

"Germany's Renewable Energy Revolution: Paving the Way for a Sustainable Energy Transition"

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Abstract:

This study sought to present the rationale of the German experience in supporting renewable energies in light of the interest in promoting the energy transition. Since renewable energies are one of the most important primary sources, Germany has focused on supporting these energies, especially their role in achieving the Sustainable Development Goals. Germany has taken important steps to lead by example in promoting the renewable energy sector, through several mechanisms, policies and strategies, through which it has sought to effectively embody future visions capable of ending the energy dependence on fossil energies. Encouraging a sustainable transition towards a green economy:

Keywords: energy transition, renewable energies, German experience, renewable energy laws

JEL Classification Codes: Q,Q2,Q28.

ملخص:

تهدف هذه الدراسة إلى عرض حيثيات التجربة الألمانية في دعم قطاع الطاقات المتجددة، في ظل الاهتمام بتعزيز التحول الطاقوي. وتكون الطاقات المتجددة من أهم المصادر الأساسية ركزت ألمانيا على دعم هذه الطاقات خاصة ودورها في تحقيق أهداف التنمية المستدامة، خطت خطوات مهمة يحتذى بها في تعزيز الاستثمار قطاع الطاقات المتجددة. من خلال عدة آليات وسياسات واستراتيجيات سعت من خلالها إلى التجسيد الفعلي لرؤى مستقبلية قادرة على إنهاء التبعية الطاقوية للطاقات الأحفورية. وتشجيع بذلك التحول المستديم نحو الاقتصاد الأخضر؛

كلمات مفتاحية: التحول الطاقوي، الطاقات المتجددة، التجربة الألمانية، قوانين الطاقة المتجددة

تصنيفات JEL : Q,Q2,Q28.

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1. INTRODUCTION

The topic of energy has become the most prominent within the policies of countries. In recent years, there has been increasing recognition of the interaction between environmental and economic concerns in many of them due to a series of challenges they have been facing regarding energy sufficiency and climate challenges. As a result, these economies are actively seeking sustainable solutions to meet their energy needs and promote sustainable economic growth. Germany stands out as one of the leading countries in the field of energy and promoting the growth of clean and renewable energy projects as part of its plans to enhance the energy transition. Through the implementation of various strategies and measures, this sector demonstrates a firm commitment to achieving harmonious integration between economic development and environmental preservation. And this is an example of how efforts are focused on building a more sustainable economy. through the commitment of countries to the necessity of moving away from energy dependency. The Germany authorities have focused on rationalizing their policies to enhance investment in renewable energies. In light of this, the following main question can be posed:

- **What are the mechanisms and strategies that the German economy has adopted to support renewable energies within the framework of enhancing the energy transition?**

To address this question, the following **sub-questions** were formulated:

- What are the most important laws enacted by Germany to support renewable energies? What are the most important laws adopted by Germany to support renewable energies? What is the reality of the renewable energy sector in Germany?
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- As a preliminary answer to the previous questions, the following **hypotheses** can be proposed:

- The German government has imposed several laws related to renewable energies and climate...

-The renewable energy sector is considered one of the most important sectors contributing to the German economy;

- **Importance of the study:** Given the significance of renewable and clean energy as a strategic option for achieving the dimensions of sustainable development, and considering that the German experience is regarded as a successful model in the field;
- **Study divisions and methodology:** In order to address the issue and achieve the study's objectives, the descriptive-analytical method was used. And due to the nature of the subject, the study was divided into the following points:

- The motivations for the energy transition to renewable energies in Germany;
- Strategies and policies adopted by Germany to enhance the role of renewable energies;
- The reality of the renewable energy sector in Germany;

2. Reasons and motivations of the energy transition to renewable energies in Germany;

Germany is considered one of the leading countries in greening the economy. Especially with the challenges of the global energy gap, which naturally affected the environment. Which necessitated adopting a green approach in its strategies and priorities. This aligns with the policies of the European Union, which emphasized the necessity of transitioning to a sustainable economy, especially with the issuance of the Green Deal. Starting from the year 2000 with the agreement on the "nuclear consensus," Germany focused on transitioning to renewable energies, with its main objectives related to the "energy concept" and the "German Energy and Climate Program of 2007." The "energy vision" aims to shift towards renewable energies in energy consumption (بودرجة، 2017، صفحة 614). Germany has clearly focused, within the calls from the European Union, on the necessity of achieving sustainable energy self-sufficiency for several reasons and motivations: (Camille Defard and al, 2021, pp. 1-6)

- **Gradual phase-out of nuclear energy:** Germany has decided to gradually phase out

nuclear energy, which has historically been the cornerstone of its energy strategy. By 2025, Germany aims to eliminate the use of nuclear energy and coal before 2038.

- **Renewable energy sources:** Wind and solar energy have developed tremendously. Germany has now succeeded in implementing its "energy transition" by increasingly relying on renewable energy sources.

- **Climate neutrality goal:** To achieve the climate neutrality goal by 2045, Germany must go beyond mere "transformation." The next government will have to make decisions that align with the "major transformation" or even the "revolution" in energy.

- **Reducing carbon emissions to protect the environment and contribute to combating climate change.** Since 1990, greenhouse gas emissions in Germany have decreased by 35.7% by 2019, reflecting the efforts made to achieve national and international climate goals. In 2023, renewable energy sources contributed to reducing the equivalent of 250 million tons of carbon dioxide. (umweltbundesamt.de, 2024) Germany aims to become greenhouse gas neutral by 2045. It has set interim targets to reduce emissions by at least 65 percent by 2030 compared to 1990 levels, and by 88 percent by 2040. (cleanenergywire, 2024)

- **Enhancing energy independence** and reducing reliance on imported fossil fuels, thereby lowering the economic costs associated with global oil and gas price fluctuations. It also creates new job opportunities in the renewable energy sector, which provided around 1.3 million jobs in Germany by 2021. (umweltbundesamt.de, 2024)

- **Benefiting from the opportunities available in the global markets for clean energy and low-carbon technologies:** The global markets for clean energy and low-carbon technologies are a crucial factor in transferring green innovation, with total investment in these markets reaching 156 billion dollars in 2021, ensuring a share for them in these markets. (Development, 2023, pp. 38-40)

3 . Strategies and policies adopted by Germany to promote the renewable energy sector;

The German government has worked on rationalizing its policies, which are intended

to pave the way and establish a regulatory and legislative environment to enhance the role of the transition to renewable energies within its goals of transitioning to a sustainable energy economy. In this context, the German government has enacted several legislations that have been implemented in Germany to promote this. The frameworks of these fundamentals and strategies can be divided into two parts. An organizational aspect and a financial aspect

3.1 The regulatory aspect: It refers to the set of regulations, laws, and policies adopted by Germany to encourage projects related to renewable energies;

- **Energiewende** : is the slogan that Germany adopted in the energy sector in 2010, which means "energy transition." The German government decided to revolutionize the energy sector by shifting from reliance on fossil fuels as an energy source to primarily using clean renewable energy sources by the middle of the 21st century. This is in order to maintain a clean and sustainable environment by reducing greenhouse gas emissions compared to their levels in 1990 by 40% by 2020, and increasing the reduction rate to 80% by 2050. (Khalida, 2020, p. 68) Germany relied on the following strategies: (Ohlhost, 2015, pp. 306-307)

- **The first strategy:** Germany focused on closing nuclear reactors by relying on alternative and renewable energies. By enhancing the infrastructure, where they built more than 22,000 wind turbines to optimally harness wind energy. And encouraging scientific research in the fields of more efficient energy;

- **The second strategy:** Focus was placed on building infrastructure that aligns with the energy transition. It is expected that the cost of this phase will reach 250 billion US dollars. In this context, the German authorities have moved to increase electricity tariffs to support renewable energies and develop industrial processes and environmentally friendly green technologies.

- **The third strategy:** At this stage, Germany focused on encouraging the private sector to develop energy sources;

- **The fourth strategy:** At this stage, it focused on encouraging innovation in the

renewable energy sector by implementing several innovative and creative projects in the sector.

- **Issuing laws and regulations related to renewable energy:** Among the most important of these laws, we mention the following:

- **The Renewable Energy Act (EEG)** The German ruling coalition plans to amend the Renewable Energy Act (EEG) to promote the long-term expansion of renewable energy and achieve 65% clean electricity production by 2030. The law, which came into effect in January 2021, aims to make electricity supply and carbon consumption neutral before 2050. The Renewable Energy Sources Act of 2021 stipulates an annual monitoring and a reduced tax on renewable energy of 0.065 euros per kilowatt-hour, resulting in a 1 percent decrease in the average household energy prices. The government also intends to reduce the fees to 6 cents in 2022 to combat the economic repercussions caused by the coronavirus. The Federal Cabinet approved the amendment to the EEG 2021 and the Federal Requirements Plan Act, which regulate the expansion of the electricity grid. (iea, 2024)

- **Renewable Energy Heat Act EEWärmeG:** The law aims to increase the use of renewable energy in providing thermal energy to 14% by 2020. It mandates the use of renewable energy for space heating and hot water in new buildings and provides budget requirements for market incentive programs. The law allows for alternative measures such as increasing energy regulation requirements, providing combined heat and power, or using district heating systems. (iea, 2024)

- **KWKG Combined Heat and Power Act:** The specific goal set in 2009, when the first amendments came into effect, was for Germany to obtain 25% of its energy supply from combined heat and power units by 2020, with a bonus for each kilowatt-hour of energy produced. This energy has priority on the grid and requires the unit to reduce primary energy consumption by 10% compared to separate generators. The law was updated in 2016, slightly reducing the 2020 target to 110 kWh. Germany exceeded this target in 2017, achieving 117 kWh, which is close to the 2025 target of 120 kWh. The incentive

comes in the form of a bonus for the energy produced. (wiki.energytransition, 2024)

- **The National Action Plan for Energy Efficiency (NAPE):** It is Germany's strategy for energy efficiency. It emphasises energy efficiency as a fundamental pillar of the energy transition and the deployment of renewable energy. This policy includes immediate measures and long-term operational processes to achieve Germany's national energy efficiency goals, which aim to reduce primary energy consumption by 20% by 2020 and by 50% by 2050. The program consists of three main pillars: enhancing energy efficiency in buildings, making energy efficiency a model for investment and business, and promoting individual responsibility for energy efficiency. It also aims to improve the effectiveness of advisory programs and build trust in qualified advice. The Energy Efficiency Networks initiative targets energy efficiency in industry, commerce, and services. (iea, 2024)

- **Circular Economy Act KrWG:** A German waste legislation that transposes the EU Directive 2008/98/EC into German law. It includes amendments to Directives 2018/851/EC and 2019/904/EC, aimed at reducing the environmental impact of certain plastic products. The law also includes a five-step hierarchical sequence for waste management measures, including prevention, recycling, recovery, and disposal. It assigns disposal responsibilities to manufacturers and distributors, and tasks public procurement with preferring sustainable products. The law also stipulates a duty of care, which requires producers, retailers, and platform sellers to use goods even if they are not suitable or returnable. (oneplanetnetwork, 2024)

- **Issuing the Climate Protection Act (Klimaschutzgesetz):** the federal law on climate change aimed at protecting against the effects of global climate change. The law ensures the achievement of national climate goals and compliance with European objectives. Takes into account the environmental, social, and economic impacts; (gesetze-im-internet, 2024)

- **The National Hydrogen Strategy:** The updated National Hydrogen Strategy in Germany aims to accelerate the growth of the hydrogen market across all sectors and

maintain its leadership in hydrogen technologies. The challenges include setting 2030 targets, developing a hydrogen storage strategy, creating an import strategy, ensuring consistency with other policies, simplifying approval procedures, and promoting carbon contracts for difference. The strategy also emphasises imports from Denmark and Norway and securing the production of "blue hydrogen" from fossil gas. (hydrogen-centra, 2024)

- **Supporting green innovation:** The federal government, led by the Federal Ministry of Education and Research, has implemented the "Future Research and Innovation Strategy" across all ministries. This strategy focusses on creating a strong scientific and research environment, supporting pioneering research in universities and companies, and enhancing cooperation between industry and academia. In addition, the federal report on research and innovation provides comprehensive information on Germany's policy in the field of research and innovation. Germany's innovation system benefits from a well-resourced network of research organisations, universities, and an innovative business sector. In addition to enhancing the role of green financial technologies;

- **German Feed-in Tariffs (FiTs):** The German feed-in tariff, introduced in 2000, aims to encourage renewable energy production and investment. It includes priority access to the grid, a fixed price for energy producers, differentiation by source, plant size, installation year, and an additional charge on energy users. The policy ensures investment security and financial support for renewable sources, allowing Germany to increase its renewable energy market share. The tariff has been successful, with renewable electricity production increasing from 6.2% in 2000 to 28% in 2014. The tariff is often cited as a transferable model and has served as a template for similar legislation in over 80 countries, particularly China. (futurepolicy.org, 2024)

- **Good governance:** This sector is managed by several governmental bodies and institutions that play a significant role in implementing and enforcing policies and regulations related to renewable energy, including: the Federal Ministry for the

Environment, Nature Conservation and Nuclear Safety (BMU), the Federal Environment Agency (UBA), the Federal Agency for Renewable Energy (AEE), the German Solar Industry Association (BSW-Solar), and the Fraunhofer Institute for Solar Energy Systems (ISE). These institutions play a vital role in supporting the development and use of renewable energy in China, and in promoting international cooperation in this field. And ensuring the sustainability and development of energy infrastructure;

3.2 The financial aspect: The German government has already promoted and supported sustainable financing through various mechanisms:

- **Tax and fiscal policies:** The fiscal aspect is considered one of the most important incentives for environmentally friendly behaviours in energy sustainability. In 1999, the German Bundestag approved the "Ecological Tax Reform" (Ökologische Steuerreform), which consisted of financial legislation as the first phase of the reform in 1999, followed by the second and third phases at the beginning of 2000 and 2001, respectively. And two more phases in 2002 and 2003, each phase involving an increase in the tax rate. The goal of the environmental fiscal reform is to reduce energy consumption and the emissions resulting from it, and to promote the development of environmentally sound products and technologies. The tax revenue is used to reduce pension insurance contributions. (Stefan Bacha, 2020, p. 803) The most important environmental taxes in Germany include the following:
 - **Energy tax:** This tax is imposed on energy consumption, encouraging companies and households to consider environmental costs when making production and purchasing decisions;

- **Car tax:** This tax is imposed on vehicles and encourages cleaner transportation options;

- **National emissions trading revenue:** income generated from a public auction of emissions permits in emissions trading;

In 2021, the total revenue from environmental taxes in Germany reached 68 billion dollars. However, the share of environmental taxes in total tax revenue has been declining since 2005 and currently stands at 8.2%.

In addition to this, the German government has adopted a set of plans to enhance sustainable financing. Among them: (Government, 2021, pp. 12-13)

- **Promoting products and financial policies**, including those related to energy conservation, clean energy, and green buildings. It also aims to develop new points of economic growth through these projects. In addition to enhancing financing such as green credit and pollution discharge rights mortgages, and implementing pilot projects for environmental pollution liability insurance;

- **Enhancing sustainable financing** through the banking system, as the KfW Group, the largest national promotional bank in Europe, works to promote sustainability and climate goals in the German financial market. In 2020, financing volumes reached 135 billion euros, an increase of 75 percent compared to the previous year due to measures related to the coronavirus. KfW is considered one of the largest issuers of green bonds worldwide, with a total issuance volume of approximately 31 billion euros by the end of 2020. Sustainability aspects are of central importance for the German government's export credit guarantees, known as "Hermes Chraft," which assess the environmental and social impact and the effect of projects on human rights. The German government has developed a climate strategy to complement international requirements, with specific conditions for renewable energy projects in 2020;

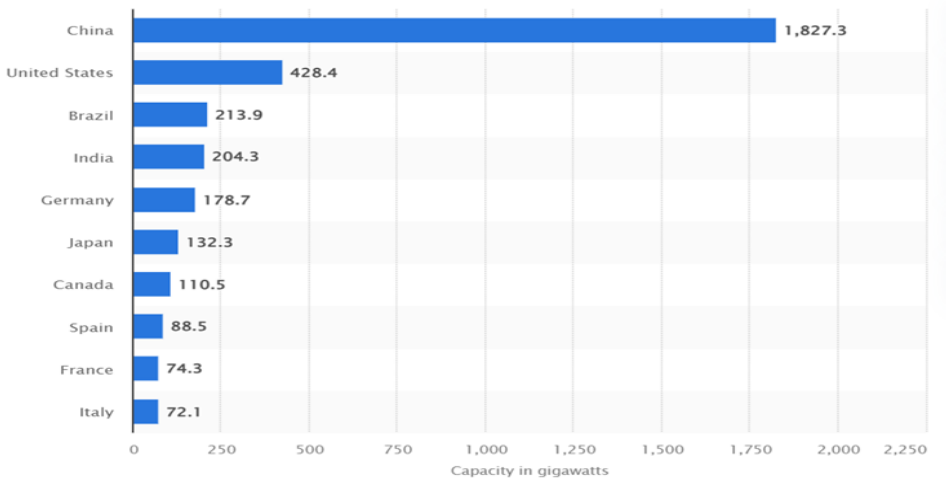
- **The German Nuclear Waste Management Fund, "KENFO,"** which was established in 2017 as a public law institution, invests the funds transferred to it—approximately 24 million euros—across various investment sectors to utilise the capital assets and financial revenues to cover the disposal costs that the German government will incur in the coming decades. In doing so, the organisation follows an investment approach with a return orientation that already integrates environmental, social, and governance sustainability criteria into its investment strategy.

4. The renewable energy sector in Germany;

Germany is considered one of the leading countries in the renewable energy sector, as evidenced by the developments in investment and growth indicators in this sector.

What reflects Germany's commitment to improving its energy fabric and its continuous efforts to achieve its goals;

Fig .1. The leading countries in the field of renewable energy globally in 2024



Source: statista,2024, <https://www.statista.com/statistics/267233/renewable-energy-capacity-worldwide-by-country/> consulted on 30/12/2024

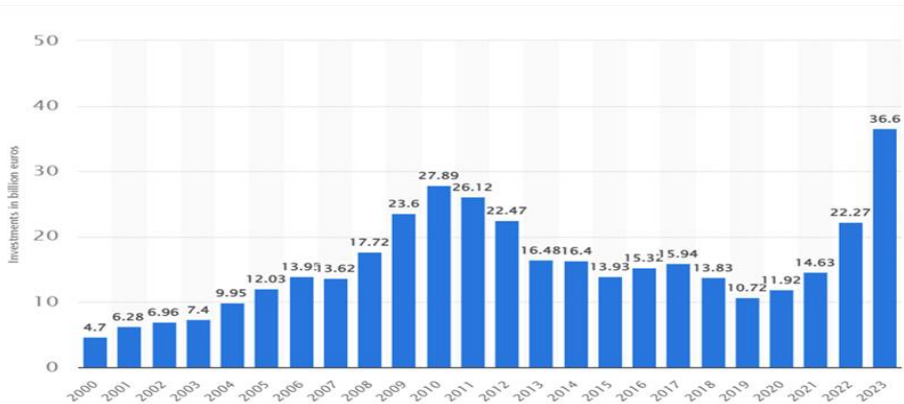
The previous figure shows the ranking of leading countries in the field of renewable energy in 2024. Both China and the U.S. are leading. U.S. A and Brazil. India ranks with a production capacity of 1827 428,213 and 204 gigawatts respectively. Germany ranks fifth with a capacity of 178 gigawatts compared to 167 gigawatts in 2023. Which shows the development in renewable energy production to support the energy transition and enhance the achievement of Germany's sustainable development goals;

4.1 The role of renewable energies in achieving the economic dimension in Germany;

In light of the German government's policies and strategies to develop this sector, it has clearly focused on encouraging investment, especially private investment. And which was among its priorities, especially achieving the economic dimension within the sustainable development goals;

Fig.2. The volume of investment in the renewable energy sector in Germany during the period 2000-2023

Unit: one billion euros

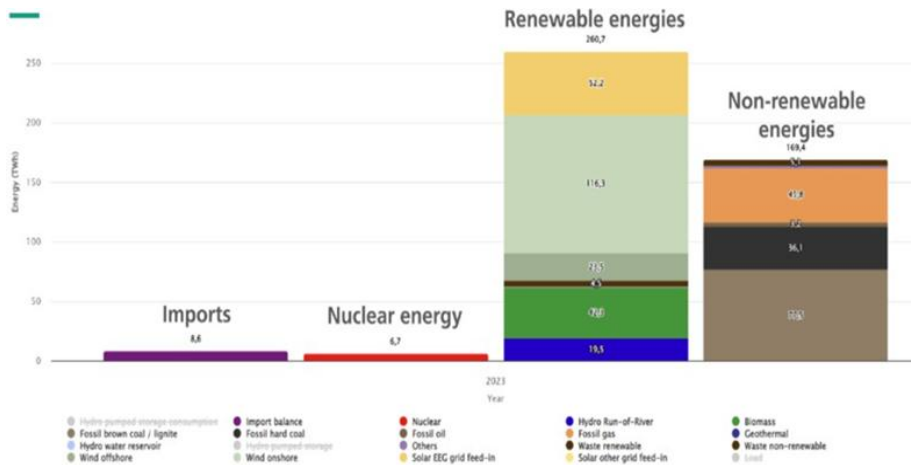


Source: statista,2024, « Renewable energy plant investments Germany 2023 Statista <https://www.statista.com/statistics/583526/investments-renewable-energy-plants-germany/> consulted on 30/12/2024

The previous figure represents the development of investment volume in the renewable energy sector in Germany during the period 2000-2023. Through the curve, the clear fluctuation in the volume of investment in the sector is evident. It reached 4.7 billion euros in 2000 and continued to rise until 2010, when total investment reached 27.89 billion euros. It then decreased in 2011 and 2012 respectively until 2015, when it reached 13.93 billion euros. This was with the recommendations of the European Investment Bank and the decisions of the German government. It declined after this period but then rose again until it reached its highest value in 2023, where the investment volume exceeded 36 billion euros. It shows the continuous efforts of the German government to support this trend, representing a significant increase compared to previous years. This significant investment reflects Germany's commitment to sustainable development and its transition towards cleaner energy sources. Furthermore, Germany ranks second globally for companies interested in investing in renewable energies, according to Ernst & Young's Renewable Energy Country Attractiveness Index.

- ✓ Electricity generation is the most important sector in which renewable energies contribute to its production. Through the figure, the extent of renewable energy's contribution to electricity generation is shown:

Fig.3. Contribution of renewable energy sources to electricity generation in Germany for the year 2023
Unit: trillion watts



source:ise, 2024, www.ise.fraunhofer.de consulted on 30/11/2024

The previous figure shows the contribution of renewable energy sources to electricity generation in Germany for the year 2023. Through the figure, renewable energy sources constituted a record share of 260.7 trillion kilowatt-hours of net public electricity generation in Germany, accounting for 60.6%. While fossil energy reached 169.4 trillion watts, contributing 39.3% to electricity generation. Wind energy was the largest contributor to electricity production, reaching 116.3 kilowatts out of a total of 260.7 kilowatts invested in renewable energy, with a contribution rate of 44.6%. Solar energy production reached 52.2 kilowatts with a contribution rate of 20%, and biomass energy reached 42.3 kilowatts with a contribution rate of 16.2% within the energy mix. With contributions from other sources. Within fossil fuels, oil remained the largest contributor to the non-renewable energy mix, with a contribution of 42.7%. It is noted that there has been a continuous increase from 2000 to 2023 due to the incentives provided by the German government within financial laws and policies to encourage

clean and renewable projects to support the energy sector.

- ✓ Germany commissioned more than one million new solar projects in 2023, with a total electricity generation capacity of 14.1 gigawatts to meet 12% of Germany's total energy demand, according to the German Solar Industry Association. BSW announced the installation figures, and since then it has continued to point out that these totals are a record for the German solar sector, exceeding the government's target of 9GW of new solar installations in 2023. BSW also noted that this was an 85% increase from the 7.5 gigawatts of new capacity installed in 2022, marking the tenth consecutive year of the largest capacity additions in the global solar sector, dating back to 2014. (.pv-tech.org, 2024)
- ✓ **Investment in green buildings: Germany** is a leader in the field of urban green buildings, focussing on improving energy efficiency, reducing carbon emissions, and promoting the use of renewable energy. In 2023, Germany witnessed significant progress in this field with some important statistics and supporting initiatives. The value of investments in green commercial buildings reached approximately 8 billion euros. Although this is less than investments in non-certified buildings, there is an increasing focus on sustainability in the commercial construction sector.
- ✓ **The 2023 Green Bond Report** reveals the allocation of approximately 18.4 billion euros for eligible green expenditures in Germany. These funds were proportionally allocated to four securities issued in 2023: Green Bond (Oct 2025), Green Bond (Oct 2027), Green Bond (Feb 2023), and Green Bond (Aug 2023). The allocation was based on sectors such as transportation, international cooperation, research, innovation, awareness, energy and industry, agriculture, forestry, landscapes, and biodiversity. Nearly half of the 2023 issuance volume (38.38 billion euros) supports high-quality railway networks in Germany, alternative fuels, driving technologies, and public transport. The report also highlights that green financing contributes to Germany's transition to a green economy through efforts such as the development of railway networks, alternative fuels, and international cooperation.

and research and innovation; (Finance, 2024, pp. 3-14)

4.2 The Role of Renewable Energies in Achieving the Environmental Dimension in Germany ;

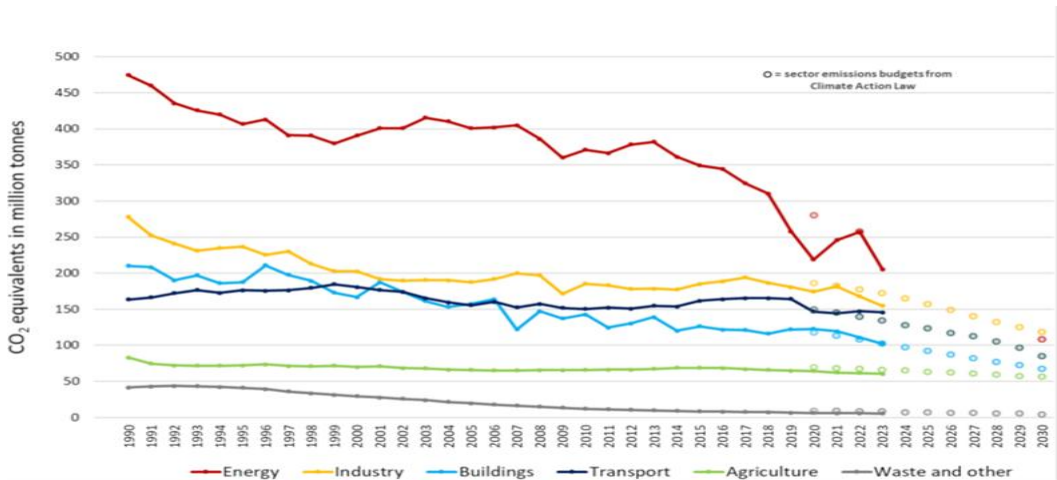
Achieving the environmental dimension is considered one of the main priorities of the German government, especially with the challenges of climate change. This has necessitated the adoption and commitment to all global decisions and resolutions to achieve the main dimension within the Sustainable Development Goals. The Environmental Performance Index in Germany provides a comprehensive assessment of its environmental performance. In the Expanded Immunisation Program for 2024, Germany ranks 10th in the world with an overall score of 77.2 out of 100. Here are some key points: (epi.yale.edu, 2024)

- **Air quality:** Germany ranks 19th in air quality, with a score of 81.1. This includes factors such as PM2.5 levels and the use of solid household fuels.
- **Biodiversity:** Germany performs well in biodiversity, ranking 4th with a score of 88.8. It excels in protecting terrestrial and marine biomes.
- **Climate change:** In terms of climate change, Germany ranks 14th with a score of 71.5. This category takes into account the carbon dioxide growth rate, methane emissions, and other climate-related factors.
- **Water resources:** Germany's water management is strong, earning it 8th place with a score of 97. Wastewater treatment is a notable strength.
- **Fisheries:** The country ranks 58th in fisheries, highlighting the need for sustainable practices and fishery management.
- **Pollution emissions:** Germany performs well in combating pollution, ranking 28th with a score of 96.
- **Ecosystem services:** The vitality of the ecosystem in Germany ranks 12th, with a score of 68.9. It focusses on biodiversity.

4.3 The role of renewable energies in achieving the environmental dimension in Germany: The renewable energy sector plays a crucial role in reducing gas emissions,

as shown in the following figure:

Fig.4. Reduction of greenhouse gas emissions by sectors in Germany during the period 1990-2020 (in carbon equivalents)



Source: Clean Energy Wire, <https://www.cleanenergywire.org/factsheets/germanys-greenhouse-gas-emissions-and-climate-targets> consulted on 30/11/2024

The curve shows the volume of emissions by energy sources between 1990-2023. All sectors have achieved varying reductions, especially under the German Climate Action Law. The energy sector is the largest contributor to greenhouse gas emissions. It decreased by more than 50% by 2023 compared to 1990. Especially within the framework of shutting down power generation plants and moving towards renewable energy sources. Most sectors, such as industry, buildings, transportation, agriculture, and waste, have experienced a significant reduction in emission levels, indicating a strong commitment to effectively controlling and rationalising these emissions.

4.4 The Role of Renewable Energies in Achieving the Social Dimension in Germany:

In 2022, 387 700 people were employed in the renewable energy sector in Germany, an increase of 15 percent from the previous decade. The energy transition contributes to Germany's prosperity and competitiveness. Job opportunities in the fields of solar energy, offshore wind, and heat pumps have

increased, while employment in the coastal wind industry has decreased by nearly 10 percent. Investments in renewable energy systems and their components stimulate demand for labour. However, the labour shortage poses a significant challenge to Germany's renewable energy expansion goals, with rising demand for jobs.

5. Conclusion:

Renewable energies represent exceptional opportunities as an alternative solution to fossil fuels. Because of their characteristics that serve sustainable development. Within this importance, it has become one of the sectors of interest to policymakers and environmental stakeholders. Countries have embarked on this path towards this sector in line with international agreements and the recommendations of relevant environmental and climate bodies. Germany is one of the leading countries in the sector, responding to the recommendations of the European Union regarding the importance of energy transition and supporting renewable sectors, especially the necessity of transitioning to a green economy in light of environmental and climatic changes. The German government has dedicated several policies, measures, and strategies to ensure the smooth transition of this sector; The following results were reached through this study:

- Low-carbon renewable energies are considered one of the most important projects that receive focus in the context of promoting the transition towards creating a sustainable energy mix, by providing the necessary investments and infrastructure to advance this sector.
- Germany's experience in renewable energies is considered one of the pioneering experiences in the energy sector, especially with the establishment of a legal, regulatory, and financial framework that plays a role in this field.
- **Study recommendations:** The following recommendations can be included:

- Generalising the benefit from Germany's experience in the field of renewable energies;
- Germany, through its experience in the sector, has adopted several strategies that can be pursued in developing countries.
- The necessity of incentivizing the private sector as a strategic partner in the field of renewable energies through financial and legislative incentives;
- The necessity of having a future vision for developing the renewable and clean energy sector, through the establishment of realistic policies with specific objectives. And setting a timeline for their implementation and support from governments;

References

- (2024, 11 03). Retrieved from cleanenergywire: <https://www.cleanenergywire.org/factsheets/germanys-greenhouse-gas-emissions-and-climate-targets>
- (2024, 11 04). Retrieved from iea: <https://www.iea.org/policies/12392-germanys-renewables-energy-act>
- (2024, 11 4). Retrieved from wiki.energytransition: <https://wiki.energytransition.org/the-book/policies-for-clean-energy/german-cogeneration-act/#:~:text=The%20goal%20defined%20in%202009%2C%20when%20the%20first,and%20that%20power%20has%20priority%20on%20the%20grid.>
- (2024, 11 5). Retrieved from oneplanetnetwork: <https://www.oneplanetnetwork.org/knowledge-centre/policies/circular-economy-act/#:~:text=The%20Circular%20Economy%20Act%20%28Kreislaufwirtschaftsgesetz%20KrWG%29%20is%20the,and%20transposes%20the%20Directive%202008%2F98%2FEC%20into%20German%20law.>
- (2024, 11 05). Retrieved from gesetze-im-internet: https://www.gesetze-im-internet.de/englisch_ksg/englisch_ksg.html
- (2024, 11 6). Retrieved from hydrogen-centra: <https://hydrogen-central.com/germany-commits-blue-hydrogen-updated-national-strategy/>
- (2024, 11 30). Retrieved from .pv-tech.org: <https://www.pv-tech.org/bsw-solar-met-12-of-germanys-total-energy-demand-in-2023/#:~:text=Germany%20commissioned%20more%20than%20one%20million%20new%20solar,according%20to%20German%20solar%20association%20Bundesverband%20Solarwirtschaft%20%28BSW%29.>
- Camille Defard and al, C. J. (2021). *The Germany Energy Transition - A review of 20 years of political decisions.*

- Development, U. N. (2023). *Technology and Innovation report 2023 Opening green windows Technologie opportunities for a low-carbon world*.
- *epi.yale.edu*. (2024, 12 5). Retrieved from <https://epi.yale.edu/epi-results/2020/country/deu>
- Finance, F. M. (2024). *Green bond allocation report 2023*.
- *futurepolicy.org*. (2024, 11 6). Retrieved from <https://www.futurepolicy.org/climate-stability/renewable-energies/the-german-feed-in-tariff/#:~:text=1%20In%202000%2C%20the%20German%20Feed-in%20Tariff%20%28EEG%29,Priority%20access%20to%20the%20power%20grid%20for%20RE>.
- Government, T. f. (2021). *German Sustainable Finance Strategy*.
- Khalida, B. (2020, 05 20). Transition towards a green economy for sustainable development- The green Experience-. *Revue Internationale des Sciences de gestion*, p. 68.
- Marcel, J. (2001). *Sustainable Finance and Banking: The Financial Sector and the Future of the planet*. london: earthscan.
- Ohlhost, D. (2015). Germany's energy transition policy between national targets and decentralized responsibility. *journal of Integrative Environmental sciences*, 12, pp. 306-307.
- Stefan Bacha, M. K. (2020, jul). The effects of environmental fiscal reform in Germany: a simulation study. *energy policy*, 39(09), p. 803.
- *umweltbundesamt.de*. (2024, 11 03). Retrieved from <https://www.umweltbundesamt.de/en/topics/climate-energy/renewable-energies/renewable-energies-in-figures>
- ليلاف للبحوث و الدراسات -.الطاقات المتجددة و دورها في تحقيق التنمية المستدامة- تجربة ألمانيا نموذجاً. (2017). *بدرجة*, 5, p. 614.