УДК 339.13 (4)
DOI 10.14258/epb202548

ВОЗОБНОВЛЯЕМАЯ ЭНЕРГИЯ КАК МЕХАНИЗМ ПЕРЕХОДА К ЗЕЛЕНОЙ ТОРГОВЛЕ В ЕВРОПЕЙСКОМ СОЮЗЕ

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В исследовании используется описательная и аналитическая методология для изучения стратегии Европейского союза по включению возобновляемых источников энергии в качестве основного катализатора зеленой коммерции. Европейский зеленый курс позиционирует ЕС как мирового лидера в принятии технологий возобновляемых источников энергии для перехода к устойчивой экономике с низким уровнем выбросов углерода. В статье подчеркивается решающее значение возобновляемых источников энергии — солнечной, ветровой, гидроэнергии и биомассы — для сокращения выбросов парниковых газов и содействия экономическому росту посредством зеленой торговли. Инициативы ЕС, такие как Директива о возобновляемых источниках энергии (RED II) и Механизм корректировки пограничных выбросов углерода (CBAM), заметно ускорили переход к устойчивой энергетике, подкрепив обязательство ЕС по достижению климатической нейтральности к 2050 году. Технологии возобновляемых источников энергии повышают энергетическую безопасность и стимулируют зеленую коммерцию, способствуя потоку экологически устойчивых товаров и услуг в ЕС и с глобальными партнерами. Более того, финансовые инструменты (зеленые облигации и устойчивые инвестиционные инициативы в рамках Механизма справедливой трансформации) способствуют этой трансформации, гарантируя ее инклюзивность и экономическую осуществимость.

Исследование показывает, что возобновляемая энергия является основополагающим компонентом системы зеленой торговли ЕС, помогая соблюдать международные климатические соглашения и повышая конкурентоспособность на мировых рынках. Тем не менее препятствия сохраняются, включая технологическое неравенство среди государств-членов, значительные первоначальные инвестиционные расходы и сложную нормативную базу. В статье предлагается усилить трансграничное сотрудничество, увеличить финансирование инноваций и укрепить государственно-частное партнерство для преодоления этих препятствий.

Ключевые слова: возобновляемая энергия, зеленая торговля, Зеленый курс, выбросы газов, зеленые облигации, Европейский союз.

RENEWABLE ENERGY AS A MECHANISM FOR THE TRANSITION TO GREEN TRADE IN THE EUROPEAN UNION

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This study employs a descriptive and analytical methodology to investigate the European Union's strategy for incorporating renewable energy as a pivotal catalyst for green commerce. The European Green Deal positions the EU as a global leader in the adoption of renewable energy technology for the transition to a sustainable, low-carbon economy. The report emphasizes the crucial importance of renewable energy, such as solar, wind, hydropower, and biomass — in mitigating greenhouse gas emissions and fostering economic growth via green trade. EU initiatives, like the Renewable Energy Directive (RED II) and the Carbon Border Adjustment Mechanism (CBAM),

have markedly expedited the transition to sustainable energy, bolstering the EU's pledge for climate neutrality by 2050. Renewable energy technologies boost energy security and stimulate green commerce by facilitating the flow of ecologically sustainable goods and services within the EU and with global partners. Moreover, financial instruments like green bonds and sustainable investment initiatives under the Just Transformation Mechanism facilitate this transformation, guaranteeing its inclusivity and economic feasibility.

The research indicates that renewable energy is a fundamental component of the EU's green trade system, aiding adherence to international climate accords and improving competitiveness in global markets. Nonetheless, obstacles persist, including technological inequities among member states, substantial initial investment expenditures, and intricate regulatory frameworks. The report advocates for the enhancement of cross-border collaboration, the augmentation of innovation financing, and the fortification of public-private partnerships to overcome these obstacles.

Keywords: renewable energy, green trade, Green Deal, gas emissions, green bonds, European Union.

INTRODUCTION. Renewable energy includes energy from naturally occurring renewable sources, such as wind, solar, hydropower and biomass. The EU has been at the forefront of adopting renewable energy technologies as part of its broader strategy to transition to a sustainable, low-carbon economy. Renewable energy technologies also form an important part of green trade in the EU, contributing to reducing greenhouse gas emissions and supporting the EU's goals under the European Green Deal. The transition to renewable energy is crucial to boosting green trade within the EU and with its trading partners. This transition will impact various sectors, including energy production and distribution, manufacturing, transport, construction, and building efficiency. The EU has implemented several policies and initiatives to support the growth of renewable energy and green trade. This study will explore this.

1. Renewable energy policy in the European Union. The European Union has an ambition to reduce its carbon emissions by at least 55% by 2030 compared to 1990 levels. This is just a medium-term goal. The ultimate goal of the European Union is to become climate-neutral by 2050. To achieve this, the European Union must implement mechanisms and policies to help it achieve its ambitions. We will review these as follows:

— Gradual increasing price for carbon: A price that covers all emissions and increases gradually over time is the most efficient mechanism to ensure that households and companies modify their behavior to reduce emissions. The emissions trading system

— implemented by the European Union has succeeded in controlling emissions, but the coverage, which is still limited to electricity generation, should be expanded to include all sectors gradually. (Dora, Alfred, & James, September 24, 2020) [1].

— Using carbon pricing revenues to support sustainable growth: Carbon revenues can be used to reduce labor and other taxes, encourage productive green investments, and support those affected by the transition to a green economy. The International Monetary Fund study shows that with efficient use of resources, the economic cost of climate policies becomes very low in the short term, and in the long term the benefits become better, which improves air quality and reduces pollution, which is reflected in the positive economic health gains.

— Support green investments and targeted non-price policies: Carbon pricing alone is not enough to quickly overlap in many sectors, such as transportation and buildings. It has become necessary to adopt some complementary policies to address all carbon waste, the most important of which are financing and imperfect markets. For example, governments can direct the capital agreement towards infrastructure, including electric vehicle charging stations and electrical power grids to support the delivery of electricity through natural and clean sources.

— Ensure a fair transition: All segments of society that are most affected by the transition from traditional energy to cleaner energy should be supported. For the transition to be successful, it must be fair and equitable. This support can include providing direct transfers to low-income households.

— Prevent “carbon leakage” through global cooperation: EU emissions represent only 10% of global emissions, and the best way to reduce global emissions and prevent carbon leakage is by shifting high-emission production to countries with lower carbon prices. (European Commission, 2020) [2].

Mechanisms for achieving it: To achieve the goals of the “European Green Deal”, the European executive and legislative institutions have developed a package of political initiatives and laws, which

represent the legal and executive framework for putting the strategic climate plan into practice. These mechanisms include:

1. European Climate Pact: In December 2020, the European Commission launched the Climate Pact today, a Union-wide initiative calling on individuals, communities and organisations to take part in climate action and build a greener Europe. The Pact provides an open, inclusive and progressive climate action initiative. It calls on regions, communities, industry, schools and civil society to share information on climate change and environmental degradation and how to combat these threats, through an online platform. (EUROPEAN COMMISSION, 2024) [3]

2. Zero Pollution Action Plan: In May 2021, the European Commission adopted the EU Action Plan "Towards Zero Pollution of Air, Water and Soil", under which air quality standards will be closely aligned with the latest WHO recommendations, water quality standards, including for rivers and seas in the EU, will be revised, and the majority of EU waste laws will be revised to bring them into line with the principles of a clean and circular economy. (EUROPEAN COMMISSION, 2024) [4].

3. Organic Production Action Plan: The European Commission has developed a comprehensive organic action plan for the EU, with an action plan aimed at achieving the European Green Deal target of 25% of agricultural land under organic farming by 2030. The action plan is divided into three interconnected axes that reflect the structure of the food supply chain and the ambitions of the Green Deal sustainability goals: first, stimulating demand for organic products and ensuring consumer confidence. Second, stimulates the shift towards organic farming and strengthens the entire production chain. Third, it improves the contribution of organic farming to environmental sustainability.

4. Offshore renewables strategy: In November 2020, the European Commission presented the EU Offshore Renewables Strategy. This plan proposes to increase Europe's current 12 GW of offshore wind turbine capacity by at least 60 GW by 2030 and 300 GW by 2050. Over the same period, the Commission intends to complement this capacity increase with 40 GW of ocean energy and other emerging technologies such as floating wind and floating solar. (Commission européenne, 19 Novembre 2020) [5].

5. Methane Strategy: In October 2020, the European Commission presented the EU strategy to reduce methane emissions, the second largest contributor to climate change after carbon dioxide. It is also a powerful local air pollutant that causes serious health problems. It is therefore essential to combat emissions of this gas in order to achieve the goal of climate neutrality by 2020.

6. Chemicals Sustainability Strategy: In October, the European Commission adopted the EU Chemicals Sustainability Strategy, which aims to strengthen the protection of human health and the environment from harmful chemicals, with particular attention to vulnerable population groups, and includes: phasing out consumer products, such as toys, baby care products, cosmetics, and detergents, in particular endocrine disruptors. (EUROPEAN COMMISSION, 2020) [6].

2. The European Green Deal of the European Union. At the end of 2019, the European executive institutions approved a long-term strategic plan for climate transition called the «European Green Deal» that aims to make the European economy sustainable and transform it into a climate-neutral entity by 2050. To this end, a package of interim goals was set in the form of indicators to measure the achievement of the major goals, which are:

A. Increase EU climate ambition between 2030 and 2050: The EU has already begun modernizing and transforming its economy to achieve climate neutrality. Between 1990 and 2018, it reduced global warming by 23%, the economy grew by 61% and current policies will reduce emissions by 60% by 2050. (État de l'Union, 17 septembre 2020) [7].

B. Build and renovate in an energy- and resource-efficient way: Building requires a lot of energy and 50 million Europeans struggle to keep their homes properly heated. to meet the challenge of renovation and the EU's lack of income, and this renovation will contribute to reducing bills and poverty and unemployment.

C. Mobilise industry for a clean, circular economy: To achieve a circular economy, the full mobilisation of industry, especially the important raw materials needed for clean technologies, digital, space and defence applications, is a prerequisite for achieving this transformation. The EU needs climate entrepreneurs and resources to develop the first commercial applications of advanced technologies in key industrial sectors by 2030. Priority areas include clean hydrogen, fuel cells and other alternative fuels, energy storage, and carbon capture, storage, and utilisation. (European Commission, 2020) [2].

D. Supply clean, affordable, and secure energy: Decarbonising the energy system is crucial to achieving the climate transition goals. Energy production and use across economic sectors account for more than 75% of the EU's greenhouse gas emissions. The EU therefore needs to develop an energy sector that is largely based on renewables, complemented by a rapid phase-out of coal and decarbonisation. At the same time, the EU's energy supply must be secure and affordable for consumers and businesses. For this to happen, it is essential to ensure that the European

energy market is integrated, interconnected and digital, while respecting technology neutrality. The transition to climate neutrality also requires smart infrastructure. Increased regional and cross-border cooperation will help realise the benefits of the transition to clean and affordable energy.

E. Accelerating the transition to sustainable and smart mobility: Transport accounts for a quarter of greenhouse gas emissions in the EU and is still rising. To achieve climate neutrality, transport emissions need to be reduced by 90% by 2050. Achieving sustainable mobility means putting users first and providing them with accessible, healthier and cleaner alternatives to their current mobility habits. The Commission has developed a strategy for sustainable and smart mobility in 2020 that will address this challenge, tackling all sources of emissions. The EU will be committed to stepping up the production and deployment of sustainable alternative transport fuels; by 2025, around one million public recharging and refueling stations will be converted for the 13 million zero- and low-emission vehicles expected on European roads. (European Commission, 2020) [2].

H. Designing a fair, healthy and environmentally friendly food system: The European food system remains an environmental challenge, as food production continues to pollute air, water and soil, contribute to biodiversity loss and climate change, consume large amounts of natural resources, and a significant portion of food is wasted. The EU has therefore developed a «Farm to Fork» plan to address climate change, protect the environment and preserve biodiversity, which will focus on the Common European Agricultural Policy and Common Fisheries. The Commission's proposals for the Common Agricultural Policy for the period 2021–2027 stipulate that at least 40% of the overall CAP budget and at least 30% of the Marine Fisheries Fund will contribute to climate action.

3. Renewable energy is an infrastructure for green trade in the European Union. Evolving policies, geopolitical shifts and falling costs have accelerated the deployment of renewable energy in global markets. COP28 has set a target of tripling renewable energy capacity by 2030. 2023 set a new record for renewable energy deployment, adding 473 gigawatts to the global energy mix. To increase renewable energy capacity, approximately 1,100 gigawatts of renewable energy will need to be installed annually by 2030, more than double the record set in 2023. This suggests that annual investments in renewable energy generation will need to increase from $570 billion in 2023 to an average of $1,550 billion per year between 2024 and 2030.

FIRST: DEVELOPMENTS IN RENEWABLE ENERGY. The history of renewable energy in Europe dates back to the early 1990s, when Germany announced the first electricity feed-in tariff for renewable energy sources in the European Union in 1991. Less than 6 years after Germany's tariff, the European Union announced in 1997 the first indicative target for renewable energy, targeting 12% of the electricity mix by 2010.

The actual launch of renewable energy in Europe came from Denmark, which announced the first large-scale offshore wind farm in 2000, followed by the European Union issuing a directive on the production of electricity from renewable energy related to national indicative targets in 2001, and the European Union issued a directive on biofuels and renewables in 2003 in the transportation sector under the so-called «National Biofuel Targets.» In 2008, Spain launched the largest solar power plant in the world, «Omedilla,» with a capacity of 60 megawatts, sufficient to supply 40,000 homes with electricity annually, which was considered at the time the largest global project in the solar energy sector.

In 2009, renewables in Europe received a major boost from the European Union, with the future target raised to 20% by 2020. Onshore wind became cheaper than coal, gas and nuclear for the first time in 2014, a major development for the future of renewables in Europe. In 2018, the EU raised its renewables target to 32% by 2030, according to the Energy Research Unit. The biggest shift came in 2019, with wind and solar power overtaking coal for the first time in the EU. Global renewables continued to grow at record levels, reaching 3,372 gigawatts (GW) at the end of 2022, increasing renewables stock by a record 295 GW or 9.6%. 83% of the previous year's total new generation capacity came from renewables. This continued record growth reflects the resilience of renewables in the face of the ongoing energy crisis. Renewable hydropower accounted for the largest share of the global total at 1,256 GW, with solar and wind accounting for most of the rest, with total capacities of 1,053 GW and around 899 GW respectively. Other renewable energy capacity included 149 GW of bioenergy, 15 GW of geothermal energy, and 524 MW of marine energy, followed by wind at 75 GW, renewable hydropower at 21 GW, bioenergy at 8 GW and geothermal at a very modest 181 MW (International Energy Agency (IEA), 2022) [8].

A. Share of renewable energy in total final energy consumption. The share of renewable energy in the European Union as a percentage of total final energy consumption from 2010 to 2022, peaking at a share of 23.0% in 2022. Of its total final energy consumption from renewable sources in 2022, almost 1.1 percentage points higher than in 2021. This indicates a steady increase in the contribution of renewables to total energy consumption in the EU. The graph thus highlights a significant and consistent

rise in the share of renewable energy over 12 years. Starting from around 14% in 2010, the share increased to 23% by 2022. This growth reflects the EU's strong commitment to the transition to a low-carbon economy, driven largely by EU policies, such as the Renewable Energy Directive, which set binding targets for Member States to increase the share of renewable energy in their energy mix. These policies have boosted investment in renewable energy infrastructure and technology. Figure No. 1.

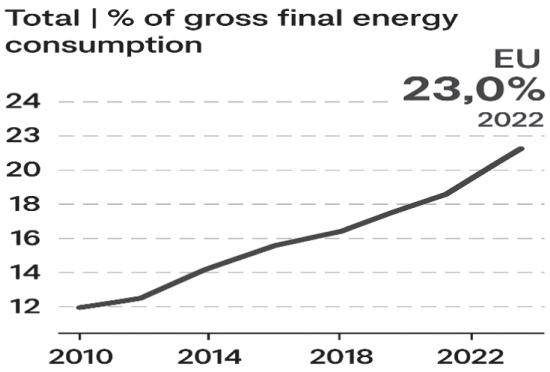

Fig. 1. Share of renewable energy in total final energy consumption. Source: (EUROSTAT, 2024) [9]

Figure 2 shows that the performance of each country varies greatly, with Sweden leading by a wide margin, with 66% of its energy coming from renewable sources. Finland, Latvia, Denmark and Estonia also performed well, each exceeding the 40% mark, while countries such as Portugal, Austria, Lithuania and Croatia are in the middle range, with a share of around 30–40%. Ireland and Malta have the lowest shares among the countries listed, at 13% and just above 13%, respectively

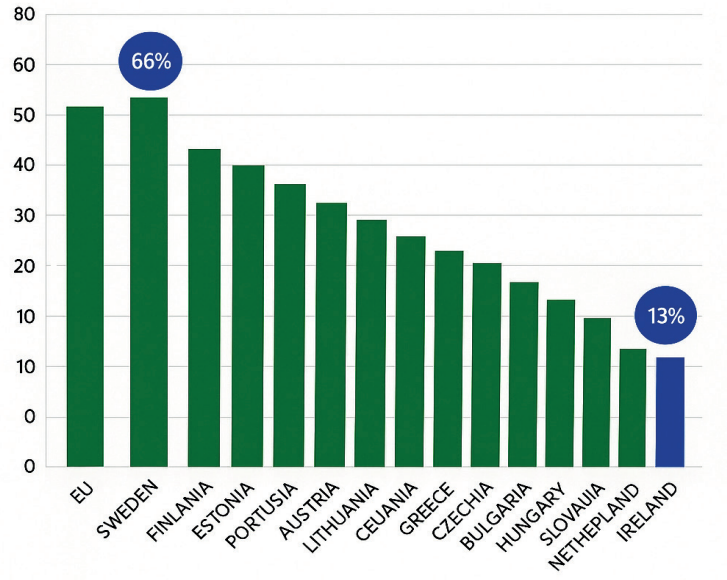

Fig. 2. Share of renewable energy in the European. Source: (EUROSTAT, 2024) [09]

B. Share of energy from renewable sources in total electricity consumption

The share of renewable energy in total electricity consumption of different European countries and the EU average in 2022 Norway leads significantly with a renewable share of over 120%, likely due to its extensive hydropower capacity and ability to export excess renewable energy, followed by Austria with a renewable share of around 100%, and several countries, including Sweden, Denmark and Portugal, have renewable shares of over 60%. The EU average is around 40%, indicating significant progress but also room for improvement. Countries such as Malta, Hungary and Cyprus are at the lower end, with shares of less than 20%. There is a wide range of performance across Europe, from over 120% to

less than 10%, although there are exceptions, with most Western European countries tending to have higher shares than Eastern European countries. Figure No. 3.

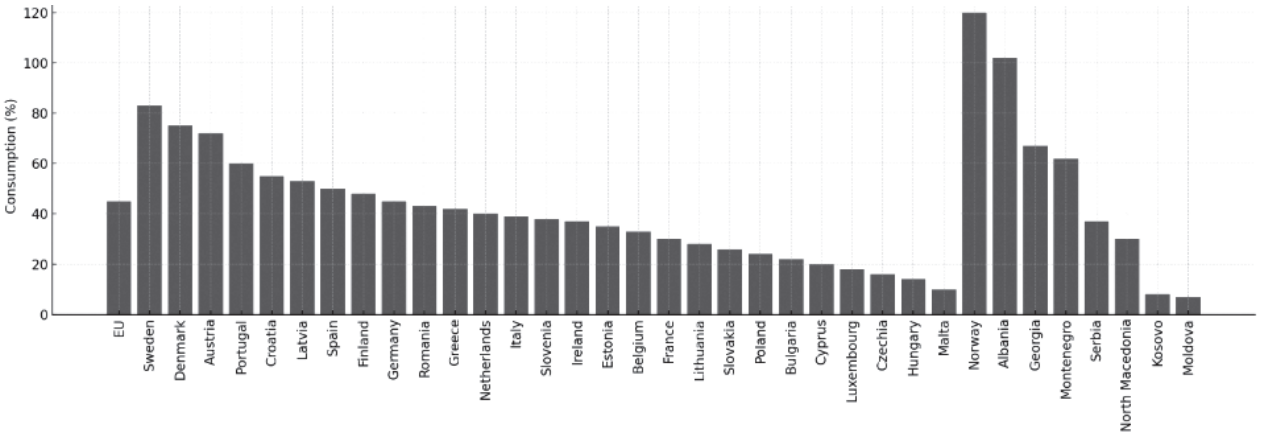

Fig. 3: Share of energy from renewable sources in total electricity consumption, 2022%.
Source: (EUROSTAT, 2024) [09]

C. Share of energy from renewable sources in transportation. Share of renewable energy in the transport sector for European countries in 2022, along with the 2030 target. Sweden leads significantly with a share of around 30% of renewable energy in transport, well ahead of other countries and already achieving the 2030 target. Finland comes next with a share of around 19%, the second highest among the countries shown. The Netherlands is third with a share of around 11% of renewable energy, while the EU average is around 10%, indicating that significant progress is needed to reach the 2030 target of 29% (as shown by the blue diamond). Most countries fall between 5% and 10% of renewable energy share in transport. Countries at the lower end include Croatia (around 3%), Latvia (around 2%), and Greece (around 5%). Non-EU countries such as Norway (around 24%) and Georgia (around 2%) are also included, showing a wide range. From performance, there is a stark contrast between the top performers (Sweden, Finland, and the Netherlands) and the majority of countries. Many Eastern European countries tend to have lower shares, with some exceptions such as Bulgaria, which has performed close to the EU average.

The 2030 target of 29% therefore seems ambitious for most countries, given their current situation, with only Sweden and Norway currently exceeding or coming close to the 2030 target. Countries such as Kosovo, Moldova, and Montenegro also show very low shares, close to 0%.

This highlights the disparities in renewable energy adoption in the transport sector across Europe. EU countries are also making the significant efforts that most countries will need to make to meet the 2030 target, with Sweden emerging as a clear leader in this shift. Figure No. 4.

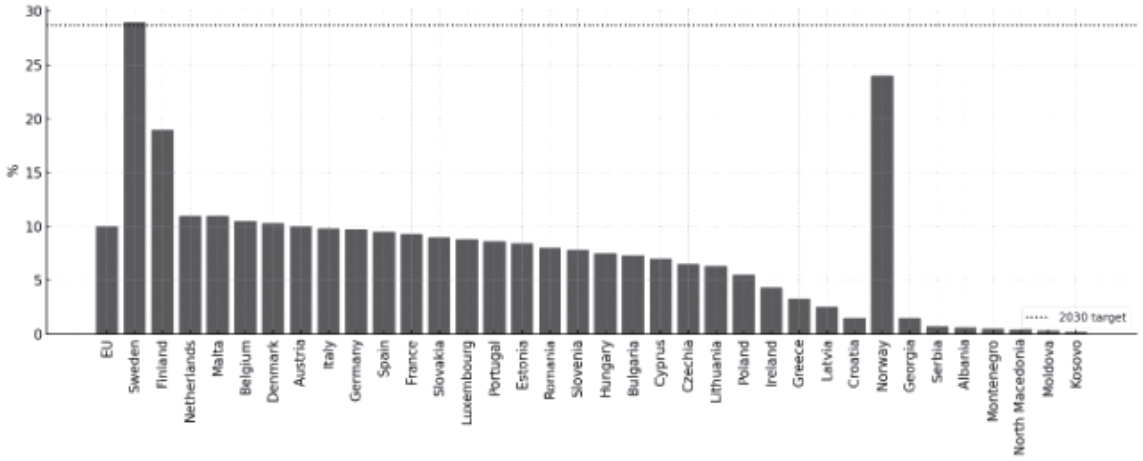

Fig. 4. Share of energy from renewable sources in transport for European countries, 2022%.
Source: (EUROSTAT, 2024) [10]

D. Greenhouse gas emissions. The EU net greenhouse gas emissions index from 2008 to 2022, with 1990 as the base year (the index is set to 100). The general trend indicates a significant decrease in greenhouse gas emissions over this period, which is reflected in the decrease in the index value, which reached 69.0 in 2022.

In the initial period (2008–2013): Graph No. 05 shows a decrease from around 84 to around 76. This continuous decrease indicates successful initial efforts to reduce emissions, probably due to the implementation of various EU environmental policies and regulations aimed at reducing industrial pollution and promoting renewable energy sources.

In the period (2013–2020): The index shows a more pronounced decrease, with noticeable fluctuations. The peak in emissions reductions in 2014–15 and the short increase in 2017–18 may reflect economic factors such as the recovery from the 2008 financial crisis, adjustments in industrial production, or shifts in energy policy.

2020–2022: There is a sharp decline, reaching its lowest point in 2021, due to the economic slowdown caused by the COVID-19 pandemic. The slight recovery thereafter may be related to the economic recovery after the pandemic.

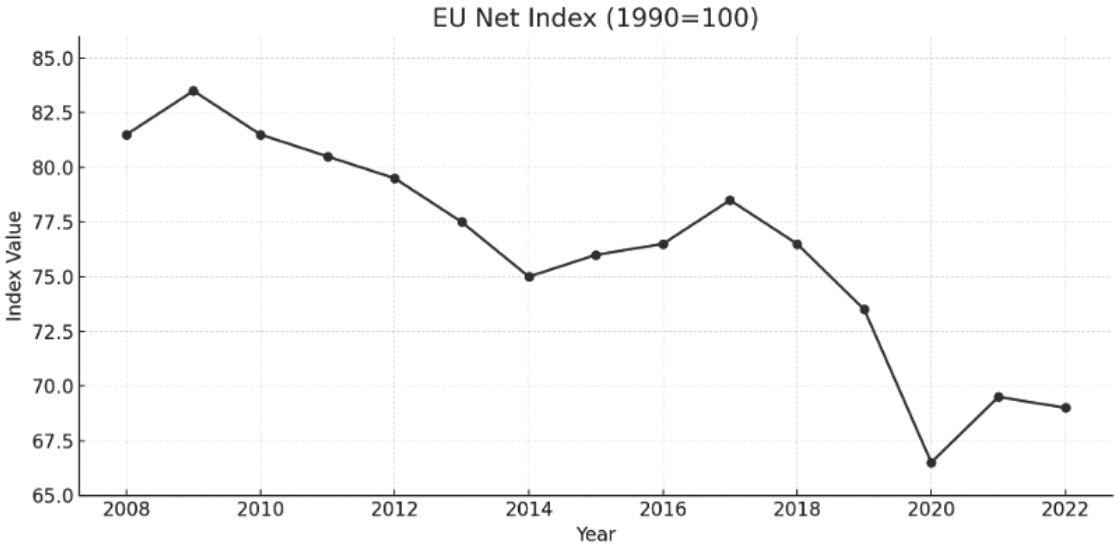

Fig. 5. The percentage of greenhouse gas emissions in the European Union. Source: (EUROSTAT, 2024) [10]

E: Green bond issuance. The growth of green bonds in the European Union as a percentage of total bonds issued from 2014 to 2022. The chart shows a clear upward trajectory in green bond issuance as a percentage of total bonds in the European Union, peaking at 8.85% by 2022. This indicates a growing commitment to sustainability and environmentally friendly projects within the region. The stages of green bond development and growth are as follows:

1. Early development (2014–2016): The early years show little growth, suggesting that green bonds were a niche market with relatively low adoption, due to a lack of awareness, fewer regulatory incentives, or limited demand for sustainable investment products at the time.

2. Growth phase (2017–2020): The share of green bonds starts to rise, especially around 2017. This period is likely to reflect increased awareness of climate change and a push by both the public and private sectors to finance sustainable projects. Policy initiatives and regulations put in place by the EU, such as the introduction of sustainable finance frameworks, also contribute to this growth. The increase in 2020 is also supported by the EU Green Deal and the alignment of financial markets with sustainability goals.

3. Accelerated growth (2021–2022): There is a sharp rise in the share of green bonds from 2021 onwards. This acceleration is driven by the EU's post-COVID-19 recovery plans, which have placed a significant focus on green investment as part of the NextGenerationEU fund.

Increased investor demand for sustainable investments and greater regulatory support are also key drivers. The figure of 8.85% in 2022 indicates that green bonds have become a significant part of the bond market, reflecting the EU's leadership in promoting environmental sustainability through financial markets. The chart also shows a strong and accelerating trend in the growth of green bonds within the EU. This is in line with global efforts to combat climate change and indicates that the EU is positioning itself as a

leader in sustainable finance. Continued support from regulatory frameworks and investor demand for green financial products has led to continued growth in this area. Figure No. 6.

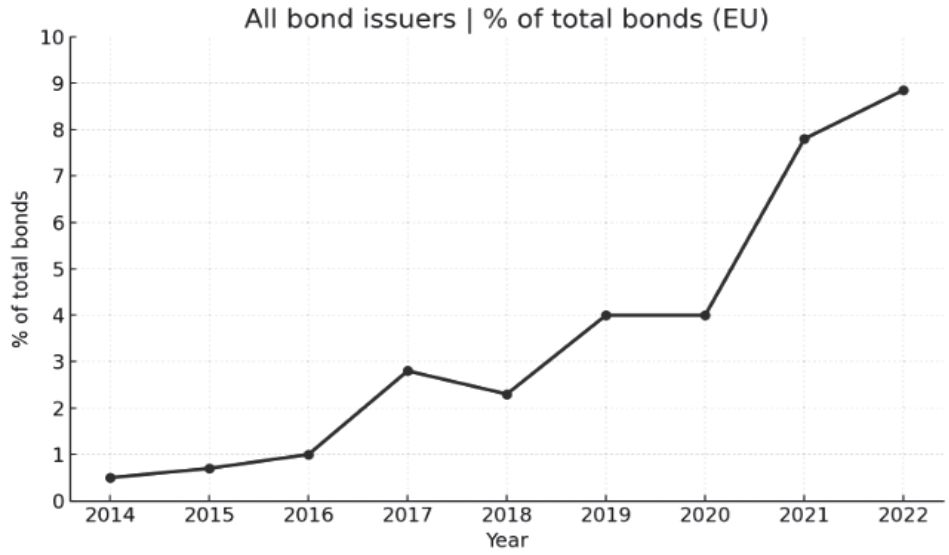

Fig. 6. Green bond issuance by issuer type. Source: (EUROSTAT, 2024) [10]

The pillars of green trade in the European Union

A. **Extra-EU in selected green energy products, 2022.** Non-EU trade (trade with countries outside the EU) in selected green energy products for 2022, measured in millions of euros. Figure 07 shows the following.

For solar panels, a large trade deficit is shown, with imports (around 22,500 million euros) exceeding exports (around 1,000 million euros). For liquid biofuels, there is also a slight trade deficit, with imports (around 5,000 million euros) exceeding exports (around 1,500 million euros). For wind turbines, there is a trade surplus, with exports (around 1,500 million euros) exceeding imports (around 1,000 million euros).

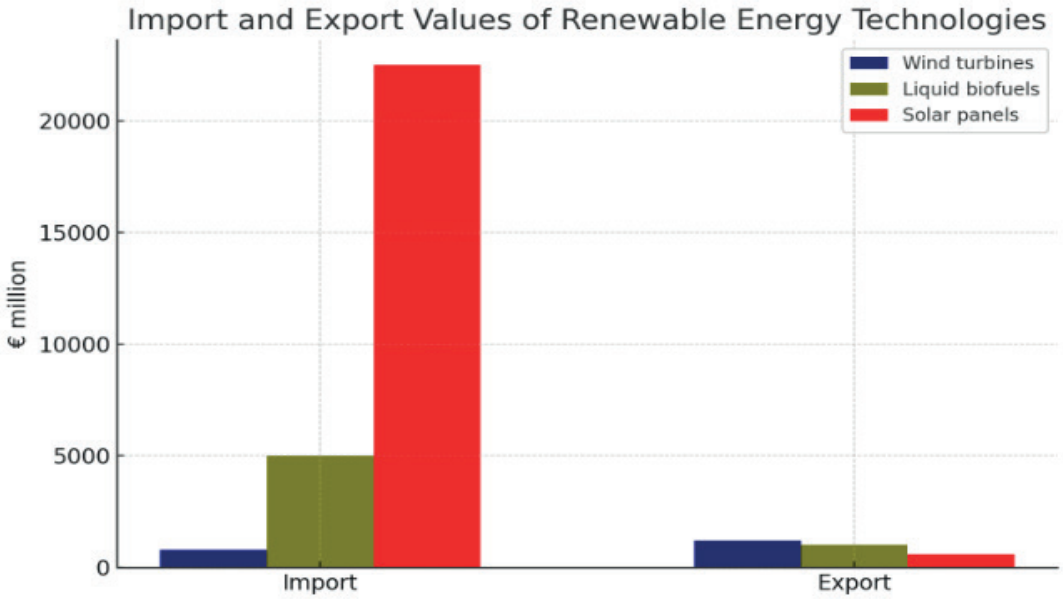

Fig. 7. Selected green energy products outside the EU, 2022. Source: (EUROSTAT, 2024) [09]

As for import dependence: The EU shows a high dependence on imports for solar panels and liquid biofuels, indicating a lack of local production capacity or cost competitiveness in these sectors. Exports: The EU shows export competitiveness in wind turbines, indicating a strong domestic industry in this sector. This

shows that it has a developed wind turbine industry capable of meeting domestic demand and competing globally. While the solar panel industry appears less developed, with a heavy reliance on imports. So the EU is making great progress in adopting green energy, there are opportunities to develop domestic industries further, especially wind turbines, to achieve trade balance and enhance energy security.

B: Extra-EU trade in wind turbines, 2022. Non-EU trade in wind turbines in 2022, broken down by percentage of imports and exports. China dominates EU wind turbine imports with 61%, with India the second largest source with 32%. Other countries account for 7% of imports. As for exports, the UK is the largest destination for EU wind turbine exports with 40%, the US is second with 17%, Canada receives 8% of exports, Taiwan accounts for 6%, Norway and Chile each receive 5%, Morocco accounts for 4%, and other countries together receive 15% of exports.

EU wind turbine imports are therefore highly concentrated, with 93% coming from just two countries (China and India). EU exports are more diversified, spread across multiple countries, although the UK and US together account for more than half. Figure No. 8.

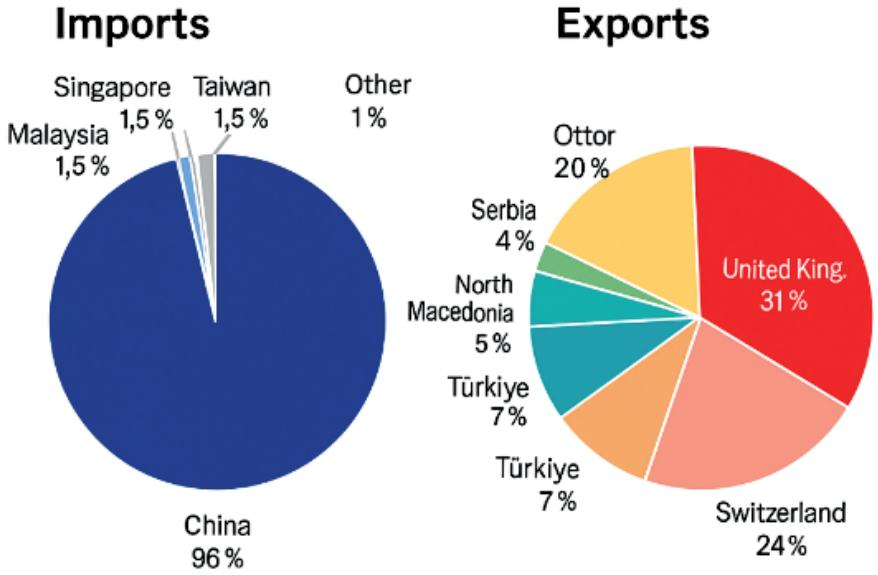

Fig. 8. Trade in wind turbines outside the EU, 2022. Source: (EUROSTAT, 2024) [09]

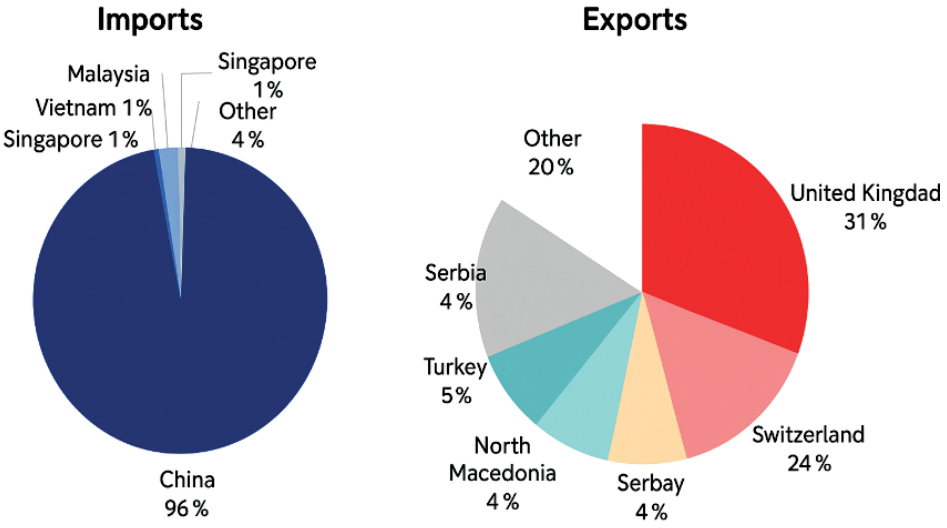

Fig. 9. Trade in solar panels outside the EU, 2022. Source: (EUROSTAT, 2024) [09]

C. Extra-EU trade in solar panels, 2022. Non-EU trade in solar panels in 2022, broken down by percentage of both imports and exports, China dominates EU solar panel imports with an overwhelming 96%, other countries (Vietnam, Malaysia, Taiwan and Singapore) each account for 1% of imports, the remaining 1% is attributed to «other» countries The UK is the largest destination for EU solar panel exports with 31%, Switzerland is the second largest export destination with 24%, the US receives 7% of exports, Turkey and North Macedonia each account for 5%, Serbia and Norway each receive 4%, other countries together account for 20% of exports.

The EU is, therefore, heavily dependent on China for solar panel imports, creating significant supply chain vulnerability. EU exports are becoming more diversified, with a focus on neighbouring countries and developed markets. Figure No. 9.

Conclusion. The steady increase in the share of renewable energy in the EU highlights the successful transition to a greener economy. Including enhanced energy security, job creation and new export opportunities in the global green technology market,

This growth in renewable energy not only boosts the EU economy, but also places it in a leading position in global green trade, influencing markets and policies around the world. However, to maintain this trajectory, the EU must continue to invest in technological innovation and address the challenges associated with integrating high levels of renewable energy into its energy system. Policies such as the European Green Deal, stricter emissions trading systems and investments in green technologies contribute to a sustainable reduction in global greenhouse gas emissions. Key findings of the study include:

— The EU's leadership in renewable energy technology has positioned it as a major source of green technologies and services. Countries around the world, especially in developing regions, look to the EU for technology transfer and expertise in building their renewable energy capacity.

— The increase in the share of renewable energy directly contributes to reducing global greenhouse gas emissions.

— By exporting renewable technologies and services, the EU strengthens green trade relations, stimulating the growth of green trade.

— As the EU increases its share of renewable energy sources, it also influences global market standards for renewable energy technologies, shaping regulations and best practices. This can create a competitive effect, prompting other countries to adopt similar standards, thus expanding markets for EU products.

— The continued decline in emissions suggests that industries are increasingly adopting cleaner technologies, which can involve significant capital investment.

— Reducing emissions is crucial for the EU's competitive position in international trade, especially as global demand shifts towards sustainable products and practices. EU leadership in reducing emissions can provide an advantage in future trade negotiations, especially with regions that prioritise sustainability.

— The shift towards a green economy, which includes increased jobs and economic activity in the renewable energy, energy efficiency and sustainable transport sectors.

— The continued growth suggests that the EU green bond market is maturing, with increasing acceptance among issuers and investors.

— Supports the EU in considering policies to boost domestic production of solar panels and liquid biofuels to reduce dependence on imports.

— Significant trade in these green energy products reflects the EU's commitment to renewable energy, balancing environmental goals with economic realities.

Study prospects:

— While the growth trend is positive, maintaining this momentum requires continued technological innovation. Investments in research and development are crucial for enhancing the efficiency of renewable energy technologies and further reducing costs.

— A higher share of renewable energy sources poses challenges related to energy storage and grid stability. The intermittent nature of some renewable sources, such as solar and wind, requires advanced grid management and storage solutions.

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Поступила в редакцию: 07.04.2025.
Принята к печати: 21.05.2025.