Leuphana Universität Lüneburg

Synergies for the Energy Transition: Interactions Between Guarantees of Origin and the Corporate Sustainability Reporting Directive in the German Electricity Market

A Master's Thesis

submitted for the degree of

M.Sc. Nachhaltigkeitswissenschaft - Sustainability Science

Hana van Loock

https://doi.org/10.48548/pubdata-2357

First Examiner: Prof. Dr. Thomas Schomerus
Second Examiner: Prof. Dr. Claudia Kemfert
Date of Submission: 17.06.2025

Abstract

As the EU advances toward its 2050 climate neutrality goal, Guarantees of Origin (GOs) have evolved to play new roles in renewable energy market expansion and corporate accountability under frameworks like the Corporate Sustainability Reporting Directive (CSRD). This thesis investigated whether interactions between GOs – specifically those issued for renewable electricity – and the CSRD create positive synergies that support the energy transition, focusing on two research questions: (I) What are the regulatory overlaps between GOs and the CSRD? (II) Do these overlaps incentivize renewable energy additionality and prevent greenwashing? Using a socio-legal approach combining comparative legal analysis and exploratory expert interviews focused on the German market, this study found that while regulatory overlaps exist, they remain largely administrative and uncoordinated. The CSRD could potentially increase transparency and stimulate corporate demand for GOs, but it does not prescribe criteria that would ensure additionality or prevent misaligned climate claims. The instruments' current implementation results in only weak synergies based on voluntary corporate action; political uncertainties and other market mechanisms continue to play a far greater role in shaping the renewable energy transition. Improving the interaction and strategic value of GOs and the CSRD for the energy market will require clearer regulatory alignment, agreement on their intended roles, market reform, and stricter corporate sustainability criteria.

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List of Abbreviations

Abbreviation	Definition
AIB	Association of Issuing Bodies
AR	Application Requirements
CSRD	Corporate Sustainability Reporting Directive
DR	Disclosure Requirements
EAC	Energy Attribute Certificate
EEA	European Economic Area
EEG	German Renewable Energy Act (Erneuerbare-Energien-Gesetz)
EGD	European Green Deal
EnWG	German Energy Industry Act (Energiewirtschaftsgesetz)
ESRS	European Sustainability Reporting Standards
ETS	EU Greenhouse Gas Emission Trading System
EU	European Union
GHG	Greenhouse Gas
GO	Guarantee of Origin
HKNR	Register of Guarantees of Origin (Herkunftsnachweisregister)
HkRNDV	Guarantee of Origin Ordinance (Herkunfts- und Regionalnachweis-Durchführungsverordnung)
PPA	Power Purchase Agreement
REC	Renewable Energy Certificate
RED	Renewable Energy Directive
RES	Renewable Energy Sources
RFNBO	Renewable Fuels of Non-Biological Origin
SME	Small and Medium-Sized Enterprise
TEU	Treaty on European Union

Abbreviation	Definition
TFEU	Treaty on Functioning of the EU
UBA	German Environment Agency (Umweltbundesamt)

1. Introduction

As Europe is faced with the urgent need to reduce greenhouse gas (GHG) emissions to meet its 2050 climate neutrality target, the energy sector remains a crucial area of intervention. In the European Union (EU), the energy sector stands as the largest source of GHG emissions, accounting for about 75% of total emissions (Eurostat, 2023). While efficiency and sufficiency strategies are important in this regard, accelerating the shift towards renewable energy sources (RES) and decoupling energy generation from fossil fuels is crucial, especially as global and European energy demands are expected to keep rising over the next years (Çam et al., 2024). The EU has introduced and updated various policy frameworks under the European Green Deal (EGD) to support this energy transition, with the revised Renewable Energy Directive (RED; RED II and RED III) being one of the key components aimed at increasing renewable energy production. Over the past decade, there has been some significant progress, as the RES share of total energy consumption increased by 12 % to 24.5% from 2010 to 2023 (European Commission, n.d.-b), and the EU electricity mix reached a record RES share of 44% in 2023 (Brown et al., 2024, p. 6). However, the current pace of renewable integration remains insufficient to achieve EU climate goals (Brown et al., 2024, pp. 9-10). Especially as electrification continues to be pursued in many sectors, this will remain a pressing problem due to rising electricity demand.

A central mechanism of the renewable electricity market within the EU is the Guarantee of Origin (GO) system. Introduced during the liberalization of the electricity market in the late 1990s, GOs are issued for each unit of renewable electricity produced, certifying its origin and serving as a transparency and consumer protection tool (Maaß et al., 2019, p. 4). As demand for renewable electricity grows, particularly among corporate consumers pursuing sustainability strategies, the role of GOs has evolved. They are increasingly seen as a market-based support mechanism for the energy transition (Bogensperger et al., 2023; Hamburger, 2019; Hauser et al., 2019; Lorenz et al., 2022), as well as a verification tool for reporting corporate renewable energy consumption and GHG emissions reductions in sustainability reports (dena, 2022; Sakhel, Mundt, et al., 2022). These position GOs not only as a tool to enable renewable electricity trade in the market, but also as a market instrument and corporate reporting tool, bridging renewable energy claims with corporate accountability.

However, the GO system faces substantial criticism concerning its effectiveness in facilitating renewable energy expansion. One major critique revolves around the concept of additionality, where GOs should stimulate the development of new renewable capacity rather than simply

transferring existing green quality around the market. Critics argue that in its current form, the GO market often fails to signal that renewable energy claims correspond to new investments, undermining its role in accelerating the energy transition (e.g. Wimmers & Madlener, 2024). This disconnect has fueled accusations of greenwashing, where renewable utility providers sell renewable electricity products that do not necessarily contribute to the energy transition (e.g. Bogensperger et al., 2023).

Greenwashing concerns extend further under corporate sustainability reports. As companies increasingly rely on GOs to substantiate Scope 2 GHG emission reductions, the integrity of these claims is called into question, particularly due to the risks of double counting (e.g. Brander et al., 2018). Especially in light of the Corporate Sustainability Reporting Directive (CSRD), which aims to standardize sustainability disclosures across the EU, the proper understanding and governance of such risks are crucial to not obscure real emission reductions, eroding stakeholder trust.

The introduction of the CSRD requires a robust GO system to ensure credible and verifiable emissions and energy reporting in corporate sustainability disclosures. At the same time, it is expected to accelerate corporate demand for GOs by increasing external pressure for sustainable practices. These evolving requirements underscore the need to understand how these frameworks interact. This thesis explores the intersection of GOs and the CSRD, focusing on their regulatory overlaps and potential to drive the energy transition while addressing concerns of additionality and greenwashing. Through an interdisciplinary socio-legal analysis, this study aims to determine whether these mechanisms can reinforce each other to foster credible decarbonization.

1.1. Thesis Scope

Although GOs apply to all energy sources, this thesis focuses on the electricity market due to its established regulatory framework and pivotal role in the decarbonization process. Unlike other sectors still undergoing transition, the electricity market is more mature and has established mechanisms that support the implementation of regulatory frameworks designed to promote renewable energy. This makes it an ideal context for examining how market-based solutions and regulatory policies can interact to foster environmental progress.

While EU directives are analyzed, the focus of the market analysis is specifically on the German electricity market. Germany serves as a particularly relevant case study because of its unique regulatory environment, which significantly influences the functioning of the GO

market. Furthermore, as one of the largest electricity markets in Europe and a leader in the EU's energy transition, Germany provides valuable insights into the broader challenges and opportunities within the European GO system.

This thesis examines energy demand primarily from industry and large corporations rather than households, as the focus is driven by interactions with the CSRD. While household energy consumption is important, industrial and corporate sectors dominate electricity consumption (see Section 2.1.2), making them central to discussions on regulatory impact and market transformation.

1.2. Research Questions and Outline

To gain insight into the current and future market developments, this thesis seeks to answer the following research question: *Do Guarantees of Origin (GOs) and the Corporate Sustainability Reporting Directive (CSRD) generate positive synergies that contribute to accelerating the energy transition?*

To address this main question, the following subquestions are examined:

I) What are the regulatory overlaps between GOs and the CSRD?

II) Do the regulatory overlaps interact to:
   a. Create economic incentives to promote the additionality of renewable energy production?
   b. Prevent greenwashing?

The thesis is structured as follows: It begins by establishing a theoretical framework that introduces the EU's sustainability governance approach, with a focus on the energy transition and corporate accountability. This is followed by an overview of the GO market, highlighting key criticisms from the literature, and an introduction to the CSRD, including emerging indications of potential synergies between the two instruments. Building on this foundation, the research questions are revisited to reflect their grounding in the theoretical and regulatory context. Using a comparative legal analysis, the thesis then examines the relevant legal texts underpinning the GO framework and the CSRD to identify direct and indirect regulatory overlaps. To complement this, exploratory expert interviews are conducted to capture practical insights into market dynamics, corporate behavior, and regulatory impacts. Finally, the findings from both the legal and empirical analyses are synthesized to assess whether synergies between GOs and the CSRD can contribute to accelerating the energy transition.

2. Theoretical Framework and State of Research

To build a theoretical foundation for the thesis, it is essential to first situate GOs and the CSRD within the broader EU governance frameworks. Therefore, this section begins with a brief overview of the EU's governance frameworks on sustainability and climate change, and the sustainable energy and corporate accountability frameworks that derive from it. The mentioned policies and legal frameworks are not exhaustive and serve to contextualize the regulatory environment relevant to this thesis. Following that, the specific policy instruments relevant to this thesis will be examined: GOs and the CSRD.

2.1. EU Sustainability Governance and the Energy Transition

This subsection introduces the EU's sustainability governance structure, focusing on the legal and policy frameworks that drive emission reductions and the energy transition, especially within industry and corporate domains. A brief background on these frameworks will serve as a foundation to understand the GO system and the CSRD within the broader context of the EU's decarbonization objectives and energy transition.

2.1.1. Policy and Legal Frameworks

The EU's climate and energy governance framework is shaped by ambitious global climate commitments, especially those under the Paris Agreement (2015). To fulfill these international commitments, the EU has established a comprehensive set of policy instruments and legal measures designed to achieve climate neutrality by 2050. Its legal framework is both broad and multifaceted, spanning multiple legal domains and policy areas.

EU law is generally divided into *primary law* and *secondary law* (de Sadeleer, 2015, p. 40). *Primary law* encompasses treaties such as the Treaty on European Union (TEU) and the Treaty on Functioning of the EU (TFEU), which establish foundational principles, including those of environmental protection and sustainable development (e.g., Art. 3 TEU; Art. 11 TFEU). *Secondary law* consists of binding legal instruments such as regulations and directives, which translate policy objectives into enforceable requirements, as well as non-binding instruments consisting of opinions and recommendations (de Sadeleer, 2015, p. 52). Regulations take immediate effect, while directives need to be transferred into national law by member states (de Sadeleer, 2015, p. 53). Because the European Economic Area (EEA) aims to extend the EU internal market to Iceland, Liechtenstein, and Norway, EEA-relevant EU secondary legislation is subject to incorporation into the EEA Agreement by the EEA Joint Committee and can then take legal effect in EEA states (Art. 102 EEA Agreement).

Given the complexity and far-reaching implications of sustainability across multiple domains, there is no single "sustainability law". Instead, sustainability-related legal measures are embedded within various areas of EU law, such as environmental law, energy law, or economic law (de Sadeleer, 2015). As a result, policy strategies like the EGD play a crucial role in shaping and coordinating regulatory frameworks under a common sustainability objective.

Introduced by the European Commission in 2019, the EGD is the EU's overarching policy framework for achieving climate neutrality by 2050. The European Commission (2019) recognizes the need for systemic transformations beyond climate governance and describes the EGD to be a tool to "exploit the available synergies across all policy areas" (p.3). Key areas of the EGD are climate, energy, circular economy, buildings, pollution, ecosystems and biodiversity, farming, mobility, as well as aspects of financing the transition and ensuring a just transition (European Commission, 2019, p. 3). One of the first legal measures adopted under the EGD was the EU Climate Law, which writes down the 2050 climate neutrality target into a legally binding commitment and establishes an interim target of 55% GHG reductions by 2030, compared to 1990 levels. Other initiatives under the EGD include the "Fit for 55" policy package, which has accelerated the ambition and scope of climate governance (Dupont et al., 2024, pp. 5-7). To facilitate the required investments, the EGD Investment Plan commits over one trillion euros, and additional mobilization of private capital is planned through legislative instruments in sustainable finance (European Commission, n.d.-a).

One of the central elements of the EGD is the energy transition, targeted through the expansion and deployment of RES. Although public intervention in the energy sector aims to balance the "three energy pillars" of security of supply, economic efficiency, and environmental protection, over time, the urgency of addressing climate change has shifted policy priorities (Iliadou, 2024, pp. 142-143). EU energy legislation has evolved to focus on environmental protection by promoting renewable energy, which, in the long run, can improve all three energy pillars. EU legislation also helps mitigate the higher short-term costs incurred during the transition. As such, legal measures favoring RES over fossil fuels have been implemented based on the EU primary law's principles of environmental protection and sustainability. While favoring certain technologies would typically conflict with free market competition rules, it is justified in this case as they support these sustainability principles (Iliadou, 2024, p. 145). All EU member states are going through their own transition within this governance structure, integrating individuals and companies in this process through national laws that align with the EU legal framework. As this transition unfolds, the active involvement of industry and corporations is

crucial in driving the shift towards a more sustainable energy system, as will be explored in the following section.

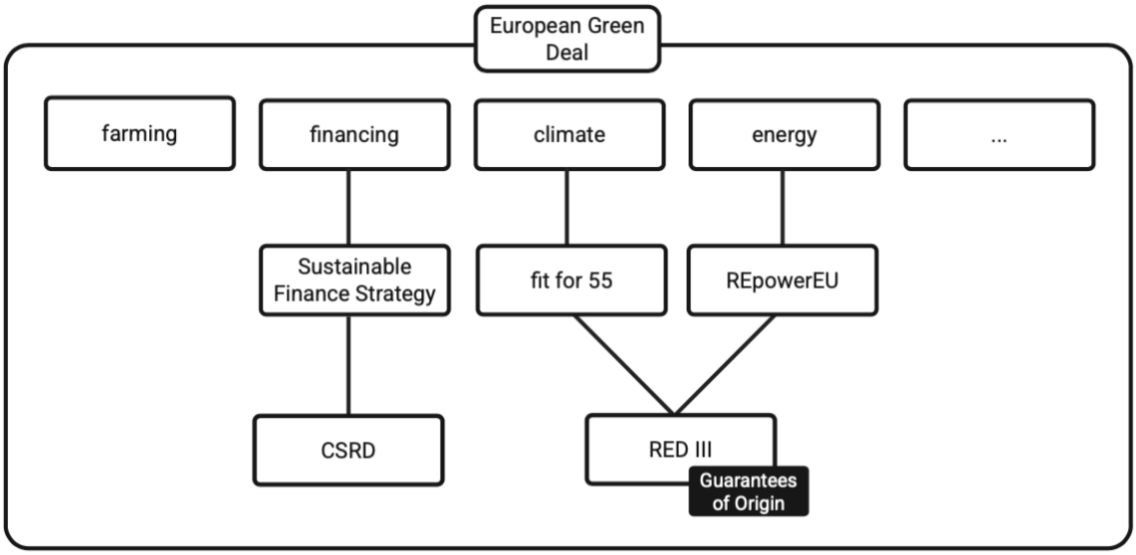
2.1.2. Corporate Sustainability Governance in the Energy Transition

As some of the largest energy consumers and GHG emitters, corporations are central to the EU's efforts to meet its climate and sustainability goals. Industry, services, and transport collectively make up about 70% of total EU energy consumption compared to 27% for households (Eurostat, 2024, p. 13). Industrial and corporate energy use therefore accounts for a disproportionate share of EU energy consumption, positioning corporations as essential actors in achieving energy transition targets. In general, some of these corporations have a significant impact on the environment. Folke et al. (2019) highlight the disproportionate global influence and control exerted by major transnational companies, illustrating how their current business practices substantially contribute to environmental degradation, thus threatening the integrity of the global biosphere. However, they also observe a shift that some of these influential corporations are beginning to adopt more sustainable practices, which could be used as a leverage to significantly accelerate global sustainability efforts if "combined with effective public policies and improved governmental regulations" (Folke et al., 2019, p. 1401). Although corporations are currently major contributors to environmental degradation, their substantial influence over global markets and resource flows positions them as crucial leverage points for steering sustainability transformations. For many industrial companies, transitioning their energy sourcing is already a key course of action to contribute to climate protection and decarbonization, whether it be due to legal obligations, economic incentives, or on a voluntary basis (Bowe & Girbig, 2021, p. 8). Thus, the interplay of legal mandates, regulatory instruments, and voluntary market mechanisms is crucial in determining the extent of such corporate participation in the energy transition.

The key EU regulatory frameworks that govern industrial emission reductions and the energy transition under the EGD are: the EU Greenhouse Gas Emission Trading System (ETS), the Effort Sharing Regulation, the Energy Performance in Buildings Directive, and the updated RED (Bowe & Girbig, 2021, p. 11). Next to the ETS, which establishes a cap-and-trade mechanism that progressively reduces emission allowances across industries, including the energy sector, the RED also serves as a cornerstone of the EU's energy transition. While the ETS targets emissions reductions through market-based mechanisms, the RED focuses on increasing the share of renewable energy in the energy mix. The latest revision, RED III, adopted in 2023, builds on previous versions (particularly RED II) and strengthens the EU's

commitment to increasing renewable energy production and reducing GHG emissions. It sets a new legally binding renewable energy target of 42.5% of gross final consumption by 2030, which all EU member states are required to contribute toward with their own national targets. It covers the electricity, heating, and transport sectors and aims to facilitate their electrification as well as renewable fuels deployment in areas where electrification is not yet feasible (European Commission, n.d.-b). Some of the mechanisms outlined in the RED III include the promotion of cross-border renewable energy collaborations and the facilitation of GOs as a certification tool for verifying the renewable origin of electricity. The following figure provides a simplified overview of how the RED III and GOs are positioned within the broader framework of the European Green Deal (see Figure 1).

Figure 1 *Mapping the CSRD and GOs within the European Green Deal*



Note. This simplified schematic illustrates how the CSRD and GOs are embedded within the broader context of the European Green Deal. It highlights key thematic pillars such as financing, climate, and energy, and shows relevant policy strategies – including the Sustainable Finance Strategy, Fit for 55 Package, and REPowerEU – which have influenced the development of the CSRD and RED III.

From the perspective of sustainable finance and corporate reporting, the EGD guides company practices toward sustainability through the Sustainable Finance Strategy, which includes regulatory initiatives such as the EU Taxonomy, the Sustainable Finance Disclosure Regulation, and the CSRD (Netz-Regett et al., 2022, p. 1). They aim to include sustainability factors in the decision-making processes for investments and financing and thus foster sustainable business practices across a wide area of the economy and industry. On the one hand, it is proven that such legally binding measures can shape company participation in sustainable practices. For

instance, Li & Jia (2022, pp. 144-145) show that even the mere announcement of mandatory reporting requirements improves the sustainability performance of affected companies. This effect is even stronger in countries with a high rule of law index, a category in which many EU countries rank highly. However, other studies report ambiguous results on the effects of mandatory reporting on sustainability performance, suggesting that variations in enforcement, corporate loopholes, and sanctions may influence their effectiveness (Hummel & Jobst, 2024, pp. 322-323). The EU's aim with these reporting measures is to stimulate a shift toward a sustainable global economy. This includes establishing a classification for environmentally sustainable activities, enhancing the comparability of reporting, preventing greenwashing, promoting sustainable financing and investment, and strengthening investor protection (Hummel & Jobst, 2024, p. 331).

In this context, the CSRD also seeks to encourage a shift toward renewable energy production and consumption. Unlike the RED III, which sets legally binding targets and provides guidelines for EU member states to improve energy market design for the transition, the CSRD does not impose sustainability goals or targets. Instead, it functions as a disclosure and accountability mechanism, incentivizing companies' voluntary commitment to climate-friendly practices by increasing transparency about the types of energy they produce or consume, and making this information accessible to investors, consumers, and civil society. Some literature suggests that, due to its transparency requirements, the CSRD could foster demand for RES and trigger changes in the renewable energy market, with implications for the GO system (e.g. Bogensperger et al., 2023; dena, 2022). Other discussions highlight the importance of the credibility of the GO system for corporate claims about renewable energy consumption (e.g. Sakhel, Mundt, et al., 2022; Styles et al., 2021). Chrysikopoulos et al. (2024, p. 33) further emphasizes in their analysis of the GO research landscape that upcoming research should focus on the relationship between harmonized European GO markets and broader sustainability objectives, including how corporate sustainability reporting frameworks can strengthen renewable energy distribution. The recent Omnibus Regulation, which reduces the scope of the CSRD, represents a new development that may impact the effectiveness of these initiatives. This will be explored in more detail in Section 2.3.

2.2. Guarantees of Origin for Renewable Electricity

The following sections explore the GO market, examining its legal foundations, unique characteristics of the German market, and, most importantly, the key issues that contribute to the lack of additionality and the prevalence of greenwashing claims.

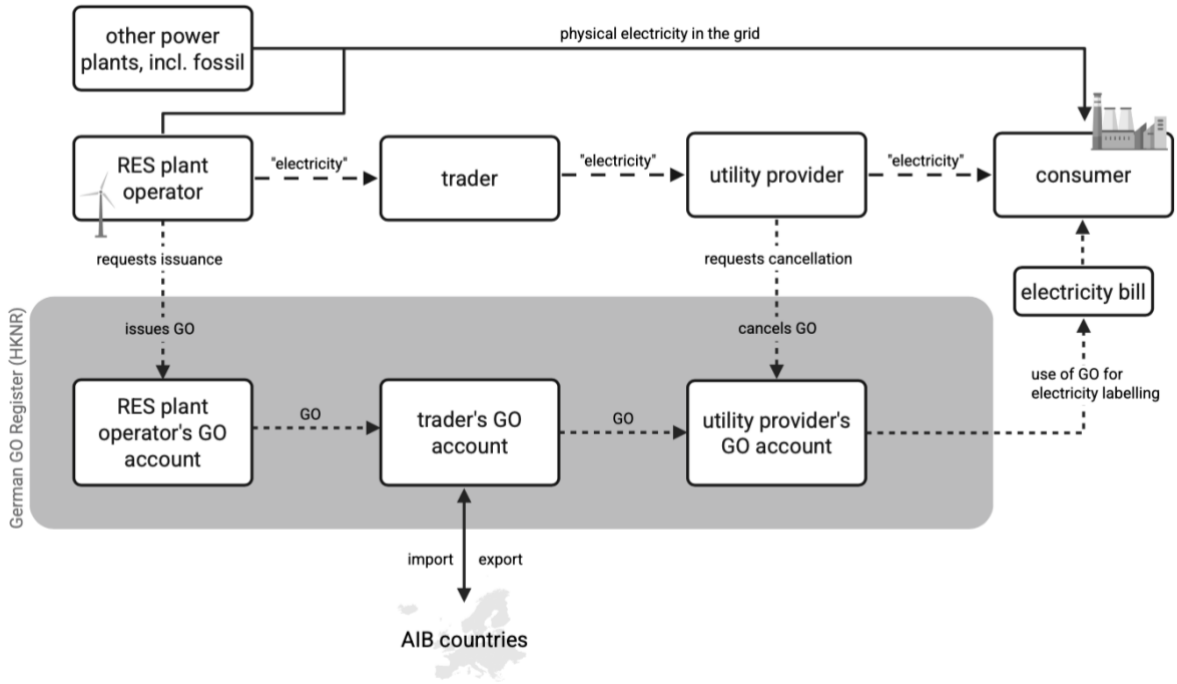
2.2.1. Guarantees of Origin and the Voluntary Green Electricity Market

A Guarantee of Origin (GO) is the official standardized digital certificate used across most European countries to verify the renewable origin of electricity. It is a digital document that certifies the renewable origin of one MWh of electricity and contains information such as energy source, technology, plant age and plant location (Styles et al., 2021, p. 6). Similar certificates are referred to as energy attribute certificates (EAC), green certificates, or renewable energy certificates (REC), with these terms sometimes used interchangeably in literature (Chrysikopoulos et al., 2024, p. 5). EACs, RECs, and GOs all certify renewable energy generation, with EACs being the overarching category, RECs the North American standard, and GOs the European standard.

GOs were introduced under the RED I in 2001 to ensure that each unit of renewable electricity is marketed as green electricity only once, preventing multiple claims on the same energy unit (Lorenz et al., 2022, p.9). This regulation became necessary due to the liberalization of the electricity market and the emergence of the voluntary green electricity market in the late 1990s, which allowed consumers to influence their electricity mix by deliberately choosing to purchase electricity generated from renewable sources (Maaß et al., 2019, p. 4). It created the need to clearly distinguish renewable electricity from other electricity. However, as electricity is physically homogeneous and travels the shortest path through the energy grid to the nearest point of demand, it inevitably mixes with electricity from all other energy sources, including coal, nuclear, and gas power plants. This physical characteristic means that green and grey electricity cannot be distinguished from another in the grid (Maaß et al., 2019, p. 4). Therefore, it was necessary to establish a separate market mechanism that mimics the trade of green electricity independently of the physical energy flow.

The current legal basis for GOs is set in Art. 19 RED II. In Germany, the legal framework is implemented in the German Energy Industry Act (EnWG, Energiewirtschaftsgesetz), the German Renewable Energy Act (EEG 2023, Erneuerbare-Energien-Gesetz), and the Guarantee of Origin Ordinance (HkRNDV, Herkunfts- und Regionalnachweis-Durchführungsverordnung). It prescribes the German Environment Agency (UBA, Umweltbundesamt) the role of governing the GO market in Germany through the Register of Guarantees of Origin (HKNR, Herkunftsnachweisregister), overseeing their issuance, transfer, and cancellation (see Figure 2).

Figure 2 *Functioning of the German GO Register in Separation from Physical Electricity and Power Trade*



Note. This figure is based on and expanded from UBA (2025). It visualizes the distinction between three elements: the physical flow of electricity through the grid (where renewable and non-renewable sources are mixed), the trade of electricity, and the separate trade of GOs.

When renewable electricity is generated, the HKNR issues a GO for each MWh produced to the plant owner upon request. The GO can then be traded within the EU and all members of the Association of Issuing Bodies (AIB), which governs the European Energy Certificate System and standardizes and links the national registers of the member countries (Hauser et al., 2019, p. 49). GOs can be bought and sold independently of the associated electricity, but once sold to an end consumer, they are canceled to prevent reuse (Lorenz et al., 2022, p. 9). Exemplary trading prices for GOs are provided in Section 2.2.3 to illustrate typical market rates. Electricity suppliers can only label electricity as renewable on electricity bills and advertisements if they have canceled GOs corresponding to that electricity amount in the HKNR.

Legally, the primary function of GOs remains aligned with their original intent: facilitating consumer transparency in green electricity tariffs. According to Art. 19 RED II, GOs serve two main purposes: (1) providing consumer information, specifically by “demonstrating to final customers the share or quantity of energy from renewable sources in an energy supplier's energy mix and in the energy supplied to consumers under contracts marketed with reference

to the consumption of energy from renewable sources", and (2) enabling the trade of renewable attributes of energy through "[t]ransfers of Guarantees of Origin". They are not formally recognized as a tool for regulatory compliance beyond this, which is also clearly stated in Recital 55 RED II: "Guarantees of origin issued for the purposes of this Directive have the sole function of showing to a final customer that a given share or quantity of energy was produced from renewable sources". Further, the regulatory framework outlines that GOs operate independently of national renewable energy target accounting. As stated in Art. 19(2) RED II, GOs do not contribute to the calculation of European or national renewable energy expansion targets, ensuring that national energy accounting is based on physical renewable electricity production rather than market-based attribute trading. Holzapfel et al. (2024) emphasize this point: "The GO system remains a disclosure system for the private electricity market and plays no role in governmental electricity accounting" (pp. 2-3). This means that while GOs can be traded across national borders, they do not influence the national energy mix. Additionally, although GO sales can generate additional revenue and serve towards financing for plant owners (dena, 2022, p. 4), German law explicitly states that GOs are not classified as financial instruments (§ 79 EEG 2023). Thus, from a purely legal perspective, GOs neither contribute to national or European RES target calculations nor do they function as financing mechanisms for RES projects.

However, their role in the energy market has evolved over time. While their primary legal function remains consumer information, they are now also expected to create market-based incentives for RES production (e.g. Bogensperger et al., 2023; Hamburger, 2019; Hauser et al., 2019; Lorenz et al., 2022). Styles et al. (2021, p. 15) outline the expanded instrumental role of GOs, which include the market-driven support for the expansion of RES, supporting the implementation of other energy policy instruments, and as a tool for statistical or monitoring purposes. This shift is also reflected in the European Commission's long-term perspective, as Hamburger (2019, p. 488) points out that the impact assessment accompanying the RED II suggests that the GO market may serve to complement and potentially replace public support for renewable energy over time. A significant regulatory development in RED III further strengthens this by establishing the transferability of GOs within Power Purchase Agreements (PPAs) and identifying GOs as "a key tool […] for the further uptake of renewable energy purchase agreements" (Recital 48 RED III). PPAs are long-term contracts in which an electricity producer sells electricity to a buyer at a predetermined price. While PPAs can exist independently of GOs, in the case of green PPAs – where the buyer seeks to claim the

renewable origin of the electricity – the transfer of the GO is essential, as it provides the legally recognized proof of renewable origin under EU law. These contracts, when combined with GOs, offer long-term financial stability for renewable energy projects outside of governmental support schemes, making GOs indirectly relevant for project financing in market-based renewable energy transitions.

Beyond market incentives, GOs are increasingly becoming an essential tool to verify and document specific qualities of green electricity, particularly in corporate sustainability reporting and GHG emissions accounting. They serve as a recognized instrument to track renewable energy procurement and its related emissions reduction, a role highlighted in dena (2022) and Sakhel, Mundt, et al. (2022). While a green electricity contract may indicate a company's commitment to renewable energy, it is the GO that provides the verifiable proof needed for accurate GHG emissions accounting. As regulatory developments such as the CSRD, EU Taxonomy, Supply Chain Act, and new requirements for green hydrogen advance, companies face increasing pressure to demonstrate their renewable energy use and emissions reductions (dena, 2022, p. 4; Sakhel, Mundt, et al., 2022, p. 5). In this context, GOs are playing an expanding role in ensuring compliance with these evolving regulations and facilitating the documentation of a company's sustainability efforts.

In parallel to these GO developments in practice, academic research in this field also highlights the recent evolving role of GOs and other EACs across the world. GO research seems to have contemporary relevance, as Chrysikopoulos et al. (2024, p.8) show in their bibliometric analysis of the EAC landscape that 67% of publications in this field were in the last decade (2013-2022), and 41% were in the past five years (2018-2022). Despite their growing significance, concerns remain about the GO system potentially creating perverse incentives that do not support Europe's broader energy transition. The market for GOs faces numerous challenges, some unique to the German market, which the following sections examine.

2.2.2. Specificities of the German Legislation and Market

While Germany is part of the broader European GO market, aspects of its regulatory framework and market dynamics set it apart. Their role in Germany is uniquely constrained by national regulations, particularly concerning state-subsidized renewable energy under the EEG.

The EEG, whose first version was introduced in the year 2000 (EEG 2000), has been the central instrument for increasing the share of renewable energy in the electricity sector, playing a major role in the German renewable energy transition (Hauser et al., 2019, pp. 112-113). It has been

continuously revised to promote the expansion of renewable energy. The EEG requires grid operators to prioritize connecting all RES plants to the grid, take the electricity they produce, and transmit it (UBA, 2023). Additionally, the EEG compensation ensures the financing of RES plants whose returns are uncertain over the long term and therefore cannot economically operate without financial support. It is designed to cover the difference between the fluctuating market price of electricity and the amount needed to make renewable energy production financially viable, usually over a time period of 20 years (UBA, 2023). The EEG compensation used to be funded through an EEG levy, a fee that all electricity consumers paid as part of their electricity bill. This levy helped cover the difference between what plants earned from selling electricity and the fixed support they were entitled to under the law. Since the abolition of the EEG levy mid 2022, the compensations are covered by the federal budget (UBA, 2023), and could now be considered a classical subsidy.

A key element of the EEG in the context of GOs is the *Doppelvermarktungsverbot* (double marketing prohibition) in § 80 EEG 2023, which bans plant operators receiving EEG support from being issued GOs. The European legal framework leaves it up to EU member states whether GOs can be issued for already subsidized electricity or only for unsubsidized green electricity. The Doppelvermarktungsverbot was initially introduced to protect electricity consumers, who contribute to the EEG levy, from being financially burdened twice for the "green" nature of EEG-supported electricity (Kahl & Kahles, 2020, p. 5). However, as federal budgets now fund the EEG compensation and many plants are now partially financed through market-based mechanisms (e.g. subsidized direct marketing), the original rationale for this prohibition – protecting consumers from double charges – has weakened. This has led to calls for a (partial) relaxation of the legislation (e.g. Kahl & Kahles, 2020). Despite these developments and most EU member states issuing GOs for subsidized plants, Germany, and, as of 2021, Ireland, are the two only nations which have opted for this special rule whereby subsidized plants do not receive GOs (Styles et al., 2021, p. 14). Because EEG compensation is usually more financially attractive to plant operators than GO sales, the vast majority of renewable electricity in Germany is EEG-supported and, consequently, does not receive GOs (Styles et al., 2021, p. 17). In Germany, GOs are therefore primarily relevant for renewable energy plants operating outside the EEG support scheme, i.e. those financed purely through market-based mechanisms such as Power Purchase Agreements (PPAs) or direct sales on the electricity market.

The electricity generated by EEG-supported plants is sold as grey electricity in the voluntary electricity market. Meanwhile, the renewable attribute is distributed to all energy consumers in their electricity consumption mix, regardless of whether they choose a green electricity contract or not, as all consumers support renewable energy expansion through the EEG (UBA, 2024). However, when selling a green-electricity product, the utility company must still acquire GOs for the entire amount of electricity supplied, even though the EEG-subsidized amount is also listed on the electricity label (Wettingfeld et al., 2025, p. 9). Renewable electricity providers in Germany therefore rely on foreign GOs to meet the demand, as the domestic supply of GOs is restricted and green utility companies are very reliant on GOs.

As a result, Germany operates with a significant GO trade deficit. The European GO market is largely dominated by Norway, which accounted for approximately 45% of the total traded volume (including both imports and exports) within the AIB zone in 2023, while Germany contributed only about 3% (Wettingfeld et al., 2025, p. 9). Germany is the largest net importer within the AIB, with 193.6 TWh in imports and only 32 TWh in exports (Wettingfeld et al., 2025, p. 10). The majority of these imports originate from Norwegian hydropower (dena, 2022, p. 6), and this dependency has continued to rise in recent years (Wettingfeld et al., 2025, p. 11).

Another distinctive aspect of the German GO system is that GOs can only be canceled by utility companies within the framework of electricity disclosure (§ 30(1) HkRNDV). While this is also the case in countries like Ireland, Italy, and Austria, other EU countries permit large end consumers, such as industrial companies, to cancel GOs themselves (Sakhel, Mundt, et al., 2022, p. 5). In many countries, industrial customers can purchase GOs regardless of the electricity they consume, to improve their emissions balance. In contrast, businesses in Germany – regardless of size or energy consumption amounts – must procure green electricity contracts from utility companies to obtain GOs and use these to verify emissions reductions. As corporate demand for transparent and verifiable renewable electricity sourcing grows, this regulatory framework may become an increasing point of discussion, particularly in the context of harmonizing regulations across the GO market and corporate energy procurement and sustainability reporting trends.

2.2.3. Criticisms of the GO Market: Additionality and Greenwashing

The concepts of additionality and greenwashing are central to the criticisms of the current GO system. Before delving deeper into the criticisms of current GO market issues, it is crucial to define these terms and explain how they are relevant to the functioning of the GO market.

Additionality

The concept of *additionality* originates from the term "additional"; yet it remains to be precisely defined in the context of climate change and development, despite over two decades of debate (Michaelowa et al., 2019, p. 1213). In the Kyoto Protocol, the term is defined in relation to climate mitigation efforts as *mitigation additionality* (LRI, 2014, p. 1). In this context, it serves as a criterion for determining whether the activity which reduces emissions or the actual reduction in emissions (Art. 3(4), 6(1), and 12(5) Kyoto Protocol) is "additional to what would happen in the absence of the activity" (LRI, 2014, p. 1). The Kyoto Protocol also discusses *financial additionality* in the context of climate finance; however, there seems to be no internationally agreed upon definition in this context (LRI, 2014, p. 2). In literature, additionality applies across various thematic fields beyond its use in carbon markets, including energy, water, biodiversity, land use, and other natural resources (Gillenwater, 2012, p. 7). After an extensive review of various different interpretations of additionality in climate policy literature, offset standards, and programs, Gillenwater (2012) proposes the following generalized definition:

> "Additionality is the property of an activity being additional. A proposed activity is additional if the recognized policy interventions are deemed to be causing the activity to take place. The occurrence of additionality is determined by assessing whether a proposed activity is distinct from its baseline" (p. 21).

While broadly formulated, it becomes clear that there is an emphasis on the change that the relevant activity causes, compared to the status quo. Michaelowa et al. (2019, p. 21) further refine this concept, stating that a support mechanism is only considered additional if it is the decisive factor in a project's financial viability or if it enables the deployment of technology that would not otherwise be used – always assessed against a business-as-usual baseline. In the context of green electricity markets, Gillenwater et al.'s (2014) study applies additionality in relation to the financial effect of RECs. The authors test whether the RECs market results in additional investments in renewable energy capacities, whether it be the construction of new plants or repowering existing plants (p. 457). This suggests that they consider RECs to be additional only if investments driven by these RECs result in new renewable energy capacities that would not have been realized in their absence.

Literature on GOs does not always explicitly use the term additionality, though they do often discuss whether GOs create economic incentives for the expansion of renewable energy capacities (Bjørn et al., 2022; Bogensperger et al., 2023; Holzapfel et al., 2024; Sakhel, Mundt, et al., 2022). Styles et al. (2021) further specify that such new capacities need to be additional

to the already existing "public support framework" (p. 23), as renewable capacities built with government subsidies would have been developed regardless. In Germany, due to the separation of the EEG and the voluntary market, this mechanism is distinctly identifiable. Others seem to frame additionality in a much broader context, such as Bowe & Girbig (2021) who see the term "in the sense of a generally accelerated energy transition" (p. 56).

Additionality is also a key concept in the context of green hydrogen production in EU legislation. One way to ensure that hydrogen is renewable is to show that electricity used for green hydrogen production comes from newly built renewable energy plants, rather than existing ones that were already supplying other consumers directly (Bogensperger et al., 2023, p. 12). The goal here is to ensure that hydrogen production genuinely contributes to expanding renewable energy capacity instead of simply reallocating already-existing green power, which would not increase the overall share of renewables in the system. The RED II refers to additionality specifically in the context of renewable fuels of non-biological origin (RFNBO), stating that RFNBOs like hydrogen should be additional, by which they mean that "the fuel producer is adding to the renewable deployment or to the financing of renewable energy" (Recital 90 RED II).

Given these nuances, for the purpose of this thesis, additionality will be considered as the concept that the trading of GOs should contribute to new RES generation beyond existing capacities, benefiting the overall energy transition. This understanding will serve as a reference point for subsequent sections.

Greenwashing

Based on the systematic literature review on *greenwashing* by de Freitas Netto et al. (2020), this term, too, does not have a general agreed upon definition. Its multidisciplinary character spans several areas, including business, communication, economy, production engineering, social sciences, environmental management, and law (de Freitas Netto et al., 2020, p.10). Most literature revolves around the narrow definition of "deliberate corporate action with the presence of misleading elements, focused on the deception of stakeholders" (de Freitas Netto et al., 2020, p.10), which usually encompasses specific instances of wrongful marketing. But there is also a much broader concept of greenwashing, which involves the critique of green capitalism: "Greenwashing is a discursive tool – or a collective doublethink – to persuade us that sustainability is possible without radical political change, and is therefore an essential part of the continued legitimisation and (dis)functioning of market capitalism" (Williams, 2024, p.

8). Greenwashing in the broader sense, therefore, does not only apply to deliberate deceptions by businesses but also systems which shift the responsibility for environmental protection onto individuals, creating a false sense of agency. It also critiques certification schemes, particularly voluntary ones, for being ineffective, inconsistent, and reinforcing power imbalances, while failing to drive meaningful environmental change (Williams, 2024, p. 9). Whether greenwashing is seen narrow or broad, a major issue of greenwashing is the fact that it is difficult to identify: "Even among consumers considered expert consumers, well informed about greenwashing and the market in question, it is a challenge to identify greenwashing" (de Freitas Netto et al., 2020, p. 10).

In GO literature, the term greenwashing is explicitly defined in Hauser et al. (2019, p. 22), who describe it as a measure through which an entity (companies or other institutions) claims sustainability engagement, despite the measure itself having no significant environmental impact. While few papers provide definitions, they often describe greenwashing in the context of utility companies, industrial companies, and other actors marketing domestically generated grey electricity as green solely through the use of GOs, often sourced from Scandinavian hydropower plants (e.g. Sakhel, Styles, et al., 2022, p. 9). This practice has led to growing skepticism among consumers and stakeholders regarding the credibility of green electricity claims.

For the purpose of this thesis, greenwashing is understood as the practice of making misleading claims about the environmental benefits of electricity consumption by using GOs without ensuring a real contribution to renewable energy deployment or emissions reductions. Importantly, such claims do not necessarily imply malicious intent; rather, they can result from structural shortcomings and distorted incentives within the GO market itself. A broader discussion of these market challenges will be described in the following.

Key GO Market Challenges

The concerns of additionality and greenwashing manifest in multiple GO market challenges. These will be categorized into the following three key aspects for the purpose of this thesis: (1) low and volatile prices, (2) physical reality mismatch, and (3) double counting. The following section will explore how these problems contribute to the shortcomings of the market and its failure to adequately address additionality and greenwashing.

(1) Low and volatile prices

A central issue in the GO market is that the prices of GOs are too low and too volatile to effectively incentivize the development of new RES projects. In theory, the GOs that are sold provide the RES plant operator with additional revenue, improving the competitiveness of renewable energy production in the energy market (Bowe & Girbig, 2021, p. 55). The effectiveness of this mechanism is significantly influenced by the weight of the GO revenue's contribution to financing the investments for such RES production (Styles et al., 2021, p. 21). It can be said that the higher the GO price, the greater the incentive for new RES project developments. However, current prices remain too low and too volatile to have any significant effect, as highlighted in the following studies.

GO prices are primarily determined by supply and demand. Nordic Hydro GOs (hydropower from Denmark, Finland, Iceland, Sweden, or Norway) are the most common and serve as a benchmark for all GO prices (Hauser et al., 2019, p. 213; Wimmers & Madlener, 2024, p. 5). For instance, the years 2018 and 2019 were low rainfall years in Nordic countries which would have led to lower hydropower capacities, affecting supply, leading to price increases of GOs in those years (Lorenz et al., 2022, p. 12). Although other factors such as age, technology, location of power plant influence specific GO prices; fundamentally, supply and demand play the most important role overall (Wimmers & Madlener, 2024, p.4). The reason for low GO prices is therefore most certainly the oversupply of GOs in relation to the existing demand. Hulshof et al. (2019, p. 707) note that many issued GOs in the European market remain unclaimed, supporting the fact that the demand does not match supply. This imbalance partly arises because countries have flexibility in choosing their preferred emissions accounting method. In countries like Norway, where renewable energy shares are high, companies often use location-based emissions factors instead of market-based accounting (Herrmann et al., 2023, p. 7), which can reduce reliance on GOs and lower their demand. The role of different accounting methods in GO demand will be explored in more detail in Section 2.3.1.

In Germany, the GO market operates through over-the-counter trading, a form of bilateral trading where seller and buyer privately agree on a price through brokerage firms or over-the-counter platforms (Lorenz et al., 2022, p. 10). Large utility companies often rely on brokers to structure demand and coordinate the solicitation of offers (Hauser et al., 2019, p. 195). Although prices are not publicly available due to the bilateral nature of trading, studies are still able to identify price ranges. For example, in 2020, GO prices in Germany ranged between 0.1 EUR and 0.4 EUR per MWh. Since mid-April 2021, a ceiling of 0.5 EUR per MWh has been

observed. During the years of low Nordic hydropower supply, GOs reached around 1.73 EUR per MWh in 2018 and 2019 (Lorenz et al., 2022, p. 12).

Still, even those relatively higher numbers seem not to be significant enough to drive new RES investments. In 2020, GOs accounted for only 0.3–1.3% of the total electricity price, which indicates that the price signal is too weak compared to other market factors such as wholesale electricity prices (Lorenz et al., 2022, p. 13). Wimmers & Madlener (2024, pp. 7-8) describe GO revenues as a "nice-to-have" by-product rather than a decisive factor in investment decisions. Although Hauser et al. (2019, pp. 21-27) predict that GO prices could stabilize and play a larger role as a revenue source for plant operators since supply and demand started to balance for the first time in the 2019/2020 reporting period, Wimmers & Madlener (2024) find that at present price levels without policy changes, GOs remain insufficient to stimulate new renewable investments. To become investment-relevant, prices would need to exceed current governmental support schemes. However, their price projection models until 2040 indicate that even under scenarios that would lead to highest GO prices, GOs will not reach such levels (Wimmers & Madlener, 2024, pp. 22-23). Nonetheless, their study suggests that GOs could serve as an additional revenue stream for older plants exiting subsidy schemes, such as German wind turbines falling out of the 20-year EEG support period (p. 22).

The low prices lead to two main problems regarding *greenwashing* and *additionality.* First, as acquiring GOs is typically cheaper than investing in actual RES facilities, utility companies can label their electricity sales and consumption as "green" while continuing to generate or invest in fossil-based energy (Bogensperger et al., 2023, p. 9). This can mislead energy consumers, as well as discredit the green electricity consumption claims that companies make. Secondly, GO revenues are currently only benefitting already established renewable sources, such as Nordic hydropower or old established wind turbines in Germany, instead of going to generating new renewable energy that would not have been generated without GOs. The majority of GOs issued in Norway originate from hydropower plants that are between 41 and 70 years old (Paris et al., 2024, p. 1664). Because of the advanced age of the plants and the low rate of new hydropower development, these Norwegian GOs offer limited additionality and fail to generate new capacity necessary for a true energy transition. However, this is contrary to what electricity consumers assume. The voluntary green electricity market often implies that purchasing a green electricity contract directly supports new renewable capacity, but most GOs do not. This is not a new issue, as research on similar systems as the GO system, such as the U.S. REC market, had already established that these instruments have minimal influence on

additionality in 2014. Gillenwater et al. (2014, p. 457) concluded that the voluntary REC market in the U.S. does not significantly impact the economic feasibility of wind power facilities. This suggests that the problem of non-additionality is neither unique to the European GO system nor a new issue. Consequently, low prices can reinforce or justify greenwashing claims (Sakhel, Styles et al., 2022, p. 9).

Additionally, mistrust in the GO system arises from the fact that the financial flows, although not sufficient to drive additionality, primarily support RES in the country of origin, rather than the country of consumption. This is particularly relevant for Germany, where the volume of GO cancellations has been growing more rapidly than domestic renewable electricity production (Wettingfeld et al., 2025, p. 11), indicating that a substantial portion of green electricity consumption is not being met by domestic renewable generation. This situation is intensified by the heterogeneous implementation of the RED II and III across EU countries, where Germany maintains a strict separation between GO issuance and government subsidies while other countries do not (see Section 2.2.2). This can lead to misconceptions among German buyers who may assume that GOs from other EU countries also originate from unsubsidized plants (Bowe & Girbig, 2021, p. 57). Also, the strict legal separation between the voluntary green electricity market and the EEG restricts the ability to meet consumer demand with German GOs, limiting the green electricity market's growth through consumer choice and its potential to contribute to Germany's energy transition (Maaß et al., 2019, p. 10). Moreover, the argument that RES expansion should be promoted where costs are lowest is constrained by the fact that Norway's electricity generation is already renewable and that transmission capacity to the rest of Europe is limited (Paris et al., 2024, p. 1665) – a systemic issue further explored next.

(2) Physical reality mismatch

Another major criticism is that GO trading does not reflect the physical realities of electricity transmission, creating misleading incentives that do not align with the actual needs of the energy system. One problem is that GO trading volumes can surpass the actual electricity exchanged between countries due to grid capacity limitations (Sakhel et al., 2022, pp. 19-20). Hamburger (2019, p. 499), analyzing GO trade from 2016 to 2018 in comparison with physical electricity flows, concludes that traded attributes far exceeded physical capacity, with over 70% of GO exports and over 60% of imports occurring without corresponding physical electricity flows. Such case can be observed in the trade between Norway and Germany, in which electricity physically flows in much smaller volumes than at which Norwegian GOs are being

sold and used for green electricity claims. While there is a physical interconnection between these countries, other GO trade happens between countries that do not even have a physical grid connection, such as Cyprus, Iceland, and Ireland (Hamburger, 2019, p. 500). This highlights a fundamental reality of the GO system: it functions as a bookkeeping tool, distinct from the physical flow of electricity. Companies in Germany can purchase Icelandic and Norwegian GOs and claim to use renewable energy, even though the electricity they consume is most likely generated from domestic sources, including fossil fuels. The current system allows for a mismatch between certificate trading and grid realities, raising concerns about the credibility of corporate sustainability claims and the true impact of GOs on the energy transition. Also, it may weaken incentives for renewable energy expansion in regions where companies actually operate (Sakhel et al., 2022, pp. 19-20).

Not only does GO trading not match grid capacities, but there is also a time granularity problem. Electricity can be certified as green using a GO as long as the GO was issued within a 12-month period. Based on annual accounting, the GO system fails to capture the real-time fluctuations of renewable energy generation (Lorenz et al., 2022, p. 16). As a result, consumers can fulfill RES quotas using certificates from technologies that do not generate power consistently throughout the year (e.g. solar), leading to a mismatch between the price signal and the physical reality of RES generation. It wrongly assumes that electricity can be stored unlimitedly, which leaves open accusations of greenwashing, as the GO system assumes a "fictitious world in which green electricity can be stored and dispatched at no additional cost and in unlimited quantities throughout the year" (Lorenz et al., 2022, p. 3). It also encourages investments in the most affordable RES technologies instead of technology that is most significant for the RES transition (p. 17). For example, if GO certificates would need to match their actual electricity consumption each hour, prices during scarcity hours (e.g. nighttime, cloudy days, windless days) would increase. These would incentivize investments in technologies like storage solutions and wind power, or east-west facing PV, as the market sends higher price signals during that time (Lorenz et al., 2022, p. 18). This would create more geographical and technological diversity, supporting grid-supportiveness and grid-expansion, benefitting the energy transition long-term and making it less reliant on fossil sources. These price signals would also set incentives for flexible demand, and shift energy intensive activities to hours where there is high renewable generation (Lorenz et al., 2022, p. 18). However, weak timestamping fails to incentivize such investments in flexible renewable solutions like storage or demand-response systems and fails to contribute to broader system integration.

Neither the electricity price signal (due to the high share of fixed price components) nor the verification system using annually valid GOs adequately reflect existing and increasing future grid constraints, specific market values, contributions, or (demand-side) flexibility options of renewable energy for system integration (dena, p. 11). This hampers *additionality*, as the incentives provided by the GO system are not effectively driving the development of the technologies required to transition to a low-carbon energy system. During low renewable generation hours, the system keeps relying on fossil sources. Moreover, the ability for companies to purchase these non-granular GOs allows them to claim they are supporting renewable energy without necessarily supporting the technologies or projects that would have the most impact on reducing emissions. Also, companies may procure green electricity on paper while still relying on fossil fuels during periods of insufficient renewable supply. This means that their renewable energy sourcing is primarily accounting-based (or *book-and-claim*), rather than physically matched to actual electricity consumption. While this system enables flexibility, it can create a misleading perception among consumers, who may not understand the difference between the physical energy mix and the accounting certificates (Sakhel, Styles, et al., 2022, p. 9). As a result, companies can claim to source renewable energy without having a tangible impact on the local energy mix or contributing to new renewable capacity. This mismatch opens the door for *greenwashing* and undermines the integrity of sustainability claims.

(3) Double counting

Double counting occurs when the same unit of renewable energy or its derived environmental benefit is counted multiple times, distorting market signals and misleading stakeholders about the actual contribution of renewable energy. It usually occurs when renewable electricity is accounted for both in a country's national energy mix and in a corporation's consumer energy mix (Sakhel, Mundt, et al., 2022, p. 17). While the term *double counting* is commonly used as the overarching term, some other terms emerging in this regard are *double claiming, perceived double counting*, or *double marketing*. Norway serves as a well-known example of this issue: while the country generates almost 100% renewable electricity, most of its GOs are sold abroad. This creates a situation where international buyers claim the use of renewable energy through imported Nordic Hydro GOs, while domestic consumers claim renewable energy consumption based on the country's high renewable share, despite the fact that, in GO accounting terms, their electricity mix includes fossil fuels when subtracting the exported amounts (Hauser et al., 2019, pp. 66-67). Another famous example is Iceland, which generates 100% of its electricity from RES. It was found that the three major aluminum companies in Iceland, which consume

around 63% of the country's electricity, claimed that their steel is produced with renewable energy although 79% of Icelandic GOs are exported (Herrmann et al., 2023, p. 4). Although Iceland was banned from the AIB in April 2023 as a result, this export ban was lifted only two months later (Herrmann et al., 2023, p. 5). It is therefore likely that such double counting still exists.

A specific issue is GHG emissions accounting in corporate sustainability reporting, as companies can choose between two primary methods for accounting for their Scope 2 emissions: the location-based and market-based approaches. Companies using market-based accounting may claim renewable energy usage based on GOs, while others report emissions reductions using local grid-average emission factors from location-based accounting, effectively leading to double claiming issues (Maaß et al., 2019, pp. 66, 72-73; Bjorn et al., 2022, p. 543). These location-based and market-based accounting methods and their implications for corporate sustainability claims will be explored in more detail in the following Section 2.3.1.

As noted by Brander et al. (2025, p. 4), double claiming reduces the scarcity of GOs in the market, thereby weakening the price signals needed to support new renewable projects. This means that actual demand for GOs may decline because companies can claim renewable electricity consumption through location-based accounting, even when the environmental attributes have already been sold elsewhere via GOs. This undermines the *additionality* effect of GOs. Furthermore, these practices can facilitate *greenwashing*, allowing corporations to present themselves as sustainable without genuinely contributing to decarbonization (Maaß et al., 2019, pp. 66-67).

All three market challenges outlined in this section, low and volatile GO prices, non-granular and non-grid-related GO trading, and double counting, are intertwined with the concepts of additionality and greenwashing (see Table 1). Low prices fail to incentivize new projects that could be considered additional, while non-granular trading and double counting both create misleading incentives and allow companies to make false claims about their sustainability efforts. Together, these issues prevent the GO market from effectively supporting the energy transition and contribute to the misrepresentation of corporate sustainability practices, thereby fueling greenwashing and undermining the core objective of driving additional renewable energy development.

Table 1 *GO Market Issues and their Key Effects on Additionality and Greenwashing*

	Additionality	Greenwashing
Low GO prices	weak incentive for new RES projects (e.g. Wimmers & Madlener, 2024)	flooding of cheap non-additional GOs and misleading green claims (e.g. Bogensperger et al., 2023)
Physical reality mismatch	low price signal; incentivizes cheapest technologies and locations, instead of most system-beneficial (e.g. Lorenz et al., 2022)	claims of 100% green power while relying on fossil sources for 24/7 production (e.g. Lorenz et al., 2022)
Double counting	reduced GO scarcity weakens investment incentives (e.g. Brander et al., 2025)	undermines credibility of corporate sustainability claims (e.g. Hauser et al., 2019)

Despite claims that GOs serve as a greenwashing tool, some papers argue these concerns are unsubstantiated. For example, Sakhel, Styles, et al. (2022, p. 51) suggest that labeling electricity GOs as greenwashing oversimplifies their role and overlooks their functional capabilities. Rather than dismissing the entire system, they advocate for a more nuanced approach – examining the qualities of different GO types, their intended purposes, and their impact on the energy transition. Given the expanding roles that GOs are expected to fulfill (as outlined in Section 2.2.1), regulation must also evolve to accommodate their functions beyond the original purpose of a simple electricity disclosure tool. There are some targeted solutions currently emerging in the market, and academic literature as well as industry reports propose further strategies to improve the effectiveness of the GO market, which will be briefly touched upon in the following.

Responses to GO Market Challenges

In response to the criticisms of the GO market, both practice and research have begun to develop targeted solutions. On the one hand, price differentiation and quality labels are increasingly shaping market behavior. On the other hand, scholars and research institutes have proposed reforms in market design to strengthen the GO system.

From a market perspective, buyers are increasingly differentiating GOs based on attributes such as technology type, plant age, geographic origin, and whether the plant receives subsidies. GOs from newer, unsubsidized wind and solar plants tend to be preferred over those from older or subsidized hydropower facilities, and GOs from domestic facilities are particularly popular and tend to be more expensive in Germany than imported ones (Hauser et al., 2019, p. 209-216; Styles et al., 2021, p. 16). This development has given rise to voluntary premium markets and quality seals or labels that seek to certify the additionality and environmental impact of specific

GO types (Sakhel, Styles, et al., 2022). These market-driven developments toward quality differentiation are also reflected in international accounting standards, such as the ongoing revision of the GHG Protocol (WRI & WBCSD, 2024). In this context, key aspects under discussion include the incorporation of quality criteria for GOs, such as time granularity, geographic location, and additionality as prerequisites for credible renewable electricity claims and emissions reporting.

At the same time, academic and policy-oriented literature has called for more structural reforms to address the GO system's limitations. Holzapfel et al. (2024, p. 8) explore the idea of limiting or prohibiting cross-border trade, which would lead to supply shortage, GO price increases in net importing countries like Germany, and could encourage the development of new RES plants. Others discuss the issuance of GOs for newly subsidized plants in Germany, which would enable companies to participate more actively in the expansion of domestic renewable energy, reduce the burden on federal funding, and strengthen premium markets for high-quality GOs (dena, 2022; Maaß, 2021; Sakhel, Styles, et al., 2022; Wimmers & Madlener, 2024). However, this would lead to an overall increase in GO issuance, which could offset the decrease in GO supply that Holzapfel et al. (2024) are suggesting. Several authors also emphasize the importance of time-granular GOs for promoting grid-supportive integration of renewables (Bogensperger et al., 2023; Lorenz et al., 2022; Sakhel, Styles, et al., 2022; Wimmers & Madlener, 2024). Finally, digitalization is widely discussed as a cross-cutting enabler that could improve traceability, enhance market functioning, and address multiple GO market challenges (Bogensperger et al., 2023; dena, 2022; Maaß et al., 2019; Sakhel, Styles, et al., 2022).

Another critical lever for change lies in strengthening demand, which Maaß et al. (2019, pp. 36-49) identify as a key driver of the voluntary green electricity market's continued growth. They argue that there is considerable potential to further increase demand from private consumers, public institutions, and companies, especially in light of ongoing electrification in sectors such as mobility and heating. Dena (2022, p. 2) similarly emphasizes that greater financial participation by businesses and industry could accelerate the expansion of renewable energy. Necessary demand can be generated by effective policy pressure on industrial consumers (Wimmers & Madlener, 2024). Thus, realizing this potential requires not only market readiness but also coherent policy frameworks that shape purchasing decisions and guide corporate behavior. Against this backdrop, the

CSRD introduces a new governance mechanism that could influence the future of the GO market.

2.3. Corporate Sustainability Reporting Directive

The CSRD (Directive 2022/2464), which came into force in 2023, marks a significant expansion of corporate sustainability disclosure obligations in the EU. Introduced as part of the European Commission's broader policy agenda under the EGD and the Sustainable Finance Strategy, the CSRD aims to integrate sustainability considerations more deeply into corporate strategy, risk management, and capital allocation (Bogensperger et al., 2024, p. 17). The CSRD is an update to the Non-Financial Reporting Directive (NFRD), which set the regulations around sustainability reporting for corporations since 2014. It widens the scope of both the number of companies which are required to report, as well as the content that is to be disclosed. At the core of the CSRD is the principle of double materiality, which obliges companies to disclose not only how environmental and climate-related factors affect their financial position ("outside-in" perspective), but also how their operations impact society and the environment ("inside-out" perspective). These impacts, risks, and opportunities must be assessed across the entire value chain, both upstream and downstream (Sakhel, Styles, et al., 2022, p. 10). The European Sustainability Reporting Standards (ESRS) set the guidelines as to which qualitative and quantitative data need to appear in the sustainability report. The first set of ESRS were published in the form of a delegated regulation (Delegated Regulation 2023/2772) in December 2023. The disclosure requirements are structured around the three topics of environment, social, and governance, which are then again split into various sub-topics such as Climate change (ESRS E1), Pollution (ESRS E2), Water and marine resources (ESRS E3), among others. Each sub-topic specifies a set of disclosure requirements, covering both narrative information and quantitative indicators. In total, the ESRS framework encompasses a wide range of sustainability issues, aiming to enable a comprehensive, standardized, and comparable representation of corporate sustainability performance across sectors.

On February 26, 2025, the European Commission published the Omnibus I as a package of proposals, aiming to "simplify EU rules, boost competitiveness, and unlock additional investment capacity"(European Commission, 2025). A key aspect of this proposal is the simplification of sustainability reporting requirements, particularly to reduce the administrative burden on businesses, especially small and medium-sized enterprises (SMEs), and enhance the competitiveness of European companies. It is the first package of three, targeting multiple reporting legislations, including the CSRD. While nearly 50,000 companies were initially

expected to fall under the CSRD's reporting obligation (KPMG, n.d.), this new proposal would reduce this number by 80% and postpone sustainability disclosures by two years if adopted as proposed (European Commission, 2025). Such changes could significantly weaken the intended impact of mandatory sustainability reporting, slowing down progress toward EU climate goals (EEB, 2025). However, as Omnibus I remains a proposal, its final form is uncertain, particularly amid considerable criticisms from multiple institutes, researchers, and NGOs (e.g. Docherty & Leung, 2025; EEB, 2025; Velte et al., 2025; WWF, 2025). Although some countries have already implemented the CSRD into national legislation, such as Ireland, Norway, or Sweden (Ius Laboris, 2025), a political agreement has been reached to delay the CSRD's application by two years, with further updates expected shortly (European Parliament, 2025). Overall, the aspects discussed in the following will likely remain unchanged, although the scope of application may be reduced.

2.3.1. GOs under the CSRD: Energy and Emissions Reporting

Recent GO literature identifies the CSRD as a new application area for GOs. Specifically, as companies must disclose comprehensive information about their energy consumption, energy mix, greenhouse gas emissions, as well as general climate change mitigation targets. Companies utilizing renewable energy to support sustainability claims, marketing strategies, or contractual obligations increasingly rely on GOs to validate these claims (Bogensperger et al., 2023, p. 19).

A critical aspect of GHG reporting is Scope 2 emissions, associated with purchased electricity, heating, and cooling, disclosed through both location-based and market-based methods in line with the GHG Protocol. While the location-based method limits emission reductions strictly to reduced electricity consumption, the market-based method enables companies to reflect emissions improvements resulting the type of energy they procure. Market-based emissions are calculated by applying consumption data to emissions factors (CO_2 equivalents per unit of energy). Consequently, emissions are lower with reduced consumption and procurement of energy with lower emissions factors (Sakhel, Mundt, et al., 2022, p. 14). These factors can be verified through supplier documentation, GOs, or direct contracts like PPAs. The market-based method therefore aligns well with liberalized electricity market principles by reflecting changes in corporate sourcing behavior toward renewables (Maaß et al., 2019, p. 43; Sakhel, Styles, et al., 2022, pp. 16-17).

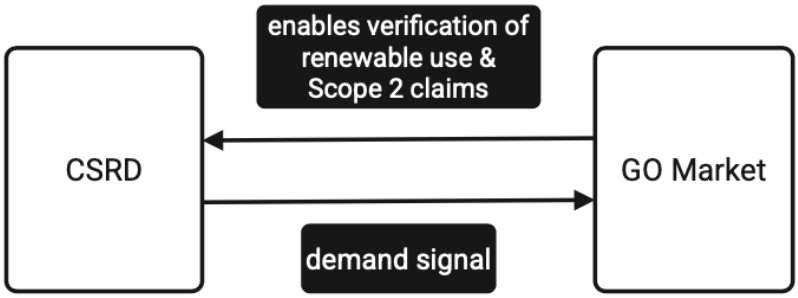
Accurate data on the energy mix and clear attribution of energy sources are becoming increasingly important as investors and stakeholders view CO_2 emissions as proxies for corporate environmental performance. This dynamic is helping to drive demand for renewable electricity (Maaß et al., 2019, p. 40). In fact, the most frequently cited benefit of corporate green electricity usage by companies is its contribution to climate protection, primarily through the improvement of the company's CO_2 balance (Hauser et al., 2019, p. 140). While voluntary reporting of Scope 2 emissions in accordance with international standards such as the GHG Protocol, Science-Based Targets Initiative, and the Global Reporting Initiative, has been standard practice among many large companies globally in recent years, the CSRD now formally integrates emissions reporting into mandatory, audited corporate sustainability disclosures for a much broader range of entities. Whether this shift to mandatory reporting will yield a measurable impact remains to be seen, and other factors such as electrification of certain sectors and more competitive price developments for renewables will likely also play a role. Nevertheless, companies with poor performance in sustainable governance will likely face high costs when seeking market financing in the future, as aligning with sustainablilty principles and carbon emissions becomes essential for managing financial risk (dena, 2022, p. 4). The resulting demand for renewable electricity is likely to cascade throughout value chains, as larger companies increasingly pass on reporting and sustainability requirements to their suppliers (Maaß et al., 2019, p. 40).

However, the widespread use of GOs for reducing Scope 2 emissions has drawn criticism. Bjørn et al. (2022, p. 544) find that 42% of reported Scope 2 emissions reductions among a studied group of companies do not translate into actual emission reductions, largely due to issues in the GO market, mainly lack of additionality and double counting (see Section 2.2.3). Brander et al. (2018) reach similar conclusions, arguing that only GHG reductions directly attributable to an entity's actions should be eligible for carbon claims – a criterion non-additional GOs do not meet – and that market-based reporting lacks credibility under current market conditions. Double counting, in particular, remains a persistent concern. Under international reporting standards, companies may choose between the location-based and market-based approaches for Scope 2 reporting. This flexibility allows organizations to select the method most favorable to their emissions profile, which can inadvertently lead to overlapping claims. For example, a company using the location-based method might account for grid-average emissions, while the associated GOs from renewable electricity fed into the grid are simultaneously redeemed by another entity using the market-based approach (Sakhel,

Mundt, et al., 2022, p. 17). In such cases, the same environmental attribute is effectively claimed twice. Companies in countries like Norway, which already have low-carbon electricity mixes, often rely on the location-based method and make minimal use of GOs (Herrmann et al., 2023, p. 7). Another issue of market-based reporting is visualized by Brander et al. (2018, p. 31): In their scenario, Company A purchases contractual emission factors to reduce its reported Scope 2 emissions to zero, without altering its actual electricity consumption or contributing to additional renewable energy generation. By contrast, Company B uses the equivalent resources to implement an energy efficiency program, achieving a real 10% reduction in electricity use and associated emissions. Despite this, stakeholders may view Company A more favorably, due to its apparently superior emissions profile. This example highlights how market-based reporting, in its current form, can misrepresent the true climate impact of corporate behavior, and distort incentives away from genuine mitigation actions. The CSRD's new requirement to disclose both location-based and market-based emissions introduces a potential mechanism to address these inconsistencies. However, whether this dual-reporting obligation will be sufficient to eliminate double counting remains uncertain.

Overall, the effectiveness of the CSRD in promoting credible energy mix and emissions reporting depends on the robustness of the GO system. Reliable GOs are essential to ensure that corporate claims regarding energy mix and emissions reductions are verifiable and reflect genuine environmental benefits; otherwise, such claims risk being perceived as greenwashing. At the same time, the CSRD holds the potential to accelerate demand for renewable energy and GOs, positioning it as a possible market driver. This bidirectional interaction between the CSRD and the GO market is summarized in Figure 3.

Figure 3 *Verification and Demand Dynamics between the CSRD and the GO Market*



Note. Own illustration based on a synthesis of the literature cited in the preceding text.

The potential implications of this dynamic on additionality and greenwashing are explored in the following section.

2.4. Potential Synergies: Guiding Assumptions and Research Questions

Building on the interactions described in Section 2.3.1, this thesis aims to assess the potential impacts on existing challenges within the GO system (see Section 2.2.3), and what this might imply for the energy transition in the context of EU governance. In particular, the three central challenges identified earlier, (1) low GO prices, (2) physical reality mismatch, and (3) double counting, serve as thematic focal points for the analysis. Several guiding assumptions can be drawn from the literature, although further aspects will also be explored.

First, the CSRD may act as a driver for increased demand for GOs. By requiring companies to provide verifiable documentation of renewable electricity consumption, the directive could encourage greater use of GOs as proof of sustainability claims. As seen in Section 2.2.3, supply and demand are key factors influencing GO prices. Therefore, an increase in demand could exert upward pressure on prices. However, the effects of demand are not isolated and other factors may also play a role. This study therefore seeks to examine whether the CSRD's push for verifiable renewable consumption could drive up GO prices and promote additionality in the German electricity sector.

Second, while an increase in demand can be expected, it is unclear whether this will apply uniformly across all types of GOs or concentrate primarily on low-cost certificates, such as those from Nordic hydropower. According to Styles et al. (2021, p. 39), industrial consumers may increasingly value the qualitative attributes of renewable electricity – such as technology type, geographical origin, or commissioning date – particularly in the context of climate and sustainability reporting. The authors argue that the ability to distinguish between different types of GOs allows companies to align procurement with their strategic goals and environmental values. Such a trend may further reinforce price differentiation among GOs and potentially promote additionality by supporting newer or more impactful renewable projects. However, whether this development is driven specifically by the CSRD remains to be determined.

Third, double counting remains a critical challenge in the GO system that risks undermining the credibility and effectiveness of renewable energy claims. It is yet to be established whether the CSRD’s governance framework aimed at transparency can prevent double counting in practice, particularly in the context of cross-boarder and multi-stakeholder claims.

The research interest lies in the interplay between the CSRD and the GO system and whether, together, they can strengthen corporate renewable energy procurement, reduce risks of greenwashing, and improve the additionality of renewable energy markets. Through its

reporting requirements, the CSRD not only increases the visibility of GOs in sustainability disclosures but also raises expectations regarding traceability, credibility, and the environmental value of renewable electricity claims. In light of these potential developments, this thesis explores whether the CSRD can be expected to address existing GO market challenges. The underlying research question is whether GOs and the CSRD generate positive synergies that contribute to accelerating the energy transition. Despite earlier studies having explored the role of GOs in the context of GHG accounting, decarbonizing of industry, and corporate energy procurement (e.g. Bjørn et al., 2022; Brander et al., 2018; Paris et al., 2024), this thesis aims to explicitly evaluate the intersection with the CSRD and potential new market dynamics from it. In doing so, it focuses on two central subquestions:

I) What are the regulatory overlaps between GOs and the CSRD?

II) Do the regulatory overlaps interact to:
   a. Create economic incentives to promote the additionality of renewable energy production?
   b. Prevent greenwashing?

These questions guide the following legal and empirical analysis, which aims to explore the potential of these overlapping governance instruments to strengthen a corporate-driven energy transition.

3. Methodology

Two different approaches are used to answer the research questions. The first subquestion focuses on identifying legal overlaps and can therefore be answered through an analysis of legal texts. The second subquestion is exploratory and covers the effects of such legal overlaps on the market. Because consistent data on the European green electricity market is limited (Hauser et al., 2019, p. 209), and much GO trading occurs over-the counter through brokers or direct transactions, with price data often not publicly accessible (Hulshof et al., 2019, p. 701), empirical insights from experts were chosen as a practical way to gain understanding. While alternative approaches could be possible, consulting experts provides valuable, first-hand perspectives to address gaps in existing data.

Aiming to analyze the two dimensions of written law and market dynamics, this thesis adopts a socio-legal research approach. Socio-legal research is an interdisciplinary field that combines legal analysis with empirical methods from the social sciences (McConville & Chui, 2017, p. 5). It encompasses a large range of research methodologies and is generally interested in the impact of the legal system on society, rather than simply understanding the law and order as it is often the case with classical legal research (Dobinson & Johns, 2017, p. 23). Socio-legal research inspired the research design for this thesis, which consists of a comparative legal analysis of relevant legal texts, followed by semi-structured exploratory expert interviews. In this section, each method will be discussed in detail.

3.1. Comparative Legal Analysis

To answer the first subquestion *What are the regulatory overlaps between GOs and the CSRD?*, a comparative legal analysis was conducted to identify the overlaps and potential synergies between the relevant legal texts.

3.1.1. Data Collection: Relevant Legal Documents

The data for this analysis was collected from the official texts of the revised RED, specifically Directive (EU) 2018/2001 (RED II) and its amendments under Directive (EU) 2023/2413 (RED III), as well as the official texts of the CSRD, specifically Directive (EU) 2022/2464 (CSRD) and its Commission Delegated Regulation (EU) 2023/2772 (ESRS). These documents were accessed through the EUR-Lex. The understanding of these primary documents was supplemented by a review of secondary sources such as academic papers, reports by governmental institutions, and clarifications from legal experts during face-to-face meetings.

3.1.2. Data Analysis: Direct References and Thematic Overlaps

The analysis process was structured based on a distinction developed for this study between two types of overlaps: *direct references* and *thematic overlaps*. Direct references are defined as the explicit mentions of GOs or any cross-references between the directives. Thematic overlaps address broader themes that can be found in both directives, and aim to find synergistic potential across objectives, scope, and implementation mechanisms.

To search for *direct references*, a keyword search was conducted. The keywords "Guarantee of Origin" and "Guarantees of Origin" were searched in all four documents. To find cross-references, the keywords "Directive (EU) 2018/2001" and "Directive (EU) 2023/2413" were searched in the CSRD and ESRS documents to see if they directly refer to the RED II and RED III. The keywords "Directive (EU) 2022/2464" and "Commission Delegated Regulation (EU) 2023/2772" were searched in the RED II and RED III documents to find any direct references to the CSRD or ESRS. While the keyword search results gave direct indication of whether the two directives explicitly reference each other, the number of keyword occurrences alone is not necessarily meaningful. Therefore, each passage containing the keywords was examined in detail to assess the nature and significance of the connection. This involved evaluating whether the reference had operational or implementation significance, or if it is incidental and does not provide further regulatory implications.

Identifying *thematic overlaps* involved multiple readings of the four documents. Any passages containing recurring topics across the documents were highlighted. These involved aspects identified in the literature review (as outlined in Section 2), but also other aspects. Passages that fell outside the scope of this research, such as social sustainability topics in the CSRD and ESRS or detailed definitions of biomass conditions in the RED II and III, were excluded. The highlighted passages which were considered relevant or potentially relevant after this review process were compiled into a table (see Appendix A, Sheet 3). The highlighted passages from the table were assigned themes, such as "GHG emissions", "RE in industry", "policy objective", "transparency", etc. A comments/insights column provided a few keywords that summarizes its key points. For each theme, a comparison between the contents in the RED framework and CSRD framework were analyzed, focusing on the similarities, differences, and synergistic potential given the regulatory intent, potential interactions, and implications for the energy transition.

While this analysis provides valuable insights into the interaction between the RED and the CSRD, it is limited by the author's lack of a legal background. The analysis is primarily focused on thematic aspects that build on knowledge gained from the literature review and other informal sources such as podcasts and published interviews and may not fully encompass deeper legal interpretations or implications.

3.2. Exploratory Expert Interviews

Exploratory expert interviews were conducted to gather insights into the market for GOs and the potential market changes introduced by the CSRD, in order to answer the second subquestion: *Do the regulatory overlaps interact to […] promote additionality […] and prevent greenwashing?* This method was selected because research at the intersection of these two market instruments constitutes an emerging field with little prior academic coverage, largely due to the recency of the CSRD (see Section 2.3). In such a new and under-researched area, exploratory interviews are particularly appropriate to uncover not only existing knowledge but also emergent perspectives and systemic uncertainties. Following Kruse's (2015) summary of Bogner and Menz's (2005) categorization of expert interview types, exploratory expert interviews are designed to empirically uncover central knowledge dimensions that are not yet fully researched or poorly documented. To gain new insights from the expert's specialized knowledge, the interviewer takes on an open and curious listener role and the interviews are only loosely structured and primarily monological with an explanatory focus (Kruse, 2015, p. 167). The expert is considered a representative of the actions, perspectives, and knowledge systems of a specific group of experts or a particular professional field (Kruse, 2015, p.166). To realize this format, experts were carefully selected, and a semi-structured interview guide was developed.

3.2.1. Data Collection: Expert Identification and Interview Procedure

To decide on which experts to interview, relevant individuals were identified through searches for the terms "Guarantees of Origin" and "GO", as well as the German terms "Herkunftsnachweise" and "HKN" across various mediums, including LinkedIn, X, and websites of organizations within the energy industry or research institutes working on renewable energy topics. After creating a list of experts from different areas whose role descriptions and/or social media posts signaled that they have expertise in the field, they were assigned expert categories of *industry expert, market & policy expert,* and *regulatory expert*. The invited participants were selected with the aim of covering all three categories, ensuring

that the knowledge collected stems from both practical market experiences as well as research and regulatory frameworks, thus providing a more comprehensive understanding and well-rounded analysis of potential synergies and challenges. Effort was made to contact GO traders to incorporate a trading perspective to the study, however, this proved challenging as individuals contacted through direct outreach were unable to refer to suitable contacts. Invitations were prioritized for those experts who demonstrated knowledge not only in the GO market but also in corporate sustainability reporting and/or low-carbon corporate energy supply. In total, seven experts were interviewed. Table 2 gives an overview of the number and expertise area of the interviewees.

Table 2 *Expert Interviews – Expertise Area and Number of Interviewees*

Expert Category	**No. of Interviewees**	**Area of Expertise / Type of Organization**
industry expert (IE)	3	renewable energy provider; strategy consulting for B2B energy trade and sales; energy industry association
market & policy expert (MP)	2	independent energy agency; management solutions for energy certificates
regulatory expert (RE)	2	environmental and energy law; energy law consulting

The development of the interview guide was informed by thematic focal points identified in the literature review and comparative legal analysis, ensuring that the questions remained relevant to the research objectives while leaving room for new insights. Question generation followed the SPSS method according to Helfferich (2009, pp. 182.-189), which involves collecting, reviewing, sorting, and subsuming possible questions to align with research aims (Sammeln, Prüfen, Sortieren, Subsumieren). The structure of the guide was finalized in accordance with Kruse's (2015, p. 213) design principles for interview guides. The final version of the interview guide is provided in Appendix B. Rather than adhering to a rigid question-and-answer format, the interviews were conducted in a flexible manner, with questions adapted to the expertise and responses of each interviewee. This enabled a dynamic and open conversation flow that encouraged the exploration of emerging insights.

The interviews were conducted between January and February 2025 on Microsoft Teams. The duration ranged from 35 to 48 minutes. Due to multiple requests from interviewees to see the interview questions before agreeing to an interview, all participants received only the main questions from the interview guide prior to their scheduled interview. Follow-up and detailed questions were intentionally excluded to avoid influencing responses and to encourage open-

ended answers. All participants signed a consent form (Einverständniserklärung; see Appendix C). The interviews were recorded, transcribed, and pseudonymized to ensure confidentiality. Each transcript was named after the expert category (e.g. IE1, MP2).

3.2.2. Data Analysis: Qualitative Content Analysis According to Mayring

The expert interview transcripts were analyzed using Qualitative Content Analysis of *content structuring / theme analysis* following Mayring (2014, p. 104). This method was chosen because it enables a systematic and theory-informed analysis of qualitative data, while allowing for inductive refinement to accommodate new insights. Although the interviews were exploratory in nature, the research questions and thematic focal points were established prior to data collection (see Section 2). Accordingly, a deductive framework was used to predefine the *themes* by which interview content was analyzed. The method nonetheless allows flexibility by enabling the development of inductive *subcategories* within the themes to reflect emerging nuances from the material.

Following Mayring's (2014, pp. 96-105) recommendations, the analysis proceeded in two stages. First, a deductive system of *themes* was developed to address the research questions on additionality and greenwashing. Theme 1 was designed to establish a baseline of expert perspectives on the role and functions of GOs, while Themes 2 through 4 examined the three key market problems (low GO prices, physical reality mismatch, and double counting) that were identified to each negatively affect additionality and greenwashing in Section 2. In the coding and analysis, particular attention was given to their relevance for corporate reporting and energy procurement practices.

The four deductive themes are:

(1) Functions and Roles of GOs
(2) Market Signals and Investment Incentives
(3) Physical Integrity and Technology Impact
(4) Transparency and Double Counting

Each theme was defined through a structured coding guideline that included the theme name, a definition, an anchor example, and coding rules (Appendix D, Sheet 1). Coding was conducted systematically in MAXQDA.

In the second stage, the coded material was reviewed to inductively develop *subcategories* and, where appropriate, sub-subcategories that captured emerging distinctions within each theme. When new patterns or nuances became apparent, (sub-)subcategories were created to better

reflect the data structure. Segments that did not fit existing categories prompted a review of coding rules and, where necessary, an expansion of the category definitions. The coding guideline was updated to include all inductively developed (sub-)subcategories (Appendix D, Sheet 2 & 3).

To ensure reliability of the coding process, transcripts were re-read to confirm that all relevant segments were included and that inductively developed (sub-)subcategories were applied consistently. Some segments were double-coded, reclassified into a different (sub-)subcategory, or removed due to irrelevance, while additional relevant segments were added. This iterative re-coding ensured internal consistency, improved category precision, and enhanced the reliability of the analysis. The final coded material is presented in Appendix E.

Once coding was completed, the content under each subcategory was summarized to identify key elements, recurring patterns, and divergent perspectives. The analysis focused on their implications for the research questions on additionality and greenwashing. Insights that did not relate directly to the research focus were excluded from the analysis. The findings from this analysis are presented in Section 4.2 and form the basis for the discussion of implications for additionality and greenwashing in Section 0.

Since the interview data was originally collected in German, all quotes cited in the findings section have been translated into English by the author for clarity and accessibility. These translations aim to preserve the original meaning and tone as closely as possible while ensuring readability for an English-speaking academic audience. The original German phrasing has been retained in the full transcripts (see Appendix F), which were used as the basis for coding and analysis. Where helpful for interpretation, paraphrased or contextually adapted translations have been used in the body text, with exact wording available in the source transcript.

4. Results

The results section presents the findings from the comparative legal analysis, followed by a detailed exploration of key themes and topics emerging from the exploratory expert interviews.

4.1. Comparative Legal Analysis

This section presents the results of the comparative legal analysis. First, direct mentions of GOs and any cross-references between the directives are examined (direct references). Then, thematic overlaps are explored, which include the alignment of objectives and common themes.

4.1.1. Direct References

First, explicit mentions of GOs are examined. There are 56 and 31 mentions of "guarantee(s) of origin" in RED II and RED III, respectively (see Table 3). The frequent appearance of GOs in these directives is expected, as they originate as a policy instrument specifically developed within the RED framework (see Section 2.2). Most references to GOs are concentrated within Art. 19 RED II, titled *Guarantees of origin for energy from renewable sources*. This article sets the legal framework for GOs and has been further updated in Art. 1(9) RED III.

For a comprehensive overview, the sections explicitly referencing GOs within the RED framework include:

- Art. 19 RED II: Defines the purpose, scope and implementation of GOs.
- Recital 89 RED III: Addresses the role of GOs in mitigating double-claiming risks for renewable gas.
- Art. 1(5)(d) RED III: Introduces the use of GOs for long-term renewable energy purchase agreements.
- Art. 1(9) RED III: Amendments to RED II Art. 19 regarding purpose, scope and implementation of GOs.
- Art. 1(22) RED III: Establishes the role of GOs in the Union database for sustainable biofuels.

These references to GOs in RED III show the evolving role of GOs in the EU's renewable energy framework, although its main role as a tracing instrument to certify the renewable origin of electricity and other energy carriers has not changed. The expanded role of GOs in the RED III accommodate new energy market developments such as the (expected) rise in hydrogen use, long-term corporate energy procurement options through PPAs, and improvements of traceability and accountability within the energy sector.

Table 3 *Direct References – Keyword Search Results*

	Matches in…			
Keywords	**RED II**	**RED III**	**CSRD**	**ESRS**
Guarantee of Origin	17	7	0	2
Guarantees of Origin	39	24	0	0
Directive (EU) 2018/2001	–	–	0	6
Directive (EU) 2023/2413	–	–	0	0
Directive (EU) 2022/2464	0	0	–	–
Commission Delegated Regulation (EU) 2023/2772	0	0	–	–

Note. The values represent the number of keyword matches found through a full-text search in each legal document. A dash (–) indicates that no search was conducted because the document in question is the source of the reference itself (e.g., cross-references within the same law are not applicable for this type of analysis).

The ESRS, which operationalize the CSRD, reference GOs explicitly in two Application Requirements (AR): AR 32 and AR 45. These ARs outline the guidance for calculation necessary to disclose information in the respective Disclosure Requirements (DR) E1-5 – *Energy consumption and mix*, and E1-6 – *Gross Scopes 1,2,3 and Total GHG emissions*.

As specified in AR 32(j), when preparing energy consumption data under DR E1-5, renewable energy consumption must be proven by clear contractual arrangements through instruments such as GOs:

> "[…] The undertaking shall only consider these energy consumptions as deriving from renewable sources if the origin of the purchased energy is clearly defined in the contractual arrangements with its suppliers (renewable power purchasing agreement, standardised green electricity tariff, market instruments like Guarantee of Origin from renewable sources in Europe or similar instruments like Renewable Energy Certificates in the US and Canada, etc.)" (AR 32(j), Appendix A, ESRS E1, Annex I to the ESRS).

This means that companies must demonstrate renewable energy use for their European operations through renewable PPAs, certified green electricity tariffs, or the direct purchase of GOs. GOs play a central role, as they are the legally recognized tracking instrument required to substantiate the renewable origin of electricity in the EU, therefore also for such PPAs or green electricity tariffs (Art. 19 RED II; § 42 EnWG; see Section 2.2.1). In Germany, however, GOs must be cancelled by a licensed electricity supplier, meaning companies cannot directly

purchase and retire unbundled GOs for disclosure purposes (see Section 2.2.2). Therefore, companies operating in Germany must rely on green PPAs or certified green electricity tariffs to prove renewable electricity consumption, both of which typically involve the supplier or utility company holding and cancelling the corresponding GOs.

Similarly, AR 45(d) highlights the importance of GOs for Scope 2 GHG emission claims under DR E1-6:

> "[…] Market-based method quantifies Scope 2 GHG emissions based on GHG emissions emitted by the generators from which the reporting entity contractually purchases electricity bundled with instruments, or unbundled instruments on their own (GHG Protocol, "Scope 2 Guidance", Glossary, 2015); in this case, the undertaking may disclose the share of market-based scope 2 GHG emissions linked to purchased electricity bundled with instruments such as Guarantee of Origins or Renewable Energy Certificates. The undertaking shall provide information about the share and types of contractual instruments used for the sale and purchase of energy bundled with attributes about the energy generation or for unbundled energy attribute claims" (AR 45(d), Appendix A, ESRS E1, Annex I to the ESRS).

Companies must also calculate their Scope 2 GHG emissions in accordance with the GHG Protocol Scope 2 Guidance from 2015. As a result, European operations must rely on GOs to substantiate renewable electricity use for Scope 2 reporting (WRI & WBCSD, 2015, p. 48).

From these two excerpts above, it becomes clear that when preparing a sustainability report according to the CSRD, GOs are to be used as a verification tool for renewable electricity consumption, as well as for the calculation of the marked-based method of Scope 2 GHG emissions calculations. While GOs are not the central focus of sustainability reporting obligations, the inclusion in the ESRS signals an operational link between the two instruments.

Cross-references between the directives exist in six instances (see Table 3). They can be found in the ESRS footnotes, and all six refer to the RED's definition of renewable energy. These cross-references are important to ensure a consistent definition of RES across legislative instruments; however, this finding is not particularly relevant in the context of this thesis.

Overall, the analysis of the direct references shows that GOs are defined in the RED framework, with their role continuing to evolve. The CSRD's reporting requirements outlined in the ESRS incorporate GOs as a key instrument for verifying corporate energy mixes and Scope 2 GHG emission claims. While this establishes an operational link between the directives, there is no explicitly stated regulatory intent or purpose for fostering synergies to advance the energy transition.

4.1.2. Thematic Overlaps

A slightly broader perspective is applied in the following to understand the shared thematic elements beyond the direct legal references. This subsection adopts a structured perspective to clearly articulate thematic overlaps beyond direct legal references, categorizing key shared elements into the distinct thematic areas of (1) Climate and Sustainability Objectives, (2) Renewable Energy, (3) Transparency and Accountability, (4) Financial Alignment and Green Investments, and (5) Auditability and Verification.

(1) Climate and Sustainability Objectives

An examination of the *recitals*, which are stated at the beginning of EU legal documents to present the context and objectives of the legislation (Thomson Reuters, n.d.), reveals that both directives are embedded within broader EU climate policies. Both the RED III and the CSRD reference the European Green Deal in their first recitals (Recital 1 RED III; Recital 1 CSRD), linking their objectives to the EU's overarching climate neutrality goal by 2050. While the RED focuses on the goal of reducing GHG emissions (e.g. Recital 2 RED III), the CSRD targets zero GHG emissions (Recital 1 CSRD), signaling stronger emphasis on corporate accountability in this sustainability transition.

However, these climate and sustainability goals differ significantly in both scope and focus. While RED III is primarily concerned with emissions reductions and energy transition at the government and energy market design level, the CSRD takes a much broader approach, addressing environmental, social, and governance factors. This discrepancy in focus creates potential misalignments: while RED III targets energy and emissions reductions, the CSRD encourages a more comprehensive, corporate-level sustainability agenda that may not directly drive the specific energy changes needed. Such misalignment may may impede effective progress toward the energy transition, as corporate sustainability practices may not align with the national energy system goals set out by RED III. The result could be a lack of coherence in the broader transition to climate neutrality, where businesses may report progress on environmental, social, and governance factors but fail to make the necessary contributions to the energy system transformation pursued by the RED.

(2) Renewable Energy

Although different in scope and focus, a key thematic overlap between the two directives is the topic of renewable energy and their complementary roles in driving the energy transition. The RED sets a binding EU-wide RES target of 42,5% (Art. 1(2)(a) RED III), requiring member

states to define their national contributions to this target as part of their integrated national energy and climate plans (Art. 3(2) RED II). It also establishes sector-specific targets, including for transport, industry, buildings, and the heating and cooling sector. For instance, the industrial sector is required to increase its use of renewable energy by 1.6% per year (Art. 1(12) RED III). The RED also encourages the implementation of support schemes and PPAs to facilitate the uptake of renewable energy deployment (Art. 1(2)(c) RED III) to reach this goal. In the AIB's analysis of the RED III (AIB, 2023, p. 2), it is suggested that these provisions will lead to a substantial increase in the amount of energy receiving GOs. This would directly affect GO supply.

In contrast, the CSRD does not impose direct obligations for renewable energy expansion but instead sets reporting obligations that can indirectly drive demand for RES through external market pressures. Such pressure is created through disclosure requirements for several energy- and emissions-related information in the ESRS, particularly the ESRS E1 *Climate Change*. Key disclosures include:

- Strategy, policies, and targets: Companies must disclose key strategy elements that relate to sustainability matters, including whether they are active in the fossil fuel sector in which case revenues derived from coal, oil, gas, etc. need to be disaggregated (DR SBM-1, ESRS 2, Annex I to the ESRS). They must also disclose policies addressing climate change mitigation, energy efficiency, and renewable energy deployment (DR E1-2, ESRS E1, Annex I to the ESRS). Additionally, companies with GHG reduction targets must specify the quantitative contributions of decarbonization levers, such as energy efficiency improvements, fuel switching, or RES adoption (DR E1-4, ESRS E1, Annex I to the ESRS).
- Energy consumption and mix: Companies must disclose their total energy consumption disaggregated by fossil, nuclear, self-generated RES, or purchased RES (DR E1-5, ESRS E1, Annex I to the ESRS).
- GHG emissions: Companies must disclose their total GHG emissions, broken down into Scope 1, 2, and 3 emissions (DR E1-6, ESRS E1, Annex I to the ESRS). For Scope 2 emissions, location-based and market-based data is required. For marked-based emissions, purchased or acquired electricity, steam, heat, and cooling consumed are to be included and verified by GOs or RECs (AR 45, Appendix A, ESRS E1, Annex I to the ESRS).

These detailed disclosure requirements for energy-related information may reveal or expose the financial risks associated with fossil fuel dependence, thereby increasing investor and stakeholder pressure for companies to transition towards renewable energy. Additionally, the dual reporting requirement for location-based and market-based Scope 2 emissions may incentivize companies – especially those in countries with high shares of renewables in the grid mix, who have so far reported only location-based emissions – to actively purchase renewable electricity, as they are now required to report market-based emissions as well. Civil society actors scrutinizing corporate sustainability efforts could further reinforce this effect (see next subsection *Transparency and Accountability*). This has potential to boost demand for renewable energy and, consequently, GOs; however, this effect is indirect. It is important to note that because the CSRD does not set specific sustainability targets and the implementation of sustainability strategies remains voluntary for corporations, the pressure it exerts may not be sufficient to drive the achievement of RED III's more explicitly defined energy targets. Without binding targets or requirements, there is a risk that the CSRD may not effectively lead to meaningful changes in energy sourcing behavior.

(3) Transparency and Accountability

Creating enhanced transparency is a core CSRD objective, explicitly aiming to serve stakeholders such as investors, civil society actors, business partners, and customers (Recital 9 CSRD). The CSRD explicitly addresses the avoidance of greenwashing and double counting as key objectives, aiming to prevent misleading sustainability claims through standardized and audited disclosures (Recital 13 CSRD). The directive recognizes that stakeholders are concerned about double counting in regard to GHG accounting and offsetting standards, and that they are interested in clear and accurate reporting on corporate climate mitigation efforts, especially regarding actual emission reductions (Recital 47 CSRD).

Similarly, the RED framework seeks transparency for investors and consumers regarding energy sources, with GOs serving as the primary tool for verifying energy claims and preventing double counting (Recitals 30, 55, & 57 RED II). While the RED does not explicitly use the term *greenwashing*, its GO system indirectly addresses this risk by ensuring that renewable energy attributes cannot be counted more than once. Recent updates to RED III also strengthen requirements for renewable gases to mitigate risks of double counting along the supply chains, further reinforcing the directive's role in maintaining credibility in renewable energy markets (Recital 89 RED III).

(4) Financial Alignment and Green Investments

Both directives support the alignment of financial resources toward renewable and sustainable activities. RED III explicitly promotes corporate engagement in renewable energy through instruments such as long-term green PPAs, facilitating direct corporate investment in renewable capacity and the smooth transfer of GOs in this regard (Art. 1(5)(d) RED III). This could encourage corporate-driven renewable energy expansion, supporting market-based mechanisms for investment.

Complementarily, PPAs can serve as credible instruments for demonstrating Scope 2 emission reductions under the market-based accounting approach in sustainability reports required by the CSRD (AR 32(j), Appendix A, ESRS E1, Annex I to the ESRS). Additionally, the CSRD obliges companies to disclose both their climate-related risks and the extent to which their activities align with environmentally sustainable economic activities, as defined in Art. 8 of the EU Taxonomy Regulation (DR E1-1, ESRS E1, Annex I to the ESRS; and corresponding AR 4, Appendix A). Together, these requirements not only help identify financial risks related to unsustainable practices but also create a baseline for directing investments and corporate capital flows toward renewable energy and other sustainable activities.

(5) Auditability and Verification

The auditability of sustainability claims is another point of convergence, as the CSRD mandates external assurance for reported sustainability data (Art. 3 CSRD), while GOs serve as verifiable proof of the renewable origin of electricity and ensure accurate Scope 2 emissions accounting. By standardizing and verifying corporate sustainability reporting and energy attribute claims, both directives contribute to reducing the risk of misleading information and reinforcing trust in sustainability efforts.

In conclusion, it can be said that both directives play a role in accelerating the renewable energy transition, though through different mechanisms. RED III primarily governs the energy system at the sectoral level by setting national and EU-wide targets for renewable energy deployment, while the CSRD targets the corporate level by imposing sustainability reporting obligations directly on companies. In doing so, it integrates private-sector actors into the EU's broader climate and energy governance framework. Although their legal scopes differ, with one focusing on energy policy and market regulation, and the other on corporate sustainability reporting, their objectives regarding sustainability and emissions reductions are complementary. The CSRD has a broader thematic focus on various sustainability topics, but the overlaps in

the topics of emissions reductions and energy are still notable. In theory, the CSRD's disclosure requirements may increase demand for renewable energy and GOs, and the RED III ensures that GOs function as a reliable certification system to verify these renewable claims. These interactions suggest that RED III and the CSRD structurally intersect on transparency and accountability in energy sourcing, though the extent of real-world synergies remains to be explored. While these interactions are not the result of explicit legal coordination, they may create mutually reinforcing effects in practice. The thematic overlaps identified here, combined with the literature outlined in Section 2, form a conceptual basis for the following expert interviews, which aim to assess their relevance, impact, and feasibility in the real-world application of both directives. Overall, the combined effect of the RED and CSRD has the potential to foster a transparent, credible, and effective renewable energy market, with the goal of mitigating greenwashing risks and steering financial resources toward genuinely sustainable activities.

4.2. Exploratory Expert Interviews

This section presents the most relevant themes that emerged from the expert interviews. The themes are discussed in the order of the predefined themes (see Section 3.2.2): (1) Functions and Roles of GOs, (2) Market Signals and Investment Incentives, (3) Physical Integrity and Technology Impact, and (4) Transparency and Double Counting. Within each theme, the findings are presented by subcategory, supported by illustrative references to interview excerpts. At the end of each theme, a focused conclusion summarizes the main findings. This structure aims to highlight critical patterns and insights that inform the broader analysis of additionality and greenwashing risks.

(1) Functions and Roles of GOs

The first theme looks at expert perspectives on the role and functions of GOs. Understanding how experts perceive these roles is crucial for assessing the relevance of additionality concerns and greenwashing risks. The interview findings reveal three main functional categories of (a) Traceability for Electricity Disclosure, (b) Corporate Accounting and Reporting, and (c) Economic Signaling and Investment Value.

(1a) Traceability for Electricity Disclosure

Experts described the fundamental function of GOs as instruments of traceability and consumer information. A clear consensus emerged across all expert groups that the primary role of GOs is to act as a verification tool, documenting the renewable origin of electricity and enabling

transparent and verifiable electricity disclosure. As one interviewee explained, “Guarantees of Origin […] have an attribution function and a verification function” (RE2, 02:45). For electricity suppliers, it is crucial to be able to attribute electricity correctly because this enables them to legally verify and market it as green power. For end consumers, GOs allow them to recognize the electricity on their electricity bill as green energy. This dual role supports both compliance for suppliers and transparency for consumers. It was also highlighted that this function is grounded in legal requirements. In German law, § 42 EnWG requires both the physical electricity and the GO for legal electricity disclosure. Another expert quoted § 3 No. 29 EEG 2023 to underline the legal function of GOs as information carriers about the amount of renewable energy in the final consumers’ electricity disclosure.

One expert pointed out that the temporal misalignment between electricity markets and GO validity is not necessarily problematic within this function. While power markets operate in 15-minute intervals, GOs remain valid for up to 18 months. Although this discrepancy may affect other GO functions, the expert stressed that it does not undermine the GO’s role in electricity disclosure: “for the verification, it is actually almost a bit irrelevant […] the verification is still given” (IE, 05:19).

(1b) Corporate Accounting and Reporting

The increasingly important role of GOs within corporate emission accounting and reporting systems and documenting corporate renewable electricity procurement was highlighted as key response by several experts. Industry and market & policy experts agreed that the traceability function of GOs provides a solid foundation for emissions accounting, particularly in Scope 2 emissions accounting under the GHG Protocol and CSRD reporting frameworks. As one expert explained, this traceability function is what makes GOs suitable for climate reporting purposes: “this is essentially also the basis for the possibility of actually somehow using this Guarantee of Origin in climate reporting” (IE1, 03:28). Another expert highlighted the growing institutionalization of GOs in climate reporting standards like the GHG Protocol and CSRD, which explicitly prioritize the use of state-based certificates like GOs over voluntary certification schemes: “it always says, the state certification systems should be preferred over voluntary certification systems” (IE2, 04:38).

Despite this emerging role, concerns were raised about whether the current system is adequate for corporate use. One expert pointed out that while the current GO system may be sufficient for electricity labeling, its long validity period and simplified structure may not meet the time

granularity required for rigorous climate disclosures: “for climate reporting, I think it needs to become better” (IE1, 17:23). This uncertainty was further reflected in their description of GOs having “another role […] forced upon” (IE1, 00:57), suggesting that the current GO framework may not have been designed for its expanding function in corporate sustainability reporting.

One expert also emphasized the potential of GOs in documenting renewable electricity procurement for industrial processes and value chains. GOs were framed as “THE vehicle to attribute green electricity to industrial processes and supply chains in the future” (IE2, 02:10). This reflects a shift in perception, from merely serving as tools for emissions disclosure in external reports to being strategically used in large-scale corporate sustainability strategies. There is an expectation that, as the share of renewables in corporate energy use increases, GOs will play an even larger role in setting certain requirements for suppliers: “if we continue moving towards 100% renewables […], that I, as an industrial company […] document my sustainability requirements through it” (IE2, 03:14). At the same time, the expert noted a misalignment between current sectoral renewable energy targets and the structure of the GO system, indicating a need for further development to support future demands.

(1c) Economic Signaling and Investment Value

A recurring theme was the underutilization of GOs in their role to generate additional revenue streams for plant owners and to incentivize corporate investments in RES.

Market & policy experts advocate for a market-driven approach to renewable energy funding through GOs, emphasizing the value of GOs as financial instruments and the potential for greater private sector involvement in renewable energy investments. One expert pointed out that, in other countries, GOs are already viewed and used as such financial or investment instruments, turning the green attribute of electricity into a tradable value. They argue that in markets that treat GOs as a value component, investments can be steered towards renewables. Although this perspective is not yet widespread in Germany, the expert highlighted that such financing is already occurring to some extent, even if the current market price is low:

> “even if the GO is currently very cheap, around one Euro or even cheaper than one Euro, especially the GOs from Norway, it still amounts to these 100 or 200 terawatt-hours times about 1 euro, or even just 80 cents, which flow to Norway. In that sense, a financial exchange is already taking place” (MP2, 03:17).

One industry expert emphasized the need to separate financial incentives for renewable energy investments from actual electricity consumption, proposing that GOs be viewed primarily as investment tools. Similar to market & policy experts, they described GOs as an “elegant

instrument to generate an additional revenue stream to cover capital costs" (IE3, 03:34). However, they clarified that GOs should not be confused with electricity consumption; rather, they are a separate investment mechanism. To illustrate this, they gave the example:

> "I live in Leipzig, we have a […] plant in Riesa, 50 kilometers away, and I say, I would like to invest in plants there that generate regional electricity. Then, I could support exactly this plant with Guarantees of Origin, and at the same time, I could obtain my electricity from the municipal utilities or from EON or RWE in another way" (IE3, 26:02).

This example shows how GOs can incentivize investments in specific renewable energy projects while allowing flexibility in how consumers obtain their electricity. The expert argued that by separating financial flows between the electricity and the GO, treating the GO as an investment contribution or economic promotion for a specific technology or country, greenwashing claims become less valid. They recommended that regulators adopt this approach in future market designs.

Legal experts, while agreeing that GOs can foster renewable energy development in the voluntary markets, see GOs primarily as a complementary mechanism to state subsidies, underscoring the need for a strong regulatory framework to ensure GOs are used effectively to drive additional renewable energy investments.

In summary, while experts agree on GOs' potential to promote renewable energy investments, views diverge on how GOs should relate to state subsidies and whether they should be viewed primarily as market-driven instruments or as complementary to existing support schemes.

Conclusion of (1) Functions and Roles of GOs

Overall, the primary function of GOs seems to remain rooted in their original role within electricity markets: enabling credible supplier claims and enhancing end-user transparency. While their role as instruments for corporate reporting and as market signals is increasingly recognized, these emerging roles continue to rely on the foundational traceability GOs provide. Moreover, experts appear to somewhat disagree on the scope and design of the functions that GOs will need to fulfill in their evolving roles. The following themes will examine these evolving roles in greater detail, with particular attention to the barriers and enablers that shape the effectiveness of GOs in corporate reporting and in supporting market-based renewable energy expansion. Special focus will be given to the influence of the CSRD and whether it strengthens these functions or is outweighed by other regulatory or market drivers.

(2) Market Signals and Investment Incentives

This theme looks at demand development, price signals, and barriers to examine whether the CSRD has an influence on GOs creating a market signal for additionality. Within this theme, two main clusters of topics emerge: (a) Demand Dynamics and Drivers, (b) Price Volatility and Market Distortions.

(2a) Demand Dynamics and Drivers

Across expert groups, a consistent trend was identified: rising interest in GOs driven by both regulatory pressures and voluntary corporate decarbonization strategies. This trend is particularly evident in the industrial and commercial sectors, where green electricity is becoming a strategic priority. Alongside this growing demand, there is also an increasing willingness to pay for renewable energy: “by now, there is a willingness to pay in the industry that also says, we want green electricity, we want to become green” (RE1, 10:11). This willingness has further supported the expansion of voluntary green electricity markets, encouraging the development of unsubsidized RES installations.

These developments are also increasingly affecting value chains. Many companies are setting ambitious climate-neutral strategies, aiming to decarbonize their operations and supply chains. Especially large corporations increasingly require their suppliers to meet stringent sustainability criteria and provide comprehensive documentation of environmental performance. This extends to the sustainability of energy supplies, which has become a critical criterion in energy procurement and product integration.

Some interview segments suggest that these trends may be driven by voluntary corporate initiatives, such as sustainability-focused brand positioning. Firms aiming to position themselves as environmentally conscious leaders are making voluntary investments in renewable electricity procurement as well as self-owned installations. Companies increasingly recognize the competitive advantage of verifiable renewable energy consumption, not only to reduce emissions but also to differentiate themselves amid growing consumer awareness.

On the other hand, several regulatory drivers were also mentioned by the experts. First, the introduction of the CSRD is expected to increase demand for GOs due to its sustainability reporting requirements, particularly for Scope 2 emissions. To credibly report renewable energy consumption and related emission reductions, companies will increasingly rely on GOs. A regulatory expert noted that the Delegated Acts under the CSRD (the ESRS) explicitly name GOs as key instruments for certifying renewable electricity consumption. This formal

acknowledgement signals the European Commission's expectation for companies to use GOs to demonstrate their renewable energy claims, solidifying their role in sustainability compliance: "this basically shows that the Commission, which drafted this Delegated Act, also expects that Guarantees of Origin will be used to indicate the source of electricity, specifically renewable electricity. Therefore, I assume that the demand for Guarantees of Origin will increase" (RE2, 11:24).

The EU Taxonomy was also highlighted as a significant regulatory driver, linking sustainable investments to financial market requirements. Banks and long-term investment funds, driven by sustainability guidelines, are increasingly demanding verifiable green energy claims from companies. This alignment with capital markets pressures companies to demonstrate renewable energy usage, often verified through GOs. Consequently, the EU Taxonomy serves as a substantial lever, enhancing the importance of GOs as instruments for green financing and portfolio assessment. As an industry expert highlighted, this could be an effective lever to increase revenue streams for RES producers: "[the EU Taxonomy] is an EXTREME lever. If you continue to turn that screw, all of a sudden GOs – or let's say the greenness […]. I do believe that if you develop it properly, you will also get a price signal that eventually reaches the producer" (IE2, 20:45).

Another significant regulation mentioned was the RFNBO requirements, which stipulate additionality criteria and restrictions on state-subsidized electricity for green hydrogen production post-2030. To qualify as green hydrogen under EU law, production must use unsubsidized renewable electricity, traceable through GOs. This regulatory requirement is expected to drive demand for GOs specifically linked to new RES projects outside state support, thus fostering voluntary markets.

Additionally, the Electricity Price Compensation Mechanism (Strompreiskompensation), was noted as a mechanism allowing industrial companies to benefit from reduced electricity costs if they can demonstrate ecological contributions, such as purchasing green electricity verified through GOs. This creates a direct economic incentive for companies to source renewable energy. Lastly, the upcoming Green Claims Directive is anticipated to further tighten requirements for substantiating green energy claims in corporate communications and marketing, likely reinforcing the necessity of GOs for transparent and verifiable proof of renewable energy usage.

In summary, demand for GOs is expanding steadily, driven by a mix of voluntary corporate strategies and regulatory pressures and incentives. While the CSRD and EU Taxonomy provide indirect incentives, instruments like the Electricity Price Compensation Mechanism deliver direct financial benefits. The CSRD is expected to amplify demand for green electricity, and thus GOs, by embedding Scope 2 accounting more firmly in corporate sustainability disclosures, though it remains one of many influential drivers.

(2b) Price Volatility and Market Distortions

Despite the rising demand for GOs, it remains uncertain whether this will effectively address the long-standing issues of price volatility and persistently low prices in the GO market. GO prices seem to be heavily influenced by political decisions that affect both the expansion of RES and the growth in demand for GOs. Price development remains highly unpredictable due to numerous influencing factors. One expert emphasized that even consulting firms' prediction studies often fail to forecast GO price trajectories accurately (IE1, 31:56). Regulatory uncertainties further contribute to this unpredictability, such as potential adjustments to Germany's double marketing ban for new plants, which could open the market for domestic GOs and impact pricing. Similarly, changes to additionality criteria under the CSRD or the GHG Protocol could radically alter demand behavior, making supply and demand dynamics difficult to anticipate. These political dependencies also lead to fragmented regulatory frameworks across Europe, resulting in disparities in green electricity markets. Countries with more flexible rules can sell GOs more freely, creating imbalances that disrupt overall price stability.

In the German GO market, liquidity remains a critical challenge, largely due to the Doppelvermarktungsverbot and regulatory constraints. Interviewees highlighted that limited trading activity prevents effective price signals from reaching renewable energy producers: "that the liquidity in the market is too low, so there is too little trading activity, and therefore the price signal does not reach the producer […] and that is why more market participants are desired" (IE2,02:10). This lack of liquidity means that the price of GOs does not properly reflect the dynamics of supply and demand, undermining the incentive for producers to invest in RES projects.

Compounding the liquidity issue, cross-border dynamics significantly distort price signals within the German market. In particular, the influx of low-cost foreign GOs, especially from Norway, disrupts market equilibrium. Norwegian hydropower GOs, often priced cheaply and

originating from subsidized or decommissioned plants, are introduced into the market without geographic or temporal alignment with German electricity production. As a result, these low-priced imports suppress domestic prices. An expert described this phenomenon as the: “Nordic Hydro problem, where the Norwegians ultimately throw their hydropower Guarantees of Origin onto the market for almost nothing, leading to double counting with all its associated problems and thus also driving down prices” (IE3, 16:15). The abundance of these foreign GOs creates downward pressure on prices in Germany, weakening domestic market signals and discouraging local investment.

A contrasting example is found in the UK following Brexit. Before the UK’s departure from the EU, British REGOs, which serve as the EACs for Great Britain, could be traded on the European market. After Brexit, the UK exited the international trading mechanism, which significantly reduced the availability of REGOs in the European market. This scarcity led to a dramatic price increase, with REGOs rising from around 1 EUR/MWh to between 6 and 8 GBP/MWh, despite demand remaining relatively constant (MP2, 15:06). This development illustrates how regulatory shifts can significantly impact price stability and enhance market signals. The expert even suggested that similar effects could be achieved in Germany if imports from Norway were restricted, potentially boosting the price of domestic GOs and providing stronger financial incentives for renewable energy production (MP2, 04:15).

The liquidity challenge is further exacerbated by Germany's EEG subsidy system, which guarantees fixed income for plant operators, making state-backed support far more attractive than market-based mechanisms. As one expert explained when talking about increasing demand for the “greenness-bonus”: “But we cannot make any statement about this because if I simultaneously have state subsidies where I receive money for my plants that is 5 to 10 times, or even 20 to 30 times the revenue I would get from a GO, I don’t even think about GOs” (MP2, 08:39). This overwhelming financial advantage provided by EEG subsidies diminishes the role of GOs in revenue considerations for producers. Consequently, participation in the voluntary market remains limited, stifling its growth potential.

Although the voluntary market has struggled under the dominance of EEG subsidies, there are signs of a gradual market shift. PPAs are increasingly seen as viable instruments for market-driven renewable energy expansion. By offering long-term financial stability, PPAs enable plant operators to secure financing outside of the EEG framework. One expert noted that the growing role of PPAs demonstrates a shift towards market-driven renewable energy that is less reliant on taxpayer-funded subsidies: “renewables are increasingly able to assert themselves in

a market-driven manner" (MP1, 04:31), suggesting that renewable energy could increasingly be market-driven, albeit still in a transitional phase.

Nevertheless, the EEG remains far more dominant than the PPA market in Germany. This imbalance has led market and policy experts to argue that the future of Germany's electricity market must focus on better aligning state-driven and market-driven mechanisms. Rather than viewing PPAs and EEG subsidies as mutually exclusive, experts suggest that these instruments should be regarded as complementary, capable of working together to drive renewable energy growth. In light of the evolving EU electricity market design, some interviewees advocate for stronger support mechanisms for PPAs, such as risk-hedging instruments, to secure the financial stability necessary for market-driven renewable energy projects.

Thus, while there are signs of market-driven expansion through mechanisms like PPAs, the interplay of regulatory restrictions, cross-border distortions, and the dominance of state subsidies continue to impede price stability and effective market signals in the GO market.

Conclusion of (2) Market Signals and Investment Incentives

The analysis of this theme reveals that the growing demand for GOs is driven by both voluntary corporate sustainability strategies and regulatory pressures, with instruments such as the CSRD, EU Taxonomy, and RFNBO requirements playing significant roles. Interviewees highlighted how the CSRD is expected to strengthen GO demand by embedding Scope 2 reporting requirements into sustainability disclosures. This regulatory push aligns with voluntary market dynamics, where companies seek to meet decarbonization targets and enhance brand positioning through verifiable green electricity consumption.

However, barriers such as price volatility, low market liquidity, and the influx of low-cost foreign GOs, especially from Norway, undermine effective price signals in the GO market. Additionally, regulatory constraints like the Doppelvermarktungsverbot limit domestic trading activities, preventing stronger market-based incentives for renewable energy expansion. These challenges are further exacerbated by the dominance of EEG subsidies, which continue to offer more secure revenue streams compared to market-based GO transactions, reducing the attractiveness of voluntary market participation.

Although there are emerging signs of a shift towards market-driven mechanisms, such as PPAs, the overall market environment remains constrained by regulatory fragmentation and state-backed subsidies. As it stands, the CSRD may bolster demand for GOs, but its effect on market stability and price signaling remains uncertain given the existing structural barriers.

(3) Physical Integrity and Technology Impact

This theme examines the alignment between the trading of GOs and the physical realities of renewable electricity consumption and production. Key topics emerging from the interviews are: (a) Market Segmentation and Price Differentiation, (b) Granular and Coupled Sourcing, and (c) Conceptual Limits and Ambiguity of GOs.

(3a) Market Segmentation and Price Differentiation

The evolving market for GOs is increasingly characterized by segmentation along technological, regional, and temporal attributes, driven by rising corporate sustainability demands and evolving regulatory requirements. The growing heterogeneity in corporate demand is challenging the past assumptions in market design.

A central challenge in the current GO market is the tension between the need for standardization to ensure liquidity and the increasingly granular and differentiated demand from corporate consumers. One expert captured this conflict in the following way: “I see a certain competition there, a conceptual competition, on the one hand between standardization to bring liquidity to the market, and on the other hand the extremely heterogeneous demand of customers” (IE, 07:37). This highlights a fundamental market friction: while standardization supports tradability and price stability, it often fails to account for the nuanced preferences of companies seeking specific attributes such as regionality, technology type, or temporal alignment. The expert questions whether traditional exchange-based trading systems are still suitable given the evolving market structure, and experts imply that market liquidity and differentiation may not be mutually achievable without significant adjustments to how GOs are certified, traded, and reported.

The trend towards market differentiation is primarily driven by the desire of companies to demonstrate stronger climate commitments and align their energy procurement strategies with sustainability goals. Although still in its early stages, initial adopters signal a growing interest in more transparent and credible green electricity claims. For example, PPAs with granular GOs are emerging as a mechanism for real-time and location-specific renewable energy tracking. This shift indicates a maturing market where differentiation based on time, geography, and production type is becoming more valuable for stakeholders looking to emphasize their climate impact credibly. However, widespread adoption remains limited, particularly among SMEs, which are not yet fully engaged with such differentiated energy procurement strategies.

Regulatory changes are also beginning to reflect this demand for differentiation, as recently, it was legally mandated that the country of origin for GOs must be displayed on electricity labeling. This shift marks a significant development, as the geographical source of GOs previously played a minimal role in market perception – either energy was classified as green, or it was not. One interviewee commented,

> "I found it to be a quite interesting development because, until now, questions about […] where the Guarantee of Origin actually came from didn't really matter in the market. […] I always found that a bit of a shame. And I could imagine that with this change […] that there will be a different competition in the market" (IE1, 06:50).

This regulatory transparency may accelerate competitive dynamics, pushing suppliers to prioritize domestic or regionally sourced GOs to meet emerging consumer expectations for localized green energy. Further regulatory adjustments could deepen market segmentation, as this expert suggests to consider restricting the issuance of GOs from hydropower plants older than 20 years. While such a measure would require careful consideration, it could lead to a supply shortage in the GO market if demand from both private customers and companies continues to grow. This, in turn, could incentivize the construction of new RES installations.

Voluntary standards and certifications are playing a significant role in accelerating this trend. Programs like B-Corp and RE100 have introduced stricter sourcing requirements for GOs, prioritizing certain qualitative attributes in GOs: "if you want to get the B-Corp certification […] [you need] Guarantees of Origin from Germany" (IE1, 26:01). These standards set clear expectations for sustainability claims, prompting companies to procure GOs that represent actual contributions to renewable energy expansion. Similarly, labels such as TÜV Süd, TÜV Nord, and naturemade Swiss establish voluntary quality benchmarks, focusing on technology type, regional origin, and plant age. These labels cater to companies aiming to enhance their green credentials and meet higher sustainability expectations from stakeholders.

This development is more pronounced in international markets, where the differentiation of GOs based on quality and additionality is increasingly evident. For instance, one interviewee mentioned that in England, it has "more or less become standard that all suppliers, or at least the major ones, offer tariffs where […] customers can see from which plant the electricity came from at every hour" (MP2, 21:06), indicating that hourly traceability is now considered a premium product. In contrast, this willingness to pay for enhanced traceability and premium green electricity is less prevalent in Germany, where high energy prices dampen demand for

high-quality GOs. Although there is an interest in premium markets, companies are “not necessarily […] ready to pay an awful amount of money for it” (IE1, 37:19).

Because current Scope 2 reporting requirements allow basic Nordic hydro GOs as sufficient verification for emission reductions, industry experts generally argue that the CSRD is not significantly driving demand for higher-quality GOs. In contrast, market and regulatory experts suggest that the CSRD, depending on its interpretation, is indeed creating pressure for more differentiated and higher-quality GOs to meet stricter alignment with climate goals. One regulatory expert noted that depending on the interpretation, the CSRD could encourage quality differentiation, given its requirements for companies to demonstrate how their sustainability strategies align with the Paris Climate Agreement and climate neutrality goals. This alignment is increasingly perceived as credible only if it satisfies additionality criteria rather than mere paper-based claims. As the expert stated, “it is also the case that under the CSRD, as a company it must be demonstrated in the sustainability reporting to what extent the business activities [...] are in alignment with the Paris agreement and the goal of climate neutrality. [...] this is only the case if such additionality is given” (RE2, 41:19). However, this expert also acknowledges that it remains uncertain whether auditing firms would enforce this stringency or accept broader interpretations, such as increased GO procurement alone as evidence of climate commitment. There is also a good chance that focus will remain on the cheapest GOs as they suffice for corporate reporting. This regulatory ambiguity underscores the potential of sudden market changes if stricter interpretations gain traction.

Further shifts may arise from anticipated changes to the GHG Protocol, on which the CSRD is based. Ongoing discussions suggest that new guidelines could regionalize and time-synchronize GO requirements. One interviewee observed,

> “It is quite possible that the guidance will then say that if you want to offset your market-based emissions to zero, the Guarantees of Origin must, in the future, be monthly, weekly, hourly, and from the same bidding zone where your company is located. That is where the discussion is currently heading in the GHG Protocol” (E1, 27:50).

Such changes could restrict companies to using GOs from their local bidding zones for emission accounting, potentially triggering a surge in demand for high-quality, local GOs, especially from German renewable sources. This could create a market squeeze as availability tightens. The GHG Protocol changes are also expected to create further differentiation of "green shades" within the market – ranging from basic green certifications to high-grade, temporally matched GOs for enhanced sustainability claims.

While the growing differentiation in the GO market can provide stronger market-based incentives for the development of renewable energy plants that contribute to additionality, it also introduces challenges, particularly for energy-intensive industries. The resulting price volatility and lack of predictability in sourcing renewable energy, due to the temporal and geographic alignment of GOs, can complicate financial planning and procurement strategies for these industries. This is why cheaper, non-differentiated GOs from regions like Norway are more attractive despite their lack of alignment with additionality criteria.

To conclude, the GO market is increasingly segmented by technology, region, and time granularity as corporate sustainability demands and regulatory changes evolve. Regulatory adjustments, such as mandatory country-of-origin labeling, signal a push toward more transparent and localized green energy claims, while voluntary standards like B-Corp and RE100 are setting higher benchmarks for GO sourcing. Internationally, markets like England are moving towards hourly traceability, reflecting premium demand, whereas in Germany, high energy costs limit uptake. The CSRD and anticipated changes to the GHG Protocol may further drive demand for higher-quality, regionally aligned GOs to some extent, though regulatory ambiguity and reliance on cheaper Nordic hydro GOs persist. These developments suggest potential market shifts towards stronger incentives for additional RES expansion but also highlight risks of price volatility and sourcing challenges for energy-intensive sectors.

(3b) Granular and Coupled Sourcing

Granular and coupled sourcing is emerging as a strategic approach to align renewable energy consumption more closely with local generation and granular timeframes. This development is led by both voluntary corporate sustainability initiatives and regulatory measures aimed at strengthening the credibility of green energy claims. Moreover, corporate strategies such as PPAs and on-site renewable energy investments are becoming increasingly prevalent in industry. Within this context, two primary dimensions are taking shape: geographic and temporal granularity and coupling.

Regional alignment of GOs is gaining traction as market participants aim to substantiate local renewable sourcing. One expert predicts for the future that “the more decentralized the supply facility or GOs are located at the production site, the higher the value component” (MP1, 16:32), suggesting that energy produced and consumed within close geographic proximity could carry higher market value. This indicates a shift towards decentralized energy procurement strategies that prioritize local renewable assets, potentially encouraging industrial relocation to regions

with optimal conditions for renewable generation. Additionally, regulatory measures under the RFNBO guidelines in the revised RED mandate that renewable installations intended for green hydrogen production must be located within specific zones and be connected via a direct line. This regulatory push strengthens the concept of additionality by ensuring that renewable energy claims are tied to new capacity instead of pre-existing infrastructure. Geographic coupling of GOs therefore becomes ever more important.

In addition to geographic alignment, there is a notable trend towards real-time or hourly matching of renewable consumption with generation. This push is not solely market-driven but also underpinned by upcoming regulatory mandates. As one interviewee noted, "from 2030 onwards, time-stamped Guarantees of Origin must be introduced" (MP2, 16:15), highlighting that timestamped GOs will soon be required to reflect the exact hour – or even quarter-hour – of production. This change is expected to reshape market dynamics, fostering dynamic pricing models where GOs generated during periods of high renewable output (e.g., midday solar peaks) lose value, while those produced during scarcity periods (e.g., winter evenings) become more valuable. The introduction of timestamped GOs encourages alignment with grid availability. Solar installations, for instance, may increasingly adopt east-west orientations to capture morning and evening sun, optimizing both market value and grid efficiency. One expert emphasized this shift, stating that

> "In the future for green hydrogen […] if time stamping needs to be complied with […] I, [as a solar installer] would be rewarded twice if I don't position fully towards the south […] because I will not only get better prices on the electricity market but also better prices on the GO market for that hour" (MP2, 21:10).

Temporal granularity not only incentivizes renewable deployment but also enhances demand-side flexibility, as corporate consumers adjust consumption patterns to match periods of renewable abundance. Storage technologies are expected to play a crucial role in this model.

The trend towards coupled sourcing is mirrored in corporate energy procurement strategies, which are not always driven by sustainability goals. PPAs have become key mechanisms for achieving long-term price stability and securing GOs linked to specific renewable installations. One expert explained, "that is also the main reason why companies enter into PPAs, […] price stability on one hand and the assurance that they will receive the Guarantees of Origin from these facilities" (IE1, 9:39). This dual benefit of predictable pricing and verifiable renewable sourcing positions PPAs as essential tools in corporate energy strategies. Moreover, the economic disruptions of COVID-19 and geopolitical tensions have spurred a rise in on-site

renewable installations and direct investments in wind and solar assets. Increasingly, corporations are bypassing traditional auctions to invest directly in renewable projects, gaining greater control over production costs and hedging against market volatility. Large-scale investments like BASF's billion-euro wind park exemplify this trend towards energy sovereignty. An expert noted, "if I directly purchase an offshore wind farm, it's cheaper than buying electricity on the market. And, of course, I suddenly have control over the asset. […] If I'm lucky, I can then sell the surplus amount at a profit" (IE3, 38:14). Such direct ownership not only shields companies from market volatility but also creates opportunities for selling excess generation during peak demand.

Granular and coupled sourcing represent a fundamental shift in corporate energy strategies, driven by both voluntary commitments and regulatory pressure. While geographic and temporal alignment enhances the credibility of green energy claims and drives investment in localized and granular renewable projects, corporate energy strategies such as PPAs and on-site generation are proving vital for securing cost predictability and asset control in renewable energy sourcing. The CSRD was not mentioned within these contexts.

(3c) Conceptual Limits and Ambiguity of GOs

The conceptual limits and ambiguities of GOs raise fundamental questions about their role in reflecting true environmental impact and renewable energy consumption. Within the context of the theme, these limitations highlight the gap between market-based certificate trading and the physical realities of energy flows, casting doubt on whether GOs genuinely align with decarbonization goals or merely serve as abstract claims disconnected from actual grid dynamics. The following synthesizes expert insights on the commodity versus quality debate and explores whether GOs are equipped to meet growing market demands for credible and transparent sustainability claims.

A few experts highlighted the fundamental nature of electricity as a commodity, regardless of its origin. Unlike tangible products like regional strawberries or Fairtrade coffee, electricity's source is irrelevant to its physical properties: "Electricity is a commodity. It comes out of the socket. This means that the connection between electricity delivery and the quality of the generation technology is, I believe, what makes it dangerous" (IE3, 35:23). This misunderstanding of GOs proving a certain electricity "quality" seems to fuel accusations of greenwashing in the energy sector, which the expert finds misleading. The physical delivery of electricity remains unchanged irrespective of the production method: "If I stay in this way of

thinking, that the Guarantee of Origin defines some sort of product quality, then greenwashing exists" (IE3, 25:13). The expert also criticizes the legal and regulatory framework, pointing out that the link between GOs and electricity delivery is artificially constructed and driven by market logic rather than physical reality: "In the pure sense of the word, I simply believe that greenwashing does not exist like that, because it cannot exist" (IE3, 25:13). They attribute these misconceptions to a lack of technical understanding among policymakers and NGOs, which has led to regulatory complexities that distort the true nature of green energy claims.

Across expert groups, there is consensus that the problems are not inherent flaws within the GO system but rather a mismatch between market expectations and the legal design: "The reservations or accusations one hears against the Guarantee of Origin system […] actually have nothing to do with the system itself or its flaws, in my view, but rather with expectations that the system simply cannot fulfill" (RE1, 04:24). This misalignment arises because many expect GOs to guarantee ecological quality, which is beyond their intended function. Interviewees generally seem to agree that that GOs are not inherently of "good" or "bad" quality, and that legally, all GOs suffice as documentation tools for selling renewable electricity. This distinction is crucial for corporate reporting, where GOs serve primarily as proof of renewable energy consumption rather than as instruments for emissions neutrality. A regulatory expert adds that while the CSRD does not differentiate GO quality, some interpretations of GO attributes might infer additionality or its absence.

The longstanding debate over whether the voluntary electricity market should ensure additionality continues, especially given the difficulty of defining criteria for additional investments. Some experts firmly state that additionality is not a role of GOs. Moreover, one interviewee argues that emphasizing additionality in climate reporting is misguided because the carbon impact is identical regardless of whether electricity is generated by an old hydropower plant or a new solar installation: "In production, the electricity is CO2-free or greenhouse gas-free. And that makes no difference" (IE1, 12:05). While technically renewable electricity is nearly CO2-free rather than absolutely zero-emission, this quote underscores their take that for accounting purposes there should be no difference between established and new renewable sources. Expecting GOs to drive new investments, they contend, places unrealistic demands on a mechanism not designed for that purpose.

One expert proposes a paradigm shift, suggesting that GOs should be viewed as financial contributions to technology investments rather than direct proof of green consumption: "I believe we need to think more in the direction of investment subsidies, and then greenwashing

would not exist" (IE3, 26:02) The expert highlights that this approach would shift the logic from product consumption to economic support for technology, decoupling the misleading narrative of greenwashing: "I contribute economic support in Iceland. And that is a different approach" (IE3, 26:02).

GOs face conceptual limits rooted in the inherent nature of electricity as a homogeneous commodity, leading to misunderstandings about their role in proving ecological quality and driving additional investments. Rather than being flawed themselves, GOs suffer from mismatched market expectations and regulatory constructs.

Conclusion of (3) Physical Integrity and Technology Impact

While the trends in quality differentiation, regional, and time alignment are emerging, they largely reflect corporate strategies to align with long-term sustainability goals or ensure energy security, rather than a direct response to CSRD or regulatory mandates. The potential future evolution of the GHG Protocol or CSRD could address this gap by introducing requirements for higher-quality GOs that more accurately reflect actual physical renewable energy consumption. However, under current regulatory frameworks, a GO is legally recognized as valid proof of renewable electricity consumption regardless of its specific attributes, meaning the law treats all GOs equally without requiring additionality or alignment criteria. This highlights that the role of additionality and quality differentiation primarily resides in the voluntary market, where corporate buyers often seek to go beyond legal minimums to drive meaningful investments in grid-supportive, time-aligned, and regionally sourced renewable energy. The conceptual limits of GOs reflect a core tension between market-based certificate trading and the physical realities of electricity systems. While GOs are legally sufficient for documenting renewable energy use, expectations that they ensure ecological quality or additionality often exceed their intended function. Their evolution toward greater environmental credibility is mostly seen as a responsibility of voluntary market initiatives or emission accounting systems rather than regulatory reform or changes to the GO system itself. Overall, this theme highlights tensions between the legally uniform function of GOs as documentation tools and growing voluntary market demands for differentiated attributes that better reflect true environmental impact.

(4) Transparency and Double Counting

This last theme examines the use of GOs in emissions and energy disclosure systems, with a focus on consistency, transparency, and the risks of overlapping or multiple claims. Before

examining these subcategories, it is important to clarify a key terminological inconsistency observed during interviews. The terms “double counting”, “double claiming”, and “double accounting” were often used interchangeably, with industry experts in particular primarly referring to “double accounting”. The following analysis relies on a legal expert’s precise distinction between double counting and double claiming. According to this expert, double counting refers to the scenario where a single amount of electricity is assigned two separate GOs, which is prohibited under RED III: “I have a certain amount of electricity, and for this amount, I obtain a Guarantee of Origin, and then I issue another Guarantee of Origin for the same electricity[…] thus, one amount of electricity, two Guarantees of Origin. This is not allowed under RED III” (RE2, 28:37). In contrast, double claiming occurs when the environmental attribute associated with a GO, e.g. CO_2-reduction, is claimed more than once across different jurisdictions or by different companies. However, the GO is still only issued and cancelled once. Throughout the coding process, each interview segment was examined to determine whether the expert referred to double counting or double claiming according to this distinction. Therefore, the analysis of this theme was split into the subcategories of (a) Double Counting and (b) Double Claiming.

(4a) Double Counting

Interviewees widely recognized the importance of avoiding double counting in the GO system, viewing it as a fundamental criterion for the credibility, auditability, and legal compliance of RES tracking. However, most agreed that the current GO system, particularly in Germany, is robustly designed to prevent such risks. Experts emphasized that GOs are largely fail-safe from a double-counting perspective due to centralized issuance and cancellation processes. One participant noted: “if the central registry does not issue the Guarantee of Origin, then it doesn’t exist” (MP2, 26:14). The risk of overlapping claims is minimized through official national registries that exclusively track GOs within defined geographic boundaries. In Germany, the UBA and HKNR were consistently praised for reliability, with no major cases of fraud or duplicated issuance known.

The GO system's integrity was universally affirmed, with one expert describing it as “a well established and also reliable verification system” (RE1, 04:24). Instead, it was stated that the challenge lies not in the system itself but in its interaction with other mechanisms like emissions accounting and product labeling, leading to double claiming. Misalignment with these systems, rather than flaws in GO design, was seen as the primary concern.

(4b) Double Claiming

Double claiming emerged as a significant, albeit indirect, issue within the GO market. Unlike double counting, double claiming is linked to inconsistencies in reporting obligations, residual mix accounting, and most importantly, the coexistence of market-based and location-based emission disclosure.

Norway and Iceland were frequently cited as prime examples. In these countries, which have nearly 100% renewable grid mixes, companies may report low emissions using the location-based method while simultaneously exporting their GOs for use in market-based accounting elsewhere. As one expert remarked, “Norwegians [...] ship their Guarantees of Origin to us and at the same time claim that they are green. [...] Financially, Norwegians are actually the biggest environmental pigs” (IE3, 26:59). Although this practice does not technically breach regulatory guidelines, it undermines transparency and enables a form of double counting that distorts the integrity of green claims.

Several interviewees identified this as a regulatory loophole stemming from the flexibility companies have in choosing between market-based and location-based reporting approaches. While operationally convenient, this flexibility is seen as problematic: “These two systems are not compatible [...] And in this chaos, NGOs and green electricity producers naturally wrestle with the inconsistencies” (IE3, 26:59). Another expert noted, “As long as they allow these industrial companies to claim nearly 100% renewable energy based on the national production mix, this naturally continues to lead to [double claiming]” (MP1, 20:21). A similar issue also arises in lifecycle assessments and product carbon accounting, where there is ambiguity about which calculation methods should be used to prevent double counting.

Notably, experts agreed that this is less an issue of GO system design and more a reflection of emission accounting frameworks. One regulatory expert highlighted that double claiming falls under competition law, specifically the Unfair Competition Act (UWG, unlauteren Wettbewerbsgesetz) in Germany, since marketing electricity as green after its GO has been exported could be construed as misleading. Thus, it is a matter of unfair business practice, rather than a fault in GO regulation.

Despite the current gaps, some interviewees were optimistic that the CSRD, with its mandate for dual reporting of both location-based and market-based methods, could significantly improve transparency. One participant stated confidently: “if the legal adjustments are made and all companies comply with the laws, then I don't see [the problem of double claiming]”

(IE1, 21:37). Additionally, some experts suggested that the new audit requirements could help detect discrepancies between reporting methods, reducing the risk of double claiming. Stricter audits, they argued, would expose inconsistencies more readily and enforce greater accountability. However, not all experts were equally convinced of the impact. Some believed that, audit-wise, everything is compliant "by the letter of the law" (MP2, 31:11), and the real issue lies in how emission calculation rules are structured rather than how they are audited.

One tangible example of CSRD's potential impact was provided: in Norway, an industrial association petitioned regulators to limit GO exports out of concern that future market-based reporting requirements would force them to retain GOs domestically. This may be an early indicator of CSRD's influence, although the interviewee was not sure about its broader effectiveness. In general, a lot of these statements regarding CSRD effectiveness to combat GOs were falling with not so much confidence, as softening words deflate the confidence behind these statements: "I guess", "I think", "it is likely", "possibly", etc. So it is difficult to draw a clear expert opinion.

However, a recurring concern across several expert interviews was the growing complexity of emissions reporting obligations, particularly under the combined influence of the CSRD, and evolving GHG Protocol guidance. The dual reporting requirement of market-based and location-based emissions is not only a technical challenge but mainly organizational, as SMEs are disproportionately affected. As one expert put it, "we have a lot of B2B customers who are rather small, they often don't have sustainability experts, which means they don't even know how they should do it" (IE1, 23:39). Experts emphasized that many stakeholders struggle to even distinguish between Scope 1, 2, and 3 emissions, let alone understand how product- or supply-chain-based assessments interact with electricity sourcing methods. As a result, this leads to much confusion.

Beyond conceptual challenges, experts noted significant administrative burdens. There was concern that this expanding compliance burden may reinforce asymmetries in market access, with highly standardized and well-documented energy purchases favored in procurement, regardless of their real-world sustainability impact. Some interviewees questioned whether the bureaucracy generated by dual reporting is proportional to its benefits. "That essentially creates more bureaucracy from the companies' perspective […] so it's a matter of weighing the options" (RE2, 32:14) one noted, suggesting that although such complexity might be legally justified, its practical impact should not be underestimated. A few experts emphasized that instead of focusing on audits and bureaucratic solutions, it would be better to create further economic

incentives that fosters renewable energy procurement and production: “I’m more in favor of saying, if I create economic incentives for companies to do it independently, then I don’t need to audit it” (IE3, 38:51).

Conclusion of (4) Double Counting and Disclosure Integrity

In conclusion, while the RED is effective in prohibiting double counting, double claiming remains a problem in the market, especially due to the coexistence of different accounting practices. The core issue lies in misaligned reporting frameworks, allowing companies to exploit reporting flexibility to appear greener than they are. While double claiming does not inherently violate GO system rules, it can still breach competition law due to misleading claims about renewable energy sourcing. More importantly, it represents a significant greenwashing risk for corporate reporting, posing reputational, legal, and compliance challenges. The CSRD is viewed as a promising regulatory development that could address this by mandating dual reporting and expanding audit requirements. There is cautious optimism that this may at least mitigate the well-known “Norway problem”, though broader reform of emission calculation frameworks, as well as adjustments to the GHG Protocol, are still considered necessary. That said, it remains uncertain whether these increasingly bureaucratic solutions are truly the most effective means to address the underlying issues.

5. Discussion

The comparative legal analysis establishes that GOs, as defined under the RED, remain a central certification instrument for renewable electricity, while the CSRD incorporates GOs into corporate sustainability reporting frameworks, particularly within the ESRS as key evidence for verifying renewable energy consumption and Scope 2 emissions. Although these directives pursue complementary sustainability objectives, they operate within distinct legal scopes: RED III governs the energy system and renewable deployment targets at the sectoral and national levels, whereas the CSRD targets corporate transparency and accountability by imposing detailed sustainability disclosure obligations. This creates an operational linkage where the CSRD may indirectly drive increased corporate demand for GOs, while RED III ensures the integrity and certification function of the GO system. The emerging role of GOs in the CSRD, as discussed, for example, by Sakhel, Styles et al. (2022) and Wettingfeld et al. (2025), is thus explicitly grounded in legal texts, indicating a deliberate intention by the legislator to integrate GOs into corporate sustainability governance. However, the analysis also highlights that there is no explicit legal coordination aimed at fostering synergy, leaving room for regulatory fragmentation and uncertain real-world interactions between these frameworks.

Building on this foundation, the expert interviews reveal how GOs continue to fulfill their foundational role as instruments that enable credible energy supplier claims and ensure transparency for end consumers. This core function underpins their expanding use in corporate reporting and market signaling, where their traceability remains essential. Nonetheless, the effectiveness of GOs in these newer roles depends heavily on overcoming barriers related to market design, regulatory coherence, and the clarity of reporting standards.

Demand for GOs is rising, driven by both voluntary corporate commitments and regulatory pressures such as the CSRD, EU Taxonomy, and RFNBO mandates. The CSRD is expected to strengthen corporate GO demand by formalizing Scope 2 emissions disclosure requirements for many companies across various industries, as also anticipated by earlier studies (e.g. dena, 2022; Maaß et al., 2019). However, significant market challenges persist – most notably price volatility, low liquidity, and regulatory constraints like the Doppelvermarktungsverbot – that undermine the ability of GOs to function as strong market-based investment incentives for renewable energy expansion. The dominance of subsidized EEG mechanisms further complicates the emergence of fully market-driven dynamics. These findings are consistent with previous studies, including Bowe & Girbig (2021), Hulshof et al. (2019), Maaß et al. (2019), and Styles et al. (2021), among others. At the same time, the interview data point to the greater

practical relevance of other instruments and regulatory frameworks in driving renewable electricity uptake, such as the Electricity Price Compensation Mechanism and the EU Taxonomy, suggesting that GOs currently play a more limited role within the broader regulatory incentives. Additionally, hydrogen-related regulations, as well as the cost-benefit of in-house renewable energy production are increasingly shaping corporate energy investment decisions.

Further, while quality differentiation and regional and temporal alignment of GOs are gaining traction, as also suggested by, for example, Styles et al. (2021), it was found that these trends predominantly reflect proactive corporate strategies aimed at energy security and genuine sustainability commitments rather than being driven by regulation. Current legal frameworks, including the CSRD, treat all GOs equally regardless of additionality effect or physical alignment. This creates tension between GOs' documentation role in sustainability reports and the physical realities of electricity consumption. These physical dimensions, such as time and location, are environmentally significant, as they determine whether renewable electricity is actually displacing fossil-based generation at the time and place of consumption. While the issuance of a GO does correspond to the generation of renewable electricity – and therefore a carbon reduction somewhere in the system – this does not guarantee that a company's own electricity use is fossil-free or supports the expansion of new or local renewables. Without time- and location-based alignment, companies may still rely on carbon-intensive electricity in practice, even as they claim renewable use in their sustainabiltiy reports. The conceptual limits of GOs become apparent, where expectations about ecological quality or additionality exceed the instrument's formal purpose.

Finally, the issue of perceived double counting (or double *claiming*) remains a critical challenge, confirming concerns that have been known in the market for years (e.g. Brander et al., 2018; Hauser et al., 2019; Herrmann et al., 2023). Although the RED effectively prohibits double counting, misaligned accounting and reporting practices continue to allow for double claiming. The CSRD offers promising developments by requiring enhanced audit and dual reporting mechanisms, but uncertainties remain about the sufficiency and efficiency of these bureaucratic solutions without broader reforms to emissions accounting frameworks.

The following discussion addresses the research questions by reflecting on how these findings contribute to understanding the practical effectiveness of GOs under the evolving regulatory landscape, their capacity to drive meaningful market signals, and their (mis)alignment with physical renewable energy consumption. Additionally, it examines the extent to which the

CSRD's regulatory push interacts with voluntary corporate strategies and existing market structures, shedding light on the implications for both corporate transparency and the broader EU energy transition.

5.1. Interpretation of Results

This subsection interprets the study's findings in relation to the research questions presented in Section 1.2. It is structured accordingly: Section 5.1.1 examines the regulatory overlaps between the CSRD and the GO system; Sections 5.1.2 and 5.1.3 analyze the isolated effects of the CSRD on the GO market, focusing specifically on additionality and greenwashing concerns. This leads to a final assessment of whether the identified regulatory overlaps and market interactions between GOs and the CSRD contribute positively to accelerating the energy transition in Section 5.1.4, placing the isolated effects into the broader context of the overall transition.

5.1.1. Regulatory Overlaps between GOs and the CSRD

The comparative analysis of RED III and the CSRD reveals both direct and thematic overlaps concerning the GO system. GOs are explicitly referenced in the ESRS as instruments for verifying corporate energy mixes and disclosing Scope 2 emissions, establishing an operational link that enhances standardization and transparency in reporting. This reflects a shared thematic emphasis on *auditability* and *verification*, with both directives requiring reliable instruments to ensure the credibility of energy and climate-related claims. However, this alignment remains primarily administrative, with no clear regulatory intent to strategically coordinate GOs as tools for accelerating renewable energy deployment or incentivizing market-based decarbonization.

This reflects broader policy fragmentation: while GOs facilitate corporate disclosure and support *transparency* and *accountability*, which are both core objectives of the CSRD and RED III, they are not tied to criteria that promote additional renewable capacity or system-beneficial investments. The current design enables companies to substantiate green claims without necessarily contributing to new renewable generation. Thematic overlaps in climate and sustainability objectives show that both directives align with the European Green Deal and aim toward climate neutrality, yet diverge in scope and operational mechanisms. RED III focuses on systemic energy transformation through binding renewable energy targets and sectoral obligations, while the CSRD promotes a broader, corporate-level sustainability agenda. This lack of coherence may weaken the energy transition by allowing ESG reporting practices that are disconnected from energy system goals.

Although thematic overlaps between RED III and the CSRD suggest potential synergies, particularly in linking renewable energy sourcing with corporate energy reporting, the absence of coupling to project-based or additionality-driven mechanisms limits the transformative potential of these instruments. For instance, while RED III facilitates renewable expansion through support schemes and encourages corporate PPAs, the CSRD merely requires disclosure of renewable sourcing and climate policies, without imposing binding sustainability actions. This weakens the regulatory pull for firms to engage in high-impact energy sourcing strategies.

Looking ahead, the CSRD's mandatory Scope 2 disclosures may increase corporate demand for renewable electricity and GOs, especially as firms seek to mitigate financial risks linked to fossil fuels. Concurrently, RED III's higher renewable targets are expected to boost renewable generation and GO issuance. Yet, supply-demand dynamics remain uncertain due to regulatory barriers like Germany's *Doppelvermarktungsverbot*, which restricts GOs for subsidized energy. If demand outpaces supply, GO prices could rise, potentially incentivizing new capacity, but only if the market distinguishes GOs from additional projects rather than existing installations. Regulatory reforms may be needed to prioritize GOs from new capacity and enhance their contribution to decarbonization. Still, rising GO prices could also drive up renewable electricity costs, which would in turn make green electricity less attractive, posing trade-offs.

In conclusion, in response to Research Question I, while overlaps between the CSRD and RED III in relation to GOs exist, they are mostly administrative. Despite shared objectives under the European Green Deal and several thematic alignments, including in climate targets, transparency, renewables, finance, and verification, the current implementation of both directives lacks strategic integration. As a result, their combined potential to accelerate the energy transition through the GO system remains underutilized.

5.1.2. Economic Incentives for Additionality

To address Research Question IIa, which examines whether the legal overlaps between GOs and the CSRD enhance additionality, insights from expert interviews provide critical perspectives. The majority of experts anticipate an increase in demand for GOs driven by the CSRD's enhanced reporting requirements. Given that supply and demand dynamics are widely regarded as the primary determinants of GO prices, as supported by existing literature (Wimmers & Madlener, 2024), a rise in demand would logically result in price increases. Since low GO prices have been identified as a major barrier for GOs to incentivize renewable energy expansion (see Section 2.2.3, Problem 1: "Low Prices"), an upward shift in prices could, in

theory, strengthen the additionality effect of GOs, contributing to more substantial renewable energy investments.

Furthermore, some experts suggest that the CSRD's dual-reporting obligations, encompassing both location-based and market-based emissions, could expose instances of double claiming (see Section 2.2.3, Problem 3: “Double Counting”) through enhanced transparency and audit mechanisms. One expert even contends that if companies fully adhere to the new reporting standards, double claiming would effectively be eliminated. This perspective is supported by a concrete example from another expert: an industrial association in Norway petitioned its regulatory authorities to limit the export of GOs, expressing concerns that if market-based reporting becomes mandatory under future guidelines, domestic industries may struggle to claim CO_2 reductions due to the scarcity of Norwegian GOs, many of which are sold abroad. Given Germany's heavy reliance on Norwegian GOs, such developments could lead to increased competition for these certificates. Even without formal restrictions, German companies may face higher GO prices as a result of growing domestic demand in Norway, which could enhance the additionality effect of GOs by strengthening the market-based incentive to invest in new renewable energy projects.

These expert viewpoints align with findings from the comparative legal analysis of GO and CSRD interactions, which similarly indicate that increased transparency and reporting obligations may drive market changes conducive to higher GO prices and enhanced additionality. However, it is important to acknowledge dissenting views: some experts argue that the CSRD's dual-reporting requirement is unlikely to serve as a robust mechanism for resolving double counting, with one expert suggesting a purely market-based approach to be more effective.

Crucially, the price dynamics described depend on two fundamental assumptions: (1) that increased demand will indeed influence GO prices, and (2) that the CSRD's disclosure obligations will meaningfully alter corporate energy procurement behavior. While expert consensus suggests that these effects are plausible, it is equally important to recognize a key limitation identified in the legal analysis. The CSRD itself does not impose specific sustainability benchmarks on companies; it merely mandates disclosure. Thus, the extent to which these reporting requirements translate into substantive changes in corporate energy sourcing practices is contingent upon external pressure, namely, how investors, civil society, and consumers engage with and respond to the disclosed sustainability information. This leads to critical follow-up questions: To what extent will investors and the public scrutinize CSRD

reports? Will this scrutiny influence capital flows and consumer behavior to the degree necessary for genuine market transformation? These questions underscore the role of societal accountability in bridging the gap between disclosure and real-world impact, highlighting the importance of stakeholder engagement in driving the additionality potential of GOs under the CSRD framework.

Despite the potential for increased demand and improved price signals, expert interviews reveal that the physical reality mismatch in the GO market is unlikely to be addressed by the CSRD. The directive imposes no restrictions on the geographical or temporal sourcing of GOs, allowing companies to continue purchasing GOs from distant regions or different seasons – such as Norwegian hydropower or summer-generated solar GOs – to offset energy use in winter months. This perpetuates the disconnect between certificate claims and real-time, local renewable energy consumption, which experts argue fails to create effective demand signals for local, system-beneficial renewable energy expansion.

One potential regulatory lever that could disrupt this status quo is the anticipated update to the GHG Protocol. The CSRD's emission reporting requirements are based on the GHG Protocol, and interview insights indicate that if the protocol were updated to mandate regional or temporal alignment, the demand for locally produced or time-matched GOs could increase significantly. In Germany, this shift would be particularly impactful given the Doppelvermarktungsverbot. If demand for regional GOs rises and local supply remains limited, this could incentivize market-driven expansion of RES. However, there is also the possibility of regulatory adjustments, such as a relaxation or removal of the Doppelvermarktungsverbot to accommodate increased market demand to keep prices low.

Overall, expert insights suggest that the legal overlaps between GOs and the CSRD could lead to a modest increase in additionality, primarily driven by enhanced demand and transparency that may elevate GO prices. Nevertheless, the CSRD's current structure does not address the physical reality mismatch, which remains a critical barrier to effective market-based decarbonization. How these dynamics ultimately influence the energy transition will be further evaluated in Section 5.1.4, where the findings from each sub-question are synthesized to answer the thesis's main research question.

5.1.3. Risks of Greenwashing

Next, the impacts of the CSRD identified from expert opinions are discussed in relation to the risk of greenwashing. While it remains unclear whether the CSRD's requirement for dual

reporting (location-based and market-based emissions) will lead to additionality, it is likely to contribute to greater transparency in corporate energy claims. This transparency enables stakeholders, such as investors and civil society, to better assess which companies are genuinely contributing to decarbonization through their energy procurement strategies. Moreover, the CSRD introduces separate disclosures for energy use in addition to emissions reporting, further enhancing clarity.

However, concern was raised in the interviews that double-claiming practices are already regulated under the UWG (Unfair Competition Act), which prohibits misleading claims intended to gain a competitive edge. Interviewees questioned whether the CSRD's additional bureaucratic layer of dual reporting, which is particularly burdensome for SMEs, is truly necessary. It remains debatable whether this added layer of disclosure significantly enhances transparency beyond what is already enforced by existing legislation, such as the UWG, particularly in mitigating double-claiming and reducing greenwashing risks. That said, the recently adopted EU Green Claims Directive may introduce additional harmonized standards that could influence national frameworks moving forward. This is especially relevant for countries like Norway, where double counting has been a significant concern; the directive's implementation will likely depend on decisions made within the EEA framework on how and when to transpose these EU rules into Norwegian law.

Furthermore, the CSRD currently does not mandate specific attributes for GOs, such as regional or temporal alignment. This gap allows companies to continue making green claims based on temporal mismatches, such as relying on summertime solar electricity generation to offset winter consumption. This form of temporal misalignment is a known flaw in the GO system, not strictly a shortcoming of the CSRD itself. However, the lack of quality differentiation in the CSRD's framework permits these claims to persist, undermining its potential to address greenwashing effectively.

The CSRD does seem to have potential impact on GO prices, as discussed in the previous subsection (Section 5.1.2). If CSRD-driven demand raises GO prices, this could, in theory, strengthen price signals in the voluntary green electricity market, enhancing additionality. However, it is uncertain whether this additionality effect alone will mitigate greenwashing claims. Experts argue that the main issue stems from the public's limited understanding of GO mechanisms, which complicates perceptions of renewable energy claims. Without clear differentiation of GO "quality" attributes, such as additionality or temporal alignment, higher prices might only reflect increased demand rather than genuine environmental impact.

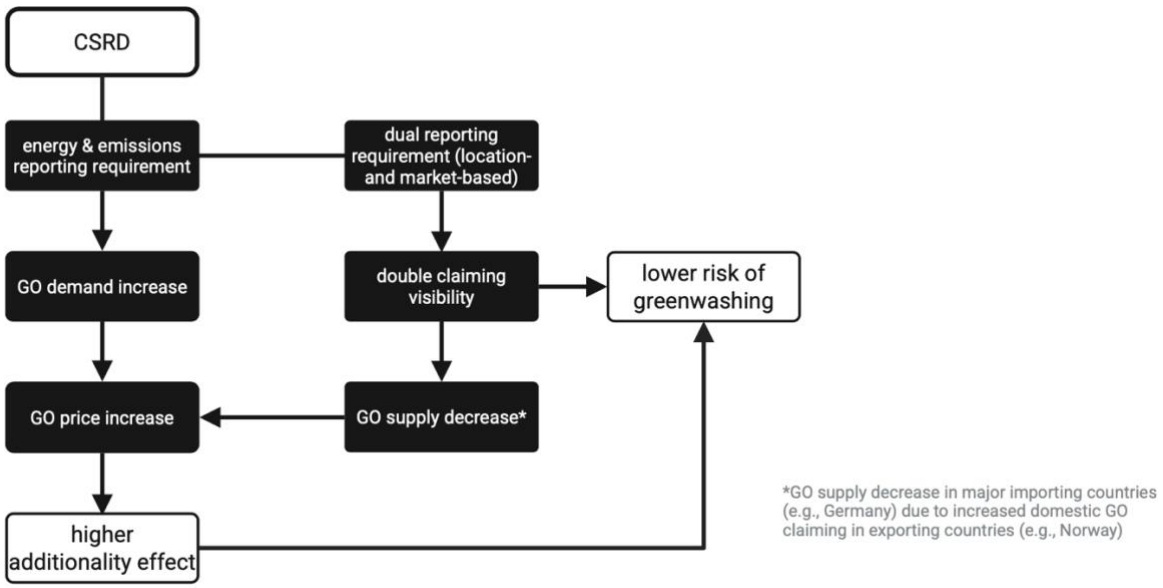
Notably, experts highlight that the role of certifying the "quality" of GOs, whether they are additional, regionally aligned, or time-synchronized, is not the responsibility of the GO market itself. GOs are designed solely to track MWh of renewable electricity, regardless of its environmental impact or temporal attributes. Instead, quality differentiation currently falls under voluntary certificates and market-driven interpretations. This market-driven differentiation is not mandated by the CSRD, meaning that the perceived "greenness" of a company's energy claims remains largely unregulated under its framework.

Overall, the CSRD's influence on greenwashing appears limited. While it may marginally address double claiming through enhanced transparency, its broader contribution to mitigating greenwashing is weak. Its lack of attention to GO quality differentiation and temporal alignment allows misleading claims to persist, suggesting that its impact remains primarily superficial in tackling core greenwashing challenges.

5.1.4. Effects for the Energy Transition

There are legal overlaps between the CSRD and the RED with regard to the use of GOs. When examined in isolation, as seen in the previous subsections, these overlaps exhibit some marginally positive effects in terms of encouraging additionality and mitigating greenwashing. The most significant effects discussed are depicted in Figure 4.

Figure 4 *Effects of the CSRD on the German GO Market – Conceptual Pathways in Isolation*



Note. This conceptual model reflects the anticipated impacts of the CSRD on the German GO market regarding additionality and greenwashing. It is based on qualitative findings and

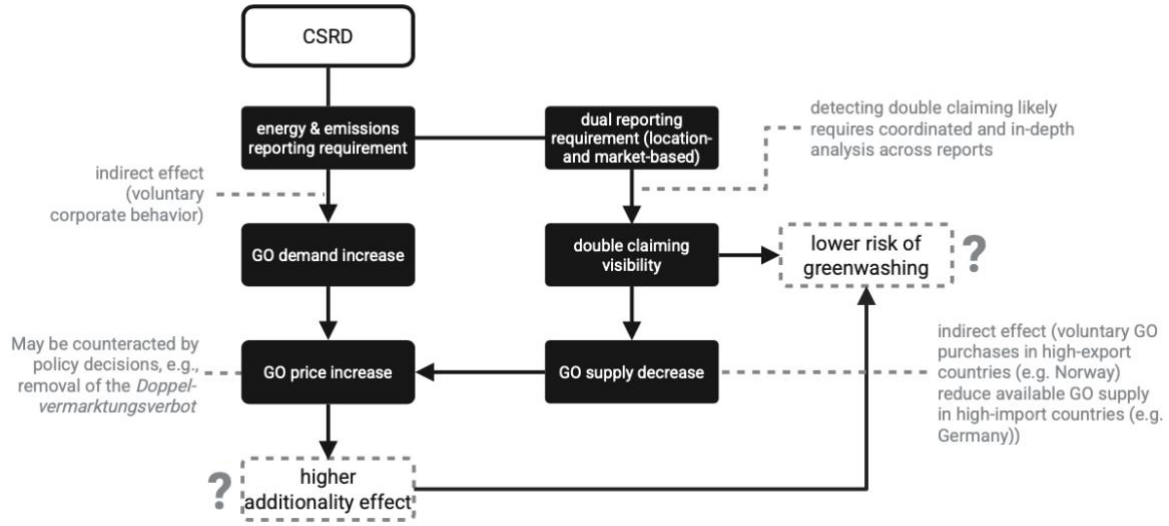
interpretive reasoning using basic supply-demand logic. Broader market dynamics, interacting regulations, and external drivers are intentionally excluded to highlight direct effects.

However, these CSRD-driven effects remail largely indirect. While the CSRD amplifies the transparency and accountability role of GOs by embedding them within mandatory corporate sustainability reporting, it does not mandate specific sustainability targets or renewable procurement thresholds. It continues to rely on the assumption that increased transparency will trigger voluntary corporate action. This assumption was reflected in several expert interviews, but it remains speculative and is not yet supported by concrete evidence. Thus, while expert insights are credible, they reflect anticipated trends rather than observed impacts and should be interpreted with caution. Similar uncertainty surrounds the projected rise in GO demand in Norway, which some interviewees feared could limit availability for countries like Germany. Yet this outcome depends on whether Norwegian firms choose to substantiate their claims through GOs in their market-based accounting.

Moreover, while some interviewees suggested that the CSRD's dual reporting requirement could help expose instances of double claiming, it is unlikely that such cases will become immediately apparent. Instead, identifying double claiming will likely require detailed cross-comparisons of multiple corporate reports and disclosures. This complexity may explain the wide range of expert opinions on the issue, ranging from the view that dual reporting effectively prevents double claiming, to more skeptical perspectives suggesting that its impact may be low to none.

Taken together, these insights point to a plausible but still speculative trajectory: increased GO demand, driven by CSRD-enhanced transparency, could raise GO prices and improve their additionality effect in markets like Germany. Higher prices might incentivize new renewable investments by enhancing the impact of voluntary procurement. Yet this could also raise electricity costs—an outcome politically sensitive and unfavorable for energy-intensive industries, as noted in interviews and by Bogensperger et al. (2023, p. 21), who noted the industry's preference for cheaper Norwegian GOs to make low-cost green claims. Consequently, countermeasures like lifting the Doppelvermarktungsverbot may be considered, potentially flooding the market with subsidized electricity certificates, lowering GO prices, easing cost pressures but weakening decarbonization incentives. These uncertainties and voluntary dependencies are illustrated in Figure 5, which conceptually revisits the CSRD's indirect effects on the German GO market.

Figure 5 *Uncertain and Indirect Effects of the CSRD on the German GO Market – A Conceptual Reconsideration*



Note. This conceptual model revisits the anticipated impacts of the CSRD on the German GO market by highlighting areas of uncertainty and indirect effects. Question marks and explanations indicate assumptions or effects that are tentative or depend on voluntary behavior. This figure intentionally excludes broader market dynamics, interacting regulations, and external drivers to focus on conceptual reconsiderations based on qualitative findings and interpretive reasoning.

Moreover, the interview findings suggest that the overall impact of these CSRD-related effects is limited in the broader context of the energy transition. This is due to several persisting issues in the GO market and the wider regulatory environment, which are explored below.

On one hand, significant structural problems in the GO market continue to undermine its effectiveness as a driver of renewable energy investment. These include price volatility, limited market liquidity, and regulatory constraints such as the Doppelvermarktungsverbot. Furthermore, the continued dominance of state-subsidized schemes such as the EEG in Germany limits the emergence of fully market-driven investment dynamics. These conditions weaken the potential for GOs, even when integrated into the CSRD framework, to serve as credible market-based instruments that stimulate additional renewable capacity. If Germany aims to reduce reliance on the EEG, alternative pathways such as promoting green PPAs and encouraging on-site renewable energy generation must be further developed and supported. For example, results show that the self-consumption represents a particularly strong economic incentive for companies to invest in their own renewable installations. This indicates that, from

an additionality perspective, GOs appear to be a relatively weak lever compared to direct investment drivers such as onsite generation and PPAs.

On the other hand, it appears that other market forces and regulatory mechanisms are currently playing a stronger role in driving corporate demand for renewables. Corporate investment in renewable energy is increasingly motivated by energy security concerns and high electricity prices, leading some companies to acquire wind parks or enter into long-term power purchase agreements. These decisions are not necessarily influenced by CSRD requirements but rather by strategic and economic considerations. In parallel, voluntary initiatives and other regulatory instruments, such as the EU Taxonomy and the Electricity Price Compensation Mechanism (Strompreiskompensation), seem to exert more direct influence over investment decisions and sustainability performance. Expert perspectives from the interviews suggest that while the CSRD may hold increasing importance as a disclosure mechanism, its direct impact on additional renewable capacity remains limited. Additionality is therefore better understood as a separate dimension influenced by practical investment incentives beyond GO demand and reporting requirements.

The EU Taxonomy was mentioned by experts as a more tangible regulatory lever for aligning financial flows with the energy transition. Moreover, regulatory frameworks governing RFNBOs are exerting growing influence on corporate behavior. In contrast, the CSRD was described as a formal disclosure mechanism that does not, on its own, generate direct pressure for companies to increase their renewable energy procurement. However, its relevance may increase in the future, particularly if the GHG Protocol is updated to require stricter Scope 2 accounting standards. Since the CSRD refers to the GHG Protocol for emissions accounting, a revised protocol could indirectly create pressure on companies to procure higher-quality GOs (e.g., time- or location-aligned), potentially contributing to additionality. That said, the current version of the CSRD explicitly references the 2015 edition of the GHG Protocol, meaning that any regulatory effect from future updates would require an amendment or reinterpretation of the CSRD's legal references. Even then, these changes would remain an external market pressure rather than a binding regulatory requirement. To achieve stronger alignment with EU renewable energy targets under the RED, the CSRD would likely need to incorporate threshold-based requirements or sector-specific emissions targets. Yet, given current political developments and deregulatory trends in the EU, exemplified by the Omnibus proposal, such advancements appear unlikely in the near term.

In general, this study found that the dual role of GOs, as both a disclosure tool and an investment signal, presents a fundamental challenge for regulatory alignment. Different stakeholders, including corporations, energy producers, and investors, have varying expectations about what GOs should represent. While GOs are legally sufficient for documenting renewable energy use, expectations that they ensure ecological quality or additionality often exceed their intended function. This misalignment has led to fragmented reform proposals and conflicting market practices. According to the experts interviewed in this study, the evolution toward greater environmental credibility is mostly seen as a responsibility of voluntary market initiatives or emission accounting systems rather than regulatory reform or changes to the GO system itself. For synergies between the CSRD and the GO system to materialize, a clearer or updated definition of the function of GOs is likely needed. Policymakers must decide whether GOs are primarily a reporting mechanism, an investment instrument, or if a dual-track approach should be considered – with each function governed by distinct and consistent rules. Attempting to merge these functions under one system risks regulatory confusion and ineffective outcomes.

Even if greater alignment between the CSRD and the GO market were achieved, this would address only one dimension of the broader energy transition. Electricity plays a critical and expanding role – especially due to ongoing electrification of transport and industry – but it remains just one part of the overall energy system.

In conclusion, this study finds that while the CSRD and GOs are linked through overlapping regulatory frameworks, their combined effect does not yet produce strong positive synergies that accelerate the energy transition in a systemic way. Addressing the main research question – *Are there positive synergistic effects of GOs and the CSRD that accelerate the energy transition?* – the evidence suggests that it does not resolve fundamental structural challenges and market failures within the GO system. Without clearer alignment on the intended purpose and function of GOs, and without mechanisms effectively linking corporate sustainability reporting to tangible renewable energy investments, the potential for meaningful synergy remains limited. Finally, while GOs continue to serve an important role in proving the greenness of energy consumption, their capacity to drive additional renewable capacity remains constrained. Consequently, voluntary initiatives, corporate energy strategies such as onsite renewables and power purchase agreements, and complementary regulatory instruments currently exert a stronger influence on accelerating the energy transition.

5.2. Limitations and Future Research

This thesis is an exploratory study examining the potential effects of the CSRD on the GO market and its implications for the energy transition. While it offers early insights into regulatory interactions, several limitations should be acknowledged, which also inform directions for future research.

A key limitation lies in the timing of this study: the CSRD is still in the early stages of implementation, and many of its real-world impacts are not yet visible. As a result, the analysis relies heavily on expert assessments and anticipated trends, rather than measurable changes in corporate behavior or market outcomes. In addition, the potential impact of the Omnibus proposal introduces a critical source of uncertainty. If adopted, the proposal could drastically reduce the number of companies subject to CSRD reporting requirements. This would significantly weaken the CSRD's reach and could render any effects discussed in this thesis. As such, ongoing regulatory developments must be closely monitored. Future research could adopt longitudinal designs to trace the actual GO market effects of the CSRD once implementation progresses.

This study is based on seven expert interviews, which, while rich in insight, limit the generalizability of findings. The qualitative nature of the research necessarily involves subjective interpretation, and the absence of certain perspectives, such as GO traders, represents a notable gap. Moreover, although open-ended questions were used, the CSRD-focused interview structure may have steered discussions away from other important market or policy drivers.

From a methodological standpoint, the use of predefined thematic categories enabled structured analysis, but it may have limited the emergence of unexpected themes. While inductive subcoding was applied to counteract this, a more grounded, fully inductive approach might have yielded additional insights. Future studies should aim to include a broader and more diverse range of stakeholders, including traders, corporate energy buyers, and policymakers, to better capture market dynamics.

Moreover, the thesis spans multiple domains – including corporate sustainability reporting, EU energy law, and renewable electricity market design in multiple countries – which introduces analytical complexity. Given the researcher's limited legal background, certain regulatory intricacies, e.g., interactions between national support schemes and GO markets, could not be addressed in full detail. While this interdisciplinary approach provided a valuable overarching

perspective, future research might benefit from a more focused scope to allow for more in-depth analysis. This could be sector-specific (e.g., corporate procurement in heavy industry) or disciplinary (e.g., legal analysis of GO-trading rules). Additionally, it may be useful to further differentiate between the credibility of green electricity tariffs versus the integrity of corporate sustainability disclosures.

Further research could also explore regional differences in the GO market. For instance, a comparative study of how the CSRD is impacting GO use in countries with different regulatory environments (e.g., Germany versus Nordic countries) could provide valuable context. Building on expert interview insights, future work could also investigate market design features from countries such as England and Switzerland, which were mentioned as examples addressing some structural challenges in the GO system. Examining these international approaches may provide useful guidance for reconsidering and improving GO market design and regulatory integration in Germany and the EU.

Another promising area for investigation involves analyzing how evolving terminology, such as *double counting*, *double claiming*, and *additionality*, is understood and used by market actors. Establishing a standardized vocabulary across regulatory frameworks and stakeholder groups could reduce confusion and improve coherence and market and regulatory development.

Beyond GOs, future studies should explore the broader regulatory landscape. Interview insights suggest that the EU Taxonomy and other regulation may serve as even more influential drivers of renewable energy investment than the CSRD, as they have the potential to exert substantial pressure on financial institutions and corporations to align capital flows with the EU's energy transition objectives. These mechanisms, which directly target financial institutions and investor disclosures, may influence corporate behavior independently of GO-related strategies. Such research could contribute to a more comprehensive understanding of the EU's overall regulatory impact on the energy transition.

6. Conclusion

This study investigates the evolving role and effectiveness of GOs within the European renewable energy market through two complementary lenses: a comparative legal analysis of the RED III and the CSRD, and qualitative insights drawn from exploratory expert interviews. Together, these perspectives shed light on the regulatory foundations and real-world dynamics that shape GO markets and corporate reporting practices.

First, while regulatory overlaps between the CSRD and the RED III – which governs the GO system – do exist, they remain largely administrative in nature. The CSRD recognizes GOs as a verification tool for energy sourcing and market-based Scope 2 emissions reporting. However, there is no strategic coordination or regulatory intent to use these overlaps to promote additional renewable energy capacity or to enhance the environmental integrity of corporate climate claims. As such, the mere coexistence of the two instruments does not automatically generate positive outcomes for the energy transition.

Second, the CSRD could indirectly improve the effectiveness of GOs by increasing transparency and market demand. If corporate buyers respond to enhanced disclosure obligations by seeking more GOs, this could lead to higher prices, potentially improving investment signals for new renewable energy projects. Yet, this effect remains speculative and dependent on voluntary behavior. The CSRD does not itself require companies to procure renewable electricity, nor does it enforce quality criteria for GOs that would ensure additionality.

Third, while the CSRD introduces dual-reporting requirements that could help uncover double claiming and misleading renewable energy usage, its capacity to address more structural forms of greenwashing is limited. The GO system allows for spatially and temporally misaligned claims, which the CSRD does not rectify. The absence of time or geographic granularity in both instruments means that companies can continue to purchase cheap GOs to claim climate benefits without necessarily contributing to decarbonization.

Taken together, the findings suggest that the combined effect of the CSRD and GOs may result in incremental improvements, particularly in transparency and corporate accountability. However, these improvements fall short of delivering a transformative shift toward additional renewable energy capacities or to combat greenwashing risks. The CSRD, as it currently stands, is primarily a disclosure framework.

Ultimately, the study concludes that while there are some weakly positive interactions between GOs and the CSRD, these are insufficient to meaningfully accelerate the energy transition on their own. More targeted regulatory alignment, a rethinking of the GO market design, and stricter sustainability criteria may be necessary to transform these instruments into effective levers for decarbonization. Although both instruments were introduced under the broader framework of the European Green Deal, reflecting shared goals of transparency, decarbonization, and market-driven climate action, their current implementation remains disconnected. This case illustrates that a common policy origin does not ensure strategic synergy.

List of Referenced Legislation

CSRD	Directive (EU) 2022/2464 of the European Parliament and of the Council of 14 December 2022 amending Regulation (EU) No 537/2014, Directive 2004/109/EC, Directive 2006/43/EC, and Directive 2013/34/EU, as regards corporate sustainability reporting. Official Journal of the European Union, 16.12.2022, L 322, 15-80.
EEA Agreement	Agreement on the European Economic Area. Official Journal of the European Communities, 3.1.1994, L 1, 3-522.
EEG 2000	Gesetz für den Vorrang Erneuerbarer Energien (Erneuerbare-Energien-Gesetz – EEG) sowie zur Änderung des Energiewirtschaftsgesetzes und des Mineralölsteuergesetzes (BGBl. 2000 I Nr. 13).
EEG 2023	Erneuerbare-Energien-Gesetz vom 21. Juli 2014 (BGBl. I S. 1066), zuletzt geändert durch Artikel 1 des Gesetzes vom 21. Februar 2025 (BGBl. 2025 I Nr. 52).
EnWG	Energiewirtschaftsgesetz vom 7. Juli 2005 (BGBl. I S. 1970, 3621), zuletzt geändert durch Artikel 1 des Gesetzes vom 21. Februar 2025 (BGBl. 2025 I Nr. 51).
ESRS	Commission Delegated Regulation (EU) 2023/2772 of 31 July 2023 supplementing Directive 2013/34/EU of the European Parliament and of the Council as regards sustainability reporting standards. Official Journal of the European Union, 22.12.2023, L, 1-284.
EU Taxonomy	Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088. Official Journal of the European Union, 22.06.2020, L 198, 13-43.
HkRNDV	Herkunfts- und Regionalnachweis-Durchführungsverordnung vom 8. November 2018 (BGBl. I S. 1853), zuletzt geändert durch Artikel 8 des Gesetzes vom 8. Mai 2024 (BGBl. 2024 I Nr. 151).
Kyoto Protocol	Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 10, 1997, 2303 U.N.T.S. 162.

RED I	Directive 2001/77/EC of the European Parliament and of the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources in the internal electricity market. Official Journal of the European Union, 27.10.2001, L 283, 33-40.
RED II	Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast). Official Journal of the European Union, 21.12.2018, L 328, 82-209.
RED III	Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652. Official Journal of the European Union, 31.10.2023, L, 1-77.
TEU	Consolidated version of the Treaty on European Union. Official Journal of the European Union, 26.10.2012, C 326, 13-45.
TFEU	Consolidated version of the Treaty on the Functioning of the European Union. Official Journal of the European Union, 26.10.2012, C 326, 47-199.

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Appendices

All appendices (A-F) are available in the following cloud folder:

link

The appendices include the following materials:

Appendix A – Comparative Legal Analysis

This Excel file contains structured tables used to support the comparative legal analysis.

- Sheets 1-2: Support the analysis of direct references.
- Sheet 3: Supports the analysis of thematic overlaps.

Appendix B – Interview Guide

The semi-structured guide used to conduct the expert interviews. It provided a flexible framework and was adapted in response to interviewee's input.

Appendix C – Consent Form (Einverständniserklärung)

The standard form signed by all interview participants before the interview, ensuring ethical compliance.

Appendix D – Interview Coding Guideline

This Excel file outlines the structure of the coding process.

- Sheet 1: Definitions of main themes.
- Sheet 2: Definitions of subcategories.
- Sheet 3: Overview of sub-subcategories.

Appendix E – Coded Segments

This Excel file provides an overview of all segments that were coded in MAXQDA, structured according to the coding framework.

Appendix F – Interview Transcripts

Full transcripts of the seven expert interviews conducted (IE1, IE2, IE3, MP1, MP2, RE1, RE2).

- IE: Industry Expert
- MP: Market and Policy Expert
- RE: Regulatory Expert