

TECNOLOGIA, ENERGIA RENOVÁVEL E FINANCIAMENTO VERDE NO AGRONEGÓCIO – DAS ASPIRAÇÕES POLÍTICAS NACIONAIS ÀS IMPLICAÇÕES JURÍDICAS INTERNACIONAIS

TECHNOLOGY, RENEWABLE ENERGY, AND GREEN FINANCING IN AGRIBUSINESS – FROM DOMESTIC POLICY ASPIRATIONS TO INTERNATIONAL LEGAL IMPLICATIONS

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Resumo

A interseção entre o direito do comércio internacional e a política de energia renovável tornou-se cada vez mais complexa à medida que os Estados implementam medidas para apoiar indústrias verdes domésticas. Este artigo examina a jurisprudência inicial da OMC sobre disputas relacionadas à energia renovável, com foco em casos como *Canadá – Energia Renovável* e *Índia – Células Solares*. Esses casos evidenciam o conflito entre as obrigações comerciais e os esforços nacionais para desenvolver setores de energia limpa. Embora exceções sob o Artigo XX do GATT tenham sido propostas como justificativas, nem sempre foram bem-sucedidas na defesa de exigências de conteúdo local. Além disso, desafios relacionados a políticas de conteúdo local e regulamentações de sustentabilidade, como nas disputas sobre o óleo de palma, demonstram as dificuldades de equilibrar a liberalização do comércio com os objetivos ambientais. O artigo argumenta que as regras comerciais devem permitir maior flexibilidade para que os Estados promovam indústrias de energia renovável, especialmente em países em desenvolvimento. Para garantir uma transição justa, os acordos comerciais devem incorporar mecanismos que apoiem a inovação verde sem distorcer o mercado. Em última análise, o estudo destaca a necessidade de ajustes regulatórios que harmonizem o comércio e os objetivos ambientais, facilitando a transição global para a sustentabilidade.

Palavras-chave: *Energia renovável, direito do comércio internacional, disputas na OMC, sustentabilidade, política industrial verde.*

Abstract

The intersection of international trade law and renewable energy policy has become increasingly complex as states implement measures to support domestic green industries. This paper examines early WTO jurisprudence on renewable energy-related disputes, focusing on key cases such as *Canada – Renewable Energy* and *India – Solar Cells*. These cases highlight the tension between trade obligations and national efforts to develop clean energy sectors. While exceptions under GATT Article XX have been proposed as justifications, they have not always succeeded in defending domestic content requirements. Additionally, challenges related to local content policies and sustainability regulations, such as in the palm oil disputes, demonstrate the difficulties in balancing trade liberalization with environmental objectives. The paper argues that trade rules should allow greater flexibility for states to promote renewable

energy industries, particularly in developing countries. To ensure a just transition, trade agreements must incorporate mechanisms that support green innovation while preventing market distortions. Ultimately, the study underscores the need for regulatory adjustments that harmonize trade and environmental goals, facilitating a global shift toward sustainability.

Key words: Renewable energy, international trade law, WTO disputes, sustainability, green industrial policy.

1. Introduction

Agriculture as a critical pillar cannot be divorced from the broader economy. Just as money is fungible, so is energy, and therefore, the legal and institutional framework around renewable energy and sustainable technology, for whatever purpose, will apply. Countries at various levels of capacity may address the climate crisis and energy needs through implementing policies. While these policies may seek to be responsive to domestic environmental, economic, and political realities, they take place in the context of global commitments made by their countries to their trading partners. This article will examine the implications of these international legal commitments for countries' ability to set policies on renewable energy and technology.

The reference to *early* in this article refers not only to the fact that the cases themselves are recent (by legal scholarship standards) but also to the fact that we are in the early stages of developing jurisprudence in this area. For example, the history of the World Trade Organization (WTO) is only 30 years old, having been formed on January 1, 1995.

While, strictly speaking, much or all the WTO jurisprudence to date would and does affect the international trade in renewable energy, the discussion here will be limited to actual cases and provisions that deal with renewable energy trade. Similarly, while the judgments may touch on many issues, those directly addressing and citing renewable energy will be highlighted for space and relevance. This is not to be taken as an argument that other parts were overlooked or unimportant.

This article will proceed in three sections. The first section will look at the general theme of technology, renewable energy, and green financing in agribusiness, as well as the policy motivations and implications on the part of governments, specifically in Brazil. This provides the setting and motivation for why governments would attempt these policy initiatives. The second section will look at these issues in the context of broader international trade agreements at the regional level. The final section will analyze specific disputes in the World Trade Organization where the subject matter was renewable energy and technology. In addition to the legal aspects, the political and economic environment and implications will also be discussed.

2. Methodology

This study employs a qualitative, multi-faceted approach to analyze the interplay between trade policy and environmental regulations. It draws upon a combination of academic literature, WTO dispute settlement cases, and relevant government documents to provide a comprehensive understanding of the implications of these international legal commitments on the ability of countries to set policy on renewable energy and technology. This approach is justified by its capacity to capture the complex legal, policy, and scholarly dimensions of the research problem.

Data Sources and Selection

Academic Literature

A systematic literature review was conducted using databases such as JSTOR, the WTO Dispute Resolution cases, and other academic journal repositories. Keywords including "WTO," "trade barriers," "environmental regulation," and "trade in renewable energy and technology" were employed to identify relevant peer-reviewed articles, books, and reports.

Inclusion criteria focused on publications that directly addressed technology, renewable energy, and green finance in agribusiness, as well as the legal framework of WTO agreements, the impact of trade on specific policy areas, and a comparative analysis of national regulations. Exclusion criteria included cases and materials not directly relevant to these topics.

WTO Dispute Settlement Cases

Relevant WTO dispute settlement cases were selected based on their pertinence to technology, renewable energy, and green financing in agribusiness in or affecting developing countries. The WTO website was the primary source for these cases. Data extraction focused on the legal arguments presented by the parties, the panel and Appellate Body findings, and the procedural history of each case. These cases were selected to provide empirical examples of how the WTO framework interacts with technology, renewable energy, and green financing in agribusiness.

Government Documents and Websites

Relevant federal and local government agencies in the United States, European Union, and Brazil's websites were consulted. Document types analyzed included policy papers, regulations, legislative texts, and official reports. Specific search strategies were employed on government websites, using keywords related to technology, renewable energy, and green financing in agribusiness. The selection of these sources allows the analysis of the domestic application of the rules and the policy intentions of the governments involved.

Data Triangulation

The data gathered from academic literature, WTO cases, and government documents was triangulated to enhance the validity of the findings. This involved comparing information from different sources to identify convergent and divergent patterns.

Analytical Framework

This study employs a qualitative comparative analysis guided by the conceptual frameworks of legal pluralism, regulatory governance, and international trade theory; these frameworks informed the interpretation of the data and the development of analytical categories. The analysis of WTO cases involved a legal methodology, examining the interpretation and application of relevant WTO provisions—the analysis of the government documents involved examining the policy goals and the legal implementation of those goals. The comparative analysis focused on the dimensions of legal arguments, policy outcomes, and regulatory approaches across the selected cases and documents.

Limitations

This study acknowledges the potential limitations inherent in qualitative research, including the subjective nature of interpretation. Potential biases arise from the selection of cases and documents and the inherent limitations of relying on publicly available data. The scope of the study is limited to the selected WTO cases and the government documents of the chosen nations and may not fully represent the global situation. Data access limitations may have restricted the scope of available government documents.

Ethical Considerations

This study relied on publicly available data and did not involve human subjects. Standard academic ethical principles were adhered to throughout the research process.

3. Results and Discussion

Technologies, Renewable Energy, and Green Financing in Agribusiness: An Overview of Brazil

The increasing integration of renewable energy technologies into the agribusiness sector is a key area of focus in the global shift towards sustainable development. As economies worldwide seek to reduce their carbon footprints and meet their climate targets, agribusinesses are exploring innovative ways to incorporate renewable energy solutions into their operations. From solar and wind power to bioenergy and hydropower, these technologies reduce greenhouse gas emissions, enhance energy security, and reduce operational costs for agribusinesses (Arndt et al., 2019).

In Brazil, where agriculture is a critical sector of the economy, the potential for renewable energy solutions to bolster agribusiness operations is particularly significant. Brazil's agricultural sector is characterized by a growing demand for energy, driven by large-scale operations in areas such as livestock farming, grain production, and food processing. Consequently, the need for sustainable energy solutions has prompted various stakeholders, including farmers, agricultural firms, and government agencies, to explore renewable energy options as part of the broader effort to decarbonize the economy (Torres et al., 2020).

Brazil's vast land area, significant natural resources, and favorable climate conditions provide a unique opportunity to deploy renewable energy technologies at scale. Solar energy has shown considerable promise in powering agricultural operations, especially in rural areas with limited access to the grid. Photovoltaic (PV) systems are increasingly being adopted to meet the energy needs of agricultural facilities, from irrigation systems to cooling technologies for storage and processing (Barbosa et al., 2019). Wind energy is another renewable resource explored in areas with high wind potential, such as in northeastern Brazil, where it can contribute to the electrification of agribusinesses and rural communities (Ferreira et al., 2020).

Bioenergy, specifically through the production of biogas and biomass, also plays a critical role in renewable energy strategies for agribusinesses. With agricultural waste and by-products from crop and livestock production, biogas production offers a sustainable energy source for agribusinesses. Additionally, biofuels like ethanol, which Brazil is already a global leader in producing, are essential in the transition toward greener energy systems in the agricultural sector (Lima et al., 2021). These technologies align with Brazil's established policy framework, such as the RenovaBio program, which aims to reduce the carbon intensity of fuels, thereby promoting sustainable biofuel production and consumption.

The transition to renewable energy technologies in the agribusiness sector is not only a technological and policy challenge but also a financial one. Green financing mechanisms for renewable energy in agribusiness have emerged as an essential tool for supporting renewable energy projects, particularly as the cost of renewable energy infrastructure remains a significant barrier. These financing mechanisms are designed to support sustainable projects by providing funds through green bonds, climate financing, and other financial instruments specifically dedicated to environmental projects (Tello et al., 2020).

In Brazil, the development of green financing has been closely linked with the national and international push for environmental sustainability. The Brazilian Development Bank (BNDES) has been instrumental in financing renewable energy projects in agribusiness, offering credit lines and incentives for companies that seek to reduce their carbon emissions. Additionally, international green finance initiatives, such as the Green Climate Fund (GCF) and financing through international banks, have further facilitated the flow of capital into Brazil's renewable energy sector (Leite et al., 2019). These financing instruments are pivotal in de-risking investments in renewable energy technologies for agribusinesses, ensuring that such ventures are financially viable and attractive to private investors.

Moreover, the growing trend of sustainability-linked loans (SLLs) provides further financial incentives for agribusinesses to adopt renewable energy solutions. These loans offer favorable terms for companies that meet specific sustainability targets, including adopting clean technologies and renewable energy systems. Implementing such financing structures can scale up the adoption of renewable energy in the agribusiness sector while aligning financial interests with environmental goals (Anderson & Wrigley, 2021).

Despite the apparent potential of renewable energy technologies and green financing in the agribusiness sector, several challenges remain. One of the primary barriers to the widespread adoption of renewable energy in Brazilian agribusiness is the high initial capital cost of renewable energy infrastructure. While the long-term savings in energy costs and environmental benefits are substantial, the upfront investment can be prohibitive for many smaller agribusinesses (Arndt et al., 2019). This challenge underscores the importance of green financing tools that reduce the financial burden on agricultural stakeholders.

Additionally, integrating renewable energy into agribusiness operations requires significant changes in rural areas' energy infrastructure. While expanding the national grid is an ongoing process, many rural areas remain disconnected from it, creating obstacles to the widespread adoption of renewable energy solutions. In these areas, decentralized energy solutions such as solar-powered microgrids or biogas production facilities could effectively solve energy access issues while contributing to the sector's sustainability (Ferreira et al., 2020).

At the same time, the transition to renewable energy presents numerous opportunities. For one, the global demand for sustainable products and services is rapidly increasing, creating new markets for agribusinesses that adopt renewable energy solutions. Brazil's emphasis on renewable energy, through initiatives like the RenovaBio program, is positioning the country as a global leader in sustainable agriculture and bioenergy. Moreover, adopting renewable energy can help agribusinesses achieve greater energy independence, reduce volatility in energy prices, and improve their overall competitiveness in domestic and international markets (Leite et al., 2019).

Government policy is crucial in enabling the widespread adoption of renewable energy technologies in agribusiness. In Brazil, policies such as the National Policy on Climate Change (PNMC) and the RenovaBio program have provided a supportive framework to facilitate the development of renewable energy in the agricultural sector. These policies incentivize agribusinesses to invest in clean technologies by offering tax breaks, subsidies, and financing options for green projects (Torres et al., 2020).

Furthermore, international agreements like the Paris Agreement have driven greater emphasis on adopting renewable energy in agribusiness. By aligning national policies with international climate goals, Brazil can access new sources of green financing and attract global investments that support sustainable agricultural practices (Tello et al., 2020).

As Brazil continues to advance its renewable energy agenda, policies must focus on adopting clean technologies and ensuring that small and medium-sized agribusinesses are included in the transition. This could involve targeted green financing initiatives that offer favorable terms for smaller farmers and rural communities, ensuring that the benefits of renewable energy are accessible to all sectors of the agribusiness community.

Trade Agreements and Green Technology Cooperation: A Step Towards Sustainable Global Trade

Trade agreements have long served as instruments to shape global commerce, but recent developments signal a shift towards integrating climate goals with trade practices. This is particularly evident in the trade deal between the United Kingdom (UK) and the European Union (EU), which includes provisions designed to promote the transition to a low greenhouse gas emission, resource-efficient economy. The agreement is a notable example of how international trade can actively support deploying green technologies, focusing on clean energy, renewable goods, and energy-efficient products.

Zero Tariffs and Green Technology Promotion

A pivotal aspect of this trade agreement is the elimination of tariffs and quotas on clean technologies, which are crucial for fostering the green technology sector. The deal stipulates that the UK and the EU will cooperate in promoting trade policies that facilitate the transition to environmentally sustainable economies. This includes encouraging trade and investment in renewable energy technologies, energy-efficient products, and services and advancing the circular economy (Gehring, 2021). Specifically, the agreement emphasizes zero tariffs on clean technologies, a significant move considering that the green tech sector would have faced substantial barriers without such provisions.

One of the most significant focus areas within this agreement is the promotion of electric vehicles (EVs). To qualify for zero tariffs, goods must meet specific 'rules of origin,' meaning they must be manufactured or sufficiently processed within the UK or the EU. This approach encourages local production of green technologies while facilitating broader trade.

As Dr. Markus Gehring, a sustainable development lawyer at the University of Cambridge, highlights, including robust climate language in this trade deal is unprecedented. He notes that this is the "most ambitious climate language" he has seen in any trade agreement, with the EU pushing the envelope further by making climate commitments a "make-or-break issue" for future trade relations (Gehring, 2021). Such a move indicates that the global trade framework

increasingly aligns with environmental goals, demonstrating the intersection of trade policy and climate commitments.

U.S. Green Industrial Policy: The Inflation Reduction Act (IRA)

Parallel to these developments in the UK and EU, the United States has made a significant move with the passage of the (IRA), which aims to fulfill the country's obligations under the Paris Agreement while fostering the growth of clean energy industries. One of the central features of the IRA is its support for renewable energy technologies through financial incentives, including tax credits for clean energy projects, loans for energy infrastructure, and subsidies for electric vehicles and energy-efficient products. Notably, the IRA allocates approximately \$11.7 billion to support clean energy projects, with an additional \$100 billion in loan authority for the Department of Energy's existing loan programs (U.S. Department of Treasury, 2022).

A unique feature of the IRA is its requirement that contractors and workers on clean energy projects are paid prevailing wages, with provisions for utilizing registered apprenticeships (U.S. Department of Treasury, 2022). This inclusion aims to ensure that the transition to a green economy creates good-paying jobs, aligning environmental goals with social and economic benefits.

However, the IRA has not been without controversy, especially regarding its condition for local inputs in clean tech products, which has raised concerns within the EU. Some politicians and corporations have voiced concerns that these local content requirements (LCRs) could disrupt global supply chains and create trade barriers. This issue has historically been a contentious point in the renewable energy sector (Lewis, 2014). Including such requirements reflects a broader trend where governments increasingly use renewable energy support measures as tools for green industrial policy, fostering domestic industries while promoting environmental goals (Bigdeli, 2014).

The Role of Local Content Requirements in Green Industrial Policy

Local content requirements (LCRs) have become an important feature of renewable energy subsidies in various countries, including those in the EU and the U.S. These measures mandate that a certain percentage of the materials or components used in renewable energy projects be domestically produced, thereby fostering local industries and job creation. While LCRs may be beneficial for creating green jobs and advancing local technological capacities, they can also result in trade disputes, as they restrict market access for foreign producers.

For instance, in the context of the EU-Central America trade agreement, LCRs are discussed as a tool to support green industrial policies. Governments may use LCRs to enhance the competitiveness of domestic industries in renewable energy sectors, thus addressing domestic employment concerns while advancing global sustainability objectives (Salzman & Wu, 2014).

However, these policies can also create friction in international trade, as they may be perceived as protectionist measures by other nations, potentially leading to trade conflicts. As Bigdeli (2014) observes, LCRs are at the heart of many trade-environment disputes, particularly in sectors where the balance between environmental and trade priorities remains delicate.

The relevant provisions in international trade agreements.

To examine the law applicable to international trade in renewable energy and technology, we start with the basic principles of the WTO, which are the central frameworks of global trade. The WTO trade regime relies on several fundamental principles. The most relevant for our study are the most-favored-nation principle in Article I (1) GATT and the national treatment principle in Article III (4) GATT.

Article I (1) GATT states that: "[...], any advantage, favor, privilege or immunity granted by any contracting party to any product originating in or destined for any other country shall be accorded immediately and unconditionally to the like product originating in or destined for the territories of all other contracting parties."

Article III (4) GATT states that: "The products of the territory of any contracting party imported into the territory of any other contracting party shall be accorded treatment no less favorable than that accorded to like products of national origin in respect of all laws, regulations, and requirements affecting their internal sale, offering for sale, purchase, transportation, distribution, or use. [...]"

The following analysis explores the key principles outlined in Article I(1) and Article III(4) of the GATT, which are fundamental to promoting fair and non-discriminatory trade among member countries.

Article I(1): Most-Favored-Nation (MFN) Principle

Article I(1) of the GATT enshrines the Most-Favoured-Nation (MFN) treatment principle, a cornerstone of international trade law.

This provision requires that any trade advantage, favor, or privilege granted by a member country to another country must be extended to all other GATT members. In simpler terms, if one member of the GATT gives preferential treatment (such as lower tariffs or better market access) to another member, that same treatment must be given to all members.

The MFN principle aims to ensure that trade relations between countries are transparent and non-discriminatory. It prevents countries from selectively favoring certain trade partners over others, fostering a more equitable and predictable global trading environment. This principle reduces the complexity and discrimination of bilateral trade agreements, encouraging broader cooperation and trade liberalization among nations. While there are exceptions, such as preferential agreements with developing countries or regional trade arrangements, the core idea is that trade should be as open and non-discriminatory as possible.

Article III(4): National Treatment

Article III(4) of the GATT addresses the principle of National Treatment, which aims to prevent discrimination against imported goods once they have entered a country's market. Specifically, it prohibits member countries from applying internal taxes or regulations that treat imported products less favorably than domestic products.

The provision ensures that the domestic market does not treat imported goods unfairly. Once a product crosses a country's border, it should not be penalized with higher taxes, stricter regulations, or other discriminatory measures that would make it less competitive than locally produced goods. This principle promotes a level playing field, encouraging free trade by

ensuring that foreign goods are treated on par with domestic products regarding taxation, regulation, and other internal measures.

In essence, Article III (4) reinforces the idea that the benefits of trade liberalization should be preserved at the border and within the domestic market, thereby preventing domestic policies from undermining the principles of open and fair trade. Articles I (1) and III(4) are foundational to GATT's aim of promoting non-discriminatory and transparent international trade. The former establishes the broad rule of non-discrimination in trade relations. At the same time, the latter ensures that imported goods are not unfairly disadvantaged in domestic markets, helping create a fairer global trading system.

While other relevant articles of the agreements will be cited as necessary, these are highlighted here as they have been and will be the core of any trade dispute, including those dealing with trade in renewable energy, sustainable technologies, and related products.

Analysis of World Trade Organization cases on renewable energy

Canada–Renewable Energy

The *Canada–Renewable Energy* dispute marks a landmark case in the WTO dispute settlement mechanism, as it is the first to address issues surrounding renewable energy policies. This case is also relevant for Brazil as a federal country in that it represents the effort of a sub-national entity (the province of Ontario) to develop its domestic renewable energy capacity. The case involves a challenge to Ontario's feed-in tariff (FIT) program, which aimed to promote renewable energy by guaranteeing long-term prices for wind and solar energy suppliers. While the FIT program sought to encourage investment in green industries and increase the share of renewable energy in Ontario's energy mix, it also included a domestic content requirement, stipulating that renewable energy equipment be sourced from within the province. This policy aimed to boost the use of renewable energy and foster local manufacturing of renewable energy technology.

The central issue in this case was the compatibility of Ontario's FIT program with WTO rules, particularly regarding the local content requirements. The dispute was brought by Japan and the European Union, which argued that the local content provision discriminated against foreign producers of renewable energy equipment. They raised three primary claims under WTO provisions:

Violation of the Agreement on Trade-Related Investment Measures (TRIMS): The local content requirement was seen as inconsistent with Article 2.1 of the TRIMS Agreement, which prohibits measures that violate national treatment obligations, and with GATT Article III:4, which mandates non-discrimination in internal taxation and regulation.

Stand-alone Claim under GATT Article III:4: The claim also centered on whether the local content provision violated GATT Article III:4, which prohibits discrimination against imported goods.

Violation of the Subsidies and Countervailing Measures (SCM) Agreement: This claim contended that the FIT incentives amounted to subsidies contingent on domestic over imported goods, violating SCM Articles 3.1(b) and 3.2. The key issue was whether the FIT incentives constituted subsidies under the SCM Agreement.

The Appellate Body upheld the Panel's findings that the local content provision violated GATT Article III:4 and, by extension, TRIMS Article 2.1. However, the Appellate Body did not rule on the stand-alone issue under GATT Article III:4, finding it unnecessary. The Panel also refrained from making a definitive ruling on whether the FIT incentives amounted to subsidies under the SCM Agreement, leaving uncertainty in this area.

The Appellate Body did, however, offer important insights into the definition of "benefit" under the SCM Agreement. It clarified that where a government creates a market, it cannot be said to distort the market, as there would be no market without the government's intervention. This interpretation provides a potential defense for governments, allowing them to argue that they are creating new markets rather than distorting existing ones under the SCM Agreement (Flood, 2014).

Contributions to WTO Jurisprudence on Renewable Energy

The *Canada–Renewable Energy* case has significantly advanced WTO jurisprudence concerning renewable energy, technology, and subsidy supervision. According to the Appellate Body, while the existence of a benefit under the SCM Agreement depends on a market comparison, the market analysis must account for governmental decisions regarding the appropriate energy supply mix. This decision represents a pivotal development in the WTO's approach to trade and environmental policy (Whitsitt, 2013).

The case has contributed to the growing body of WTO jurisprudence on the intersection of energy, environmental policy, and subsidies. Domestic policy measures promoting renewable energy, such as FIT programs, may encounter trade challenges due to their potential to distort international markets, particularly for renewable energy equipment. This tension between domestic priorities and international obligations will continue as more disputes emerge over government subsidies promoting renewable energy (Meyer, 2018).

The Complex Issue of Subsidies

At the core of the *Canada–Renewable Energy* case is whether the FIT program constitutes a prohibited subsidy under the SCM Agreement. The case illustrates the complexity of determining whether government interventions, such as price guarantees for renewable energy, constitute subsidies. According to the SCM Agreement, a subsidy requires a financial contribution and a benefit. While the Panel and Appellate Body agreed that the FIT contracts constituted a financial contribution, neither body made a conclusive determination on whether the FIT program provided a "benefit" to recipients. This uncertainty in interpreting "benefit" under the SCM Agreement is a critical issue in international trade law (Flood, 2014).

The *Canada–Renewable Energy* case also highlights two distinct markets: (1) the market for renewable energy equipment production and investment and (2) the electricity market. The renewable energy equipment market is global, with Ontario's local content requirement potentially raising the cost of renewable energy technology within the province and Canada. Conversely, the subsidy effects are most apparent in the electricity market, which is historically a domestic market due to infrastructure and logistical constraints. Payments to electricity producers in the FIT program essentially incentivize the expansion of renewable energy capacity and the associated technology (Whitsitt, 2013).

While the Appellate Body bifurcated the analysis into these two markets, it focused primarily on the electricity market, where the subsidy effect would be most directly felt. This approach reflects the nature of electricity as a fungible commodity—essentially identical across jurisdictions, which allows for substitution between different sources of energy.

The Future of FIT Programs and WTO Rules

This case has important implications for the future of FIT programs and government incentives for renewable energy. The Appellate Body's ruling suggests that FIT schemes can only be targeted when they include local content requirements. If a FIT program is found to fall under the SCM Agreement, it could be deemed a prohibited subsidy under Article 3 of the SCM Agreement, which would require its removal without delay. However, this would be largely irrelevant in the *Canada–Renewable Energy* case, as the local content requirements were already deemed inconsistent with national treatment obligations under GATT and TRIMS.

Notably, the Appellate Body's partial carve-out from the SCM Agreement regarding FIT programs and its application of Article 14(d) to determine "benefit" provides a significant precedent for future cases. The Appellate Body did not extend its findings to other forms of government procurement, leaving room for future disputes in which the relationship between government procurement and subsidies will continue to be debated (Whitsitt, 2013).

Aftermath

Following the ruling, the Ontario government ultimately terminated its FIT program, going beyond eliminating the WTO-incompatible local content requirement provisions. This move reflects the political dynamics of local content requirements, where governments often justify the use of public funds for domestic industry development through the promise of job creation and economic benefits. However, as the case demonstrates, these domestic political pressures can conflict with global trade rules, particularly in international trade agreements prioritizing non-discrimination and market access.

The Path Forward

Looking ahead, the *Canada–Renewable Energy* case raises key questions about how governments can pursue renewable energy goals without infringing WTO rules. With or without local content requirements, government incentives for renewable energy technology manufacturers are more likely to violate WTO subsidy rules, as renewable energy equipment is widely traded internationally. This increases the likelihood of trade disputes with other WTO members.

One potential response is to extend the application of Article XX of the GATT to address conflicts between the rules on subsidies and the need to combat climate change. Article XX(g) of the GATT allows for exceptions related to the conservation of exhaustible natural resources if the measures are "reasonably related" to achieving environmental objectives. Similarly, Article XX(b) could be invoked to justify measures necessary for protecting human health or the environment, such as climate change mitigation efforts (Farah & Cima, 2015).

In practice, however, to justify renewable energy subsidies under Article XX, they must meet strict criteria, including being less trade-restrictive than alternative measures. If governments impose trade remedies on renewable energy technology, this could increase costs and hinder

the global transition to clean energy, thus undermining the overall objective of combating climate change (Farah & Cima, 2015).

The *Canada–Renewable Energy* dispute underscores the complexities of balancing domestic energy policies with international trade obligations. The WTO's approach to renewable energy and subsidies is evolving, and the case highlights the challenges governments face seeking to promote green industries while adhering to international trade rules. As renewable energy becomes an increasingly important part of the global energy mix, further disputes are likely, requiring the WTO to continue refining its approach to energy, environmental policy, and subsidy regulation.

India – Solar Cells

India – Solar Cells revolves around India's Jawaharlal Nehru National Solar Mission, which was launched to promote energy security and ecologically sustainable growth in India. The mission's key objective was to generate 100,000 MW of solar power by 2022. To achieve this, the Indian government implemented a policy requiring solar energy producers to use domestic solar cells and modules in their projects. The United States contested this requirement, arguing that it violated India's WTO obligations, particularly under the General Agreement on Tariffs and Trade (GATT) and the Trade-Related Investment Measures (TRIMs) Agreement.

Summary of the Dispute

The National Mission aimed to foster energy security through renewable energy. Under the policy, the government committed to purchasing electricity from solar energy producers at a guaranteed rate for 25 years. However, to qualify for this government procurement, solar producers were required to use a certain percentage of domestic solar cells and modules to produce energy. The United States argued that this requirement violated the principle of national treatment under GATT Article III:4, which mandates that products from foreign origins receive no less favorable treatment than domestic products. This case is significant as it follows from the *Canada-Renewable energy* above, and India tried to rely on the Article XX exceptions.

Key Legal Findings

Violation of National Treatment (Article III:4 GATT and TRIMs Agreement)

The WTO panel found that India's requirement to use domestic solar cells and modules violated the principle of national treatment under Article III:4 of GATT. The Panel noted that these domestic content requirements, mandatory under Indian law, favored domestic over imported products, thus violating trade rules. Additionally, the TRIMs Agreement prohibits trade-related investment measures that contravene national treatment principles, reinforcing the Panel's findings. India did not appeal this conclusion.

Government Procurement Exception (Article III:8(a) GATT)

India attempted to justify the measure under the government procurement exception in Article III:8(a) of GATT, which exempts government non-commercial purchases from national treatment obligations. The Panel, however, rejected this justification, emphasizing that the electricity purchased by the government was not in direct competition with the solar cells and

modules subject to discrimination. The Appellate Body agreed, ruling that the domestic content requirement did not fall under the procurement exemption.

Climate Change and Energy Security Exceptions (Article XX(j) and XX(d) GATT)

India sought to justify its discriminatory measures under two exceptions in GATT: Article XX(j) (measures essential to the acquisition or distribution of products in short supply) and Article XX(d) (measures necessary to comply with international obligations related to sustainable development and energy security). India argued that solar cells and modules were in short supply in India due to insufficient domestic production capacity. However, the Panel found that Article XX(j) applies only to shortages of products from all sources, not just domestic supply. The Panel rejected this justification since India did not provide evidence of a broader shortage that included imports. The Appellate Body concurred, adding that the analysis should encompass domestic and imported products.

Regarding Article XX(d), India argued that the domestic content requirement was essential for meeting international climate change obligations under the United Nations Framework Convention on Climate Change (UNFCCC) and other international agreements. The Panel and Appellate Body rejected this defense, concluding that the international instruments cited by India did not directly affect India's domestic legal system. The Appellate Body emphasized that for an instrument to be considered a "law or regulation" under Article XX(d), it must meet specific criteria, such as enforceability and normative authority. India's cited international instruments did not meet these criteria.

The WTO panel and Appellate Body concluded that India's domestic content requirements for solar cells and modules violated the principle of national treatment under GATT Article III:4 and the TRIMs Agreement. India's attempts to justify the measure under the government procurement exception (Article III:8(a) GATT) and climate change-related exceptions (Articles XX(j) and XX(d) GATT) were unsuccessful. The case marked a significant precedent in WTO jurisprudence, particularly regarding the interpretation and application of exceptions for trade measures related to sustainable development and energy security.

European Union Palm Oil Cases: WTO Disputes by Malaysia and Indonesia

The European Union (EU) palm oil cases are highly significant for major oil-producing countries like Malaysia and Indonesia. They would have similar implications for countries such as Costa Rica, Colombia, Honduras, and Brazil for producing biofuels from rainforests. These nations have raised challenges against EU regulations that classify palm oil and oil palm crop-based biofuels as at high risk of causing indirect land-use change (ILUC) and argue that these measures are discriminatory. The core issue centers around the EU's restrictions on palm oil-based biofuels, which Malaysia and Indonesia argue threaten their economies and undermine their agricultural sectors.

Background

The EU's Renewable Energy Directive (RED), initially set out by Directive 2009/28/EC, aimed to increase the share of renewable energy in total energy consumption by 2021, specifically focusing on achieving 10% renewable energy use in transport fuels by 2020. Initially, the directive focused on second-generation biofuels derived from lignocellulosic biomass, excluding biofuels from crops like sugarcane, cereal, or vegetable oils like palm oil.

In 2018, the directive was revised with Directive (EU) 2018/2001, which introduced new renewable energy targets for 2030: a mandatory share of at least 32% of final energy consumption from renewable sources and 14% of transport fuel. A key change in this revision was the decision to gradually phase out palm oil-based biofuels by 2030 due to concerns about the high risk of significant greenhouse gas emissions arising from ILUC. This decision aimed to limit the EU's reliance on biofuels contributing to deforestation and environmental degradation.

Considering the Russian-Ukrainian conflict, the EU further strengthened its environmental policies, pushing for reduced dependence on Russian gas while continuing to advance renewable energy development. With the RED III directive, the EU aims to increase its renewable energy share to 45% by 2030.

Economic and Societal Significance

Palm oil plays a critical role in the economies of both Malaysia and Indonesia. In 2021, palm oil accounted for 4.5% of Indonesia's GDP and 2.7% of Malaysia's GDP (Ahmad et al., 2023). The industry is particularly vital in regions such as Riau in Indonesia, which contributes 20% of the country's palm oil production (Afrino & Syahza, 2022). Palm oil is also significant, contributing 11% to Indonesia's total export value in 2021 (Observatory of Economic Complexity).

In Malaysia, 40% of palm plantations are owned by smallholders, and the sector directly employs 570,000 people, with an additional 290,000 in indirect employment. This includes families, meaning over 2 million Malaysians rely on palm oil for their livelihoods. According to the International Labour Organization, palm oil supports 17 million direct and indirect jobs, both formal and informal, in Indonesia.

Politically, both countries have used palm oil to foster agricultural development and provide essential livelihoods, particularly in rural areas. The EU's restrictions on palm oil have thus become a point of contention, further complicated by the broader geopolitical context of the US-China conflict.

The Deforestation-Free Product Regulation and RED II

In May 2023, the EU introduced the Deforestation-Free Product Regulation (EUDR), which came into force on June 29, 2025. This regulation aims to reduce the EU's contribution to global deforestation and support the consumption of products sourced from deforestation-free supply chains. As part of this shift, RED II will apply, gradually phasing out crop-based biofuels, including palm oil, by 2030. Under this framework, palm oil-based biofuels are no longer considered renewable transport fuels due to the environmental impacts associated with their production.

A 2008-2015 EU study highlighted the role of palm oil in deforestation. 45% of oil palm expansion occurs in areas with high carbon stocks, exacerbating greenhouse gas emissions (European Commission Proposal for RED II, 2018). As a result, Malaysia and Indonesia, the world's two largest producers, challenged these regulations at the World Trade Organization (WTO).

Overview of the individual cases:

Malaysia

In January 2021, Malaysia initiated a WTO dispute (DS600) against the EU's measures, marking the first WTO case directly related to deforestation in biofuels. The WTO panel largely supported the EU's right to regulate biofuels that contribute to deforestation. However, it also found that certain aspects of the EU's approach—mainly how the measures were prepared and administered—amounted to "arbitrary or unjustifiable discrimination" against Malaysia. Specifically, the Panel criticized the EU's outdated methodology for assessing the ILUC risk of palm oil, which was based on data from 2008-2016 rather than using the entire lifecycle of palm oil cultivation (up to 30 years). The Panel ruled that while the EU could regulate biofuels for environmental reasons, it needed to revise its methods to avoid discrimination.

On March 5, 2024, the WTO upheld the EU's right to implement environmental regulations but insisted that the EU must change its policy to avoid discriminatory practices against palm oil.

Indonesia

Indonesia also challenged the EU's measures on palm oil biofuels, particularly those imposed by France. Indonesia argued that these measures violated several WTO agreements, including the Technical Barriers to Trade (TBT) Agreement and the General Agreement on Tariffs and Trade (GATT, 1994). The WTO panel found that the EU's measures—such as the 7% cap on palm oil biofuels—were technical regulations under the TBT Agreement. However, Indonesia failed to prove that these measures were inconsistent with international standards or that they caused serious prejudice to its trade interests.

The Panel ruled that France's TIRIB measure—which excluded palm oil-based biofuels from qualifying as renewable—was inconsistent with WTO rules. It imposed higher internal taxes on imported palm oil biofuels compared to domestic biofuels like rapeseed and soybean oil. This ruling highlighted concerns about discriminatory treatment between domestic and imported biofuels.

Implications for Malaysia and Indonesia

Both Malaysia and Indonesia have responded to the EU's measures with significant efforts to improve the sustainability of their palm oil industries. In 2011, Indonesia introduced the Indonesia Sustainable Palm Oil (ISPO) certification, followed by Malaysia's Malaysian Sustainable Palm Oil (MSPO) certification in 2013. These certifications aim to enhance the environmental image of their palm oil industries and increase their competitiveness in global markets, including the EU.

Additionally, both countries have taken retaliatory steps. For instance, in June 2023, Indonesia banned the export of bauxite—one of its key resources—for use in the EU's renewable energy sector. This action reflects Jakarta's intent to force a shift in EU policy, particularly regarding energy transition materials like bauxite, which are crucial to producing electric vehicles.

In conclusion, the WTO disputes between Malaysia, Indonesia, and the EU over palm oil biofuels highlight the complexities of balancing environmental sustainability with economic development in agricultural sectors. While the EU has the right to regulate biofuels based on environmental concerns, the WTO rulings have called for revisions to ensure that these measures do not unfairly discriminate against palm oil-producing countries. As both Malaysia

and Indonesia continue to improve the sustainability of their palm oil industries, their responses may shape future trade and environmental policy decisions globally.

4. Conclusion

The integration of climate objectives into trade agreements, exemplified by the UK-EU deal and the U.S. IRA, illustrates the growing convergence between trade policy and environmental sustainability. These agreements can accelerate the green transition; however, challenges remain, mainly concerning local content requirements and trade barriers. Moving forward, it will be essential to balance the need for green industrial policies with the principles of free trade to ensure that global trade contributes effectively to addressing climate change without undermining international cooperation and competitiveness.

Incorporating climate goals into trade agreements marks a significant shift in global trade dynamics. These agreements aim to mitigate climate change and stimulate economic growth by promoting the green technology sector and ensuring a just transition for workers. The focus on zero tariffs, the promotion of local green technologies, and the expansion of funding for clean energy projects demonstrate that trade policy can play a pivotal role in addressing the dual challenges of economic growth and environmental sustainability.

In this context, the European Commission has prioritized market access for environmental goods and services, particularly in the renewable energy and energy efficiency sectors. The Commission aims to ensure that trade policies support the green transition by addressing tariff and non-tariff barriers. This includes greater access to raw materials and goods needed to produce clean energy technologies (European Commission, 2020). The concerted effort to harmonize trade and environmental goals reflects a promising pathway toward achieving global sustainability objectives, ensuring that the green transition is both environmentally viable and economically beneficial.

However, the cases examined highlight the tension between state efforts to advance environmental goals and their international trade obligations. In the *Canada-Renewable Energy* and *India-Solar Cells* disputes, attempts to build domestic capacity in new technologies were successfully challenged by trade partners. While recourse to Article XX of the GATT was considered following *Canada-Renewable Energy*, such justifications failed to protect India's domestic content requirements. Conversely, in the palm oil cases, suppliers of a fuel source challenged regulations that would curtail its use within the EU trading bloc. The WTO found these restrictions permissible, provided they were transparent and based on robust methodology.

Ultimately, international legal commitments, such as trade agreements and those made at the WTO, constrain countries' policy space in developing domestic renewable energy and technology industries. It is argued that environmental considerations are significant enough to warrant a carve-out from these restrictions at the regional and international levels until the renewable energy sector reaches the necessary maturity. This is especially crucial for developing countries, whose industries may need additional support to achieve this maturity. Moreover, rural populations in these countries stand to lose the most—not only due to the negative impacts of climate change and environmental degradation but also because of competitiveness challenges stemming from high energy costs.

The implications of such regulatory frameworks—or the lack thereof—can have far-reaching economic and social impacts, particularly in rural areas. As trade policies evolve, careful consideration must be given to how these regulations affect production chains and rural economies. Without a balanced approach, there is a risk of exacerbating social and economic inequalities, further hindering the capacity of vulnerable populations to adapt to the green transition.

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