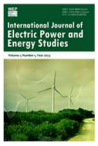
WEP Warwick Evans Publishing

International Journal of Electric Power and Energy Studies

ISSN: 3006-2004 (Print), ISSN: 3006-0826 (Online) | Volume 3, Number 2, Year 2024
DOI: https://doi.org/10.62051/ijepes.v3n2.05
Journal homepage: https://wepub.org/index.php/IJEPES/index



French Energy Transformation under the Russia-Ukraine Conflict and Reflections on China-France Energy Cooperation in the Future

Chengyu Yong

Department of Foreign Languages and Literature, Southwest petroleum university, Chengdu, 610500, China

ABSTRACT

Since the beginning of the 21st century, France has increasingly prioritized climate change as a central focus of its energy transition strategy. In the wake of the Russia-Ukraine conflict, EU countries are now grappling with a new energy crisis. As one of the major powers within the European Union, France has been continuously adapting and refining its energy transition policies in response to these shifting energy dynamics. This paper examines the various factors contributing to the current energy crisis and analyzes France's strategies and directions for energy adjustment. It also explores the future prospects of energy cooperation between China and France, particularly in the area of renewable energy. Building on this analysis and drawing parallels with China's own energy transformation path, the paper offers insights and suggestions that may serve as a reference for China's future energy transition efforts.

KEYWORDS

Energy Transformation; French; Russia-Ukraine War.

1. INTRODUCTION

In 2022, the world began to emerge from the COVID-19 pandemic, with the global economy slowly recovering from its stagnation. However, the outbreak of the Russia-Ukraine conflict once again plunged the global energy market into turmoil. This situation has drawn significant attention to the energy transition strategies of EU countries. As the third-largest economy and the second-largest energy consumer in Europe, France, alongside other EU nations, has been actively pursuing the development of clean energy under the framework of climate change goals. France's progress in this regard has yielded notable results, making the EU's clean energy initiatives a model for other nations to emulate. Amidst the current energy crisis, understanding how France navigates these challenges and adjusts its energy transition strategy becomes a critical area of inquiry. At the same time, China and France share a long history of diplomatic relations, and in recent years, they have deepened their cooperation in renewable energy to advance China's energy transition and sustainable development goals. By examining France's energy policies and strategies, this paper seeks to shed light on the future prospects of Sino-French energy cooperation while offering valuable insights and recommendations for China's ongoing energy transformation.

2. CURRENT PROBLEMS FACING FRENCH ENERGY

First of all, France's current energy self-sufficiency is relatively low. The 21st century has witnessed simultaneous economic and technological advancements alongside worsening environmental and

climate challenges. These developments have prompted EU countries to recognize the critical importance of addressing environmental and climate issues in their energy policies. Consequently, under the leadership of the Paris Agreement, combating climate change has become a fundamental prerequisite for each country in designing its own energy transition strategy. In response, France has embarked on a comprehensive energy transition aimed at reducing carbon emissions and achieving carbon neutrality [1]. Under its carbon-neutral energy transition strategy, France has significantly adjusted its use and exploitation of fossil energy sources, including natural gas, oil, and nuclear energy. According to data from the International Energy Agency (IEA), France's total energy production declined from 5,653.86 TJ in 2018 to 5,019.14 TJ in 2020. The most significant decreases were observed in the production of coal, nuclear energy, and natural gas. Specifically, coal production dropped from 382,344.0 TJ to 221,854.0 TJ, natural gas production declined from 154,182.0 TJ to 146,098.0 TJ, and nuclear energy production fell sharply from 450,480.82 TJ to 385,995.0 TJ. This downward trend in domestic energy production has made France increasingly reliant on imports of fossil energy sources. While the majority of Europe's energy imports come from Russia, a dominant energy supplier on the Asian continent, France's dependency on Russia varies by energy type. Although France's reliance on Russian crude oil and coal imports is lower compared to countries like Germany and Italy, its dependence on Russian natural gas is significantly higher. By 2019, France had become almost entirely reliant on imported natural gas [2].

Second, France's domestic energy prices have soared, and energy imports are in short supply. In 2022, under the dual impact of the Nord Stream II pipeline explosion and the Russia-Ukraine conflict, both domestic and international energy markets in France were thrown into disarray, leading to a sharp increase in energy prices. Since the onset of the Russia-Ukraine conflict, France's energy inflation rate has steadily risen, reaching 33.1% in June 2022-a record high over the past five years [3]. According to the U.S. Energy Department, domestic oil prices in France stabilized at $1 per gallon in 2020, but domestic oil prices climbed all the way to $1.78 per gallon in 2022 [4]. And natural gas energy, the price of EU countries, including France, has also gradually increased from less than 51 euros per 1,000 cubic meters in 2020 to a peak of 1,147 euros per 1,000 cubic meters, enough to increase the price of about 22 times, which gives France a significant increase in the purchase of natural gas energy financial burden. [5]. The price of coal in France has also risen under the influence of the Russia-Ukraine war, although the increase has been less dramatic compared to that of natural gas. According to the European Union's energy statistics, the price of coal in France and other EU countries increased from 95 euros per kilowatt-hour in 2020 to 528 euros per kilowatt-hour. Such drastic changes in energy prices not only pose a significant risk to France's energy security but also continue to escalate the cost and pressure associated with energy purchases. As a result of Russian energy sanctions, France's natural gas imports have declined. To compensate for the natural gas shortage and meet the growing domestic power demand, electricity costs have continued to rise, further increasing economic pressure. In response to the energy crisis, the EU has introduced policies aimed at mitigating its effects. France, along with other member states, has actively responded to these policies while continuing to adjust its energy development strategy based on its national circumstances, with the ultimate goal of reducing dependence on Russian energy.

3. REASONS FOR FRANCE'S ENERGY PROBLEMS

The causes of France's current energy challenges are multifaceted and can be categorized into two primary groups: direct and indirect factors. The direct factors include the Russia-Ukraine conflict and the deliberate sabotage of the Nord Stream II gas pipeline. Indirect factors, on the other hand, encompass structural issues within France's energy consumption framework, natural and geographical limitations, socio-economic and livelihood-related tensions, as well as historical influences.

3.1. Direct Reasons

First, in February 2022, France was directly affected by the Russian-Ukrainian conflict, and domestic energy prices, which had just stabilized, began to fluctuate again, blocking major energy import channels.

Before the outbreak of the Russian-Ukrainian conflict, France had just gone through a two-year-long process of economic depression within the country until 2022, when the domestic economic situation grew in favor. According to the World Bank GDP data, France's domestic GDP in 2020 is 6.8% higher than in 2019 [6]. Energy prices in France are also slowly stabilizing at this time. According to data from the International Energy Agency, oil prices in France have remained below $80 per barrel, natural gas prices have remained at 100 euros per 1,000 cubic meters, and coal prices have stabilized at 53.65 euros per ton.

When the Russia-Ukraine conflict began, France and other EU countries were subjected to energy sanctions from Russia, which raised energy prices. According to data from the International Energy Agency (IEA) and the U.S. Energy Agency, energy prices in France have risen rapidly since the beginning of the Russia-Ukraine conflict. The price of natural gas has risen from less than 100 euros per megawatt-hour (MWh) to 1,000 euros per 1,000 cubic meters (m3). According to data from the European Union's Office for National Statistics (ONS), the price increase of natural gas in France in 2022 for both household and non-household consumers is estimated to be around 0.07 euros per kilowatt-hour (kWh) for households, excluding taxes [7]. This creates a huge energy challenge for the French population during the harsh winter months; according to the Global Oil Prices website, the price of oil in France will be 1.349 euros per liter in 2022-2023 and continues to rise; the price of electricity in France is also rising in 2022, with the price of residential electricity rising to 0.206 euros per kilowatt hour and the price of commercial electricity standing at 0.341 euros per kilowatt hour. French energy imports also decreased after the start of the Russian-Ukrainian conflict, and according to statistics from the Dutch Center for Energy and Clean Energy, EU countries were still buying large quantities of Russian fossil energy during the first hundred days of the Russian-imposed invasion. Russia's energy exports at this time were down, but still at a record high [8]. As can be seen in Chart 1: The ranking of Russian energy importers shows that France is in seventh place and still maintains a high level of imports of Russian energy. Under Russian energy sanctions, France's energy imports have been on the decline since the outbreak of the Russia-Ukraine conflict. In addition, France's domestic GDP is down 4.2% from 2021, and the country's newly recovering economic environment is being negatively impacted.

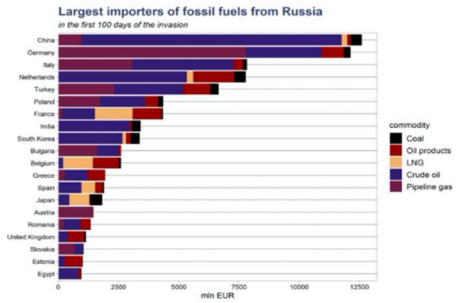


Figure 1. Largest importers of fossil fuels from Russia

Second, the blow-up of the Nord Stream II pipeline in September 2022 exacerbated France's energy supply shortfalls and price disruptions in the energy market. According to data from the Netherlands Energy and Clean Energy Center's analysis of Russia's energy exports in November 2022 and March, April, and May 2023, the EU's total imports of Russian energy in November 2022 ranked first in the

world, with France's total imports of Russian energy ranked second among EU countries, and although France's energy imports at this time have been restricted, its dependence on Russian energy is still high [9]. The data for March 2023 show that the EU's total imports of Russian energy fell to third place in the world, with China in first place, where France's total imports of Russian energy fell to fifth place in the EU, and it is clear from this set of comparisons that France's and other EU countries' imports of Russian energy have been declining [10]. The data for April 2023 show that total EU energy imports to Russia rose to the second highest in the world, but imports fell by about €2.5 billion compared to March, with France's energy imports to Russia falling by about €130 million compared to March, when France's energy imports to Russia were still on a downward trend. The data for May show that France's energy imports to Russia rose, from about €270 million to About 430 million euros, which also shows that France wants to get rid of Russian energy imports in a short period of time can not be achieved, which is more in the Netherlands Energy and Clean Energy Center in July 2023 on the Russian energy exports in the study, in the European Union, including France, after the enactment of a ban on Russian energy, the European Union, including France, is still purchasing natural gas energy from Russia.

3.2. Indirect Reasons

In addition to direct causes, a number of indirect causes have progressively increased the extent of France's current energy problems.

3.2.1. Own Energy Mix and Natural Constraints

As a country with a high degree of energy dependence on imports, France's current energy consumption structure is dominated by nuclear power generation, which poses a great potential danger to France's energy security. According to the video of the French-language program "This is France" in France 24, before the implementation of the carbon-reducing transition strategy, France had an energy structure dominated by nuclear energy, which accounted for 70% of its electricity generation. But since 2022, more than half of France's nuclear power plants are now being repaired and shut down as a result of the positive response to the EU's carbon-reducing energy transition strategy, which will bring the country's nuclear energy to an all-time low in 30 years. Today, France's energy mix is 40% nuclear, 28% oil, 16% natural gas and 14% renewables (with hydroelectricity in first place). According to the video of the French program, 99% of oil and natural gas are imported [11]. In addition, according to the International Energy Agency's analysis of the Russian-Ukrainian conflict in the topic of the EU countries on the degree of energy dependence on Russia's statistical data show that France's dependence on Russia's oil imports accounted for the majority of the 2018 before to remain at more than 12.9%, the dependence on Russia's coal imports of energy is also increasing year by year, in 2018 is reached 29.7%, the dependence on Russian natural gas imports accounted for a high proportion of energy imports is also still in the range of 24%-35%. The proportion of energy import dependence also remains high, with a rough range of 24%-35%. The high dependence on energy imports has led France to lose its energy sovereignty after the outbreak of the Russia-Ukraine conflict and to be threatened by Russia's energy imports.

France's own terrain and climatic conditions not only determine its energy structure to a certain extent, but also on the development of new energy sources to form a certain impediment, which is also France in the loss of natural gas and oil energy imports after the stability of new energy sources to replace. France's terrain is high in the southeast and low in the northwest, with the plains accounting for two-thirds of the total area. The southern part of France belongs to the Mediterranean climate, with high temperatures and little rain in summer, and warm and humid winters; the northern part of the country has a temperate oceanic climate, with mild rainfall throughout the year and relatively uniform precipitation. Due to the terrain and climate conditions, France's power resources mainly come from hydroelectric power and wind power generation. However, the high summer temperatures and low rainfall in most parts of France have caused evaporation of rivers and lakes, and the water level has

been dropping, which has brought greater challenges to hydroelectric power generation [12]. Since hydro and wind power could not meet the domestic demand for electricity, France increased the proportion of nuclear power generation, but later on, under the influence of the European Union's policy, nuclear power was cut down significantly, which is one of the reasons why France has become a predominantly energy-importing country.

3.2.2. Legacy of Historical Issues

The legacy of historical problems refers mainly to the legacy of the energy crises in Europe and the long-lasting effects of the CKP epidemic. The historical energy crises are the oil energy crisis of 1973, 1979 and 1990 and the gas energy crisis of 2021. These energy crises have had a lasting and long-lasting impact on energy security. Although numerous energy measures were taken to solve the energy problems in France, these crises had lasting effects on subsequent energy development, such as the uncertainty of energy prices. Energy development was also slowed down by the lag in economic development during the epidemic.

3.2.3. Domestic Political Party Divisions and Social and Livelihood Conflicts

In 2022, France's domestic parties will no longer be polarized between the left and the right [13]. Many new types of political parties are emerging, which has also led to different differences in how French political parties approach energy development decisions. At the beginning of the 20th century, the Socialist Party played a pivotal role in France, and has long been the ruling party in the country, leading and restraining other parties and politics, with the left and right parties as the main checks and balances in France. However, in the 21st century, at the time of the 2017 general election, France's domestic political parties blossomed, and the two major parties, the Socialist Party and the Democratic Party, are on the decline [14]. With globalization and the development of other leadership forces, France has seen the growth of extreme political parties (such as the far-right Rassemblement National and the far-left) and new, non-traditional political parties (such as the République En Marche (REM) party, which Macron is leading in the general election) [15]. According to French media sources, in 2022, as a member of the Socialist Party, a traditional center-left party, French Prime Minister Elisabeth Bornet announced that France needs to overcome the energy crisis through decarbonization and energy conservation, but the French opposition does not agree with this measure. On the other hand, the Baath party, represented by Macron, stated at the time of the election that France would become a country of new creations, and Socialist Party member Dominique Poitiers called for "getting rid of the European absurdity" of correlating the price of electricity with the price of natural gas [16]. In addition to domestic political party divisions, France's domestic social and livelihood conflicts are also contributing to its energy problems. After Macron took office, he made ecological transition the main goal of his next term, but according to the latest 2022 poll conducted by the French Elabe Polling Institute for BFMTV and L'Express, about one half of the respondents believe that ecological transition is not the first priority for France at present, and that the country should turn its attention to purchasing and economic growth instead. attention to purchasing power and economic growth [17]. As the ecological transition strategy requires the closure of a large number of nuclear power plants and the development of renewable energy, this has resulted in a serious shortage of electricity resources in France. The high price of electricity in the winter has put a burden on society and people's livelihoods, which has triggered a lot of social discontent and hindered France's eco-transformation strategy. The cold winter for the large demand for electricity, so that France will focus on natural gas imports, so that the domestic energy demand and ecological transition strategy to achieve a balanced state, which also for the current energy problems faced by France planted a seed.

4. DIRECTIONS AND MEASURES FOR THE ENERGY TRANSITION IN FRANCE

In order to respond positively to the green energy policy of the European Union, France has been focusing on climate change and reducing the share of nuclear energy and fossil energy, and has been making continuous efforts to achieve the goal of carbon neutrality. As a result of the new energy crisis, France has had to accelerate the pace of its energy transition and adjust and improve its energy development strategy.

4.1. Direction: Carbon-neutral Strategy as the Main Focus, Complemented by Nuclear and Renewable Energy Development Plans

Guided by climate change and EU policies, the main direction and trend of France's current energy transition is to achieve carbon neutrality. Under the influence of the Russian-Ukrainian conflict, France has accelerated the pace of its energy transition by introducing a policy bill to accelerate the development of renewable energy and vigorously develop nuclear power [18]. As a result of the impact of global climate change, the European Union convened a climate change conference in Paris, France, and enacted the Paris Climate Agreement, which calls on European Union countries to reduce carbon dioxide emissions and phase down the development and use of fossil energy sources [19]. Actively developing new energy sources to achieve carbon neutrality. France has enacted energy policies in 2015, 2017 and 2019 to respond positively to the energy transition strategy for carbon reduction [20]. Setting a goal of carbon neutrality by 2050 [21]. Although the current impact of the Russian-Ukrainian conflict has made France's energy transition a difficult path, the direction of France's long-term energy transition remains carbon neutral [22]. In 2024, France's draft bill on energy sovereignty emphasizes the expansion of nuclear energy, which is a further response to the transition to a new energy crisis [23].

4.2. Measures for Energy Development

4.2.1. Active Response to and Implementation of EU Policies to Address the Energy Crisis

According to the news released by the European Commission: at the time of the energy crisis, the European Union combined with the different degrees of damage in each country and region to introduce the energy crisis policy, France and other EU countries to reach a consensus and joint efforts to deal with the energy crisis.

With regard to stabilizing energy prices, the EU has expanded its energy price toolbox mainly to include short-term market interventions and long-term improvement measures [24]. For short-term market interventions, the EU proposes that governments can achieve this mainly through tax cuts, energy subsidies and energy efficiency. For example, on October 18, 2022, the European Commission proposed the continuation of the gas price limitation mechanism and energy subsidies for household and commercial electricity, and France is also actively pursuing short-term interventions. According to Eurostat data, France's household and commercial untaxed electricity prices in 2022 will increase at a relatively flat rate; France also subsidizes domestic fuel consumption, and after the outbreak of the Russian-Ukrainian conflict, the price of diesel gasoline in France rose over 2 euros/liter, and the government immediately announced that it would receive a discount of 0.15 to 0.18 euros/liter for each liter of gasoline added to the pump [25]. With the low availability of hydropower and nuclear power generation in EU countries due to extreme weather and prices, the European Commission has agreed to reduce electricity demand and capture unintended energy sectors to allocate more revenue to citizens and industry. For long-term interventions, the EU proposes to actively develop clean and green energy, develop energy storage capacity, and revolutionize energy efficiency. According to the EU implementation plan, EU countries need to achieve the target of 90% natural gas reserves by October 1, 2022, as a way to survive the harsh winters.

For energy security, the European Union has put forward the REPower EU program, hoping to gradually get rid of the dependence on Russian energy imports through the cooperation of EU countries. The program aims to reduce energy imports from Russia through internal cooperation among EU countries, energy sharing and energy reserves. According to Enerdata, the French energy statistics institute, France is already sending natural gas to Germany and Germany is transferring excess electricity resources back to France, thus realizing the goal of energy solidarity in the context of the Russo-Ukrainian conflict [26].

4.2.2. Restarting and Vigorously Developing Nuclear Energy

Under the double pressure of blocked energy imports and insufficient energy supply, France has promptly adjusted its domestic energy development strategy by restarting and vigorously developing nuclear energy as a means of bridging the gap caused by blocked energy imports and insufficient energy supply.

According to the official website of the French National Assembly, after the beginning of the Russian-Ukrainian conflict, France held no fewer than 10 hearings on energy independence and development, and all the members of the National Assembly discussed the energy crisis currently faced by France and debated the direction of the future energy transition, and France ultimately proposed that the measure that can maintain the domestic energy balance in the short term is to restart the nuclear energy program, open up nuclear power plants that have been shut down to achieve carbon reduction goals and upgrade these old nuclear power plants to improve their efficiency and accelerate the development of nuclear energy. The measures proposed by France to maintain its energy balance in the short term are to relaunch its nuclear energy program, to open up the nuclear power plants previously shut down in order to achieve carbon reduction targets, to upgrade these old plants, to improve their efficiency and to accelerate the development of nuclear energy. To this end, the bill on procedures for accelerating the construction of new nuclear facilities in the vicinity of existing nuclear facilities and the operation of existing facilities has been undergoing a process of revision, reading and finalization, culminating in the publication on June 22, 2023 of the text of a law on procedures for accelerating the construction of new nuclear facilities in the vicinity of existing nuclear facilities and the operation of existing facilities [27]. In addition to this, in 2023 France also released an investment plan for small nuclear reactors for 2030, which will invest 1 billion euros by 2030 in the development of small, innovative and better waste management nuclear reactors in France [28]. In 2024, France's Energy Transition Minister Agnès Pannier-Runacher said the French government submitted a bill on the independence of energy sovereignty to Parliament in January. The French government plans to build six European Pressurized Water Reactors (E PWRs) and eight more in subsequent developments, increasing the development of nuclear energy, which will change France's share of nuclear energy in the future [29]. Reform and full nationalization of Electricité de France to ensure the further development of nuclear energy and renewable energies [30].

Given the importance of nuclear energy in the development of the European Union, the restructuring and acceleration of France's nuclear energy program is likely to lead to a corresponding change in the energy landscape within the European Union. In the future, France's energy position in the EU is likely to increase.

4.2.3. Accelerating the Development of Renewable Energy Sources

Even before the Russian-Ukrainian conflict, the European Union had already included the development of renewable energies in order to achieve carbon neutrality, mainly hydrogen, solar, wind and hydroelectric power, and biomethane energy. The Russia-Ukraine conflict has accelerated the development and transition of renewable energy in France and the EU as a whole. On March 10, 2023, France published legislation to accelerate the production of renewable energies and promote a new wave of renewable energy development [31].

Firstly, in the area of offshore wind and hydroelectric power generation, France has been working to fill the energy gap and accelerate the pace of the energy transition by providing legislative, financial and planning support for offshore wind and hydroelectric power generation. According to the content of the legislative document enacted in 2023 to accelerate the production of renewable energy, France will be each offshore façade to establish a map prioritizing the establishment of marine and terrestrial areas within ten years from the date of its release, the use of wind energy in the production of renewable energy offshore installations and their connection to the public transmission network, the document also specifies the development of offshore wind power by 2050 priority areas and the establishment of a series of penalties. The document also identifies priority areas for offshore wind development by 2050 and sets out a series of penalties for non-compliance. In addition, the French Senate held a hearing on technological innovations in offshore wind power, in an effort to find innovative ways to develop offshore wind power [32].

With regard to the development of hydrogen energy, as a clean energy source, hydrogen has long been recognized by the European Union as one of the elements of its energy transition strategy. France has also made the development of hydrogen energy an important element of the renewable energy transition. According to the France 2030 plan shows that since hydrogen energy is exactly why we reduce emissions and optimize consumption, which will allow us to revolutionize our model through new practices France has specifically set aside a place for hydrogen energy development. According to the plan, France has developed a 7 billion euros carbon-free hydrogen strategy, and the France 2030 program will add nearly 2 billion euros to help accelerate development [33].

5. PROSPECTS AND REFLECTIONS ON FUTURE SINO-FRENCH ENERGY COOPERATION

5.1. Prospects for Future Sino-French Energy Cooperation

First of all, in 2024, which is the 60th anniversary of the establishment of diplomatic relations between China and France, China and France will have more exchanges in economy, politics, culture and other aspects, which also lays a good foundation for future energy cooperation; secondly, China and France have always been adhering to the direction of carbon reduction in the energy sector, and France plans to achieve the goal of carbon neutrality by 2050, while China strives to achieve carbon peak by 2030, and to achieve the carbon neutrality goal by 2060. In order to cope with the new round of energy crisis, both China and France are focusing on the development of renewable energy, and there are promising prospects for cooperation between China and France in the development of renewable energy in the future. France has introduced a plan to accelerate the development of renewable energy and speed up the pace of energy transition; China's renewable energy development prospects and market is broad, according to China's Ministry of Ecology and Environment released in October, "China's Climate Change Policies and Actions 2023 Annual Report", by the end of 2022, China's proportion of non-fossil energy consumption to reach 17.5%, the total installed capacity of renewable energy to reach 1.213 billion kilowatts. billion kilowatts. In order to achieve the carbon reduction goals, the cooperation between China and France in the field of electricity and hydrogen energy is more prominent.

So far, Sino-French power cooperation has a history of 40 years and has gone through the stages of nuclear power, thermal power and wind power cooperation. Under the guidance of the latest draft of the French bill on energy independence and sovereignty, China and France will further deepen their cooperation on nuclear power in order to realize their respective energy transition and carbon neutrality goals. China and France could deepen nuclear energy cooperation in terms of new nuclear power projects in China and third-party markets, as well as deepening cooperation in the research and development of cutting-edge nuclear power technologies. In addition to this, France has recently been innovating offshore wind power technology, and future Sino-French cooperation in its field will be a

trend; according to the European Times, China is the world's largest investor in clean energy. According to the International Energy Agency's statistics, China's clean energy investment reaches $380 billion in 2021. The International Clean Energy Agency predicts that China's clean energy investments will expand, and that China has a bright future in clean energy. France in the development of hydrogen energy can be said to be among the best, in September 2022, according to the European Times reported that France announced that it would build 10 plants to develop carbon-free hydrogen energy production industry, the future cooperation space is huge, as a large country of carbon dioxide emission law, China can accelerate the development of hydrogen energy through cooperation with France, reduce carbon dioxide emissions, and realize the goal of carbon peak as soon as possible [34].

5.2. Reflections on Sino-French Energy Cooperation

First of all, energy security is a national priority, in the search for energy transition road at the same time to be vigilant by other countries to choke the throat of energy, energy sanctions. According to Xinhua about France and Germany on the U.S. energy to take the opportunity to increase the price of news reports to see, under the Russian energy sanctions, France had to increase the amount of natural gas energy imports from the United States and Norway, and the United States at this time the price of natural gas energy prices rose directly to the previous price of four times the price of natural gas energy, causing strong dissatisfaction with the European Union countries, but France still have to rely on this part of the energy imports to make up for the Russian energy imports decreased in the gap. Russia's energy imports to reduce the gap [35]. Therefore, the basis of Sino-French energy cooperation is to guarantee the energy security of the two countries, to implement the energy transition strategy suitable for their own countries, and to maintain national energy security and independence.

Secondly, energy cooperation needs to be based on national energy conditions. In the wake of the Paris Conference, the European Union has advocated a reduction in the use of fossil fuels and carbon dioxide emissions by its member States. While exploring its own path of energy transition, France has never given up the development of nuclear energy. At France's insistence, the EU finally included nuclear energy as a clean energy source. Due to Russia's energy sanctions, France's domestic natural gas energy supply is insufficient, and it is nuclear power generation that makes up for this big gap. The future energy cooperation between China and France should follow the path of their own domestic energy development, in order to complement each other.

Finally, there are still some obstacles to the future energy cooperation between China and France. Firstly, the energy structure of China and France is quite different, and the breadth of energy cooperation has yet to be developed; secondly, the instability of the external international environment has brought certain negative impacts on Sino-French energy cooperation, and due to the intertwining of national interests, France's future policy towards China needs to be further explored; and thirdly, the uncertainties of the domestic factors of China and France, such as the political parties in France, the direction of China's future development and other factors will all have a certain impact on Sino-French future cooperation. have a certain impact on the future cooperation between China and France.

REFERENCES

[1] International Energy Agency. Low-Carbon National Strategy[R].2020.

[2] Hu Desheng The structural transformation and institutional evolution of energy supply in Germany, France, and the UK, and their implications for China [J]. Journal of Xi'an Jiaotong University (Social Sciences Edition), 2022, 42 (04): 61-73.

[3] U.S.Energy Information Administration (EIA),"Europe is a key destination for Russia's energy Exports"(2022-03-14),https://www.eia.gov/today inenergy/detail.php?id=51618.

[4] U.S. Energy Information Administration. IEA Energy Prices Monthly [R].2023.

[5] International Energy Agency. European Union CO2 emissions allowances, natural gas prices, coal price index, and variable electricity generation costs, 2021-2023.Available online: https://www.seai.ie/search/?query=European+Union+CO2+emissions+allowances.

[6] Word Bank. France annual GDP growth rate. Available:https://data.worldbank.org/indicator/NY. GDP.MKTP.KD.ZG?locations=FR.

[7] Eurostat Statistics Explained. Natural gas price statistics[R].2023.

[8] The Centre for Research on Energy and Clean Air. Financing Putin's war: Fossil fuel imports from Russia in the first 100 days of the invasion[R]. https://energyandcleanair.org/publication/russian-fossil-exports-first-100-days/.

[9] The Centre for Research on Energy and Clean Air. Financing Putin's war: Fossil fuel imports from Russia in the first 100 days of the invasion[R]. https://energyandcleanair.org/publication/russian-fossil-exports-first-100-days/.

[10] The Centre for Research on Energy and Clean Air. Weekly snapshot - Russian fossil fuels 13 to 19 March 2023[R]. https://energyandcleanair.org/weekly-snapshot-russian-fossil-fuels-13-to-19-march-2023/.

[11] France 24. C'est en France. https://youtu.be/G9UOaCJjGB4.

[12] Wu Chen, Niu Wenjuan, Li Hu, etc Analysis of Foreign Energy Transition Strategies and Electricity Pricing Systems under the Low Carbon Background and Reflections on Their Implications for China [J] Electricity Demand Side Management, 2022, 24 (01): 111-116.

[13] Bolet, D. 2022. "The janus-faced Nature of Radical Voting: Subjective Social Decline at the Roots of Radical Right and Radical Left Support." Party Politics 28 (4). Accessed 11 May 2022. https:// journals.sagepub.com/doi/full/10.1177/13540688221085444.

[14] Zhang Ji The transformation of political party structure and the development dilemma of the French Socialist Party [J]. Contemporary World, 2021 (11): 53-57.

[15] Andrew K. France's party system in 2022[J]. Modern & Contemporary France,2022,30(4).

[16] Plateforme de l'info. Le Premier Ministre français pousse la transition énergétique[R].2022. Available:https://www.afp.com/fr/search/results/Le%20Premier%20Ministre%20fran%C3%A7ais%20pousse%20la%20transition%20%C3%A9nerg%C3%A9tique?solrsort=ds_afp_date%20asc.

[17] Meng Ziqi France's Carbon Neutrality Strategy: Goal Setting, Implementation Path, and Prospect Analysis [J]. French Research, 2023, (02): 68-85.

[18] CRE, "La CRE publie son avis sur le projet de loi relatif à la souveraineté énergétique"(2024-01-25).Available: https://www.cre.fr/actualites/la-cre-publie-son-avis-sur-le-projet-de-loi-relatif-a-la-souverainete-energetique.

[19] KARTAL M T, PATA U K, KıLıç DEPREN S, et al. Effects of possible changes in natural gas, nuclear, and coal energy consumption on CO2 emissions: Evidence from France under Russia's gas supply cuts by dynamic ARDL simulations approach [J]. Applied Energy, 2023, 339.

[20] IEA. Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action[R].2018.

[21] IEA. Law on Energy Transition for Green Growth (LTECV)[R].2015.

[22] Emilien R, Frédéric G, Franck N. Is a fair energy transition possible? Evidence from the French low-carbon strategy[J]. Ecological Economics,2022,196.

[23] Nouvelle d'europe, France plans to build 14 nuclear reactors. Available: https://www.euronews.com/.

[24] European Commission. EU actions on high energy prices and security of supply[R].2022.

[25] Liu Fang France takes multiple measures to maintain energy price stability [N]. Economic Reference Report, September 6, 2022 (002).

[26] Enerdata. France starts sending gas to Germany at a volume equivalent to 1.2 bcm/year[R]. Available:https://www.enerdata.net/publications/daily-energy-news/france-starts-sending-gas-germany-volume-equivalent-12-bcmyear.html.

[27] Sénat. l'accélération des procédures liées à la construction de nouvelles installations nucléaires à proximité de sites nucléaires existants et au fonctionnement des installations existantes[R].2023.

[28] IEA. France 2030 Investment Plan"- Small Modular Reactor investment[R].2023.

[29] Euronews,France plans to build 14 nuclear reactors. Available: https://www.euronews.com/.

[30] Euronews,The power generation company will be fully nationalized and delisted,. Available: https://www. euronews.com/.

[31] Sénat. Dossier Législatif : LOI n° 2023-175 du 10 mars 2023 relative à l'accélération de la production d'énergies renouvelables [R].2023.

[32] Assemblée nationale. Audition sur les innovations technologiques de l'éolien offshore partager[R].2023. Available:https://www.assemblee-nationale.fr/dyn/actualites-accueil-hub/audition-sur-les-innovations-technologiques-de-l-eolien-offshore.

[33] IEA. “France 2030" Investment Plan- Hydrogen sector funding[R].2022. Available: https://www.iea.org/policies/14465-france-2030-investment-plan-hydrogen-sector-funding.

[34] Wang Bing Sino French power cooperation from the perspective of energy transition: characteristics, opportunities, and challenges [J]. French Research, 2022 (02): 19-33.

[35] French people. La France et l’Allemagne exaspérées par le prix excessif du gaz américain[R].2022. Available:http:///french.peopledaily.com.cn/International/n3/2022/1013/c31356-10157590.html.