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THE SYNERGISTIC IMPACT OF GREEN FINANCE AND ENVIRONMENTAL REGULATIONS ON ENERGY RESILIENCE: EVIDENCE FROM OECD NATIONS

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ABSTRACT

This study examines the effects of green finance and environmental regulation on energy resilience across 38 OECD countries from 2001 to 2023, using World Bank panel data. Energy resilience is the capacity of energy systems to withstand, adapt to, and recover from economic, environmental, and geopolitical shocks while maintaining reliability and sustainability. Amid rising climate risks and market uncertainties, strengthening resilient energy systems has become essential. To ensure robust results, the study applies several econometric techniques, including variance inflation factor (VIF) analysis, fixed-effects models, and ordinary least squares (OLS) estimation. The findings show that both green finance and environmental regulation significantly enhance energy resilience. Green finance has a strong positive effect, underscoring the importance of sustainable investment in resilient energy development, while environmental regulations also support resilience outcomes. The study concludes that integrating green financial development with effective environmental policies can promote sustainability, innovation, and long-term energy resilience.

Keywords: *Green finance, effects on environmental regulation, energy resilience, renewable energy, Gross Domestic Product*

Introduction

Energy resilience is a strong, reliable energy system that helps businesses and communities play an essential role in enhancing energy-related interactions among the state, society, and the economy. Energy resilience continues to operate during emergencies and disasters, positively affecting business productivity and thereby improving sustainable economic development. Effective energy resilience policies have emerged as urgent measures to promote sustainability through low-carbon energy production and consumption and to support energy sources and sustainable economic growth (Dabbous et al., 2025). Resilience and energy efficiency may reduce energy weaknesses and promote mitigation. As the world faces environmental challenges, energy resilience can mitigate them and reduce environmental pollution. Two basic concepts in the conceptual structure of social and economic sustainability are energy resilience and sustainable finance (Lunde, 2023; Alim et al., 2025).

Energy resilience and sustainable finance are fundamental to achieving stable, sustainable economic growth, safeguarding the natural environment, and ensuring equitable resource distribution. Policymakers and governments have been deeply concerned about environmental degradation and have implemented numerous strategies to address environmental issues and promote renewable energy systems (Barbieri & Capoani, 2025). Energy resilience policies have become the

primary tools for enhancing the sustainability of low-carbon energy generation, consumption, and supply. Efforts have been made to encourage more sustainable, low-carbon business strategies in line with global scientific opinion to counter the effects of emissions and climate change. Energy resilience has become a fundamental concern for sustainable development amid climate change and intensifying geopolitical conflicts (Ohta, 2025).

Green Finance and Energy Resilience

Green finance refers to financial instruments such as loans, bonds, and investments designed to support environmentally friendly businesses or commercial initiatives. It is simply about investing in activities that benefit the planet. The key objective is to direct funds to projects that enhance environmental sustainability. These include clean technology, renewable energy production, and sustainable infrastructure development. In short, green financing facilitates the transition from the traditional, resource-intensive economic model to a low-carbon, sustainability-driven one. Such a financial mechanism can accelerate the development of renewable energy industries by reducing capital requirements and stimulating new development. Diversifying renewable energy will reduce dependence on fossil fuels, enhance energy security, and improve a nation's ability to absorb supply shocks, price fluctuations, and even weather disruptions. Therefore, green financing enables the creation of a more robust and stable energy system and supports sustainable economic growth (Wen et al., 2025).

Green financing and renewable energy are becoming important instruments for achieving environmental sustainability and enhancing economic stability. Green finance can play a crucial role in strengthening energy security by reducing reliance on fossil fuels through lower consumption and by accelerating the transition to cleaner, more diversified energy sources (Khan et al., 2022). Resilience is based on a diversified energy structure. It eliminates the risks of fuel price fluctuations, reliance on imports, and geopolitical theatre. Due to this combination, energy systems will be able to withstand external shocks, such as fuel price fluctuations, supply crises, and extreme weather conditions, more effectively. In sum, green financing should be promoted as a sound approach to long-term economic stability and to ensure the reliability of energy infrastructure and environmental safety (Cooper & Messina, 2023).

Green finance increases energy resilience and protects the environment. Essentially, energy resilience is the capacity of the energy system to recover after disasters such as climate change, natural calamities, or fuel shortages. Green financing funds environmentally friendly projects, making the energy system greener. It reduces reliance on imported fossil fuels and invests in renewable energy sources such as hydro, wind, and solar, thereby enhancing energy security and eliminating supply risks. These investments also drive advances in current storage technology and robust power generation grids (Gilchrist et al., 2021). Other initiatives that green funding drives include low-carbon technology, energy conservation, and smart grids. These efforts reduce greenhouse gas emissions while providing greater grid flexibility and reliability (Chang et al., 2022).

Green bonds are financial instruments issued by banks, governments, and non-governmental organizations to finance environmentally friendly projects. They have primarily been used to support renewable energy sources such as hydro, wind, and solar, thereby reducing reliance on fossil fuels. Green bonds contribute to climate targets and sustainable development by reducing harmful CO2 emissions (Aneja et al., 2023). Major players such as the World Bank also use green bonds to build climate-resilient energy infrastructure. Simply put, green bonds will build resilient energy systems that recover quickly from future aftershocks, thus enhancing sustainability (Lian & Li, 2024). To ensure long-term economic stability, management must become sustainable, as natural resources are being exhausted (Toromade et al., 2024), and to enhance energy resilience (Chen et al., 2023).

Environmental Regulation and Energy Resilience

Green environmental policies aim to ensure they do not cause severe harm to the planet while using natural resources more intelligently. They also promote clean, renewable energy, which reduces CO2 emissions. This enhances the

overall energy climate, making it healthier and more stable by minimizing pollution (Nabi et al., 2025). Governments present these rules to encourage greater production of renewable energy. Even a small investment in renewables will reduce reliance on fossil fuels. Using fewer fossil fuels provides a more stable power supply. Energy-efficient strategies enhance system performance and reduce unnecessary energy use. Supported by innovative eco-tech, improvements are being made in energy storage and smart grid construction. Through this technology, energy systems have become more resilient to climate shocks and other energy disruptions. Thereby, with a high level of reliability, flexibility and sustainability, green policies are powering energy resilience (Morshed, 2025; Nepal et al., 2024).

Global warming and climate change have become the biggest concerns for governments and decision-makers. The world's rising carbon emissions are endangering the world economy's ability to grow, as the cost of repairing the environment now exceeds the increase in emissions. To address these problems, economies around the world have stepped up efforts to tackle important environmental issues, analyzing how effectively strict environmental regulations reduce environmental impact through innovation and renewable energy sources (Song et al., 2024). Energy resilience sources may help reduce the effects of environmental change by eliminating air pollution and greenhouse gas emissions. Strategic investments in energy resilience and green financing are essential, as they are prerequisites for reducing greenhouse gas emissions and ensuring sustainable financial development (Meltzer, 2016).

The whole world has been working on environmental problems by determining how to preserve energy and natural resources. Due to the direct impact of climate change and global warming on energy resilience, governments and experts are no longer so careless. In fact, financial development supports the development of a shock-adaptive energy system, the reduction of CO2 emissions, and the advancement of green innovation. Green innovation also ensures environmental justice, the emergence of energy supply, and the establishment of robust infrastructure that every economy requires (Qudrat-Ullah, 2022). With green technology policies, energy becomes more reliable and less prone to environmental shocks, keeping economies on course to grow. Efficient use of natural resources also strengthens the energy system and supports sustainable growth. Both financial inclusion and environmental regulations support the adoption of clean energy alternatives. Healthy systems, with intelligent resource utilization, the development of green technology systems, and financial growth, are enough to keep systems in check during stress. Generally, green finance and innovation are important for establishing policies that maintain energy resilience and improve the economy without promoting environmental degradation. Financial development is important for facilitating the transition to green economic growth (Nauman et al., 2023; Dogan et al., 2022) and achieving sustainable development goals (Jin et al., 2023). To realize green growth, institutional arrangements and well-organized policymaking are key, regardless of the economy's status; the same holds for developing countries (Nur et al., 2025).

Literature Review

Green Finance and Energy Resilience

Jawadi et al. (2025) examine how green finance influences sustainable industrialization across 56 developing countries from 2000 to 2021, using panel data on these countries' development trajectories. The findings show that green finance significantly improves sustainable industrialization in most countries, with a stronger effect in Asia and South America. According to research, to combat unemployment, poverty, inequality, and social injustice, these countries must prioritize environmentally friendly finance (Khan et al., 2022). Alatrash et al. (2025) examined how green finance affected air quality and carbon emissions among industrial firms in China between 2008 and 2015. The results show that green finance reduces CO2 and air pollution, helps develop more sustainable corporate energy systems, and reduces SO2 and carbon dioxide. The findings are relevant to the growth of green financing and the decrease in emissions. The paper examined how green finance influences reductions in smoke emissions across 30 Chinese provinces and areas. It was found that

green finance plays a positive role in reducing haze-related air pollution, which can be achieved through refining industrial frameworks and advancing technological capabilities. Pollution reduction can be achieved through green finance and by minimising energy use. There is significant geographical disparity in green finance, with higher positions indicating greater efficiency. Decentralisation of operations and environmental enforcement reduces pollution (El Dessouky, 2024; Fan et al., 2024; Shi et al., 2024; Zhang et al., 2023; Cheng et al., 2023).

Qing et al. (2024) analysed the importance of green finance and renewable energy investments for achieving the Sustainable Development Goals and the outcomes of COP26. It examines whether the Programmes have any impact on environmental quality, economic sustainability, and carbon-neutrality goals using panel data from 12 Chinese provinces. The study underscores the need for clean energy and environmentally friendly financing to support stable country growth, minimize reliance on modern technologies, and promote environmentally friendly control. Another scholar was also reviewed on this matter (Qamaruzzaman, 2025; Xiong & Dai, 2023; Rasoulinezhad & Taghizadeh-Hesary, 2022; Sharma, 2022; Zhang, 2022). BRICS countries place high value on environmental sustainability because they are concerned about their dependence on fossil fuels, which contribute to increased greenhouse gas emissions. Carbon neutrality can be achieved through financial technology and green finance, leveraging annual time-series data from 2000 to 2018. Green finance, fintech, and energy innovation improve environmental quality, whereas natural resource rents and economic growth have a negative effect. BRICS nations prioritised the creation of green financial products and increased banks' capacity by providing green credit facilities. Different authors explored the same topic related to the result (Zaid et al., 2025; Sethi et al., 2024; Tariq & Hassan, 2023; Udeagha & Ngepah, 2023).

Kwilinski et al. (2025) examine the impact of green finance on the environment of interest and on countries within the European Union during 2008-2020. The study uses a spatial Durbin model and panel data to examine the relationships among green finance, governance, and social and environmental performance. The results show that green finance programmes have a positive impact on the environment by conserving natural resources, reducing greenhouse gas emissions, encouraging renewable energy initiatives, creating sustainable infrastructure, protecting ecosystems, and facilitating a transition to a low-carbon economy. Various authors have reported similar results on this topic (Habib and Khan 2025; Xing et al., 2024; Xie 2024; Minhas et al., 2024; Fu et al., 2023; Wang et al., 2023; Hunjra et al., 2023; Sun et al., 2023; Yang et al., 2022; Zhou et al., 2020).

Zheng et al. (2021) examine the effects of green finance on the sustainability performance of financial intermediaries in developing economies, including Bangladesh. However, the concepts of green finance and sustainable investment have become increasingly popular in the context of the Sustainable Development Goals (SDGs). The research also reveals the extent to which banks and non-bank financial entities across the country implemented green financing between 2015 and 2020. It turned out that, in terms of the total share of green financial activity (78.12 percent), the private-sector commercial banks make the largest contribution. Green financing is linked to the economic, social, and environmental aspects of the Sustainable Development Goals (SDGs). Moreover, 95 percent of bankers believe that green finance is instrumental to both short- and long-term banking strategies in Bangladesh (Abuatwan, 2023; Ziolo et al., 2021; Sinha et al., 2021).

Environmental Regulation and Energy Resilience

Alalmaee (2025) examined the quantity and quality of use across 40 countries over the 1990-2021 period, along with the intensity of environmental regulations, using annual data. It utilised the Environmental Policy Stringency Index (EPSI), which measures the stringency of environmental laws. The findings indicate that strict regulations reduce the availability of financial services and increase the levels and efficiency of the finance sector. The results would tell policymakers much about why they should balance financial development with environmental protection. The Environmental

Policy Stringency Index has a statistically significant impact on Total Financial Development. A similar outcome was also reported by other authors (Maghyereh et al., 2025; Akram & Srivastava, 2024; Mahalik et al., 2024; Hassan et al., 2023; Li & Shao, 2023).

Mihai et al. (2023) examined how stringent environmental regulations in OECD nations affect the use of renewable energy and greenhouse gas emissions. The results suggest that market-based instruments and technology-based policies can significantly reduce emissions. The study also shows that stricter emission rules and limits can play a major role in minimising risks from climate change. The effects of stringent environmental regulations and the shift to renewable energy on environmental characteristics in the BRICS countries were investigated. The study concludes that, although renewable power reduces carbon emissions, strict regulations are most effective at cutting emissions in BRICS countries. Similar outcomes were also reported by other authors (Wang et al., 2022; Syed et al., 2025).

Banga (2019) analysed the effects of stringent environmental regulations on bank performance over 21 years worldwide. It appears that stringent environmental regulations usually hurt bank performance, though the extent of this effect varies widely across developed and developing countries. The review points out that environmental rules should align with each financial institution's capacity and suggests exploring this theme by examining technological and geographical variables. It also discusses the flexibility of green bonds to help developing nations raise funds for mitigation and resilience. It describes the main forces behind and barriers to their borrowing, such as high transaction costs and a shortage of institutional frameworks. The report recommends leveraging national and regional development banks as intermediaries and offering assurances to local governments to overcome these barriers. Another author also analysed this matter (Nasim et al., 2025).

By analyzing data from 40 European countries, the study examines the long-term influence of fiscal expansion on ecological degradation. A large number of variables were collected between 1990 and 2019. It was found that measures to combat environmental degradation increase with foreign direct investment and institutional quality, but financial development negatively affects these measures. To retard environmental degradation over time, the report proposes going green by establishing effective institutions and regulations for green finance (Kharb et al., 2024; Afzal et al., 2022; Wang et al., 2022; Lee, 2020).

Rasheed (2024) examined how economic, environmental, and trade variables interacted across G7 economies between 1990 and 2022 and their implications for CO2 emissions. The paper uses multiple regression (MLR) models to analyse the roles of economic and environmental factors in CO2 emissions. It demonstrates positive correlations between GDP growth and employment, but negative correlations with income inequality. Negative correlations are observed with industrial and energy-related CO2 emissions, highlighting environmental challenges. The paper highlights that policymakers should focus on economic expansion, income inequality, and long-term trade relations. This issue was further explored by various authors (Hasan et al., 2022).

Theoretical Framework

Porter Hypothesis

Green finance focuses on projects and investments that benefit the environment by creating sustainable infrastructure, increasing energy efficiency, and using renewable energy. Being more sustainable and financially secure is easier for energy systems if they can access green finance (Han et al., 2024). By supporting new energy sources, reducing fossil fuel use, and advancing technology. Regulations may lead people to change their behavior, shifting from coal, which pollutes the air, to solar and wind, which do not. The result can be an increase in the energy system's ability to adapt and remain strong, which aligns with the Porter hypothesis in this case as well (Wang et al., 2019). The author points out that rigorous yet inventive laws promote industry development, boost efficiency, and introduce better technology. With this innovation, the energy grid's resilience is enhanced. However, the pollution haven hypothesis gives a different explanation. It shows that companies can set up or relocate to places with stronger environmental laws. The situation might lead to a loss of power system resilience in countries with tight policies and to less investment in domestic renewable energy

projects (Wu & Lin, 2022). The Porter Hypothesis highlights the extent to which a well-designed policy plays a crucial role. However, in an environment that is clear, consistent, and, in fact, stimulates creativity, there is a far greater likelihood of initiating innovation than in the alternative.

Pollution Haven Hypothesis

According to the pollution haven hypothesis, companies can shift their production facilities to countries with weak environmental laws and high pollution levels (Singhania & Saini, 2021). Their main aim is to reduce costs and increase profits. Strict rules discourage polluting enterprises and encourage the use of cleaner technologies. Strict environmental regulations, combined with green finance, may drive technological developments that improve energy resilience, including improvements in energy efficiency and the adoption of renewable energy. The pollution haven theory raises interesting questions about how to balance environmental preservation and economic growth, and about how green finance can mitigate the negative environmental impacts of industrialization. Developing countries may be more open to polluting businesses because of the potential for economic development, job creation, and the attraction of foreign direct investment (FDI) (Bashir, 2022). The Pollution Haven Hypothesis is simply an illustration of how environmental regulations may backfire if not properly managed, particularly in green finance and energy resilience. It warns that if businesses continue relocating their operations to jurisdictions with fewer regulations, the worldwide push for clean energy and sustainability may stall.

Methodology

The analysis examines the impact of several factors on Energy Resilience (EnRe), including Green Finance (GF), Environmental Regulation (ER), Gross Domestic Product (GDP), Foreign Direct Investment (FDI), and Carbon Dioxide Emissions (CO2). In this paper, the relationship between environmental stringency policy and the energy resilience dataset is leveraged for 38 OECD countries from 2001 to 2023. The data used in the paper are panel data, sourced from the World Bank.

$$EnRe = \beta 0 + \beta 1\, GFit + \beta 2\, ERit + \beta 3\, GDPit + \beta 4\, FDIit + B5\, CO2\, it + \varepsilon it$$

Variables Description

Variables	*Measurement*	*Sources*
Energy Resilience	Renewable energy consumption (% of total final energy consumption.	WDI
Green Finance	Volume of green bonds issued (USD, % of total bonds).	WDI
Environmental Regulation	OECD environmental policy stringency (EPS) index.	WDI
Foreign Direct Investment	FDI as % of GDP.	WDI
Gross Domestic Product	GDP (constant 2015 US$ or PPP).	WDI
Carbon Emission	CO_2 emission (metric tons per capita).	WDI

Results And Discussion

Table 1: Descriptive statistics

Variables	*Observations*	*Mean*	*Standard deviation*	*Minimum*	*Maximum*
EnRe	736	1.84e-09	1.159854	-1.448769	4.573627
ER	736	2.498861	1.155083	0	5.040079
GF	736	21.2676	16.54026	.8	82.9
CO_2	736	352.2158	932.2244	2.959	5888.309
GDP	736	37385.9	21885.32	5887.686	112417.9

Descriptive statistics summarize the primary variables we considered, based on 736 observations. The PCA index (an aggregate statistic based on principal component analysis) is centered at zero, as would be the case following the standard normalization operation. However, the SD is 1.16, and the values range from -1.45 to 4.57. Hence, the variation is massive in terms of country placement, with some far back and others trampling on others. The regulatory variable has a mean of 2.49 and an SD of 1.15; overall, it is mid-level, with high variation across countries, ranging from 0 (basically no regulation) to more than 5 (extremely strong regulation). Financial development, though it has a mean of 21.27 and a relatively large standard deviation of 16.54, is widely dispersed, indicating that some countries have fairly advanced finance and others are yet to catch up. A lower limit of 0.8 implies the presence of very poorly developed financial regimes in several economies, and an upper limit of 82.9 on the scale suggests well-developed financial sectors.

Table 2: Correlation Matrix and Variance Inflation Factor (VIF)

variables	*EnRe*	*ER*	*GF*	*Co_2*	*GDP*
EnRe	1.0000				
ER	0.0723	1.0000			
GF	0.7001*	-0.0984	1.0000		
CO_2	-0.2204*	0.0180	-0.2499*	1.0000	
GDP	0.1705*	0.3783*	0.1481*	0.1369*	1.0000

Variance Inflation Factor

Variable	VIF	1/VIF
ER	1.21	0.826049
GF	1.15	0.872317
CO_2	1.11	0.899580
GDP	1.27	0.788938
Mean VIF	1.18	

The correlation matrix and variance inflation factor (VIF) indicate that the pairwise correlations among the independent variables are generally low to moderate. None of the correlation coefficients exceed the commonly accepted threshold for multicollinearity.

Table 3: Pooled Ordinary Least Squares Regression

EnRe	*Coef.*	*Std. Err.*	*t*	*P>|t|*	*[95% Conf. Interval]*
ER	.153081	.0216308	7.08	0.000	.1106152 to 0.1955467
GF	.0571558	.0015106	37.84	0.000	.0541903 to 0.0601214
-Cons	-1.598095	.0700918	-22.80	0.000	-1.7357 to -1.460491
Prob > F	= 0.0000		Adj R-squared = 0.6622		

The regression findings reveal the effects of the regulatory framework (ER) and green finance (GF) on energy resilience (EnRe). The model is crystal-clear, with a Prob of 0.000, indicating that

the two independent variables together explain a substantial amount of the variation in energy resilience. The coefficient of (ER) equals 0.153, which is positive and statistically significant (t = 7.08, p = 0.001). Essentially, regulatory framework enhancement increases energy resilience by 0.153 units, other things held constant, for each one-unit increase in regulatory quality, and the 95 percent confidence interval supports this relationship. GF is equally good; its coefficient is 0.057 (t=37.84, p<0.001). This indicates that the higher the availability and use of green finance, the greater the energy resilience, and that the large t-value reflects the strength of Geoffrey and Finance as predictors. The constant is negative and of large magnitude (−1.598, p < 0.001), suggesting that, in the absence of regulatory support and green finance, energy resilience would be significantly lower.

Table 4: Hausman Test

chi2(2) =	*1853.04*
Prob>chi2 =	*0.0000*

Table 5: Fixed Effect Model

EnRe	*Coef*	*Std. Err.*	*t*	*P>|t|*	*[95% Conf. Interval]*
ER	.0116085	.0215028	0.54	0.058	-.0306081 to 0.0538251
GF	.0510879	.0013662	37.39	0.000	.0484056 to 0.0537703
CO_2	-.0000478	.0000244	-1.96	0.050	-.0000957 to 1.72e-08
GDP	1.95e-06	1.12e-06	1.73	0.083	-2.57e-07 to 4.15e-06
-Cons	-1.115525	.0697805	-15.99	0.000	-1.252525 to -0.9785245
					Prob > F = 0.0000

The conditional effects regression findings examine the impacts of environmental regulation (ER), green finance (GF), carbon emissions (CO2), and economic growth (GDP) on the Energy Resilience Index (EnRe Index). The model accounts for any time-constant disparities among the units we are concerned with. The regression coefficient is positive (β = 0.0116), indicating that higher levels of regulation are associated with greater energy resiliency. However, the effect is not statistically significant at 5, (5) = 0.058, and, therefore, regulation, per se, does not appear to have a strong, valid influence on resilience at the sample period. The positive and statistically significant impact of green finance on energy resilience is β = 0.0511 (p = 0.01). This implies that the resilience increases as the quantity of green financial activities increases. To be more precise, a one-unit increase in green finance corresponds to an approximately 5.1 per cent increase in the energy resilience index, which is why sustainable finance is crucial to more robust energy systems. The CO2 emissions coefficient (β = -0.0000478) is negative and statistically significant at the 5% level (p = 0.050). This suggests that increased carbon emissions reduce energy resilience, underscoring how environmental destruction undermines the stability and sustainability of energy provision.

Discussion

Energy resilience can be defined as the capability of an energy system to anticipate, absorb, and

promptly recover from hiccups without disrupting supply and making it unstable, unreliable, or unaffordable (Wei et al., 2025). As the dangers of climate change, geopolitical drama, and unpredictable energy prices rise, energy resilience has become a top policy priority (Gholizadeh et al., 2025). With a unified vision of creating sustainable energy infrastructure, reducing reliance on fossil fuels, and maintaining long-term economic and environmental stability, the primary instruments we may employ to achieve this goal are green finance and environmental regulation (Razi et al., 2024). Green financing can be used to fund sustainable infrastructure, energy-efficient technologies, and renewable energy initiatives, as it has a significant impact on enhancing energy resilience (Jiakui et al., 2023; Kumar et al., 2022). Green financing, therefore, is an effective, secure approach to the energy system that will make us less reliant on fossil fuels and imported energy, of course, with investments in solar, wind, and other renewable energy sources (Zhang et al., 2021). Green finance further reduces exposure to supply shocks (such as price fluctuations, weather extremes, or political instability). It allows us to diversify our power sources. Through instruments such as green bonds, green loans, climate funds, and sustainable investment portfolios, green finance enables both government and corporate actors to invest in clean energy solutions that make systems more resilient and adaptable (Ding & Li, 2026). At a time when price shocks, supply disruptions, and geopolitical concerns can often undermine our continued reliance on fossil fuel supplies, such investments can help us reduce our reliance on foreign supply chains and imports (Kim et al., 2025). It is believed that green financing significantly increases the energy mix by supporting projects such as solar, wind, hydro, and biomass. It is an important aspect of resilience, as it reduces reliance on a few sources (Wang & Guo, 2026). The countries driving green financing are essentially increasing their self-reliance and reducing their exposure to shocks. Moreover, green financing pushes us to green buildings, green transit and green businesses. This reduces infrastructure's load-bearing capacity for low-carbon transport, smart industrial technology, and energy-efficient appliances (Al-Masri & Ibrahim, 2025). Stability is also enhanced by reducing energy consumption, particularly during peak periods or emergencies. Moreover, the savings in operational costs for both folks and firms are stronger, providing economic and energy resilience. Also, green finance is fundamentally an enormous stimulus package for new energy technologies, such as digital energy management devices, energy storage systems, and smart grids (Wongsinhirun et al., 2026; Chen et al., 2024). These works serve as a way to store additional renewable energy when the grid is depleted or you face an emergency, and smart grids are excellent for monitoring the entire system, which can be tailored in real time when something goes awry.

Conclusion

This Study examines the relationships among green finance, environmental policy strictness, and energy resiliency in OECD countries between 2001 and 2023. Using panel data and considering GDP, FDI, and CO2, tested the idea that these financial and regulatory instruments can, in practice, make our national energy systems more predictable, steadier, and sustainable, particularly in the face of geopolitical stressors, climatic disturbances, and economic volatility. In general, I wanted to find out whether the transition to greener financial frameworks and the introduction of stricter environmental regulations contribute to the functioning of a future shock-resistant energy system. The findings continue to indicate that green finance is an important stakeholder in increasing energy resilience. Both pooled OLS and fixed-effects analyses demonstrate that green finance is positively and significantly associated with energy resilience, substantiating the idea that it is a primary driver rather than a peripheral factor.

It supports the notion that, when aligned with sustainability goals, financial markets can be transformative. Green finance will help us become less reliant on fossil fuels by investing in renewable energy projects, smart grids, storage, efficient infrastructure, and low-carbon technologies, thereby providing a more diverse energy mix. In addition, a sustainable instrument reduces the vulnerability of high-carbon-intensity assets, alleviating transition risks arising from climate policies and climate-

change mitigation plans. Green finance also supports long-term planning by encouraging investors to look beyond short-term earnings. Taking an econ course and have been taught that instruments such as green bonds, climate funds, blended finance, and sustainability-linked loans essentially direct finance toward ventures that aim to balance wealth with the health of the planet. It is a redirection of funds that not only adds systemic resilience by integrating risk management, transparency, and accountability into our energy investments but also benefits the environment. Simply put, green finance is one of the elements on the path to cleaner, more flexible, diversified, and resilient energy systems. When implemented properly, foreseeably, and in an innovation-driven way, environmental regulations can provide a true progressive boost to tech innovation, energy efficiency improvements, and cleaner production. It is not surprising to find evidence that the converse is true. When the rules are either too strict or inadequately fixed, the cost of compliance is borne with little or no incentive to innovate, which is perversely counter-cyclical. These notes are consistent with the Porter Hypothesis, which holds that effective environmental regulations can spur innovation and confer a competitive advantage on companies. This allows companies to adopt technology flexibly by setting clear performance standards while still allowing them to achieve those standards. In such scenarios, regulation serves more as an impetus for system upgrades than a hindrance. Nevertheless, the data also align with the Pollution Haven Hypothesis: if regulations are too stringent and backed by finance, companies may either shift capital elsewhere or reduce their investments. The strictness of regulations is not enough; it must go hand in hand with green finance to achieve the best results.

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