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Understanding the Guarantees of Origin and their impacts on the electricity value chain

A comparative case study of Norway and Germany

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ABSTRACT

The Renewable Energy Directive 2001/77/EC (2001) introduced a system of Guarantees of Origin (GOs) to be able to track the renewable electricity consumption in Europe. By purchasing a GO which is an electronic certificate, 1 MWh of electricity can be claimed as being from a renewable source. The purchase of GOs was made mandatory for any renewable claim in the revision of the Renewable Energy Directive (December 2018).

The ultimate goal of this Master's Thesis was to identify the impacts of GOs on the electricity value chain, composed of five activities associated: electricity production, transmission, distribution, trading and consumption. In order to identify the impacts, this Master's Thesis constructed beforehand a knowledge base necessary to understand the GO system. Broadly speaking, the European Directives relevant to the GO system were analyzed, relevant published academic research was reviewed, the practical use of the GOs in electricity tracking was investigated and the GO market was described. In addition, the differences that prevail in the implementation and the use of this system among the Member States were identified and outlined by providing a comparison between Norway and Germany.

The literature review, other reliable online sources and a number of semi-structured interviews with practitioners and renewable energy experts led to several findings. First, dealing with GOs has become an extra task for the agents along the electricity value chain: the eligible electricity producers receive and resell the GOs, the Transmission System Operator is in some cases assigned as the Competent Body for GOs and electricity retailers have to purchase GOs to back the electricity they sell to the customers asking for renewable electricity. Secondly, unlike the wholesale electric power that has a single price, many types of GOs exist and are priced differently depending on various characteristics (renewable energy source, location, age of the power plant, etc.). Additional revenues provided by GOs to power producers and traders are therefore largely varying and difficult to assess for the following reasons: (i) it depends on the GOs' characteristics, (ii) GO prices are very volatile and (iii) GO prices are not transparent to market outsiders. The price paid by end-consumers for GOs is also difficult to estimate because prices are not transparent to them and the GOs are often included in products offering additional specificities, such as eco-labels for example. Thirdly, it was found that in today's market the impact of GOs on renewable investments is very limited due to their low price and to the fact that renewable investments are triggered by governmental subsidies which are substantially higher than the GO prices. Finally, regarding Norway and Germany, the major differences identified are the issuing rules which impact a lot the volume of GOs traded in these countries and in the market in general. The demand for GOs is also substantially different in the two countries.

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List of abbreviations

AIB Association of Issuing Bodies

CDP Carbon Disclosure Project

CHP Combined Heat and Power

DSO Distribution System Operator

EAM European Attribute Mix

EECS European Energy Certificate System

EEG Act Erneuerbare-Energien-Gesetz: German Renewable Energy Source Act

EU European Union

FIT Feed-in tariff

GHG Greenhouse Gas

GO Guarantee of origin

HKNR Herkunftsnachweisregister = German GO Registry

MS Member States

NECS Norwegian Energy Certificate System

PPA Power Purchase Agreement

REDISS II Reliable Disclosure System Phase II

RES Renewable Energy Source

RM Residual Mix

TGC Tradable Green Certificate

TSO Transmission System Operator

UBA Umweltbundesamt = German Issuing Body

1. Introduction

1.1. Context of emergence and introduction to the GO system

Guarantees of Origin (GO) were introduced in 2001 driven by two major trends: the liberalisation of the electricity market and the adoption of renewable energy sources (RES).

The European Commission began liberalising the electricity market with its 1996/92/EC Directive which has been replaced by the Directive 2003/54/EC and later by the Directive 2009/72/EC (Pollitt, 2009). With the aim to create a common internal market, the Directive sets out common guidelines for the generation, transmission, distribution and retail of electricity (Council Directive 2003/54/EC, Art 1). The Directive called for an independent regulatory agency for electricity in each Union's country to be set up and emphasised the need for competition in generation and electricity retail by requiring the decoupling of transmission and distribution from the generation and electricity retailing (Pollitt, 2009). Thereby removing entrance barriers for new generators and retailers by requiring Member States and national regulatory authorities to facilitate cross-border access for both (Council Directive 2009/72/EC, (8)). Regarding the transmission and distribution activities, the European Commission looked to foster the establishment of a natural monopoly performed by an independent regulator (Pollitt, 2009). Finally, its goal was the creation of an harmonised European electricity market (Pollitt, 2009).

There was already considerable interest in the production of renewables prior to the electricity market liberalisation. A few pioneering countries such a Denmark, Germany and Spain had developed support schemes[1] before any European Policies on Renewables were enforced (Bocquillon & Solorio, 2017). But the real shift resulted from the release of the Commission's Green Paper on renewable energy sources (RES) on the 20th of November 1996 (Bocquillon & Solorio, 2017). Recognising the benefits of RES and the obstacles hindering their exploitation, the Green Paper set out recommendations and fixed an ambitious objective consisting of doubling the contribution of RES to the gross inland energy consumption in order to reach 12% by 2010 (COM, 1996). The reactions from Member States' agencies, industries, regional associations, non-governmental organisations, institutes and professional associations, as well as, extensive public debates gave birth to the White Paper one year later, in 1997. Following

[1] A support scheme is a national governmental support used to foster investments in renewable energy in order to meet the desired level of renewables in the EU (European Commission, n.d.c.). It can take several forms such as a feed-in tariffs, tradable green certificates or a tendering procedure.

the Green Paper, the White Paper confirmed the target of 12% and enclosed strategies and action plans to reach it (COM, 1997).

In the same year, the Kyoto Protocol was adopted, setting internationally binding emission reduction targets for its members for the period 2008-2012. The protocol finally entered into force in February 2005, after at least 55 parties accounting for at least 55% of the total carbon dioxide emissions of 1990 had signed it, as agreed upon its establishment (UNFCC, n.d.).

Within this framework, the European Commission published its first directive on the promotion of electricity produced from RES in the internal electricity market, namely the Directive 2001/77/EC. It is in the same directive that the GO system was introduced.

A GO is a tradable electronic certificate certifying the consumption of 1 MWh of renewable electricity. It should not be confused with the Tradable Green Certificates (TGC) that are used as a support scheme in some European countries. Unlike the GO system, which is voluntary, consumers are compelled to buy a certain amount of Tradable Green Certificates to fulfill a quota set by the government.

The Directive 2001/77/EC that spearheaded the GO system and fixed a target of 12% RES share of the European Union's gross consumption for 2010, was replaced in 2009. The Directive 2009/28/EC set a new ambitious target of 20% for 2020. Lastly, last December, the Directive 2009/28/EC was further amended into the Directive 2018/2001 with an even more visionary target of a share of at least 32% of renewable energy by 2030. Member States have two years to implement the new Directive, during which the Directive 2009/28/EC applies.

1.2. Research question

Major changes took place with the creation of the GO system. Two new directives (Directive 2009/28/EC and Directive 2018/2001) on the promotion of the use of RES were approved after the Directive 2001/77/EC, with increasingly more ambitious renewable energy targets, as well as bringing in some modifications to the GO system.

GO trading has continuously grown since its creation, partly driven by an increasing number of European countries taking part in this market. Although, some flaws remain in the GO market, the prospects are positive, and the demand and supply are expected to rise and might eventually reach an equilibrium, after an historical oversupply.

Yet, the GO system and its market seem to be solely directed to businesses, and the fact is that very few citizens (end-consumers) understand the system, although as electricity consumers, it

concerns everyone. The purpose of this Master's Thesis is to construct the knowledge base necessary to understand the GO system as of today. A clear understanding of the GO system and its market is essential to understand the last revisions of the system introduced in the new Directive and their likely effects. More specifically, this Master's Thesis aims at identifying the impacts of the GOs on the electricity value chain. The physical electricity value chain is composed of four parts: the generation, the transmission, the distribution and the consumption. After its production by a generator, the electricity is transported over long distances at high voltage under the responsibility of the Transmission System Operator (TSO). The distribution system operator (DSO) is then in charge of distributing the electricity, at a lower voltage, to the end-consumers who consume it for heating, lightening, electronic equipment, etc. Besides the physical electricity value chain, trading electricity is also a very important activity without which none of the previously cited activities are economically viable. For that reason, this Master's Thesis considers electricity trading as part of the value chain and will identify how it is affected by the GOs. The two key features of electricity are that its generation and consumption happen almost instantly as the flow of electricity is continuous, and secondly that it is also almost impossible to trace the source of electricity as it is impossible to distinguish electricity generated from dirty or clean energy sources or to know exactly where the electricity comes from. This is simply due to the fact that all electricity is fed into the grid, regardless of the energy source it comes from. The only certainty is that the electrons forming the electricity choose the shortest route from the point of generation to the point of consumption. Taking this as the research focus, the research question was formulated as *"What is the impact of the GO system on the electricity value chain"?*

Furthermore, despite the fact that it is a Europe-wide system, Member States have some freedom in the implementation of the GO system which in turn leads to variations that affect the electricity value chain. This Master's Thesis aims to provide insights and clarifications on how this works by using the cases of Norway and Germany to illustrate similarities and differences.

1.3. Limitations and scope of the study

First of all, this Master's Thesis focuses solely on the European Energy Certificate System (EECS) GOs. Other types of certificates carrying the same function can be traded outside the European borders but they are not addressed in this Master's Thesis.

Secondly, Member States have two years from December 2018 to implement the new Directive 2018/2001 in their national legislation. The evolution of the GO market is thus bound by the choices Member States make; and the GO market depicted in this Master's Thesis is the snapshot of the situation today which might not be representative in the years to come. Furthermore, this snapshot is limited by the lack of data available. Unfortunately, the GO market is not transparent, especially information about pricing. Additionally, prices are very volatile and change from day to day. Hence, the pricing information presented in this Master's Thesis is limited.

The Master's Thesis identifies the impacts of GOs on the electricity generation, transmission, distribution, consumption and trading. The aim was to identify the transformation of the roles of the various players in the electricity value chain, the impacts on costs and revenues generated and if the introduction of GOs influenced the choice of power generation and/or consumption. As previously mentioned, it was difficult to gain accurate information on costs and revenues in order to assess their impacts, as the GO market and its pricing are not transparent and additionally the prices depend on varying criteria. Thus this Master's Thesis is intended to be thorough exploration of the matter with the view to identify areas for a future research.

Finally, the choice of Norway and Germany as two examples was motivated by the fact that Norway is the largest net exporter of GOs and Germany is the largest net importer of GOs. Other interesting aspects are that these two countries have different rules regarding the energy sources eligible for GOs, different national support schemes and different demand for GOs.

2. Methodology

2.1. Justification for the methodological choices

This research is exploratory and has been conducted using a qualitative methodology, considered by Jacquemin (2017/2018) to be the most promising method for exploratory research. A lot of information was gathered from company reports, academic papers and other various online sources but specific information about the market was collected via semi-structured interviews with market players in order to gain practical insights in the functioning of the GO market. Adam (2015) describes the semi-structured interview method as asking open- and closed questions to one person at a time, often followed by a series of questions to explore how and why things happened in this way. Moreover, the discussion is not strictly bound to the agenda and can lead to unexpected findings.

2.2. Construction of the sample

A sample of Norwegian and German companies playing different roles in the GO market and in the GO system was collected. Norwegian companies were relatively easy to find whereas German companies were more reluctant to take part in an interview. Eventually, we managed to conduct interviews with four Norwegian market players (Becour, BKK, ECOHZ, Kinect Energy Group) and two German market players (Innogy and a trader who wished to remain anonymous). The market players sample is composed of four traders (Becour, ECOHZ, Kinect Energy Group and the anonymous trader), two producers (BKK and Innogy) and one Distribution System Operator (BKK). In addition, we conducted two interviews with the Issuing Bodies of Norway and Germany (Statnett for Norway and UBA for Germany).

2.3. Interview methodology

As required by the semi-structured interview methodology, the companies were approached with questionnaires prepared for each type of role. The questionnaires were slightly adjusted for each respondent based on our research and their time availability. During the interviews, other questions evolved as the conversations unfolded, but these were mainly focused on the GO market or system in general and the precise role of the interviewee. Regretfully, we couldn't follow this methodology for all the companies as the two German companies preferred to answer the prepared questionnaire directly.

2.4. Structure

The first chapter and the second chapter covered the introduction to the GO system and to the Master's Thesis, as well as the methodology applied in the thesis. The third chapter focuses on the GO system as designed in the currently implemented directive. This chapter sheds light on the purpose of the GO system and its design, which is necessary to understand the literature review that is presented in the fourth chapter. The literature review gathers together the published research conducted until now on GOs and helps to pinpoint some aspects of the GO system that could impact the electricity value chain. Chapter five tackles the effective use of GOs in the electricity disclosure (i.e. the disclosure of the shares of energy sources making up the electricity consumption of end-consumers) and outlines the way GOs affect the consumption statistics. The following three chapters more fully explore the GO market and analyse the different players, pricing and volumes. A brief outlook based on the new directive is then offered, as well as the expectations regarding the future GO price, likely tradable volumes and the expected trading environment. Finally, the second last chapter gathers the relevant information to identify the impacts on the electricity value chain and is followed by a conclusion.

3. GOs in the European Directives

3.1. Definition

Although the term « guarantee of origin » was introduced for the first time in the Directive 2001/77/EC, it only defined in its subsequent Directive eight years later:

> 'guarantee of origin' means an electronic document which has the sole function of providing proof to a final customer that a given share or quantity of energy was produced from renewable sources as required by Article 3(6) of Directive 2003/54/EC; (Council Directive 2009/28/EC, 2009, Article 2(j), p. 27).

The GO's definition must be read together with the Article 3(6) of the Directive 2003/54/EC which concerns the common rules for the internal market in electricity. The Article 3(6) of the Directive 2003/54/EC, called « Public service obligations and consumer protection », describes the role of the electricity retailers and says:

> 6. Member States shall ensure that electricity suppliers specify in or with the bills and in promotional materials made available to final customers:
>
> (a) The contribution of each energy source to the overall fuel mix of the supplier over the preceding year;
> (b) At least the reference to existing reference sources, such as web-pages, where information on the environmental impact, in terms of at least emissions of CO_2 and the radioactive waste resulting from the electricity produced by the overall fuel mix of the supplier over the preceding year is publicly available. (Council Directive 2003/54/EC, 2003, Article 3(6), p. 42).

In other words, the GOs have been created to enable electricity retailers to document the renewable electricity they sell and therefore to help them to fulfill their obligation of disclosure of all energy sources to the customers as required by this article.

3.2. Purpose and utilisation

The Directive 2009/28/EC stipulates that GOs have been created for the « sole » purpose of guaranteeing to end-consumers that the green electricity they purchase is effectively from RES (Council Directive 2009/28/EC, 2009, Article 2(j), p. 27). Since the 27th of October 2003, all

Member States have to safeguard that any electricity produced from RES can be certified with GOs upon a generator's request (Council Directive 2001/77/EC, Article 5(1)).

This unique legislative purpose is further strengthened in Directive 2009/28/EC, which specifies that GOs have no role to play with compliance to national target for renewable consumption fixed in the same directive (Council Directive 2009/28/EC, Art 15(2)).

Beside the purpose defined in the Directive, other informal uses have appeared over the years and through trading GOs. It also appears that retailers and companies often use GOs as a marketing tool. As they are convenient for carbon footprint calculations, companies use them to reduce the environmental impact of their production and activities in their sustainability reports (Bröckl, Pesola, Vehviläinen & Tommila, 2011). In response to growing environmental concerns, retailers also build on GOs to offer differentiated products to consumers. By offering eco-labels based on GOs or different GOs depending on the energy source or characteristics of the production plant, consumers can choose the products that match their personal values, and for example contribute to additionality or specific environmental projects (Bröckl et al., 2011). An eco-label for renewable electricity is more than just documenting the renewable source of the electricity as they include other environmentally friendly criteria to be met. For instance, additionality is a criterion often used in eco-labels, and is cited as a major reason why consumers purchase GOs. A GO can be considered to be additional if the revenue it generates enables the expansion of the current renewable capacity, and if this expansion would not have taken place without the ~~i~~nvestment of these revenues (Haddon & Powers, 2017).

3.2.1. Eligibility criteria

According to the Directive 2009/28/EC, a GO is an electronic document corresponding to one MWh of renewable energy, issued conditionally upon the request of an eligible producer (Council Directive 2009/28/EC, Art15(2)). The eligible RES are: «wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases» (Council Directive 2009/28/EC, Article 2(a), p. 27). The Directive 2009/28/EC extended the GOs system compared to the Directive 2001/77/EC by introducing GOs for heating and cooling activities based on the RES. However, in this case, the issuance of GO may be conditional to a minimum capacity. Moreover, since 2012, GOs can also be issued for electricity produced from high-efficiency cogeneration, also called high-efficiency combined heat and power production (Council Directive 2012/27/EU, Annex X).

In any case, the GO system is voluntary. It is thus left to the eligible power producers to decide if they want to request GOs for their renewable production or not (Council Directive 2009/28/EC, Art 15(2)).

It is important to note that Member States (MS) have a certain freedom in the implementation of the GO system. The Directive can be seen as providing guidelines and is interpreted differently by the MS. As an example, the eligibility criteria vary considerably across MS. Some countries have decided to use GOs to document all energy sources and therefore issue GOs for non-renewable sources as well (e.g. Switzerland and Austria), others have decided to issue GOs only for renewable sources; and some have decided to add that GOs can only be issued by generators of renewable energy that do not benefit from a support scheme (e.g. inter alia France and Germany).

3.2.2. Competent bodies

The issuance, transfer and cancellation of GOs are incumbent to one or more Competent Bodies that can be freely appointed by each MS, as long as they are separated from the production, trade and retail of electricity and have separate geographical obligations (Council Directive 2009/28/EC, (Art 15(2)). The Renewable Energy Directive also requires each MS or their Competent Bodies to ensure the accuracy, reliability and validity of the GO system (Council Directive 2009/28/EC, Art 15(5)). In most cases, the Competent bodies are the TSO, electricity regulators or energy market operators (ECOHZ, n.d.a).

3.2.3. Informative content of a GO

The minimum information that a GO must provide is defined in Article 15(6) of the Directive 2009/28/EC:

> 6. A guarantee of origin shall specify at least:
>
> (a) The energy source from which the energy was produced and the start and end dates of production
> (b) Whether it relates to:
> (i) electricity; or
> (ii) heating or cooling;
> (c) The identity, location, type and capacity of the installation where the energy was produced

(d) Whether and to what extend the installation has benefited from investment support, whether and to what extend the unit of energy has benefited in any other way from a national support scheme, and the type of support scheme;
(e) The date on which the installation became operational; and
(f) The date and country of issue and a unique identification number (Council Directive 2009/28/EC, Article 15(6), pp. 34-35).

In the case of GOs for high efficiency cogeneration, the minimum information that must be disclosed is defined in the Council Directive 2012/27/EC and can be found in the Appendix I of this Master's Thesis.

3.2.4. Lifecycle of a GO

The maximum lifetime of a GO is 12 months from the date when the physical energy unit is produced. When the GO is bought to document the electricity consumption of an end-consumer, it must be cancelled in the national registry. In the event that the GO is not used within the 12 month period, the certificate expires (AIB, 2018a).

3.2.5. Cross-border trade

In a nutshell, when an end-consumer (a private household or a company) decides to buy green electricity backed with GOs, they pay extra for the green certification to the producers who were granted the GOs. However, in reality, it is impossible to guarantee the buyer of renewable electricity that what they receive is only from green sources since electricity from all sources (including non-renewable) are fed into the grid, and there is no way exists to track electrons. To put it another way, GOs ensure that the renewable electricity is effectively produced, but not that it is physically consumed by the buyer (van der Linden et al., 2004).

Considering that GO trading is completely decoupled from the physical power trading, no barriers should hamper their cross-border trade. For that reason, the Directive 2009/28/EC requires MS to accept the GOs issued by another MS. Should a MS have a « well-founded doubt about its accuracy, reliability and veracity » (Directive 2009/28/EC, Article 15(9), p.35), then the Directive authorises the refusal of a foreign GO upon a notification to the Commission, justifying the refusal. In case the Commission does not agree with the claims, they may require the MS concerned to accept the foreign GO (Directive 2009/28/EC, Art15(10)).

A lack of clarity on the valid justifications for a refusal was presumed by experts to cast doubts among market participants and national Competent Bodies on how to handle the cross-border

transfers of GOs. Thus, this was considered as being a restraint to the cross-border trade (Veum, Londo & Jansen, 2015). In that context, in order to harmonise the use of GOs and to facilitate cross-border trade, the Association of Issuing Bodies (AIB), launched the European Energy Certificate System (EECS) in 2007 (Veum, Londo & Jansen, 2015). Today it is composed of 23 active European Issuing Bodies (2019). The EECS system is the European Standard for GOs (AIB, n.d.a). It aims at facilitating the cross-border trade of GOs by providing an established electronic hub and by supporting the issuance, transfer and cancellation of the GOs (Veum, Londo & Jansen, 2015). The EECS standards are governed by the principle and rules of operations, which are implemented by each country by means of their "Domain Protocol" (AIB, n.d.b) In fact, each country willing to take part in the EECS system and its electronic hub must first set up a Domain Protocol defining how the EECS rules will be implemented in the country and the latter has to be approved by the AIB before the issuance, transfer and cancellation of GOs (AIB, 2018a).

A comprehensive schema of the GO system can be found below in figure 1. Note that this schema is based on the example of Norway where the Issuing Body is Statnett.

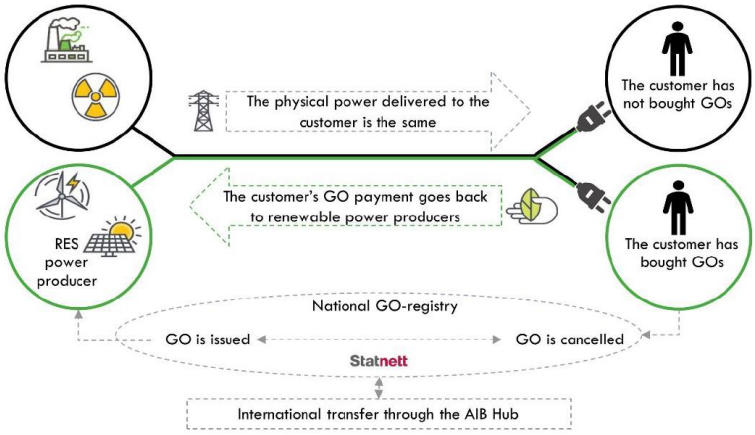


Figure 1. The GO system (Oslo Economics, 2018, p. 10).

3.3. Implementation of the GO system in Norway

In Norway, the GO system is established exclusively according to the EECS. The regulatory authority for the GO system is the Norwegian Water Resources and Energy Directorate (NVE) (Bröckl et al., 2011).

Any producer willing to register for EECS GOs must first apply to the NVE which carries out the role of production registrar and auditor. If necessary, the production device is inspected to

ensure that the requirements of the Norwegian regulations on EECS GOs are met (Statnett SF, 2018). The application automatically generates a GO license valid for five years. Once the producer has acquired the license, it is forwarded to Statnett that takes care of its registration in the Norwegian Central Energy Certificate System (NECS) (I. M. Clausen from Statnett, personal communication, February 20, 2019, Appendix B). As a matter of fact, on top of being the TSO in Norway, Statnett undertakes three other functions related to the GOs. It is the Competent Body for EECS GOs, i.e. they administer the EECS GOs, it is also the Issuing Body for EECS GOs (meaning that it manages the EECS registration database (NECS) and its interface with the EECS transfer system, the AIB HUB) and finally, it is the Measurement Body in charge of the collection and control of measured volumes of energy used in financial settlements (Statnett SF, 2018).

After the generator and its installations have been registered by Statnett, the generator can decide to use a proxy to handle the GOs on his behalf. Most of the time, a proxy is a trader but it could also be another generator. If he decides to use a proxy, he must sign an agreement with the latter beforehand and notify Statnett which will then issue the GOs directly to the proxy instead of the generator (I. M. Clausen from Statnett, personal communication, February 20, 2019, Appendix B). In fact, three types of account holders prevail in the NECS registry: generators, production aggregators (managing the installations in the registry and the issued GOs for owners who have given them power of attorney) and traders (Statnett SF, 2018).

GOs are automatically issued by Statnett every Monday for the weekly production dating back to three weeks. For instance, the GOs corresponding to the production week one are issued in the week four (I. M. Clausen from Statnett, personal communication, February 20, 2019, Appendix B). This is due to the fact that Statnett only receives the meter values for all production devices from the Elhub 15 days after the real production. This time is used to make any corrections or to settle any disputes (I. M. Clausen from Statnett, personal communication, February 20, 2019). I. M. Clausen describes the Elhub as « the Norwegian data hub for all aggregated data or meter data in the Norwegian power market ». The latter came into operation in February 2019 (I. M. Clausen from Statnett, personal communication, February 20, 2019, Appendix B, p. 92.)

Norway has historically been the largest issuer of GOs. In 2018, GOs were issued for hydro, wind and biomass but GOs can be issued for other types of renewables and non-renewable sources as well (I. M. Clausen from Statnett, personal communication, February 20, 2019, Appendix B). However, the Combined Heat and Power GO system has not been implemented

yet in Norway (AIB, 2018b). It should also be noted that no distinction is made between installations benefitting from a support scheme and those who do not.

Every GO issued can be transferred to another account holder. To do this, the seller has to initiate the transfer in the NECS, which will then happen automatically to the new account holder. All international transfers must go through the AIB hub. The cancellation of GOs is also performed by the relevant account holder, and Statnett makes sure that each GO is cancelled only once (I. M. Clausen from Statnett, personal communication, February 20, 2019, Appendix B). If GOs are not used within 12 months from the date at which the corresponding physical energy unit was produced, they expire automatically in the NECS (Statnett SF, 2018).

In return for its services and the use of the NECS, Statnett charges an annual fee of €2,569.75 as well as €0.0036 for each MWh of GOs exported, imported or transferred internally. This very low transaction fee applies to the first movement of GOs from an account to another. Should a GO be transferred several times, only the first transfer will be charged. The exchange rate used for the transactions is 0.10279 NOK/EUR (AIB, 2018f).

Finally, Statnett is also in charge of the creation and modifications of the domain protocol for Norway and it is a member of the AIB (Bröckl et al., 2011).

3.4. Implementation of the GO system in Germany

Similar to Norway, the German GO system has been established in line with the EECS rules (RE-DISS II, 2015).

The Competent Body for EECS GOs is the Federal Environmental Agency (UBA). UBA is also the Issuing Body and therefore administers the EECS registration database and its interface with the EECS transfer system. The registry of GOs operated by UBA is called Herkunftsnachweisregister (HKNR) (Umweltbundesamt, n.d.a) and has been used since January 2013 (Umweltbundesamt, 2018). However, unlike Statnett, UBA is not the authorised Measurement Body responsible for the collection and verification of the measured volume of energy. This responsibility rests with the grid operators of the plants.

An owner of renewable power facilities willing to receive GOs must register in the HKNR registry. It is only when the data has been verified by UBA that the account is activated and that the producer can register its installation(s) (Umweltbundesamt, 2018). After that, he can make a request which he can decide to do every month or for a long-term period. If the production information has been approved by the grid operator and sometimes also by an environmental

verifier, GOs are automatically issued by UBA every month provided that no governmental support is granted and that the request is uniquely for RES (Umweltbundesamt, 2018).

Besides producers, four other types of actors can be registered in the HKNR, namely traders, electricity retailers, service providers and environmental verifiers. Nevertheless, only the producers, traders and electricity retailers have a proper account (Herforth, 2015). Each account holder may appoint one or several service providers to exercise diverse functions on their behalf, such as account maintenance, trading, issuing and the cancellation of GOs. (C. Herforth from UBA, personal communication, February 28, 2019, Appendix C).

Unlike in Norway, only the traders are allowed to import and export GOs through the AIB Hub. For internal transfers however, installation operators do not need to go through a trader (Herforth, 2015). The traders are forbidden to cancel any GOs, this right lies with the electricity retailers (Umweltbundesamt, 2018). This aspect is a major difference between Germany and Norway. We recall that in Norway, the traders can also cancel the GOs for their clients.

As stated in the Directive, 12 months after the production of the corresponding electricity, the GOs expire. The expired volume is then communicated to the Federal Association of the German Water and Energy Industries that will include it into the German Residual Mix calculation which we will describe in the next chapter (Umweltbundesamt, 2018).

When it comes to the fees charged by UBA, the system is a bit more complicated than in Norway. Different annual account charges prevail for the maintenance of an account: the annual fee charged to users of an account with a turnover lower than 2,500 GOs per year is €50, for a turnover between 2,501 and 15,000 GOs the annual fee is €250, between 15,001 and 500,0000 it is €500 and for those with a turnover above 500,000 GOs, the annual fee amounts to €750. In addition to annual fees, other fees are charged in connection with the issuance, recognition, transfer and cancellation of GOs are: €0.01 for the issuance of a GO, €0.01 for the internal transfer of a GO, €0.01 for the transfer of a GO to, or from a foreign account as well as €0.02 for the cancellation of a GO. Finally, the registration of an installation costs €50 and the appointment of an installation to a new operator or to a new account of the same account holder costs €10 (AIB, 2018f).

Like Statnett, UBA is also a member of the AIB and is thus in charge of the design of the Domain Protocol (Umweltbundesamt, 2018).

4. Literature review

The topic of GOs has so far received relatively little attention in academic literature. Nevertheless, the few papers addressing this topic have allowed us pinpoint relevant aspects of this system and its market. This literature review aims to retrace the academic research conducted about GOs and to group the main ideas by theme with the purpose to understand the state of the scientific research on GOs as of today and to gain insights into the different angles of the GO system and its market. In fact, six themes emerged from our research: (1) the role and the use of GOs in electricity tracking, (2) the design of the Directive 2009/28/EC and the role of GOs in this Directive, (3) the perspective of Norwegian consumers on the GO system, (4) the impact of GOs on renewable investments, (5) the role of GOs in the company's Greenhouse Gas Protocol accounting method, and (6) the performance of the GO market.

4.1. The role and the use of GOs in electricity tracking

This topic was raised in 2007 in a study conducted at the European level. Lise et al. (2007) called for the introduction of a common tracking system for power generation attributes.[2] It was surprising that the Renewable Directive 2001/77/EC at the origin of the GO system did not specify the detailed design of the GO system, nor the role of GOs in the electricity disclosure. As a result, the EU Member States developed various initiatives regarding GOs and their disclosure which actually hindered the development of a common tracking system (Lise et al., 2007).

Lise et al. (2007) also emphasised that the tracking system should be able to cope with the different types of support schemes prevailing at a national level, and with the development of the market structures, generation technologies and physical networks. Therefore, they upheld the need to replace the implicit tracking system that was in place based on various statistics used by the electricity retailers, by an explicit tracking system. They described two possible options. The first one was a contract-tied tracking where the electricity attributes are tied to the electricity contracts and included the GOs to be transferred alongside the electricity contracts. The second one was a de-linked tracking system which suggested that GOs should be transferred independently to the electricity sales, implying an unbundled accounting system for the transfer of generation attributes. The major disadvantage with the contract-tied tracking

[2] The generation attributes are the disclosed indicators, namely: the energy sources, the related CO2 emissions and radioactive waste (Bröckl et al., 2011).

system comes from the fact that not all the electricity is traded through bilateral contracts. In fact, a growing amount is traded on the spot market and via power exchanges where there is no direct link between the seller and the buyer. The volumes are anonymously traded implying that the original generation mix of the electricity traded also cannot be traced. The de-linked tracking system, on the other hand, seemed to solve this problem as it foresaw that the GOs would be transferred independently of the physical contracts. Consequently, they promoted the de-linked tracking as an accurate and transparent method. They also raised awareness on the importance of defining clear geographical borders, the prevention of undesired double counting and the use of a register for the issuance and cancellation of GOs.

Their paper has outlined the need to define the role of GOs in electricity tracking more clearly and since then, different projects have been launched by the European Commission to provide a common European tracking system and to support MS in the implementation of the Directive 2001 and 2003 on the Internal Energy Market and Renewable Energy. The latest version of a common electricity tracking system has been developed in the REDISS II project and was funded by the Intelligent Energy Europe Programme (European Commission, n.d.a). As recommended by Lise et al., the method is based on a de-linked tracking system.

4.2. The design of the Directive 2009/28/EC and the role of GOs in the Directive

This second theme concerns the extensive discussions that arose during the development of the Directive 2009/28/EC. In fact, the Directive 2009/28/EC and the GO system presented in the chapter three is the result of extensive debates and discussions that took place over two years. The debates were mainly focused on the establishment of flexibility mechanisms allowing MS with a renewable deployment deficit to purchase the renewable deployment surplus of other MS. The target market share of 20% electricity from RES by 2020 was approved by the European Council in 2007. This 20% share was intended to be achieved by imposing individual targets to the MS based on their GDP. Since it did not reflect the RES potential of the Member States, the idea was to allow them to partly fulfil their target in other Member States (Klessmann, 2009).

The Commission's first draft proposed the trade of GOs between private market actors where the GOs would be used to prove the compliance with the national RES target. In order do so, the Commission suggested that MS extend their national support schemes for foreign renewable electricity generation. In that respect, a renewable generator would be able to decide from which

MS's support scheme to benefit, this choice implying the accounting of the GOs from his production for the individual RES target of the MS offering the support scheme (Klessmann, 2009). Arguments in favor of this proposition were the following: (i) higher flexibility for private parties to invest in low-cost RES project abroad, (ii) exploitation of the cheapest RES potentials in Europe, (iii) stimulation of RES market dynamics and (iv) the achievement of Europe's 20% RES target at lowest cost. On the other hand, the following drawbacks were identified: (i) the reduction of the cost-effectiveness of the feed-in tariffs and premium supports (both support schemes are kinds of subsidies whose levels depend on the production technology) due to a resulting common European GO price, (ii) windfall profits for low-cost RES generators and (iii) high transaction costs hindering all but large actors to benefit from the GO trade (Klessmann,2009).

Taking this into account, the Commission's proposal in January 2008 suggested to allow the exchange of GOs between governments (in addition to the exchange between private actors) but with certain conditions for both types of exchanges. The government trading of GOs would be optional whereas the GO trade between private parties would use a common European standard. Nevertheless, a system of "prior authorisation" would allow MS to restrict the GO trade or even completely step aside from it if they wished to do so. The latter option was heavily criticised, as it was viewed as violating the principle of free movement of goods and hence illegal (Klessmann, 2009).

In May 2008, the Parliament recommended some modifications: the GOs would have no role to play in measuring MS's compliance with the RES target set by the EU, which would be based on energy statistics instead. These energy statistics could be possibly bought or sold for target compliance and as requirement for the transfer of renewable statistics, the selling MS would have to over comply with its interim target of the past two years. Tradable Transfer Accounting Certificates (TACs) would replace the GOs for complying with the stated EU target leaving the GOs only as the disclosure of generation as originally intended in the Directive 2001/77/EC. In addition, the Parliament recommended to give MS the opportunity to agree on joint projects where a MS could invest in RES projects in another MS and use the associated renewable statistics for its target compliance. Finally, MS would also be able to choose to adopt jointly targets to comply with the common EU target and could use a common support scheme or open their support scheme for the renewable production of the other MS that they would have an agreement with. Simply put, the Parliament's proposal supported the preservation of MS'

control on their support schemes and emphasised the need for compliance with the interim target as a prerequisite for using flexibility mechanisms (Klessmann, 2009).

One month later, Germany, Poland and the UK made a joint proposal. Essentially, their joint proposal was identical to the Parliament's proposal except it differed on two aspects: they asked (i) to drop the use of TACs as a proof for target compliance and (ii) the withdrawal of the achievement of the interim target as a prerequisite for taking part in the flexibility mechanism, justifying that this would allow MS to enter into agreements directly and eliminate the risk that a MS would not be able to achieve its interim target while waiting to enter into an agreement (Klessmann, 2009).

The final decision, resulting in the Directive 2009/28/EC presented in the previous chapter was taken by the European Parliament and the European Council in December 2008. It was decided to abandon the use of GOs for compliance with the EU target and only use statistical transfers for that purpose. In addition, the Directive 2009/28/EC allows the use of joint projects between MS, joint projects with third countries and joint support schemes without any preconditions (Klessmann, 2009).

Klessmann (2009) assessed the different flexibility mechanisms that came up during the negotiations under various criteria. No optimal mechanism stood out from her study. Regarding the GO proposals, the unrestricted GO trade only between private parties initially proposed, appeared to perform very well on providing flexibility, involving private parties and fostering a harmonised RES support in Europe. However, the opposite was also true regarding the freedom left to the MS to optimise their support schemes and exploiting their national RES potential. This option was also likely to overcompensate low-cost RES generation technologies and to not represent the local costs and benefits of the RES technologies. Klessmann also considered the negative criteria as too important and the rejection of this option as reasonable. The restricted GO trade (between private parties and governments under certain conditions) yielded similar results but less pronounced. Here, she found that the performance is contingent to the restrictions in effect which generates according to her legal uncertainties playing out against this option.

Finally, regarding the options that were approved in the final Directive, namely joint projects, joint support scheme and statistical transfer, Klessmann's results reveal that overall their performance on the creation of flexibility and the exploitation of low-cost RES potentials is lower than with GO trading and largely depends on their implementation by the different MS.

Their strong advantage is however that they preserve the use of national support schemes (Klessmann, 2009).

Nilsson et al. (2009) similarly describe the policy discussions and processes that led to the proposal of the GOs as a flexibility mechanism and its abandonment in the final Directive but it differs as they studied the interest groups' standpoints in greater detail and considered the way competing policy frames lead to the discussions that took place. In a nutshell, they found that the decision not to include GO trading for target compliance had been driven by three factors on a short-term basis: (i) stronger incentives of the opponents regarding the proposal, (ii) stronger alliances on the opponents' side and (iii) more apparent and univocal positions and messages opposing the proposal. In the long-term, two other factors also contributed to the rejection of the GO trading: (i) the considerable experience gained with the feed-in tariffs, there were concerns that over time the GOs would have undermined their efficiency and (ii) the security of supply and innovations that were slowly taking precedence on the internal market agenda.

Finally, a similar assessment method was used by Ragwitz et al. (2008). The latter studied the advantages and drawbacks of GO trading at a company level and at a government level. Their study was made in the context of the draft proposal of the Commission and hence prior the extensive discussions that followed the draft publication and rejection of the GOs proposal. They concluded that GO trading at a government level compared to at a company level was more adaptable to the national support schemes, more efficient with respect to the promotion of RES-E generation, would avoid windfall profits, induce lower transactions costs and be more politically feasible. Hence, they recommended to use government and not use company-based trading of GOs as a flexibility mechanism.

Although, the GOs have ultimately no role to play in the RES target accounting, the papers mentioned in this literature review help to understand the genesis of the GO system and the ideas behind its design. Interestingly, the new Directive on GOs, officially published in December 2018, has not had similar attention and no academic paper on it has been published yet.

4.3. The perspective of Norwegian consumers on the GO system

The third theme addressed in the academic literature is the view of the Norwegian end-consumers towards the use of GOs for disclosure purposes. Aasen et al. (2010) focussed on the

Norwegian businesses' perspective of the EU disclosure system. More precisely they studied views on the effectiveness of the disclosure scheme with regard to enabling informed choices of consumers about electricity retailers, based on the generation attributes of the electricity they offer, and secondly on how stimulating the purchase of green electricity supported a secure and sustainable electricity system. Those two aspects are the two last objectives of the disclosure system defined by the European Commission (2004) (as cited in Aasen et al., 2010).

They conducted semi-structured interviews to analyse three main aspects impacting the effectiveness of the disclosure, namely general or consumer-specific information, placement and layout of the disclosure information and trust in the information. The interviews revealed that most of the small and medium size firms were interested in the disclosure information but the latter was not motivating them to purchase GOs. And no large company were interested, they did not trust the environmental impact and the purchase of GOs was not generally part of their environmental strategy (Aasen et al, 2010). Secondly, the authors claimed that the placement and layout of the disclosure information was a failure in Norway. The electricity disclosure information was available on the electricity bills via a link and the respondents did not use it to look up this information on the Internet and many did not even see the link. Aasen et al. (2010) suggest to use a comprehensive chart with the disclosure information on the front of the bill.

Finally, a general lack of trust was seen as strongly undermining the effectiveness of the disclosure. One of the reasons was that the proportion of electricity corresponding to the Norwegian GOs exported was disclosed as from "unknown origin". Since this information was not specific to any customers, it looked incorrect and casted doubts (Aasen and al., 2010). Aasen et al. (2010) urge that this problem should be rapidly solved. Besides this information presentation, companies expressed their distrust in this disclosure system in general. Since 99% of the electricity generation was renewable at that time, they did not see any utility in promoting a green product in Norway and pointed out that energy savings should be supported instead. What is more, they considered that as long as the revenues from the GO sales were not reinvested in new renewable projects, the GO system only resulted in extra earnings for the producers (Aasen et al., 2010). This study was clear about the negative view Norwegian businesses had regarding the GO system. However, as this study dates back to 2010, their opinion could have changed since then.

What did Norwegian households think about GOs? This question was raised in 2012 by Winther and Ericson who analysed it with an experiment with a Norwegian power company who offered

GOs to 5000 of their customers. It appeared that the disclosure information was hardly read by households. In their opinion all electricity retailers are profit-maximising firms so they assumed that all information in addition to the price on the bill would be promotional. Winther and Ericson claim that the relationship and the trust between an electricity retailer and its customers can be challenging when it comes to using information to change the energy behaviour of the consumers. Just like businesses, private households stated that the disclosure information was difficult to understand and was unreliable (Wither and Ericson, 2012). Moreover, private households also kept thinking about electricity in physical terms and thus could not conceive that the electricity that they consumed was not renewable without the purchase of GOs, due to the large share of renewables in the Production Mix.

In this regard, the authors advised the Norwegian authorities to: (i) provide clearer and easier to understand information about the GO system and its role and (ii) to improve the promotion of renewable programmes by providing comparative websites and promotional campaigns. They further warned that the GO system could become a failure because foreign consumers buying the Norwegian GOs rightfully claim that their consumption is renewable and so do the Norwegians consumers thinking of their electricity consumption in physical term and claiming their electricity consumption as being identical to the Norwegian Production Mix and hence not buying GOs. This obviously does not incentivise the generation of renewable electricity. They concluded that the Directive may have assumed that consumers would use the disclosure system as an anchoring point for action and advised paying more attention to the consumers' motivations. As of today, the Norwegian's end-consumers' perspective seems to have remained the same given the low GO consumption in Norway. However, the disclosure problem related to the exports of GOs has been corrected and is not disclosed as "unknow" anymore.

4.4. The impact of GOs on renewable investments

As touched upon in the third theme, the impact of GOs on renewable investments queried by the Norwegian consumers and business, constitutes the fourth theme of this literature review. Here also with a focus on Norway, the possible interaction between the GOs and the Elcertificates has been studied (Raadal et al., 2011). This research was done in the context of the upcoming participation of Norway in the Elcertificates system together with Sweden in 2012. The Elcertificates system is the joint support scheme used by Sweden and Norway still prevailing today. It consists of Tradable Green Certificates granted to renewable generators under certain conditions per MWh of renewable production, that can then be traded just like the GOs. The differences are that this system is mandatory, and that end-consumers are compelled

to buy a certain amount of Elcertificates to fulfil a quota set by the government (Energy Facts Norway, n.d.). The focus of this paper was to see if the GOs could generate a sufficiently high demand for renewables to increase the renewable capacity, which would in turn result in more production eligible for the Elcertificates and as a result in an excess of Elcertificates on the market. This excess supply of Elcertificates could then potentially push the governments to increase the quota obligations, in order to increase the demand which would in the end trigger new renewable investments again. They concluded that GOs have the potential to increase the renewable capacity in the long term if their price is sufficiently high. However, the GO price was too low at that time and hence would have no impact compared to the stand alone Elcertificates system (Raadal et al., 2011).

A similar study was conducted in the Netherlands, this time focusing on the environmental effectiveness of the electricity labelling system (Mulder and Zomer, 2016). The study showed that in 2014 one third of the electricity supplied by an average Dutch electricity retailer was renewable (34%). As only 10% of the electricity production in the Netherlands was effectively renewable, the remaining 24% would be ensured by importing GOs. In view with the small price difference between the grey and green electricity, Mulder and Zomer (2016) came to the same conclusion as Raadal et al., namely that the GO price was too low to play a role in increasing the RES capacity. They further concluded that GOs seemed to be mainly a marketing instrument for retailers. In order to improve the effectiveness of GOs in increasing the renewable production, they recommend as a reasonable solution to limit the issuance of GOs uniquely to new renewable installations so as to incentivise new investments and reduce the need for subsidies.

4.5. The role of GOs in the company's Greenhouse Gas Protocol accounting method

From an environmental perspective, the fifth theme focusses on the potential role of GOs in reducing greenhouse gas emissions, and more specifically on the use of GOs in the Greenhouse Gas Protocol (GHG Protocol). The GHG Protocol is the most commonly used greenhouse gas accounting standards worldwide (Greenhouse Gas Protocol, n.d.). Brander et al. (2018) recently studied the market-based method approved in the GHG Protocol to measure the emissions related to the corporate electricity purchases, called "Scope 2 emissions" and concluded that this method fails to measure the electricity consumption-related emissions genuinely and hence may not lead to effective climate change mitigation efforts. Generally, two methods prevail to calculate the Scope 2 emissions. The first method is called the "locational" or "grid average"

method and consists in dividing the total emissions related to the electricity generation in a specific area by the total volume of electricity distributed in that area during a specific period (Harmsen and Graus (2013) as cited in Brander et al, 2018). The second method is "market-based" and allows a company to use an emission factor corresponding to the electricity produced by a generator with whom the company has an agreement with. For instance, following this second method, a company having an agreement with a hydropower plant can claim its electricity consumption as 100% renewable and thus free of emissions. The instruments used in such contractual agreements can be Renewable Energy Certificates (RECs), GOs, utility green tariffs or Power Purchase Agreements (PPAs) (Brander and al., 2018). As stated in the GHG Protocol, companies are requested to use both methods to report their Scope 2 emissions but are free to pick one method to report their supply chain emissions and to measure their progress towards their emission reduction target (Sotos, 2015). Two issues regarding the market-based method were brought up (Brander et al., 2018), these were: (i) the protocol does not lead to additional renewable investments and (ii) it has a negative effect on the accuracy and relevance of GHG inventories. The first problem comes from that there is a large volume of renewable generation available for contractual agreements at a very low price. Combined with a high demand elasticity, the market for contractual emissions factors is very unlikely to increase the investments in renewable installations because the prices needed to do so are too high compared to the current price of the contractual emission factors and the demand for such a price would absent due to its high elasticity (Brander et al., 2018). The probability of contributing to additionality is further reduced because as of now (2019), the renewable investments are triggered by national support schemes. The remuneration from the support schemes has historically been higher than the GO market price and therefore, they expand beyond the threshold at which the demand for contractual emission factors (and indirectly the demand for GOs) could have an impact on investment. Their findings are consistent with the findings of Raadal et al (2011) and Mulder and Zomer (2016) which had shown that the GOs had at that time no impact on increasing the renewable capacity. Brander et al (2018) illustrate the second problem (i.e. the negative effect of the market-based method on the accuracy and relevance of GHG inventories) by mean of the following example: Company A buys contractual emission factors to cover its total electricity consumption. They report an emission-free electricity consumption in their supply chain reporting, as well as a resulting decrease in their overall corporate emissions of 30%. A similar Company B chooses to invest in an energy efficiency programme which enables a reduction in its electricity consumption and hence in the related emissions of 10%. According to the GHG accounting method, Company A has

demonstrated a higher performance although its real physical consumption was unchanged and no additional renewable electricity was produced, meaning that no reduction in the emissions released in the atmosphere took place. On the contrary, Company B has reduced its consumption and therefore also reduced its emissions. This proves that using the GOs in the GHG Protocol does not necessarily lead to emission reductions. The authors end up with two recommendations to be adopted in the ISO-standard (a standard for organisational GHG inventories) which was under revision at the time of writing. First, they advocate the use of the locational grid average method as the only method to report the electricity consumption-related emissions. Secondly, they recommend that measures effectively contributing to additionality be reported distinctly to the corporate GHG inventory and be measured by a consequential accounting method.

A second study focusses on how the GHG Protocol and the EU framework of GOs influence the choices of electricity and district heating as well as of combined heat and power production (CHP) (Nordenstam et al., 2018). The CHP technology is the simultaneous production of electricity and useful heat from the same energy source (ENERGY.GOV, n.d.). The use of the excess heat released contributes to CO2 emissions reduction compared to electricity production only (Nordenstam et al., 2018). However, it was found that the GO system, as well as the GHG Protocol reporting method, can in fact lead to higher CO2 emissions when the CHP-based District heating is influenced by *inter alia* preventing the CHP production and hence failing to exploit its emissions-reduction potential (Nordenstam et al., 2018). In fact, they found that the GHG Protocol method does not take into account the emissions reduction derived from the use of the heat from the CHP electricity production. As a result, depending on the District Heating system, the GHG Protocol method can in some cases incite District Heating producers to forgo CHP electricity production because doing so allows them to achieve lower emissions factors and hence incites businesses to use contractual emissions factors from District Heating in their corporate GHG inventory. Moreover, here again this study confirms the previous findings about the failure of GOs to contribute to additionality. They claim that the inability of GOs to generate investments in new RES facilities as well as inability to recognise the emissions reduction potential derived from CHP production together constitute a second deterrent to the CHP production.

4.6. The performance of the GO market

Finally, the last theme is the performance of the GO market. This was recently analysed by Hulshof and al. (2019). The paper assessed the performance of the European GO markets by

evaluating (i) the share of certified renewable electricity, (ii) the churn rate, (iii) the price volatility and (iv) the share of expired certificates. The analysis was conducted in 20 European countries and revealed an increasing use of GOs and most countries indicating the increasing importance of the GO market. However, the performance of the GO market was found to be still very weak due to a poor liquidity and a high price volatility. In addition, the significant share of expired certificates throughout the years suggested a continuous oversupply in GOs. Finally, they pointed out the positive influence of common international standards and the adoption of public certifiers on the market volumes (Hulshof et al., 2019).

To sum up, reviewing the academic literature has led us to the identification of six general themes: (1) the role and the use of GOs in electricity tracking, (2) the design of the Directive 2009/28/EC, (3) the perspective of Norwegian consumers on the GO system, (4) the impact of GOs on renewable investments, (5) the role of GOs in the company's Greenhouse Gas Protocol accounting method, and (6) the performance of the GO market. The first theme revealed that the method to use for electricity disclosure used to be unclear. The GOs had been introduced in 2001 as an electricity tracking tool but no official method on the use of GOs for electricity disclosure had been developed by the European Commission at that time (Lise and al, 2007). The second theme retraced the different propositions that were made regarding the design of the Directive. In spite of fierce discussions about the use of GOs for renewable target accounting, it was decided in the Directive 2009/28/EC that the GO system should only be a tool for documenting the renewable electricity consumption as foreseen at its conception (Klessmann, 2009). Regarding the third theme, it was shown that Norwegian businesses and private households did not trust the GO system and did not make use of it (Aasen et al, 2010; Winther and Ericson, 2012). This was not the case of the other European countries as it was shown that the Dutch consumers were largely buying GOs which enabled them to reach a renewable consumption of 34% in 2012 despite a renewable generation of 10% (Mulder and Zomer, 2016). The failure of GOs to contributes to additionality was raised in the fourth and fifth theme. It was found that GOs could have an impact on renewable investments if they trigger a level of demand at a sufficiently high price (Raadal et al, 2011; Mulder and Zomer, 2016). Moreover, although, it was shown that the use of GOs suggested by the market-based method of the GHG Protocol was not leading to additionality (Brander et al, 2018), it was indirectly pinpointed that the willingness to comply with the GHG Protocol was leading a lot of companies to buy GOs to calculate their GHG inventories. A growing demand for GOs was also highlighted by Hulshof et al (2019) in their analysis of the performance of the GO market.

All these findings outline that the demand for GOs is not homogenous across businesses and private households and neither across countries. Finally, regarding the performance of the GO market, Hulshof et al. (2019) also identified a poor liquidity, high price volatility and historical oversupply of GOs.

5. Impact of GOs on consumption statistics through electricity tracking and disclosure

Electricity disclosure has been introduced in the Internal Energy Market Directive and compels electricity retailers to disclose the share of each energy source in its fuel mix. Electricity retailers must disclose the previous year's fuel mix in the electricity bills or in a similar document made available to the customers (Council Directive 2003/54/EC, Art 3(9)). The purpose, in the light of liberalizing the electricity market, is to offer customers the information about their purchase and the choice to buy specific electricity sources, such as renewable electricity for instance (AIB, 2015).

GOs is the most used system for renewable energy tracking. However, it carries a risk of double counting. Double counting or double disclosure happens when the same electricity attributes are allocated to two different end-users. Therefore, the Directive 2009/28/EC prescribes GOs to be issued only once for each unit of energy produced (Article15(2)). For the same reason, as a GO can be freely transferred between different holders, the physical energy originally linked to the GO that has been sold cannot reported as renewable energy (Council Directive 2009/28/EC, (52)).

An important concept that comes into play in terms of electricity disclosure is the Residual Mix (RM). The AIB defines a country's RM as «the shares of electricity generation attributes available for disclosure, after the use of explicit tracking systems, such as GO, has been accounted for» (AIB, 2018c, p.1). The generation attributes mentioned in this definition are the disclosed indicators, namely: the energy source, the related CO_2 emissions and radioactive waste (Bröckl et al., 2011). In the same way, the RM represents the typical consumption mix of a consumer buying unspecified electricity (Bröckl et al., 2011).

The notion of double counting and the significance of the RM is illustrated in the schema below.

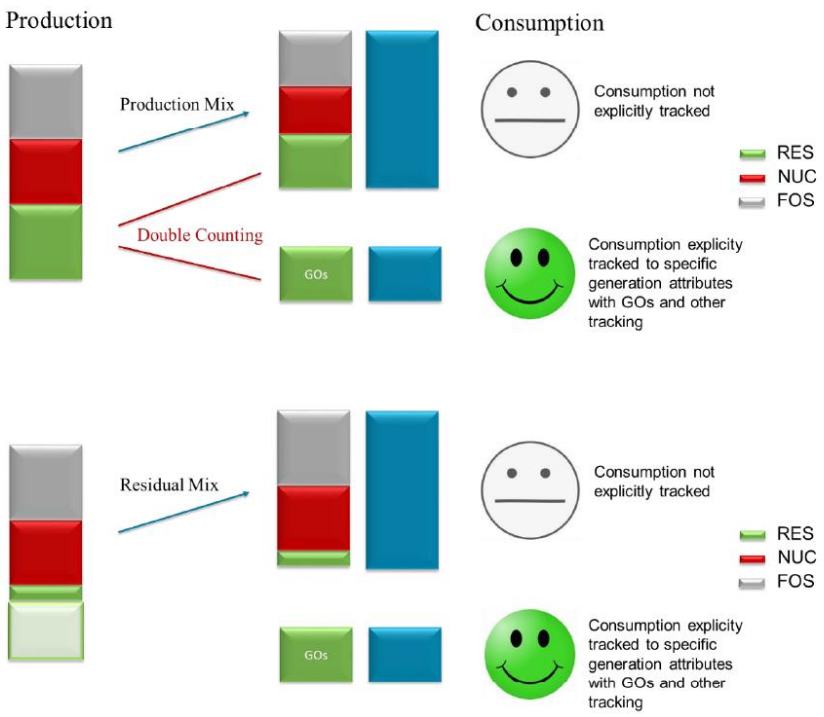


Figure 2. The idea of the Residual Mix (Aalto et al., n.d., p.8).

The consumption share of a country that is covered by GOs or other reliable tracking systems is the consumption explicitly tracked and the remaining consumption is the untracked consumption. It is clear from the above figure that if the untracked consumption is disclosed uniquely based on the Production Mix, the renewables attributes being explicitly tracked will be disclosed twice. Therefore, it is essential to disclose the untracked consumption based on the RM corresponding to the Production Mix corrected with the explicitly tracked attributes (Aalto, Klimscheffskij & Lehtovaara, n.d.).

However, given the international character of the electricity market, using independent national RM is insufficient. Indeed, in order to be accurate, the RM calculation must be based on the national and international statistics for electricity generation and should take into account imports and exports of physical electricity, imports and exports of GOs and other certificates for tracking electricity as well as bilateral contracts (Bröckl et al., 2011).

5.1. Residual Mix calculation methodology of the REDISS II project

The European Commission supported several projects (E-TRACK I, E-TRACK II, REDISS I and REDISS-II) to develop a reliable RM calculation methodology. The most recent version was developed during the REDISS-II project. Although the use of this method is not binding, the European Commission advocates the use of this method by the MS and the AIB publishes

the RM of its members every year using this method. The REDISS II Residual Mix calculation method is described in detail here below.

An important concept that comes into play in this calculation methodology is the European Attribute Mix (EAM). The EAM was created to respond to the need « to balance out deficits and surpluses of disclosure information compared to the electricity consumption in each country » (Timpe et al., 2012, p. 3). In this respect, countries exporting more GOs than physical electricity can use the data from the EAM instead of having to disclose the share of electricity as « unknown » (Timpe et al., 2012, p.3). As a reminder, the concept of "unknown" origin comes from the Directive 2009/28/EC that stipulates that if GOs are transferred between countries independently of the physical power, the exporting country cannot disclose the physical electricity associated to the exported GOs, as renewable energy. This prevails in order to avoid double counting. Therefore, since the renewable electricity volume is disclosed in the GO's importing country, the exporting country has to disclose the corresponding physical energy as either «unknown» or according to the attributes of the EAM. Disclosing part of the electricity mix as unknown like it used to be in Norway strongly hinders the comprehension of consumers as pointed out in the literature review. Therefore, the REDISS-II methodology recommends the use of the EAM, especially given that a perfect balance between exported/imported GOs and exported/imported physical electricity is hardly ever reached by a country, meaning that all of them will have to rebalance their disclosure information with other countries via the EAM (Timpe et al., 2012).

More precisely, the methodology of Residual Mix calculations described by the REDISS II (second phase of the REDISS) project consists in 4 steps:

Step 1: Data collection

Step 2: Determination of the Domestic RM and the Attribute Surplus/Deficit

Step 3: Determination of the EAM

Step 4: Determination of the Final RM

(Timpe et al., 2012).

We recall once again that the term "attribute" refers to the characteristics of the energy source, the related CO_2 emissions and the radioactive waste. As mandated by the directive, the two latter components have to be calculated all along the RM calculation as well. However, as this

Master's Thesis is only interested in the GOs and the way they affect the energy sources disclosure, the calculation of the environmental indicators will not be described.

The four steps are described here below.

Step 1: Data collection

In this first step, all relevant annual data for the calculation of the Domestic RM of a year X are gathered. These are:

- Country's net electricity production during year X
- Country's net electricity consumption during year X
- Net electricity exports and imports to and from **external** countries:
  The external countries are all countries outside EU28 except Iceland, Norway and Switzerland. Each volume imported from an external country should be disclosed in accordance with the generation mix of the specific country (or if possible, its Residual Mix). In case of a next export, the latter volume is subtracted in the shares of the Production Mix for the different energy sources.
  Note: Only net electricity exports and imports to and from the countries cited above should be taken into account.

- Country's imports, exports and cancellations of GOs and other reliable tracking certificates for the period 1.4.year X - 31.3.year X+1 per energy source.

- Country's attributes explicitly tracked by non-certificate based tracking systems, such as by feed-in-tariffs or contract-based tracking for instance. These attributes should be counted as cancellations (i.e. they are consumed in the country itself).

Note that the last two bullets points constitute together the imported, exported and cancelled attributes that will be used in the following calculations. (Aalto et al., n.d.)

Step 2: Determination of the Domain Residual Mix and Attribute Surplus/Deficit

This second step consists in calculating the yearly available generation attributes of the country, in other words the Domestic RM. The computation is done as follow:

$$Domestic\ Residual\ Mix = Generation\ Attributes\ (corrected\ with\ physical\ net\ imports\ from\ \textbf{external}\ countries) + Imported\ Attributes - Exported\ Attributes - Cancelled\ Attributes - physical\ \text{net}\ exports\ to\ \textbf{external}\ countries\ (according\ to\ shares\ of\ the\ preliminary\ \text{Domestic RM})$$

(Aalto et al., n.d.)

An illustration of the Domestic RM calculation can be found in figure 3. The volumes (in TWh) of the different attributes per energy source are summed up and subtracted according to the formula above. It should be noted that the GOs are only a fraction of the total imported, exported and cancelled attributes since part of these attributes are tracked by other tracking systems (certificate-based and/or non-certificate based, cfr. Step 1).

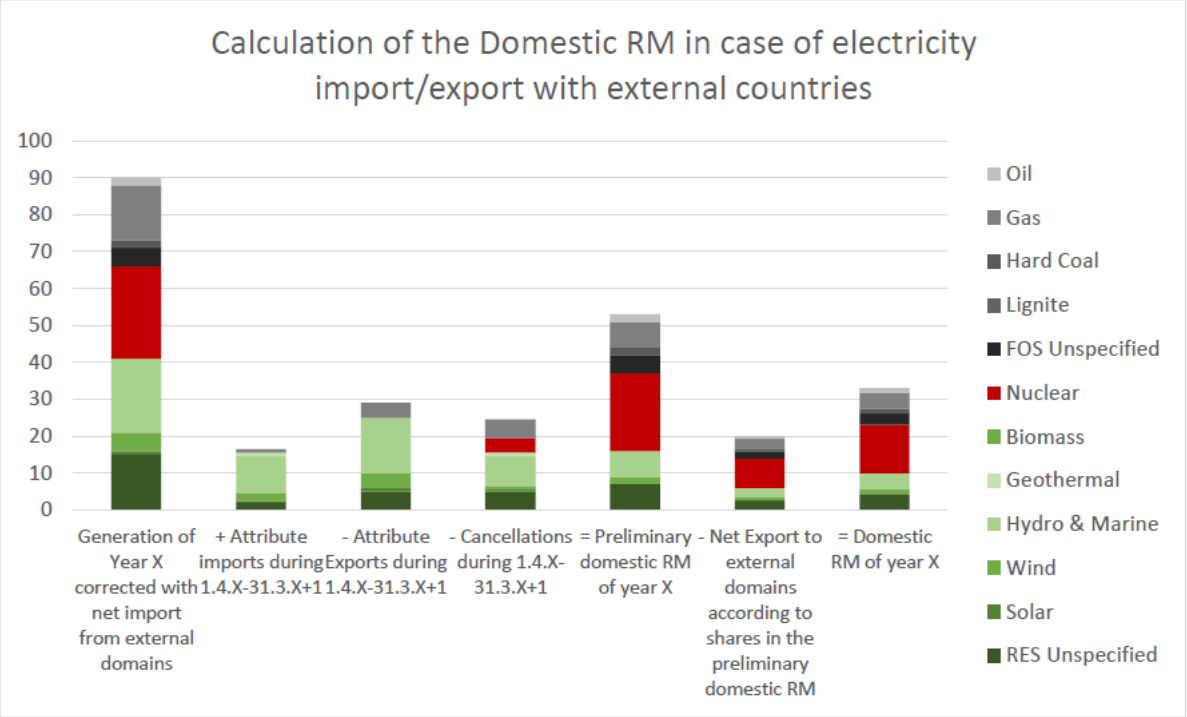


Figure 3. Calculation of the Domestic RM in case of electricity import/export with external countries[3] in TWh (Aalto et al., n.d., p. 24).

Once the Domestic RM has been calculated, the following step consists in calculating the attribute surplus or deficit. In order to do so, the volume of untracked consumption in the country has to be figured out. The untracked consumption is simply the volume of electricity consumption that has not been explicitly tracked by tracking systems (such as by GOs for instance). In other words, it corresponds to the country's electricity consumption (volume of non-differentiable electricity that has been delivered to households) after cancelled attributes have been subtracted (Aalto et al., n.d.).

$$Electricity\ Consumption\ -Cancelled\ Attributes = \ Untracked\ Consumption$$

This calculation is illustrated in figure 4.

[3] Note that external imports and exports are infrequent and will for most countries not appear in the calculation (Aalto et al., n.d.).

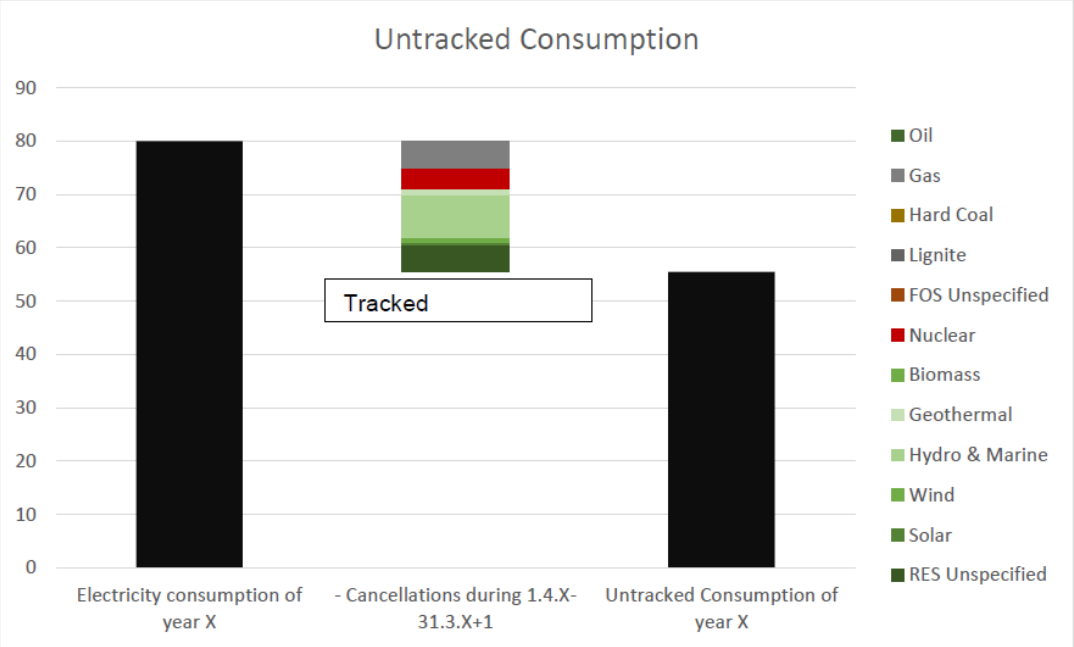


Figure 4. Untracked consumption calculation in TWh (Aalto & al., n.d., p. 25).

Finally, if the difference between the Domestic RM in year X and the untracked consumption in year X is positive, the country is said to have a surplus in attributes. Otherwise, it is said to have an attribute deficit (Aalto et al., n.d.). This is illustrated in figure 5.

Domestic RM – Untracked Consumption = Surplus (+) or Deficit (-)

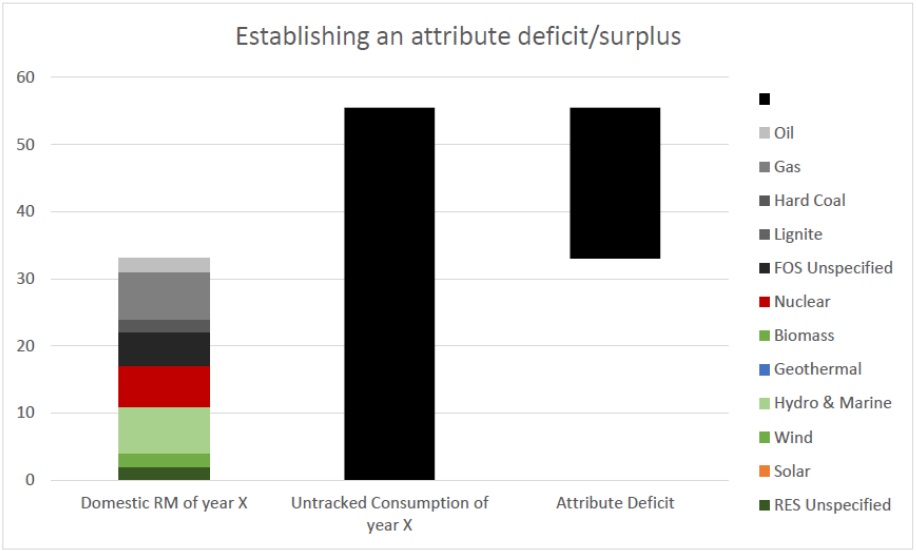


Figure 5. Attribute deficit/surplus calculation in TWh (Aalto et al, n.d., p. 26).

Step 3: Determination of the European Attribute Mix (EAM)

The EAM can be seen as a common attribute pool where all countries rebalance themselves. The EAM is used to replenish the Domestic RM of the countries having a deficit in attributes

and is replenished by the Domestic RM of the countries having a surplus in attributes (cfr. Figure 6) (Timpe et al., 2012).

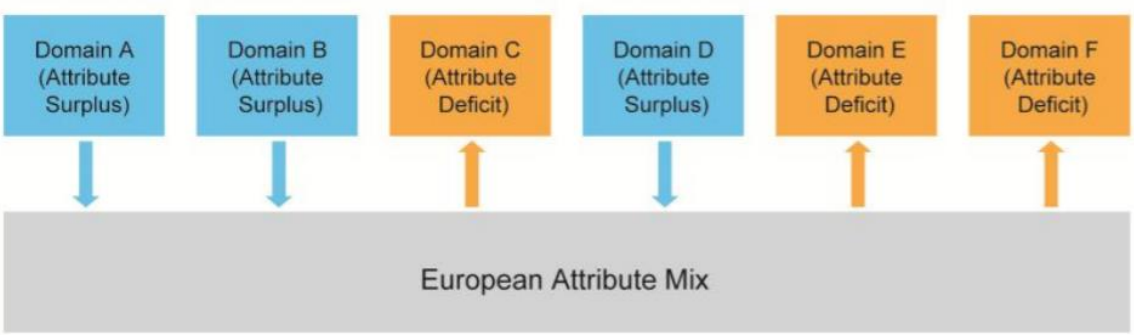


Figure 6. Rebalancing with the European Attribute Mix (RE-DISS, 2012, slide 16).[4]

Hence, a country facing a surplus in attributes will transfer this excess to the EAM in accordance with the shares of energy sources in its Domestic RM.

$$Contribution\ to\ the\ EAM_{Energy\ source\ Y,Country\ N} = Surplus_{Country\ N} * \%\ in\ the\ Domestic\ RM_{Energy\ source\ Y,Country N}$$

The final EAM is obtained by performing the above calculation for each country and each energy source (Aalto et al., n.d.).

The countries facing an attributes deficit can then use the EAM mix to make up the difference. They do so by adding to their Domestic RM the volume of attributes corresponding to their deficit according to the shares of the energy sources in the EAM.

$$Intake\ from\ the\ EAM_{Energy\ source\ Y,Country\ M} = Deficit_{Country\ M} * \%\ in\ the\ EAM_{Energy\ source\ Y}$$

The above calculation must of course be performed for each energy source (Aalto et al., n.d.).

Step 4: Determination of the Final Residual Mix

Last, but not least, the Final RM of the country has to be calculated. This Final RM represents the electricity consumption of a consumer that did not specifically ask for renewable electricity (i.e which consumption has not been covered by GOs).

A country that was initially in surplus will transfer the volume associated with the available attributes in surplus to the EAM and will retain the same Final RM as the domestic one in share of different attributes (Timpe et al., 2012).

[4] The word "domain" used in the schema refers to a "country"

A country initially in deficit will, on the other hand, see its preliminary RM merge with the inflow from the EAM to form the Final RM. Indeed, the deficit volume is taken from the EAM and disclosed according to the different attributes in the EAM (Timpe et al., 2012).

5.2. Total Supplier Mix calculation

The Total Supplier Mix ("supplier" referring in this case to the electricity retailer) is nothing else than « the total volume of attributes disclosed in a country, both tracked and those disclosed through the residual mix» (Aalto et al., n.d., p34.). It corresponds thus to the country's electricity consumption (Aalto et al., n.d.).

$$Total\ supplier\ Mix = Final\ Residual\ Mix + Cancelled\ Attributes = Total\ Disclosed\ Consumption$$

5.3. Summary of the different calculations

A summary outline of the different calculations can be found in the Figure 7. For the years 2009 to 2014, the RE-DISS II project was in charge of calculating the EAM and the national RM. The AIB has since then taken over the responsibility and has delegated the calculation task to Grexel Ltd which won their call for tenders (AIB, 2015). Although the AIB calculates and publishes the disclosure information of its members according to the RE-DISS methodology, the methodology is not binding, and MS are still free to calculate their disclosure information as they like which creates confusion and leads to double counting. Therefore, in order to be consistent, only the disclosure information and GOs statistics published by the AIB will be used in the rest of this Master's Thesis.

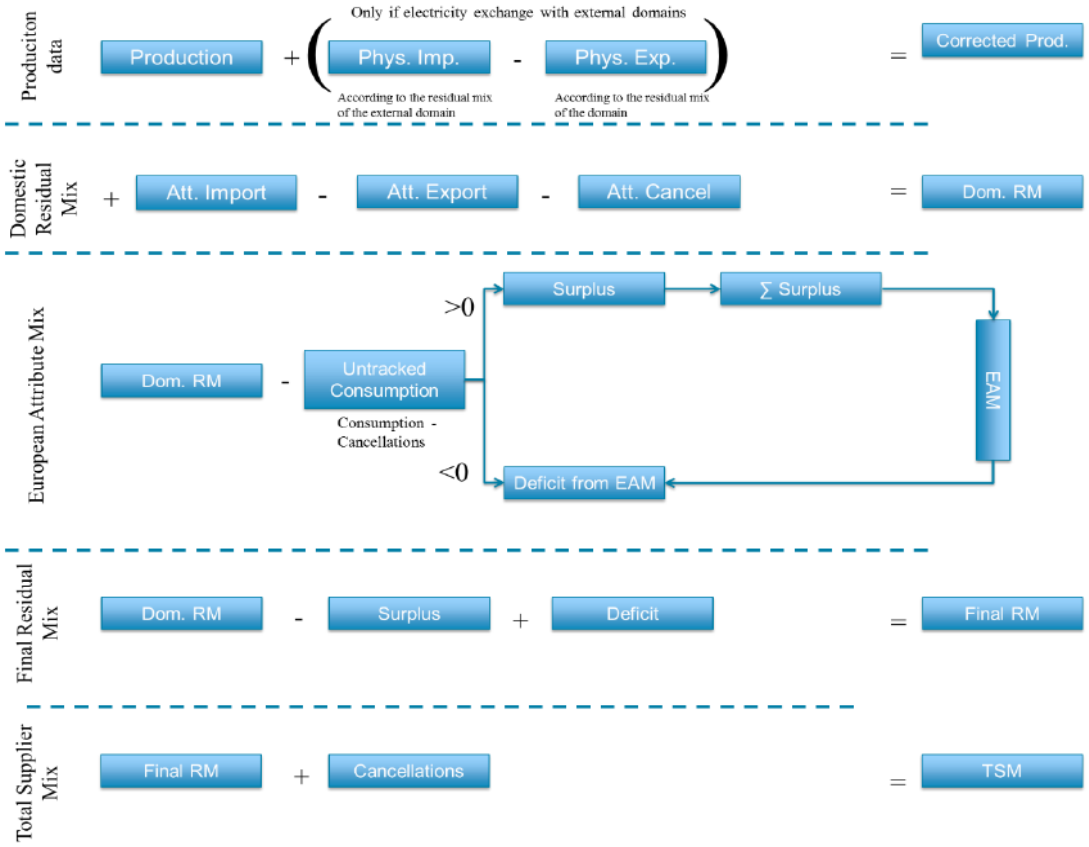


Figure 7. *Residual Mix calculation summary (Aalto & al., n.d., p.36).*

5.4. Application in practice

The data that will be presented for the case of Norway and Germany in this section refer to the year of 2017. This is simply due to the fact that at the time of writing this Master's Thesis, 2017 disclosure figures were the latest ones published.

5.4.1. The case of Norway

In 2017, 148.63 TWh of electricity were produced in Norway. Renewable electricity constituted 145.54 TWh, of which 142.12 TWh came from hydropower (and marine power), 2.72 TWh from wind power and 0.7 TWh from unspecified renewable sources. Hence, the renewable production in Norway added up to 98% of total production. The remaining 2% came from fossil energy, more precisely, 3.08 TWh was produced from gas and 0.015 TWh from unspecified fossil sources (AIB, 2018c) (cfr. Figure 8).

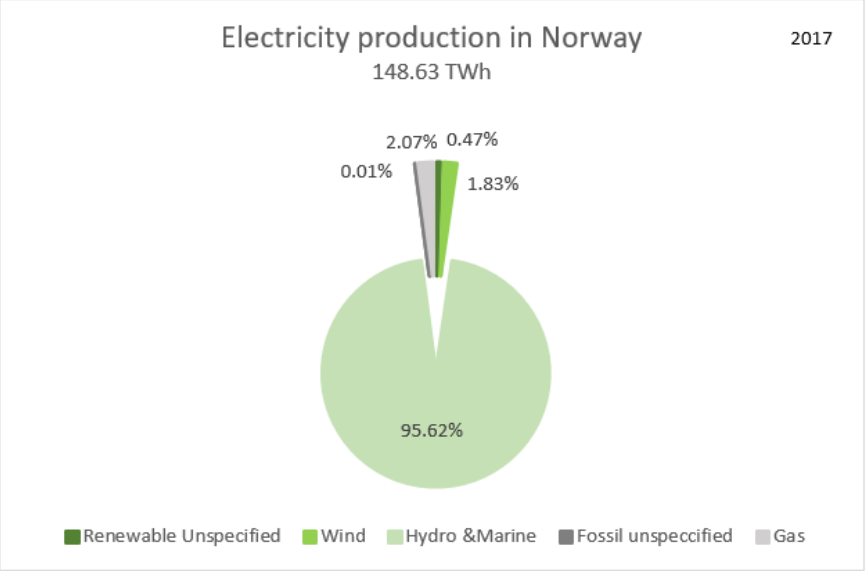


Figure 8. Electricity production in Norway 2017 (based on figures from AIB, 2018c).

According to the AIB statistics, the number of GOs issued for the production year of 2017 was 139,635,419 which corresponds to 139.64 TWh (AIB, 2019b). It was already mentioned that in Norway, GOs can be requested for any electricity sources but in practice GOs are only issued for renewables. Considering thus only the renewable electricity, this sheds light on the fact that the full GO potential was not exploited as the total renewable production eligible for GOs was 145.54 TWh. This seems to indicate that some producers are not interested in getting GOs for their production as is their right since the GO system is voluntary. Although GOs are an additional source of income for producers, some assumptions can be made as regards to their choice not to take part in the GO system. One assumption could be that the annual fee of €2,569.75 charged by Statnett for holding an account in the NECS is too high compared to the revenue they could get with the volume of GOs that they could request. An alternative for them could be not open an account in the NECS and ask for the GOs to be directly delivered to a trader account selling the GOs on their behalf. Unfortunately, in that case no information on pricing in known to us. Another assumption is that they consider the request procedure for getting GOs too burdensome which is unlikely according to Statnett (I. M. Clausen from Statnett, personal communication, February 20, 2019) or that the trading of GOs is too demanding. It might also be the case that some production comes from renewable generators producing less than one MWh and thus being not eligible for GOs.

The following bar charts in the figure 9 have been constructed with the data published by the AIB and represent the Production Mix, the Final RM as well as the Total Supplier Mix of Norway in 2017, computed according to the methodology described in the previous section.

We remind the reader that the Production Mix corresponds to the generation attributes of electricity, the Final RM is the consumption of a consumer that has not purchased renewable power and the Total Supplier Mix represent the total consumption of a country or in other words, the sum of the disclosed attributes by all electricity retailers. In addition, in this case the energy sources are represented as a percentage of the different mixes and not in TWh. In fact, if the volumes were presented, the three mixes would not have the same volume.

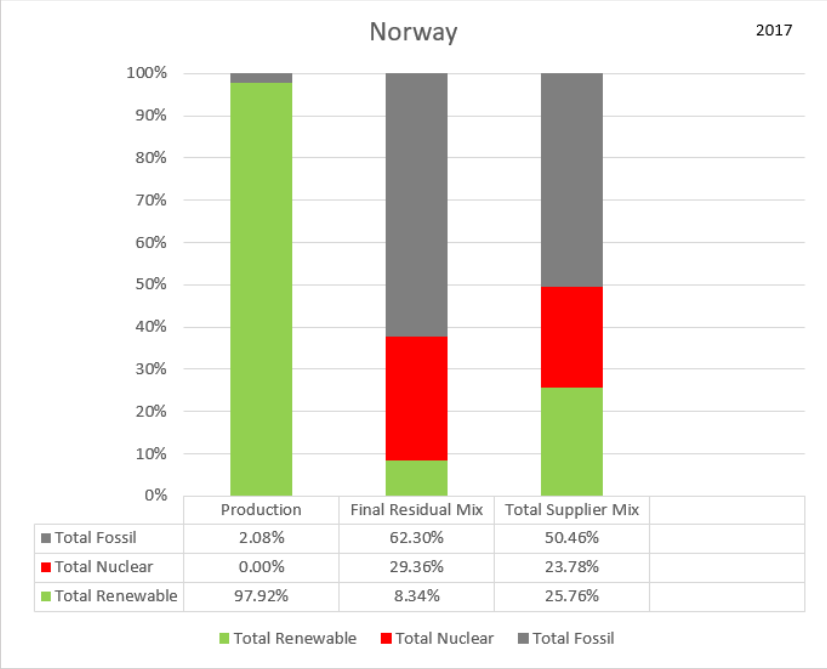


Figure 9. Production Mix, Final Residual Mix and Total Supplier Mix of Norway in 2017 (based on figures from AIB, 2018c).

Although, we did not have access to the detailed calculations but only to the final results shown above, some insights can be provided to understand the trend of the bar charts. First and foremost, assuming that Norway do not trade physical electricity with external countries[5], that GOs represent the only explicit reliable tracking system used in Norway and considering only the renewable production, the Domestic RM can be computed as follows:

$$Domestic\ RM_{Renewables} = Production_{Renewables} + Attributes\ imported_{Renewables} - Attributes\ exported_{Renewables} - Attributes\ cancelled_{Renewables} = Production_{Renewables} + GOs\ imported_{Renewables} - GOs\ exported_{Renewables} - GOs\ cancelled_{Renewables}$$

We know that the renewable production in 2017 was 145.54 TWh but have no information regarding the attributes imported, exported and cancelled between the 1.04.2017 and the

[5] The external countries are all countries outside EU28 except Iceland, Norway and Switzerland.

31.03.2018, however we have access to the GOs statistics published by the AIB for the years 2017 and 2018. These statistics are gathered together in the table 1 below. We can make the assumption that the volume of GOs imported, exported and cancelled between the 1.4.2017 and the 31.3.2018 are the average of those statistics for the year 2017 and 2018. Although in reality this is not true, and the real volume lies between the two figures.

Table 1. *Volume of renewable GOs Imported, Exported and Cancelled in Norway in 2017 and 2018 (AIB, 2019b).*

Volume (TWh)	2017	2018	Average
GOs imported	128.28	159.86	144.07
GOs exported	208.95	230.82	219.89
GOs cancelled	39.28	48.49	43.89

Two things are important to note here:

1) The numbers are the volumes of GOs effectively imported, exported and cancelled in 2017 and 2018 and not the volume of GOs imported, exported and cancelled for the physical production that occurred in 2017 and 2018. It is, for example, very likely that a share of the GOs exported in 2017 was issued for the production year of 2016. Similarly, part of the productions of 2017, has seen its GOs being exported in 2018.
2) It may seem odd that the volume exported in 2017 was higher than the volume of the production that was eligible for GOs in 2017. This is because most of the GOs imported are reexported, which is consistent with the low cancellation volume showing that very few GOs are effectively consumed in Norway.

Using the renewable production and GOs statistics from 2017, the hypothetical Domestic RM for the renewable attributes in Norway can be assumed to be:

$$145.54 + 144.07 - 219.89 - 43.89 = 25.84 \text{ TWh}$$

Needless to say this number is extremely small. Based on the Domestic RM, the surplus/deficit in renewable attributes in Norway should be calculated as follows:

$$\textit{Domestic RM}_{\textit{Renewables}} - \underbrace{(\textit{Consumption} - \textit{Cancellations})_{\textit{Renewables}}}_{\text{Untracked consumption}} = (+)\ \textit{Surplus}_{\textit{Renewables}}\ \textit{or}\ (-)\ \textit{Deficit}_{\textit{Renewables}}$$

Unfortunately, the exact consumption data could not be accessed, but it was already shown that the Domestic RM for renewables was very small and so was the volume of cancellations. Unsurprisingly, Norway faced a deficit in renewable attributes in 2017 and this volume had thus to be disclosed according to the EAM. The exact attributes deficit for all energy sources published by the AIB is shown in the following bar chart (figure 10). Note that it represents the

deficit in attributes already filed in with attributes from the EAM and is this case depicted in TWh. As mentioned earlier the EAM contains all the attributes in surplus from the other members countries of the AIB.

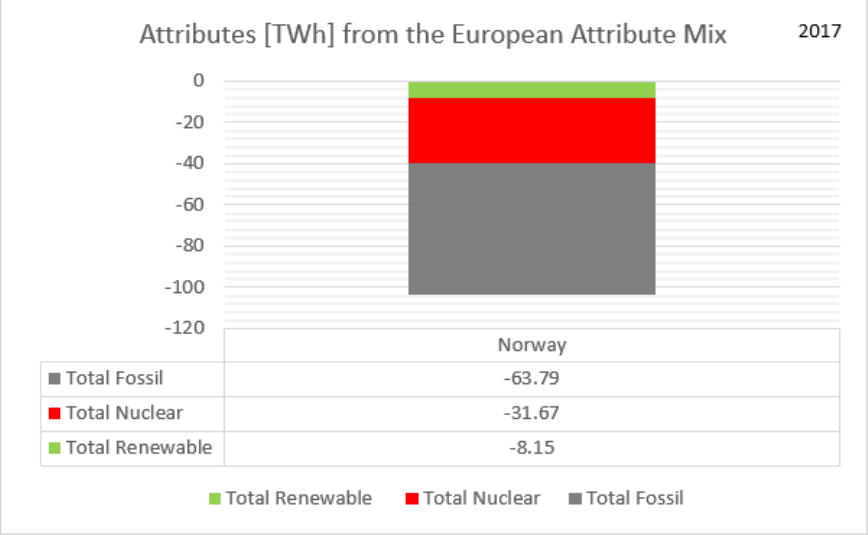


Figure 10. Attributes [TWh] from the European Attribute Mix in 2017 for Norway (based on figures from AIB, 2018c).

Knowing the Domestic RM and the intake in attributes from the EAM, the Final RM illustrated in the figure 9 can be obtained by simply adding the intake from the EAM for each energy sources to the Domestic RM.

$$Final\ RM_{Norway} = \sum_{Energy\ Source} (Domestic\ RM_{Energy\ Source\ Y} + Intake\ from\ the\ EAM_{Energy\ Source\ Y})$$

Comparing the Production Mix and the Final RM of Norway from figure 9, we can see that the large exports of GOs and the little consumption of them (given by the cancellation volume) have caused a large deficit in attributes that was filled with fossil and nuclear attributes.

Finally, the Total Supplier Mix of Norway was obtained by adding the cancellation volume to the Final RM. Thanks to the small consumption of GOs (i.e cancellation volume) in Norway, the total consumption remained slightly greener than the Final RM but remained very far from the share of renewable attributes of the Production Mix, indicating that most of the green attributes related to the Norwegian electricity production were consumed abroad.

5.4.2. The case of Germany

In 2017, the generation volume in Germany was almost four times higher than the Norwegian generation volume and amounted to 595.91 TWh (figure 11). Renewable electricity constituted 205.89 TWh and was mainly produced from wind power and solar power. These two renewable energy sources amounting respectively to 103.39 TWh and 35.52 TWh. This total renewable

production made Germany the largest producer of renewables in Europe in 2017. Nevertheless, fossil electricity still constituted the largest share of its generation mix in 2017 with 317.92 TWh, with the main fossil sources being Lignite and Hard Coal with 137.30 TWh and 84.14 TWh respectively. Finally, nuclear electricity accounted for the smallest production share (72.17 TWh) (AIB, 2018c) which is in line with the nuclear phase-out policy that was started in reaction to the Fukushima disaster in 2011 (David & Kanellos, 2018).

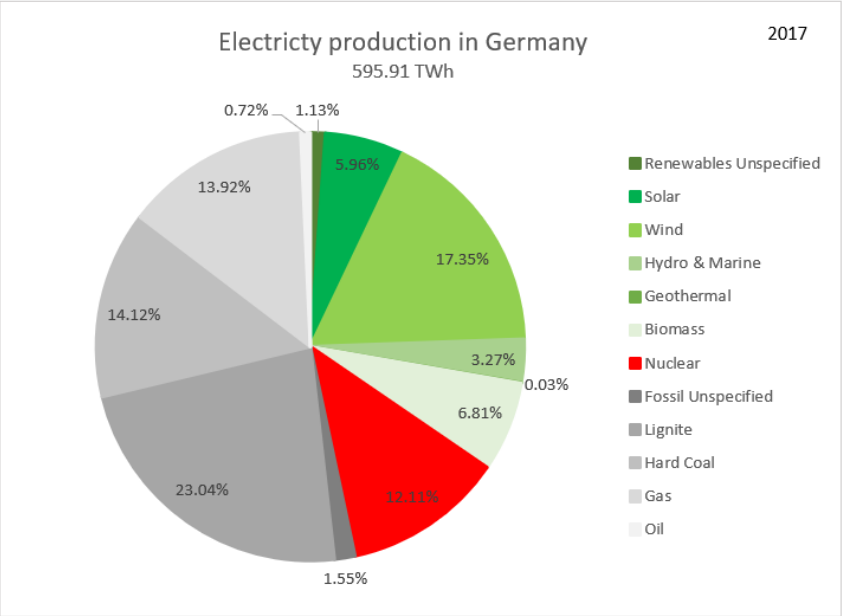


Figure 11. Electricity Production in Germany 2017 (based on figures from AIB, 2018c).

According to the AIB, 17,022,380 GOs were issued for the renewable production of 2017 (AIB, 2019b). Corresponding to 17.02 TWh, it indicates that only 8.27% of the renewable production was certified by GOs in 2017. Although it might seem odd at the first glance, this is simply due to the fact that the national legislation prevents GOs to be issued for any renewable production benefitting from support schemes, which is the case for most of the renewable production in Germany. In spite of that, German electricity retailers still have to buy GOs to document the renewable electricity they sell (R. Kok for Innogy, personal communication, May 8, 2019, Appendix E) and since very few national GOs are available, German retailers source the GOs outside the borders which is convenient since countries like Norway have a lot of GOs to sell. The statistics below in table 2 speak for themselves and show that Germany is a large consumer of GOs thanks to its large imports.

Table 2. *Volume (TWh) of GOs Imported, exported and cancelled in Germany in 2017 and 2018 (AIB, 2019b).*

Volume (TWh)	2017	2018	Average
GOs imported	87.31	92.04	89.67
GOs exported	7.77	12.47	10.12
GOs cancelled	91.74	99.91	95.83

When it comes to the Final RM and the Total Supplier Mix, it would be very incorrect to use only the GOs statistics to approximate the latter because we do not know the volume of supported renewable production which also accounts for cancelled attributes. Nevertheless, being mainly a producer of fossil electricity, and having a high consumption of green attributes thanks to large GOs imports, we expected Germany to have a surplus in fossil and nuclear attributes. This is indeed what the AIB figures tell us (cfr. figure 12).

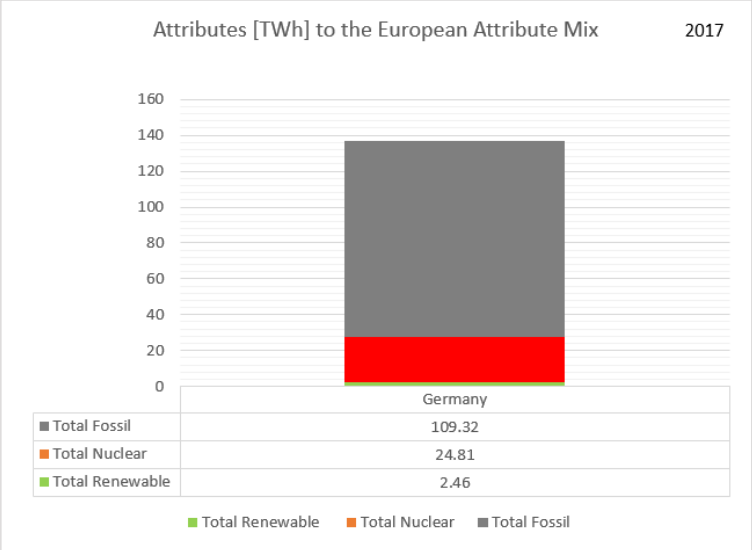


Figure 12. Attributes (TWh) to the European Attribute Mix from Germany in 2017 (based on figures from AIB, 2918c).

The above bar chart above shows the volume of attributes in TWh per energy sources that was transferred to the EAM for the year 2017. The largest surplus is in fossil attributes. This is not surprising as the production is quite high (317.92 TWh) and not as much of that production is consumed, since the Germans are very keen on consuming green electricity and largely use the GO mechanism to do this. The trend is similar for the nuclear energy, the surplus being lower due to a lower production of 72.17 TWh. Finally, the surplus of renewable attributes is very low and accounts for less than 2% of the total attribute surplus. The attribute surplus is thus transferred to the EAM and deduced from the Domestic RM to shape the Final RM.

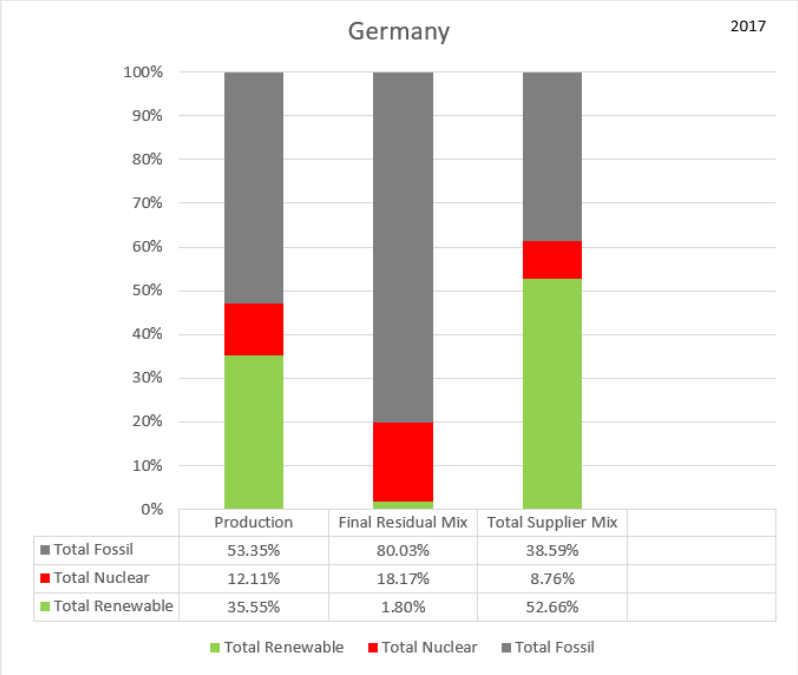


Figure 13. Production Mix, Final Residual Mix and Total Supplier Mix of Germany in 2017 (based on figures from AIB, 2018c).

As can be seen from the three bar charts in figure 13, the Final RM is the largest composed of fossil fuel sources with a very small part of renewable energy. The Final RM is the typical consumption of a consumer buying unspecified electricity (Bröckl et al., 2011), this shows that most of the renewable attributes in Germany are explicitly tracked and hence do not appear in the Final RM. However, there are accounted into the Total Supplier Mix which reveals that more than 50% of the total German electricity consumption was renewable in 2017 compared to a physical production of 36% of renewable electricity.

The two examples of Norway and Germany reveal the significant impact that GO trading can have on the final consumption of a country. GO trading in Germany has resulted in German electricity consumption to be cleaner than its Production Mix, while in Norway where the production is already considered clean it has not stimulated the choice of renewable electricity over specifically and has resulted in Norwegian consumption to be less clean than its Production Mix. It is not surprising that without knowing the calculation methodology, consumers do not understand why their electricity consumption is not similar to the Production Mix of their country and hence consider the disclosure information as unreliable. It is therefore unclear if the large difference in GO consumption in Norway and Germany indicates a difference in understanding and trust in the GO system or simply a different willingness to pay for renewable electricity.

6. Trading actors in the EECS GO market

The present chapter aims to describe the different actors involved in the GOs market as well the flow of GOs exchanged between them.

6.1. Actors

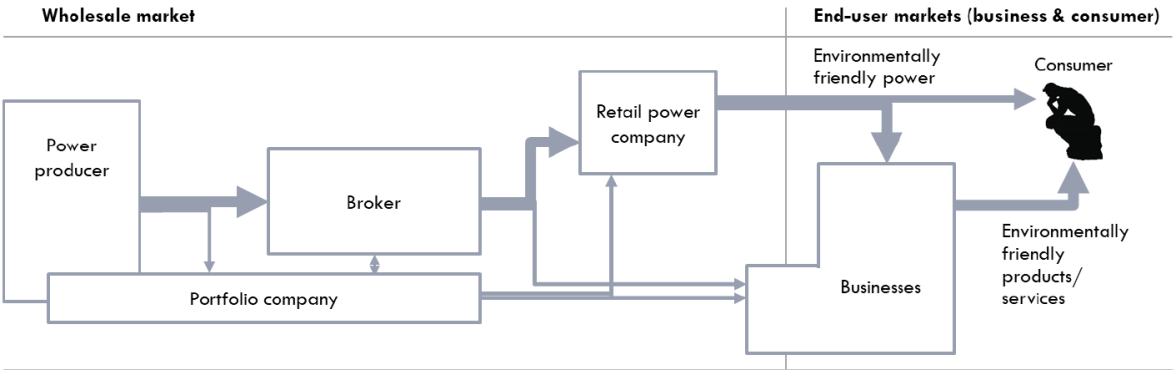


Figure 14. Actors in the GO market (Oslo Economics, 2018, p. 16).

As it can be seen from the figure 14 depicting the different actors, a distinction can be made between the wholesale market, composed of the power producers owning the GOs and the GO traders, and the end-user market composed of private households and businesses. The players are interconnected by arrows and the width of the arrows gives a rough idea of the importance of the trade between them. Based on that, it seems that in the wholesale market, producers' favored intermediaries are the brokers which then sell the GOs on to electricity retailers and that both businesses and private households purchase GOs in the end-user market. Private households appear to be more willing to buy products involving GOs from businesses, than renewable power backed with GOs from their electricity retailer.

An alternative way to look at the GO trading is to look at the supply side, the demand side and the different intermediate actors. This way is used below for clarity purposes.

6.1.1. Supply side

The supply side is composed of all producers whose production is eligible for GOs. As mentioned in the first chapter, the Directive 2009/28/EC that is currently applied, allows GOs to be issued for any type of electricity, heating or cooling and high efficiency cogeneration. MS have some freedom regarding the implementation of the Directive and most of them have defined their own national eligibility criteria. Thus the GO supply side differs between countries according to the eligibility criteria enforced in the national laws.

6.1.2. Demand side

The demand side is composed of private households and businesses consuming the GOs. As mentioned earlier, the private households buy power from electricity retailers and environmentally friendly products from businesses. Companies have historically been the largest buyers of GOs to document their electricity consumption (Oslo Economics, 2018).

As the GOs were created to enable informed choices and hence to be the channel for the consumer's voice, by buying GOs, consumers and investors express their demand for renewable products, services and investments. Electricity retailers and companies respond by tailoring their offers to the customers' demand and their willingness to pay (Oslo Economics, 2018). In reality, the different preferences of consumers and their willingness to pay for what they judge as environmentally friendly has incited the traders to largely use product differentiation (Oslo Economics, 2018). Oslo Economics' consultants in their report refer to more than thousand different GO products existing in theory, mostly differing in the characteristics of the power plants they were issued for, such as the location, age, technology, those benefitting from subsidies, etc. For example, ECOHZ, a provider of renewable energy solutions, offers a product called GO^2. This product consists in making a higher payment for the GOs that will be transferred to the ECOHZ Renewable Energy Foundation, a foundation offers loans to invest in new renewable generations facilities in Europe (N. T. Iversen & D. P. Zwick from ECOHZ, personal communication, March 4, 2019, Appendix D). This product built on GOs contributes to additionality which had appeared to be a major source of concern for the end-consumers in the literature review. A large number of eco-labels have also been created based on GOs. Examples are: Bra Miljöval (Swedish label for renewable power plants protecting the ecosystems), OKpower (label ensuring additionality) or even W+ (label where the proceeds go to empowering women in developing countries).

In most cases, companies purchase GOs in order to fulfill criteria of reputable environmental standards or labels which are a powerful marketing tool. Most of the initiatives on transforming the global energy market and the transition to a low carbon economy are taken on the business side. Among those initiatives, the most famous is the RE100. RE100 Initiative rallies companies committed to using 100% of renewable electricity by a certain year, most of the companies having chosen 2020 as a deadline (ECOHZ, 2017a). This collaborative and global initiative is monitored by the Climate Group and CDP[6]. Launched in 2014, 166 companies currently

[6] Formerly called the Carbon Disclosure Project, CDP is a non-profit organisation supporting companies, cities, states and regions to measure and manage their environmental responsibility (CDP, n.d.)

participate in the initiative. In 2018 when there were only 155 participating companies, they increased the demand for renewables to more than 188 TWh per year, comparable to the 23rd world's largest country electricity consumption (Dinnadge, Alarcon & Reynolds, 2018a). Coming from all four corners of the world, each company has to warrant its renewable claims by buying the necessary amount of GOs in Europe, RECS in North America and I-RECS in Asia, Latin America and Africa (ECOHZ, 2017a). Note that RECS and I-RECS certificates are similar to EECS GOs but are traded outside Europe. Among the 166 companies currently taking part in the initiative, four originate from Germany: Alstria, BMW, Commerz-bank and SAP, and two are from Norway: DNB and Elopak (Dinnadge, Alarcon & Reynolds, 2018b). Pursuing all the same goal, companies may opt for very diverse strategies. Some companies are disposed to provide capital and resources to build new generation sites, whereas others prefer to use Power Purchase Agreements with renewable power plants (ECOHZ, 2017a). In either case their intention is to purchase the power and the associated GOs, without which no renewable claim is valid. As an example, last year Facebook signed a 15-year PPA in Norway for a total output of 294 MW. Facebook is thus bound to purchase 1,000 GWh from wind parks located near Stavanger every year. The electricity purchased and the related GOs will be used to cover the consumption of its Nordic data centers (Shumkov, 2018). It is crystal clear that this initiative contributes to a significant increase in the demand for GOs and similarly increases their value.

Another motivation for companies to make use of GOs, as introduced in the literature review, is that, besides from being the response to the demand for renewable features and products of their customers, GOs represent a very convenient tool for carbon footprint calculations and sustainability reporting (Oslo Economics, 2018). Today, the GHG Protocol is the most extensively international accounting tool used for greenhouse gas emissions reporting (ECOHZ, n.d.b). Other well-known standards for carbon reporting, and more broadly speaking standards for sustainable reporting, are those developed by the CDP, the Global Reporting Initiative (GRI) organisation and the ISO 1400 standards. Because, these standardised reporting method allow the use of GOs for carbon reporting, they are the major source of the business's demand for GOs despite being strongly questioned by some people with regard to their real impact on climate mitigation (as demonstrated in the literature review).

6.1.3. Intermediate players

As illustrated in figure 14, several intermediaries are active in the wholesale market to enable and ease the trade of GOs between the producers and the end-users. Although the role of an

electricity retailer speaks for itself, the role of a broker or a portfolio company is less straight forward and deserves some additional information.

A Broker, the preferred option by power producers (Oslo Economics, 2018) is an independent player, acting as an intermediary between the GO holder and the retailer or another trader. Overseeing most of the GO transfers, he is known for its expertise in the GO market. For each transaction realised, a fixed commission is taken (Companie Financière Tradition, n.d.). The advantages of brokers are that they increase the market liquidity and transparency as they provide prices to buyers and sellers (N. T. Iversen & D. P. Zwick from ECOHZ, personal communication, March 4, 2019, Appendix D). However, when it comes to the risks, brokers do not eliminate them, the transaction remains a bilateral trade and the producer has to credit check the companies to whom he sells to ensure that the risk is controlled (P. K. Olsen from BKK, personal communication, February 27, 2019, Appendix H).

Turning to a **portfolio company** is another option for GO holders. A portfolio company takes charge of the volume of GOs of small and medium power producers. Contracting with both GO sellers and GO buyers, it is always the counterparty. Its role goes beyond that simple function, a portfolio company tries to meet its customers' needs with the wide varieties of GOs it deals with. It also advises consumers and supports them in implementing and documenting their renewable energy consumption. Moreover, a portfolio company usually offers GOs bundled with labels, certifications as well as marketing and promotional material (Oslo Economics, 2018), in other words, they use product differentiation. A portfolio company can also take care of the entire process related to GOs for the producer. In that case, the portfolio company receives the GOs of the producer directly in its account and manages the trading of those GOs, as well as their cancellations (Oslo Economics, 2018). Although, a portfolio company could be a very convenient option for producers reluctant to be involved in GO trading, the drawback is that the producers have to let the portfolio company manage their GOs (P. T. Ørstavik from Kinect Energy, personal communication, February 25, 2019, Appendix G) and therefore do not know who ends up buying their GOs. In addition, portfolio companies are also less transparent in their dealings than brokers, in that unlike a broker who takes a fixed and known commission per transaction, the margin taken by a portfolio company is not clearly stated and varies according to the transactions (N. T. Iversen & D. P. Zwick from ECOHZ, personal communication, March 4, 2019, Appendix D).

Taking a closer look on the schema above (cfr. figure 14), there is a small arrow between brokers and portfolio companies. As a matter of fact, GOs are frequently traded several times.

Hence, a portfolio company can buy GOs through a broker and/or sell GOs through a broker. In a similar manner, it could be the case that a producer buys GOs from another producer with the purpose of speculative trading (P. K. Olsen from BKK, personal communication, February 27, 2019, Appendix H). GOs are thus sold and resold several times before being cancelled in the end-user market. This indicates that each intermediary involved in the journey of a GO from the producer to the consumer, will retain a certain fraction of the price paid by the final consumer that will therefore never reach the producer.

In order to avoid the loss of value and the lack of transparency, a producer could opt for a **bilateral trade**. This implies a direct trade between the power producer and a retailer or a public organisation. In the case of a bilateral trade, some companies seal long-term Power Purchas Agreements (PPAs) with producers for a period of several years, during which they commit to buy GOs with or without the power associated. Big companies can also enter into a bilateral trade contract with a power producer selected by a public tender (Oslo Economics, 2018). Nevertheless, although bilateral trades are ideal for producers, P. K. Olsen from BKK explains that this type of trade is not easy to establish between small producers and small consumers that do not know each other, (and it can be very costly and time consuming if a producer had to travel all over Europe to meet clients and enter into a contracts with them) (personal communication, February 27, 2019, Appendix H).

Recently, a new type of intermediary has entered the GO market. it is represented by the company Becour. Created last year, the Norwegian company Becour strives to provide more transparency and to rule out the need for other intermediaries in the GOs market. In order to do so, they offer the producers a clear pricing mechanism: 80% of the final price obtained for the sale of the GOs is redistributed to the producer and 20% is retained by the company to cover its costs. This mechanism provides transparency to the producer as well as to the customer that knows exactly who is getting the money he pays and in which proportion. To date and as far as they know, they are the only ones providing this type of pricing model (M. Mouilleron for Becour, personal communication, March 6, 2019, Appendix F).

Finally, some exchange trading used to occur in the GO market but were discontinued because they were hardly ever used. GO trading is thus today solely happening “Over the counter” (Oslo Economics, 2018).

7. Price formation

7.1. The wholesale market price formation

The price of a GO is set by the supply and the demand which can be seen as the number of GOs issued and cancelled. Due to the plethora of GOs differing in many aspects, the prices can substantially differ and are not straightforward. However, one type of GO is used as a price benchmark: the Nordic Hydro GO (Münzer, 2019). The Nordic Hydro accounts for the largest supply and demand. It is also the cheapest one and is largely consumed abroad. In fact, it generates a lot of interest among companies and electricity retailers willing to make a renewable claim at the lowest cost (N. T. Iversen & D. P. Zwick, personal communication, March 4, 2019, Appendix D). The majority of the other GOs follow the price development of Nordic Hydro, apart from the Swiss and Dutch GOs (Münzer, 2019).

In the GO market, the two main trading options used are the spot price contracts and forward contracts. They differ in the date of transfer and of payment for the GOs but both contracts settle the price on the date of the agreement (Oslo economics, 2018). P. K. Olsen from BKK explained that he is mostly working with one-year contracts but could make a contract for a delivery up to three years ahead (personal communication, February 27, 2019, Appendix H). This statement was confirmed by P. T. Ørstavik from Kinect Energy Group who further affirmed that no buyers and sellers are ready to sign a contract beyond a three-years horizon (personal communication, February 25, 2019, Appendix G). Although the wholesale market is said to be transparent, price-information is not easily accessed by market outsiders (Oslo economics, 2018). The interviews conducted with market players seem to indicate that most of them price their products based on the information shared by the brokers which we recall are considered as the most transparent market players and therefore the most reliable. Another source of pricing information used by market players are online platforms such as Montel or Greenfact (Oslo Economics, 2018). To provide some insights, the table 3 below contains the prices for the regular GO Hydro quoted by the broker STX and published on Montel.

Table 3. *STX GO Hydro Price for 2018, 2019 and 2020 (retrieved from Montel.no on March 10, 2019)*

Product	Bid	Ask	Close	Time
GO Hydro 2018	0.7	0.89	0.88	28.01.2019
GO Hydro 2019	1.35	1.45	1.45	28.01.19
GO Hydro 2020	1.42	1.51	2.2	28.01.19

M. Mouilleron from Becour describes the GO market as a small market where everybody knows each other and shares recent market developments and pricing information (personal

communication, March 6, 2019, Appendix F). Hence, based on the basic GO price information shared by the brokers, the other traders determine a price for their products covering the costs linked to the additional services they provide, the eventual compliance with some labels and ensuring their margin. Due to the high heterogeneity of the GOs products, no fixed prices exist, and they are free to price their GO-related products as they like, as well as to negotiate with producers and customers. All in all, they try to differentiate themselves in the products they sell and compete in price (N. T. Iversen & D. P. Zwick from ECOHZ, personal communication, March 4, 2019, Appendix D).

When a portfolio company makes a forward contract, it assures the agreed price on the producer side as well as on the buyer side. In other words, the price is fixed for the buyer and the seller of the GOs, the purpose of this being to avoid any risks linked to the price volatility. In fact, GO prices are highly volatile and as a result, every market player is very alert to the price development to make sure that they make the best deals and minimise the losses.

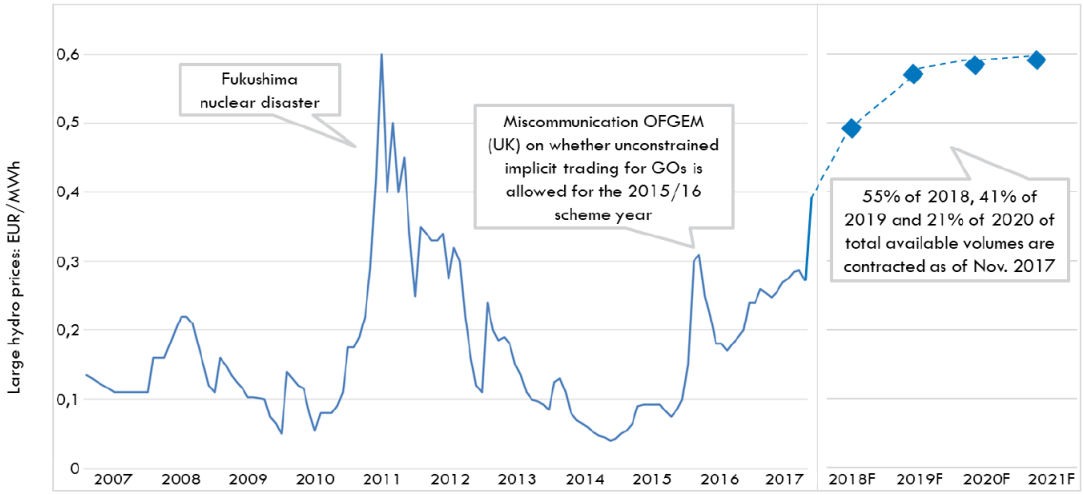


Figure 15. Price of large Nordic Hydro GO 2007-2017 and future prices for 2018-2021 (Oslo Economics, 2018, p. 21).[7]

The figure 15 depicts the price evolution of large Nordic Hydro in the wholesale market between 2007 and 2017. This graph shows that the GO price has been historically low and has been variating between 0.1 €/MWh and 0.25€ /MWh on average due to a large oversupply (Münzer, 2019). Yet, two peaks in GOs prices were recorded in history even though the increases did not last long. The first increase took place after the nuclear Fukushima disaster in 2011. The event raised the interest in green power, especially from Germany which also started a nuclear phase-out policy (Münzer, 2019). The second peak in 2015 was caused by a miscommunication of the power sector regulator in the UK which announced a regulatory

[7] Note that in this graph, numbers are set out with comma for decimals (e.g. 0,6 stands for 60 euro cents).

change that would allow British companies and consumers to buy foreign GOs and caused the demand for EECS GOs to increase consequently (Oslo Economics, 2018).

However, what this graph does not show and what was unexpected, is the huge peak in the Nordic Hydro price in September 2018, when the Nordic Hydro reached the record price of 1.96€/MWh for the first time, which was particularly exiting for the market players (P. T. Ørstavik from Kinect Energy, personal communication, February 25, 2019, Appendix G). In fact, in January 2019, Greenfact reported that 2018 had been « a historic year for green energy in Europe », they further declared: « the prices in the wholesale market for GOs reached unprecedented highs » (Münzer, 2019 p.1, para1). The surge in the Nordic Hydro price took place between the end of 2017 and September 2018. In this period, its price rose from 0.48 €/MWh to 1.96 €/MWh. This 300% increase was caused by three main factors: an increase in demand from electricity retailers committing to offer 100% of renewable energy, an increase in demand from companies eager to become greener, and a decrease in hydro production in Norway caused by a dry and hot summer. The trend reversed in autumn when significant rainfalls caused the Nordic Hydro GO price to fall around 1€/MWh. At the end of 2018, the price had slightly recovered to hit 1.24 €/MWh (Münzer, 2019).

Besides the surge in the Nordic hydro price and in all the other GOs that follow its price development, the Swiss Hydro and the Dutch Wind also encountered price increases. Contrary to most of the other GOs, these GOs are mainly consumed in their respective countries and therefore follow their own market dynamics (Münzer, 2019). The rise in the Swiss Hydro price was driven by the enforcement of "full disclosure" in the beginning of 2018. The use of GOs to disclose any energy source became mandatory so many electricity retailers hurried to buy Swiss Hydro GOs to make their mix looks better. This behavior caused the price to rise from 1 CHP/MWh early in 2017 to 5 CHP/MWh at the end of 2017 to finally level off at 3 to 4 CHF/MWh in 2018 (Münzer, 2019). With respect to the Dutch Wind GO, the latter was priced above 8 €/MWh in February 2019. Corresponding to an increase of more than 80% compared to the 2017 price level, the three major underlying causes were: a relatively slow growth in supply, climate change sensitive customers and the use of an effective Corporate Social Responsibility instruments (CO2-ladder) (Münzer, 2019).

The GO price being obviously very volatile, it was attempted to see if there were any correlation between the wholesale Nordic Hydro GO price and the wholesale power price. In order to provide some insights, the development of the power price in the wholesale market in Norway between 2007 and 2017 was analysed. The following line chart (figure 16) shows the wholesale

price evolution in Norwegian kroner per MWh. Although, it is not depicted in €/MWh as in figure 15 on GOs, the upward- and downward-sloping trends of both price developments can be compared. It appears that the wholesale Nordic Hydro GO price does not follow the wholesale power price, the volatility of GOs prices does thus not add up to the volatility of power faced by the power producers.

Figure 16. Wholesale electricity price in Norway 2007-2017. (Reproduced based on the data from Statistics Norway, https://www.ssb.no)

7.2. The end-user markets price formation

It is not an easy task for a market outsider to get access to the GOs' wholesale pricing information and an end-consumer is even more unlikely to be aware of the price of the different GOs that he buys or could possibly buy. The reason lies in that most of the end-consumers receive GOs included in an electricity tariff or in a package containing other attributes as well, resulting in a non-explicit pricing of GOs. This is the case for most eco-labels. The latter differ in what they offer and projects they support and makes it almost impossible for consumers to know the real price of the GOs involved. Similarly, different levels of transparency also prevail in the case of companies or electricity retailers buying GOs to cover their activities. Some of them tend not to publish the GO price linked to their renewable claim and to not charge an explicit premium for their renewable claim (Oslo economics, 2018). Oslo economic (2018) cites as an example, an explicit pricing case where 70% of the GO price charged to the customer went to the electricity retailer to cover its marketing and procurement expenses as well as its margin.

8. Volume traded

Every quarter, the AIB publishes the annual statistics for the EECS GO transactions.[8] Two methods are used to display the data[9]:

*a. by production date***:** the number of GOs issued, cancelled and expired are recorded according to the date of the production of the electricity.

*b. by transaction date***:** the number of GOs issued, cancelled, expired, exported and imported are recorded according to the date of the transaction, i.e. without considering the timing of production of the related electricity (AIB, n.d.c). For instance, a GO could be issued in 2019 for a production that took place end of 2018, if the generator only requests the GO for that production in 2019. In that case, this GOs would be counted in the issuance volume of the year 2019 by transaction year but in the issuance volume of 2018 by production year.

The figures 17 and 18 below are the annual GO statistics for the whole market displayed by production date and by transaction date and published by the AIB (AIB, n.d.d.). The "tranfers" in the figure 18 refer to GOs transferred within a country and the "imports" refer to the GOs imported or more simply the GOs transferred internationally.

As outlined in the two figures, GO activity has been increasing over time which has been noticed with enthusiasm by the AIB members, who see this trend as progress towards increasingly reliable disclosures. The number of expired GOs has also been decreasing[10], which might indicate the possible near end of an era of oversupply, making way for an equilibrium between the supply and the demand. In fact, the growing volume of cancellations reflects the increasing demand for GOs and the increase in price that follows. Note that in both figures 17 and 18, the volume of GOs cancelled and expired together represent less than the issuance volume, indicating the existence of a GO inventory each year. This simply comes from that GOs have a lifetime of 12 months from the date at which the corresponding electricity was produced and hence do not have to be cancelled in the same calendar year.

[8] GOs transaction by AIB members only

[9] Note that GO exports and imports can only be reported by transaction date. Choosing between displaying the GOs by production date or transaction date is thus only necessary for the issuance, cancellation and expiration statistics. Moreover, although the statistics obtained by the two methods differ on a yearly basis, in a longer time span, if well implemented, the differences should fade.

[10] Note however, that there will always be some expired GOs. In fact, since suppliers are legally obliged to back their supply by GOs and cannot predict the exact amount of energy that they will sell during the year, they hedge by retaining slightly more GOs than their forecasted need (P. Moody, email, February 12, 2019, Appendix J).

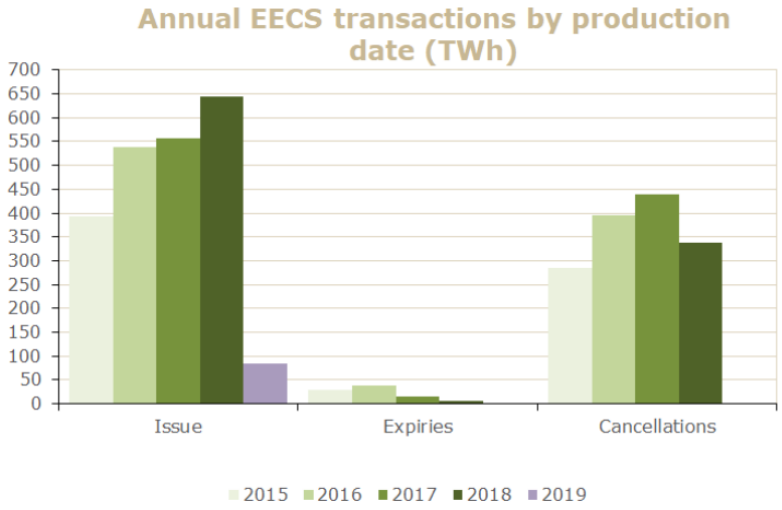


Figure 17. Annual EECS transactions by production date in TWh (AIB, n.d.d.).

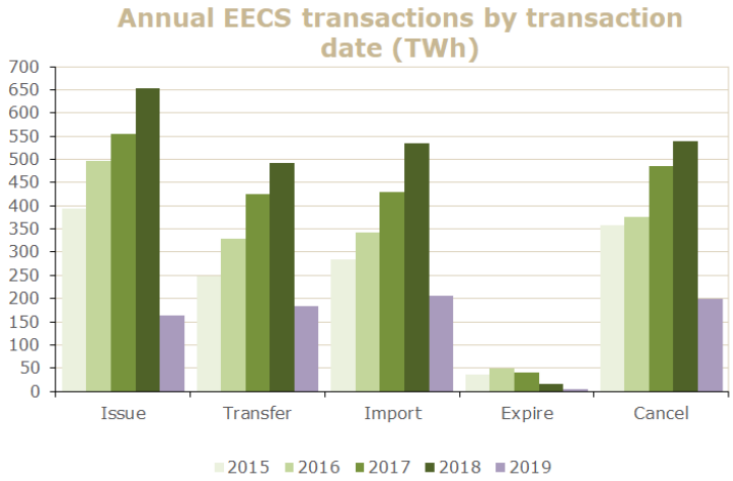


Figure 18. Annual EECS transaction by transaction date in TWh (AIB, n.d.d.).

In overall, the growth in the GOs' activity is due to an increase in the activity among current members as well as due to the enlargement of the membership taking part in the hub (AIB, 2018d).

It is worthy to note that all charts relating to AIB data presented in this chapter account for GOs issued for non-renewable sources as well. GOs issued (by transaction date) for nuclear and fossil sources amounted together to 7% of the total issuance volume in 2018 (by transaction date) (AIB, 2019b).

The following bar chart in figure 19 represents the volume of GOs issued and cancelled by transaction date per country in 2018. We can see that the three major issuers of GOs in 2018 were Norway, Spain and Italy whereas the three major consumers of GOs were Germany, Spain

and Switzerland. The difference between the number of GOs issued and cancelled in each country reveals the extensive trade that prevails in this market.

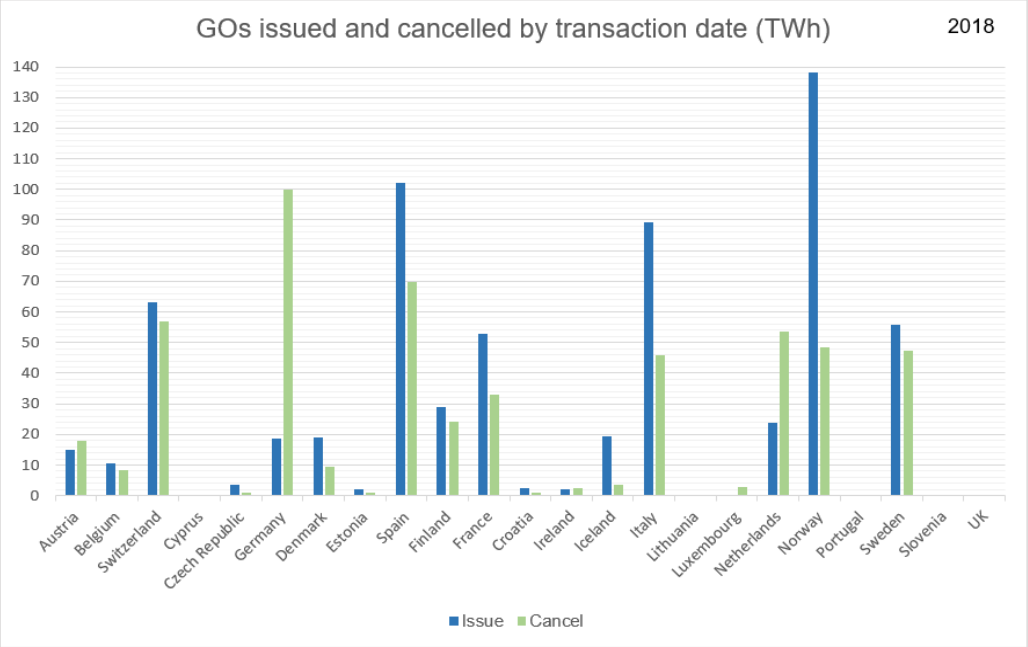


Figure 19. GOs issued and cancelled by transaction date in TWh in 2018 (based on figures from AIB, 2019b).

When it comes to the cross-border trade, in 2018, the three largest importers of GOs were Norway, Germany and Belgium and the three largest exporters were Norway, Italy and Sweden (cfr. figure 20). At first glance, it may seem odd that some countries import and export GOs in the same year. This simply outlines that GOs are transferred between countries based on the advantages in transactions fees and registry facilities that can be taken (AIB, 2018d). It is also probably the case that a country's imports and exports differ in the nature of the GOs. Note here that although Norway was the biggest importer of GOs in 2018, as stated in the chapter 5, most of its import value was mainly reexported and part of it expired, resulting in a very low consumption. Consequently, in the case of Norway, the large import volume does not signal a high demand and willingness to pay for GOs.

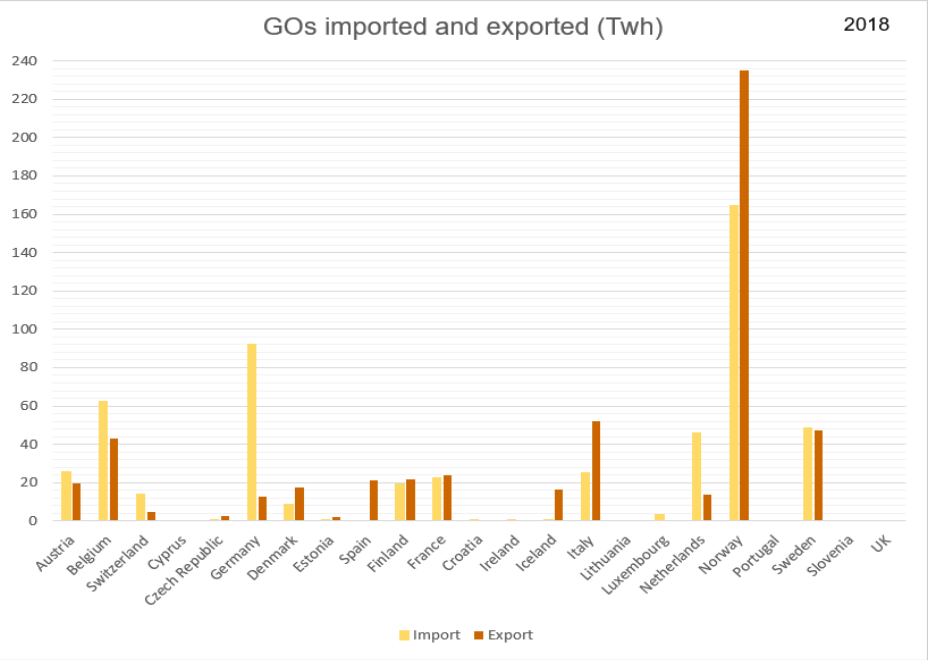


Figure 20. GOs imported and exported (TWh) per country in 2018 (based on figures from AIB, 2019b)

As regards to the nature of the GOs issued, the pie chart below (figure 21) shows that hydropower takes the lion share followed by wind and biomass. This chart captures the GOs mix of 2018, but a similar trend was observed for the previous years.

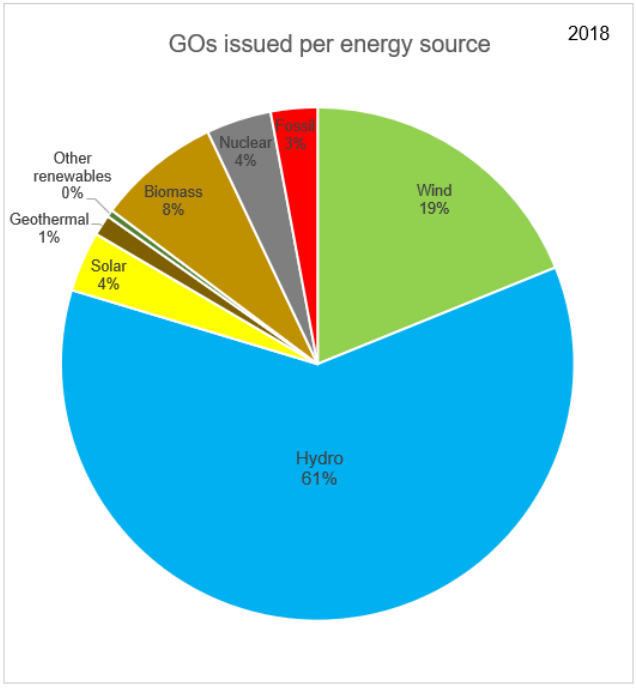
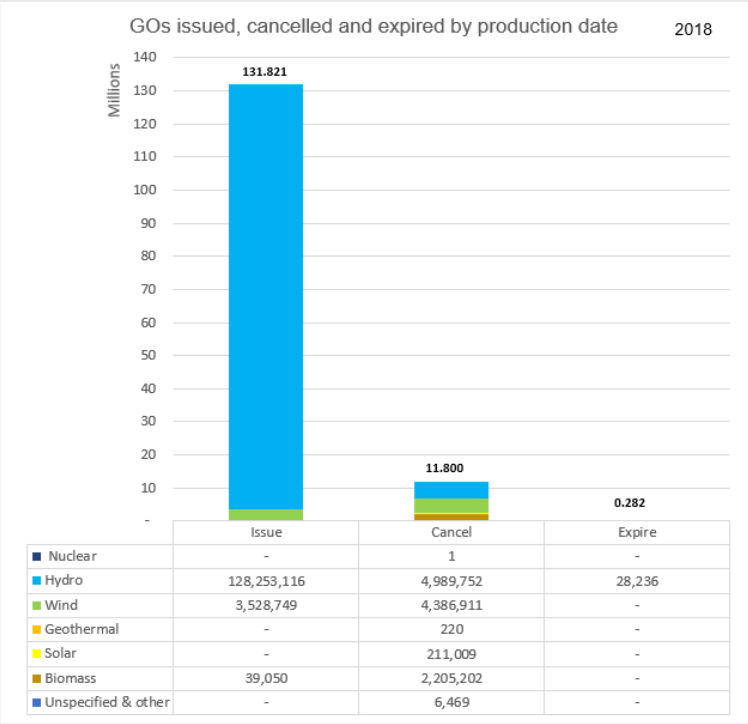


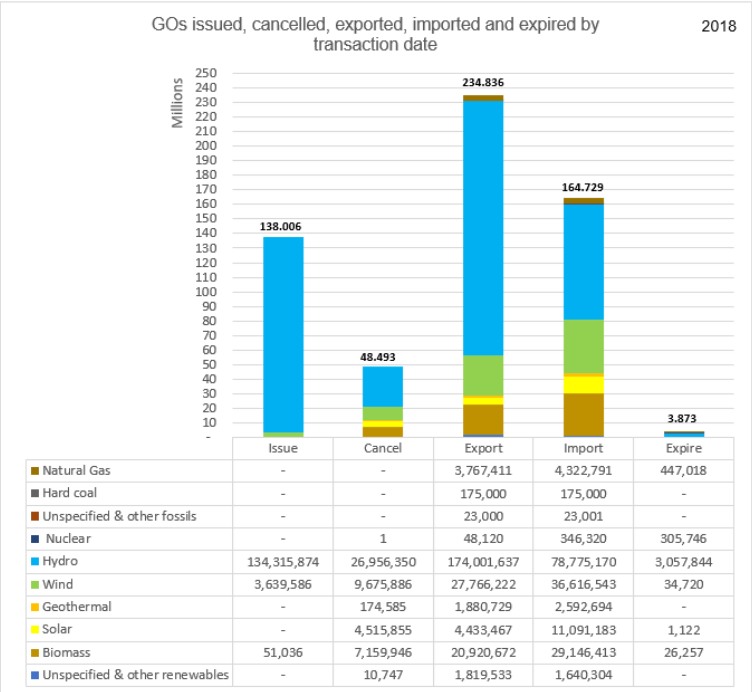
Figure 21. Share of GOs issued per energy sources in 2018 (based on figures from AIB, 2019b).

8.1. The GO market in Norway



	Issue	Cancel	Expire
Nuclear	-	1	-
Hydro	128,253,116	4,989,752	28,236
Wind	3,528,749	4,386,911	-
Geothermal	-	220	-
Solar	-	211,009	-
Biomass	39,050	2,205,202	-
Unspecified & other	-	6,469	-

Figure 22. GOs issued, cancelled and expired by production date in 2018 in Norway (based on figures from AIB, 2019b).



	Issue	Cancel	Export	Import	Expire
Natural Gas	-	-	3,767,411	4,322,791	447,018
Hard coal	-	-	175,000	175,000	-
Unspecified & other fossils	-	-	23,000	23,001	-
Nuclear	-	1	48,120	346,320	305,746
Hydro	134,315,874	26,956,350	174,001,637	78,775,170	3,057,844
Wind	3,639,586	9,675,886	27,766,222	36,616,543	34,720
Geothermal	-	174,585	1,880,729	2,592,694	-
Solar	-	4,515,855	4,433,467	11,091,183	1,122
Biomass	51,036	7,159,946	20,920,672	29,146,413	26,257
Unspecified & other renewables	-	10,747	1,819,533	1,640,304	-

Figure 23. GOs issued, cancelled, exported, imported and expired by transaction date in 2018 in Norw*ay* (based on figures from AIB, 2019b).

As it can be seen from the two bar charts above (figures 22 & 23), the methodology used to display the data has a high impact on the GOs' statistics. Still, both methods are interesting as

they display different facets of the market. To understand this, Phil Moody, Secretary General of the AIB suggests an analogy with groceries: « the consumers want to know how fresh the products are, i.e. they look at the data by production date, whereas store managers are interested in when the sales happen and therefore look at the data by transaction date » (P. Moody, email, February 26, 2019, Appendix J, p. 147).

Another important aspect that comes into play when analysing the GOs statistics provided by the AIB, and that has not been raised until now, is the ex-domain cancellations. Ex-domain cancellations refer to cancellations made in a country for GOs transferred and consumed in another country. Usually, ex-domain cancellations happen when the beneficiaries are not part of the EECS system (not a member of the AIB) and thereby cannot import the GOs accurately in an electronic registry. All AIB member countries are for their part, requested to transfer the GOs via the Hub and ex-domain cancellations are hence prohibited between AIB members countries unless it is momentary and rectified afterwards (Grexel, n.d.a). Albeit ex-domain cancellations are not frequent, Norway accounted for 63% of the total ex-domain cancellation volume in 2018 (AIB, 2019a).

Table 4. *Ex-Domain Cancellations in 2018 in Norway (AIB, 2019a).*

Ex-Domain cancellations 2018	
Destination	Norway
UK	21,303,765
Poland	375,034
Hungary	151,431
Russia	145,199
Portugal	74,289
Greece	56,162
Romania	48,062
Slovakia	43,582
Serbia	42,424
Bulgaria	37,000
Albania	29,685
Lithuania	**29,370**
United States	20,622
Saudi Arabia	9,307
Sweden	**8,479**
Peru	8,000
Latvia	7,564
Ukraine	3,632
Brazil	1,100
Turkey	1,096
Chile	900
United Arab Emirates	73
Australia	38
Bosnia	5
TOTAL	**22,396,819**

EDCs to member countries
EDCs to European non-member countries
EDCs outside of Europe

The table 4 summarises the volume that was cancelled in Norway per destination country. As it can be seen, although prohibited, ex-domain cancellations occurred with two AIB member countries. The ex-domain cancellation to Sweden was due to technical difficulties in exporting GOs and in the case of Lithuania, it was due to the fact that Litgrid, the transmission operator

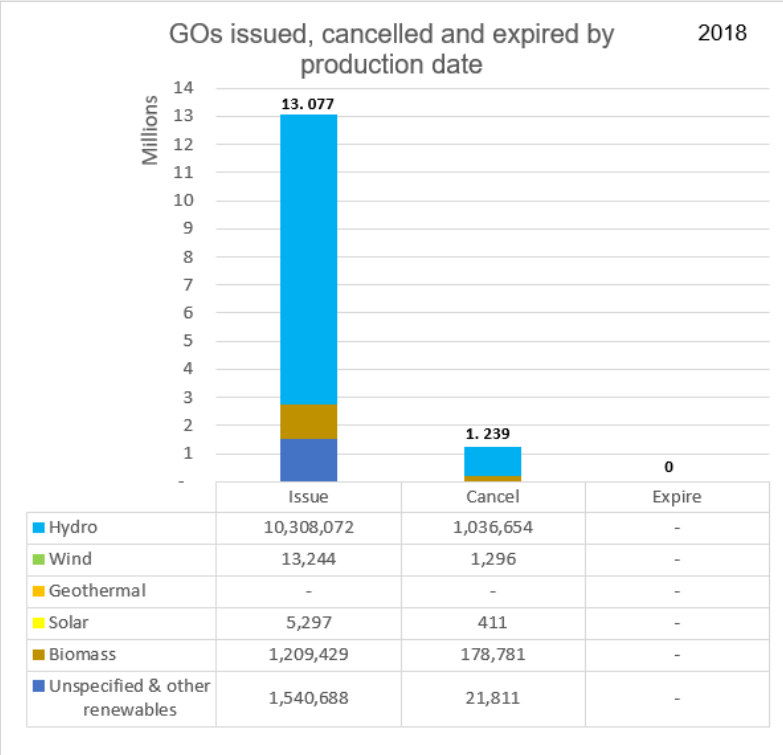
and the Issuing body of Lithuania, were not connected to the HUB before summer 2018 but this is now being rectified (AIB, 2019a).

Consequently, to have an accurate idea of the cancellation volume due to Norwegian consumption, the total of 22,396,819 GOs has to be substracted from the cancellation volume in the two charts above[11] . This resulting lowered cancellation volume further ascertains the very low interest in GOs from the Norwegian industries, businesses and private households that had been identified in the third theme of the literature review. Oslo Economics estimated in June 2018 that households and businesses were buying GOs for less than 100 million Norwegian kroner per year (Greenfact, 2018). Greenfact also pointed out a phenomenon of double perception. Knowing that 98% of their Production Mix is renewable (in 2017), Norwegians tend to think that their consumption is necessarily green (Greenfact, 2018), whereas in fact the renewable share in the Total Supplier Mix accounts for 25.76% only (share in 2017). This double perception problem leads some businesses to claim that they consume renewable energy thought it is not according to the GO system (Greenfact, 2018). Another assumption could simply be that consumers are not willing to pay more for green electricity and therefore do not, since it is voluntary. This is consistent with the fact that the largest buyers of GOs are businesses.

The system is however well understood by the producers who are largely benefiting from the GO system. Recall that in Norway any generator is free to request a GO for the production of one MWh regardless of the energy source produced and if the installation benefits from Elcertificates or not. The study conducted by Oslo Economics estimated that up to NOK 1 billion of additional income were generated to power producers thanks to GOs (Greenfact, 2018).

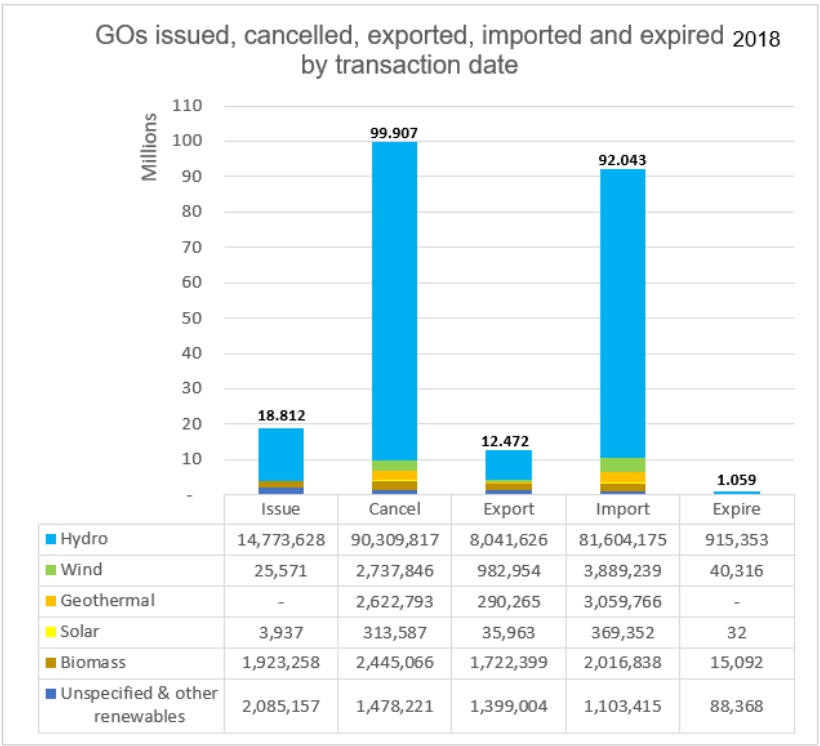
[11] Although the ex-domain cancellations are here accounted as cancellations, the RE-DISS II Method for the calculation of the Final Residual mix presented in chapter 3 requires them to be accounted as exports. The Production Mix, Final Residual Mix and Total Supplier Mix presented for Norway in chapter 3 has been published by the AIB and should be thus be consistent with this rule.

8.2. The GO market in Germany



	Issue	Cancel	Expire
Hydro	10,308,072	1,036,654	-
Wind	13,244	1,296	-
Geothermal	-	-	-
Solar	5,297	411	-
Biomass	1,209,429	178,781	-
Unspecified & other renewables	1,540,688	21,811	-

Figure 24. GOs issued, cancelled and expired by production date in Germany in 2018 (based on figures from AIB, 2019b).



	Issue	Cancel	Export	Import	Expire
Hydro	14,773,628	90,309,817	8,041,626	81,604,175	915,353
Wind	25,571	2,737,846	982,954	3,889,239	40,316
Geothermal	-	2,622,793	290,265	3,059,766	-
Solar	3,937	313,587	35,963	369,352	32
Biomass	1,923,258	2,445,066	1,722,399	2,016,838	15,092
Unspecified & other renewables	2,085,157	1,478,221	1,399,004	1,103,415	88,368

*Figure 25.*GOs issued, cancelled, exported, imported and expired by transaction date in Germany in 2018 (based on figures from AIB, 2019b).

The difference between the two data collection methods is even more glaring in the case of Germany (cfr. figures 24 & 25). Those two graphs illustrate that the German law indeed prohibits the issuance and trade of GOs other than from renewable sources. Another unusual particularity is that they only accept GOs from AIB members that are connected to the European grid, import of Icelandic GOs are for instance forbidden (P. T. Ørstavik from Kinect Energy, personal communication, February 25, 2019, Appendix G).

The figure 25 also shows a striking difference between the number of GOs issued and cancelled which is due to the fact that no GOs can be issued to supported production. Most of the German renewable production indeed benefits from subsidies which justifies the large volume of GOs imported. Moreover, the nature of the GOs imported let us think that they mainly import Nordic Hydro since 89% of the GOs imported are from hydroelectric sources.

Regarding the issuance volume, it can be observed that the vast majority of GOs issued are from hydropower, whereas it was shown before that Germany was mostly producing wind power and solar power. The support scheme mainly used in Germany so far was the Feed-in tariff (FIT). A FIT basically ensures a fixed remuneration above the power price for a certain duration. The FIT system has been reviewed several times, but most installations were offered a FIT for 20 years. Roland Kok from Innogy explains that the FIT revenue per MWh varies depending on the renewable sources but is in any case significantly higher than the GO revenue. The FIT price is usually a two-digit number whereas it was shown above that the GO price is very low. For that reason, no renewable German producer would ask for GOs instead of the FIT (R. Kok from Innogy, personal communication, May 8, 2019, Appendix E). Based on that, we can assume that the GOs are mainly issued for hydropower because those are the facilities have run out of subsidies.

Although FITs are still in use today due to their long duration period, Germany switched to auctions in response to the European Commission call for a harmonisation of the renewable energy policies across MS in 2014 (The Heinrich Böll Foundation, n.d.). Hence, fixed premiums are granted to installations by a tendering scheme. The major difference with the previous system is that renewable electricity targets cannot be surpassed anymore (The Heinrich Böll Foundation, n.d.). Nevertheless, small power plant up to 100 kW can still benefit from a FIT. Different programs also offer low interest loans for investments in new plants and an additional subsidy is provided for the installation of flexible biogas capacities (Legal Sources on Renewable Energy, n.d.).

The choice made by the German government not to issue GOs to the generators benefiting from state subsidies was motivated by the idea of letting the society benefit from those GOs. R. Kok from Innogy explains that the GOs for the supported production are still issued but kept by the government. They are thus non-tradable and do not appear in the GO statistics. In return, each German citizen is ensured to have a least a fraction of renewable electricity corresponding to the supported production on their energy bills. Then, if they want to have a 100% renewable electricity consumption, their electricity retailer has to buy GOs to make up the difference (R. Kok, personal communication, May 8, 2019, Appendix E).

Even if this system ensures the German citizens to have at least part of their electricity consumption documented as from renewable sources, this seems not enough for them. The large volume of GO cancelled shows their large interest in consuming renewable energy. When it comes to the nature of the GOs demanded, many German consumers opt for the Nordic Hydro GOs allowing them to make a renewable claim at the lowest cost. In fact, regardless of the countries, the Nordic Hydro GO is the most demanded on the market (M. Mouilleron from Becour, personal communication, March 6, 2019, Appendix F). However, ECOHZ and another big German market player (willing to remain anonymous) both also describe the German GOs buyers as being keen on certified GOs. It really matters for them to have a third party verifying the quality of a GO product (N. T. Iversen & D. P. Zwick from ECOHZ, personal communication, March 4, 2019, Appendix D). Therefore, a large fraction of the GOs are sold in eco-labels and the demand for GO-labels has been steadily increasing over time. More precisely, the GO-labels the most sold in Germany are: TÜV Nord, TÜV Süd, TÜV Rheinland RenewablePLUS and ok-power (Anonymous market player).

TÜV Nord A75 is a German label directed at the promotion of renewable energy from new power plants. In order to be eligible for that certification, a power plant must besides producing 100% of renewable energy free from any government support, fulfill one of the two following criteria: an investment of 2.5 €/MWh must be provided for the construction of new renewable energy generation or, a minimum of 33% of the total renewable production must be produced from a new power plant or upgraded less than 6 years ago (ECOHZ, n.d.c).

Regarding the TÜV SÜD labels, many different categories exist, the most traded being inter alia the TÜV SÜD EE01, EE02 or EE+. Each of these sub-categories has its own specific requirements. The TÜV SÜD EE01 label for instance requires a minimum of 25% of production from a recently built production facility (TÜV SUD Industrie Service, 2012).

TÜV Rheinland RenewablePLUS is a label that ensures that the full income generated by GOs certified as such is reinvested in new power plants and/or in increasing the capacity of existing facilities and/or voluntary ecological measures related to the generation of renewable electricity (TÜVRheinland, n.d.).

Finally, to be eligible for OK-Power, electricity products and providers must ensure that the electricity is 100% renewable, free of governmental support and that they have no stake in nuclear or coal power plant (ECOHZ, n.d.d).

In conclusion, those labels clearly point out that German consumers particularly value GOs contributing to additionality (which is ensure by the labels), and therefore strive to increase the uptake of renewables in the global energy transition.

9. Future Outlook

9.1. Changes brought by the new Directive 2018/2001

The new Directive enforced in December 2018 brought some modifications to the GO system which have to be implemented by the MS within two years.

In fact, the GO activity is expected to rise following up an important word change in the Directive. The new Directive stipulates that electricity retailers *shall* use GOs to prove the share of renewable electricity they sell. Changing the word *may* to *shall* makes the use of GOs mandatory for any renewable claim and disclosure (Council Directive 2018/2001, Article 19(18)).

The new Directive also extends the GO system to renewable gases such as biomethane and hydrogen and still allows MS to implement full disclosure if they wish to do so. When it comes to the supported renewable electricity, it is still left to MS to decide if they allow the issuance of GOs for supported electricity. Yet, if GOs are issued for supported production, the new Directive requires the market value of the GOs to be accordingly considered in the relevant support scheme (Council Directive 2018/2001, Article 19(2)). For instance, for support schemes in the form of a tendering procedure or tradable green certificates, if the producers consider the value of GOs while making their bids, it will lower the need for financial support and avoid overcompensation (Joint statement on Guarantees of Origin, 2018).

The Directive also allows for the issuance of GOs directly to the electricity retailers or consumers who buy the renewable electricity in the competitive market or via a long-term purchase agreement. Furthermore, MS have as a possible option to issue a GO to a producer and to cancel it right away. Doing this implies that no GO trading is taking place. N. T. Iversen & D. P. Zwick from ECOHZ illustrated these options by means of two examples. First, taking the case of Germany where most of the producers of renewable electricity benefit a from support scheme, it could be decided that the GOs are issued directly to the retailers or end-consumers and cancelled directly when consumed. This would allow the renewable attributes to be disclosed with GOs without “subsiding twice” the supported producers, i.e. by providing an additional GO revenue on top of the financial support. The second option, consisting in issuing GOs to a producer and to cancel those directly, can be a solution for producers consuming their entire production. N. T. Iversen & D. P. Zwick give, as an example, a citizen producing electricity by means of a solar panel on the rooftop. He would usually consume his whole

production. Issuing the GOs for that example and cancelling those right away would allow to keep track of this renewable production which does not show up in the statistics today.

When it comes to lifecycle of the GOs, their validity period will remain 12 months from the production of the corresponding electricity, but companies and retailers will have up to six months after the end of the validity period to cancel them. Hence, MS shall make sure that the GOs not cancelled, expire within a maximum period of 18 months from the electricity production date. Furthermore, MS are now required to enclose the volume of expired GO in their RM computation (Council Directive 2018/2001, 2018, Art 19(3)). This was already the case in the methodology developed by the REDISS II project, but since MS are free to recalculate their RM and Supplier Mix themselves, it was not applied to all. Those changes bring more harmonisation across the different MS.

9.2. Future trends for the volumes

The GO trading activity is jointly predicted to keep increasing. Like in the last few years, an increase in both the supply and the demand is expected for the years to come but at a higher pace according to Greenfact (Münzer, 2019). The supply in GOs is expected to increase as a result of investments in new renewable power plants driven by the renewable energy targets set by the EU. Those have proven to be more and more ambitious over time. The renewable target set for 2020 is a share of 20% from renewable energy in the Union's gross consumption and the target for 2030 has been raised to a minimum of 32%. In a long-term perspective, the EU has set as an objective for 2050, a reduction of the greenhouse gas emissions by 80 to 100% in comparison to the 1990 levels (European Commission, 2018). This will undoubtedly require significant investments in renewable energy hand in hand with an upgrading of the grid infrastructure and a higher interconnectivity. As a matter of fact, in 2014, the European Council urged the MS to have an interconnection capacity equivalent to minimum 10% of their installed electricity production capacity by 2020 (European Commission, n.d.b). At the present time, a subsea cable is being built between Germany and Norway. The latter will be 623 km long, have a 1,400 MW capacity and is expected to be ready to operate in 2020 (Statnett, 2018). A second subsea cable meant to connect Norway and the United Kingdom is also under construction since 2015. The completion year is expected to be 2021. 700 km long, this cable will have a capacity of 1,400 MW as well (Statnett, n.d.).

The location of the physical interconnections does not matter for the GO market since GOs can be transferred independently of the physical power. Nevertheless, new interconnections signal

an increase in the physical capacity of the market which is necessary to support an increase in the renewable production which will in turn results in a larger production volume eligible for GOs and hence in an inflow of new GOs. Although this inflow will be partly limited due to non-certifiable supported production, the volume of new GOs is still expected to be promising. As a matter of facts, the first subsidy-free projects have shown up, mainly thanks to the falling cost of wind and solar, and are spreading across Europe (IEEFA.org, 2018).

Currently wind power capacity is growing overall in Europe (P. T. Ørstavik from Kinect Energy, personal communication, February 25, 2019, Appendix G). This will give rise to GOs from new generation power which are higher-priced, some of them will also contribute to additionality. In the same vein, P. K. Olsen from BKK also mentioned the local feature of these incoming GOs. Being partly produced closer to where the customers live, people might be more willing to buy local GOs which could result in a decrease in the demand for Nordic Hydro (personal communication, February 27, 2019, Appendix H).

When it comes to the demand for GOs, the regulatory measures taken by the EU to fight climate change and promote renewable energy sources are reflected in the board meetings of companies that are increasingly taking measures to reduce their environmental impact. As mentioned earlier, the number of businesses joining the RE100 initiative is continuously increasing and together they contribute to a very large demand for GOs. More and more companies use GOs and green labels built on GOs in their sustainability reports (P. T. Ørstavik from Kinect Energy, personal communication, February 25, 2019, Appendix G). Besides, they also express a growing demand for GOs contributing to additionality that are now offered by traders in various options and packages (Oslo Economics, 2018).

Last but not least, the obligation to use GOs for any renewable claim enforced in the new Directive 2018/2001, will beyond shadow of a doubt, increase the demand for GOs from electricity retailers. And the possibility to issue GOs for supported productions if not traded on the market, will inflate the statistics as well.

9.2.1. Future volume in Norway

Norway has historically been a world leader in sustainable energy and is expected to stay so. Thanks to its Production Mix made up of 98% of renewable energy, Norway has developed solid competences in the renewable energy sector. Besides they have a high-quality education, science parks, business incubators and strong clusters (Innovation Norway, n.d.). The Norwegian Government has enlarged its support for renewable energy from NOK 495 million

in 2017 to more than 1 billion in 2019 which is more than a twofold increase. In addition, the Government is also increasing its contribution towards Nordfund which is the Norwegian Investment Fund for Developing Countries. All in all, NOK 1.875 billion in new assets will be remitted to the Nordfund in 2019 (Government.no., 2018).

In this context, the investments in renewable energy in Norway will keep increasing. The major investments are mostly directed to wind power which experienced an increase in power delivery of 22% between 2017 and 2018. At the moment, Europe's largest onshore wind power infrastructure is being built in Norway, called "Fosen Vind" this project is composed of six wind farms and will deliver a total production of 3400 GWh from 2020 (Statkraft, n.d.). An inquiry of commitments by private and state agents revealed that Norway's export in renewable energy should increase 8-fold by 2030 driven by the wind and solar sector (Osmundsen, 2019).

Another factor attracting foreign investors are to the favorable conditions for hydropower and wind power. For instance, the city of Munich in Germany is willing to finance wind power in Norway. Munich has as a goal to reach 100% of renewable electricity by 2025. Since it is impossible for Munich to achieve the necessary renewable electricity production on its own, the city is willing to invest in wind power in Norway and export the power from there to Germany. This project and other wind farms in general are however not welcomed with open arms by some Norwegians who protest about the shrinking wilderness in Norway caused by the building of windfarms in sensitive areas (Paraskova, 2019).

Norway, and broadly speaking Scandinavia, are also particularly attractive for corporate PPAs (PPAs signed between a company and a producer). In 2018, the corporate PPAs signed for wind in Sweden and Norway amounted to a total volume of 1.4 GW which corresponds to the sum of corporate PPAs signed in the rest of Europe in 2017. The reasons lying behind this attractiveness are the stability of the political environment and low costs. A large demand for PPAs comes from companies willing to establish their data centers in Scandinavia (Froese, 2018). For instance, this is the case for Google that signed a 12-years PPA in 2016 with the wind farm of Tellenes while it was still under construction (Lindblom, 2016). Similarly, Facebook signed a 294 MW wind PPA in Norway last May. It has committed to buy 1000 GWh per year for the 15 next years and will use the power to run its Nordic datacenters (Shumkov, 2018). Although popular to power energy-intensive datacenters, PPAs are attractive to other types of businesses as well. As an example, the aluminum company Alcoa signed its third PPA in Norway last summer. This time they have committed to purchase the production from a 197.4 MW wind farm located near Florø. This PPA will last 15 years from the commissioning date

of the power plant which is expected for 2020 (Wind Europe, 2018). As illustrated in the above examples, PPAs are often signed prior to investments and therefore carry weight in the investment decisions. They are seen as a good solution for subsidy-free projects since they ensure a continuous revenue for the producer and a long-term attractive power price for the corporate buyer which can in addition use the corresponding GOs for its renewable claims (Froese, 2018).

Elcertificates which form the joint support scheme used in Sweden and Norway, used to carry weight in investment decisions. As a reminder, an Elcertificate is a technology-neutral certificate granted to producers per MWh of renewable production. Electricity retailers and some consumers are then obliged to buy a certain quota of Elcertificates set by the government (Energy fact Norway, n.d.). Given their high price in the past, Elcertificates played a major role in renewable investments in Norway. The figure 26 below depicts the price evolution of the Elcertificates between 2003-2015. The highest price was reached in 2008, where the Elcerts were valued above 300 NOK/MWh.[12]

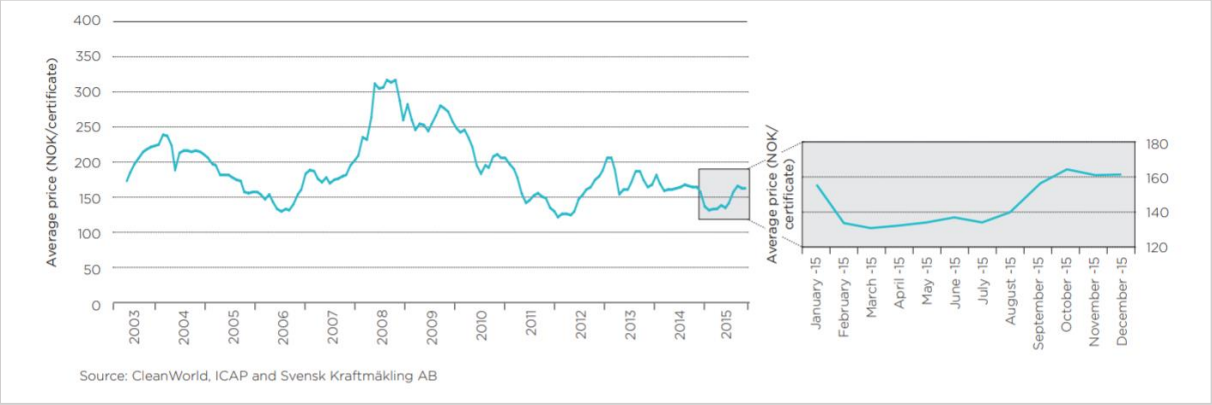


Figure 26. Elcertificate prices 2003-2015 (NVE & Energimyndigheten, 2015, p.27).

Although their value used to be very interesting for the producers, the trend is now changing. Meant to be terminated in 2036, the quota of Elcertificates set by the government is planned to be raised incrementally until 2020 and will then be decreased progressively until 2036. The

[12] As an indication, this is equivalent to more than €37.5 at the exchange rate from June 2008 published by Thomson & Reuters (8 NOK/EUR).

price that follows is intentionally decreasing over time. The table below shows the Elcertificates price in SEK/MWh quoted by the broker Cleanworld and published on Montel (Montel, 2019).[13]

Table 5. *Cleanworld Elcertificates prices in SEK/MWh for 2019, 2020, 2021, 2022, 2023 and 2024 (retrieved from Montel.no on May 3, 2019).*

Product	Bid	Ask	Close	Time
Elcertificate Spot	52.00	55.00	53.00	02.05.2019
Elcertificate March-20	53.00	57.00	56.00	09:01
Elcertificate March-21	24.00	26.00	25.00	08:50
Elcertificate March-22	15.00	19.00	17.00	25.04.19
Elcertificate March-23	9.00	13.00	12.00	17.04.19
Elcertificate March-24	8.00	13.00	11.00	17.04.19

Moreover, Elcertificates are issued upon stricter conditions than the GOs meaning that less power producers are eligible for Elcertificates compared to GOs. For instance, the total volume of Elcerts issued in Norway is 2015 was 2.8 million (NVE & Energimyndigheten, 2015) compared to 134.7 million of GOs (AIB, 2019b). All in all, Elcertificates played a critical role in renewable investments but the situation is changing, they are expected to have a small positive impact in the very short term but not at all in the long term.

The link between the renewable investments and the volume of GOs is straightforward. In Norway, GOs can be issued for any renewable production regardless of if it was supported or not. That is to say, all the investments in renewable, inevitably lead to new GOs. With the growing number of investments in wind power facilitated by corporate PPAs agreed prior investments, we can expect a higher share of GOs from wind power.

9.2.2. Future volume in Germany

Like in Norway many investments in renewables are taking place in Germany and this trend is set to continue. Germany comes in the 5th position of Bloomberg's 2018 global renewable investment ranking after China, the US, Japan and India, and for a total investment of 10.5 billion dollars in renewable energy (Amelang, 2019).

Another strong signal for increasing renewable investments in the near future comes from a decision taken this January (2019) when Germany has announced the shutdown of all its coal power plants by 2038 (Wacket, 2019).

Accordingly, if it is clear that a lot of new renewable projects will flourish in Germany, the amount of GOs resulting from those investments is less certain because GOs are banned from

[13] As an indication, the exchange rate of the 12th of May 2019 published by Reuters is 1.1032 SEK/NOK and and 10.7964 SEK/EUR. For instance, the close price for 2021 is SEK 25, NOK 22.66 or €2.31.

being issued to supported production. The volume of new GOs will hence depend on the support scheme allocation. Nevertheless, a growing number of GOs issued is still expected. As a matter of fact, in 2020 4.4 GW of German onshore wind will stop receiving the FIT from the government. Most of the windfarms in Germany have been constructed under the EEG Act which ensured them a fixed annual subsidy for 20 years. This period is about to end for most of the windfarms and a total of 16 GW will drop out the 20-year support scheme by 2025. For small windfarms, taking part in the wholesale market and being able to face the volatility of the power prices can be a challenge. PPAs may then represent the perfect opportunity for them. The power producer can continue to benefit from a fixed revenue whereas the buyers benefit from a relatively cheap power price[14] and can use the associated GOs (Knight, 2018).

Statkraft has taken the lead by signing several PPAs with wind parks going out of the EEG-subsidy scheme in 2020. The Norwegian company already contracted for a total capacity of 46 MW and is willing to sign additional PPAs to reach a contracted capacity up to 4 GW. The contract duration that Statkraft is looking for is between one and six years, the contract terms being mainly dependent on whether the power producers are seeking to extend or renew the installations which would require them to apply for new subsidies at an auction (Kamprath Buli, 2018). Regarding the 46 MW PPA, Statkraft has made another contract with Mercedez-Benz which committed to purchase this volume, making the car maker the first company to have signed a PPA in Germany (Jovanovic, 2019).

When it comes to the implications for the volume of GOs, the windfarms dropping out the EEG-scheme will be responsible for a higher issuance volume, whereas the effect of new investments is uncertain and will depend on whether they are support-free or not.

9.3. Evolution of the prices

The price of the different GOs are set by their respective demand and supply and is hence specific to each GO type. The opinions of the traders diverge when it comes to the future prediction of price, some think that the demand and supply will increase at a similar pace, reaching an equilibrium (P. K. Olsen from BKK, personal communication, February 27, 2019, Appendix H), and others think that the demand will increase slightly faster, resulting in higher GO price (M. Mouilleron from Becour, personal communication, March 6, 2019, Appendix F). Furthermore, the anonymous trader mentioned in the interview an expected increase in price

[14] Note that the fixed price can be revised upwards or downwards in accordance with the wholesale price before the contract effectively comes into effect (Knight, 2018).

fluctuations, hedging and speculations caused by more draughts and extreme weather conditions.

9.4. Evolution of the GO trading environment

The GO trading activity may also be organised differently in the future. One of the major flaws in the GO market is the lack of transparency. Although brokers provide transparency and hence are the major source of information, we have seen that GOs are traded several times before ending up in the hands of an end-consumer. Most of the time, the GOs also go through portfolio companies that bundle them with other criteria and then sell them in a final product. In that case, the buyer is unlikely to know the value of the GOs associated with that product, and the producers initially owning the GOs do not know at which price they were sold, and which margin was taken by the intermediaries. This flaw has spurred the development of new type of trading actors such as Becour, created one year ago. Becour provides a clear pricing mechanism where 80% of the revenue generated by the GO sales automatically goes to the producers.

Becour is also a pioneer in real-time matching. Real-time matching basically consists in matching the renewable power consumption with the power production in real time. As of today, GOs are mostly delivered in bulk to companies once a year to certify the annual electricity consumption as renewable. The idea with real time matching is to deliver the GOs in smaller time-units being more in line with the power consumption of the consumer. Becour's real-time matching service is currently under development and no information in known on its working in practice (M. Mouilleron from Becour, personal communication, March 6, 2019, Appendix F). An identical service is also being developed by BKK and Tibber. Those new services are foreseen to increase the transparency and hence to increase the credibility in the GO system which can in turn result in a higher demand.

A new technology that might come on stage in the future is the Blockchain technology. It is at present heavily discussed whether this technology will come through and alter the energy sector, as well as, the GO system. In a nutshell, Blockchain technology provides a new approach to deal with data, mainly from decentralised databases. It ensures that data is stored on many computers or nodes in a secure and reliable way which discards the need for intermediaries in the transactions. With regards to the energy sector, this technology could foster decentralisation by making peer-to-peer transactions viable and hence reduce the need for third parties. As of today, the energy sector is facing a growing decentralisation with the increasing numbers of small renewable installations such as houses equipped with solar panels on their rooftops for

example. Blockchain is in that view seen as a desirable solution to help this decentralisation and balance the grid by allowing peer-to-peer trading and encouraging the matching of consumption and production. In the same vein, Blockchain technology could be used for electricity tracking and prevent double counting by using the data of smart meters (Ekoenergy, n.d.a). Some think that the technology has the potential to replace the GOs, since the market actors will soon be able to track electrons going through the system at any time. In GO trading as well, Blockchain has the capacity to remove the need for third parties by ensuring fully transparent transactions. That would represent a lower counterparty risk and savings in transaction fees that are currently ending up in the pockets of intermediaries (Sverrisson, 2018). Last but not least, it would allow the issuance of energy certificates to new market actors, such as aggregators pooling the production of small producers, who could never receive GOs before due to a production below the threshold of 1 MWh (EKOenergy, n.d.a) Yet, views are differing about the value of this new technology (Sverrisson, 2018). Moreover, Blockchain is criticised for its intensive energy consumption (EKOenergy, n.d.a). Becour (as cited in Sverrisson, 2018) is skeptical when it comes to the real increase in value generated by Blockchain and describes the technology as not being mature yet. The same standpoint is adopted by Statnett (as cited in Sverrisson, 2018). The Norwegian TSO is doubtful about the revolution in the energy sector that this technology seems to promise. In like manner, ECOHZ (as cited in Sverrisson, 2018) depicts the GO system as working properly and therefore believe that no disruptive technology is needed for electricity tracking. They believe that if Blockchain was to be used, it should improve the technology for electricity tracking but not replace the current GO system. They further added: « If Blockchain can provide an infrastructure which is cheaper and more efficient to operate, more transparent and secure, while creating more value for the market participants – Blockchain should be embraced by the industry » (ECOHZ, 2018, last para.).

10. Impacts of GOs on the electricity value chain

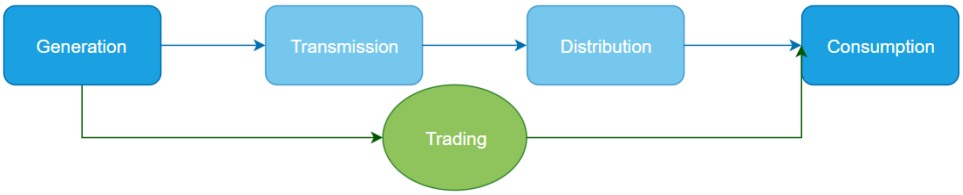


Figure 27. Electricity value chain.

10.1. Generation

Eligibility

The GO system is a European system and is thus only used in European MS. Whether a generator's production is eligible for GOs depends on the eligibility criteria enforced in each nation. Those criteria strongly vary among MS, some of them using a full disclosure system such as Austria and Switzerland where all power producers are eligible for GOs, and some of them limiting the issuance of GOs to renewable generation only. Moreover, governments are free to ban the issuance of GOs to supported production such as Germany or France, for instance. The volume of GOs issued in each country is thus dependent on the production capacity and the eligibility criteria enforced.

Handling of the GOs

When meeting the national eligibility criteria, a generator can request GOs for its production and then sell them on the market. Each GO traded provides the generator with additional earnings. Two things are important to note here. First, they have only 12 months from the date at which the corresponding electricity was produced to sell them, after which the GOs expire. Secondly, taking part of in the GO market generally implies that they have to open an account in their country's GO registry and hence pay different types of fees (i.e. annual fixed fee and transaction fees) whose levels also vary according to the country. When this is done, they can trade their GOs. GOs trading is usually not a negligible task and many big generators establish their own trading department. They usually develop a strategy to sell their GO at best price and closely watch the wholesale GO prices because of their volatility. Another option for small producers, that do not have the resource to trade the GOs themselves, is to make an agreement with a portfolio company or similar intermediary which can take care of the selling of their GOs.

In most cases, the GOs are traded separately from the power and their price does not interact with the power price. However, the supply of GOs is contingent to the supply of the power since GOs are issued per MWh of physical power production.

Additional stream of revenue

When it comes to the revenue generated by the GOs, the latter is very difficult to assess and here again depends on various factors. A GO has a different value according to its technology, location, time of production, etc. Its price is based on the demand and the supply and varies from day to day. Certain trends are still constant. For instance, the Nordic Hydro GO is known for its very low value and has historically been traded at less than €1, whereas the Dutch Wind GO and the Swiss Hydro GO have a substantial higher value (up to 8€/MWh and 4CHF/MWh respectively).

Looking at the cases of Norway and Germany, the revenue effect is certainly higher in Norway where all the generators are theoretically eligible for GOs. In practice, only renewable energy generators ask for GOs. Despite the low GO price, for the big generators the high volume of GOs they own guarantees them a relatively large additional stream of revenue. For instance, with an annual production of 7 TWh of renewable power, BKK's income from power amounts to € 280,000 on average and the average annual income for GOs is between € 5,000 and €7,000 (P.K. Olsen from BKK, personal communication, May 16, 2019, Appendix K). In Germany on the other hand, it was already mentioned that the high subsidy level for renewables compared to the GO price causes all renewable generators to ask for governmental subsidies instead of GOs. Only old renewable assets that have run out of the subsidies can ask for GOs and thus account for the total issuance volume in Germany, which is insignificant compared to Norway.

Impact on the generation mix

Assessing the impact of GOs on renewable investments is not an easy task and it is generating lots of debates. The term used to characterise this is "additionality". Usually, it is said that a GO brings additionality if the revenue it generates enables the expansion of the current renewable capacity and if this expansion could not take place without the revenues from GOs. Although the directive defines the role of GOs as only being a tool to document the purchase of renewable power, GOs contributing to additionality is what a growing number of consumers are asking for. The GO system encounters a lot of criticism from people who consider the system to be greenwashing. As an example, the BEUC organisation (the European Consumer Organisation) reported in 2017, that the GOs were not satisfying the consumers' demand

because they were not supporting additional investments in renewable power facilities. They added: « Consumers are usually not informed that suppliers[15] often build only a green façade with cheap tradable certificates, so-called Guarantees of Origin (GOs), while having no substantial commercial relations with any renewable power plant operator » (BEUC, 2017, p.1).

To fix this gap some companies and traders are offering products based on GOs more effectively contributing to additionality. We already mentioned the GO^2 product offered by ECOHZ. As a reminder, for each GO^2 purchased, a fraction of the money is added to the ECOHZ Renewable Energy Foundation which is used to finance new renewable energy projects (ECOHZ, n.d.e). The first wind power plant financed by GO^2 came into production at the end of 2017. This windfarm, generating 18 GWh annually, was exclusively financed by a RE100 member. Under the GO^2 system, the loan has to be paid back within two to four years and is then reused to finance another project. Based on the evidence for this specific case and providing the circularity of the system, ECOHZ estimated that the same company will have contributed to the establishment of four similar projects by 2030 (ECOHZ, 2017b). Kinect Energy Group also developed its own GO product contributing to additionality called "Track my Electricity". For each GO bought, €0.10 is used to finance renewable energy projects in isolated, off-grid communities, the main focus being here to fight the energy poverty and develop sustainable societies. They are currently working on projects in Peru and Burma (Kinect Energy Group, n.d.). The EKOenergy ecolabel offers the same solution. For each MWh purchased, €0.10 goes towards their Climate Fund which is also used to establish renewable installations in isolated communities (EKOenergy, n.d.b). Those products are examples of initiative taken by traders to enable end-consumers to effectively contribute to additionality. This is made possible thanks to a higher pricing of the GOs and the constitution of a fund exclusively dedicated to new renewable investments. It indirectly indicates that GOs on their own are not likely to trigger investment due to their low price.

When it comes to additionality occurring in Norway and Germany, the impact of GOs on investments is very questionable. In Norway, investments used to be triggered by Elcertificates. However, as mentioned before their value has been strongly decreasing over time. I. M. Clausen explained that producers were now assigning a higher value to GOs than Elcertificates when planning investment because they deem the GOs to be « everlasting attributes » (personal communication, February 20, 2019, Appendix B, p.94). P. K. Olsen explained that the value of

[15] « suppliers » refers to electricity retailers.

GOs is taken into account when planning investments if sufficiently high. For instance, for a value of €0,30, the GOs would not be taken into account (personal communication, May 16, 2019, Appendix K). Whether the GO revenue is sufficiently high to be decisive for the investment decision is thus hard to tell. In Germany, it is sound to assume that renewable investments are assessed against the governmental subsidies that can be obtained and that GOs have hence no role to play.

The contribution of GOs on their own (i.e. not bundled in products) to additionality is thus very questionable, and most likely absent, but this might change if the GO value increases significantly. The organisation RECS International underlines that additionality is a controversial topic because of disagreements regarding its definition. They added that it is incorrect to deem GOs as completely additional or not at all, since multiple factors come on board such as the price of the GO or the revenue and cost structure of the renewable power plant (RECS International, n.d.).

10.2. Transmission/Distribution

Potential congestion

The fact that GOs are traded independently of the physical power comes from the fact that it is not possible to distinguish the energy sources fed into the grid. Moreover, in view with the existing interconnection capacities between the European countries, it would have been impossible to make the physical power exported/imported coincide with the GOs exported/imported. GOs could create congestion on the grid and drive down the power price if they were largely contributing to investments in countries where the grid and interconnection capacities are already at their maximum and where the demand for power is much lower than the supply. Nevertheless, as discussed in the previous section, only the GOs bundled in products specifically designed to bring more additionality could have an impact, and those represent a very small fraction of the GOs traded. In the chapter 9, we discussed the increasing investments in renewable power that are expected in Europe. Those are not triggered by GOs but mainly by (i) the renewable target set by the European Union and the support schemes used by MS to ensure the realisation of this target and (ii) by big companies willing to market themselves as environmentally friendly and contracting large PPAs with windfarms, making the realisation of those windfarms possible. We discussed in the same chapter the building of new interconnection cables between countries designed to cope with those expected investments. As a conclusion, it is our opinion that no congestion is created or expected by the trading of GOs.

New roles

In some countries the TSO is appointed as Competent Body. It is then in charge of the issuance of the GOs, manages the GO registry and charges fees in return for its services. TSOs and DSOs may also be responsible for the measurements of the production eligible for GOs fed into the grid. In fact, the TSO of Norway, Statnett, is the Competent Body of GOs and manages the GO registry called NECS. No role in the GO system has be appointed to the TSO and DSOs in Germany.

10.3. Power trading

The activity of power trading is not part of the physical electricity value chain but can be seen as part of the electricity value chain, in general. Without power trading none of the previous steps are economically viable. Just like for GOs, a lot of intermediaries exist between producers and end-consumers such exchanges, brokers, retailers, etc.

Electricity retailer

The trading agent the most affected by the GO system is undoubtedly the electricity retailer in direct contact with the private households. Every electricity retailer is now bound by the new Renewable Energy Directive to purchase GOs to make a renewable claim. In other words, they have to take part in the GO market unless they commit to only sell non-renewable power. As already mentioned, the price premium charged to end-consumers for renewable power is substantially higher than the GO wholesale price. Oslo Economics (2018) gave an example where only 30% of the premium charged by the retailer covered the wholesale GO price and the remaining 70% covered the procurement costs, the marketing costs and the margin taken by the retailer (Oslo Economics, 2018). It is also important to note that the power price charged to the consumers does not only cover the wholesale power price and the GO price but is mainly composed of other elements such as taxes, transmission and distribution costs and subsidies. R. Kok from Innogy estimated the GO price to represent substantially less than 5% (probably around 1 or 2%) of the electricity bill for renewable electricity in the EU countries (personal communication, May 8, 2019, Appendix E). P. K. Olsen from BKK confirmed this statement and affirmed that a Norwegian end-user was paying about €2 to €3 per GOs which is around 2 to 3% of the final power price.

The technical scope of the role may also differ among MS. In Germany for example, electricity retailers have to cancel all the GOs themselves regardless of if there are sold to private households or companies whereas in Norway, businesses can cancel the GOs themselves or ask a portfolio company to do it for them.

Other traders in the wholesale market

Trading power and trading GOs are two separate activities and taking part in one does not force you to take part in the other. Some portfolio companies do however like to do both. This is for example the case of Kinect Energy Group.

10.4. Consumption

The GO system was expected to have the most impact on the consumption component of the electricity value chain. GOs were created as a tool to enable consumers to purchase renewable electricity if they wished to do so. End-consumers represent demand in the GO market, and their willingness to pay is a key factor in the GO price formation. As of today, we see a much higher willingness to pay for GOs from the business side than from the private households. Big companies use GOs both as a marketing tool and as a carbon reporting tool. Interestingly, some businesses are ready to pay a high price for very specific GOs, indicating that their customers value environmentally friendly products and companies that use renewable electricity. By purchasing products from those companies, their customers bear part of the renewable cost (including the GOs' cost). The fact that they are more willing to pay for renewable products from companies than power backed by GOs from their electricity retailers might seem inconsistent and pinpoints a lack of understanding in the GOs system from the private consumers' side. All in all, in view of the growing number of GOs cancelled and their low price, we can deduce that they are willing to consume renewable power or products but only at a low price.

Taking a closer look to Norway and Germany, we have seen that the demand for GOs in Norway is very low whereas in Germany the demand is considerably higher and is mainly fulfilled by cheap Norwegian GOs. This mainly comes from the fact that Norwegians think of their electricity consumption in physical terms and hence consider it as already green and do not see the point of purchasing GOs. In Germany, end-consumers are more willing to use GOs to be able to officially claim their consumption as renewable. Having a cultural preference for tested and certified products, their consumption is higher for GOs included in labels.

11. Conclusion

This Master' Thesis evaluated the impacts of GOs on the electricity value chain, namely the electricity generation, transmission, distribution, trading and consumption. In order to identify these impacts, a preliminary research was conducted on the GOs. We first addressed the EU Directive designing the system. We then looked at the role of GOs in the electricity disclosure in practice by looking at the Residual Mix calculation. After that, we researched the GO market, giving some insights on the evolution of the GO system and its market in the near future. In addition, we particularly focused on the use of GOs in Norway and Germany as case studies and identified the similarities and differences between them.

During the preliminary analyses, several issues in the system and its market were pinpointed. First of all, by looking at the GO system in Norway and Germany we established that Member States have a considerable freedom in the implementation of the GO directive which has allowed them to make different choices. The most striking is example is *the different eligibility criteria for GOs* enforced in the different Member States. Although this is not perceived as a problem in itself, it can be very confusing and it is important to be aware of this as it largely influences the GO supply and indirectly, the GO price.

As we have seen in the literature review, the design of the Directive 2009/28/EC had prompted a lot of debates. Allowing Members States to make different choices probably was and still is, a way for the European Commission to ensure their participation in the GO system as no measures towards a harmonisation of the eligibility criteria has been taken in the new Directive. A key feature of the GOs is that they can be traded across borders independently of the physical power they are originally related to. We think that this was necessary to enable end-consumers to claim their renewable energy consumption at a reasonable cost for two reasons. First, it is physically impossible to guarantee to a consumer that their electricity consumption is effectively green since the energy sources are indistinguishable in the grid. Thus, the use of unbundled certificates from the physical power is therefore a necessity. Secondly, countries do not have the same renewable generation potential, implying that if GOs could only be traded internally, the demand for renewable electricity from a consumer living in a country with a limited renewable potential could not be met, or if it could the costs would not be bearable.

The unbundling of the GOs from the physical power and their cross-borders trade has created the need for a reliable electricity tracking methodology and has led to a second issue, namely

the issue of *double counting*. We described the Residual Mix calculation method supported by the European Commission and used by the Association of Issuing Bodies for electricity disclosure. But, although the Association of Issuing Bodies publishes the Residual Mix for each of its members, the latter are not mandated to use those statistics and are free to recalculate their Residual Mix themselves. This leads to double counting, or in other words to the disclosure of the same renewable attributes several times. As an example, Sweden uses a Nordic Residual mix (Grexel, n.d.b) but the other Nordic countries use their own national Residual Mix, meaning that some of the other Nordic countries' attributes are double counted. In our opinion, and based on the evidence of this study, this issue is the most pressing to deal with. If the GOs are to be freely traded in the European market, we believe that the Residual Mix calculation methodology should be the same for all countries, otherwise consumer trust in the GO system will be lost as the statistics displayed on their electricity bill are likely to be inaccurate.

Another issue harming the consumers' trust and hence their participation in the GO market is the *lack of transparency*. It is almost impossible for an end-consumer to know what fraction of its electricity bill covers the GO costs and impossible to know what fraction goes to the power producer. Moreover, only very few consumers understand the working of the GO market, and the fact that the GO price they pay mainly covers the margins kept by the intermediate traders buying and reselling the GO during its one-year lifetime, is a strong deterrent for buying GOs.

Finally, from our analysis the loss of confidence and resistance from consumers' participation is likely to be caused by the large product variety based on GOs, making it *impossible for them to compare the prices.* We recommend a better communication to the end-consumers about the GO system, how it effectively works and how are the statistics displayed on their electricity bill computed. Moreover, we think that end-consumers have the right to know the price they pay for the GOs. This is important to regain the trust of the consumers and make them effectively participate in the GO market which could in turn increase the GO value and may then eventually impact the renewables investments.

Regarding the electricity value chain, the GO system has broadened the role of the electricity value chain actors: power generators must in addition to producing and selling their power, request the GOs and sell them, the Transmission System Operator (usually assigned as the Competent Body for the GOs) must manage the GO registry, and electricity retailers and other traders respectively must/can procure and sell the GOs to the end-consumers. Private households, however, do not have to do anything apart from explicitly asking for renewable electricity since their electricity retailer takes charge of the procurement and the cancellation of

the GOs for them. On the other hand, businesses buying GOs can decide to cancel the GOs themselves or not. The monetary impacts of GOs are hard to assess due to the lack of transparency of the GO prices, which undermines a reliable comparison of the extra revenue streams generated by the GOs to the producers and traders, and of the GO prices paid by consumers. For the generators, the revenue from GOs is country- and power plants' characteristic-specific and hence strongly varies from one generator to the other. Traders and end-consumers can normally respectively trade and consume any GO from any country and any type, and the revenue/cost depends on the GOs they choose to trade or consume.

The approach used in this Master's Thesis was mainly deductive, we looked at the use of the GO system and its current market to deduce the impacts on the electricity value chain. In order to have the most thorough information as possible, we conducted semi-structured interviews mainly with market players. With a little hindsight, we think that conducting interviews with consumers would also have brought a lot of valuable information about their willingness to pay instead of deducing it from the GO price and their demand. Future research could focus on the willingness to pay of private households for GOs in the different European countries to understand better why their demand for GOs is so different, and to assess the potential of the voluntary GO system to make citizens want to take part in the energy transition by choosing more sustainable consumption patterns.

This Master's Thesis is innovative in that it compares the GO system and market between Norway and Germany. Such a comparison facilitates the understanding of the GO system and its flaws. Studying the GOs in the other European countries could also be interesting future research. More generally, the thesis has also contributed to gathering of a lot of valuable and up-to-date information about the GO system and its different angles and to present the information in an accessible way for a large public. It must however be kept in mind that the Member States will have until end of 2020 to implement the new directive and the GO market will evolve according to the Member States' choices.

Finally, the identification of the impacts of GOs on the electricity value chain should be seen a preliminary work for a further assessment of these impacts with recognised assessment tools.

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Appendixes

Appendix A - List of interviewees

Anonymous

Current position: Anonymous, German company

Interview type: Questionnaire

Date: 2019-03-18

Note: the interview was not included in the following appendixes to reasons of confidentiality.

Clausen, Ivar

Current Position: Head of the unit for the Norwegian registry for electricity certificates and guarantees of origin for electric power, Statnett

Interview type: Telephone

Date: 2019-02-20

Herforth, Christian

Current Position: Researcher at the Federal Environment Agency, UBA

Interview type: Questionnaire

Date: 2019-02-21

Iversen, Nikolai & Zwick, David

Current Positions: Key Account Managers Partners Sales Europe, ECOHZ

Interview type: In person

Date: 2019-03-04

Kok, Roland

Current Position: Head of Customer Solutions within Innogy Renewables

Interview type: Telephone

Date: 2019-05-08

Mouilleron, Marine

Current Position: Market Analyst Europe, BECOUR

Interview type: Telephone

Date: 2019-03-06

Ørstavik, Paul

Current Position: Lead Originator at Kinect Energy Group

Interview type: Telephone

Date: 2019-02-25

Olsen, Preben

Current Position: Hedgetrading and portfolio management, BKK

Interview type: In person

Date: 2019-02-27

Appendix B - Interview Statnett: Ivar M. Clausen

Legend:

M = Margaux Snoeck

I = Ivar Much Clausen

M: Hi, I don't know if you have seen but I sent you the questions in advance to give you an idea.

I: Yes, I have them in front of me and I just browsed them while I was waiting for you. But let's set the scene first. So, you are writing a master thesis on GOs, right?

M: Yes, for now my goal is to make a comparison between the system in Germany and Norway. I am looking at the system in general, how it works and also at the market. But I haven't done any other interviews yet so I don't know how far I will go with all the information.

I: Yes, Ok. And you are writing in Bergen, at the NHH?

M: Yes.

I: Good, is there any other interest in the GOs there or just you? Every time when there is a student contacting us, we are just happy that students are aware that we exist and that there is academic interest for what we do. So that's why I am asking.

M: Well, I just had a class on electricity last semester and was interested in understanding more the GO market. I don't know if there is any other interest.

I: And are you French?

M: I am from Belgium, but I speak French yes.

I: Okay, the AIB which governs the GO system is registered in Belgium. There are a lot of Belgian people active within the AIB so you should be able to get some information there. Ok let's start.

M: What are the preliminary steps for the issuance of a GO? What must the producers do? Which actors are involved in this process?

I: At the beginning, a production device meaning a power plant, we generally called them "pds" or production devices so that you are aware that if I say "pds", it means a power plant. So, the owner of the pd must apply to NVE (Norwegian Water Resource and Energy Directorate) in order to get a valid GO license. This is an automatic application so, as soon as they apply, they get a license which is valid for 5 years. Then, when the producer has acquired the license, it is forwarded to us and we register the pd in our system called NECS (Norwegian Energy Certificate System) and from there, what the producer has to do, depending on whether he wants to handle the GO for himself, most producers don't. They have a proxy doing this for them. ECOHZ is a company that handles GOs for a lot of producers and also sell them on the European market for example. So, the producer has either to open an account for himself or to enter an agreement with a proxy that will handle the GO for them. When they enter an agreement, they have to send to Statnett a power of attorney confirming which of these proxys are to act on their behalf. Then, we set up the system so that the GOs for that pd are issued to that proxy. And then, from a certain date, we start recording the meter values from that production device because all these meter values, they are now going to the Norwegian Elhub on a daily basis. So, we get them from Elhub, and we can see the actual production in any given day from any given power plant which is eligible for GOs.

M: How would you define Elhub?

I: The Elhub is the Norwegian data hub for all aggregated data or meter data in the Norwegian power market. You can look it up at Elhub.no. They went into operation on Monday. That's basically where both consumption and production meters are recorded, all values are every 24h available for the market the next day. Beginning from next week, all market players can connect to Elhub and check their production or consumption on all devices that they are related too, the day after the production or the consumption happened. It is a three-hour lecture, but it is very interesting for the power market, not so interesting for the GO market. So, then we receive the meter values from the Elhub for all the production devices that are eligible for GOs. We receive them 15 days after the real production. That has to do with the rules of the market. So, that means that we only receive meter values when the initial dispute has been settled. Because there are a lot of disputes in this world. There are meters running wrong, etc. So, after 15 days, all the initial disputes are settled so it's fair to start with those numbers. Every Monday we issue GOs for the week 3 weeks back. So, in week 4, we issue GO for week 1, etc. Now that we are in week 8, we issue GOs for week 5. I think that this is the answer to question one.

So, the preliminary steps are that you have to apply to NVE, make a deal with a proxy if you don't want to handle the GOs yourself and then we have to set it up in our system and then the issuing happens automatically.

M: In the Oslo economics report on the trade in Guarantees of Origin from 2017, they mention that "in theory, up to thousands of different GOs exist, differentiated along the information they carry on their attributes such as technology, age, subsidy-eligibility, etc". Are the GOs differentiated at the moment of issuance? If not, when does the differentiation occur and who is in charge of that?

I: The GOs are differentiated at the moment of issuance. That means that when I issue a GO in my system, all the relevant information is put in that, it is an electronic certificate and all the relevant information is put in that certificate immediately. That means that it contains the name of the plant, what kind of technology is used for the plant being water, wind, bio ..., for all different type of heat plant that you have, we also record what fuel is used. So, if you fuel on municipal waste or biomass or whatever or diesel or a combination of anything, this is also recorded. The commissioning date meaning the first operation date for the plant is also recorded on every single GO and the period of production. In Norway, it is only 1 day per GO because we have mostly big plants but all this information is recorded on the GOs.

And then, how do they split this in different products, that's something that I do not care about at all. But the point is that the market is willing to pay much more for a new wind powerplant that hasn't received any governmental support than paying for old hydro power plant that received production support or construction support. We record everything according to the EECS rule, as we are governed by the AIB. And then it is up to the market players to define if this is a product and then market it towards their markets and whatever.

I don't know the number. For example, old Nordic hydro are the stable goods of the GO market. So, if you don't have any other specific interest, you buy Nordic Hydro. But for example, the Dutch government, they are obliged to cover they own consumption by Dutch GOs, and Dutch production is very scarce. Therefore, Dutch Wind for instance is highly valued because a lot of people are dependent on buying wind GOs. Nordic Hydro currently would cost you 1€ - 1,2€, something like that. Dutch Wind would probably cost you 5, maybe 8€ per MWh.

Another important word is "additionality", it is the case for plants that would only have been realised because of the GOs. Without the GO, this plant wouldn't be economically feasible so this additionality thing will also be recorded on the GOs.

Then, there are a lot of other standards that come from how you build, whether or not you are taking care of fish in the rivers, etc. This is not recorded on the GO but there might be other standardisation for the production device and then the market actors, they might sort of put on top of one and other different

standards handled by different organisations and different governments. And put together packages. For example, in Sweden, you have power plants that are defined as Bra Miljöval, that has something to do with the way it has been build. This is not directly related to the GOs, but it concerns the same plants so therefore they can take the GO with some set up attributes and connect it with other standards and say all in all, the power produce from this production device complies with all these standards.

I think that that answers question 2.

M: Yes, thank you. How do you manage the registry of GOs? When do you cancel the GOs (do you cancel the GO when it has been bought by a broker or portfolio company (or whatever intermediary) or when it has been bought by the final consumer or Business?

I: We manage the registry by allowing account holders to open accounts, helping them when they have technical issues, all these kinds of things and we also charge them of course. We do not cancel GOs, that is something that the account holders do for themselves. But a GO has a lifetime of 1 year and if they are not used within that year, they are withdrawn from circulation but that is something else than being cancelled. Cancelled means being used. The traders, they take the GO and say:" Ok, I have a client", for example IKEA. IKEA has used 100 MWh last year and they want to make sure that they had consumed green electricity. So therefore, I take these 100 GOs, I cancel them and on the cancellation statement, I write that this was cancelled to cover so and so consumption of IKEA for instance. And then, whatever happens regarding audit and making sure that the correct amount is cancelled etc, that is outside our hands because GO are 100% voluntary. So, the government doesn't do anything about that. But they are sort of market standards that say that you need independent auditing. For instance, IKEA which is a member of this RE100 initiative, they have independent auditors that check that all the right amount of GOs are cancelled. What Statnett does, is that when the GO has been cancelled, they make sure it can't be cancelled anymore.

M: What is your role as part of the AIB? And how do you set the Domain Protocol? How often do you revise it? Is the Domain Protocol in Norway very different from the other countries? Is there a will to harmonise or make the domain protocols similar to the other domain protocol from AIB's members? If yes, is there some barriers? If not, why?

I: My personal role is that I am a member of the board of AIB. And also, member of what is called "General Meeting" that is where most of the decisions are being made. Statnett and Norway is by far the largest producer in Europe. We produce something around 20% of the total production. And also, the Norwegian Registry NECS is also the most popular and widely used registry in Europe. So, by share size alone, Norway is in AIB terms as big as number 2,3,4 and 5 together. The total market of GOs in Europe is 500 million GOs roughly, and 400 million GOs go to my system every year. That means that Statnett has a rather important role in the AIB. The AIB governs the EECS rules that is the rule set that we use for the GOs. We also do audit of all members to make sure that they comply to the EECS rules. When we do the audit, we check that the Domain Protocol is respected. The Domain Protocol is kind of the national translation between the EECS rules and the national legislation. The EECS rule are a set of European rules but they are not law binding in any way. It is impossible to be completely aligned with all countries. For instance, in Germany, GOs are considered to be only green certificate so therefore, GOs from coal or nuclear is not allowed. For other countries, GOs are a way to track the content of the production so if somebody would like to pay for using coal, it is strange, but it is fine by us. It is up to the market to decide. In Norway, GOs for coal are allowed. Some countries require that the issuing country of the GO is interconnected to the European mainland. So Icelandic GOs are allowed in some countries but not in others. Also, there are a lot of technical differences and all of these are set out in the Domain Protocol. So, I would say that the Domain Protocol are 80% alike and 20% different. The Norwegian Domain Protocol is probably one of the least different. We don't have that many special rules. We are accepting most of GOs. Of course, it would have been nice to harmonise or make the Domain Protocol similar in order to reduce the barriers, but I would say that compared to other markets,

the barriers of cross-border GO trade are low. This is a fairly harmonised market I don't think that in practice you will find many markets that are much more harmonised actually.

M: Is the low GO price high enough to incentivise generators to request it?

I: I would say definitely yes. Last year price's hike has meant that the GOs prices are now very relevant for the producers. Several producers I have been talking to (for instance Adger Energi) have been active in the GO market for many years but now when they consider new investments, they actually put the value of the GO higher than the value of the Elcerts because they consider the GOs to be everlasting attributes. For a lot of projects, the value of the GOs is what puts it over the limit of whether or not it is economically feasible to do it.

M: Aren't the GOs volatile?

I: The electricity price is volatile, the GO price has certainly been volatile but still if you consider that in the long run the GOs price is not going to drop below the current level then probably, it is going to rise somewhere between 1,50 and 2 € and that is what a lot of people are estimating as a stable long term level. There, you are talking about somewhere between 7 and 10 % of the total price they get for the power. When you look at an investment, generally when you have a 7 or 5% ROI, that would make it a very good project or at least a good project so then the GO is more or less equal to the return on the investment.

M: Has the number of GOs issued and cancelled in Norway increased? Why? Is it because the value of GOs has increased? Do you consider that the request procedure is easy or tedious/burdensome which could explain why some generators don't ask for GOs?

I: Almost 100% of the production in Norway is eligible for GO issuing and almost everything is. You could look at our page to see the public statistics. The number dropped last year but that was due to the fact that it was a very dry year and nothing to do with the GO system. But it is somewhere between 136 and 142 TWh per year. It has stayed rather stable for the last 4-5 years. So, another fact that caused the Norwegian share to drop as a percentage of the European market is because the market has increased, it is not that the Norwegian production has decreased. The number of cancelled GOs in Norway is a bit lower than what I would have wanted. But you'll find the yearly statistics on the NVE website. Don't use the number you find on our webpage because the number you find on our webpage might be a bit confusing regarding cancellation.

M: I am actually using the numbers from AIB.

I: Yes, those are fine. You need to be aware of this thing called ex-domain cancellation. You must be certain that you are not using numbers from Norway including ex-domain cancellation. Ex-domain cancellation is that some consumers outside the AIB area still would like to consume GOs in order for their power consumption to be green. And they can do that. And then, the cancellation is done in Norway. If you have a Russian client for example who wish to use GOs, you can cancel these GOs in Norway, but you mark them in such a way that they are not counted as not being used in Norway, it is just that the technical cancellation is being done in Norway. If you look at the statistics from our site, you might be fooled, you might include all these ex-domain cancellations and blow up the number of GOs being cancelled toward Norwegian consumption. So, pay attention to not get an inflated number. Even thought, the NVE numbers are old, at least take a look at them so that you see that you use comparable numbers.

M: I was also wondering, the GO system that you have is the EECS but there is also other type of GOs, like I-REC for example, is that completely different?

I: No, it is not completely different at all.

M: What I don't understand is why there is ex-domain cancellations if they could just buy other products that are meant to be international?

I: That's a good question. I can't necessarily answer this because I don't know that part of the market. But I think one of the reasons is that there is ample supply of GOs under the EECS rules and of course, when you have one type of certificate being issued for a certain production, you can't have another type of certificate issued for the same production, that would be double counting.

The EECS GOs are naturally ample or at least have been historically ample in supply, whereas the different I-recs products might be much more of a niche product. Initially the AIB and RECS International was the same organisation. So, the EECS standards comes out of the RECS standards and are quite similar. But, as the GO system is part of the European system and is accepted in both current and the coming Renewable Energy Directives, they have another organisation governing this and only this standard. That is the broad outline of history.

The number of GOs that has been cancelled in Norway has increased a bit, it should have increased more if you ask me, but ok. I think some of the industry initiatives like the RE100 and others are one of the main drivers and that's exactly the way the GO system is meant to work. That the big consumers around Europe say that "we want to be renewable" and therefore also our power plants are renewable. GOs is the best and most credible way of achieving that. I think that the GO cancellation has increased a bit, but it should have been more. I don't think that the request procedure for getting GOs for Norwegian plants is especially burdensome. I think, some market players don't believe in the system. So, it is a political choice, for others it is just not that important. There are a lot of small players up there that have more than enough with copping with whatever they have to do. But the actual process of getting GOs in Norway is quite easy.

M: Do you see the GO system as completely independent of the Elcert system?

I: The GO system is completely independent from the Elcert system. By definition, they are not connected at all. They are governed by different laws, and Statnett, we are performing these two tasks separately. The fees are collected separately, and we keep them economically separated all the way. But for practical reasons and to make both schemes as cheap as possible, they are handled in the same electronic system and managed by the same people, but they are two completely separated schemes.

M: Do you issue more GOs or more Elcerts? Is the Elcert system mandatory? Do all producers of renewable power receive an Elcert?

I: We issue more GOs than Elcerts by far, that has to do with how the Elcert scheme is defined. The GO system is open for all solutions, The Elcerts system was made to provide a certain amount of new renewable energy and it is completely different setups. I don't know the numbers by heart, but you can check our statistics and if you see the monthly issuing, I think we produce 8 or 10 times more GOs than we do Elcerts, but you can see that in our statistics.

M: You mean that less people are eligible to get Elcerts?

I: Yes. So, the Elcert system is mandatory for us as consumers but not for the producers. As I said, look into how that works because it would take too long to explain but it is a support scheme. Not everybody is eligible for a support scheme. But everybody has to pay for it, so we pay for it on our electricity bills. For 2018, I think the number is 15.3 % so for every 100 MWh consumed, 15.3 Elcerts must also be consumed. So, it is mandatory on the consumption side but not all producers receive Elcerts.

M: Do you know about the difference in revenue that is generated between Elcert and GOs? Which certificate is the most profitable for a producer?

I: This question is also a bit strange. I think you should look a bit more into both solutions and then you will understand that they are not comparable. Drop that question.

M: Who determine the quota of Elcert that has to be bought? Who are the buyers? Only companies?

I: The quota is determined by the Ministry, the Parliament had to change it because it wasn't in the law and now it is in the secondary legislation, so the Ministry can do this. In Norway, you can generally split your power consumption into two. And that's the part of the power consumption that you need to pay taxes on and the part of the power consumption that you don't need to pay the electricity taxes on. If you have to pay an electricity tax on the consumption, you also need to buy Elcerts for that power consumption. That means that lots of the industrials are exempt for Elcerts whereas small and medium businesses, private consumption, all the rest is eligible for Elcerts but this, you can also find in the law.

M: Do you think that GOs and Elcerts together is a source of confusion for consumers? They maybe think that their electricity consumption is from renewable energy sources because of the quota they bought whereas in fact, if corresponding GOs are exported, the renewable electricity is not counted in the final residual mix.

I: I think this is a question you should more ask to the NVE. You should speak to "Krisitine. V" at NVE. She is responsible for the unit over there but oversees my activity. But I think there should be no reason why Elcerts and GOs should be confusing for the consumers. The Elcerts should be completely invisible for the consumers and actually, I used to work with NVE, so I know it quite well. The regulation regarding information towards consumers state that Elcertificates should not be declared towards the consumers because it is a mandatory thing and the consumer can't make a choice about it. Therefore, that information shouldn't be available to the consumer at all. Then of course, there are a lot of people breaking those rules but still in principle the Elcerts should be invisible for the consumers.

When it comes to the GOs, I think that there is a risk that the power producers aren't necessarily following the regulations as strictly as they should. You are not allowed in Norway to market electricity as renewable if you are not backing it up with GOs. It is the only way of making a legal renewable claim on power consumption. There are some companies from time to another that don't take this as serious as they should, but both the industry standards and the secondary legislation state very clearly that the only way of selling electricity in Norway and claiming that it is renewable is by having the correct amount of GOs. The problem is that History, nature and what everybody thinks is difficult to change. So, when everybody sees the physical production of Norwegian supply, it is difficult for them to understand that the financial situation differs from the physical production. This is not something Statnett has an official view on, so this is not something you could quote me on, but this is just to give you my personal opinion on this and that is where the problem is. The problem is not that Norwegian suppliers or producers try to screw the rules. The problem is that it is very hard to change 100 years of electricity history and saying that the financial facts are different from the physical facts. But of course, the entire power market is built on the assumption that the financial and physical facts don't relate. Some of the criticisms of the GOs say that it has nothing to do with the physical world, but well basically the entire power market doesn't have that much to do with the physical world. So that's nothing different from when you buy power from a power supplier or when you buy a GO. In both cases, they are completely disconnected from the physical world. Because that's the criticisms that you will meet.

M: How is the price of an Elcert set? Does it influence the power price? Or, is it influenced by the power price?

I: It is set in a market based on expectations on production and mandatory consumption. No, it does not influence the power price I would say because the power price is set completely independently of the Elcert and also most of the players that are able to react on the power price being the big industry players aren't exposed to the Elcert price so therefore it does not fluctuate together with the power price. And also, the Elcert price right now for 2018 and 2019 is acceptable, around 20 Swedish kroner per MWh.

But due to how the Swedish have decided to implement their stop rule, they will basically kill off the entire market. Right now, the Elcert for this year and next year is traded at 140 Swedish kroner. From 2021, they will be traded at 20 Swedish kroner, so you see the Elcert market is going to die. Then we are going to keep it artificially alive until 2035 in Norway and 2046 in Sweden.

How does the price of GO and Elcert interact? I think you should ask someone else because I am not an expert on this market. So, it is difficult for me to answer.

M: Could it be that GOs increase in the long term the renewable production (increase in GO demand) and cause an excess in Elcertificates? Which will thus cause an increase in the quota level and increase in renewable production? Is it already the case?

I: That's the idea, isn't it? That the GO result in long term increase of renewable production. But this is a very classical market so the reason why the GOs are higher priced now is that the demand has increased due to industrial initiatives and national legislations around the renewables, etc. So, therefore, of course it makes it more attractive to start a new production to get GOs which again will increase the production that might end up in decreasing the price. But I would say that on a short- and medium-term horizon, let's say 5 to 7,8, 9 years, I would argue that the demand drivers are probably much stronger than the production drivers. There are more forces which will move towards increasing the demand than there are forces that will move towards increasing the supply. Because the supply is at least from Norwegian 'side, already at basically max. There isn't a reserve if GOs just waiting up there to be release in the market.

Of course, there are some members that are not part of the AIB and getting them on board with the AIB will increase the supply a bit: Portugal, etc. But not very significantly. So, the increase in supply will happen from increased actual renewable production which of course is a good thing and is what we are aiming for.

M: My question was more about if the renewable production increase, then I guess more people will be eligible for Elcerts?

I: Skip Elcerts, you don't need to think about Elcert, Elcert is dead. To be honest, I wouldn't waste a page. In a master thesis, I would describe it and then I would talk to NVE and get some explanation on the Swedish stop rule and the implications for the market and then I would understand OK, Elcert is dead, there is no point spending time to understand that. Spend your time on the GOs, that is where things are happening. As I said, Elcerts prices are trading at 20 kroners for the rest of their life so it is no fun at all.

M: Why was the GO system designed as voluntary and technology specific while the Elcert system is mandatory and technology unspecific?

I: To understand why the GO system is voluntary, that is because that was the initial idea. One way to drive the switch to renewables, was too say "ok, for those of you who wish to be in the front seat and want to be renewable, we are providing you with a tool that can give you the legitimate claim of renewable power consumption". You could argue that there are two ways you can become renewable in your power consumption. First, if your plant is somewhere in Germany near a coal plant, what you can do is you can close your plant and move it to a nice Fjord in Norway and fight with anyone saying that we want to keep this Fjord nice and clean and then you plug your plant in the production device right next to the beautiful waterfall and then voilà, you are renewable in power consumption. So that's one way of doing it. The alternative way is of course to build parallel supply grids. Saying that we have this one supply grid with dirty, grey power and we build another one with green power. Of course, neither of these solutions are very environmentally friendly. Therefore, it was decided that ok, let's split this and say that the physical power you consume is actually not something you can make an informed choice about because it has to do with physical factors of where you are placed in the grid and really, you can't

influence it at all. For example, a lot of industry in Norway who would claim that they are green, if they operate at night, they are not green at all. Most industries in the southern parts of Norway, if you track their electrons, most are from time to time fueled by completely grey power sources. And they must not fool themselves to believe anything else. During the daytime, there have a strong case that they are physically almost a 100% renewable. But if they have 24h operations, you need to be far up in the North, at least north of Trondheim to be sure you don't have a rather high influx of grey electricity physically. But you have no control of it and that's our point. Since you have no control of it, it is not really interesting because if you want to make a green choice and want to be green, at least alternatives have to be provided, you know, if there are no green alternatives available then who are they to say that you are not a good person because you don't choose green? That's the complete idea about the GOs, to provide credible tool for consumers that wish to choose to be green. On my private part, I have GOs at home. It was a conscious choice made by me. For car producers for example, BMW has signed up for the RE100 initiative. That means that they can guarantee that the same amount of the power they consume has been produced in a renewable way. Without the GOs or any other credible tracking system, the only way they could do that is by plugging in an offshore windmill physically or into a hydropower plant by a waterfall. For me I think, it is a logical way of doing it, saying that if you wish to make an environmental statement and do the right environmental choices, we offer an opportunity to do this. It is not free of charge of course.

M: How do you charge the producers asking for GOs?

I: Our system has a fee structure which of course we find brilliant. It is fantastic but it is a bit difficult to understand. That is always the downside of brilliant. It is very very good for those who use it and not necessarily so intuitive for the rest of the world. But, the point for GOs is that to have a GO account, you need to pay 25 000 Norwegian Kroners a year, considering the volumes that are moved around, that is cheap. But in addition, we have a small transaction fee per GO. Well, you can just for your purpose just say that we have a transaction fee. Currently, the transaction fee is 3 Norwegian øre, 0.03 Norwegian kroner. From April, it will be increased to 0.035 per GOs. But if you compare that, I think on the AIB website, it is available. It is complicate to encompass all the fee structures in all the AIB countries, it is very difficult. As you have probably noted with the Domain Protocols, we all have a tendency of thinking that our own way is the best way. So, there is a spreadsheet, probably on the AIB website, showing the fees from all the European Registries and that will show you that the Norwegian registry is very cheap compared to others. I would say 1/3 to 1/10 of the price of the others.

M: Well, that was my last question, thanks a lot for your time!

I: No worries, if you have further questions, please contact me.

M: Thanks a lot, bye.

Appendix C - Questionnaire UBA: Christian Herforth

1. *What are the preliminary steps for the issuance of a GO? What must the producers do? Which actors are involved in this process?*

   All information on the use of the German Guarantee of Origin Register can be found in the corresponding handbook. This manual can be found in English at
   https://www.umweltbundesamt.de/en/document/manual-for-use-of-software-of-guarantees-of-origin
   Another source of information is our portal www.hknr.de (English version).
   Here you will find helpful links.

2. *In the Oslo economics report on the trade in Guarantees of Origin, they mention that "in theory, up to thousands of different GOs exist, differentiated along the information they carry on their attributes such as technology, age, subsidy-eligibility, etc". Are the GOs differentiated at the moment of issuance? If not, when does the differentiation occur and who is in charge of that?*

   The GOs in Germany are provided with this information electronically at the time of issuance. It is therefore carried out by the HKNR.

3. *How do you manage the register of GOs? When do you cancel the GOs (do you cancel the GO when it has been bought by a broker or portfolio company (or whatever intermediary) or when it has been bought by the final consumer or Business?*

   In Germany, GOs are canceled exclusively for the purpose of electricity labelling. This is carried out exclusively by electricity supply companies. Whenever such a company sells green electricity to end customers, it must cancel the corresponding number of GOs in the HKNR. A cancelation of GOs is possible over the entire lifetime of the respective GO, which is 12 months. If a GO is not cancelled within this lifetime, it will be validated by us and can no longer be used.

4. *I saw that Germany was one of the major importers of GOs, how does it work with the register? Does any consumer that import a GOs have to inform you so that you can update the register? In the same way, how does it work for GOs issued in Germany but consumed somewhere else?*

   The import of GOs to Germany is carried out by traders who have an account in the HKNR. They buy GOs abroad and sent them from a foreign register via the Hub of the AIB to their account in the German HKNR. The export from Germany to other countries takes place accordingly. Special information on the part of the exporter or importer about these procedures is not necessary as long as Germany recognises proofs of origin from the respective countries. All that is required is registration in the "Trader" market role in the German register.

5. *What is your role as part of the AIB? And how do you set the Domain Protocol? How often do you revise it? Is the Domain Protocol in Germany very different from the other countries? Is there a will to harmonise or make the domain protocols similar to the other domain protocol from AIB's members? If yes, is there some barriers? If not, why?*

   We are member of the AIB. The German Domain Protocol reflects the legal basis in Germany. Accordingly, the Domain Protocol will be changed as soon as the legal basis changes. First and foremost the legal basis is decisive.

6. *Is the GO price high enough to incentivize generators to request it?*

   Our task as an authority extends exclusively to the illustration of the trade, to making it possible to issue and validate the GOs as well as to the control of compliance with the legal requirements we cannot make any statement about prices of GOs.

7. *Has the number of GOs issued and cancelled in Germany increased? Why? Is it because the value of GOs has increased? Do you consider that the request procedure is easy or tedious/burdensome which could explain why some generators don't ask for GOs?*

   For the Number of issued and Cancelled GOs see: https://www.aib-net.org/national-datasheets-on-gos-and-disclosure. We don't have any information's about the further aspects.

8. *What are the conditions to benefit from a support scheme in Germany and what are the support scheme prevailing?*

   Information can be found, for example, at https://www.bmwi.de/Redaktion/EN/Artikel/Energy/res-2017.html

9. *Is the low amount of GOs issued in Germany caused by the fact that benefitting from a support scheme prevents you from requesting GOs? Or are there some producers that are eligible for GOs but still don't request any?*

   EEG remuneration is currently more lucrative than the market price of GOs. In this fact, we see the reason for the comparatively low request from German electricity producers.

10. *Do you know if the GOs system is considered as a credible tool by the German consumers?*

    We do not have any information on this subject

11. *Regarding the price of GOs now, is it more profitable for a producer to benefit from the support scheme or to request GOs instead and sell them?*

    See Answer to Question 9

12. *Do you have an idea of the annual additional income that is provided by the German GOs to the German producers? What about the annual additional income provided by the different support schemes?*

    We do not have any information on this subject

13. *GOs can't be issued to producers benefitting from any support scheme because of double disclosure. What is the system used to disclose attributes and calculate the residual mix of Germany via the support scheme? Is there any website providing the calculation methods?*

    Please find the Information at: https://www.bdew.de/media/documents/Leitfaden_Stromkennzeichnung_08-2018.pdf

14. *Do you think that the support schemes in Germany will be reduced or even phase out in the future to let more space to the GO's market development? (for example, in Norway, the Elcert system will be terminated in 2035.)*

We do not have any information on this subject

15. *Who defines the support schemes and the eligibility criteria? Are the support schemes often reviewed or adapted*?

    The support schemes are defined by the legislator. There are reviews from time to time

16. *I read an article about a new system of GOs called the Regional GOs. What is the purpose of this new system? What needs does it fulfill?*

    According to the legislator, regional certificates should strengthen the acceptance of the energy change in the region. Consumers should be in a position to buy electricity from plants within a 50 km radius of their place of residence. For this purpose, regional GOs can be issued for the electricity of a suitable renewable installation which is supported by market premium. This enables the supplier to offer a regional electricity product. The regional GOs serve exclusively as proof of the regional character of the electricity in the electricity labelling.

    Further Information:
    https://www.umweltbundesamt.de/themen/klima-energie/erneuerbare-energien/regionalnachweisregister-rnr

17. *Will this new product reduce the demand for normal EECS GOs? Will it be cheaper for a consumer to buy a Regional GO than a regular GOs?*

    Regional GOs and GOs are two completely different instruments. GOs are used in Germany to supply green electricity. Accordingly, they are only issued for electricity that has not been promoted. If a customer buys a "green electricity product", a corresponding number of GOs must be used for this product. Only then is the product is considered "green".

    Regional GOs, on the other hand, are issued exclusively for electricity subsidised by the market premium. For each regional GO, the market premium is reduced.

    Regional GOs are an instrument for electricity labelling in order to be able to offer regional electricity products. The regional certificate only makes a statement about the regional origin of the electricity, but not about other qualities.

    We therefore assume that there will be no competition between the GOs, as the GO will be used for the marketing of green electricity (and nothing else) and the regional GO will be used for the marketing of a regional (and exclusively this) characteristic.

18. *Do you think it adds complexity to the system and may make the GOs system even more unclear for consumers?*

    We cannot answer this question at this time because of the lack of experience values so far

19. *Do you have any thoughts about the future of the guarantees of origin? Will the system remain the same? Can we forecast the price of the GOs in the future? Will the GOs be used for other purposes?*

    This question concerns, in relation to Germany, future political developments that we cannot foresee.

20. *What are the fees charged by UBA for GOs?*

Please find the Information at:
https://www.hknr.de/Uba/Home/Index?ReturnUrl=%2fUba%2fUser%2fSignOut

Appendix D - Interview ECOHZ: Nikolai T. Iversen & David P. Zwick

Legend:

M: Margaux Snoeck

D: David P. Zwick

N: Nikolai T. Iversen

M: Hello, thank you for letting me interview you, I would suggest that I explain you the context before asking all the questions. I will first explain you precisely what I am doing. So basically, I am doing a double degree between the Norwegian School of Economics and the Université Catholique de Louvain in Belgium in Energy and Supply Chain. So, I got to know about the power market last semester, and I discovered the guarantees of origin a few months ago. What I want to do for this master thesis is to explain the system in general, I would like to be the most comprehensive as possible and talk about what is said in the directives, talk about the residual mix computation, also the GO market, the link between GOs and the support schemes. And in addition, I want to do a comparison between the market in Germany and Norway. I don't know if there are a lot of differences yet, but this is what I am trying to figure out. I prepared a lot of questions so I don't know if we will have time to go through everything.

N: We have time, the best thing would be to start now.

M: Perfect, I suggest that we start with the second part of the questions I prepared just to be sure. If it is fine for you?

N: Yes.

M: So, I realised this weekend that there was a new Directive from 2018. And I saw on your website that you had been involved in that, what was your role?

N: We have been involved by being involved in the lobbyism. We were lobbying about how to create a mutual message that the market participants would share and also involved by answering the public questionnaires. We did that to make sure that our thoughts and meanings about the market got to the politicians designing the Directive.

M: So, there were also a lot of companies like you involved?

N: Yes, a lot of companies. So, also other companies from the industry sector.

D: They were also participating in the questionnaires, they probably had different sights about the GO system, I mean the GO system is a very small part of the whole directive. And we are a company dealing with GOs on a daily basis, so of course we had more expertise in just that part and we ensured that it was correctly received by what it is and what it supports and what stands for by the politicians and people making the Directive.

N: That's how we involved ourselves, participating by lobbying and by answering the questionnaires and getting others to answer them as well.

M: The thing is that when I read the Directive from 2009, I saw that it was still in force. So, I didn't think about looking for a new Directive.

N: No, but the Directive from 2009 is still in force. It takes two years from the Directive is approved until it takes action. The members countries have two years to implement the Directive, before two years it is not mandatory. So, they have until the end of 2020 to implement it.

M: Okay, so it is not applied yet.

N: No, the member countries have to work out how to apply the Directive. They have two years to ratify the Directive and implement into the laws of the country.

M: In the new Directive, they talk about GOs for gas and hydrogen. Does it exist yet?

N: Maybe not for hydrogen but you can receive GOs for other sources of biogases which are produced from renewable sources. There are registries for this as well and it becomes more and more popular to use it.

M: But is it another registry than the NECS?

N: Yes, there is no Norwegian registry. But there is a Danish and a Dutch and one in UK I think and there are some green gas registries.

M: The NECS is only for electricity?

N: That's correct.

M: So, there will never be hydrogen in that?

N: Well, it can be and that depends on the government that will appoint one entity that is supposed to govern the registry and follow the rules set up by the laws and the EU Directive. So, if the Norwegian government appoints Statnett, it can be green gas certificates in the NECS. So, it depends on what the government decides and that varies around the EU.

M: There was another point that I didn't understand in the new Directive. It says that GOs can be issued directly to the supplier or consumer. It is the question 17.

N: Yes, an example of that could be Germany for example, where you have feed-in tariffs. By law it is decided that GOs should be consumed by the German end-consumer which is paying for the feed-in tariff. So, the German consumer gets all the GOs and they are cancelled and that is to count the production and create the fuel mix disclosure and get the consumption of the renewable energy to the end-consumer instead of the GOs being is eligible for sale and trading.

D: It is the EEG share. Every consumer pays for it because the Germans, they have to increase the renewable share in the fuel mix. So, automatically if you buy grey electricity, you have I think it is almost 50% of renewable electricity because you pay for it. And the feed-in tariff is not like here, it is not market-based, so if you want to build a new windfarm for example, you will get a fixed price for 20 years, that's the feed-in tariff, you have income for 20 years. So, for every wind park developer, they know that they will get this money for the next 20 years and the consumers are paying for it, if they want it or not.

N: One of the conditions to receive it is that you must let the German public consume the renewable attribute of the production.

D: If your production gets supports by the feed-in tariff, you cannot issue GOs and then the GOs are issued directly to the producer or the client and it is cancelled automatically.

M: Is that the case already? Because when I look at the statistics, the number of GOs issued is super low in Germany because of the support scheme.

N: Yes, that is true but if you look at the fuel mix disclosure of Germany, you see that the renewable share is 50%.

M: Yes, but I thought that the number of GOs cancelled was high because of imports.

D: That is also true because the Germans are very keen on consuming renewable. So, you have 50% renewables because of the feed-in tariffs and the rest, you need to import or buy German GOs. There are also some power plants that do not receive the feed-in tariff anymore or did never receive it like some old hydro power plants and they are issuing GOs and you can buy GOs from these power plants. But Germany is the largest market for GOs, and they like to consume 100% of renewable electricity and then they buy the 50% on top.

M: So, the GOs that are issued to consumers and cancelled directly, are they accounted in the number of GO issued?

N: No, they are not issued towards any consumers. If you don't buy any GOs for your consumption, you would get the residual mix. In that grid, there is 50% renewable. And then, if you want to have 100%, you have to cover the rest with GOs. Issuing and cancelling GOs directly is just a possibility on how to address that problem because now, it doesn't show in the statistics. Of course, they wanted to show in the statistics, it is just that the Member States can do that if they need to.

M: But I think it is not done already.

N: It is not done in Germany by now, but another example for this is when you are a consumer with a small production facility, think about a household with a big solar panel. They would in Norway on a general basis consume about 25 MWh per year. And they have a big solar panel, so they produce for example 10. Their net is 15 MWh of consumption from the grid and the 10 left is thus renewable solar panel from the roof. And then, you could issue the GOs directly to the households and cancel it directly. Like this, it would be easier to follow the statistics of what is used and produced. It is a rule that is designed to improve the statistics and the consumer choice.

M: Why couldn't he sell it?

N: It is already consumed.

M: Ok, I would have imagined that the household would first feed the electricity he produces in the grid. But they always look at the net difference?

N: Basically, they would always consume everything. If you are at +, you need to have a meter between your house (internal consumption) and the grid, you could have this available for sale. And then it is only what is produced from your solar panel and sold to the grid. Then you can sell it, and it becomes available for the market.

M: For example, if I sell my electricity to the grid, I could also sell the GOs that I get for that production but if I consumed all the electricity, it is cancelled directly.

N: Yes, that's the whole point. But the Directive says Member States "may" do that.

M: So, in that case, you wouldn't have any role.

N: No, we would never touch these GOs because it is not available for the market.

M: What about the renewable share of energy target for each Member for 2020 and 2030? Have GOs something to do with that? How do they calculate the share of renewable energy?

N: I don't know about the calculations, but they don't use the GOs as a tool.

M: So, they probably look at the production instead of energy consumption. Because the target is a "share of renewable energy consumption" so I was expecting the GOs to be used.

D: For production they don't look at GOs but for the consumption, the GOs are the only tool to prove, document that you have a renewable consumption. So, for the consumption, it should be included.

M: That's what I mean, for Norway if you look at the renewable consumption, then you are far from the target but if you look at the production there is not much to do. So, I suppose the target is about production but because they use the word "consumption", I was confused.

D: The Norwegians, they know that they have almost 100 % renewable production, so the industries they take it for given: it is cheap, and it is renewable, so they don't want to pay for the GOs. In Germany, it is different because they know they have some old nuclear and coal power plants, so that's why they have the incentive to pay. So, they want to import GOs to prove the consumption, and the consumption is quite good. But they have to work on the production. So, I guess the Norwegians are probably not in favor of an ambitious renewable share in consumption.

N: That will probably be a more pressing issue when you have full disclosure because now, we don't issue GOs for the fossil sources.

M: But you do that for the coal, no? That's what Statnett told me.

N: Not in Norway but other countries do that. We can do it, but no one is doing it because there is a cost, and no one would buy that. But yes, you could do it. But it has not been included that it should be full disclosure in the new Directive so that will probably not happen.

M: So, I guess you don't know the target for Norway for 2030? I couldn't find it.

N: It is 32,5% for all Europe and the shares are calculated differently according to the country.

M: I know, but I couldn't find the precise share for Norway. Do you know if it is already available?

N: I don't know. But the GOs has nothing to do with the goal of renewable share.

M: Ok, do you know if there are new directives or new agreements coming in which the GOs could be implied?

N: Well, all the member countries that have to implement the new energy Directive, they are making their own law text, in their own languages. This is part of the process now. But there is nothing new that is coming apart from the directive that won't be changed until 2030, I guess.

M: ok, perfect. Now we can move to the first part of the questionnaire I prepared. What are your main activities? Do you only sell GOs or do you also supply electricity?

D: We are not a supplier of physical electricity. So, we are trading renewable energy certificates that might be GOs, RECS, I-RECS. This is our main focus area.

M: If we look only at the GOs, what are the different products that you sell? I can see the GO^2 there on the board, is it a label?

D: Yes, it is our own product.

N: It is a financing tool to release more renewable energy to the grid. So, you buy GOs and pay a premium that goes to the ECOHZ renewable energy foundation that then lends out that money to projects in need of finance which wouldn't be realised without any contribution.

M: So, it is additionality?

D: Right.

M: So basically, you lend the money and you get interest on that.

N: Yes, we take an interest that is a little bit higher than the bank because we do not have any other security for this. So, if the project goes bankrupt, we will not get our money back most likely. That is why we take a higher interest rate as well. It is probably also the first money that goes out of the project

because it has a higher interest. And when it is paid back in full, we just relend it out to new projects. So, your one-time contribution would stay alive many many years.

M: What about the different types of GOs? Do you have GOs for every type of renewables?

D: We have a wide spectrum. It could be old hydro, new hydro, semi-old hydro, hydro with support, without support, hydro from different countries. This is just for hydro, but it applies to other technologies as well. So, upgraded power plants, power plants with specific environmental standards, fish friendly, salmon river I think we have, heritage: so very old power plants. Some people love new power plants and pay a premium for that, but other love old power plants because they don't have any impact on the animal habitat or whatever because they have been there for 100 years so everything has been adjusted to it, instead of taking new landscapes and completely ruining the whole habitat there.

M: So, there is also a premium for old hydro?

D: Yes, we have the label Bra Miljöval. They want older power plants which received an upgrade.

N: This is sort of local market mechanisms and how they work. There is culture and there is opinion and different stuffs that come into play when the consumer wants to choose. And that is the whole point of the GO market, that consumers should also be allowed to choose what kind of power and production they buy from. They should be able to choose for whatever they want and not only for the fossil fuels sources.

D: You can buy GOs where the producer has no link with fossil or nuclear production. There are plenty of different products, you have the same for wind, bio, geothermal but the most traded product is definitely the hydro. But maybe it will be wind because the share of wind is increasing.

M: But now, it is the hydro that sets the price for all the GOs?

D: Yes, old hydro from the Nordic is the base price.

M: I am asking that because it is the only price, I have access too.

D: Yes, the other prices are built up on it. Wind was more expensive in the market for some time but now wind and hydro are more together. But if you take old hydro as a benchmark, maybe European hydro as a benchmark is quite good.

M: Alright. You mentioned the label Bra Miljöval but how many labels do you offer to the customers?

D: We have at least 10, I think. That is because people in different markets want different things, our producers want different things. So, we have a large portfolio and it is best to be able to deliver whatever they want. So, we have OKpower, TUV Nord, Bra Miljöval, we have EKOenergy, we have TUV SUV AA, TUVSUV AA01 and other things. We have a lot of products which is nice for the client, he can choose whatever he likes. It is not one commodity but as I said, the most traded is old hydro, that's a standard.

M: But is it the most traded because it is the GO the most available or this is the most traded because it is the most demanded?

D: For now, it is both.

N: Yes, Hydro is the one that has the most production amount as well, and it has always been the most traded. It is the most commoditized product.

D: Because a lot of consumers want large volumes for a cheap price.

M: Ok, so you said that the customers wanted different things, do you experience a different demand between Germany and Norway?

N: Yes, definitely.

D: In Norway, cheap electricity and renewable is given, it has always been there. They have so much water everywhere, they have a lot of space, large powerplants. In Germany, we don't have water, we don't have space, we have some windfarms that we finance by ourselves, but we want to increase the renewable share so there is a large demand, and the largest in Europe for GOs. We want to consume green electricity and at the same time build new power plants to increase the renewable share.

M: Yes, but if you buy GOs in Norway with the additionality criteria, then you will not expand your production in Germany, you will expand the production in Norway. Does that matter you?

N: Yes, but it is a European power market, it is not national anymore. Even if you have national rules, if you put in 1 MWh of energy in Norway. 1 MWh has to be consumed somewhere within the European market because the system balances all the time on 50 MHz or 50.2 or whatever, I can't remember and you can't deviate from that, so if you put in 1 MWh, it has to be consumed at the same time. The energy market in Europe is considered as one market so it doesn't matter if you put or have a lot of windmills in Norway instead of in Germany.

M: I know but it is still the production from Norway.

N: I understand but you have cables between the countries, so you export and import which makes Europe as one market.

M: I know I am just thinking from a statistical point of view.

D: Yes, but Germans want to have renewables, but they also want it cheap, so German GOs are usually more expensive because as I said, we don't have that much space, we don't have that many rivers. Of course, it would be ideal that the Germans could finance power plants in their country. When the windmills will go out of the EEG which is happening stepwise now because after 20 years they go out and then suddenly they can issue GOs and then the Germans will be able to buy those GOs. But still, since it is a European connected market, if you want to make impact and have a green consumption, you can buy GOs elsewhere. If that wind park is in Norway, that is fine, they have space.

M: So, you would say that they are more looking to make an impact instead of increasing their national renewable production?

D: Yes.

M: And would you say that the German consumers want cheap GOs with additionality? That would be their main criteria?

D: Well, the Germans came up with a lot of products. They came up with buying new renewables where they have a lot of products. Based on that effect, they want six years and younger to be able to support this kind of producers. They want semi-old, they want to buy GOs from producers which they know they invest in renewables. They came up with a lot of products to increase the capacity.

M: So, you would say that the Norwegian try to buy the cheapest thing as possible while the Germans are more picky and want specific stuffs.

N: I think this is more based on cultural differences, it is not that they are more "picky". They want someone to verify that this is ok. They are crazy about this stuff, if you look at even toys or whatever stupid stuff, you need a TUV stamp to even sell basic stuffs like cups or whatever to check that the product is ok, so that's German people and that is cultural-based, or cultural market differences.

D: The Norwegian basically produce and the Germans consume, you cannot 100% say that but it is not so far away, maybe exaggerated but not so far away.

N: If you get to read about the physics of electricity, electrons will always use the shortest way from the point of production to the point of consumption. Meaning that if you have two powerplants next to each other, one renewable and one fossil and if you have two clients, they would share the whole thing. If one consumer is closer to the coal power plant, he would get 100% coal. GOs are the only way of documenting and consuming renewable electricity. This is why it is based on a certificate. Also, it is impossible to have one line from renewable power plants to every consumer that wants to consume renewable electricity. So, there is no other way to capture the willingness of customers to pay for renewable.

D: But I think you asked two questions. So, you asked why would Germans pay for something to increase the Norwegian production? But I think, one buys renewable electricity just to document that he consumes green and some of them also pay to increase the capacity. But maybe that first motive is already strong enough to buy renewables because you can document. If it comes from France or Norway, Austria, the Netherlands, Belgium... it is the European market, but you can document that you consume green electricity. That is already an enough incentive to pay for it. But of course, there are different types of products which have a different quality.

M: Would you say that there is only one GO market being the European market, or do you make a difference between the German and the Norwegian market?

D: It is one market place, of course the demand in the different countries is different and maybe also the products differ from market to market, like we have Bra Miljöval which is a Nordic label and we have EKOenergy which is a totally international label, we have TUV labels which are only for Germany but it is still one market. But you have some pockets, like for instance that are products and country-specific. The Swiss hydro for example has a really high price or Dutch wind also has a higher price.

M: Alright, so there are different products and demands according to the country but as a consumer I can still buy every product at the same price independently of the country I come from.

D: Exactly.

M: Then, I would like to know how it works exactly. You sign an agreement with producers and then receive their GOs? It would mean that you have an account in the NECS and properly have the GOs in hand before transferring them?

D: Yes.

M: But are the GOs issued directly to you?

N: They are issued directly to our account if the producer agrees to that, then he doesn't even see the GOs. It is just like a bank, you let the bank handle your account, but you have access to it, and they are not allowed to do anything that you haven't agreed with them of course. For example, if you want to buy some chairs in a company, they are probably the one that do it for you, you say they should do this. The producers give us consent to handle this for them. It is the same for the consumers or electricity suppliers. They give us consent to do the redemption on behalf of them, so that they don't have to go in the registry and do that themselves.

D: You can imagine like an online banking. You have different accounts and you get money from different people.

M: But are the GOs necessarily issued to you or some producers can still decide to do the transfer themselves to your account?

N: they do both.

M: What about the consumption side? You sell to industries, suppliers and private households?

N: No private households. We have end-consumers that are businesses, it is only B2B.

M: Do you cancel the GOs for your customers meaning that the GOs never move from your account or do you transfer the GOs to them and they cancel themselves?

N: Yes, we can cancel the GOs for our clients. We also have clients that don't want this, so we sell the GOs and transfer them into their account for example in Sweden, in Germany or wherever in Europe where the registries are connected. Then, the customers can do whatever they wants: cancel it or transfer it forward.

D: Let's say we have a client in France, we also have an account in France, so we transfer to France and cancel in France or Switzerland or wherever. If there is a consumer in a country without registry, you can cancel the certificate in Norway.

M: So, this is ex-domain cancellation?

D: Yes, it is not best practice but sometimes you have to do it because the client has no registry.

M: And are ex-domain cancellation forbidden in the new Directive?

N: No, because if you are a consumer and want renewable energy and are outside one of the connected markets, how can you then consume renewable energy? Even though, it is not best practice, it is the second best.

M: But in the new directive it is written that: « Member States shall not recognise guarantees of origin issued by a third country except when the Union has concluded an agreement with that third country on mutual recognition of guarantee of origin issued in the Union and compatible guarantees of origin systems established in that third country, and only where there is direct import or export of energy.»

N: No, but that is if you have another registry or with another standard of GOs. Take for example UK which is now a part of the EU and they have their registry, so they are obliged to accept the GOs. But when they will have concluded Brexit, they will not be part of the EU any longer so the EU will not recognise the GOs from the UK without prior mutual agreement.

M: Alright. If we go back to the registry system, do you need to have an account in every country to which you sell GOs except if your client has an account himself in that country?

D: Yes. But in some countries like in Germany, we cannot cancel, then it is bound to the delivery of physical electricity. So only the electricity suppliers can cancel GOs in Germany.

M: Ok, so you would have to deliver to the supplier of your end-consumers. But so, they cannot buy GOs without electricity?

N: Yes, they can buy GOs without power, but they need an electricity supplier to cancel them.

M: Do you also sometimes sell through brokers?

N: Yes, we do. There is a market for the brokers. The brokers connect with clients and charge us with a small fee. They are increasing the liquidity and the transparency of the market by providing prices to clients and providers.

M: But do you that for most of your GOs?

N: It is hard to answer but some clients are concerned by internal rules in their company saying that they have to use brokers to ensure that they have sort of a neutral price and stuffs like that. Some only buy GOs once or twice a year so they don't want to engage actively in the market and then they use a broker and get the best deal that day.

M: But why are the brokers more transparent?

N: Because they are only matching buyers and sellers. So, they will find the market price for you and you don't get fooled. That is just like in the real estate markets.

M: But for you it wouldn't change that much? You would probably get the same price if you sell through a broker or directly to your consumer?

N: Yes, but there is another aspect that we can sell. It is all the products that we have developed internally which are not connected to the standards GOs but to services that we provide to our clients.

M: Like for example?

N: Portfolio management, GO^2, labels and stuffs.

M: Alright. How do you define the price of your labels and products? Do you choose the price yourself?

N: It is market price on almost everything and there are also negotiations with our clients, so there is a mix of this.

M: But is there a market price for every single GO that you mentioned before?

N: Almost because it is built upon standard prices for standard hydro GOs. You have like a base price and then fix add-ons on everything.

M: So, you decide the add-ons yourself.

N: Yes, we do but maybe they can be exposed to competition and competitors that can provide a better price. There are costs related to these eco-labels. And there are hundreds of ways to calculate these costs. So, it is point of being a competitive market provider of GOs because the smart buyers would then say: "hey, your competitor here is cheaper than you, why should I buy from you?". And then I would say a lot of good reasons, for example you have GO^2 or we have other stuffs that we can deliver and that create a higher value for the customers and then we compete on price.

M: So, based on the basic GO products, you kind of build on your own products and try to find a price that covers your costs and is competitive enough.

N: Yes, exactly.

M: Then, what is the margin that you take? Do you have a fixed standard?

N: It varies a lot. It is dependent on the product, the solution and the total package you deliver to the customer.

M: And do the customer know what margin you take?

N: Yes, we can be open with that but also, we can be closed. But we take our margin and of course we have to provide an economic incentive for our owners to own and we have to get our salaries and cover our costs, so we need a margin on our products.

D: But we have our own portfolio so when prices are highly volatile, you may have higher margins, but you also may have a loss because you have GOs in your account and prices fall or rise.

M: So, do you adapt the price of your products according to the volatility of GOs?

D: If you do not adapt with the market price, then you are not competitive. If we bought our GOs for €2 and the market price drops to 1, we cannot sell them for €2.

M: Yes, but I guess you have long term contracts, don't you? So, for example, if a customer would like to buy for next year, then you fix the price in advance.

D: Yes, we sell forward for sure. But let's say we bought 20 GWh of GOs last week because we want to sell them this week, but the price was €2 last week and now the price dropped to €1 , we have to take the loss, it is not easy to say: "what is the margin"? But if the price increase to €3, then we were lucky, and the margin is way higher. But when you see a stable price level in the market which was there, not last years, but it exists, then of course, it is easier to calculate the margin we can take.

M: But for example, if you sell for three months ahead, you fix the price now and take the risk that the price may change?

N: No, we don't take the risk. So, if we sell to the clients for three months, we buy for the same three months at the same time. For example, if a client buys for one year, we would have secured the price on the opposite side already to reduce the risk. So, we buy for one price and sell for another price at a fixed price, not at a variable price. So, if the price changes we don't have any risk. If the price goes up, the client is very happy and if the price goes down, then the producer is very happy.

M: So, you fix the price on both sides to ensure you have zero risk, ok. Then, I think we are almost done. Do you have any advices on which other aspects I should investigate to build a comprehensive comparison of the GO system between Germany and Norway?

N: Yes, but you know the system is the same because it is defined by the EU Directive.

D: You should call it market, not system because the system is the same. But the market is different. And you can look at the demand side because it is interesting. On one side, you have Norway, large production and very small demand and in Germany, you have small production and large demand. And then, the support scheme is different because it is market-based and then the EEG is just a fixed price for the next 20 years and the cancellation is different. Also, in Norway, we can cancel on behalf of people, and in Germany they want the retailer of physical electricity to cancel it. The fuel mix disclosure is also different because in Germany, you can still buy 18 - GOs until October 2019 and you can only use 18 for 18 and 19 for 19. And in Norway, you can use this year for 2019 and everything from 18 which has not expired before cancellation. So, for the 19-fuel mix, you can use 18 volume as long as they did not expire of course. And in Germany, you can only use 19 volumes.

M: Ok, I see. And do you think that I should talk about the link between the GOs and the Carbon Capture and Storage or EU Emission trading or for you, it is not linked. Because maybe a company would buy GOs if it is cheaper, but if quotas are cheaper to buy, than maybe it would buy emission right instead?

N: It is an extreme difference because on one side, you consume renewable energy and on the other side, you buy the right to emit Greenhouse gases.

D: I would mention it, but I don't think I would compare it.

M: And even for the CO2 capture and storage? Because this is doing some good too.

N: But you know it is very expensive technology and it is hard to make it profitable still.

M: So, you are not looking at that?

N: No, we are not exposed either in the market.

M: What about your future prospects for the GO market?

D: The new Directive supported the GOs as "THE tool" to document renewable energy consumption, so it is really good.

M: But it was already the case no?

D: No, it changed from “may” and now “shall”, that is very very important. If you are talking about the Directive, you should mention these two words.

M: Yes, that is true, I remember to have seen that on your website.

N: Yes, there are a lot on data on our website, you should dig and read all the information that are public.

M: Alright, and do you think that there are still issues in the GO system now or that all issues have been tackled by the new Directive?

N: Probably not.

M: But did you ask for example for something that hasn’t been done?

N: The biggest thing is that the Member countries exclude EU market players. For example, we are excluded from the market because they are having rules like in Germany that go against the rules in the EU that are the main trading rules that there should be free flow of goods and services, but this exclude us from the German market in a way.

D: It is that the electricity suppliers are the only ones who are allowed to cancel on behalf of the client.

M: Yes, but you can still sell to them so what is the difference?

D: But of course, it is better to sell to the end-consumer. Because we always need an electricity supplier on our end: “can you please help us?”.

M: But do you manage to get the end-user price, or do you sell at the wholesale price anyway?

D: In the reseller market, it is wholesale price but of course in the end-consumer market, the clients are more attractive.

M: So, there you can get the end-user price. So, you are not only in the wholesale market.

D: No.

M: But is it because you are a portfolio company? Because brokers only use the wholesale price?

N: Yes, brokers only present the wholesale price. But they also provide the price for a commodity, not a product. Their products do not include any services. For example, cost of delivery, finance cost and everything.

D: Yes, brokers just connect the people.

M: Yes, they just take a fixed rate anyway. Alright thank you very much for your time and this interview.

Appendix E - Interview Innogy: Roland Kok

Legend:

M = Margaux Snoeck

R = Roland Kok

M: Hi. Thanks for letting me interview you. As first question, I would like to ask you what is your function and in which department of Innogy do you work?

R: Hello. So, my role is Head of Customers Solutions within Innogy Renewables. And I work in the Commercial Development department. We have a lot of assets at Innogy (solar, hydro, wind onshore, offshore, biomass). We also distribute power from A to B, we do that in Germany and eastern Europe and we also have a retail business, but I only work for the renewable sector. So, I can answer your questions for guarantees of origin and all the basis for a producer of renewable energy. So, we sell our GOs, but we do not trade them so to say, we do not have a buying interest. It is still within your scope, right?

M: Well, most of my questions were prepared for an electricity retailer must maybe I can still ask you some questions and see if you can answer them. One thing I don't understand in Germany is that you don't receive GOs if the production has been supported, right?

R: Yes, it is correct. That is a choice that the German government made, so the same is actually applicable in France for subsidised assets and you also see that in few other countries. Every country that wants to comply with the energy directive must issue GOs. However, they don't need to issue them for the sake that the project owner will get them. So, like in Germany, the German government decided that basically the value of renewable power that is supported by the state subsidies, the society should benefit from that. So, every single German citizen basically gets x% of renewable power automatically being attached to their energy bill. The reason why they choose that is a political discussion I think but the main take-away for me is that every nation has the freedom of the choice on how to deal with the this GO ownership. And what we see in Germany is that the German government decided just to keep them in the society and just not let them trade freely in the market. France is doing the same, we see for instance that the Netherlands is doing it different, we see that the UK is doing it different, we see that in Spain actually, the situation is equal to the system in Germany. So, there are all kinds of different schemes, but they all have in common that they have to issue GOs, every EU nation has to issue GOs. It is just a matter of who own it.

M: But so, you mean that for the supported renewable production, GOs are issued but they are kept by the government?

R: Absolutely, that is the case, yes.

M: So, it just means that the producer does not own the GOs.

R: Yes, and they cannot just trade them freely. So if you want an example, for example for France, if you as a producer of renewable energy say that you want to get GOs for your own assets, you will instantly lose your subsidies for the rest of the lifetime of that subsidy and that is of course the situation that a lot of asset owners don't want because the value of GOs is significantly lower than the height of the subsidy. The subsidy is way higher than the value of GOs.

M: Yes, so the producers have more incentives to ask for the subsidies instead of the GOs.

R: Yes, absolutely. You would never exchange the subsidies for GOs. We could say that the price of a GO is between 0€ and maybe 8€ these days in the Netherlands. But it would never be the case that the subsidies are around these levels. It is significantly higher. We talk about two digits numbers normally.

M: But what I don't understand is more the disclosure. If German consumers ask for renewable to their suppliers, does that mean that the supplier always has to buy GOs to cover the production.

R: Yes, if you don't have GOs in your portfolio and do still claim renewable power, that is fraud. That is an interesting thing. What is happening in Germany or in France at the moment is that a lot of parties and utilities are selling renewable power, but it can only come from foreign sources normally or from sources that do not have a subsidy anymore like old hydro assets for example. You see that a country like Germany is importing a lot of GOs from other nations within the EU or from Switzerland or Norway. The latter are not EU countries but are taking part in the so called EECS system.

M: Ok. But let's imagine an electricity retailer makes a contract with a renewable generator benefitting from a governmental support.

R: So, you mean basically, there is a contract between a utility in Germany and they buy power from a windfarm?

M: Yes.

R: Then this is seen as power. Not necessarily green power. It sounds a bit stupid, but you can only claim renewable power if you attach the power as well as the GOs in one package. You would never be able to claim that the power is coming from a specific asset. GOs were never invented for commercial trade. They can be traded but the reason that they are there is just to show what is produced with what technology at what time.

M: I don't know why but I am really struggling with the supported renewables because I don't understand. You mean that they are just disclosed as like grey power if you don't buy GOs.

R: Yes, this is correct, that is how it works. You also need to distinguish the fuel mix disclosure which utilities normally need to do. So, let's take an example, in Germany, we have EnergyRetail. EnergyRetail sells 100 GWh of power, 60 GWh of that is sold and is claimed as renewable. So, they need to buy at least 60 GWh of GOs for that power. That is what they need to do, and this is also what they need to disclose on their fuel mix disclosure. Otherwise their claim is not valid and not objective, and they are lying and that is not acceptable by the competition authorities, NGOs, etc. But I do understand that this is confusing because every nation has its own system. Every nation in the EU decides if the GOs can be traded freely and be owned by assets operators or by the society or not. And there is no harmonisation, every nation has its own rules, they are just a few things that are comparable but still there is not one European system, there are multiple registers of GOs that connect to each other, we call it the AIB hub. But still everything is different.

M: Yes, I am asking that because a Norwegian trader told me that Germany had almost 50% of renewables in the production mix due to the support schemes. And he said that they were covering the 50% left by GOs to make sure they have a 100% of renewables.

R: No that is not true, this is not how it works.

M: So, in Germany, if all the renewables were supported, it would mean that 100% is in the beginning grey and then depending on what volume of GOs you buy you become more renewable.

R: Yes, that is correct. However, in the German system, also the government decided that a specific portion of your energy bill is seen as renewable anyway. So, the people living in Germany get in the end what is produced from the part that is supported. So, let's assume, Germany produce 40% of renewable and 30% of that is supported. German consumers would see on their energy bill that among the 100%

power they have received, 30% of it was renewable. And if they need to have more, if they want to have a claim on 100% renewables, then their utility company needs to buy the additional 70% from the market.

M: Ok, does the consumers know that the electricity retailers buy GOs or they just know that they have 100% of renewable and don't know the price they pay for the GOs.

R: I think that in general, consumers never know what the GO price is. I think in general consumers don't really know how the GO system works even though there are explanations on the website or in the terms and conditions from the power retailer.

M: Ok, but do you have an idea of how much it represents, what fraction of the electricity bills does the GO price represent?

R: It is a fraction of the cost. Well, if you take a look at the base commodity price of electricity, let's say that it is around 50€/MWh these days in Europe on average. However, there are also a lot of fees attached, there are a lot of margins and if you take a look at the gross value of GOs, it is only a small fraction of the total price for renewable electricity. It is nothing, I would say it is less than 5% in all EU countries, it is significantly less than 5%, it might even be around 1%, 2%.

M: Is that only the GOs that differentiate the price between buying renewable or non-renewable or is the difference bigger than the 5% you just mentioned.

R: I think the difference is the GO plus the margin the retailer wants to make.

M: Ok but do you talk about the GO price in the wholesale market or in the end-user market?

R: We are active in both, so we sell to utilities, we sell to trading firms and we sell to corporates being for example, large corporates who want to skip the utilities, the trader, the middlemen, and want to buy GOs directly from the source.

M: Ok, but then you as a producer wouldn't it be more interesting to receive subsidies instead of GOs? Or are the GOs a significant revenue for you.

R: It is not a significant revenue. In Germany we earn almost nothing with GOs. We only get something from the assets that have run out of subsidies. In the Netherlands or in the UK, we get lots of them. In Poland also.

M: Ok, so you are active in several countries.

R: Yes, are active across the globe, we are active in the US, in Australia. But GOs are of course only in Europe. We have other types of certificates in US and Australia, etc. In some markets in the EU, the GO price is very very high like in the Netherlands, in some markets, they are very very low like in Poland. It is still a nice additional revenue stream next to the power price and next to the subsidies.

M: But in Germany, you would thus rather ask for the subsidies then.

R: Yes, always, without any doubt. In Germany we only have GOs from assets that ran out of subsidies.

M: Ok because I was expecting quite a high price for German GOs since the German supply is very limited.

R: It depends on what aspects the consumer wants. Germany is a major importer of GOs, in Germany a lot of power is greenwashed with Norwegian Nordic Hydro, that is crystal clear. They would never buy Dutch wind because it is 8 € and nobody would be ready to pay for that in the market. And that is interesting if you ask me. What is the real value of GOs? It is directly related to supply and demand. If the demand increases, the price goes up. Of course, the local GOs in Germany are a bit more expensive

compared to GOs coming from other countries, but you should not see that as a significant additional revenue stream because the delta between let's say the commodity product and the special product is very low. It is not as if we were talking of euros of difference. We talk more about a few cents per GO. And let's assume a household on average do use 3 to 4 MWh per year, you can imagine the delta from a commodity perspective is just a few cents. That is like nothing.

M: Ok, and what are the conditions to receive subsidies in Germany?

R: Currently we have the FIT and new projects will receive a so-called contract for difference meaning that for every MWh that you inject into the grid, you get a subsidy. However, if the power price goes higher than the contract for difference price, then you need to pay something back.

M: Is that a feed-in premium?

R: It is a premium but let's assume the power price goes to 200€/MWh (which is not realistic), you would have to pay something back and in the FIT system, you just get something for every MWh that you produce. In that case, the government doesn't care about what you get from the market.

M: Don't you use a tender procedure now?

R: These days, there is yes. But in the past, the FIT was the only thing. At the moment, there is a sort of auction. You can win a deduction, normally the lowest bidder wins.

M: Do you get a feed-in tariff for any type of renewables or is it only for specific sources or for example for young sources or new sources?

R: We get a FIT based on a category such as wind power onshore, offshore, solar PV, etc. I know that there is a market for young GOs and old GOs but that has nothing to do with the FIT system. There is no single relationship between those.

M: Ok, but so the FITs are different according to the energy sources but still you can ask for any sources of renewables.

R: Yes, but the market defines which technology has the higher value. So, for example, a wind park has a higher value than hydropower.

M: I also had a question about the fact that in Germany only the retailers can cancel the GOs. What happens for example if a German company makes a contract with traders, for example a portfolio company. Does he also have to do a contract with a power supplier so that the GOs can be cancelled.

R: Yes, we can transfer the GOs to their suppliers so that they cancel them for the company. The alternative is that they open their own GO account in their country for example in Norway, in Sweden, in the Netherlands, etc. You can open your own user account so there are multiple ways to redeem GOs in the way that they like it the most.

M: But isn't that a disadvantage the fact that you have to go through a supplier? Isn't that more expensive for you?

R: No, because we need to transfer the GOs anyway. It doesn't make any difference if we transfer the GOs to a German register or a Dutch register or a Norwegian register.

M: And does the company has to pay more.

R: No, usually we don't count the transfer fee. We have to transfer the GOs anyway. In that perspective, it does not matter to which register member we transfer.

M: I was asking that because then a Norwegian trader for example, cannot get the end-user market price because they have to go through electricity retailers, and I know that some traders are complaining about that.

R: Well, if there is any party in the market I don't feel sorry with, it is the Norwegian GO traders because they are only exporting what they have in Norway, but it means that the renewable power in Norway is not closed to 100% renewable anymore. So no, I don't feel sad because these prices are nothing compared to the total margin these Norwegian parties made.

M: Alright. I think I have two last questions, because the other questions I prepared are more for an electricity retailer.

R: Ok yes, I am a producer, but I can maybe put you in contact with a retailer colleague at Innogy.

M: Ok, as fist last question, do you know if the new Directive will change anything for the GOs and the GO market?

R: I have a view about that. Now, the new Renewable Energy Directive will have to be implemented by all EU Member States. The thing is that there is no reasons for any nation to deviate from what they have done before. Every country still has the chance to issue GOs, one risk is foreseen from a commercial perspective and that is a coordination, especially the nations that were not giving the GOs to the owners of the assets, they will auction these. France is doing this at the moment, Luxemburg is doing this. It might be that Germany is going to do this as well. But that is speculation from my side. There is no objective clarity about it. My view is that GO market as of now will not be significantly influenced by the new EU Directive. Of course, there will be some changes, it is more about trying to harmonise the failures of the system and to improve it, but I don't have the feeling that it will significantly change.

*M: Ok, because there is a difference. Before, it was written that the suppliers **may** back the renewable electricity they sell with GOs, and now it is written that they **shall**.*

R: That is true, Directives are always in the details and specific words can be interpreted by Member States in different ways, so it still provides enough freedom for a nation to interpret this, it is for guidance. I don't see in what nations should change their way of working. They are some nations that are still not part of the AIB and its Hub such as Poland for example. The new Directive emphasise the exchangeability of the GOs, so the pressure is on that, they really need to comply now. So, I assume that more Member States now will also be part of the AIB meaning that more GOs will be transferred across Europe.

M: But I mean for Germany, I was already mandatory to buy GOs to cover renewable electricity.

R: Yes, but the thing is that back in the days, there were some countries which used voluntary products in the form of GOs and there also obligatory products like in the UK for example you need to buy some "ROCS", Renewable Obligations Certificates, and a lot of utilities and corporates were mixing these things up and that is not acceptable anymore according to the EU.

M: Ok, again I am asking that because Norwegian companies were insisting on that word.

R: Yes, Norwegians company are trying to push for this but Norway as far as I remember is not an EU member. So, Norway, will all the respect, should remain calm and silent about these kinds of things or otherwise become an EU Member but they don't want to. I am pro Europe, but it is always a bit of a strange system because they like to export all their GOs, but they still don't comply with any other Renewable Energy Directive. They are only a member of the GO system. But the Renewables Directive are way broader than just the GO system.

M: Alright, thank a lot, I think I don't have any questions left.

R: Ok, I hope it was helpful, if there is anything, I can still help you with, just send me an email. If you still want me to connect you with a colleague, please send me an email. Good luck with finalising your analysis.

M: Thank you, bye!

Appendix F - Interview BECOUR: Marine Mouilleron

Legend :

S : Margaux Snoeck

M : Marine Mouilleron

S : Ma première question est : « Que faites-vous exactement chez Becour ?»

M : Alors, on fait le lien entre les producteurs d'énergie renouvelable et les consommateurs: on vend les garanties d'origine. Après, on fait d'autres petites tâches comme les rapports carbones et on leur propose aussi des solutions pour les émissions liées à la consommation d'énergie. En gros ça c'est ce qu'on fait. Après, quand on vend les GOs, c'est un peu plus complexe que juste les vendre, on offre une stratégie parce que le produit des GOs peut être très différent. C'est un certificat mais chaque certificat représente quelque chose de différent et chaque entreprise à un besoin différent où ils veulent par exemple, au niveau du marketing faire passer un message spécifique donc voilà. Nous on essaye de faire rencontrer l'offre et la demande au mieux pour pouvoir valoriser le plus le prix des certificats des garanties d'origine.

S : Ok, et est-ce que vous vendez tous les types de certificats ou pour certaines sources uniquement ?

M : On peut tout vendre, pour l'instant on a surtout de l'hydroélectrique. On est en Norvège donc c'est normal qu'on ait surtout des relations avec des producteurs norvégiens. La plus grosse partie c'est hydro mais après selon les besoins des clients, on arrive à trouver des producteurs d'un peu partout. Cela peut être de n'importe quel pays. On a aussi un partenaire en Asie et aux Etats-Unis ou là ce sont des certificats différents, ce n'est pas le même système. Hydrogène et Biogaz, on en n'en pas.

S : Je demande ça parce que je viens de lire la nouvelle directive et ils parlent d'élargir le système des GOs pour l'hydrogène et le gaz mais ils ne précisent pas quel gaz.

M : Oui j'imagine que c'est pour le biogaz, en tout cas on n'en vend pas.

S : Mais je ne sais pas si c'est déjà le cas. C'est aussi parce que j'ai lu le système CertifHy qui vise à développer des GOs pour l'hydrogène mais je pense que pour l'instant ce n'est encore qu'un prototype.

M : Ok, après chez nous, la plus grande demande de certificats c'est pour l'électricité donc on ne vend que ça.

S : Et est-ce que vous vendez des labels comme ECOHZ par exemple? Ils ont leurs propres produits et des labels standards.

M : il me semble que oui, on peut en vendre. J'ai entendu qu'il y avait des clients qui voulaient acheter ça mais je ne suis plus sûre. Renvoie-moi un mail peut être.

S : Je demande ça parce que j'avais l'impression que vous n'étiez pas pareil qu'un « broker » ou « portfolio company » parce que vous faisiez directement le lien entre le producteur et le consommateur.

M : Oui, alors j'ai vu qu'il y avait une question où tu demandais si on était les seuls à faire ça. Alors oui en tout cas à ma connaissance et à la connaissance des gens dans l'entreprise, oui on est les seuls à faire ça parce que les certificats c'est fait pour tracer d'où vient l'électricité mais la plupart du temps, ce que font nos concurrents, c'est qu'ils achètent le plus possible de certificats au plus bas prix et après ils mélangent tous ces certificats et les revendent au plus haut prix à quelqu'un d'autre. Et on va dire que leur but, c'est bien sûr d'avoir la plus grosse marge. Mais nous, on est plus intéressé par redistribuer le plus d'argent possible au producteur parce qu'à la base, le certificat c'est fait pour ça. Le but, c'est que le consommateur ait envie d'investir dans les énergies renouvelables et que grâce aux GOs, les producteurs reçoivent plus d'argent. C'est vrai que maintenant sur le marché, on peut dire que c'est

« market failure », la plupart du revenu et de la valeur créés par les GOs est juste perdue par les brokers ou les traders. Nous, on essaye vraiment de repenser le système comme il a été créé à la base quoi.

S : Mais c'est quoi alors la grosse différence ? J'avais vu sur site que vous essayiez d'éliminer les intermédiaires, mais qu'est ce qui est différent par rapport à eux ?

M : Nos concurrents par exemple, ils vont juste essayer de trouver les certificats les moins cher, peu importe plus ou moins d'où ça vient et si ça passe par des traders, tant pis. Ils vont juste essayer de se resourcer avec le prix le plus bas et puis de revendre au prix le plus haut. Alors que nous, on va essayer de matcher le plus possible. Il y a des clients qui vont être prêts à payer un haut prix pour les GOs pour une demande bien spécifique. On essaye vraiment de faire la connexion entre les besoins des clients et nous le portfolio qu'on a. On a plusieurs générateurs d'énergie avec qui on travaille tous les jours, on vend les GOs pour leur production. Donc, on est vraiment du côté des producteurs, on les représente quand on vend.

S : Mais je n'arrive pas trop à voir la différence parce que je me dis vous devez quand même acheter à l'avance pour eux et puis peut-être que vous prenez une plus petite marge mais le principe c'est le même non ?

M : Mais enfait, si tu veux, les producteurs qu'on a dans notre portfolio, on reçoit leur GOs ou on leur achète. Et on a un an pour les revendre. Mais après la différence, c'est vraiment la transparence, parce que notre client, il va savoir exactement d'où vient l'électricité et quelle partie de ce qu'il a payé va au producteur alors que chez nos concurrents, tu ne sais pas forcément d'où ça vient. Après oui, tu peux le voir sur les certificats mais les clients ça ne les intéresse pas trop. Et surtout, de ce que tu paies, tu ne sais pas vraiment ce qui revient au producteur du coup c'est vraiment un manque de transparence et ça perd un peu de ce pour quoi le système a été créé.

S : Oui d'accord, les clients n'ont pas vraiment accès au « wholesale price » ?

M : Oui c'est cela, je pense que si tu demandes à un client de nos concurrents, combien de ce qu'il a payé revient au producteur, je pense qu'il n'en a aucune idée et que nos concurrents ne veulent surtout pas le divulguer.

S : Mais enfait, vous avez ce système de 20/80 où vous gardez 20% des revenus et vous retransférer 80% aux producteurs, mais ça ne veut pas forcément dire que vous avez une plus petite marge, la différence c'est la transparence.

M : Après, ça dépend d'où les autres achètent les GOs mais le producteur en général, il ne reçoit pas du tout 80% s'il passe par des traders. Il reçoit beaucoup moins d'argent. Dans le rapport d'Oslo Economics, ils disent qu'en moyenne sur 1€, le producteur reçoit 20 centimes, quelque chose comme ça. Pour l'instant, le système est vraiment inversé, c'est tous les intermédiaires qui reçoivent à peu près 80% et le producteur il reçoit 20%. Nous, on fait l'inverse.

S : Mais du coup, quel prix utilisez-vous ? Est-ce que vous utilisez le « wholesale price » pour le client ou est-ce que vous essayez plutôt de vendre les GOs au prix final que le client devrait payer dans le « end-consumer market » et, à partir de là vous reversez 80% au producteur ?

M : Enfait, les prix ils sont différents presque à la minute. C'est un peu exagéré mais en tout cas, sur le marché le prix, il change tout le temps et par exemple, maintenant c'est un très bon moment pour acheter pour le client, le prix il a un peu descendu. C'est vraiment adapté par rapport aux fluctuations du marché et le problème c'est que pour l'instant le marché est assez volatile. Et c'est un peu à cause des traders parce qu'eux, c'est leur but qu'il y ait des grandes fluctuations, c'est là où ils peuvent gagner le plus d'argent. Mais du coup, le prix il est différent pour chaque client en fonction du certificat qu'il va acheter, en fonction de l'année, etc. Le prix il va être proportionnel au prix du certificat.

S : Mais dans ce cas-là c'est le prix du « wholesale market » ? Donc par exemple, €1,30 pour de l'hydro en 2019 ?

M : Le problème c'est qu'il n'y a pas de prix, si par exemple quelqu'un achète une garantie d'origine, il va avoir son propre prix, mais il ne va pas savoir ce que le voisin, il a eu comme prix. Chacun a des prix différents après oui il y a des sites où tu peux trouver des infos mais il n'y a pas UN prix pour le certificat.

S : Oui ok donc il n'y a pas de règles. Je demande ça parce que souvent, l'idée qui ressortait c'est que le Nordic Hydro forme la base du prix et puis en fonctions de tous les critères des GOs, les vendeurs augmentent et ajustent le prix.

M : C'est-à-dire qu'il y a tellement de production nordique qu'au niveau du volume, c'est une grosse représentation de la production européenne. Mais je dirais que c'est vraiment une différence de l'offre et de la demande. Je ne sais pas si tu as vu mais au Pays-Bas la demande pour la production locale est super grande, donc le prix est super élevé. Et c'est vraiment par rapport à la demande. Et puis après oui, quelques fluctuations dues aux traders.

S : Mais je suppose quand même que vous surveillez les prix des autres vendeurs ?

M : Oui, après on fait des transactions presque quotidiennement (enfin ça dépend des semaines) mais oui on est sur le marché et on a accès à des prix. Par exemple, moi souvent je suis en contact avec pas mal de traders comme ça je peux avoir les prix et le feeling du marché pour avoir des informations. Mais dans tous les cas, le producteur reçoit plus d'argent de nous. Le trader, lui, il essaye de tirer le prix le plus possible vers le bas. La transparence, ça passe par les deux côtés. Le consommateur, il sait d'où vient l'électricité mais le producteur, il sait aussi qui achète son énergie et il sait à quel prix on va le vendre alors que s'il vend ce certificat à un trader, il ne va jamais savoir à qui va aller le certificat et surtout pas le prix que le trader va en tirer, donc nous on a ce truc de se dire que le producteur doit savoir pour combien on a vendu le certificat à un consommateur final et si il y a une trop grande différence c'est qu'il y a de l'arnaque.

S : Ok, et lorsqu'un producteur et un consommateur passent par vous, il y a un contact entre eux ? Ou vous êtes au milieu et fixez le prix mais êtes juste super transparents par rapport à ça ?

M : Ça dépend en fait. Par exemple, là il y a un client qui veut de l'énergie renouvelable qui vient de nouvelle production. Du coup, là parfois ça vaut le coup pour eux de voir vraiment qui est leur producteur pour qu'ils comprennent que leur achat ça aide vraiment à dynamiser la production et tout ça mais après, en général, non par forcément. Je pense que c'est assez rare qu'on fasse ça mais on peut le faire, oui. C'est juste que tout le monde n'est pas intéressé par ça, il y en a qui sont juste intéressés par acheter les GOs pour réduire leurs émissions de CO_2. Il y en a qui sont juste intéressés par le prix le plus bas.

S : Ok, mais est ce que le client vient chez vous en disant : « je voudrais acheter ça pour tel prix » et puis vous trouvez un accord ou est-ce que vous avez vos produits et vos prix.

M : C'est plutôt nous qui disons le prix, et après lui il dit oui ou non. Eux, ils n'ont pas de prix. Je pense que c'est super dur pour un consommateur normal d'avoir les prix parce que comme j'ai dit, ça change tout le temps et aussi si tu achètes maintenant les certificats de 2018, ils sont beaucoup moins chers que ceux de 2019 donc pour la même production d'une même centrale électrique, les prix vont être différents selon la date et tout.

S : Mais pour le broker c'est quand même le consommateur qui décide je pense, parce qu'il match l'offre et la demande.

M : Le truc c'est que je pense qu'il y a des consommateurs qui peuvent nous mettre la pression sur le prix mais bon moi pour l'instant je n'ai pas eu de relations directes avec des clients à propos de prix. Je

pense qu'ils peuvent mettre la pression en disant qu'une autre entreprise leur offre un prix plus avantageux mais après, ça dépend de nous où est ce qu'on veut faire descendre le prix. Parce que c'est quand même pour le producteur à la fin et du coup ça dépend, c'est vraiment adapté pour chaque situation.

S : Du coup, je suppose que le produit le plus demandé, c'est de l'hydro ?

M : Oui car ce sont les moins chères.

S : Ok, parce que je sais que dans tous les cas, le plus vendu c'est de l'hydro mais je ne sais pas si c'est vraiment le plus demandé.

M : Ça dépend de la stratégie du client. Par exemple, je sais qu'en France, ils sont hyper intéressés pour avoir de la production locale, mais c'est local ou rien, donc là le prix il est assez élevé. Les demandes auxquelles j'ai eu accès c'était vraiment des demandes pour des nouvelles productions. Et aussi, de plus en plus des gens qui veulent acheter des certificats d'énergie renouvelable mais exclusivement renouvelable. Par exemple, EDF, ils ont du nucléaire et aussi du renouvelable et il y a des gens qui ne veulent pas forcément de ce genre de producteurs parce qu'ils savent que le revenu revient au producteur mais en même temps, comment tu sais que lui va vraiment investir dans le renouvelable et pas dans le charbon ou ce qu'il a d'autre ? Et c'est vrai que ce n'est pas bête. Et même quand tu regardes Equinor, eux aussi ils essayent de se développer dans le renouvelable mais il y aura des clients qui n'auront vraiment pas envie d'acheter des certificats de leur part, parce que ça reste renouvelable mais il y a quand même une portée super éthique dans le certificat et je crois que ça, ça grandit de plus en plus.

S : Et du coup vos producteurs et consommateurs, ils viennent d'où ?

M : Producteurs c'est plutôt de Norvège, après on a des relations avec des producteurs d'un peu partout en Europe et en ce qui concerne les consommateurs, puisqu'on a commencé l'entreprise il y a un an, les consommateurs, ils sont surtout Norvégiens, Suédois ou en tout cas Scandinaves. Sinon, moi j'ai travaillé pas mal avec des clients français donc on en a quelques-uns français. Et puis après, pas mal qui sont internationaux.

S : Et vos producteurs, ils sont plutôt petits ou aussi grands qu'Equinor par exemple ?

M : Plutôt des petits producteurs, je pense plutôt des producteurs régionaux et qui ne produisent que de l'énergie renouvelable.

S : Après, si vous êtes super récents, peut-être que cela prendra plus de temps pour les grandes boîtes de venir vers vous.

M : Après, on est récent, mais Hans Petter celui qui a créé l'entreprise, c'est lui qui a créé Bergen Energi et puis après Bergen Energi a été racheté par Kinect. Donc lui, il connait tout le monde. Donc après même si l'entreprise est vraiment nouvelle, il a énormément d'expérience, énormément de contacts. Donc bien sûr, il faut gagner une réputation mais après Hans Petter, il a participé à la création du système des garanties d'origine donc il n'y a pas de souci là-dessus. Ce que nous on fait là, c'est vraiment pour essayer de rendre ce système mieux. Je sais qu'il y a pas mal de clients qui sont assez sceptiques et assez négatifs parce qu'ils pensent que ça ne sert à rien ce système.

S : Et enfait, je pense que c'est BKK qui m'avait donné le nom de votre entreprise parce que je pense qu'ils essayent eux aussi de développer un produit un peu comme le vôtre. Parce que je pense qu'ils sont en contact avec l'entreprise Tibber et veulent aussi matcher la production et la consommation.

M : De fait, je sais qu'on est en contact avec eux. Je ne me suis pas occupée de ça mais je pense qu'on a un bon contact avec eux.

S : Ok, est-ce que tu as une idée du volume que vous vendez ?

M : On a à peu près 12 TWh par an, donc c'est beaucoup.

S : Ok, en gros, vos producteurs, ils peuvent décider de soit transférer les GOs sur votre compte eux-mêmes, soit de faire en sorte qu'elles soient directement transférées sur votre compte ?

M : Oui.

S : Et est-ce que vous les annulez vous-mêmes ou est-ce que vous transférez les GOs chez votre client qui après lui l'annule ?

M : Alors je sais pour certains producteurs, ils nous transfèrent les GOs. Pour certains producteurs, on est les vendeurs exclusifs de leur GOs. Toute leur production arrive sur notre compte NECS. Et après, il y a d'autres producteurs avec qui on est en relation et si on a un besoin, on les appelle et on leur achète les GOs que l'on va revendre et dans ce cas-là, ils les transfèrent sur notre compte. On peut en effet annuler les GOs pour nos clients.

S : Et du coup, si le producteur décide de les transférer direct chez vous ou s'il le fait par la suite, est-ce que ça change quelque chose pour vous ?

M : Oui, il y a un petit coût. En Norvège, tu dois payer pour avoir un compte NECS et chaque pays a des coûts de transfert différents selon que ce soit un export, import ou en interne. En Norvège, il y a un coût juste pour la première fois que tu transfères le certificat donc c'est-à-dire que par exemple, si nous on va acheter le certificat au producteur, le producteur, il va payer ce coût qui n'est presque rien du tout, je crois que c'est €0,0036. Donc c'est vraiment très petit. Dans le cas où nous on reçoit directement les GOs sur notre compte et après on les revend, c'est nous qui payons ce coût. Après, si le producteur revend ses GOs à un trader qui les revend à un autre trader qui les revend à un autre trader, après, il n'y aura plus de coûts, c'est juste le premier transfert qu'il faut payer.

S : Et est-ce que tu sais s'il y a une différence entre la demande allemande et norvégienne ?

M : Je pense qu'il y a une plus grosse demande en Allemagne et je pense que les Allemands, ils ont une demande beaucoup plus spécifique, par exemple que cela soit une nouvelle production, ou une source précise ou une année précise, etc.

S : Ok, et en général, vos clients ce sont plutôt des consommateurs ou des entreprises ?

M : On n'a pas de consommateurs privés (ménages). Nos clients, c'est plus des grandes entreprises et après quelques fournisseurs. On ne vend pas juste le certificat, on peut aider pour faire des rapports et faire le marketing pour l'entreprise pour qu'elle dise au mieux qu'elle achète de l'énergie renouvelable.

S : Mais donc, ce sont les rapports de sustainability par exemple ?

M : Oui, c'est ça.

S : Est-ce que tu considères qu'il y a différents marchés pour les GOs en fonction des pays ou de toute façon, tu considères que c'est international et donc qu'il n'y a qu'un seul marché européen.

M : Je ne suis pas sûre de comprendre. Il y a ce système AIB hyper standardisé en Europe donc cela facilite énormément mais après, on va dire qu'il y n'a pas qu'un seul certificat, mais il y a vraiment différents biens donc ce n'est pas un seul marché comme le marché des certificats de CO_2 où tu achètes ça et ça va vraiment être le même pour tout le monde. Ici, il y a des biens très distincts, après ça dépend de la demande des gens.

S : Mais du coup, ce serait plutôt différents marchés pour les différents types de produits plutôt que différents marchés selon les pays ? Je demande ça pour savoir comment moi, je peux parler de ça.

M : Là je pense que du coup, il n'y a pas une seule réponse, parce quand on regarde les Pays-Bas ou la France, eux ils sont très intéressés pour que cela soit locale ou du moins nationale, mais après dans d'autres pays, ils sont peut-être plus intéressés par la source par exemple. Je pense que ça va être difficile de définir différents marchés dans le marché des GOs parce qu'il y a tellement de types de certificats différents. Et il n'y a pas vraiment de données sur la demande, la demande elle suit toujours énormément la production.

S : Et juste pour avoir une idée, quels sont les types de contrats que vous faites ? Et ce qu'ils sont basiques par exemple un an à l'avance.

M : Alors, c'est vrai que le plus basique c'est un an, surtout pour les entreprises qui sont intéressées par les GOs pour leurs rapports annuels mais après, il y en a de plus en plus qui demandent pour trois ans.

S : Et est- ce que par exemple, si une entreprise vous fait une commande pour 1 an, vous livrez petit à petit ou il faut juste un certain quota à la fin de l'année ?

M : Alors ça va dépendre du prix et de ce qu'ils veulent parce qu'enfait, tu peux essayer de matcher la production et la consommation de l'entreprise le plus possible du coup si l'entreprise est intéressée de faire ça, par exemple imaginons qu'en mai ils veulent être surs qu'ils ont acheté autant d'électricité renouvelable que ce qu'ils ont consommé, alors on peut faire ça. Mais sinon, je pense que ça, c'est un peu technique pour les clients, du coup s'ils décident d'avoir de l'électricité sur 3 ans, je pense que les périodes ça ne les intéressent pas trop, tout ce qu'ils veulent c'est avoir la même quantité que leur consommation à terme.

S : Ok, mais je veux dire si vous faites un contrat avec eux pour un an, dans tous les cas, vous avez fixez le prix à l'avance non ? Pour le producteur et le consommateur.

M : Après, je ne sais pas trop comment cela se passe au niveau des contrats. Je sais que s'ils veulent des GOs pour leur consommation pendant un an et qu'ils ne sont pas intéressés par la date et par matcher leur consommation, je pense que oui, le prix est établi dès le début. Mais après s'ils veulent adapter leur achat de GOs par rapport à leur consommation, je pense que dans ce cas-là, on les prévient que le prix va être différent automatiquement.

S : Qui définit le prix en général ? Vous ou le producteur ?

M : ça dépend, dans certains cas, on demande au producteur son prix et d'en d'autres cas on ne consulte pas le producteur.

S : Mais comment ils font ? Ils connaissent un peu le marché ?

M : Oui voilà. Déjà le marché, il est européen mais il n'est pas très grand. Tout le monde se connait, tout le monde à un contact avec tout le monde. Nous on est en relations avec pas mal de traders et on a toujours les actualités qui arrivent sur les prix pour avoir une idée quoi. Donc nous, c'est vraiment une toute petite partie de ce qu'on fait mais je suppose que les producteurs, eux ils sont vraiment intéressés par ça et ils savent vraiment pour combien le voisin a vendu son électricité.

S : Mais je veux dire, imaginons un client qui voudrait recevoir les GOs au fur et à mesure de sa consommation, et si les prix augmentent parce qu'il y a peu de neige par exemple, le producteur va demander plus, non ?

M : Je pense que si on fait ça du coup, les prix ne sont pas fixes ou du moins il ne sera pas fixé tout au début de l'année, peut-être uniquement pour le premier mois ou premier trimestre. Et puis même si un client vient nous voir aujourd'hui pour acheter un volume de GOs et nous dit qu'il va revenir vers nous dans trois semaines, on va lui donner un prix indicatif mais dans trois semaines on lui donnera le vrai prix du moment.

S : Mais du coup pour vous c'est plus intéressant quand les prix augmentent parce que dans ce cas-là, vos 20% sont plus grands ?

M : Oui, le but c'est vraiment que le prix de la GO soit la plus grand comme on dit au producteur, nous on est vraiment de leur côté et on veut que les certificats aient le prix le plus haut possible. Ce n'est pas dans notre intérêt de faire baisser le prix le plus possible du côté du producteur pour le revendre après au plus haut prix possible.

S : Du coup sur votre site, il est noté que vous offrez un real time matching entre la production et la consommation. Mais est-ce que vous êtes aussi fournisseur d'électricité ?

M : C'est juste pour les garanties d'origine parce qu'on ne fournit pas d'électricité. Après, je pense qu'on ne le fait pas encore mais que l'on travaille là-dessus.

S : Mais comment vous allez faire ? Parce que de toute façon les garanties d'origine sont quand même émises après la production, quelques semaines après du moins.

M : Alors, moi je ne travaille pas du tout sur ça. Mais enfait, c'est que tu vas pouvoir voir que ta consommation elle est créée en temps réel par une certaine centrale électrique.

S : La consommation de certificats ?

M : Oui, voilà. Parce que là, les entreprises, elles consomment leur électricité, donc elles ont un fournisseur basique et après elles achètent les GOs chez nous ou chez quelqu'un d'autre mais donc pour l'instant les GOs, elles arrivent comme un bloc. Et ici, le but c'est de montrer qu'à chaque minute, ta consommation vient d'être produite en temps réel.

S : Et du coup, ils recevraient des GOs au fur et à mesure mais qui ne sont quand même pas tout à fait liées à la production réelle parce qu'elles sont un peu en retard ?

M : Je pense que cet intervalle de temps doit être le plus petit possible. Je pense que ça arrive et puis c'est annulé directement je pense.

S : Ok. Et est-ce que vous avez déjà entendu parler des GOs régionales en Allemagne ? Ce sont des garanties d'origine qui sont émises pour une production qui à lieu dans un rayon de 50Km du consommateur final.

M : Non.

S : Je demande ça parce que vous faites des rapports sur comment le marché des GOs va évoluer non ?

M : Oui, on fait des rapports d'analyse.

S : Parce que moi, une question que je me pose c'est : « Est-ce que cela ne réduirait pas la demande pour les GOs normales ? », par ce que je me dis que si les Allemands ne demandent plus que des GO régionales, ça pourrait peut-être diminuer la demande.

M : Enfait, j'ai lu un article là-dessus en Espagne et ils disaient que dans la nouvelle Directive, ils disent que si un fournisseur vend de l'électricité renouvelable, il peut dire que c'est renouvelable qu'en achetant des GOs.

S : Mais ce n'était pas déjà le cas avant ?

M : Non, ce n'était pas le cas avant, avant ils *pouvaient*. Les GOs, c'était un des moyens pour « claim » que ta production est renouvelable mais maintenant c'est obligatoire. Donc si tu es un fournisseur et que tu as juste acheté ce type de certificat qui est régional, alors tu ne peux pas dire que ta production elle est renouvelable à moins que tu aies aussi acheté des GOs.

S : Mais enfait, ce qui est particulier en Allemagne, c'est que ce sont uniquement les producteurs qui bénéficient de feed-in tariff and feed-in premium qui peuvent recevoir ces GO régionales.

M : De toute façon, ces producteurs-là, dans tous les cas, ils ne vont pas avoir de GOs donc peut-être qu'ils veulent trouver un autre système pour certifier cette production, du moins j'imagine que c'est pour ça.

S : Mais, après si cela pouvait avoir un vrai impact, probablement que vous en discuteriez déjà, non?

M : Oui, je pense que ça ne va rien changer mais ça va permettre aux producteurs qui n'ont pas les GOs d'eux aussi vendre leurs certificats.

S : Mais enfait, ce que je ne comprends pas bien c'est que je pense que l'énergie renouvelable en Allemagne qui a été produite grâce à des subsides, elle est quand même enregistrée quelque part. Donc je ne vois pas trop ce que ça va changer de rajouter un certificat. Ça va peut-être changer quelque chose pour le consommateur mais rien dans leurs statistiques de production, etc.

M : Mais du coup, je pense que c'est vraiment ça. Pour les fournisseurs, ça va changer un gros truc de pouvoir dire que tu vends de l'électricité, elle est renouvelable ou pas car ça change vraiment les prix auxquels tu la vends.

S : Mais je veux dire, le consommateur sait quand il achète de l'énergie, il doit bien savoir que la centrale de production a été subsidiée, donc il doit bien se douter que c'est renouvelable non ?

M : Oui, après je ne sais pas trop comment cela se passe en Allemagne, mais en France par exemple tu as EDF. EDF a pleins d'énergie nucléaire et après un peu de renouvelable aussi. Mais du coup, à moins que tu payes un peu plus pour le renouvelable, tu ne sais pas d'où elle vient.

S : Et est-ce que c'est le même principe en France ? Ils ne reçoivent pas de GOs ?

M : Oui c'est pareil, tu ne peux pas recevoir les GOs si tu as un support de l'Etat mais maintenant, ils vont avoir les GOs mais ce sera l'Etat qui les prendra. Donc, l'Etat va s'exproprier automatiquement les GOs et il va les vendre par enchères.

S : Mais ça, c'est dans la nouvelle directive, non ?

M : C'était dans le brouillon, ils ont parlé des enchères et du coup, ils avaient écrit un article là-dessus dans le brouillon, et après, ça avait fait énormément de débat et du coup, ils ont juste enlevé l'article. Ça veut dire qu'il n'y a juste pas de règles sur ça mais tu peux le faire donc c'est ce qu'ils font en France. Je sais qu'il y a des enchères aussi en Italie mais pour le reste je ne sais pas trop.

S : Du coup, l'Allemagne, elle a juste décidé d'utiliser un système différent ?

M : Oui, je ne sais pas trop comment cela va se passer en Allemagne, mais en France, le revenu qui va être crée par les GOs des productions qui ont des subsides, ce revenu va revenir à l'Etat et non au producteur.

S : Ok, est ce que tu sais si le système des GOs est mal compris par les consommateurs et est-ce que tu penses qu'il y a des différences en fonction du pays ?

M : Je pense qu'un peu partout les gens ne savent pas trop ce que ce sont les GOs. Même les gens qui s'occupent de la partie sustainability et tout ça dans les entreprises ne connaissent pas les GOs à moins qu'ils ne travaillent vraiment dans le pôle énergie. Donc, ils connaissent le truc d'énergie renouvelable mais après, ils ne savent pas comment cela se passe vraiment. Donc pour moi, ce n'est même pas que c'est mal compris, ce n'est juste pas connu quoi et après les gens qui le connaissent, ils ne comprennent pas forcément. Déjà, l'achat de l'électricité, ce n'est pas quelque chose de très sexy.

S : Ok, et est-ce que tu penses qu'il y a des raisons particulières qui causent la non-compréhension du système et est-ce que certaines choses devraient être changées pour que cela soit plus compréhensible ?

M : Je pense que déjà, il faudrait enlever les intermédiaires parce que pour l'instant c'est un peu du style : « tu achètes des certificats, tu es trop content, tu as ton énergie renouvelable mais c'est juste pour toi que tu le fais, c'est pour la production en générale et le truc c'est qu'avec tous les intermédiaires, ça ne sert presque à rien. Au final, tu as payé un gars dans son bureau en train de faire du trading toute la journée ». Bien sûr, cela a mauvaise réputation et il faudrait changer ça. Il faudrait que cela soit plus transparent et plus simple pour les gens. Acheter de l'électricité, ce n'est pas compliqué mais ce n'est pas ce que les gens font.

S : Et, est-ce que chez Becour, vous pensez qu'il y a quelque chose en particulier dans le système qu'il faudrait changer. Par exemple, que cela soit plus harmonisé entre les pays, etc. Est-ce qu'il y a quelque chose dans la nouvelle directive qui aurait dû être changé et qui n'a pas été fait ?

M : Alors moi personnellement, je pense que c'est bien qu'ils aient enlevé le truc des enchères mais ils auraient dû faire quelque chose pour que cela ne soit pas autorisé. Mais après, ça c'est très spécifique pour la France. Sinon, c'est déjà hyper standardisé et c'est pour cela qu'il y a AIB, pour que cela soit très simple de faire les transactions entre les différents pays. Donc je pense que le système, il a été bien créé, mais après ce sont juste les acteurs, qui l'ont un peu déformé.

S : OK. Et à propos de la nouvelle directive, est-ce que vous avez déjà commencé à changer des choses pour vous adapter à cette nouvelle directive ? Est-ce que cela change quelque chose pour vous ? Après, je pense que les pays membres ont deux ans pour s'adapter donc vous avez le temps.

M : On n'en a pas encore vraiment parlé mais le plus important dans cette nouvelle directive, c'est vraiment le fait de rendre obligatoire les GOs pour tous les fournisseurs qui vendent de l'énergie renouvelable. Et du coup, ça veut dire une augmentation de la demande pour les GOs, probablement une augmentation du prix aussi, ça dépend après de si l'augmentation de la production suit ou pas. Mais je pense que c'est le plus gros impact que nous on va ressentir de cette directive.

S : Mais cette nouvelle règle, ça veut dire que même si un fournisseur achète de l'électricité qui a bénéficié d'un support de l'Etat, il devra quand même acheter des GOs pour cette production-là ?

M : oui. Je pense que s'il achète de l'énergie renouvelable d'une centrale électriques qui a reçu des subsides, il ne va pas payer quelque chose en plus, il va juste payer l'électricité. Donc oui voilà, ça c'est la plus grosse différence.

S : Ok, j'aimerais juste te demander 2 conseils. Premièrement, est-ce que tu penses qu'il y a certains aspects que je devrais plus regarder pour faire une comparaison entre la Norvège et l'Allemagne mis à part la demande ?

M : Moi, je pense personnellement que ce qui est intéressant c'est le fait qu'en Allemagne tu ne puisse pas avoir des GOs si tu as des subsidies ou feed-in tariffs, je pense que c'est intéressant de voir ce que les producteurs préfèrent. C'est intéressant de voir quels sont les producteurs en Allemagne qui demandent des GOs pour leur production, c'est probablement des producteurs qui ont des centrales électriques un peu vieille et qui donc n'ont plus de subsides pour ça. C'est aussi intéressant d'analyser quel est l'impact de ne pas autoriser toute la production d'énergie renouvelable à recevoir des GOs.

S : Dernière question sur l'évolution du marché. Est-ce que Becour pense que le volume et le prix des GOs vont continuer d'augmenter ?

M : Oui, la production et la demande n'ont fait qu'augmenter. Maintenant, la demande augmente plus vite que la production donc on s'attend à ce que le prix augmente aussi.

S : et aussi, on m'avait dit que dans quelques années, la production de GOs allait augmenter car pas mal de centrales en Allemagne vont sortir du système de subside et vont donc recevoir des GOs.

M : Oui, après, ça ce sont des informations qui sont déjà connue du marché donc ça ne va pas être une surprise. On sait que ça va arriver donc dans tout ce qui est prix, prévisions, etc, c'est toujours plus ou moins pris en compte.

S : Et tu sais plus ou moins quand ça va arriver ?

M : Non.

S : Ok, bon ben je pense qu'on a terminé. Merci beaucoup. Je te renverrai un mail avec des questions si besoin

M : Oui pas de souci, renvoies moi un mail avec les questions auxquelles je n'ai pas répondu.

S : Un tout grand merci en tout cas. Bonne journée.

Appendix G - Interview Kinect Energy Group: Paul T. Ørstavik

Legend:

M = Margaux Snoeck

P = Paul Thomas Ørstavik

M: Thanks a lot for sharing the information with me and for your time. I do really appreciate. So just to explain you the context, I am writing a master thesis on guarantees of origin in Germany and Norway. I did not know much about GOs before starting and while searching for information on the GO market, I noticed that it was not that easy to find accurate information. That is why I decided to make some interviews. The thing is also that I do not know how international the GO market is and if there are differences between Norway and Germany, so depending on the information I find, I will try to adapt my topic

P: Alright, I see. You can start with the questions.

M: How would you describe your role as a portfolio company in the GO market?

P: So, as you said, we are a portfolio company. We have a lot of power producers in Norway. So, we contacted them about 10-15 years ago and asked them if they wanted to have somebody to help to manage the GOs and a lot of them said yes, so we have about 10-15-20% of the power production in Norway that we are managing. So, all these companies, they are all renewable producers because we only have renewable in Norway. We so to say get their GOs and then we try to sell the GOs at the highest possible price for them. And the customers are normally not in Norway at all, but they are all over the world and mostly in Europe, most of the customers are in Germany.

The biggest supply side is Norway as we have above 100 TWh of GOs produced per year and Germany has very little renewable production that is also eligible for GOs but they want to be green and they have been willing to be green for a long while, so they are the biggest buyers.

M: Do you only have power producers in Norway?

P: We do also have Dutch wind, Danish, Finnish, Swedish GOs in the portfolio, that we actually manage but the biggest part is from Norway, and the second largest part is from Sweden. We also have some Icelandic, and the UK as well. Because Norway has so much pure renewable power, we have a lot of it to sell. There is now a tiny little demand for GOs in Norway but normally there has been no demand in Norway for GOs, so we had to sell them somewhere else to get money.

Our role is to build up an organisation that manages this and on one side we do the administrative stuff concerning these things. We need a couple of people (2) that we need to hire to do that. The second thing is that it is not a very standardised market, so you need to have a counterparty, you need to have someone on the other side to who you can sell your GOs and that you trust, we have a big list of potential sellers. Now the market is getting more mature and more standardised, so it is going to be easier and easier for people to do it themselves: it becomes more digitalised and more standardised. But for the moment we provide that service and we take over the credit risk of the counterparties on the other side for the producers.

That's a least trying to answer the question number 1.

M: What are the different products that you sell?

P: We try to get as much for each single GO that we have, and each single GO is different, so it will be an attribute, from a different waterfall or wind park. If the wind park is new, that means that it has some kind of additionality. That means that for the one who buys this, they can brand themselves as being

contributing to building some new renewable things. They are more expensive than a 50 years old big hydro dam. The latter is way cheaper than the newer things. That has to do with the additionality of the GO. So, we do sell everything that we can, but of course we try to differentiate. If we have something new, we try to sell that to consumers that want something newer. We also provide different brands or ecolabels. Different kind of GOs are eligible to be in these brands. So, maybe the production has to be below 6 years ago or 2 years ago, it is just lots of different criteria to be in the different brands. We try to put the GOs where it is the most for my power producer company and my customer.

M: Is It more profitable for the producer to have its GOs in a label? And do you earn more money from doing this?

P: We get a percentage of the price, so if the price is high, the number for us is going to be higher. So, we want to sell as high as possible.

M: I guess buying labels is more expensive than buying power backed by GOs only?

P: Yes, but let's say you come to Germany where there are these different labels. One of the big labels that were there at least a couple of years ago is called OK-power. There are a lot of criteria for the GOs that you can deliver in the OK-power brand and that has been harder and harder to deliver something in there because we haven't had those kinds of production facilities in our portfolio. For a lot of other people, it is hard because they want power from new power facilities. So, in the end, maybe there was a lot of demand for the OK-power brand but there wasn't any supply for it. So, nobody could sell it anymore. So, there are a lot of companies in Germany doing the same as we do, and package the GOs in different brands. We try to find based on what we have if we can match up with what their customers there want.

M: And could you give me an idea of the price of those products? I heard the GO price was around 1 €/MWh, but I guess in the labels it is different? The price for the end-customer is not the same as in the wholesale market?

P: No, but here we are talking about the Wholesale price because that is what we sell. For example, to EON, we would sell 2019, the cheapest one that is the Nordic Hydro and we sell that around 1€. One year ago, that price was at 0,5 cents and in the middle of September last years it went from 0,5€ to 2,20 € and now it is back down to 1€. It has been moving quite a bit during the last year, that has been very exciting. In the years before that, everything was just traded around 20-30 cents. The administrative cost was 0,10 cents. The supply was healthy, and the demand wasn't really that big. But in the last couple of years, the demand for GOs has peaked up very much. You have Dutch wind, this is in Holland, no one wants GOs from anywhere else. And there is not enough wind power in Holland to produce enough GOs to meet the demand. Therefore, they are priced around 9€. It is substantially above the Nordic Hydro that is at 1 €. There is another product that I sent you per e-mail, it is the Swiss Naturemade Star that has to come from very new, very small power plant and have to be good looking in nature. It can't be a windfarm because a windmill looks bad, and they are priced at around 14-15 € because it is a very scarce thing. The old GOs are price at around 1 € and the new they can be around 1 -1,5€. It also depends if it is supported or not supported. For example, a new wind would maybe be priced at 2-2,5 or even higher. So, it is not very standardised.

M: When it is supported it is cheaper, right?

P: Yes. In Germany they have a lot of renewable power now. They have a lot of wind and solar power but none of that is receiving GOs because they get a subsidy from the government. As long as they get the subsidy, you can't get any GOs for it and can't declare yourself as renewable. So, when they stop getting subsidies which is for the oldest windfarms, they go out of the subsidy scheme after 12 years and that's about 2020. So, that's when the real build out of wind in Germany started in 2008. So, from 2020,2021, 2023, we are going to have a lot of wind parks that don't get subsidies anymore in Germany.

Then, they will be eligible to get GOs. So, in the coming years, we are going to have an uptake in the supply side of GOs in Germany from the old wind park. Because it is going to be old wind, it will probably be priced like the Norwegian hydro.

M: Do you uniquely sell GOs or do you supply the electricity also?

P: We have customers for which we manage the whole package. We sell the electricity, we do the electricity management for them and we do the GO management. So, we offer electricity, gas, GOs and sustainability so to say. It is not that we are very different from other companies selling GOs, but we differ in that we sell the electricity as well. We do what the consumer want.

If you read through the Oslo Economics report, in Norway, the industries are declaring themselves as green. They claim themselves as green because they use the Production Mix of the Norwegian electricity. Because 100% of that is green, they say that all the energy they use is green. And then we sell all the GOs to Germany so the Norwegian Residual mix is not green anymore but pretty much everybody in Norway think that they are green, and nobody would pay extra to be green.

M: Do you think it is only in Norway that the people misunderstand the system of GOs or is it also the case in other country to?

P: I think that everybody is kind of misunderstanding the GO system but in Norway I think people don't really care that much. In most country, people don't really care that much. I am older so I don't know if the younger generation is going to be more into this. But the fact is that at the moment, the private households they don't care that much, it is more from industries that want to brand themselves as green for whatever reason. And those are the one that are buying our GOs. I don't know if in Germany, the green labels are better sold to the households. But I don't think that they are really taking off, it is more the industries that want green power.

M: Who are your customers? Where do they come from? Only Norway?

P: We have industries and electricity suppliers. If you are selling electricity to households in Germany, you want to have a green label as well, so then we sell you the GOs so that you can have the green label. So, it is industries and suppliers, it is pretty much where the demand comes from. They come from all over Europe, a lot from Germany but pretty much all over Europe.

M: I am not sure that I understand that part: when you sell to companies or supplier, it is the wholesale price for both?

P: We are only in the wholesale market. We do have smaller industries that buy from us and then we put on a bigger margin on it because we can and then we have more administrative costs as well.

M: So, for companies you are the last actor in the chain, but in case you sell to suppliers, they will take margins after you right?

P: Yes, he will take a bigger margin than I do. But we sell at the same price. If the supplier wants to pay less, then we just sell it to the industries and then he can go buy somewhere else. There is enough demand, the price is the same for everybody.

M: So, you sell the same product for both at the same price?

P: Yes.

M: Which product is the most popular?

P: Nordic Hydro has the biggest supply and that is what we have the most in our portfolio, so this is what we are trying to sell and to promote. It is different and all the labels and brands are different, so everybody tries to get some kind of diversity. Absolutely, you try to have a standard, most of the GOs

that are issued are produced in facilities that are older than 6 years and are unsupported. So that's the most popular thing to sell. That's the easiest thing to sell. But every country, every region is different.

M: But ideally, I guess you would like to have GOs from new plants. Because it has more value, right?

P: We try to standardise because then you can do just loads of it and then you might not earn that much on each single deal with that one, but you can do a lot more deals with them because you have more of it. If I had very much of new and very expensive things than yes, but there isn't that much of it out there.

M: Who creates the labels? Does each portfolio company create its own labels and products, or can you sell the same labels as your competitors?

P: Everybody can do that, it is voluntary so everybody can create that. You can do it.

M: Do you have your own labels that we can find only at Kinect Energy?

P: We have something that is called "BE green", that represents most of the GOs that we have in our portfolio, it is also a bit premium. We are not selling that much of them at the moment, but I also sent you something called "Track my electricity" which is the same but that's more a solution package that we sell. It is not that much of a label. We are not that much selling into households, we are selling to industries and they come with their own criteria, the GOs has to meet this and this criterion. For instance, it has to be younger than 5 years and come from that region, and we just find it and sell it.

M: What volume do you trade? How many customers do you have? And per market?

P: I would say around 20 TWh a year. We have approximately 500 customers. This is more because we have been doing this for ages, so we have pretty much everybody that wants a GO in Europe as a customer.

M: And you said that most of your customers were from Germany, is that right?

P: Not necessarily. We have a lot of customers in Italy and in France, all over Europe but of course there is a big demand in Germany.

M: Do you experience an increase in the GO trading? What are your future expectations for that market?

P: Yes, we do.

M: Would you say that now there is an oversupply in GOs?

P: It is quite equal at the moment or maybe the demand is a bit higher than supply, at least you should expect that, it looked like that last year when the prices were exploding but they have been falling after that so it hasn't found an equilibrium yet but we expect that prices will steadily rise and that there is going to be more and more interest for GOs. We see that more and more companies want to be labeled as green, so they use GOs.

M: Is the supply of GOs in Norway at its maximum?

P: No, wind power is being built in Norway and overall in Europe. So, I think there is going to be more renewables and GOs and those things are going to be new, so they add additionality to the GOs, so the future supply is also going to rise. Also, what I talked about in Germany, I think this is going to have an impact as well. So, influx of GOs is also coming from France this year.

M: Do you consider that there is only one GO market, or we can differentiate between the GO market in Germany and GO market in Norway? Because for me it looks so international, I don't know if there is a real difference?

P: It doesn't really matter. If the Germans are happy with Norwegian GOs, then that's one market. When they say: "oh no, it has to be something that has been locally produced", then it could be seen as another market. We would like it to be one European market. And if someone wants it to be more local, then there can be a label for that. Also, the supply for Germany comes from Norway. And the demand in Norway is not so high so that is a difference. In Holland, the origin has some impact, it has to be from Holland. But in Germany, they are not so picky. They don't want GOs from Iceland because Iceland is not connected to the European grid by cables.

M: Do you know if the demand for GOs in Norway and Germany is different? Do they buy the same type of GO products? Are the prices different in those two countries?

P: Yes, it is. But the price is the same if we sell in Germany or Norway. There is no cost in moving a GO because it is a digital thing. There is no cost in moving from one country to another, no transaction cost. And we sell pretty much the same products.

*M: Do you have an idea of the market value of GOs in Germany and Norway? (Market value according to the Oslo Economic report = (total volume issued to power producers in one year - expired volume in one year) *estimated prices per country of origin). I know that I can find the amount of GOs issued on the AIB website but what about the price?*

P: You have the same price for it, it is called the EU certificates and they are priced pretty much the same as the Nordic Hydro.

M: Who are your competitors?

P: In Norway there are two companies that we consider as our competitors: ECOHZ and BECOUR. These are the only one going after Hydro producers telling them that they can get a better price than the market. But because we have been doing this for so long, we try to be a bit more sophisticated and do other things as well. We don't have real competitors but there are other market players, I listed some of them for you in the email. They are big brokers sitting in Amsterdam. They are very big and do also a lot for I-RECs around the world.

M: Do the price of your products fluctuates with the GO price? When you do an agreement, do you fix the price?

P: What we do is that we approach the renewable power producers and ask them if they want help with managing their GOs and then we take a commission of the price that we achieve for them. We don't buy from them for a long long period of time. It is more like we manage it for them and then we share some of the profit. The market as such is not very old, for longer than three years, let's say from 2022, you would hardly get anyone who wants to buy anything. We can't find customers that wants to buy GOs after 2022 at the moment. We don't want to buy anything from the producers that are longer dated than three years. The windfarm would normally come to you and ask: "could you give us a price for GOs for now until 2035?" and we would say "no, we don't want to that because we are not sure we can handle that, but we can give you a price for the next two years". And then, when we arrive in 2020, we will give you a price for 2023.

Imagine, if you want to build a windfarm at the moment, you will have to go to a bank and ask for a loan. The bank would say: "yes, but we want to see that you have some kind of cashflows" and then the wind park would come to us and ask if we can give them a price for the electricity that they produce for the next 10 years or 15 years which is easier because there is a market 10 years ahead for electricity, but then, then will also ask a price for the GOs for the next 10 years or 15 years which is not so easy because there is no market for GOs longer dated than three years. So, three years is the maximum for GOs traded forward.

Then what you are asking me is do we kind of speculate? Let's say we buy it for 0,50 cents and then keep it in our account for two years and hope the price is going to rise. So, if I buy now something from a windfarm for 2021, then I don't have to cancel it before end of 2021 or beginning of 2022. So, I would say of course buy now, fix that price and then I can speculate on the price. On the other hand, I can sell it now and speculate on the price going down. But the thing is that I just manage for my customers, but you have other players that are more speculation.

But yes, when we do a contract for two years, we fix the price and it stays the same for the two years.

M: Ok, so you don't follow the variation of the GO price, you just fix it.

P: No, there is not much of certification in that way that our customers want an index because there isn't really an index of prices, it is not very transparent the GO prices. So, nobody has come up with an index yet, but maybe we should do that.

M: But the company Greenfact, they do have a market index for GOs.

P: They might be trying to produce an index for GO so that somebody will use their index, buy their services and then use that. It has no market traction at the moment, the market is not trading on that.

M: So, you don't use those data?

P: Greenfact has a lot of data that they bundle together but because we have big enough machinery, we have enough analysts to bundle them ourselves. This is because we are a big player but of course if you are not a big player it might be useful to use Greenfact.

M: Is there any differences in any of these steps between Germany and Norway? I guess you have to adapt your processes according to the country specificities. Ex: you have to create an account in the GOs registry in Germany but not in Norway?

P: We are just a provider of GOs, we don't have customers as such in Germany. We do have but we can't have an account in Germany where we can cancel it for our customers, we have to deliver those GOs into the electricity provider in Germany to their account and then they cancel them for their customers. So, if I sell GOs to BMW in Germany, because I am not delivering the power to BMW in Germany, I have to deliver the GOs into the account of the supplier of BMW in Germany on behalf of BMW. So, this is a difference between Norway and Germany. Germany and Spain are both countries where you have to deliver it to the supplier of the electricity and then the supplier cancel it for the customers whereas in many other countries, we can cancel it directly for the customer.

M: So, for Norway, you don't have to go through suppliers?

P: No.

M: I was looking at the procedures to be registered as a producer and apparently in Germany, as a portfolio company, you also have to have an account in the German register for GOs. Do you have one?

P: To cancel these things, you need to hand them over to somebody else, you don't really need an account in Germany if you are not delivering the power to your customers as well. I am not that into how you transfer certificates around Europe, most of it is also because Norway and Sweden are the biggest suppliers of GOs. So much of the customers and player just use the Norwegian or Swedish registries to pick up the things and then they do something in their countries. We are happy to just deliver it in the Swedish or Norwegian registry which is quite easier than the German one. But we have accounts around in France or in Holland or whatever but not in Germany. The German suppliers just come and picks them up in the NECS registry.

M: What are the advantages and disadvantages for a producer to sell their GOs through portfolio companies like you instead of using a broker, an exchange or selling their GOs themselves? How do you differentiate from the other options available for producers?

P: The advantage is that we have the administrative part built up, so we can offer to take over the administrative cost at a very cheap price because we have a big portfolio. We have a scale cost advantage in that. The disadvantage is that they lose control over the GOs, they have to let us manage it. There is no real exchange for GOs, the other option would be to go through brokers but if you go through a broker, on the other side there would still be a company and you would have to credit check that company. Because we have been in the market for so long, we have credit checked all of the 500 companies that I was talking about before, so we have already done the job and we take over that credit risk for you.

M: Do you sell other types of certificates as well such as I-RECs, or RECS? What is the difference with EECS GOs? Are those other types of certificates more or less traded than GOs?

P: We do everything. We do that for every country in the world.

M: Do you trade more GOs certificates than others in volume?

P: We do trade more GOs as such so far. But that can change. The world is bigger than Europe.

M: Do you have any advices on which other aspects I should investigate to build a comprehensive comparison of the GOs system between Germany and Norway?

P: In Norway, the industries think that they are green anyway and don't need GOs. That's the biggest difference between Norway and Germany. Apart from that, I would say there is no demand for GOs in Norway but well in Germany. I don't think there is very much more. Apart from that everything is pretty straightforward.

M: Moreover, I am looking for German companies to interview to have information on the GO market. Do you know any German actor involved in GO trading that I could contact? (producers, brokers, portfolio companies, exchange), etc. Do you think I could contact your office in Germany?

P: I said Bischoff and Ditze. Then, of course you have all the industrials in Germany like EON or Uniper, you could contact power producer, you could also talk to Statkraft that has a big office in Germany.

M: That was my last question. Thank you so much for your time and sharing this information with me!

P: No worries. Just send me an email if there is something you are wondering about.

Appendix H - Interview BKK: Preben K. Olsen

Legend:

M = Margaux Snoeck

P = Preben Klyve Olsen

P: Maybe, you could tell me a bit more about the paper you are writing. You are not only writing about GOs right?

M: Yes, I do, I am discovering the system now. I want to look more into Germany and Norway. Also, I know that in Norway you have Elcerts, so I was wondering if there were any links. So, I am planning to write about the system in general, the market, and also what is the link with the support schemes, what does that imply, and I will of course talk about the new directive.

P: And investment in the new power stations, is that something you are looking at?

M: Well, that's not the main focus but I wanted to know if you were taking that into account.

So, my first question is what are your main activities?

P: So, if you look at this, BKK is organised as a group. So, we have different companies here. First, we have the production group: production of power and the distribution of power. It is our main activities. We used to have the selling of power as well. But then we got this new law in 1990 where you were forced to have the activities under competition separated. So, we started a new company Fjordkraft with another power producer. Fjordkraft is selling the power.

M: Do you say that producing and selling the power are in competition?

P: Selling the power is competition to Nordpool. The distribution is not, it is a monopoly. So, those are the two main activities and then we have innovation and development. Because a lot of things are happening in energy now, with building new power production, smart cities, whatever. And then we have the rest of the activities.

M: In which department are you working?

P: I can show you that, this is BKK production. We have four divisions. I work in production and market, we have also business development and then we have Kraftmarked who is actually making sure that the power stations are running, and the last division is the building of power stations. In my division: power and market, we are split into physical power production, the financial power trading and then we have analysis and middle office. I work in the financial trading section. In the physical production division, they run the power stations from day to day. They decide what price to put on the production before sending it to Nordpool. Do you know Nordpool?

M: Yes, I know a bit.

P: They are in the physical day ahead market whereas the financial trade, we are into the forward market. So, we hedge the power production three years ahead.

M: Is three years the maximum?

P: No, you can trade 10 years in advance, but our mandate is three years.

M: What about the analyses? Do you do that only for BKK?

P: Yes, mostly for this division but also for BKK in general. And we also do long-term price prognosis which is obviously also interesting for other divisions in BKK. I do the green market: GOs, Elcerts and also bilateral contracts. The financial trade is done at Nasdaq commodities which is the financial market in Nordpool.

M: But is that only for physical electricity?

P: Not Nasdaq. Nordpool is the physical spot market, Nasdaq is the financial market. Nordpool used to be both, but then Nasdaq bought the financial market.

M: But can you sell your GOs though Nasdaq?

P: No, it is completely apart. Nasdaq is only power. But you can also trade CO2 quotas at Nasdaq. You can trade German forward contracts, but not GOs.

M: Who trades the CO2 quotas?

P: Here we used to have a bit of trading like speculative trading but then we stopped that many years ago. And then we have a small company in Øygarden which we buy EUAs for. But that's a very small amount.

M: But every company or industry could trade CO_2 quotas?

P: Yes. We only have to buy EUAs for the small company I just mentioned.

M: Because it is not renewable?

P: Yes, we use a kind of gas. We use the waste gas to make heat and power. Then, you have a small amount of emissions from that.

M: I just have one last question about that because I am a bit curious. Do you only take into account the emissions from the production or also the offices?

P: No, only the production. That's a good question.

M: Ok. My second question is: what is your annual production of renewable electricity?

P: 7 TWh. That's the normal production. Because low production would be 5.8, high production would be 8-8,5 TWh. So, if it is wet and really rainy, we could have 8 easily.

M: And you only have hydropower?

P: Yes, but we are looking into wind power. We looked at that before in 2009, but it was not an investment decision. But now, we are starting to look at it again.

M: Do you request a GO for every MWh of your production?

P: Yes. The thing is that you have to apply for GOs at Statnett, and then they measure your production and you get the GOs issued at NECS. NECS is the Norwegian registry. So, this is all automatic. They just measure your production and you get the GOs. It all depends on where you are measuring. Is it right next to the production wall? Or is it by the grid connection? There could be a difference and they might take off 1 percent or so.

M: Because of electricity losses?

P: Yes.

M: Ok. And do you handle your GO account yourself?

P: Yes. The GOs are issued every week depending on the production. And then I sell GOs. Today, I can sell up to 22 and I have a three-years horizon. So, I sell forward in a way.

M: But how can you sell forward? Because the lifetime of a GO is of 1 year.

P: Yes, but it is a contract. I can sell GOs for the production year of 2022 today. Because there are demand for that type of contract. The German like to buy GOs years ahead.

M: So, you would only transfer the GO the next year?

P: Every contract has a transfer date. So, let's say I have a small volume, a 100 GWh to 2022. I can transfer half through 2022. But most of the contracts have a transfer date at the end of the year just to make sure you have the production and the GOs and they are still valid.

M: So, it means, that the GOs you transfer today are form earlier contracts?

P: Yes. We have sold most of the GOs for 2018. It is already sold and transferred, but I still have something like 1 TWh left of GOs for 2018. But they are from the last quarter of 2018 so they are still valid, and I can still wait.

M: So, you use forecasts to decide the volume that you will trade?

P: Let me show you. Here you can see 8 TWh, that is high. And now the production for 2019 is expected to be low because we have had very little snow. And then we have some reserves for our own consumption. Then, I have a limit of how much I can sell today of 2019 and then I have sold 3.7. And then I have a balance in a way saying how much more I can still sell today.

M: Did you fix the limit yourself?

P: No, 80%, 50%, 30% 20% is the limit of what I can sell today of 2019, 2020, 2021, 2022. The limit is fixed by my boss. That has to do with risk management. Okay, so this is my time horizon. I can't sell 2023 today, I have to wait until next year in January. This is of course moving in a way because the production prognosis is changing every week. And that is the same as what they use to hedge the power. This is kind of hedging the GOs.

M: How often do you sell GOs? Because you could sign all your contracts in January and sell everything?

P: Yes, but it depends on the price, of what I think about the price and it depends on: have I sold a lot before, have I sold little? Have you seen a price curve for GOs? Because it has been a little bit a crazy market I would say. So, this is 2010, this is Fukushima. After that, Germany decided to shut down the nuclear power stations and then the price for GOs went up. After, we had a long way down to very low prices because the demand for GOs was low and the offerings were high. And last year, in 2018, it exploded more or less. But then we have had quite a rough return to low prices again.

M: Where are we now?

P: In, 2018, it was traded around 0,6 - 0,7 € and then 2019, 2020, 2023, there are a little be above 1€.

M: But you don't know the price in advance, right?

P: No, but if I want to sell the GOs today, I can sell it. For example, for 2020, I could probably get 1,12 € today. But next week, maybe I could get 1,20€ or next week, I could have 1,9 €.

M: Where do you get all this information about prices?

P: I have brokers and they send me a report every Friday. So, then I get the prices. For example, these are the prices end of last week. And then you have the bid and the ask (the best buyer and the last seller) and the last traded. This is a kind of reference for me.

M: What is "the last trader"?

P: It is the last traded contract, the last price of the traded contract. And then I use a chat function. The brokers are chatting with me about the prices. They have the buyer on one side and then they have the sellers and try to make us meet and trade. My broker sends me prices about Elcerts and GOs. Then, I also have a platform. This is an electronic platform where I can trade. This is the only GO trading platform today. So here is a bid for 2019, and an offer at 1,12 €. I can trade this and click on that contract.

M: Do you know where the bid comes from?

P: No, but I will know afterwards. If I do the trade I would know when the trade is done.

M: Okay, because I thought that you had long term contracts and that you were always selling to the same persons, but actually it varies all the time. So, you rather sell small amount to a lot of people?

P: Yes, it is also because you wouldn't see a demand for 1TWh, a high volume traded is 200GWh, maybe 300. But a typical amount is 15 GWh. I like to trade a little bit as long as we go, I like to do 15. But it makes me kind of sharp when it comes to the prices.

M: Can we just go back to the NECS registry? When you do a contract, do you transfer the GOs or does the broker do that for you?

P: No, we do it.

M: Who is registered on NECS?

P: The producers and the buyers. Everybody could have an account at NECS.

M: But does your brokers are registered?

P: No, the brokers only do the trade and then we fix everything because it is a bilateral trade. On NECS, you can see the number of certificates you have and when they will expire. You can display the GOs per month or per power station. And then the transfer is done by my back office and I must admit I don't know how he does it, but he does it.

M: But when you sell the GOs, it doesn't really matter from which power station he comes if it is all Nordic Hydro?

P: That's correct. If you do a standard Nordic Hydro contract, we can just use every power station, but we have a power station which is new and then we have a higher price. The buyer could be interested in only some of the power stations.

M: To who do you sell your GOs and electricity? Do you only use brokers or also portfolio companies or exchange for example?

P: So, obviously, the electricity is sold at Nordpool. We do have a bilateral contract with "Hydro" which is a huge power consumer industry. I am not sure it has started yet. So, we could have some bilateral physical contracts to huge power consumers. But the rest is sold at Nordpool from day to day. GOs, we sell it through brokers, but it is a bilateral trade. Nordpool is an exchange so we don't know who is buying the electricity, the market is buying the electricity. But the GOs, I could sell the GOs to RWE for examples. It is a supplier like Fjordkraft in Norway is one of the biggest suppliers. But I could also sell it to a Norwegian power producer, Adger Energi for example.

M: You can sell your GOs to other producers?

P: Yes, if he wants to buy from me, I am fine.

M: Is that producers that have no renewables?

P: Yes, they have but they could be interested in getting more GOs for speculative trade if they think the price will go up and then they will resell the GOs. GOs are sold and resold several times.

M: And then, you can also send to industries and companies, right?

P: Yes. You should look at the Oslo Economics report, it is well explained. So, I could sell to a portfolio company.

M: Do you do that?

P: Yes, because I don't know who is asking. When the broker is saying: "I have a bid, 15GWh for 1 euro, are you interested?". If I say: "ok". And then when the trade is done, I might realise that is was a portfolio company asking.

M: But you could also sell directly to a portfolio company?

P: Yes, I have a few friends in portfolio companies that are chatting directly with me. But they like to go through a broker. I like that. They are portfolio companies but also more trading companies like Amsterdam Capital Trading is a big company in this market.

M: Ok, but I don't really get the difference between a broker and a portfolio company. How would you differentiate them?

P: The broker, I would see the buyer. For example, it could be RWE (a big company in Germany). But a portfolio company is always my counterpart. I don't see who is behind them because they are kind off a broker, they will resell it.

M: So, it is more the broker doesn't really buy your GOs whereas a portfolio company would buy them.

P: Yes.

M: And what about the risk, do you have risks for any of the two options?

P: Not really. The broker doesn't really do anything with the risk, so I end up with a counterpart risk. But we do credit checks and "know your customers" analysis to make sure they are good companies. And I have a limit on how much I can sell through a portfolio company. That's how the risk is managed.

M: So, there could be a risk with the portfolio companies also?

P: Obviously, there are risks but it is kind of handled but they are always risk.

M: Do you follow any criteria when you choose between a broker and a portfolio company or do you only look at the price?

P: The price is the most important thing for me. I don't have any problem with selling to portfolio companies when I know them. I have three or four portfolio companies asking me for prices every day. And then, I have brokers every day asking for prices. I must admit that I don't like selling GOs to Norwegian producers because obviously, they are reselling it. But I like to meet the buyers in a trade. I like to see them. Because I like that they see me as well, BKK. Because through portfolio companies, BKK just disappear.

M: Do you know if higher volumes are traded through brokers or portfolio companies? Because I talked to Kinect Energy and they have 500 customers, it seems huge.

P: Yes, back in 2015, we have sold to Kinect. We asked them to sell the power from a particular power station. Throughout the year, it ended up being something like 800 GWh. So, throughout the whole year, we asked them to make a highest price as possible. And we thought that they were selling it to businesses and getting a higher price than though a broker. But that didn't happen.

M: What happened?

P: They sold it to the way I do, in the wholesale market through brokers, etc. They ended up waiting and got a higher price because the price went up. So, the value was good, but we wanted to see the end-user buyer.

M: But is it easier for you to go through a broker? Less work?

P: No, it is the same transfer, it is the same counterpart risk. The thing is unless the portfolio company sells it to the end-customers and I get that price, then it not better. Because the price in the end-market is about 2 euros but if I sell it at 1 euro, he ends up taking 1 euro and that is not good. If the portfolio manager could say:"OK, I am giving you this price -10 %", then that would be a good deal.

M: Yes, but the broker is also selling to end-consumers. Does he take a margin?

P: Yes, the broker you just pay 0,01 €. It is fixed. Let's say I want to sell at 1,12 €, then the contract price would be 1,13 so I pay this, and I end up with 1,12€. For a portfolio company, the price would be 1,12 €. I fix the price and he accepts to buy or not.

M: So, in the end, you get the same.

P: Yes. Because when I show my prices, I only show the net price as we call it. And the broker, they have to take into account this, then need a buyer ready to buy at 1,13 €. The portfolio company would also sell it at a higher price but then I don't know. For me, obviously, I would like to sell at 2 € but I don't have the capacity to fly around to 500 companies. That's a big cost. We tried something in 2014 but we were a little bit early actually. But they are companies coming up now who are connecting the power producers to the businesses, like BECOUR. They are building a digital platform to match buyers and sellers. The buyer would see me, and I would see him, he would also see from what power station he gets the GO.

M: And so, who gets the difference between the end-user price and the wholesale price?

P: I think the suppliers take a big margin because they have costs, they have people they have a market cost for selling this.

M: What type of contracts do you make for selling GOs?

P: We make contracts for 2019, 2020, 2021, 2022. It is year-contracts. That means that the GOs should be issued during that year. I could do a contract for maybe a quarter. When I do a trade with ICAP for example, he sends me a confirmation. Here you can see a GO trade confirmation. You can see the trade date on that. This is something we sign, and then we sign a contract. A typical contract is a RECS contract, it is a standard contract.

M: Alright, we can move to the next question. I saw that you had labels on your website. How do you get those labels?

P: We have two labels: TUV SUV and Bra Miljöval in Sweden. TUV SUV is just a quality label. They check the production process, the quality of the product, and the quality of the environment. TUV SUV for renewable energy, they certify the power stations. So, they visit the power station. They make sure it is a hydro power plant, they go inside and take pictures, they also check the measuring. Because I have TUV SUV GOs, they pay me a little bit more. But when we started this, back in 2013 I think, everybody wanted to have TUV SUV certificates because the price was the double they said. At that

time, the price of a standard GO was 0,30€ and the price of a TUV SUV GO was 0,60 €. Everybody wanted to have TUV SUV certificates and the price went down. Today, the price premium is about 0,3 cents and it just covers my costs. My TUV SUV guy comes here every April, and I have to pay for the annual audit.

M: Is it the same for Bra Miljöval?

P: We have only one power station certified as Bra Miljöval. It a small power station below 10MWh and the water course is important for Bra Miljöval. For every GO you sell, you get 3 kroner per MWh for environmental projects in water course or energy efficiency projects. So, it is kind of like additionality. You get money for making the fish in the river live, etc. You also get money if you reduce your power consumption (energy efficiency). I like the additionality of Bra Miljöval because it does something more than just trading GOs.

M: Do they also come to check?

P: No, we just send a report every year. One criterion very important for Bra Miljöval is the water flow in the water course, it should not go down below a certain level. We also have to pay an annual fee but the premium for the GOs cover that costs. The GOs are always following the standard GO price but they are traded in Swedish kroner.

M: But the premium is also fixed by the market?

P: Yes, but when I show my price, it is always with the premium.

M: Do you have any criteria to choose the label, does the country of origin matter for you?

P: The labels for us is a business opportunity. We thought that TUV SUV would have make us million, but it didn't.

M: What additional revenues do you get from selling the GOs? I mean compared to the power.

P: Well, the power price was in 2014, €30 and the GO price was €0,30 and then the price of both came up. So maybe, the power price was €45 and the GO maybe €2. The income was before maybe 10 million Norwegian Kr but now we are up to 70 million of Norwegian kr. When the price was €2, everybody was talking about GOs. If you take €45*7 TWh, you have up to billions, so the GO income is low. We take GOs into account for the investments. So, if you have €2 per GO, it is put on your income side. In all cases, you put the GO value on the income side of the analysis, and it could be the difference between a yes or no. But obviously the power price is much more interesting.

M: Alright, now I have a question about the fact that you are also a distribution system operator. Do you experience new challenges and differences since the GO system was launched? For example, a higher renewable production or more intermittency or congestion problems?

P: You are talking about BKK distribution area?

M: Well, I don't know which area you manage.

P: We are into N05. So, this is what they call the BKK area. The thing is that we don't have much wind power in our area. But it might come. So, we don't have any problem when the wind is high yet. But I know that Denmark and Germany have problems when the wind is high because it causes negative prices. And also, in Sweden, due to the Elcerts we have built a lot of wind, in Norway as well. Especially in Fosen. So obviously the more we build wind power, the more problems we get.

M: So, you would say the GOs have nothing to do with this?

P: No, but the Elcert market has to do with this because we are building a lot wind. It has resulted in a lot of wind in Sweden and Norway.

M: Because wind is eligible for Elcerts?

P: Yes.

M: But why would it be the Elcerts that cause an increase in wind power and not the GOs?

P: Because the Elcert price was high at that time of investment decisions. GOs were not. Now the price of Elcerts are very low for 2021.

M: But it is also because they want to stop the system in a few years, so I think they are keeping the price low.

P: Well, the thing is that we had a goal when Norway entered the agreement in 2012, we had a common goal of 26,2 TWh before 2020. And then Sweden added 2TWh to this so 28,2 TWh. And then, in 2017 they said they wanted to extend the period until 2030 and add 18 TWh. So, 46.4 TWh were planned to be built before 2030. And already today, we are above that goal. When you look at how much is built, how much will be built, then we are 2 TWh over.

M: Because the Elcert was super interesting financially?

P: It has to do more with that everybody wanted to get into the green power. Some Dutch pension fund wanted to invest their money in green power here. That kind of took the market by surprise. The Elcertificates market has built way too much wind power and way to early. But it is kind of good, isn't it? At least, when we cable up with the rest of Europe, Europe will take advantage of the power.

M: Was this goal of the Elcerts intended to meet the 2020 target?

P: Yes, it has to do with the European Renewable agreement. It has not only to do with power production but also energy consumption. So, every country in Europe has their share of renewable energy consumption.

M: So, it is the consumption that matters, not the production? Because if you sell your GOs abroad, your consumption is darker?

P: This is only physical, the GOs have nothing to do with that.

M: But then, it is linked to the production? Because, you can't know what is in the grid?

P: Yes, but in this kind of reporting, the GO was not an issue. Because, the EU said: "Ok, you are consuming this amount of energy, obviously power, oil, gas, coal, everything" and they look at the renewable compared to the total. So, because we have very high renewable in the power, the share of renewable total energy consumption was high. Here you can see the share of renewable energy for the EU countries for 2005. Norway had 58.2% renewable energy in 2005 and we had a goal of 62% for 2020. And then, Sweden had 39.8 TWh and their goal is 49%. So, they had to do much more than we had to do. And then, Sweden decides to start the Elcertificates market for the power production. And then we joined later.

M: Do the GOs and Elcerts interact? Is it a completely different system?

P: Yes.

M: I was also wondering if GOs or Elcerts were more efficient in increasing the renewable production. But obviously, it was the Elcerts before. But I guess it depends on the price.

P: Yes, let me show you the price of Elcerts. This is the price of Elcertificates. This is 2250 Swedish kroners which is about 25 øre which is about €25. So, the power producer gets €25 on top of the power price, let's say at that time €40. That was in September 2018, but that was the short market in a way. In the spot, it was €20 and €19.

M: So, the Elcert is still higher than the GO, I didn't know that.

P: But the thing is that we only have Elcert for a very small part of our production. To receive Elcerts, you have to increase the production. You have to build a power station, or you have to increase the production. Remember, today, we have 7TWh of power production, 7TWh of GOs but we only have 0,2 TWh of Elcerts.

M: So, you also take into account the price of Elcert when you do investments?

P: Yes, because Elcertificates on this 200GWh is still interesting. But we maybe took investment decisions when the price was €20 but this is a big risk because today, the price is €2 for 2021 and on.

M: Do you do the same type of contracts with the Elcerts than with GOs?

P: We trade it through brokers (ICAP) but we do it through Nasdaq. We have something called clearing. So instead of meeting the buyer, we make Nasdaq take care of everything. Nasdaq takes care of the money. We have to send the Elcertificates through Nasdaq and they sell it to the buyers and the money goes through Nasdaq. And then, the counterpart risk is also managed by Nasdaq.

M: So, they handle everything. But Nasdaq doesn't sell GOs, it is just Elcerts.

P: Nasdaq trades, they are an exchange of Elcertificates, but they are not a big place. Very little goes through Nasdaq. Most of the trades goes through the brokers.

M: And do you get more money from Elcerts right now, even if it is a smaller part?

P: The income from GOs is higher for us today because we have 7TWh of GOs* €1*10 = 70 million Norwegian kroner income. For the Elcertificates 175 GWh*1,30 = 22 million or 23 million a year. But those are supposed to go back to the power station, the project in itself.

M: Ok, I think I have two last questions. First, do you think that it is good and important that the GOs are decoupled from the power market? Or do you think, it would be less confusing if the consumers were receiving the electricity and the corresponding GOs together?

P: That is a good question. The EEX is an exchange that tried to make a spot market with the green or renewable power. This is back 10 years ago or something, but it didn't work. So, they tried to connect the renewable side of power through the spot market. But it didn't work. The thing is that the GOs are a financial product. While our market is NO5 Nordpool. Then, obviously, the power goes from NO5 to N02, to Denmark, the Netherlands,… The market kind of distributes the power but we, BKK our market is NO5. So, if we should connect the renewable value of our power only in NO5, we wouldn't get that much premium price because it is all renewable in NO5.

M: Ok. I was asking that because I had a presentation from BKK, and she was talking about a company Tibber and then my teacher told me something like you were trying to work with Tibber to connect the GOs with the electricity.

P: Oh, you know a lot. Let me show you about Tibber. We are actually working with Tibber to digitalise the whole thing. We have made a database with all the production coming in every hour into this database, from every power station. And then, we get the ICAP prices, every week into this database. Then, we have a list of power station which are producing right now. Tibber can see, they can see the volume they buy and the price per power station. We have a little difference in the prices because some of the power stations are nice to look at. They are close to Bergen. And also, we try to match our

production with their consumption. If we manage to match the consumption profile with our production, then we are kind of connecting the GOs closer to the end-user. Obviously, our production is much higher than their consumption.

M: And is the consumption close to the production? Where do the people come from?

P: They are all over Norway. But we say to Tibber: "you should buy in NO5", we like that consumption because it is a physical consumption in our area. We have sold GOs to all Norway. But this is before the GOs are issued, because the GOs are issued one week later. But then, we match the GOs at NECS with the contract volume in a way. So, this is established today, but we are waiting for Tibber to start to order volume. So, it is kind of exciting.

M: What are the advantages?

P: It is almost like the BECOUR thing. BECOUR is also building this. So, they see the power stations and we see the buyers. On the other side, the consumers at Tibber, they have this "WIFI" thing where Tibber can run the consumption up and down depending on the price. I think they have 58 Tesla consumers. And they can shut down the charging of the Tesla consumers, and the consumers get a lower price because of that. Tibber is paid by Statnett. This is consumer flexibility and demand response. Statnett pays for you to shut down for example when a power station is shut down because of a problem. So Tibber can shut down the Tesla charging. But this is just a test, because Tibber can stop the heat, the warming of water.

M: How would you define Tibber?

P: Tibber is a supplier.

M: Finally, what do you think of the GO market today? Is there an oversupply or larger demand?

P: I would like to show you AIB. It is not easy to analyse this market. But the reason that the prices have come up is the fact that the demand has come up. It has come up quite a bit. And then, I have looked at the building of new renewable power production in Europe. I think it will increase the same speed. The installed capacity is even higher than this, but it is because some of the GOs are not sold as GOs. Germany for example, because they get subsidies can't sell GOs for that production. Looking at central west of Europe, the increase in supply of GOs will be pretty much the same as the increase in demand. There will be enough GOs in the market.

M: So, you would say it will kind of reach an equilibrium and stabilise?

P: Yes. And then, I think that the companies will be more interested in local GOs because as long as we are building, local GOs will come as well. So, I think they would rather buy local GOs instead of the BKK GOs way up north. So then, we could get a different pricing for the local GOs versus the more European GOs. And then you have to find a price for this. A local GOs is physical, because it is in your physical area but the standard GOs is not physical, so what will be the price level? I don't know, maybe 0,50 cents, or 1 €, 1,5€.

M: Alright, so that was my last question. Thank you for your help and your time

P: No worries, if you have any questions, just send me an email.

Appendix I - Information content of GOs for high efficiency cogeneration

The minimum information that must be disclosed in the case of GO for high efficiency cogeneration is defined in the Annex X of the Directive 2012/27/EU and is:

(i) the identity, location, type and capacity (thermal and electrical) of the installation where the energy was produced;
(ii) the date and places of production
(iii) the lower calorific value of the fuel source from which the electricity was produced;
(iv) the quantity and the use of the heat generated together with the electricity;
(v) the quantity of electricity from high-efficiency cogeneration in accordance with Annex II that the guarantee represents;
(vi) the primary energy savings calculated in accordance with Annex II based on the harmonised efficiency reference values indicated in point (f) of Annex II;
(vii) the nominal electric and thermal efficiency of the plant
(viii) whether and to what extend the installation has benefited from investment support;
(ix) whether and to what extend the unit of energy has benefited in any other way from a national support scheme, and the type of support scheme;
(x) the date on which the installation became operational; and
(xi) the date and country of issue and a unique identification number. (Council Directive 2012/27/EU, Annex X, p. 45).

Appendix J - Email Phil Moody: AIB

RE: Question about the GO statistics for a master thesis

Phil Moody <secgen@aib-net.org>
Tue 26/02, 14:54
Margaux Snoeck; info@aib-net.org

Reply all

Inbox

You replied on 26/02/2019 15:15.

See in red below. Good luck with the thesis!

Best regards,
Phil

Phil Moody
Secretary General
Association of Issuing Bodies

AIB

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From: Margaux Snoeck [mailto:Margaux.Snoeck@student.nhh.no]
Sent: 26 February 2019 13:43
To: info@aib-net.org
Subject: Question about the GO statistics for a master thesis

Dear AIB members,

I am currently writing my master thesis on guarantees of origin and try to make a comprehensive comparison between Norway and Germany. Therefore I am using the last excel file you published on your website with the statistics for GOs in 2018. I have several questions about the figures:

1) Can I use the data for the year 2018 or are there some missing information?
Meter data for 2018 continues to be collected into 2019 – perhaps 20% will be one quarter late. Also, transfer and cancellation figures may change as corrections are made to allow for e.g. GO's incorrectly issued (wrong fuel source etc.)

2) I am currently using the statistics for GOs by transaction date because I think it makes more sense. But when I look at Germany and Norway, some figures seem strange: for example in Norway the number of GOs exported is way higher than the number of GOs issued in 2017. I guess this is possible due to the fact that a GO is valid 1 year and therefore could be exported the year following its issuance. Do you know how I could present such statistics in a easy way to understand for the readers? I would like for example to say: " in 2018, Norway has exported X% of the GOs issued", but that wouldn't be correct if I use the data by transaction date right? Neither can I say such a thing by using the data by production date?
Perhaps because some exported GOs were issued in 2017? Also, perhaps Norway imports and exports – some may have been imported for onward sale.
You should also use production statistics, as the two display different facets of the market. Analogise with groceries: consumers want to know how fresh the product is (production), while store managers want to know when sales happen (transaction).

3) What about the statistics about ex- domain cancellation? Are their included in the file?
They are, but there are not many of these by proportion.

4) For the year 2017, do you consider January 2017 until December 2017 or also the 3 first month of 2018?
Of course: it is a calendar year. How Norway and Germany run their internal markets is of no concern to us. E.g. UK runs on fiscal year April-March, but other do not.

5) Do you have information about how the GOs system differs between Germany and Norway, for example regarding their domain protocol, etc?
This is the purpose of the domain protocol – to identify how EECS is applied in each country. I suggest you refer to this.

Thank you for your help and your time.

Best regards,

Margaux Snoeck

Appendix K - Email Preben K. Olsen: BKK

SV: Request for an interview for a master thesis on guarantees of origin

Olsen Preben Klyve <Preben.Olsen@bkk.no>
Thu 16/05, 08:48
Margaux Snoeck

Reply all

Inbox

Action Items

Hello Margaux
Sorry for late answer! Busy days.....

What is the impact of guarantees of origin on the electricity value chain?

Marginally. It depends on the price of GoO. Last year the price increased to 2 EUR/MWh. With this price level the GoO income can make the difference of a FID or not. A price around 30 eurocent means that the GO income is not put on the incomeside. However, the last years we have seen more and more PPAs, where the GoO value is included in a fixed price for the buyer of the power.

In order to assess the impact on the generation, I would like to know how much does the GO revenue is compared to the revenues from selling the power?

Power price: 35-45 EUR/MWh, GoO price 0,5-1,5 EUR/MWh

Could you tell me your revenue for both categories or a least what fraction the GO revenue is compared to the total revenue you make from selling the power?

BKK produces around 7 TWh annually. Income from power around 280 mill EUR, Income GoOs 5-7 mill EUR (all of our power stations are issuing GOs)

And what about the Elcertificates?

Annual volum around 175 GWh, price around 5 EUR today (2019), income 875 000 EUR. The elsertprice has been much higher, 20-25 EUR.

Secondly, do you agree that the GO price does not fluctuate with the power price?

Agree

Finally, do you know how much does the GO price represent in the power price paid by the final consumer? (i.e. end-user power price and end-user GO price)

GoOs are voluntary for the buyers. Large companies buy GoOs to report 100% renewable electricity consumption accordning to reporting standards (GHG protocol). The end-user is paying around 2-3 EUR for the GoO. For a Norwegian customer this is about 2-3 % of the final price (include gridcost and tax)

Hope this is OK!!

Sincerely,

Preben Klyve Olsen
Renewables and Origination

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