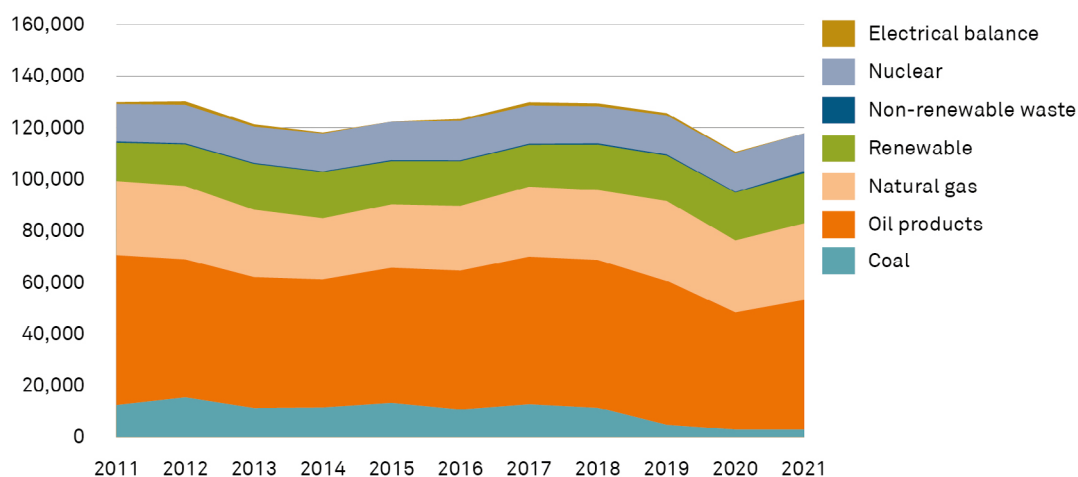
Figure 4. Evolution of direct, indirect and total contribution of renewable energies to Spanish GDP



Source: Prepared by the authors, based on data by APPA Renovables.

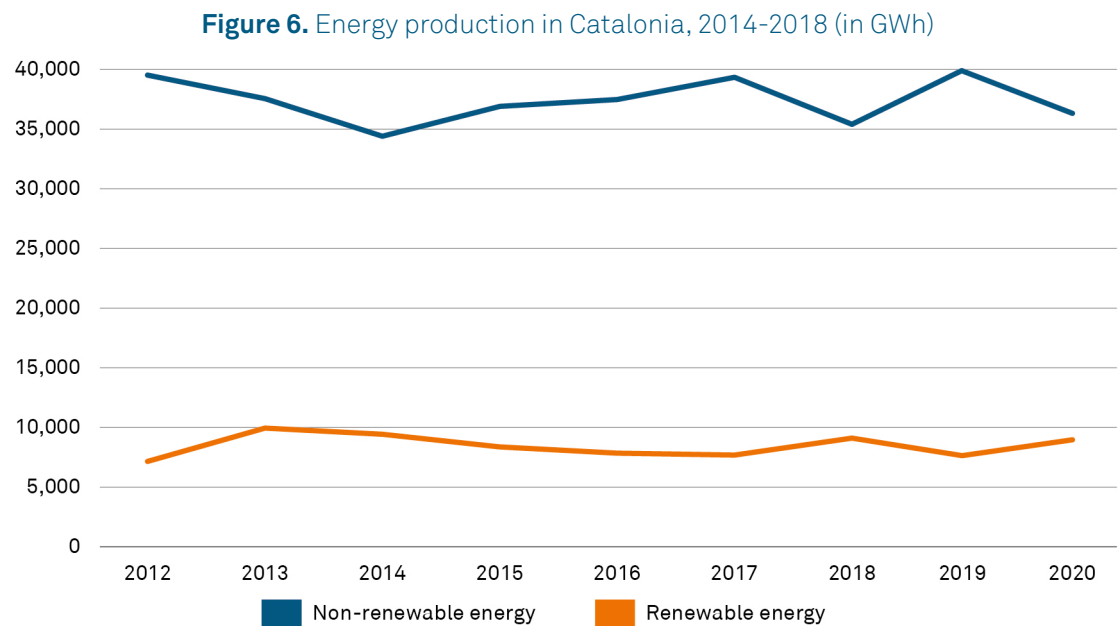
However, looking at the evolution of **primary energy consumption** in Spain, it is clear how little relative weight renewable energies still have. Primary energy is any form of energy available in nature before being converted or transformed. In Spain, renewable energy represents a small percentage (16.21%, year 2021) of primary energy consumption in relation to the total, where oil products (42.8%), natural gas (25%) and electricity production through nuclear power (12.5%) stand out.

Figure 5. Evolution of primary energy consumption in Spain



Source: Prepared by the authors, based on data by MITECO.

For the case of **Catalonia**, the behaviour of energy production is quite similar and it can be seen that **the production of renewable energy was 19.8% in 2020**.



Source: Prepared by the authors, based on data by Idescat and the Catalan Energy Institute.

Projection

and future scenarios

As shown during the present report, there are high expectations regarding growth and employment creation in the Green and Circular Economy sector. The trends that will have an impact on future scenarios are summarised below:

Weaknesses

- It is still necessary to **raise awareness** among administrations, companies and consumers **so that there is a positive reaction to the upcoming changes** (electric motor, waste recycling, energy conservation and efficiency, and others). There is, however, a certain social consensus to promote the actions needed to favour the development of this sector.
- The development of this sector poses a **challenge in terms of career guidance** due to the foreseeable changes for several professional profiles. As a consequence, custom training and retraining programmes will be needed to redirect talent towards the Green and Circular Economy sector.
- Because of the cross-cutting nature of this sector, implementing new measures may be difficult at first due to the **resistance to change typical of traditional environments**, but it will have great potential benefits in the mid term.

Threats

- Raising awareness of the **potential risks of the rise of the average global temperature** (global warming, biodiversity loss, sea level rise, and others) leads to the creation of alternative models based on a Green and Circular Economy.
- The **lack of qualified professionals** to cover the massive amount of positions that will be created with the green transition -especially in renewable energy generation- makes it imperative that custom training programmes are designed to meet the needs of the sector in order to promote talent recruitment.
- **Labour costs might become higher** as a result of the shortage of qualified professionals, which might increase the costs of talent recruitment and the transfer of professionals from other sectors.

Strengths

- Green and Circular Economy becomes an established economic activity thanks to the **contribution of the public and private sectors through regulations and investment**, which makes it safer to invest in this emerging sector and creates new professional opportunities.

- Public administrations are supporting Green and Circular Economy by creating **custom training programmes and encouraging professionals of sectors undergoing transformation to transfer to this one.**
- This sector is well-connected with the industry as well as with maintenance services and advising to other economic sectors. Consequently, it will be easier to **transform existing jobs and to promote sector transfer** by providing strategic training to long-term professionals in traditional sectors.

Opportunities

- It is **generally agreed that fossil fuels and polluting energy sources are nonviable**, which favours a broad social consensus regarding the importance of promoting decarbonisation and electrification.
- There is a **will to build up global economic governance** through international agreements and commitments, such as the SDGs (Sustainable Development Goals). This framework makes it easier for public and private organisations to cooperate so that the sector can grow.
- **Taking a step from a centralised energy production and distribution towards a sustainable and distributed energy generation** model is a good development opportunity for decentralised economic models.

All in all, **employment in this sector is expected to grow in the coming years**, but there is a risk that job searchers -especially the younger generations- are not interested in accessing these job opportunities. It will be necessary to keep raising awareness on this matter to ensure that there will be a positive reaction to the upcoming changes.

It is also foreseeable that there will be a **transfer of human resources between sectors**, for instance from the production and distribution of fossil fuels to the sustainable energy sector. This might create resistance on a personal level, as the affected individuals will require professional retraining and might have to change their workplace or place of residence. This **resistance to change** also applies to major companies and consumers (for instance, regarding the use of electric motors or separating urban waste), which may slow down the full deployment of the Green and Circular Economy sector.

In conclusion, the Green and Circular Economy sector is bound to be **a green transition vector for the rest of sectors of economic activity** (for instance, by using more sustainable packaging or remodelling the public housing stock to make them energetically efficient) and a creator of employment for all levels of professional qualification. Its major challenge will be, however, dealing with the effects it will have in the job market and the changes caused by adopting more environmentally aware production practices and individual behaviours.

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GRÉGORY ROOSE / CC. Photovoltaic power station. Cover image.

SIG_MUND. Recycling bin. Abstract.

MARKUS SPISKE. Urban garden. Abstract.

MARCEL VIRAGH. cardboard box. Abstract and pg.13.

MARKUS SPISKE. Pile of logs in the forest. Abstract.

TANVI SHARME. Plastic containers. Abstract.

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