

Upgrading the Green Economy as an Effective Mechanism for Achieving Sustainable Development: A Study of the French Experience

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ABSTRACT

France is among the leading countries worldwide in environmental preservation. Through various means and approaches, it has endeavoured to mitigate the severity of pollution resulting from rising carbon levels in the atmosphere, driven by the heavy consumption of conventional energy sources such as oil, gas and coal. This has been achieved by adopting and implementing multiple methods for developing the green economy, establishing it as a pioneering framework for sustainable development across its various dimensions, both locally and internationally.

This study aims to shed light on the measures and initiatives France has undertaken domestically and internationally to support and advance the green economy. To this end, we conducted a descriptive analysis of France's most significant achievements to develop key green economy indicators.

The results demonstrate the importance of the green economy in achieving sustainable development, particularly through the gradual reduction of atmospheric carbon. This is notable despite the considerable economic growth witnessed by France, which naturally entails substantial and increasing energy consumption.

Keywords: Green economy, sustainable development, green growth

JEL Classification: Q57, Q01

Introduction

The global economy experienced steady growth following the end of the Second World War. This was driven by several factors, the most significant of which were technological progress and the political stability enjoyed by many countries, particularly the Western capitalist states. This development positively impacted individuals' living standards, primarily through significant income growth. However, it was also accompanied by numerous undesirable environmental consequences, primarily due to increased pollution from the high consumption of conventional energy sources such as oil, gas and coal.

This substantial reliance negatively affected the ecological and environmental balance. It also adversely affected the interests of present and future generations. This has prompted the international community to seek an effective solution that can ensure current economic prosperity

while safeguarding the rights of future generations. Accordingly, the green economy has been proposed as a foundational approach to achieving sustainable development.

As France is undergoing this economic transition — from an economy primarily dependent on conventional energy sources to a green economy — and given its position as a leading state that has signed international agreements aimed at advancing sustainable development through the development of the green economy's various components, the following research question arises:

What role does the green economy play in achieving sustainable development in France?

The following sub-questions can be raised from this research problem:

What is the relationship between the green economy and sustainable development?

What are the most important measures adopted in France to develop the green economy?

What impact does the green economy have on sustainable development in France?

Study hypotheses

In light of the research problem, the following hypotheses are proposed:

Hypothesis 1: The green economy is a fundamental and effective pillar for achieving sustainable development.

Hypothesis 2: France is among the leading countries worldwide that have made substantial progress in developing the green economy.

Hypothesis 3: Green energy sources are an effective alternative to traditional energy sources (oil, gas and coal).

Previous studies:

Study (Meziane, 2019): 'The Impact of the Green Economy on Growth and Sustainable Development: An Econometric Study of a Group of Developed and Developing Countries'. The researcher found that, unlike the traditional economy, which tends to generate growth only, the green economy contributes to achieving sustainable growth. In contrast, the traditional model often leads to increased spending on repairing the negative outcomes of growth on the climate and environmental systems more broadly. The study also indicates that the green economy focuses on real production and simultaneously restores the financial markets to their true role of financing real investment rather than speculation. It also helps to restructure the economy in countries that adopt it, gradually absorbing the surplus unemployment generated by the transition. Study (Mokhtar, 2017): The Green Economy and the Challenge of Sustainable Development in Algeria. The researcher concluded that the concept of the green economy necessarily involves addressing sustainable development, as the two concepts are seen as two sides of the same coin. Furthermore, the green economy was presented as a proposal that would enable sustainable development to be implemented more smoothly and easily.

The study further emphasises that achieving the required sustainable development can only be realised by promoting the idea of the green economy after decades of environmental damage caused by the so-called 'brown economy'.

Study (Zaoui, 2016): 'The Green Economy as a Strategic Option for Algeria in the Context of Falling Oil Prices'. The researcher concluded that the green economy is linked to environmental, economic and social issues, which lead to improvements in both the human condition and the

surrounding environment. The green economy's importance lies in the economic, social and environmental benefits resulting from equal consideration of the three pillars of sustainable development: the economic, social and environmental dimensions.

Study (Adel, 2020): The Green Economy as a Strategic Approach for Achieving Sustainable Development. The researcher emphasised the importance of the green economy in achieving sustainable development and referred to several successful international examples. One such example is Germany, which currently has the highest total installed capacity globally, at approximately 20.6 thousand megawatts. Germany meets 15% of its electricity needs through clean energy sources (wind, solar and biomass). Despite its relatively high frequency of cloudy conditions, Germany has largely succeeded in producing photovoltaic panels for household use. In this way, Germany has achieved two objectives with one approach: producing renewable energy and creating approximately 2.5 million jobs.

Study objectives

This study aims to:

- identify the relationship between the green economy and sustainable development;
- highlight the most significant efforts made by France to develop the green economy sector;
- Examine the most significant results achieved in the green economy sector in France.

Study methodology

The study adopted a descriptive approach to understand the various aspects of the topic. This was achieved by addressing different theoretical dimensions and conducting a case study of France, which is considered a leading model in the fields of the green economy and sustainable development.

Structure of the study

To address the research problem, the study was divided into three sections. The first section addresses the theoretical aspects by clarifying the nature of the green economy and sustainable development. The second section examines the measures taken in France to develop the green economy. The third section discusses the implications of France's efforts to promote the green economy for sustainable development in France through statistical analysis.

First: The Essence of the Green Economy and Sustainable Development

The green economy and sustainable development are two of the most important topics for economic researchers, who have sought to identify their key theoretical foundations. The following concepts are related to the green economy and sustainable development.

1. The concept of the green economy

1.1 Definition of the green economy

The United Nations Environment Programme (UNEP) defines the green economy as follows: “An economy that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcity”¹.

It is one of the new models of rapid economic development, primarily based on new environmental knowledge. One of its main objectives is to address the interrelationship between human economies and the natural environment².

It is a low-carbon, resource-efficient and socially inclusive economy. It promotes income and employment growth through investment from the public and private sectors. The aim is to reduce carbon emissions and pollution, while enhancing the efficiency of energy and resource use. It also generates green jobs, which ultimately reduce the environmental impact of institutions and economic sectors to levels consistent with sustainability³.

Based on the above definitions, it can be concluded that the green economy is a branch of economics concerned with meeting the ever-growing needs of human beings in a way that is compatible with preserving environmental systems. This is done to avoid negative environmental consequences such as climate change, which is driven by the excessive consumption of conventional energy sources.

1.2 The importance of the green economy

The importance of the green economy is reflected in the following points:⁴

- The green economy recognises the value of natural capital and invests in it to achieve sustainable economic progress.
 - The green economy is central to poverty eradication, as it provides diverse economic development opportunities and lifts people out of poverty without exhausting the state's natural resources.
 - The green economy creates employment opportunities and supports social equity, as studies suggest that green investments tend to generate more jobs, at least in the short and medium term.
- The green economy replaces fossil fuels with sustainable energy and low-carbon technologies, reducing the risks associated with high and unstable fossil fuel prices. Furthermore, the current fossil fuel-based energy system drives climate change, as the energy sector is responsible for around two-thirds of greenhouse gas emissions.

¹- Masaouda N. Nasba, Razika Rahmoun and Mariam Tebni. 'Green Economy as an Effective Mechanism for Achieving Sustainable Development'. Journal of Business Economics and Trade, University of M'sila, Vol. 4, No. 2, 2019, p. 196.

²- Mokhtar Abdelhadi. 'Green Economy and the Challenges of Sustainable Development in Algeria'. Journal of Scientific Research in Environmental Legislation, University of Tiaret, No. 9, June 2017, p. 568.

³- Habib Asia, Hanish Ahmed. 'The importance of adopting a green economy as an approach to achieving sustainable development and diversifying the national economy'. University of El Oued, Vol. 5, No. 3, 2021, p. 304.

⁴- United Nations. Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication: A Policy Maker's Guide. (2011). Available at:

https://www.uncclearn.org/wp-content/uploads/library/unep119_arb_0.pdf

The green economy promotes improvements in resource and energy efficiency. Current studies indicate that green investments in energy efficiency could reduce industrial energy consumption by nearly half over the next four decades, compared with business-as-usual approaches relying on conventional energy sources.

The green economy enables more sustainable urban living and low-carbon mobility because it offers cities a unique opportunity to increase energy efficiency and productivity, reduce emissions from buildings and waste, and promote access to essential services through innovative, low-carbon transport methods, thereby saving money while improving productivity and social inclusion.

The green economy grows faster than the brown economy over time while preserving and restoring natural resources — without overlooking the negative impacts of climate change or the severe loss of ecosystem services. In the context of the brown economy, global economic growth is constrained by increasing energy and resource scarcity. Conversely, investment in the green economy achieves higher growth rates and increases the supply of renewable resources, thereby contributing to global wealth. This is achieved by encouraging investment in key ecosystem services and by developing a low-carbon approach to development. Furthermore, this growth is notable for its significant decoupling from environmental impacts.

1.3 Objectives of the Green Economy

The objectives of the green economy are as follows: ⁵

- enhancing green growth, generating employment opportunities and eradicating poverty;
- ensuring food security;
- protecting health from pollution and strengthening energy security;
- enhancing water security;
- Promoting sustainable industry.
- improving patterns of consumption and production;

Addressing climate change and protecting ecosystems.

The objectives of the green economy align with the goals of sustainable development because the green economy is considered a means of achieving them.

2. The nature of sustainable development:

Below, we present some theoretical concepts related to sustainable development.

2.1 Definition of sustainable development:

Certain definitions of sustainable development can be summarised as follows:

Essentially, sustainable development is based on establishing incentives that reduce pollution and waste, curb excessive energy consumption and introduce taxes on the excessive use of vital resources⁶.

⁵- Abdelrazak Ben Zaoui. 'The Green Economy as a Strategic Option for Algeria in the Context of Falling Oil Prices'. Journal of Economic and Financial Studies, University of El Oued, Vol. 9, No. 3, p. 95.

⁶- Al-Tawil, R. Z. Younes. 'Sustainable Development and Economic Security under Democracy and Human Rights'. Dar Al-Zahran, Amman, 2009, p. 89.

The term ‘sustainable development’ emerged and gained considerable attention following the publication of the Brundtland Commission report in 1987, prepared by the World Commission on Environment and Development. In that report, sustainable development was defined as follows: “Development that meets the needs of the present without compromising the ability of future generations to meet their own needs”⁷.

It is also understood to mean conserving and sustainably using renewable environmental resources to meet the social and economic needs of present-day human beings through the best available technological and scientific management, while ensuring the continuity of these resources for the benefit of future generations⁸.

Accordingly, based on these definitions, sustainable development can be defined as meeting human economic and social needs while preserving environmental and ecological systems to safeguard the interests of future generations.

2.2 Objectives of Sustainable Development:

The objectives of sustainable development are as follows:⁹

- improving the quality of life for the population;
- Raising public awareness of environmental issues.
- respecting the natural environment;
- Ensuring the rational use and exploitation of resources.
- Linking modern technology to societal goals;

Bringing about continuous and appropriate change in society’s needs and priorities.

2.3 Dimensions of Sustainable Development:

The main dimensions of sustainable development are as follows:¹⁰

2.3.1 The environmental dimension:

This refers to achieving environmental development by focusing on biodiversity, preserving the diversity of living organisms and their habitats, and protecting natural resources and assets, while preventing or reducing all types of waste.

2.3.2 The economic dimension: The economic dimension:

This involves achieving economic development through effective and sustainable means without wasting resources at the expense of other aspects or future generations. It also involves adopting environmentally sound economic policies, one of whose objectives is to reduce the consumption of materials and resources.

⁷- Satourri Al-Joudi. Sustainable Development in Algeria: Reality and Challenges'. Al-Bahith Journal, Vol. 16, No. 16, 2016, pp. 299–311.

⁸- Salah Abbas. 'Sustainable Development in the Arab World'. Alexandria: Youth of the University Foundation, 2010, p. 17.

⁹- Seddiki, Naass, Abdeldaim, Hadjer and Abdelkarim, Nadia. 'Waste Management Reality in Algeria and Its Role in Achieving Sustainable Development'. Journal of Administration and Development for Research and Studies (Algeria: Blida, as indicated), Vol. 9, No. 1, 2020, p. 246.

¹⁰- Boutoura, Fadhila; Samail, Noufal. 'The importance of medical waste management for environmental protection in the framework of achieving sustainable development'. Afaq Journal for Sciences, Vol. 5, No. 1, 2020, p. 398.

2.3.3 The Social Dimension: The Social Dimension:

This dimension is characterised by achieving justice and equality between the current and future generations, particularly with respect to the fair distribution of wealth, preserving the integrity of the environment, reducing poverty levels, safeguarding cultural and intellectual heritage, and changing production and consumption patterns, among other aspects.

2.3.4 The Technological Dimension:

This dimension focuses primarily on transitioning to cleaner and more efficient technologies, advancing society towards an era that uses fewer resources and less energy. These technological systems aim to produce the minimum amount of greenhouse gases and pollution possible, while employing specific standards to help limit expenditure by enabling reuse and recycling¹¹.

2.4 The relationship between the green economy and sustainable development:

Both the green economy and sustainable development are based on three fundamental pillars: society, the environment and the economy. These pillars work together to transform traditional growth into a new model of development that is characterised by continuity and sustainability. Accordingly, the green economy and sustainable development share a set of key characteristics, most notably:¹²

The green economy is a means to achieve sustainable development, not a substitute for it.

The green economy facilitates the integration of the three dimensions of sustainable development (environmental, economic and social).

The need to develop the green economy in line with national priorities and conditions.

The green economy addresses trade distortions, including environmentally harmful subsidies and ‘green taxes’.

The green economy is grounded in resource efficiency and sustainable patterns of producing and consuming goods and services.

Promoting the development of industrial and tourism areas so that they become environmentally friendly regions.

Optimal use of resources and rationalisation of their consumption.

It is based on the principle of fairness among individuals, generations and social groups, thereby contributing to social well-being.

It pays attention to human, environmental and community resources and works to invest in them.

Second: France’s efforts to develop the green economy

In this section, we will address the most significant measures adopted by the French government to mitigate the adverse environmental effects of fossil fuel consumption. These efforts are aimed at encouraging and developing the green economy, making it a key pillar for achieving sustainable development.

¹¹- Masaouda Nasba. (As previously cited), p. 200.

¹²- Saïd Bouchoul, djermoun souad. An Environmental Innovation Approach to Supporting Sustainable Development: A Case Study of Germany (2010–2018). Advanced Economic Research Journal, University of El Oued, Vol. 6, No. 1, 2021, p. 26.

The French strategy for achieving sustainable development through the green economy proposes a framework for public and private institutions to support sustainable, green projects and initiatives. France has identified nine strategic challenges that must be addressed within the framework of the transition to a green and fair economy:¹³

The knowledge economy;

Climate change and energy;

- Preserving and sustainably managing biodiversity and natural resources.

Public health, the prevention of risks and their management.

- Demographics, migration and social integration;

The international challenges of sustainable development and fighting global poverty.

In addition, France's green economy plan, which has sustainable development as its primary objective, focuses on six main areas. These axes are further divided into twenty-two pathways, as illustrated in the following figure:

FRANCE NATION VERTE
Après l'écologie, l'ambition

SANTÉ • CLIMAT • BIODIVERSITÉ
RESSOURCES • ADAPTATION

SE DÉPLACER

- Politique de mobilité durable (transports)
- Politique régionale durable (transports, infrastructures)
- Facteur
- Eau
- Sols
- Océans et mers

SE LOGER

- Construction et rénovation des logements
- Aménagements des villes
- Nucléaire

PRODUIRE

- Tenir les chaînes de valeur de l'économie circulaire (sans déchet)
- Prévention, gestion et valorisation des déchets
- Production d'électricité décarbonée (hors nucléaire)
- Production d'énergie décarbonée (hors éolien)

SE NOURIR

- Agriculture en action
- Alimentation
- Décarbonation de l'industrie

CONSUMER

- Consommation plus durable (produits)
- Nutrition responsable
- Produits durables de l'économie circulaire (sans déchet)

PRÉSERVER

Le plan d'action de tous les Français pour réussir la transition écologique

- 5 enjeux environnementaux
- 6 thématiques, déployées en 22 chantiers opérationnels

¹³- United Nations (Department of Economic and Social Affairs). 'Sustainable Development (SDGs Knowledge Portal)'. Available at: <https://sdgs.un.org>

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2. Passing laws to develop the green economy

In order to implement green economy programmes as a core pillar for achieving sustainable development objectives, France has taken the following steps:

- starting in 1997, it began liberalising the electricity market pursuant to Directive EC/96/92;
- In 2002, the European Union Council, of which France was a member, adopted an agreement stipulating the liberalisation of electricity markets for all customers by 1 July 2007 at the latest.
- In 2008, France and other EU member states approved the “Energy and Climate Package”, which included three objectives known as “20-20-20” to be achieved by 2020, namely:
 - reducing greenhouse gas emissions by 20% compared with 1990 levels;
 - ensuring that 20% of total final energy consumption comes from renewable energy sources;
 - improving energy efficiency by 20% compared with the baseline scenario (1990)¹⁴.
- The Energy Transition Law (17 August 2015): This law sets out France’s medium-term energy objectives, which are as follows:¹⁵
 - reducing average energy consumption by 50% by 2050 compared with 2012;
 - reducing average fossil fuel consumption by 30% by 2030 compared with 2012;
 - Increasing the share of renewable energy in final energy consumption to 32% by 2030.
 - Increasing the share of renewable energy in electricity generation to 40% by 2030.
 - reducing greenhouse gas emissions by 40% by 2030 compared with 1990.
 - Reducing the share of nuclear energy in electricity generation to 50% by 2025 (compared with 75% in 2014);
 - Halving the amount of waste sent to landfill by 2025 (i.e. reducing it by 50%).

In addition:¹⁶

Decree No. 2020-457, issued on 21 April 2020, concerns national carbon budgets and the National Low-Carbon Strategy (SNBC), as well as the required carbon-removal efforts. Article 2 specifies the carbon budgets for the periods (2019–2023), (2024–2028) and (2029–2033), at levels of 422 million, 359 million and 300 million tonnes of carbon dioxide equivalent per year, respectively.

- Law No. 175-2023, issued on 10 March 2023, concerning the acceleration of renewable energy production.
- The Multiannual Energy Programming Law (PPE), which must cover all aspects of energy production, consumption and storage in France.

3. Signing climate agreements

France has signed the following climate agreements:¹⁷

¹⁴- Badreddine Lebrouhi, Eric Schall, Bilel Lamrani, Yassine Charbi and Taïk Kousksou. *Energy Transition, France & Sustainability*. 2022, p. 3.

¹⁵- Boufalata, Mohamed Saif Eddine; Ben, Mohamed Houda; Toubal, Ibtissam. *The French Experience in Generating Green Electricity as a Sustainable Energy Alternative: Reality and Challenges*. University of Ban Taal Research Journal, Supplement 06, Vol. 05, 2019, p. 155.

¹⁶- Jérôme Dubois. *Les énergies renouvelables en France: Analysis of an impeded plan*. Éditions QUAE, 2024, pp. 30–32.

- the Stockholm Convention on Climate (1972);
- the agreement establishing the Intergovernmental Panel on Climate Change (IPCC/GIEC) (1988);
- the Earth Summit in Rio de Janeiro (1992);
- the Kyoto Protocol (1997);
- the agreement establishing the Intergovernmental Panel on Climate Change (IPCC/GIEC) (2007).
- The Earth Summit in Rio de Janeiro (2012).
- the adoption of the Sustainable Development Goals (2015).
- The Montreal Convention on Biological Diversity (2022).
- An agreement to phase out fossil fuel sources by 2050, within specified limits.

4. Encouraging scientific research

To develop any sector in any field, scientific research must be encouraged. France has done precisely this to advance the field of the green economy and treat it as a highly effective tool for achieving sustainable development. The following table illustrates this, showing the amount allocated to scientific research in France during the period 2002–2021.

Table no.: Allocations for scientific research in the renewable energy sector in France during the period 2002–2021

Unit: million euros

	2002	2004	2006	2008	2010	2012	2014	2016	2018	2021
Nuclear energy	760	750	720	650	620	750	680	650	650	820
New energy technologies	220	250	350	450	550	500	500	550	550	550
Basic research	10	10	10	10	50	50	50	50	100	100
Carbon energy research (excluding carbon capture)	260	240	150	100	80	70	60	60	40	10

Source: Ministry for Ecological Transition, Spatial Planning, Transport, Urban Affairs and Housing, Multiannual Energy Programme (2025), p. 150.

As can be seen from the above table, in 2021 France allocated 1.48 billion euros to scientific research, which is an increase of 230 million euros compared to 2002. However, the extent of this

¹⁷- Ministry of Ecological Transition, Biodiversity, Forests, the Sea and Fisheries. State of the Environment in France. 2024 report, p. 13.

increase varied from one sector to another. Nuclear energy is considered to be less polluting than other fossil energy sources (oil, gas and coal) when properly controlled. Therefore, it was regarded as a priority sector in France and received significant funding for its development. This includes building new nuclear reactors and improving uranium efficiency. In 2021, this sector received 820 million euros, accounting for 55.4% of the total research allocations. Nevertheless, expenditure remained relatively stable, increasing by only €60 million over twenty years compared with €760 million in 2002.

Spending on research aimed at developing new energy technologies doubled between 2002 and 2021. In 2021, funding reached €550 million, up from €220 million in 2002, reflecting France's efforts to reduce pollution intensity.

As for basic research, funding totalled 100 million euros in 2021. Although this figure is low compared to the nuclear energy sector and new energy technologies, it has nevertheless increased tenfold since 2002.

However, spending on carbon-energy research decreased. In 2021, it was estimated at €10 million, down from €260 million, reflecting the failure of scientific research to control and convert carbon emissions into an environmentally friendly energy source.

5. Expenditure on green technology

Green technology in France covers several areas, including renewable energy, green industry, clean vehicles, environmental protection, sustainable construction, and agriculture and agricultural activities. The following table shows the amount spent on developing green technology in France between 2015 and 2023.

Table no.: Evolution of expenditure on green technology during the period 2015–2023

Unit: million euros

Year	2015	2016	2017	2018	2019	2020	2021	2022	2023
Estimated spending	180	261	411	598	558	1132	1664	2549	2778

Source: Bpifrance (BPI France), France: Les Greentech Françaises, 3rd edition of the annual study, Journée/E-congresses of Nantes, 4 April 2025, p. 15.

As can be seen from the above table, there was a substantial increase in France's spending on the development of green technology in its various forms during the period 2015–2023. Spending rose steadily each year compared with the previous year, reaching 2,778 million dollars in 2023. This represents an increase of 15.43 times compared to 2015, when expenditure was 180 million dollars.

6. Implementing a carbon tax

The French authorities have introduced taxes on carbon emissions resulting from the combustion of fossil fuels, including petrol and diesel, as well as natural gas and liquefied gas. The following table shows how carbon taxes have evolved in France between 2014 and 2022.

Table 1: Carbon taxes in France

Years	2014	2015	2016	2017	2018	2019	2020	2021	2022	2030
Amount of tax (per tonne)	7	14.5	22	30.6	44.6	55	65.4	75.8	86.2	100

Source: Katheline Schubert, Carbon Taxation: The French Experience, 2014–2019, Paris School of Economics, University of Paris, p. 4.

The table above shows the amount of the increase and how the French economy has evolved in relation to taxes linked to the burning and consumption of carbon. In 2014, the tax was estimated at €7 per tonne, doubling in 2015 to reach €14.50 per tonne. It continued to rise, reaching €86.5 per tonne in 2022, corresponding to a 1,231.4% increase compared to 2014. Furthermore, France intends to raise the carbon tax rate further in the future, aiming for an amount of €100 per tonne by 2030, reflecting the French strategy to curb greenhouse gas consumption.

7. Encouraging international cooperation: French authorities have encouraged international cooperation as a core objective in developing a green economy to achieve sustainable development. Among the most important investment projects are the following:

The Mediterranean Solar Plan (PSM): launched in July 2008 on the initiative of French President Nicolas Sarkozy, this was one of the six projects of the Union for the Mediterranean, bringing together 43 European and Mediterranean countries. The total cost of the plan was estimated to be between €38 billion and €46 billion for the period from 2009 to 2020. The project aims to strengthen solar energy production in the Mediterranean region (North Africa and the Middle East), increase the use of renewable energies, reduce greenhouse gas emissions, and address weaknesses in the region's energy system. The project's objectives were as follows:

- Building additional solar-powered electricity generation capacity of 20 gigawatts by the beginning of 2020.

Improving local electricity consumption in the region and exporting part of the production to the European Union to ensure the profitability of the projects.

- Developing energy efficiency mechanisms and managing energy demand with the aim of achieving 20% energy savings by the beginning of 2020 compared to 2005¹⁸.

France has also allocated a budget of €1 billion to develop renewable energies in several countries. This initiative addresses the impacts of global warming and advances the fight against desertification and drought in Africa¹⁹.

¹⁸- Abdelkarim Chakakta. EU–South Mediterranean Cooperation Policies in the Energy Sector: Reality and Implications'. Algerian Journal of Public Policies, No. 6, February 2015, p. 38.

¹⁹- Takkarrat Yazid. 'The French Experience in Exploiting Renewable Energies to Produce Sustainable Renewable Electricity'. Journal of Studies and Finance, University of Echahid Hamma Lakhdar (El Oued), Vol. 11, No. 2, p. 98.

Additionally, France considers climate finance to be a priority. In 2018, France provided a financial contribution of €5 billion to developing countries, most of which was channelled through the French Development Agency (AFD), and committed to providing a similar amount by 2020²⁰.

Thirdly, we will examine the impact of initiatives to promote the green economy on sustainable development in France.

In this section, we will address the most significant achievements in France's green economy, focusing on the following areas:

1. The green economy growth index in France for 2022

In France, the rates and indicators of green economy sectors varied. The highest percentages were recorded in the indicators related to biodiversity and ecosystem protection, exceeding 70%. The highest share for environmental quality was 86.25%. The sustainable land use indicator recorded 79.49%. Meanwhile, the environmental innovation indicator recorded the lowest percentage, corresponding to Table 10.05. The following table presents the remaining shares across the other sectors:

Table 2: The green-economy growth index in Germany in 2022.

Indicator	Percentage of achievement
Effective and sustainable use of resources	%54.98
Green economic opportunities	%31.28
Green investments	%54.32
Efficient and sustainable energy	%58.36
Green employment	%49.23
Efficient and sustainable water use	%44.59
Sustainable land use	%79.49

²⁰- Climate and Clean Air Coalition (CCAC). France / Climate and Clean Air Coalition. Available at: <https://www.ccacoalition.org>

Green trade	%35.63
Environmental quality	%86.25
Protection of biodiversity and ecosystems	%71.52
Green innovation	%10.05

Source: Prepared by the researchers based on: GGGI, Green Growth Index 2022, Report No. 27, December 2022.

2. Contribution of renewable energy to total energy in France

The table below shows the contribution of renewable energy sources to total energy in France across the following sectors: Electricity, heating and cooling, and transport during the period 2015–2023.

Table 4 shows the contribution of renewable energy to total energy in France during the period 2015–2030.

Unit: %

Sector/Years	2015	2016	2017	2018	2019	2020	2021	2022	2023	2030
Electricity Sector	18.1	19.5	20.1	22	24.0	24.2	24.7	27.3	30.3	40.0
Heating and cooling sector	18.1	20.0	20.2	22.2	24.0	24.2	24.7	27.3	30.3	38
Transport sector	7	7.2	7.5	7.7	7.9	8.0	8.1	8.9	10.0	15
Average	14.4	15.56	15.93	17.06	18.63	18.8	19.3	20.5	22.3	33.0

Source: French Republic, SDES (Energy, Transport, Housing and Environment Statistics), Key Figures on Renewable Energies, September 2025 edition, p. 84.

As can be seen from the above table, the electricity and heating and cooling sectors have made significant progress in terms of their energy consumption from renewable sources. Their combined share reached 30.3% of total energy consumption, representing a 12.2% increase compared to 2012 for both sectors. In contrast, the transport sector recorded the lowest share: renewable energy consumption there was 10%, whereas in 2015 it was 7%. The overall average renewable energy consumption in France was estimated at 22.3% of total energy consumption.

The French authorities also intend to increase the share of renewable energy in the electricity sector to 40%, in the heating and cooling sector to 38%, and in the transport sector to 15% by 2030. France intends to increase its overall average to 33.0% of total energy consumption from renewable sources by 2030.

3. Reducing carbon emissions: The following table shows the reduction in greenhouse gas emissions in France between 1990 and 2022.

Unit: million tons

Year/Sector	1990	1995	2000	2005	2010	2015	2020	2022
Agriculture	100	105	108	100	95	90	88	80
Energy Sector	100	90	80	70	60	50	40	40
Manufacturing/processing industries	120	120	110	100	90	80	75	70
Residential complexes	110	100	98	95	90	88	85	80
Transport	160	150	145	140	135	130	125	120

Source: CCUS in France; Final-2: The Status of CCUS in France — Present, Future, Opportunities; July 2024; p. 6.

As can be seen from the above table, there has been a decline in greenhouse gas emissions in France across key economic sectors during the period (1990–2022). This is notable given the substantial economic development and increasing energy needs that occurred in France over the same period. Specifically, the agriculture sector recorded a reduction in carbon emissions: emissions amounted to 80 million tonnes in 2022, compared with 100 million tonnes in 1990. The energy sector also decreased by 60%, falling from 100 million tonnes in 1990 to 40 million tonnes.

Additionally, the manufacturing industries sector achieved a total decrease of 50 million tonnes of carbon emissions during the period. Overall, greenhouse-gas emissions were 70 million tonnes in 2022, down from 120 million tonnes in 1990.

The residential buildings and transport sectors also saw declines in emissions in 2022, by 30 and 40 million tonnes respectively. This followed emissions of 110 million tons for the residential sector and 160 million tons for transport in 1990.

4. Creating green jobs: The energy transition strengthens sustainable economic growth while also supporting permanent employment. This positive effect is reflected in the number of green jobs in France's renewable energy sector, estimated at 118,000 in 2022 and distributed as shown in the following table:

	Percentage	number of jobs
- Heat pumps	29%	34220
- Solar energy	15%	17700
- Hydropower (water energy)	13%	15340

- Biomass/wood energy	16%	18880
- Wind energy	12%	14160
- Offshore wind energy	6%	7080
- Geothermal energy	8%	9440
- Other sources	%4	4720

Source: Public Energy Statistics for Transport, Housing and the Environment: Key Figures on Renewable Energies, 2025 edition, p. 32.

The green technology sector, established in 2012, saw an increase in the number of job positions during this period. In 2023, it was estimated that there were 39,000 jobs, distributed across the following sectors: Environmental protection and environmental finance (9,816 jobs), renewable energies (8,126 jobs), clean vehicles (8,481 jobs), agriculture and agricultural activities (5,205 jobs), green industry (5,308 jobs), and sustainable construction (2,005 jobs).

5. Development of the number of electric vehicles in France

The following table shows the increase in the number of electric vehicles in France during the period 2010–2021.

Table: Increase in the number of electric vehicles in France during 2010–2021.

Years	2010	2011	2012	2013	2014	2015	2016	2017	2020	2019	2018	2021
Number of vehicles	980	4312	9980	15420	16654	28720	33774	42797	194881	69466	53745	315978

Source: Rechargeable electric vehicles in France, from the website: ar.wikipedia.org

Based on the above table, we can see that the number of electric cars in France increased continuously during the period 2010–2021. In 2010, the number of electric vehicles was estimated at 980. This figure then increased by 440%, reaching 4,312 electric vehicles in 2011. This upward trend continued each year during the same period, reaching 315,978 electric vehicles by 2021. This represents a 322.42-fold increase compared to 2010, reflecting the French government's efforts to reduce greenhouse gas emissions.

6. Environmental innovation: Encouraging environmental innovation in France has led to the introduction of new green products in the country. The most important of these are methane energy and nitrogen self-sufficiency — an agricultural approach aimed at reducing emissions by lowering the overall use of inputs and increasing the use of organic fertilisers. The state is also

committed to managing organic waste, with the goal of having 1,000 biogas plants by 2020 (up from 90 in 2012 and 400 in 2017)²¹.

7. Reducing fossil energy consumption in France by 2030, 2035 and 2050:

Years / Fossil Material	2030	2035	2050
Initial consumption of coal	22	13	00
Initial consumption of gas	277	203	00
Initial consumption of petroleum	499	358	00

Source: Multiannual Energy Programming (2026–2035); French Energy and Climate Strategy 2025, p. 48.

The French authorities plan to reduce primary consumption of fossil energy sources (oil, gas and coal) by 2030. Specifically, oil consumption is expected to fall to 22 million tonnes.

- **Conclusion**

France is moving steadily towards sustainable development by implementing strict measures aimed at controlling and mitigating air pollution caused by carbon emissions resulting from the exploitation of conventional energy sources (oil, gas and coal). This is achieved by adopting a long-term strategy that prioritises the green economy as a means of preserving the natural environment and avoiding negative climate impacts within France.

This approach has helped reduce air carbon emissions to 390 million tonnes in 2022, compared with 590 million tonnes in 1990.

Despite the substantial progress witnessed by the French economy each year — an evolution that naturally leads to increased energy consumption — the results can be summarised as follows:

The green economy relies on renewable energy sources, unlike traditional sources which are characterised by depletion.

The French model is considered a leading example to be emulated in its reliance on the green economy to achieve sustainable development.

France has relied heavily on scientific research to develop the key sectors of the green economy.

The green economy is seen as an alternative to the brown economy, which relies on fossil fuels.

France has adopted a wide variety of approaches and methods to develop the green economy.

²¹- Bpifrance. French Greentech: 3rd edition of the annual study (Les Greentech Françaises). Cité Congrès de Nantes, 4 April 2024, p. 13.

The green economy and sustainable development are considered two sides of the same coin, both of which are grounded in environmental preservation.

- The green economy is regarded as a 'golden opportunity' for rentier states to break free from their dependence on a single economic resource.

The green economy is distinguished by its primary emphasis on international cooperation.

France aims to eliminate carbon emissions by 2050, a particularly ambitious target given the size of the French economy.

Despite significant efforts to reduce reliance on traditional energy sources, nuclear energy still plays a substantial role in the French energy mix.

The French strategy for developing the green economy is characterised by its comprehensiveness, covering all economic sectors that make up the total output (GDP) of the French economy.

Recommendations:

- Encourage collaboration between public and private sector institutions to ensure compliance with environmental standards and promote the use of environmentally friendly technologies.

- Use various media channels (visual and audio) to raise environmental awareness and advance the green economy, thereby achieving sustainable development.

- Enact strict laws for all violators of environmental protection regulations.

Enhance cooperation and scientific research to develop modern technologies that support the green economy.

Strengthen international consultation and cooperation between developed and developing countries regarding green economy issues, establishing frameworks for international, regional and national partnerships to facilitate expertise transfer.

The need to generalise the French experience to all countries worldwide, especially Third World countries, in order to benefit from it.

Make use of the French green economy model and attempt to apply it in Algeria.

Allocate substantial budgets to developing the green economy.

- Gradually reduce carbon dioxide emissions.

- Reduce waste produced by plastic packaging containers and replace them with paper packaging containers that decompose more quickly.

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