

**The contribution of continuous investment in renewable energy sources that are not harmful to the environment in improving air and water quality - China is an example**

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**Abstract:**

Our study aimed to highlight that investment in renewable energy sources that are not harmful to the environment in China has contributed to improving water and air quality.

Despite the fact that China is the world's largest contributor to carbon emissions, it has also been quick to adopt environment-friendly methods.

The study shows that, owing to its efforts and commitment, China achieved a historic record rate of 1.05 billion kilowatts by the end of 2023, with a growth of 36% the total installed new electricity generation capacity, which raised the share of renewable energy to more than 50%. China's advancement in renewable energy investment influenced the environment positively, which resulted in constant improvements in air and water quality (given that the concentration of fine particulate matter "PM2.5" decreased by 54% from 2013 to 2023). This advancement may also lead to achieving the peak of carbon ahead of schedule during the next year or two as a result of unprecedented decrease in carbon emissions.

**Keywords :** investment, renewable energy, Air quality, water quality, China.

**JEL Classification:** Q13; P33; P28.

## **Introduction**

China's reliance on traditional energy sources to achieve the highest rate of rapid economic growth, and the huge wealth of domestic coal, along with China's imports of oil and gas, have played a central role in the development process, have worsened the effects of climate change, such as rising sea levels, changing rainfall seasons, increasing the spread of infectious diseases, and lack of availability of food, water, and health care... etc. However, all these issues urged China to adopt a series of strategies resulting in a "revolution" in the transition to clean energy sources. In recent years, investment in clean energy sources has increased owing to its effective and positive impacts on the environment. It improves water and air quality, reduces carbon emissions, reduces costs and provides sustainable economic growth, green jobs, and sustainable development goals.

Therefore, China has become a global leader in clean energy sources investment. In 2022, it invested in new projects in this sector, exceeding the amount of the investments of the rest of the world. Additionally, the contribution of wind and solar energy to the electricity mix increased to 37% by the first quarter of 2024, which was only 31% a year ago.

Given China's tremendous progress in renewable energy investment and its government's commitment to implementing policies and procedures related to the development of renewable energy and environmental protection, and thanks to its continuous efforts to combat pollution and maintain green development, it has witnessed a steady improvement in air and water quality in the first quarter of 2024. This progress may also help achieve the carbon peak ahead of schedule within the next year or two due to an unprecedented decrease in carbon emissions.

**Study problem:** In this respect, the following question arises:

**Does investing in renewable energy in China enhance environmental exchange?**

**Hypotheses:** To answer this question, the **following hypothesis** was developed in order to be tested: China has huge capacities and potentials in terms of renewable energy sources that can promote environmental exchange, thus having a positive impact on it, by improving air and water quality as a result of reducing the rate of carbon emissions resulting from the exploitation of fossil energy sources, especially coal, on which it relies heavily.

**The importance of research:** **The contribution of this study is evident in the scientific value** which it adds to the existing literature in the field, given the importance and novelty of the topic. Therefore, we aimed to clarify the impact of renewable energy when investing in it, which is positively

*The contribution of continuous investment in renewable energy sources that are not harmful to the environment in improving air and water quality - China is an example.*

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reflected on the environment, improving the quality of air and water, by reducing carbon emissions, as it is environmentally friendly.

**Research objectives:** Our topic also has a set of **objectives** that we aim to achieve, which can be summed up in showing the importance of moving towards investing in renewable energy, the extent to which the results of investing in renewable energy reflect on the environment, and its benefits and positive impacts on the environment.

**Research methodology:** In order to tackle this topic, we adopted the descriptive and analytical approach to analyze the data and information that we collected from various secondary sources: books, articles, reports, and Internet articles, etc. so as to identify and understand the nature and factors of the study variables (renewable energy and the environment) of this Chinese experiment.

### **1- The concept of renewable energy and the environment:**

Constant concerns about climate change and the growing global demand for energy urge many governments around the world to shift their energy policy towards renewable energy, with some estimates suggesting that by 2050, \$13.3 trillion will be invested in energy production, 77% of which will be devoted to renewable energy (boris, 2023)

#### **1-1- Definition of renewable energy and environment:**

Renewable energy and the environment have many definitions. Only one definition for each will be mentioned as follows:

Renewable energy is defined as “electricity generated from the sun, wind, biomass, geothermal heat, and hydroelectricity, as well as biofuels and hydrogen extracted from renewable sources ( Hani , 2000, p. 205).

The environment is defined as “the set of natural and social resources available at a certain time to satisfy human needs ( Bokoro, 2020/2021, p. 08).

#### **1-2- Benefits of renewable energy on the environment:**

The use of renewable energy has a great impact on the environment. Countries that depend on coal started searching for ways to gradually get rid of it. This was demonstrated in the United Nations conference regarding climate change resulting from smoke emissions resulting from burning coal, which causes an escalation in temperatures (the phenomenon of global warming). Since the environment is the “biosphere in which humans live, with all the natural elements it contains (water, air, and land), and the industrial elements built by humans (Environment News, 2009) , we can

demonstrate that renewable energy has many benefits for the environment, including the following:

( Lathamna, 2023)

- Preserving the environment by reducing pollution rates resulting from burning fossil fuels and the emission of harmful gases, and the ensuing respiratory diseases.
- Getting rid of global warming through the complete or almost complete switching to clean sources that preserve the climate of planet Earth.
- Reducing dependence on unclean energy sources, which in addition to polluting the environment, their mining technology earthquakes.
- Keeping water sources clean and protecting marine life.

### **1-3- The impact of energy on the environment**

Energy affects the environment either positively or negatively, and the following table illustrates this as follows:

**Table number (01): The impact of energy on the environment**

<b>The impact of energy on the environment</b>	<b>Positive impact</b>	<b>Negative impact</b>
<b>Energy and water</b>	The availability of energy sources results in the possibility of providing safe water through analyzing and treating it from all impurities.	The use of fossil energy sources results in water pollution and acidification due to acid precipitation.
<b>Energy and air</b>	The availability of energy sources results in the development of means and technologies to treat air pollution and filter it of all pollutants before it is emitted into the atmosphere.	The use of fossil energy sources results in many gas emissions (greenhouse gas such as: carbon dioxide and nitrogen oxides) which cause air pollution.

**Source: ( Boutoura & Azzaz, 2019)**

### **2- Renewable energy sources in China:**

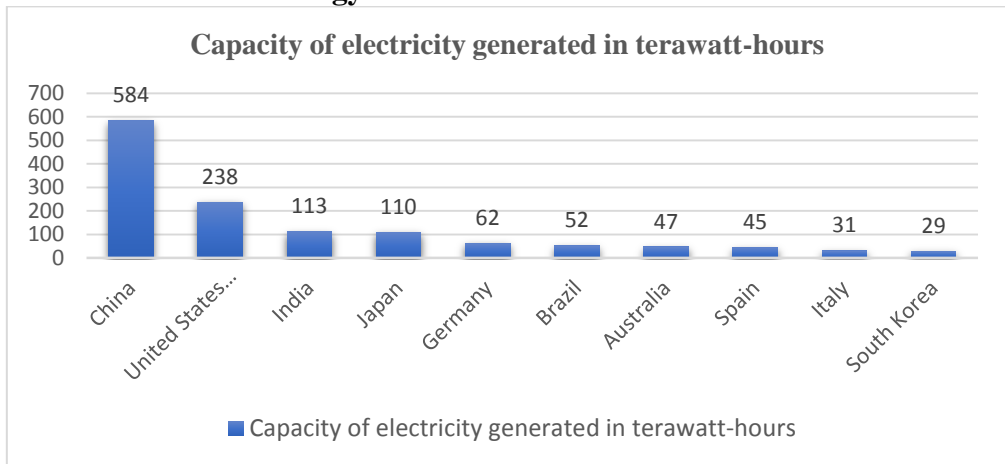
China has become a pioneer in applying renewable energy. China is expected to generate about 60% new renewable energy in the world in 2028, and thus achieving its 2030 goals in relation to wind and solar power generation in 2024, i.e., six years earlier than originally planned. China, therefore, has a crucial role in achieving the global goal of tripling renewable energy (China Network, 2024). Accordingly, the most important production capacities of renewable energy sources adopted in China are presented as follows:

#### **2-1- Solar energy:**

*The contribution of continuous investment in renewable energy sources that are not harmful to the environment in improving air and water quality - China is an example.*

China is the world pioneer in the production of solar power. During the first quarter of 2024, “China added 45.8 gigawatts of solar power, the highest rate in the first quarter of any year (...). It expects its renewable energy contribution to rise to 40% of the country’s total power generation, surpassing the power generated from coal burning in the second half of the year. 86% its investments in power generation assets were spent on non-thermal energy sources that do not involve burning fossil fuels. Both power consumption electricity network investments increased respectively by 9.8% and 14.7% yearly in the first quarter. Energy storage capacity increased by 6.7% from levels achieved by the end of 2023 (The Icon , 2024). The following figure shows the electricity generated from solar energy for the top 10 countries in 2023.

**Figure number (01): Top 10 countries generating electricity from solar energy in 2023 in terawatt/hours.**



**Source: prepared by the researchers based on (Rajab, 2024)**

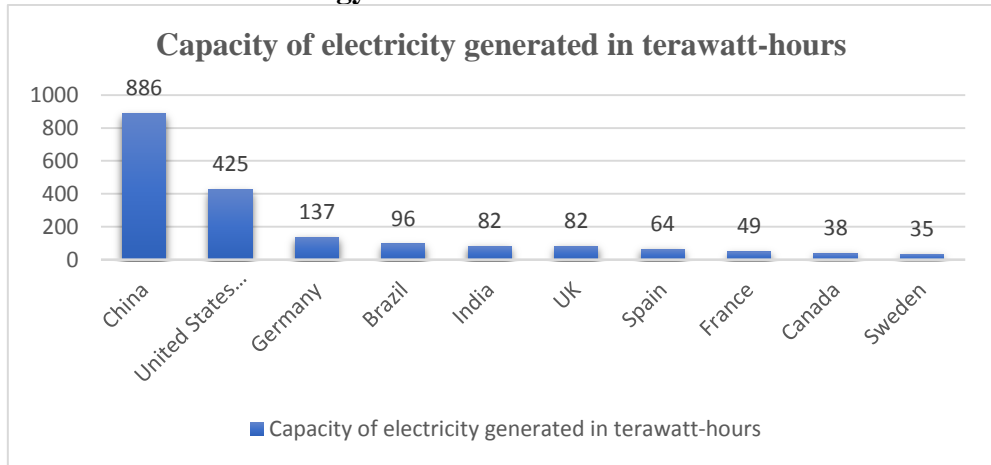
Based on figure 01, it can be noted that China is on top of the list of the 10 countries that generate the most electricity from solar energy in 2023, by a huge margin over the United States, its closest global competitor. This type of power generation increased globally to a new record rate for the eighth year in a row, growing by 23%, or the equivalent of 307 terawatt-hours, reaching 1631 terawatt-hours in the same year. This record increase contributed to the growth of solar energy in the global electricity generation mix to 5.5%, compared to nearly 4.6% in 2022. It also accounted for 51% of this record increase, with its solar power generation growing by 37%, to reach a total of 584 terawatt-hours in 2023, which reinforced its position as

the top country in the list. Within the same list and for the same year, the United States of America came in second place with its power generation volume reaching 238 terawatt-hours, followed by the following countries: India, Japan, Germany, Brazil, Australia, Spain, Italy, and South Korea with generation volume: 113, 110, 62, 52, 47, 45, 31, 29 terawatt-hours respectively.

### 2-2- Wind energy:

Global wind power capacity additions reached 116.6 GW during 2023, with an increase of 50% from 2022 when it reached 77.6 GW. China accounted for the vast majority of new installations at 65% (Chaouki , 2024). The following figure demonstrates the top 10 countries generating electricity from wind energy in 2023.

**Figure number (02): Top 10 countries generating electricity from wind energy in 2023 in terawatt-hours**



**Source: Prepared by the researchers based on ( Hussein, 2024)**

Based on figure 02, it can be noted that China is on top of the list of the 10 countries generating electricity from wind energy in 2023, more than doubling the United States, as electricity generation from wind energy in China reached 886 terawatt-hours during 2022, representing 9.4% the Chinese electricity mix. Electricity generation from wind energy increased globally to a new record rate in 2023, reaching 2304 terawatt-hours, compared to 2099 terawatt-hours in 2022. Wind and solar energies are two essential elements in reducing emissions from the electricity sector, with expectations that China will provide 70% of global electricity generation by the middle of this century (2050). Within the same list of countries generating the most electricity from wind energy for the same year (2023),

*The contribution of continuous investment in renewable energy sources that are not harmful to the environment in improving air and water quality - China is an example.*

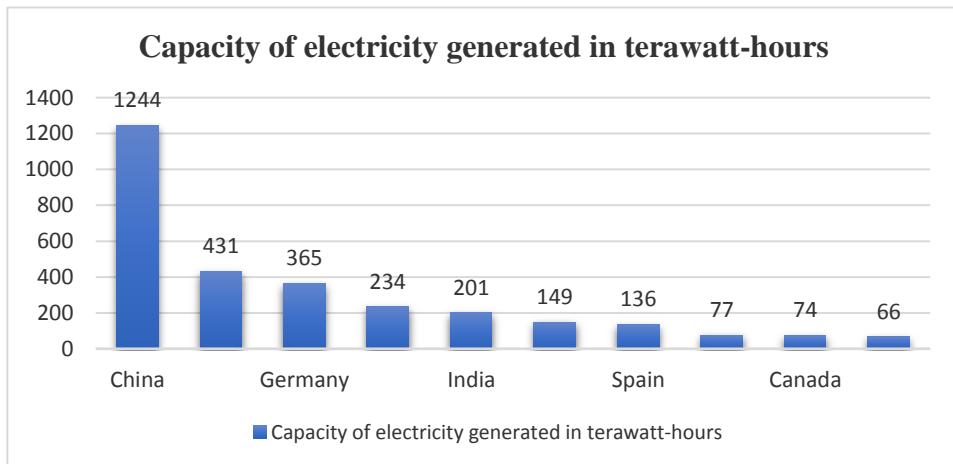
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the United States came in second with a production of 425 terawatt-hours, followed by Germany, Brazil, India, the United Kingdom, Spain, France, Canada, and Sweden with a production of: 137, 82, 64, 49, 38, 35 terawatt-hours respectively.

### **2-3- Hydroelectric power:**

China topped the list of the world's most hydroelectric power generating countries, despite its generation declining at a record pace in 2023, due to drought and high temperatures that severely affected the hydropower generation plants in most regions of the world, (affecting water levels and pushing generation rates to their lowest level in 5 years), causing global hydroelectric power generation to fall to 4,210 terawatt-hours. This level of global hydropower generation is 2.1% lower, i.e., 88 terawatt-hours, which is the largest decline ever from its production level in 2022, which reached 4,122 terawatt-hours. The following figure presents the top 10 hydroelectric power generating countries in the world in 2023.

**Figure number (03): The top 10 hydroelectric power generating countries in the world in 2023.**



**Source: Prepared by the researchers based on ( Rajab, 2024)**

Based on figure 03 above, it can be noted that China topped the list of the 10 countries generating the most electricity from hydroelectric power in 2023, outperforming its closest competitors (Brazil and Canada) by a very large margin. Its production alone reached 1244 terawatt-hours, representing 29.5% the global total in 2023, and 13% of the country's electricity mix. Within the same list of countries generating the most

electricity from wind energy and in the same year (2023), Brazil came in second globally, followed in order by: Canada, the United States of America, Russia, India, Norway, Vietnam, Japan, and Sweden, with a generation volume of 431,356, 234, 201, 149, 136, 77, 74, 66 terawatt-hours respectively.

In the first quarter of 2024, China added 45.8 gigawatts of solar power and 15.5 gigawatts of wind power, with these two sources contributing to the electricity mix increase to 37%, and their contribution is expected to rise up to 40% the country's total power generation, exceeding power generated by coal burning in the second half of 2024 (Abu Dhabi Sky News Arabia, 2024).

#### **2-4 - Geothermal energy:**

Clean energy sources including geothermal energy in China have contributed to the improvement of air quality. During a conference held on September 15<sup>th</sup>, 2023, it was stated that China has a geothermal energy capacity of more than 85 million m<sup>2</sup> after 11 years of developing its business in this field. The state-owned company "Sinopec Ma Yong Sheng" is expected to add 75 million m<sup>2</sup> of geothermal energy areas in China, in order to reach the target of 160 million m<sup>2</sup> by the end of 2025 (Ayoub, 2023).

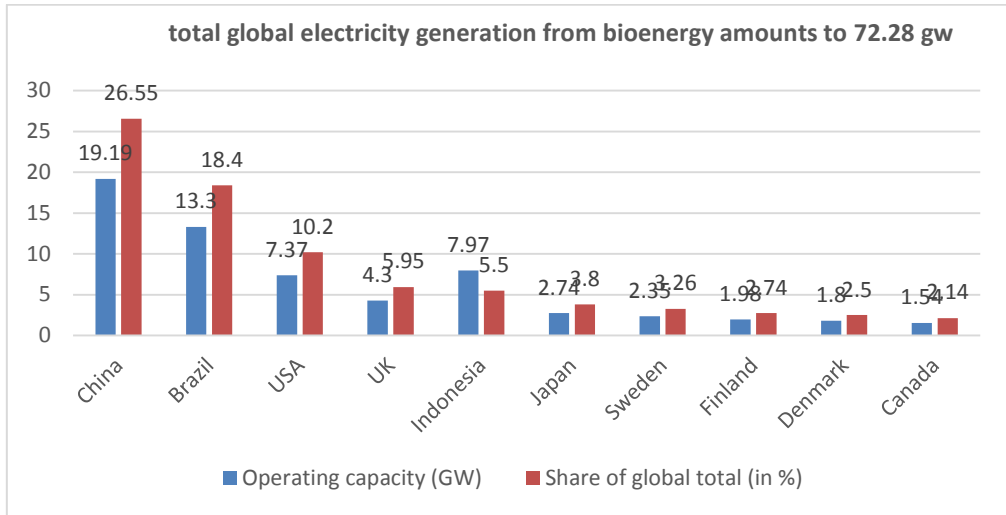
#### **2-5- Biomass energy:**

Global bioenergy electricity generation capacity reached 72.38 gigawatts by November 2023, with an expected addition of 19.67 gigawatts.

China tops the list of countries generating the most electricity from bioenergy with a volume of 19.19 gigawatts. The following figure demonstrates the capacity of bioenergy electricity generation in the world in 2023.

**Figure number (04): Top 10 countries generating electricity from bioenergy until November 2023.**

*The contribution of continuous investment in renewable energy sources that are not harmful to the environment in improving air and water quality - China is an example.*



**Source: (ammar, 2024)**

Based on figure 04, it can be noted that China topped the list, followed by Brazil with a capacity of 13.30 gigawatts, and the United States came in third, with a capacity of 7.37 gigawatts. The value of the bioenergy market is expected to rise to \$500 billion by 2050, if the world succeeds in achieving carbon neutrality for \$44 billion now.

**2-6 - Hydrogen energy**

China is pushing to make hydrogen a key component of its low-carbon energy shifting strategy, with its national plan aiming to produce 200,000 tons of green hydrogen annually by the end of 2025. This goal is most likely to be achieved earlier, since China is expected to produce 220,000 tons by the end of 2023. China is reinforcing its position as a global leader in electrolysis technology, having generated 1 gigawatt of electrolysis capacity in 2023. (Saif Bin Hilal Center for Energy Studies and Resea, 2024). “Rystad Energy” is expected to generate nearly 2.5 gigawatts by the end of 2024, producing 220,000 tons of green hydrogen annually, more than half of the world’s combined production.

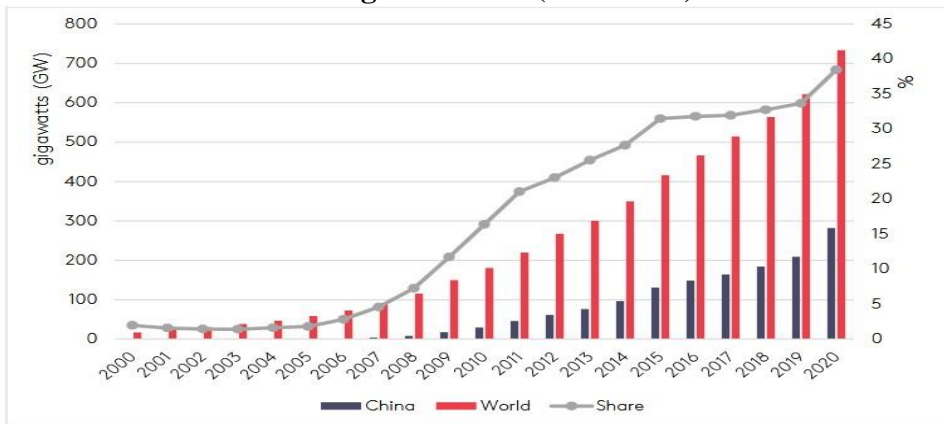
**3- China’s efforts to shift towards investment in renewable energy and to promote environmental exchange:**

Clean energy has many positive impacts on the environment; unlike fossil energy, which emits large amounts of harmful gases, and which in turn lead to global warming, air pollution, and climate change and negatively affect the environment. Clean energy does not emit any harmful

carbon in the air, therefore, it is environment friendly, and it also contributes to reducing dependence on energy sources that pollute the environment (Misbar, 2021)

Consequently, China aims to protect the environment and achieve sustainable development “by reducing carbon emissions and improving air and water quality” ( El Dourai, 2023). China is considered the largest **emitter of greenhouse gases in the world**, and also the **largest producer of energy** from wind, solar and hydroelectric sources. It currently aims to generate 33% of electricity from clean energy sources by 2025, given the fact that China produces energy from clean and renewable energy sources every year with a capacity that exceeds all countries in the world combined, adding about 75% of the total wind and solar energy capacity in the world annually, and about 80% of the total hydroelectric energy capacity. As a result, China became the owner of nearly half of the global wind energy capacity and accounts for half of the number of electric cars in the world. This is demonstrated through the two following figures.

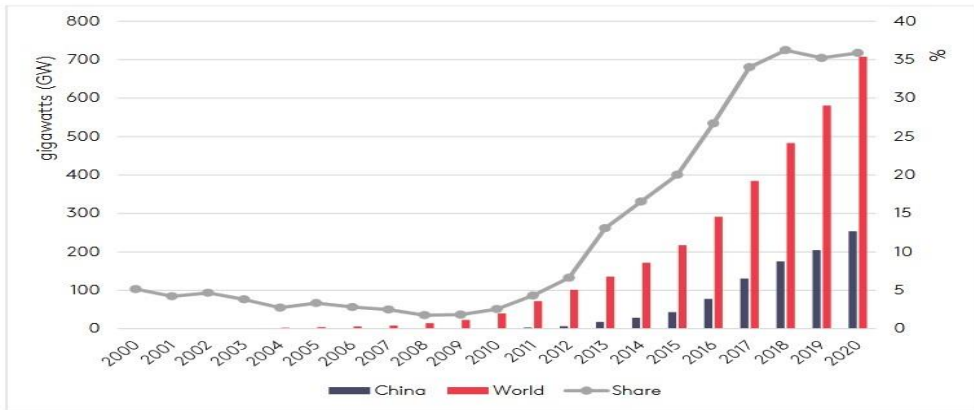
**Figure number (05): China’s cumulative installed wind power capacity and its global share (2000-2020)**



Source: ( Kyriakopoulou, Lucie , Chunping, & Policy , 2022).

**Figure number (06): Cumulative installed solar photovoltaic capacity in China and its global share (2000-2020)**

*The contribution of continuous investment in renewable energy sources that are not harmful to the environment in improving air and water quality - China is an example.*



**Source: ( Kyriakopoulou, Lucie , Chunging, & Policy , 2022)**

“As of 2020, its capacity doubled to reach 67 gigawatts in 2023, and it was producing 35% the total renewable energy produced around the world in 2023.” ( Euler, 2024)

As part of its efforts to **fight climate change**, China has adopted a set of plans and decisions that take into account the balance between economic development and the preservation of biodiversity. Over the past decade, it has adhered to the green development approach (joint construction of the Belt and Road Initiative), which aims to enhance international cooperation in the fields of green infrastructure, renewable energy, and ecological environment management, ensuring a balance between economic development, preservation of biodiversity, and combating climate change,” (Amjad, 2023) which will be demonstrated through the following table.

**Table number (02): China’s plans and decisions in balancing economic development and preservation of biodiversity**

Fields	Plans and decisions
<b>Promoting international partnerships</b>	By August 2023, China has signed more than 200 cooperation documents with more than 150 countries and 30 international organizations, focusing in particular on building the Green Belt and Road, and launched the Belt and Road Green Development Partnership Initiative with 31 countries, as an important step towards achieving sustainable development goals at the global level.
<b>Developing big data platforms</b>	China has established a big data service platform to protect ecological environment along the Belt and Road, a move that aims to collect and analyze basic environmental information from more than 60 countries, enhancing global understanding of environmental challenges and contributing to enlightened decision-making.
<b>Climate</b>	China has launched the Green Silk Road Envoy Program and the South-

<b>change combat initiatives</b>	South Cooperation Program to combat climate change. More than 40 cooperation documents have been signed with more than 30 countries, and more than 70 projects in this field have been implemented with different countries.
<b>Generating clean energy</b>	China has built the world's largest clean energy generation system and established a carbon emissions trading market. In 2022, China's new renewable energy installed capacity accounted for about half of the global increase in this field. China's exported photovoltaic and wind energy products contributed to reducing global carbon dioxide emissions by about 573 million tons, accounting for about 41% of the global emissions reduction transformed by renewable energy. (Amjad, 2023)
<b>Environment protection</b>	China is committed to protecting fresh water and green mountains. Ecological environment protection has been strengthened, and more than 10 environmental laws have been revised. China aims to integrate carbon peaking and carbon neutrality into the overall planning of economic and social development, setting red lines for environmental protection and promoting sustainable patterns of production and life. At the same time, China has supported sustainable economic growth with more than 6% annually, with energy intensity significantly reduced, and the proportion of clean energy consumption increased to 25.9%.

**Source: (Amjad, 2023)**

#### **4- Contribution of Renewable Energy to Reducing Carbon Emissions in China:**

Between 1980 and 2020, carbon emissions from the energy and industrial sectors in China amounted to about 48% the country's total emissions, while the manufacturing sector accounted to 36%, transportation to nearly 8%, and construction to almost 5% (ahmed, 2023). Since China joined the World Trade Organization in 2001 until 2019, its emissions have become 28% the world's total production" ( Al Arabi , 2023). Between 2005 and 2019, **"the emissions rate witnessed a significant increase, coinciding with the rapid increase in growth rates by about 224%, the growth rate of energy consumption increased by about 75%, compared to the growth rate of global emissions by less than 24%. The economic growth rates exceeding the carbon emissions rates led to a decrease in the index of emissions intensity resulting from economic activity to 46%"** (ahmed, 2023). However, in reality, coal consumption recorded a significant decrease every year during the period from 2014 to 2016, and has since increased steadily, coinciding with that, carbon dioxide emissions increased by 1.5% to 1.7% even during the pandemic-induced slowdown in 2020. During that year China added 38.4 new gigawatts to coal-fired power capacity in 2020, while the rest of the world decreased the net coal capacity by 17.2 gigawatts" (Maissa , 2021)

*The contribution of continuous investment in renewable energy sources that are not harmful to the environment in improving air and water quality - China is an example.*

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“During 2022, within the framework of promoting high-quality green development, China’s reduced its energy consumption and carbon dioxide emissions” ( Maghreb Arab Press Agency, 2024). During 2023, “global energy emissions increased by 410 million tons (1.1%) reaching 37.4 billion tons, due to the increased usage of fossil fuels in countries where drought has hindered hydropower production..... The global expansion in clean technology (wind and solar energies, electric cars, etc.) restricted the increase in emissions, which reached 1.3% in 2022. However, the revival of the Chinese economy and the aviation sector, and the increased usage of fossil fuels in countries with low **hydropower** production led to an overall increase” ( Al Arabiya, 2024).

In March 2024, “China’s carbon dioxide emissions fell by 3% on annual basis for the first time since the first of January 2023, which is unprecedented since the end of the epidemic crisis and the return of economic activity to normal, due to the rate of Chinese emissions reaching its peak more than half a century before Beijing’s target date ( Numbers, 2024)

“In order to preserve energy and reduce carbon emissions during 2024-2025, the State Council of China issued an action plan, whose objective was to reduce energy consumption and carbon dioxide emissions per unit of GDP by about 2.5% and 3.9% respectively in 2024. According to this plan, the energy consumption per unit of added value of industrial institutions will be reduced by about 3.5% in 2024. The amount of non-fossil energy consumption will reach approximately 18.9% in 2024 and 20% in 2025. Energy preservation and carbon reduction in key sectors and industries are expected to save about 50 million tons of standard coal consumption and reduce carbon dioxide emissions by about 130 million tons. (Arabic News, 2024)

## **5- The positive impacts of investment in renewable energy on the environment in China**

The collected data shows that China has high-level capabilities and qualifications; therefore, one can consider that investment in renewable energy has a positive impact on the environment in China. This is manifested through two main results:

### **Main result 1: renewable energy improves air quality:**

“China suffers from very high levels of pollution. Despite being one of the most polluting countries, it is one of the biggest investors in

renewable and clean energy (Sky News Arabia, 2017). In 2013, the Chinese Cabinet developed a plan to tackle the issue of air pollution, aiming to achieve the following:

- Reducing the emissions resulting from highly polluting industries by 30% by the end of 2017, by decreasing the total coal consumption from 67% to less than 65% total primary energy use, imposing restrictions on cars that operate on diesel, and increase the rate of dependence on clean energy from 11% to 13%.
- Building nuclear power plants with a capacity of 50 gigawatts by 2017, and adding 150 billion m<sup>3</sup> to the pipeline system of natural gas used in the country by the end of 2015” ( Al Jazeera , 2013).

Cities that implemented the new air quality standards witnessed an average decrease in the concentration of fine particulate matter 2.5 by 31% during the period (2013-2016). Indeed, in 2017, China was able to reach the 2020 target of reducing carbon intensity by 40-45%, and increased the area of forest cover by 21 million hectares in 10 years ( Matteo Marchisio, 2019).

Since 2013, China has allocated more than 200 billion Yuan (27.9 billion USD) to combat air pollution, launched specific national campaigns to preserve its blue skies, clear waters and clean lands, conducted environmental inspections across the country, and adopted the “**River Chief**” and “**Lake Chief**” systems to protect the natural environment of rivers and lakes. Thanks to the continuous efforts against air pollution, the number of days with good air quality reached 87.5% the total days of 2021, with an increase of 6.3% vis-à-vis 2015. The density of particulate matter 2.5 (a key indicator of air pollution) fell by 3.3% on a yearly basis to 29 micrograms per cubic meter in 2022, after declining steadily for almost a decade. While forest resources continue to decline globally, China’s forest coverage rate reached 24.02%, with forest area and stock volume increasing since 2012. (Al Arabiya Channel of China Global Television Netw, 2024). In the first quarter of 2024, “China witnessed a steady improvement in air and water quality compared with the first quarter of 2023, within the framework of the country’s incessant efforts to fight pollution and maintain green development. The average concentration of fine particles PM 2.5 in 339 Chinese cities at or above the prefecture level was 43 micrograms per cubic meter, with a decreased of 6.5% annually. The rate of days with good air quality in these cities was 83.6%, with an increase of 3.5% compared with the same period in 2023 ( People’s Daily Online , 2024) .

**Key Result 2: Renewable energy contributes to improving water quality:**

*The contribution of continuous investment in renewable energy sources that are not harmful to the environment in improving air and water quality - China is an example.*

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China's water quality has improved significantly from 2012 to December 2022, with 84.9% of **surface water** sections receiving an excellent quality rating close to that of developed countries. The total amount of freshwater resources available in lakes and reservoirs increased, the transparency of most lakes steadily improved, and biodiversity in the major lakes increased. China now has 240 innovative practice bases that align with the concept of "good natural environment represents invaluable assets", and 572 pilot areas for building ecological civilization. Additionally, the number of urban parks reached 65,000, providing more entertainment options for citizens (Al Arabiya Channel of China Global Television Netw, 2024)

In 2023, based on China's five-level water quality system, 89.4% **surface water** was at or above Level III, with a yearly increase of 1.5%. Also, the proportion of marine areas under Chinese jurisdiction that achieved high quality reached 97.9%, an annual increase of 0.5% ( Day 7 , 2024).

In the first quarter of 2024, "water quality kept improving owing to the significant measures taken by the Ministry of Ecology and Environment in protecting the aquatic ecological environment in **major river basins**. The rate of **classified water bodies** with excellent water quality nationwide reached 89.4% in 2023, with an increase of 1.5% compared with 2022, **exceeding the target set** in the 14<sup>th</sup> Five-Year Plan (2021-2025) by 4.4%, and taking the Yangtze River as an example, 98.5% of the monitored sites in its basin achieved excellent water quality during 2023, with a yearly increase of 0.4%. Besides, the number of local fish species recorded in this river increased to 227 species, with an increase of 34 species compared with 2022, while the number of protected aquatic wildlife species nationwide increased to 14 species in 2023, with an increase of three species from the previous year (Hazem & Muhammad , 2024).

## **Conclusion**

Based on our study, our findings demonstrate that China has become one of the pioneers for being able to create a friendship with the environment, despite its significant involvement in the increase of carbon emissions in the world. Within the framework of its commitment to implementing the strategy whose objective is to reduce the risks of dependence on fossil fuels, and as a result of its government's commitment and keenness on continuous development, China invested in renewable

energy, which allowed it to become a world leader in the field. Thanks to its rational energy policy, the constructed infrastructure, the provision of financial support and tax exemptions, etc., and thanks to its efforts and achievements, it became closer to its goals. The latter includes improving air and water quality continuously until the first quarter of 2024, during this period, China spent 86% of its investments in electricity generation assets on non-thermal energy sources that do not involve **burning fossil fuels**, and energy consumption increased by 9.8% annually, which is higher than the agency's expectations for demand growth, and the electricity network investments rates increased to 14.7%, supported by a 30.4% growth in spending on high-voltage lines, and energy storage capacity increased by 6.7% from the end of 2023 levels. During the same period, China added 45.8 gigawatts of solar energy, the highest level in the first quarter of any year, and the contribution of wind and solar energy to the electricity mix augmented to 37% in 2024, after being less than 31% in 2023.

**Our study reached the following findings:**

- China recorded a better environmental protection performance in 2023, with continuous improvement in air and water quality up to the first quarter of 2024.
- China's increased investment in renewable energy sources resulted in a reduction in carbon emissions and thus a continuous improvement in air and water quality.
- China became the world leader in investment in renewable energy sources, given the fact that it is the largest producer of solar and wind energy, and hydroelectric power... with an annual capacity greater than all the countries of the world combined.
- China annually adds about 75% of the world's total wind and solar power capacity, and about 80% of the total hydropower capacity, rendering China the country that produces half of the world's total wind energy, as well as half of the world's electric cars.

**Based on those findings, the following recommendations can be made:**

- It is necessary for China to carry on with its efforts in promoting international cooperation in the fields of green infrastructure, renewable energy, and ecological environment management, ensuring a balance between economic developments, preservation of biodiversity, and combating climate change.
- China should exert more efforts in protecting the environment from pollution, because it has not yet reached its goal, despite the continuous improvement in air and water quality.

*The contribution of continuous investment in renewable energy sources that are not harmful to the environment in improving air and water quality - China is an example.*

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- Raising global awareness of the importance of protecting the environment from pollution by mobilizing all countries whose economies are built on the exploitation of traditional resources to move towards investing in renewable energy because it has less negative impacts on the environment, and more positive impacts compared to conventional energy sources.
- Although companies and governments around the world are aiming to increase spending on clean energy production to reduce carbon emissions from burning fossil fuels that lead to climate change, there is still a lack of energy investment in parts of the world such as emerging and developing economies outside China.
- China must work harder to ensure that investment reaches where it is most needed, because achieving medium-term global targets for reducing harmful carbon emissions will require doubling investment in renewable energy worldwide by 2030.

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