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Greening Sovereignty: Europe's Drive Toward a Sustainable Future

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Abstract
As climate challenges intensify, the European Union (EU) has embarked on an ambitious journey to integrate sustainability into the heart of its sovereignty, redefining governance, energy policy, and economic strategy. This paper examines the EU's "Greening Sovereignty" agenda, with a particular focus on flagship initiatives such as the European Green Deal, the Fit for 55 package, and complementary measures like the Renewable Energy Directive (RED II), the Carbon Border Adjustment Mechanism (CBAM), and the Emissions Trading System (ETS) reforms. Special attention is given to the transformative potential of green hydrogen as a cornerstone of Europe's energy transition, advancing the decarbonization of industries and fostering energy independence. By analyzing these legislative packages and directives, the paper explores how the EU balances ecological imperatives with economic growth, competitiveness, and geopolitical autonomy. The study also addresses the broader implications of Europe's leadership in sustainability for global climate efforts and regional integration. Ultimately, it illustrates how the EU is shaping a sustainable future by aligning sovereignty with environmental innovation and resilience.

Keywords: Greening Sovereignty, European Green Deal, Fit for 55, Green Hydrogen.

Introduction
Europe is making significant advancements in addressing climate challenges. Since the EU established its original climate goals, there has been notable progress in reducing greenhouse gas (GHG) emissions. As of 2005, the EU had successfully reduced emissions by 20% from 1990 levels, largely due to improvements in renewable energy adoption and greater energy efficiency. However, this progress has not been consistent across all sectors. While the energy supply sector has seen considerable reductions, emissions from the transport sector, particularly in international aviation, have continued to rise (Zavyalova & Popkova, pp. 87, 174, 181). In recent years, the EU has introduced a series of strategic climate policies to advance its sustainability agenda. The European Green Deal, which was launched in 2019, serves as a major step in the EU's commitment to achieving climate neutrality by 2050. This overarching policy is backed by the Fit for 55 package, which sets a target to reduce GHG emissions by 55% by 2030 in comparison to 1990 levels. Furthermore, EU climate strategies are focused on channelling public

investments into green sectors, fostering the growth of sustainable technologies. These efforts not only prioritize the decarbonization of critical industries but also tackle the economic and social challenges that arise from the transition to a low-carbon economy, enhancing the EU's long-term environmental and economic sustainability (Cerniglia & Saraceno, 2022). Additionally, the EU has introduced innovative policy measures such as the Renewable Energy Directive (RED), reforms to the Emissions Trading System (ETS) (Solorio & Jörgens, 2017), and the Carbon Border Adjustment Mechanism (CBAM), demonstrating its strong commitment to driving significant and measurable progress in climate action (Park, 2016). Building on these significant climate policies, the European Union (EU) has identified green hydrogen as a crucial component in its broader strategy for achieving climate neutrality by 2050. As part of the European Green Deal and the Fit for 55 package, green hydrogen is seen as a key solution for decarbonizing energy-intensive industries and reducing reliance on fossil fuels. By integrating this innovative energy source, the EU aims not only to meet its climate goals but also to enhance energy security and promote economic growth through technological advancements. This alignment of green hydrogen with the EU's existing climate initiatives reinforces its commitment to a sustainable, low-carbon future ((IRENA)., 2022). This paper delves into the concept of "Greening Sovereignty," tracing its historical roots, current applications, and future potential. By examining Europe's leadership in sustainability and its broader implications, the study highlights how the EU's efforts serve as a model for addressing the interconnected crises of climate change, energy security, and economic resilience.

Navigating Climate Challenges: The EU's Path to Unified Action:

The European Union encounters significant climate challenges, such as striking a balance between mitigation efforts and adaptation strategies, accommodating the varied priorities of its member states, addressing economic costs and competitiveness concerns, and tackling uneven emissions reductions in sectors like transport. Aligning climate initiatives with broader EU objectives, fostering international collaboration, and navigating uncertainties in climate forecasts further add to the complexity. These issues underscore the difficulties in pursuing cohesive and impactful climate action across the EU (Jordan, 2023).

The European Green Deal (2019): A Pillar of Europe's Greening Sovereignty:

The European Union's climate strategy, outlined in the European Green Deal (2019), sets a clear path to achieving climate neutrality by 2050. This ambitious plan focuses on cutting greenhouse gas emissions, promoting renewable energy,

and strengthening energy security. A key element of the strategy, the Fit for 55 package, aims for a 55% reduction in emissions by 2030, introducing measures such as the Renewable Energy Directive (RED II), the Carbon Border Adjustment Mechanism (CBAM), and reforms to the Emissions Trading System (ETS). These actions are designed to improve the EU's energy resilience and diversification, while enhancing its economic and technological competitiveness (Oberthür, 2021). A pivotal aspect of this transition is the EU Hydrogen Strategy, which positions green hydrogen as a critical tool for decarbonizing industries with high energy consumption, such as heavy industry and transportation. The strategy includes a goal to deploy 40 GW of electrolyzers by 2030, enabling the production of 10 million tonnes of renewable hydrogen (Quitzow, 2021). The EU's green transition aims to address the socio-economic challenges of transitioning to a low-carbon economy, particularly in regions heavily reliant on fossil fuels and high-emission industries. To support these regions, the Just Transition Mechanism (JTM) has been established. Its primary objectives are to reskill workers, create new job opportunities in emerging industries, and revitalize areas affected by the shift. The JTM is expected to mobilize approximately EUR 17.5 billion in investments, with a significant portion coming from the Just Transition Fund (JTF). These funds will be directed toward projects focused on energy efficiency, renewable energy, sustainable transport, the circular economy, and biodiversity conservation. By funding these initiatives, the EU seeks to ensure a fair and inclusive transition, reduce dependence on fossil fuels, promote technological innovation, and enhance energy security. Additionally, the funds will focus on creating sustainable job opportunities, reskilling the workforce, and revitalizing regions impacted by the decline of fossil fuel-based industries (Heffron, 2022), so the investments will complement additional EU funds targeting energy efficiency, renewable energy, sustainable mobility, the circular economy, and biodiversity. Through these efforts, the EU aims to ensure an inclusive and fair transition, leaving no region or person behind while advancing its broader goals of reducing fossil fuel dependence, driving technological innovation, and enhancing energy security. Moreover, the European Union's renewable energy strategy emphasizes the integration of various renewable technologies, such as offshore wind and solar power, to achieve its mandatory targets. The EU is committed to improving energy efficiency and encouraging technological advancements to establish a sustainable and diversified energy portfolio. By channelling investments into innovative green technologies, including cutting-edge solar panels and advanced wind energy systems, the EU aims to solidify its position as a global leader in renewable energy. These initiatives align with the Renewable Energy Directive's goal of reaching a 20% share of renewables in final energy consumption while simultaneously fostering economic growth and lowering greenhouse gas emissions (European Renewable Energy Council, 2010

(pp. 58, 254). In essence, the European Green Deal not only addresses climate challenges but also fortifies the EU's sovereignty and global competitiveness. By prioritizing energy independence, sustainable industries, and technological innovation, it positions the EU as a leading force in the transition to a sustainable future.

Enhancing EU Sovereignty Through the Fit for 55 Package:

Another key step Europe has taken toward sustainability is the launch of the Fit for 55 package in 2021, which is central to enhancing the EU's sovereignty in terms of both energy independence and economic autonomy. Aiming to achieve climate neutrality by 2050 and reduce greenhouse gas emissions by 55% by 2030, the package strengthens the EU's self-reliance by addressing energy vulnerabilities and advancing industrial leadership. A key element is the extension of the EU Emissions Trading System (ETS) to sectors such as road and maritime transport and buildings, which helps reduce reliance on external energy sources and ensures a more resilient domestic economy. The Fit for 55 package also supports the EU's energy sovereignty by promoting the adoption of renewable energy sources and energy efficiency measures. Through revised directives like the Renewable Energy Directive and Energy Taxation Directive, the EU increases its reliance on domestic renewable energy, reducing dependence on imported fossil fuels. The introduction of new alternative fuels infrastructure and energy efficiency standards ensures that the EU becomes less susceptible to global energy market fluctuations, empowering it to take control of its energy future. The EU also leverages the Social Climate Fund to ensure that the transition to a green economy is just and equitable, maintaining internal cohesion as it shifts away from reliance on external energy markets. The expansion of the EU ETS across multiple sectors, including transport and industry, raises carbon prices, encouraging the adoption of cleaner technologies while also strengthening the EU's competitive edge in the global market. These initiatives position the EU as a sovereign entity in the fight against climate change, with the capacity to set its own energy and industrial policies free from external pressures, fostering long-term economic stability and security. Moreover, the Fit for 55 package plays a crucial role in reinforcing the EU's energy sovereignty and industrial strength, in addition to its emissions reduction targets. By extending the EU Emissions Trading System (ETS) to sectors like aviation, maritime transport, buildings, and road transport, it broadens the scope of emissions cuts across several industries. Additionally, new, independent emission trading systems will be implemented for areas such as agriculture and waste, ensuring compliance with national emissions goals. The introduction of the Carbon Border Adjustment Mechanism (CBAM) seeks to safeguard European industries from the risk of carbon leakage by levying tariffs on

imports from outside the EU that have high carbon footprints, helping to maintain the competitiveness of EU businesses during the transition. Aiming to alleviate the social and economic impacts of the green shift, The EU is also creating a Social Climate Fund to assist affected businesses and households (Dyrhauge & Kurze, 2023). The European Union (EU) is advancing a wide-ranging climate policy framework that includes targeted measures for transforming the transport sector into a more sustainable one. The REFuelEU Aviation and FuelEU Maritime initiatives are central to promoting sustainable fuel use in the aviation and maritime industries. Furthermore, a crucial goal is set to eliminate the sale of CO2-emitting vehicles by 2035. The EU also plans to update key directives, such as the Energy Efficiency Directive and the Renewable Energy Directive, aiming to lower overall energy consumption and ensure that renewable sources contribute at least 45% to the EU's energy mix by 2030. These actions are essential to the EU's ambition to reach climate neutrality by 2050, enhance energy self-sufficiency, and secure economic resilience against global energy market fluctuations. In addition, proposed reforms to the Energy Taxation Directive (ETD) and the second Emissions Trading System (ETS-2) are expected to have a significant impact on households across Europe. The ETD reform includes a reduction in electricity taxes, which benefits lower-income households. However, if the EU raises fossil fuel taxes to compensate for the loss in electricity tax revenue, rural, peri-urban, and middle-income households could face higher fuel costs. Additionally, the ETS-2 pricing for CO2 emissions in sectors like buildings and transport may put additional financial strain on households, particularly those in rural regions more reliant on fossil fuels. To alleviate these impacts, the Social Climate Fund (SCF) has been established to redistribute revenues from carbon pricing, focusing on the poorest 50% of households. The fund aims to ensure an equitable transition to greener energy, with particular attention to vulnerable communities in rural and peri-urban areas. In the maritime sector, the EU's Fit for 55 package introduces significant reforms to cut greenhouse gas emissions. The revised ETS now includes ships of 5,000 gross tonnage or more, covering emissions from intra-EU voyages, emissions at berth, and parts of emissions from extra-EU voyages. Shipping companies will be required to purchase emissions allowances, with compliance gradually increasing from 2023 to 2026, and penalties imposed for non-compliance, including restrictions on access to EU ports. Additionally, the FuelEU Maritime initiative sets progressive reductions in the greenhouse gas intensity of onboard energy, aiming for a 75% reduction by 2050. Passenger and container ships will also be required to adopt onshore power or zero-emission technologies when docked. The revised ETD includes phased fuel taxes for intra-EU voyages, with exceptions for sustainable alternatives like ammonia and advanced biofuels. The Alternative Fuels Infrastructure Directive mandates the provision of shore-side electricity for

passenger and container ships by 2030, along with LNG refueling infrastructure at core maritime ports by 2025. These measures are key components of the EU's broader climate strategy to ensure long-term sustainability and reduce emissions across all sectors. These measures operate under the "polluter pays" principle, allowing shipping companies to allocate compliance costs to entities making fuel and operational decisions. Collectively, these reforms aim to align maritime transport with the EU's broader environmental objectives (Jordan, 2023) package drives the EU's path to climate neutrality by expanding emissions trading, promoting renewables, and ensuring a just transition through initiatives like the Social Climate Fund. These measures bolster energy independence and economic resilience while solidifying the EU's climate leadership.

The Renewable Energy Directive (RED II) and the Carbon Border Adjustment Mechanism (CBAM):

The Renewable Energy Directive (RED II)

As the EU works to enhance its energy independence and economic self-sufficiency, the Renewable Energy Directive (RED II) plays a key role in advancing its commitment to a sustainable energy future. Building on the previous RED I, which aimed for a 20% renewable energy share by 2020, RED II, enacted on July 1, 2021, establishes a legally binding target of at least 45% renewable energy in the EU's overall energy mix by 2030. This goal aligns with the EU's broader climate ambitions under the European Green Deal, which strives for climate neutrality by 2050. The directive focuses on expanding the use of renewable energy across various sectors, including transport, heating, and industry, and encourages the adoption of electric vehicles, renewable fuels, and hydrogen. To facilitate this transition, the directive simplifies permitting processes, making it easier and faster to implement renewable energy projects. It also reinforces sustainability criteria for bioenergy, ensuring all renewable sources effectively contribute to the clean energy shift. This revised framework is essential for reducing the EU's reliance on external fossil fuel supplies while boosting energy security and competitiveness within the global renewable energy market (Commission, European, 2021). Technical Assistance for the preparation of guidance for the implementation of the new bioenergy sustainability criteria set out in the revised Renewable Energy Directive).

The European Union's Carbon Border Adjustment Mechanism (CBAM)

Building on these efforts, the Carbon Border Adjustment Mechanism (CBAM) addresses a critical concern: carbon leakage, as the European Union's Carbon Border Adjustment Mechanism (CBAM) is designed to combat carbon leakage, which occurs when EU-based companies move their production to countries

with less stringent climate policies or when EU goods are replaced by more carbon-intensive imports. The CBAM aims to ensure that imports face the same carbon costs as EU-produced goods, preventing unfair competition while encouraging cleaner industrial production globally. The CBAM will be fully implemented in 2026, following a transitional phase from 2023 to 2025. During this period, importers will be required to report the carbon emissions embedded in their products but will not yet need to purchase CBAM certificates. The CBAM initially applies to high-risk sectors such as cement, iron, steel, aluminium, fertilisers, and electricity. This gradual implementation allows businesses to adjust and helps refine the system's methodologies before full implementation. By 2026, importers will need to purchase and surrender certificates based on the carbon emissions embedded in their goods, aligning the carbon costs of imports with those imposed by the EU's emissions trading system (Commission, 2023). Ultimately, the Carbon Border Adjustment Mechanism is a key tool in ensuring a level playing field for European industries while promoting global sustainability and advancing the EU's climate goals.

Green Hydrogen as a Cornerstone of the EU's Green Transition:

Hydrogen is also central to the EU's efforts to decarbonize energy-intensive sectors and transition to sustainable energy. Despite accounting for less than 2% of Europe's energy consumption in 2022 and being mostly derived from natural gas, the EU has set ambitious targets to produce and import 10 million tonnes of renewable hydrogen annually by 2030, aiming for hydrogen to meet 10% of its energy needs by 2050. This effort is bolstered by the 'Fit for 55' package, which enforces renewable hydrogen adoption and supports infrastructure development. Key investment programs, such as the Important Projects of Common European Interest (IPCEIs), drive innovation in production, infrastructure, and applications (Cerniglia & Saraceno, 2022). Additionally, initiatives like the Clean Hydrogen Partnership and the European Clean Hydrogen Alliance accelerate research, manufacturing, and deployment. The EU also provides guidance on funding opportunities through the Hydrogen Public Funding Compass, ensuring comprehensive support for stakeholders. These efforts establish hydrogen as a cornerstone of Europe's pathway to a net-zero future. Together, these initiatives position hydrogen as a vital component of the EU's strategy to achieve climate neutrality, driving both technological innovation and economic growth while reducing dependency on fossil fuels (Quitzow, 2021).

Global Partnerships Driving Green Hydrogen Development: Europe's Collaborative Strategy:

To further enhance Europe's green energy strategy, these international collaborations, particularly in the green hydrogen and renewable methanol

sectors, are vital to achieving its ambitious climate and energy transition goals by tapping into valuable resources and expertise. These partnerships aim to leverage abundant renewable energy sources, develop robust supply chains, and address critical challenges such as production scalability, certification standards, and infrastructure readiness, all while accelerating the global transition to clean energy. For example, in North Africa, Morocco, Algeria, and Egypt play crucial roles. Morocco's inclusion in the H2 Med project—a proposed hydrogen pipeline linking Spain, France, and Germany—could enable the transport of solar-powered green hydrogen (Quitzow, 2021). Italy collaborates with Tunisia, exploring ways to convert existing gas pipelines for hydrogen transport while also building new infrastructure. Egypt, a major player since COP27, has signed agreements with European entities to become a regional hub for green hydrogen. However, many of Egypt's memoranda of understanding still require significant investment to move from planning to execution. The Gulf States, particularly Saudi Arabia and the UAE, have also partnered with Europe, utilizing their abundant renewable energy resources and advanced infrastructure. Germany has actively pursued agreements to secure hydrogen imports, focusing on meeting Europe's growing energy needs. These partnerships also emphasize producing low-carbon hydrogen using renewable technologies. At the global level. These alliances aim to scale up production, standardize hydrogen certification, and integrate renewable hydrogen into global value chains. Together, these partnerships aim to secure a steady supply of green hydrogen, enable Europe's energy transition, and accelerate international decarbonization efforts. Achieving these objectives requires substantial investments, regulatory frameworks, and innovations to overcome barriers related to cost, transportation, and infrastructure (Prontera, 2024). As Europe moves towards achieving its ambitious climate and energy transition goals, a key component of its strategy involves securing partnerships with various countries for the development and importation of green fuels, including methanol. These international agreements play a crucial role in shaping Europe's energy future, particularly in its push for cleaner, renewable alternatives to fossil fuels. One of the most notable efforts in this regard is the focus on e-methanol, which is being developed as part of the EU's Renewable Fuels of Non-Biological Origin (RFNBO) initiative. In this context, Europe has signed multiple treaties with countries such as Japan, South Korea, the United States, and Australia (European Court of Auditors. 2024. Special report 11/2024: The EU's industrial policy on renewable hydrogen – Legal framework has been mostly adopted – time for a reality check). The Japan-EU Green Alliance fosters collaboration between Europe and Japan in advancing green hydrogen, methanol production, renewable energy, and sustainable finance. This partnership emphasizes joint research, aligning decarbonization policies, and developing infrastructure to support the clean energy transition. Europe benefits by leveraging Japan's cutting-edge

technology to enhance its energy security and broaden its clean energy market. Japan gains access to Europe's extensive renewable energy networks and opportunities to expand its green hydrogen market, while reinforcing its leadership in clean energy technology. Together, the two sides work toward their mutual goal of achieving net-zero emissions by 2050 and driving the global shift towards sustainable energy solutions (Ministry, (n.d.)).

These partnerships and initiatives are aimed at reducing global greenhouse gas emissions, promoting the use of renewable fuels, and facilitating the development of a sustainable energy market. With these agreements, the EU and its international partners seek to meet stringent climate targets while creating a robust framework for the production, certification, and use of renewable methanol in the transportation and industrial sectors. These treaties not only emphasize emission reduction but also address the need for technological innovation, carbon capture, and global collaboration in clean energy transitions.

Sustainable Progress: How the EU Aligns Ecological Goals with Economic Growth:

All the measures, initiatives, and partnerships Europe has undertaken align seamlessly with its economic growth, reflecting the European Union's commitment to balancing ecological imperatives with economic advancement. The EU exemplifies a comprehensive approach to fostering sustainable development, integrating climate neutrality goals with economic innovation. Through initiatives like the European Green Deal, the EU integrates climate neutrality goals with economic innovation, targeting a decarbonized future by 2050. Mechanisms such as the Emissions Trading System (ETS) and the Renewable Energy Directive ensure that industries adopt cleaner technologies and renewable energy, reducing environmental impact while driving competitive advantages. Additionally, significant investments under programs like Horizon Europe and the Next Generation EU recovery plan fuel research and innovation in green technologies, promoting job creation and economic resilience. By incorporating social equity through the Just Transition Mechanism, the EU addresses disparities, supporting regions and workers affected by the green transition. Globally, it champions sustainable trade and carbon regulation through mechanisms like the Carbon Border Adjustment Mechanism, ensuring that its ecological goals align with economic competitiveness. These efforts illustrate how the EU harmonizes environmental sustainability with robust economic growth, positioning itself as a leader in the global green economy.

Integrating Sustainability, Economic Growth, and Geopolitical Autonomy in the EU's Agenda:

To further solidify this approach, the EU is not only focusing on internal policies but also enhancing its global position through strategic partnerships and initiatives that align with both its ecological goals and economic objectives. By fostering international collaborations, the (Union, 24) effectively navigates the balance between ecological responsibility and economic growth. Through the adoption of policies that integrate environmental sustainability with competitiveness, the EU exemplifies a forward-thinking approach. Initiatives like the European Green Deal, for instance, are designed to not only reduce carbon emissions and promote clean energy but also to stimulate economic growth through green innovation. This dual focus fosters the development of green technologies, creating new industries, generating jobs, and enhancing economic resilience, all while reducing dependency on fossil fuels. However, the balance between ecological imperatives and economic growth presents its challenges. The EU is addressing these through strategic investments, partnerships with the private sector, and incentivizing sustainable practices across industries. Moreover, the integration of environmental considerations into policy frameworks—such as carbon pricing, emissions reduction targets, and circular economy models—ensures a gradual and just transition to a low-carbon economy. At the same time, by nurturing innovation and competitiveness in green technologies, the EU aims to demonstrate that sustainability and economic prosperity are not mutually exclusive but rather mutually reinforcing, paving the way for long-term economic and environmental resilience.

Conclusion:

In conclusion, Europe’s commitment to greening sovereignty through comprehensive and forward-thinking initiatives is reshaping its environmental, economic, and geopolitical landscape. The European Green Deal, the Fit for 55 package, and complementary measures like RED II, the CBAM, and the ongoing reforms to the Emissions Trading System collectively illustrate the EU's resolve to confront climate challenges while enhancing its autonomy. These policies not only accelerate the decarbonization of industries but also foster innovation, strengthen energy security, and bolster the EU’s competitive position on the global stage. Green hydrogen, as a cornerstone of this transformation, promises to play a pivotal role in decarbonizing heavy industries and further reducing Europe’s dependence on fossil fuels. Through these efforts, the EU is not only aligning its sovereignty with environmental resilience but also setting a precedent for global climate action. By integrating sustainability into the very fabric of its governance, the EU is positioning itself as a leader in both climate action and sustainable economic development, proving that ecological responsibility and economic growth can go hand in hand. This multifaceted approach serves as a model for other regions striving to reconcile

economic development with environmental stewardship, highlighting the potential for a sustainable future driven by innovation, cooperation, and forward-thinking governance.

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